

**Strategic Plan 2009-2014**  
**—Environmental Science and Policy—**  
**3 June 2008**

**Mission:** ESP's mission is to conduct research, teaching and outreach on the science and social science issues critical to understanding and solving environmental problems facing California and the world. It has become increasingly evident that we live in a managed world and need to confront the many serious environmental challenges associated with the overuse of resources, a changing climate, and a mobile human population. We believe that an interdisciplinary emphasis encompassing both natural and social sciences provides the best approach for finding solutions to these challenges.

This interdisciplinary approach is increasingly being recognized by universities, funding agencies and young researchers as the wave of the future. For instance, this recognition contributed to ESP attracting four of the six new hires in the Global Environmental Change and Conservation Initiative, all of which were the top choices from the search. ESP's mission circumscribes five major areas of strength: Environmental Policy, Environmental Informatics, Regional Planning, Water and Watersheds, and Conservation Biology. Our mission is thus closely connected to many of the future areas of emphasis proposed in the CA&ES Strategic Plan: Science, Policy, and Public Perception; Environmental Informatics; Regional Change; Global Change, Water and Watersheds; and Biodiversity and Ecosystem Services. We flesh out these connections in this strategic plan and propose new initiatives. These activities will enhance our position both as a key interdisciplinary center for environmental science and policy, and as a key liaison to state and federal environmental agencies.

Our academic plan is divided into three sections: I) The state of the department; II) Goals for the next 5 years; III) Summary of proposed faculty positions.

## **I. THE STATE OF THE DEPARTMENT**

**Faculty:** 21.83 FTE Total FTE (16.19 I&R, 4.64 AES, 1.0 CE); 0.21 FTE Lecturers, 2.50 FTE Prof. Research (*Jassby, Viers and Reuter*), 1.00 FTE Academic Administrator (*McCoy*). We have added four new faculty to the department in the last two years as part of the Global Environmental Change and Conservation Initiative (Quantitative Animal Conservation Biologist-*Baskett*; Bioeconomic Modeler- *Sanchirico*; Conservation Valuation Analyst-*Springborn*; Global Change Informatics Scientist-*Hijmans*). These add considerably to our department strengths though synergisms with current faculty and among themselves as well as with the other initiative hires in other departments. At the same time, these positions have done little to deal with upcoming and recent faculty retirements. *Johnson* retired in 6/30/05; *Jassby* will retire June 30, 2008; *Cornell, Goldman, Quinn, Rejmankova, Richerson, and Sabatier* might retire within five years.

**Steady state needs:** We consider 20-21 faculty to be necessary in the near term to meet our teaching, research and outreach activities. In order to maintain a steady state, we have proposed five "Steady state" faculty hires in Section IV to compensate for five upcoming faculty retirements in the next five years.

### **Departmental specializations and core competencies (elaborated in Section II):**

Environmental Policy (*processes, evaluation, management*)

Environmental Informatics (*computing, modeling, datasets, analyses*)

Regional Planning (*environment, energy, land use, transportation*)  
Water and watersheds (*assessment, ecology, processes, management, policy*)  
Conservation Biology (*ecology, biodiversity, policy*)

**Ranking:** The environmental science program at UCD is clearly one of the best in the nation and the world (ranked 1<sup>st</sup> to 5<sup>th</sup> in various rankings). ESP contributes substantially to this reputation. Notable faculty awards include

- Albert Einstein World Prize in Science and the Nevada Science Medal (*C. Goldman*)
- Presidency in International Societies (*A. Hastings, P. Richerson, A. Sih*)
- ISI Highly Cited Researcher designation (*A. Sih*)
- MacArthur Award of the Ecological Society of America (*A. Hastings*)
- Life Time Achievement Award of the American Society of Limnology and Oceanography (*C. Goldman*)
- AAAS Fellowship (*A. Hastings, B. Orlove, P. Richerson*)
- American Academy of Arts and Letters Fellowship (*A. Hastings*)
- Journal Editors-in-Chief (*A. Hastings, M. Holyoak, B. Orlove*)
- Chancellor's Fellow (*M. Schwartz*)
- University Research Lecturer (*A. Hastings*)
- University Public Service Award (*C. Goldman, J. Ogden, D. Sperling*)

**Extramural funds:** major sources of funding include the NSF, Caltrans, NOAA, State Water Resources Control Board, CALFED, U. S. Fish and Wildlife Service, USDA Forest Service, EPA, CalEPA, California Department of Public Health, Sea Grant, Packard Foundation, Columbia University, USGS, State of Nevada, San Francisco Estuary Institute, and various other federal, state, and private agencies.

- **Total direct expenditures: \$13,918,892** (2004 – 2007) in funding from academic senate and federation members. Total expenditures for the previous four year period were \$9,704,151 and so this period represents a 43% increase. Our expenditures per FTE (average ~ \$516K/FTE) are above almost all departments in the Human Sciences, and towards the upper end for the Environmental/Natural Sciences. This is a very solid funding record for a department that features a mix of natural and social scientists and it represents a substantial increase in productivity over the previous four years. Of the direct costs from 2004-07, **\$9,782, 379** was brought in by our faculty PIs via the Information Center for the Environment (ICE: *Quinn, McCoy, Viers*) and the Tahoe Research Group (TRG: *Goldman, Reuter, Jassby* et al.). In addition, ICE (*Quinn, McCoy*) led a three-year, \$15 million, umbrella grant from Caltrans that ends in June 2008 to support UC research on environmental impacts of transportation (ICE is directly responsible for the majority of the resulting projects known as task orders that are administered by ESP totaling over \$5.5 million). A follow-up agreement is being negotiated. Because our office staff continues to be reliable and efficient (our MSO: *Patricia Conners, Nancy Louks, Shirley Holm, Susan Trigilio, Paula Nasater, Stephani Shone*), TRG and ICE grants are mostly administered in ESP rather than JMIE. However both units also have some multi-investigator funding administered through JMIE (mostly the Center for Watershed Sciences). Including all of these funds, we rank close to the top in the College in funding per FTE.
- **Our faculty also play important roles in several large collaborative grants run through other units**, including a NSF IGERT training grant on Biological Invasions (\$2.5 million; *Lubell, Richerson, Sabatier, Sih, Hastings, Schwartz, Grosholz, Harrison, Holyoak, Quinn*), a NSF IGERT on Rapid Response to Environmental Change (\$3 million; *Grosholz, Harrison, Hastings, Holyoak, Quinn, Sabatier, Sih, Schwartz, Lubell, Richerson*), a NSF grant for the Center for Research on Environmental

Decisions at Columbia University (\$5.9 million; *Orlove*) a Packard Foundation Interdisciplinary Science Initiative award (\$498,000, *Schwartz*), a TSR&TP training grant on Atmospheric Aerosols and Health in collaboration with U C Merced (\$1.6 million; *Lubell, Lin*), and an assortment of grants run through the Institution for Transportation Studies (ITS; *Sperling, Handy, Ogden*). The last includes the Sustainable Transportation Center, directed by *Handy*, with \$500,000 per year from the U.S. Department of Transportation and \$500,000 per year from Caltrans and the Sustainable Transportation Energy Pathways (STEPS) program, directed by *Ogden and Sperling*, a \$1.2 million per year research consortium funded by 21 industry and government sponsors. *Ogden* is P.I. on grants totaling about \$550,000 per year on energy and transportation topics, including grants from the U.S. Department of Energy (\$250,000 per year), the California Energy Commission (\$100,000 per year) and Chevron (\$200,000 per year). ESP faculty are also co-PIs on a number of large grants from CalFed (totaling over \$10 million to date) to establish a major watershed study in the Cosumnes River watershed and floodplain (*Quinn and Viers* lead the latest project at over \$481,000 from CalFed), and *Quinn* was lead PI for a just-completed multi-department award totaling \$3.2 million, administered through the Center for Watershed Sciences. *Mount, Lund, and Viers* in the Center for Watershed Sciences direct \$497,000 from Resources Legacy Fund Foundation to examine climate change impacts on Sierra Nevada water resources. *Goldman* and the TRG played a critical role in raising \$14.25 million for the new Tahoe Environmental Research Center (TERC), and \$3 million for the restoration of the CA&ES Special Facility (Fish Hatchery) in Tahoe City. Finally, Cynthia Lin is a faculty PI on \$795,897 of funds for biofuel research from three UC Davis Chevron Research Grants administered through The Department of Agricultural and Resource Economics.

#### Teaching programs:

- **In 2006-2007, ESP taught 6714 Student Credit Hours.** This represents an increase of 646 SCH or 11% over the previous year. Although we rank towards the bottom in the CAES for SCH per I&R FTE, this is primarily because (for historical reasons) our faculty have relatively high I&R appointments. For SCH per total FTE, we rank 11<sup>th</sup> in CAES (2006-2007), with ratios that are intermediate between natural and human science departments, as might be expected based on our faculty's mix of these disciplines. We expect to continue to improve our SCH per FTE in the next five years with the measures we are taking to even further increase our student/ faculty ratio (see Section II).
- **Undergraduate majors:** Environmental Biology and Management (EBM) and Environmental Policy Analysis and Planning (EPAP). The number of students in these two majors was 148 as of Fall 2006 (67 in EBM and 81 in EPAP), and increased by another 8% to 160 in Fall 2007. Our graduates find employment in key state and federal positions, playing a valuable role in solving applied problems and managing the environment. Our record of sending students to graduate programs in policy, planning, environmental law, and environmental sciences is also extremely strong. We have developed a new Environmental Science and Management major (ESM) in collaboration with LAWR to combine our EBM major and LAWR's ERS and SSC majors, and we expect the new major to further increase our undergraduate enrollments. The new major will combine physical and biological environmental sciences, and appropriate social sciences, for the first time at UC Davis.
- **Teaching awards:** Faculty and teaching assistants in ESP won major teaching awards – the Chancellor's Teaching Fellowship (*Sih* and TAs, *L. Yang* and *L. Pintor*), and the ASUCD Excellence in Education Award (*Ogden*, winner, *Handy*, finalist).
- **Graduate training:** We support c. 65 graduate students, most in the Graduate Group in Ecology, but also in other programs including: Geography, Anthropology, Applied Math, Population Biology, Animal

Behavior, and Transportation Technology and Policy. Our graduate students are excellent as evidenced by eight current NSF predoctoral fellowships, two EPA STAR fellowships, two DOE Graduate Fellowships, one multi-year DOD fellowship, numerous NSF Doctoral Dissertation Improvement Grants, and other awards. We administer the Graduate Group in Ecology, the largest graduate group at UCD, and play major roles in several other graduate groups, including Transportation Technology and Policy, Population Biology, Animal Behavior, and Geography. We recently received a two-year \$500k training grant from the Packard Foundation (Conservation Management Training at UC Davis) to train graduate students to solve the challenges of managing preserved natural ecosystems.

- **Outreach and Extension:** We have a long history of outreach. Most of our faculty have CA&ES projects that include outreach components. Three faculty members (*Goldman, Sperling, Ogden*) have won UCD's Public Service Award. Many generate extensive media coverage (*Goldman, Harrison, Hastings, Orlove, Quinn, Sih, Sperling*). Our one CE Specialist (*Grosholz*) has developed a well-funded statewide program addressing invasive aquatic species. Invasive aquatic species are one of the top priorities for USDA, DANR and several state agencies and UC Davis is a leader for research and extension education in this area. Ted co-authored the California Aquatic Invasive Species Management Plan, which is now the blueprint for managing invasive species in CA including \$1 million recently approved by the California Ocean Protection Council. *Grosholz* also plays a critical teaching role in ESP by training graduate students and by teaching ESP 198, Marine Conservation Biology. ICE (*Quinn, McCoy, Viers*) has cooperative agreements with nearly 20 state and federal agencies, and provides public database and GIS services that include the California Information Node of the National Biological Information Infrastructure (USGS-NBII) and the GIS framework for the state drinking water protection program. ICE urban growth models (UPlan, PECAS) have been adopted by Caltrans and a variety of county and metropolitan planning organizations as the basis for long-term growth projections in the state, and are being widely applied in Environmental Blueprint processes in the Central Valley, Southern California, and the Bay Area. ICE provides ongoing outreach and technical support to all of these efforts. We propose a CE Specialist position in Environmental Informatics to supplement these efforts and to further formalize ESP's role as a focal point for environmental outreach (see Proposed Faculty Positions).

**Collaborative Links to Other Units:** ESP is already the center and collaborator for many well-funded projects that cross disciplines, departments, colleges, and agencies. We play major roles in the TRG, ITS, JMIE, GLOBEC, CET, CECA, the Natural Reserve System (NRS), and the Center for Watershed Sciences (CWS). We have large multidisciplinary grants with faculty in WFCB, CEE, EVE, Geology, and ARE. We plan to deepen our links with Geology (through CWS, *Viers, Goldman, Quinn*), Agricultural Sustainability Institute (ASI) and Viticulture & Enology to improve sustainable viticulture research (*Tomich, Viers*), and the Biological Resources Division (BRD) of USGS (to expand the USBS/BRD environmental bioinformatics center at UCD in ESP, where we already manage several international databases and lead the California program of the NBII). Our collaboration with Bodega Marine Laboratory is strong (*Morgan, Largier, Grosholz*). With our four new hires as part of the Global Environmental Change and Conservation Initiative (*Baskett, Sanchirico, Springborn, Hijmans*), we expect to develop closer collaborative links and synergisms with PLS, LAWR, ARE, and WFCB, all of which have either have new faculty hired under the initiative or faculty with complementary interests to our initiative hires (see Section II).

**Summary:** Since our last academic plan, ESP is bringing in substantially more research funds, teaching more student credit hours, conducting more research, and doing more outreach. The most exciting recent development in our department was the successful recruitment of four new faculty for CA&ES's Global Environmental Change and Conservation Initiative. We note that, in each hire the candidate pool was such that

the committee recommended multiple acceptable candidates. Further, in each hire, UC Davis was able to attract the top ranked candidate from the search. These faculty had the option of choosing departmental homes, and chose ours. The virtually unanimous reasons given were our warm, collegial, welcoming culture, the quality of our faculty, and, most importantly, our interdisciplinary emphasis which was viewed as the key to future success in solving environmental problems. ESP was a particularly strong supporter of the main goal of the initiative, which was to create synergisms among faculty on a topic of global importance and particular regional emphasis. With these new hires, we believe that UC Davis as a whole will emerge as an even stronger center for bringing together environmental science and policy, and, in particular, for addressing challenges associated with global/regional environmental change and conservation. We view ESP, as a department, to be at the center of this activity.

## II. GOALS-5 YEAR PLAN

**Overview:** With our recent successes including our four new hires, our department is now at a critical stage in development and we are poised to become an even more powerful center of excellence in environmental science and policy. We have five main areas of strength which individually have great potential for producing high quality research, teaching and outreach: Environmental Policy, Environmental Informatics, Regional Planning, Water and Watersheds, Conservation Biology. In addition, the synergies that are emerging among these areas increase that potential even further. There are also great opportunities for interdisciplinary interactions with other departments within CA&ES and campus-wide. The overarching goal of our five year plan is to nurture these growing strengths, to further build synergisms among them, and to further enhance bridges to other units in the university and to stakeholders outside of UCD. Maintaining our strength by maintaining faculty numbers is thus of paramount importance. This section outlines specific goals for strengthening our department over the next five years. The first subsection addresses general department issues and the second addresses each of our five areas of strength and synergies with other units.

### General department issues:

- **Enhance undergraduate enrollment and retention.** We are currently over our FTE/SCH target partly because (for historical reasons) our faculty appointments have relatively high I&R ratios, and partly because we were an attractive choice as a home department for four of the hires from the Global Environmental Change and Conservation Initiative, three of whom have not yet arrived and started teaching. We are very excited with these new hires but also believe we should not be penalized for embracing the goal of the college-wide initiative. Nevertheless we are taking aggressive steps to increase our student/faculty ratio and we expect to move much closer to our target in the next five years. Our undergraduate staff advisor and recruiter, Kim Mahoney and our master advisors for the EBM major (Marcel Holyoak) and EPAP major (Paul Sabatier) have already put considerable energy into a series of recruitment and retention activities including: a redesigned website, active participation in numerous outreach events to reach undeclared students, contact with numerous student prospects, and expanded undergraduate internship and research programs. Most notably, we are in the process of implementing a new major. New initiatives that we intend to put into action in the next few years include:
  - A merged major combining elements of the EBM major in ESP and the ERS and SSC majors in LAWR. The merged major will differ from its antecedents in that it will require more physical-environmental science courses than the EBM major and more policy and ecology courses than the ERS major. It will thus be more broadly interdisciplinary without sacrificing rigor, and will better prepare students to identify and solve environmental problems, which increasingly require practitioners to interpret both physical and biological processes. It will also reduce the confusing

array of environmentally-related majors in the college and will hopefully make our major more visible to prospective students enhancing recruitment at the College level, and increasing departmental enrollments. The new, larger major should substantially increase the number of students enrolling in several of our main courses (e.g., ESP1, ESP30, ESP 100, ESP110, and a new policy course, ESP 162).

- Several additional measures to increase our student/faculty ratio:
  1. Taking on the teaching of GEO 30, using ladder rank faculty to build the high enrollments this course has had in the past
  2. Moving ladder rank faculty into the teaching of ESP 1 which had previously been taught in part by an instructor
  3. Taking on the teaching of two sections of the new Bio 2B course which will involve the teaching of hundreds of undergraduates
  4. Taking on the teaching of both of the GGE grad core courses, ECL 200A and ECL 200B which enroll 30-50 students
  5. Taking on the teaching of EVE 104 (Community Ecology) which we plan to cross-list with an ESP number and which should have good enrollment potential with the right mix of subject matter
  6. Further building enrollments in our non-majors introductory course, ESP 10 which is now up to 150 students
  7. Offering a new core course in spatial analysis, which should become a core requirement for both the new merged major and the College's undergraduate offerings in Geography
- The merger of the ESP and LAWR undergraduate environmental science clubs and additional efforts to reenergize these clubs
- **Space:** We are critically short of space. This is our most significant resource challenge in terms of achieving the goals articulated by our plan. ESP occupies roughly 21,136 sq. ft. of space. Our primary space is in Wickson Hall, where we currently occupy 20,089 sq. ft. If administrative offices and conference rooms are removed then 15,319 sq. ft. is left for research personnel. This represents 71% of our CPEC needs (28,288 sq. ft.) and only 54% of our space needs based on a revised accounting formula that includes our many research staff (primarily in ICE and the TRG) who are not included in the official CPEC formula, but who are clearly productive and need space. When VEN vacates Wickson Hall in Aug 2008, our goal is to work with the College to make sure our space needs are met for existing ESP faculty, for our three new faculty hired as part of the Global Environmental Change Initiative and for a series of initiatives that expand our role as the Center for Environmental Science and Policy and possibly, Environmental Informatics on campus, including substantially increased connections with federal and state agency scientists. When Viticulture and Enology leaves Wickson Hall in Aug 2008, we desperately need an additional 10,000 sq. ft. of space in Wickson in order to both provide existing faculty with space that better matches their needs, and to develop several exciting new initiatives (see below) and foster new, interdisciplinary interactions that play a major role in our drive to be the College's nexus for Environmental Science and Policy. We also believe that we can fund College-wide facilities for both environmental informatics and urban growth and land-use modeling (both advocated by the College Academic Plan – see below) if we receive the space, infrastructure, and staff allocations needed to sustain them (see below).

- **Increase our departmental development activities:** We suggest that for the 21<sup>st</sup> century, environmental science and policy is an ideal focus for attracting gifts and endowment funds. We propose to actively engage the CAES Development Office for advice, help and joint effort on the following activities:
  - Create an **ESP Advisory Council** made up of relevant, well-connected, influential people from academia, agencies, NGOs and industry.
  - Seek funds for an **Endowed Chair in Environmental Science and Policy (modest growth)**. One exciting model involves having a rotating Visiting Endowed Chair who would be a major international figure in the environmental world who would spend the year at UCD studying (perhaps writing a book), interacting, and giving lectures (see III. Summary of Proposed Faculty Positions).
  - Given our current success in extramural development activities (e.g., much of the private funding for the Tahoe lab and ITS were developed by ESP faculty, and we are currently negotiating with several large California foundations to support ongoing programs in environmental planning, land use, and transportation), we believe a **dedicated fundraiser** associated with the department would yield substantial private giving.

#### **ESP areas of strength:**

- **Environmental Policy:** Environmental policy is concerned with analysis of the interactions among policy institutions, human behavior, and political decisions in the context of environmental and natural resource conflicts. Funding initiatives in several major federal and state agencies have made it clear that in the 21<sup>st</sup> Century, there will be a strong emphasis on connecting environmental science AND policy. This emphasis is also recognized by the CA&ES Strategic Plan which lists “Science Policy and Public Perception” as one of the targeted areas for growth over the next five years. Whereas UC Davis has a large number of environmental natural scientists in several colleges, the campus has relatively few social scientists with expertise in environmental policy. At the same time, many state and national government agencies are highlighting the important role for social scientists in meeting their regulatory and research missions. Furthermore, as many have pointed out, solving the environmental and natural resource problems of the future requires a multi-faceted approach that integrates not just the natural and social sciences but also the diversity of social sciences, including planning, economics, political science, and anthropology.
- An important way to facilitate these interactions and integrations is by housing all of these disciplines in the same department, which is what makes ESP unique on campus. To date, ESP faculty working on these issues have built an international reputation for high-quality, quantitative social science research. The continued support of these efforts is critical to meet the current and future needs of California and the US. The recent hire of natural resource economists (*C. Lin, J. Sanchirico, and M. Springborn*) is a major step in the right direction. Over the next five years, a key goal of ESP is to maintain the critical representation of each of the social science disciplines necessary to facilitate both strong disciplinary and interdisciplinary efforts. With the retirement of *P. Sabatier* approaching, our most pressing need over this period is to find an equally qualified policy scientist to join *M. Lubell*, which will be difficult since Sabatier is the most senior and well-recognized political scientist and policy scholar on campus. His retirement will create a major gap. There is also a need on campus for more investment in risk management and outreach. In addition, *P. Richerson* is also nearing retirement and he also plays a major senior leadership role in applying ecological and evolutionary theory to human behavior. Finally, there is also a need for an expert in

trans-boundary environmental and natural resource policy to complement our recent hires from the Global Change Initiative. We thus propose the following steps to increase our presence in the social sciences:

- **Recruit a new faculty member in Environmental Politics and Policy (steady state)** (see Section III Summary of Proposed Faculty Positions for justifications for all suggested recruitments)
- **Recruit a new faculty member in Evolutionary Social Science (steady state)**
- **Recruit a new faculty member in Trans-boundary Environmental and Natural Resource Policy (steady state)**
- **Recruit a new CE Specialist in Environmental Risk Management and Communication (modest growth)**
- **Synergies with other academic units**
  1. **Enhance bridges with Resource and Environmental Economists** in the Department of Agricultural and Resource Economics. In 2006, ESP and ARE jointly hired an environmental economist, *C. Lin*. Subsequently ESP hired two additional environmental economists, *J. Sanchirico* and *M. Springborn* as part of the Global Environmental Change Initiative. A natural next step is to work with the very strong core faculty in ARE (e.g., *J. Wilen*, *D. Larson*, *R. Howitt*, *H. Farzin*) to form a unified group of environmental and natural resource economists on campus. The advantages of building such a group are numerous. For our economists, more integration is beneficial for developing access to ARE graduate students, access to the resources available from the Giannini Foundation, and for maintaining their skill sets (e.g., by teaching in ARE's graduate program). For ARE faculty, our group of economists can play an important role in furthering their ties to ecology faculty and students that are working on issues relevant to their research. The new training program in marine ecology and economics is one example of these efforts. Another example is the recent interest by *J. Wilen* in forging closer links with ESP to facilitate additional collaborative research in this area. ESP strongly concurs with this arrangement and will provide office space for Jim and his institute to bring the group closer together.
  2. **Establish a Marine Ecology, Economics, and Policy Training program.** *A. Hastings* and *J. Sanchirico* along with *L. Botsford* (WFCB) and *J. Wilen* (ARE) are proposing to develop new training program in marine ecology, economics, and policy. At least one of our new initiative hires, *M. Baskett*, will also be involved with the program, and *E. Grosholz*, our CE specialist in Marine Invasion Biology who is seeking a 20% I&R appointment, will also play a critical role. The primary objective of the program is to train the next generation of researchers to contribute effectively to the management and conservation of marine ecosystems. The core of the teaching/research program will be a quantitatively-oriented interdisciplinary Ph.D. that focuses on developing mathematical modeling, statistical, and forecasting expertise in marine ecology and fisheries economics. The teaching program will draw students together from several disciplines in research seminars, applied modeling group projects, policy seminars, summer



internships, and applied thesis projects. A secondary objective of the program is to upgrade training of researchers and policymakers involved with current policy making. This will be accomplished with a summer institute that will offer summer courses to mid-career professionals working as analysts or decision makers. The summer institute will be part of the Ph.D. training program, giving program students and policymakers and staff opportunities to interact on current policy issues. Ph. D program students will likely interact with researchers at Bodega Marine Laboratory (BML) and by the final year of their thesis research, they will be expected to have developed collaborative research relationships with institutions such as the NOAA Fisheries Science Centers, State Fish and Game agencies, conservation organizations, and policy think-tanks.

- **Environmental Informatics:** Environmental Informatics is concerned with the development and dissemination of geospatial data and technologies; the development of robust data architectures dedicated to the cataloging of global environmental information; and the creation of decision support systems geared toward improving the capabilities of resource managers in a variety of sectors. While there is considerable expertise on campus in the emerging, and well-funded, field of environmental informatics, the area has received little programmatic emphasis – a shortcoming that has been recognized by designating “Environmental Informatics” as a one of six emerging areas to emphasize in the College Academic Plan. Part of the need for new faculty with disciplinary training in informatics, has begun to be addressed with the hiring of *R. Hijmans* for a position in Global Change Informatics, along with several other new faculty in ESP (*M. Baskett*) and elsewhere (e.g., *Michael Gertz* and *Bertram Ludescher* in Computer Science, *B. Houlton* in LAWR, and *A. Latimer* in PLS) with strong environmental informatics backgrounds. Cutting-edge research in water and watershed analysis, global change analysis, biodiversity and ecosystem services, environmental and human health, and regional change all depend heavily on sophisticated spatially-specific models of future change. Recent extramural funding has supported some informatics infrastructure in ICE (GIS, land use, water) and CSTARS in LAWR (remote sensing). There has also been support for public data clearinghouses and the development and operation of widely-used large models. There is a parallel need for outreach in environmental informatics. We thus propose the following:
  - **Establish an Environmental Science and Informatics Computing facility:** This facility would greatly enhance research, teaching, undergraduate internships, and outreach in environmental informatics and associated disciplines. In fact, it would complement many of the other targeted areas identified in the CA&ES academic plan. Institutionalizing the many activities carried out by ICE and other campus units and providing an institutional core for student training and the increasing number of faculty using large datasets and high-performance computing in their research could greatly increase the College’s visibility in informatics, provide an institutional home for common-use resources (e.g., global imagery datasets) and services (site licenses and technical support for best-of-breed software), and help develop greater and more secure extramural funding. This initiative picks up on plans several years ago to establish such a facility in Hunt Hall, which was intended to build on the environmental informatics and facilities core already established by ICE (databases, GIS, web technologies), the CSTARS lab in LAWR (remote sensing and large geospatial datasets), along with the new GIS teaching facilities in Hunt and PES and several smaller GIS, RS, and spatial modeling programs elsewhere in the College. Unfortunately, renovation

costs prevented locating such a facility in Hunt. However, ICE and CSTARS alone now support nearly 40 informatics students and staff, share costs and appointments, provide RS and GIS software and support for many College programs, and operate line-item-funded government information clearinghouses for both state and federal governments (CERES, the state's main environmental web portal, water quality data, spatial data libraries, environmental project and planning tracking, etc.). These activities are spread over four buildings and lack critical infrastructure such as high-speed connectivity and facilities to host common-use global datasets and high-performance computing services. At very least, all of the ESP informatics programs should be co-located in Wickson. Consolidating cross-departmental capability within Wickson would permit a core facility to meet these College-wide needs, and would almost certainly increase our already substantial competitiveness in attracting state and federal environmental informatics funds and programs to campus. Depending on space and larger College strategies, additional programs (e.g., in hydrological and climate modeling) might be added incrementally. This facility would also support (and overlap in funding and staff) with the proposed Urban Land Use Modeling Center (see below).

- **Recruit a new CE specialist in Environmental Informatics (modest growth).**
- **Synergies with other units:** In addition to the links with LAWR and PLS discussed above, additional programs with heavy computing needs could be housed in the informatics facility. These include the following: 1) The new Center for Ecological Theory (CET) led by *A. Hastings*. 2) A new Center for Evolutionary Social Sciences (*P. Richerson, M. Lubell*, and about a dozen other faculty from multiple departments). Evolutionary social sciences is an exciting interdisciplinary field (an evolutionary economist recently won the Nobel prize) that applies evolutionary principles towards understanding human behavior, including a focus on decision-making about the environment. 3) State and federal information clearinghouses for water quality information (a proposed state drinking water clearinghouse to institutionalize a decade of public health funding for drinking water protection information systems), environmental planning information (the current state clearinghouses for public environmental restoration projects, CEQA data, land use model data), and the state environmental portals and geospatial data libraries now housed in CSTARS (CERES, CaSIL, etc.)
- **Regional planning:** Regional planning is concerned with addressing economic, environmental, social, and political problems and opportunities associated with regional change. "Regional Change" is one of the areas of emphasis recognized by the CA&ES Strategic Plan and is an area of critical importance to CA&ES because of the impacts of such change on the Central Valley of California and beyond. Interdisciplinary research in ESP as well as in other CA&ES departments forms the base of the college's strength in the study of regional change. Faculty and staff in ESP who contribute to research teaching and outreach in this area include *D. Sperling, J. Ogden, and S. Handy* who are affiliated with the Institute of Transportation Studies (ITS) as well as with ESP, and *J. Quinn and M. McCoy* who administer the Information Center for the Environment (ICE) housed within ESP. In the area of transportation, energy and environment, *D. Sperling and J. Ogden* are members of the Steering Committee for the UC Davis Energy Initiative, which involves many departments across the campus. We thus have considerable strength in the land use, transportation, and environment aspects of regional change in our department. However, in

2005, we lost *R. Johnston* to retirement. Robert was a key member of our transportation group and made important contributions to teaching research and outreach in transportation planning. In order to enhance our position as an academic center for research and outreach in regional planning, we propose a collaboration with ITS to build a major program in land use and transport planning aimed at supporting CA climate policy initiatives in this area. These initiatives are being driven and supported by the Office of the Governor. ESP's contribution to this program will be to house a new "Urban Land Use Modeling Center" which would include part of ICE. However, a faculty FTE to plan and coordinate the building of the new center and to leverage additional core funding to the ITS is required. It is also becoming clear (e. g. the 2005 federal transportation authorization bill SAFETEA-LU) that long term transportation planning and policy will require more formal environmental analysis and increased involvement of citizens, stakeholders, and intergovernmental organizations. We thus propose the following:

- **Recruit a new faculty member in Integrated Urban Modeling (steady state).**
- **Recruit a new CE Specialist in Transportation and Environment (modest growth).**
- **Synergies with other units: Establish a new "Urban Land Use Modeling Center" in ESP**  
Interest in urban modeling is rapidly increasing in the U.S., as the Clean Air Act air quality conformity rules require consistent land use and transport facility plans in serious and severe non-attainment regions. In addition, the recent California Climate Warming Act requires rapid reductions in greenhouse gases, with targets set for 2020 and 2050. The evaluation of combined land use policies and transport policies to reduce vehicle miles travelled and on-road emissions of greenhouse gases necessitate integrated urban models that combine travel demand and location choice models. UCD has more experience in this type of modeling than do the other UC campuses and is funded by Caltrans to lead the development and dissemination of these models throughout the state. *M. McCoy*, in the Academic Administrator track, now directs this work, and *R. Johnston*, though now retired, continues to contribute. Planned long-term state funding for this initiative is currently sufficient to support half a dozen technical staff, an agency liaison, and approximately 5 visiting modelers from the major transportation and planning agencies and international universities, and we anticipate commitments of several times those resources. The space and facilities needs for this activity are very similar to those for both the environmental informatics and evolutionary theory centers, and it would be effective to share computer and network core facilities, technical staff, flexible visitor space, etc. among them. We estimate that funding in hand can support enough researchers to fill a minimum of 2000 square feet of computer-intensive research space and an additional server/cluster machine room.
- **Water and watersheds:** The study of water and watersheds is concerned with finding science- and policy-based solutions to the management and sustainability of healthy freshwater, brackish, and saltwater aquatic systems. "Global Change, Water, and Watersheds" is one of the high priority areas of emphasis recognized by the CA&ES strategic plan and is an area of critical importance to CA&ES because of the effects of global change and other human impacts on California's streams, rivers, lakes, and seashore. Research, teaching and outreach in ESP make significant contributions to the college's strength in the study of water and watersheds. Faculty and researchers in ESP who work in this area include *C. Goldman*, *E. Grosholz*, *J. Largier*, *M.*

*Lubell, S. Morgan, B. Orlove, E. Rejmankova, A. Jassby, J. Reuter, and J. Viers.* Several of these (*Goldman, Lubell, Jassby, Reuter*) are associated with the interdisciplinary Tahoe Research Group (TRG), the Tahoe Environmental Research Center (TERC), and the Castle Lake Research Station (CLRS). Others (*Grosholz, Largier, Morgan*) have joint appointments or other links to Bodega Marine Laboratory (BML), and the Center for Watershed Sciences (*Viers*). In addition, there are broad overlaps between Water and Watersheds and other areas of strength in ESP, notably, Environmental Policy, Environmental Informatics, Regional Planning, and Conservation Biology. We thus have considerable strength in the biological, oceanographic, and policy aspects of sustainably managing watersheds in our department. However, we will likely lose *C. Goldman* to retirement in the next five years. Charles has been a key figure in the development of TRG, TERC and CLRS and has critically contributed to the preeminence of UC Davis in the study of aquatic ecosystems. Charles' loss is part of a larger trend of faculty losses in the area of "Global Change, Water, and Watersheds" even though TERC and TRG are two of the strongest pillars of our strength in this area of emphasis. In order to maintain our position as the academic center for Lake Tahoe research, a faculty FTE to build on the successes of TRG and TERC will be required. It is also becoming clear that synergisms between our department and BML are adding considerably to the research strengths in both units and are contributing to several areas of emphasis in the CA&ES strategic plan. *E. Grosholz*, our CE specialist in coastal marine resources has been a critical liaison between the two units and has played an important role in our graduate and undergraduate teaching in Water and Watersheds. We thus propose the following:

- **Recruit a new faculty member in Water and Watersheds Ecosystem Science (steady state).**
- **Seek a 20% I&R appointment for our CE specialist Ted Grosholz.** Ted Grosholz is currently our only CE specialist and is a leader in invasion biology, habitat restoration and ecosystem health. His research program spans a broad range of habitats from Central Valley watersheds through the estuaries to the ocean. His work bears directly on several areas of emphasis in the CAES Strategic Plan, including "Biodiversity and Ecosystem Services", "Global Change, Water and Watersheds" and "Science, Policy and Public Perception". We are seeking a 20% I&R appointment for Ted. This position will broaden and enhance several research and teaching strengths that are a high priority for ESP as well as provide new directions and initiatives. The I&R appointment will contribute to the development of new curricula in several potential areas including coastal resource management, habitat restoration, and invasive species science and management. Ted will figure prominently in ESP's efforts to develop increased instructional capacity at Bodega Marine Laboratory and develop new course offerings and summer programs. Ted also has experience and expertise in a range of areas including coastal and watershed conservation and restoration and would be able to develop or co-teach courses at the interface of science and science policy such as the Marine Conservation Biology course. In his research, Ted has significant experience collaborating with faculty in other departments and will continue these and other collaborations in the future. These include collaborations with *P. Moyle* (WFCB), *J. Mount* (Geology), *R. Dahlgren* and *G. Fogg* (LAWR) on floodplain restoration issues; *S. Williams, J. Stachowicz*, and *D. Strong* (all Evolution and Ecology) on ecosystem impacts and management of coastal invasive species; *G. Cherr* (Environ. Tox.), *S. Williams* (EVE) and *S. Morgan* (Bodega Marine Lab/ESP) on estuarine ecosystem health. This position is particularly appropriate for

ESP because Ted has worked successfully at the science-science policy interface, which is a core strength of our department because of its unique mix of natural and social scientists. With this I&R appointment, Ted brings strengths in several areas and can focus his teaching and research on a broad range of issues that are emerging high priorities for the College.

- **Synergies with other units**

1. **Maintain our strong links to TRG and TERC.** TRG conducts studies designed to restore and maintain the environmental health of the Lake Tahoe Basin, and TERC is committed to providing objective scientific information for restoration and sustainable use of the basin. Under the leadership of *C. Goldman* and others, notably *J. Schladow*, and *J. Reuter* these two units have achieved world class status and serve as models for interdisciplinary approaches to studying and managing whole watersheds. ESP's direct involvement with TRG and TERC over the years has produced synergies that have greatly enhanced the research, teaching and outreach activities of both units. A new FTE in Water and Watershed Ecosystem Science is essential to the future of TRG and TERC, and because of the success of our past relationship, we believe that ESP should continue its close association with TRG and TERC and will be the best home for the new Ecosystem Scientist.
2. **Increase our links to BML.** BML is devoted to an interdisciplinary scientific understanding of the environmental problems of marine and shoreline environments in northern California. Three ESP faculty either reside at or heavily utilize BML (*Grosholz, Morgan, Largier*). BML is an ideal site for conducting research and studying policy-linkages between the ocean, estuary and surrounding watershed. An increased connection with BML thus fits into our Water and watersheds area of strength as well as others (Conservation Biology, Environmental Policy, and Environmental Informatics). It is also a cost effective way to advance three of the targeted areas for growth in the CA&ES ("Global Change, Water, and Watersheds", "Biodiversity and Ecosystem Services", and "Environmental Informatics"). Finally, tighter links with BML should play a valuable role in various ESP undergraduate initiatives.
3. **Increase our links to the Interagency Ecological Program,** a consortium of 9 agencies (state and federal) and the SF Estuarine Institute which studies effects of the state and federal water projects on the SF Bay-Delta ecosystem. *Sih* is collaborating with scientists from WFCB (*Moyle, Klimley*) on a large project examining effects of an invasive waterweed on fish predator-prey interactions. In addition, *Sih* is working with an IEP-sponsored NCEAS group to use long-term, large-scale data sets to examine factors influencing changes in species abundances over space and time, with a particular emphasis on fish that are declining in abundance. The goal of preventing further decline of these fish (the 'POD' (pelagic organismal decline) species) has major impacts on water management in the Bay-Delta region. Other ESP faculty (*Jassby, Quinn, Sabatier*) also have long-time associations with IEP, Calfed, the Bay-Delta Science Consortium, and the

Delta Vision initiative, as advisors and collaborators. Facilitating interactions with IEP scientists is a goal here and in the following section.

- **Conservation Biology:** Conservation biology is a mix of both natural and social sciences and is concerned with the preservation of endangered species, the control of invasive species, the sustainable management of biodiversity, and the study of the effects of global change on natural ecosystems. Conservation biology meshes with the “Biodiversity and Ecosystem Services” area of emphasis recognized by the CA&ES Strategic Plan, and was a critical part of the Global Environmental Change and Conservation Initiative. UC Davis is widely considered to be one of the top universities in the world in this area, and ESP contains many of the relevant faculty, including *H. Cornell*, *C. Goldman*, *E. Grosholz*, *S. Harrison*, *A. Hastings*, *M. Holyoak*, *E. Rejmankova*, *J. Sanchirico*, *M. Schwartz*, and *A. Sih*. The Environmental Biology Strategic Planning Committee in 2003 argued that this area represents one of the strongest future directions for growth in excellence within the CA&ES. The most critical need in this area is to strategically maintain our tremendous existing strength as retirements occur. Fortunately, the University has already taken steps in this direction with the Global Environmental Change and Conservation Initiative which resulted in the hiring of six new faculty. Four of these joined us in ESP (*M. Baskett*, *R. Hijmans*, *J. Sanchirico*, *M. Springborn*), and one each joined the faculty of LAWR (*B. Houlton*) and PLS (*A. Latimer*). Our new hires will add considerably to the research, teaching, and outreach mission of our already strong Conservation Biology group. The most important next step is to make sure that the new hires are well-nurtured and thrive in the supportive culture of ESP and CA&ES. Suitable interdisciplinary relationships also need to be encouraged among the members of this group, both with other faculty in ESP and with researchers in other academic units. Finally, there is a clear and perceived need for better coordination and information exchange between faculty and stakeholders in the area of biodiversity and ecosystem services. We thus propose the following:
  - **A Global Environmental Change and Conservation Seminar Series.** Once all of the new hires arrive on campus, we propose a weekly seminar series where all could give presentations to introduce their work to other members of the group and other interested parties. The seminar meetings could serve as a forum for discussing common interests and brainstorming possible interdisciplinary projects. Further meetings could then be arranged as needed. ESP currently has our WISE seminar series which is designed to serve this same function within our department, and this could easily be devoted to serving the initiative group and others for the first year.
  - **Increase our links to agency scientists.** We propose to connect explicitly with agency scientists by providing offices and auxiliary research space for top-level agency scientists to occupy on a rotating basis. By bringing top agency scientists into Wickson Hall, we expect to substantially increase, in a cost effective way, their interactions with ESP faculty (and other environmental scientists in the core campus). This should ideally lead to significant increases in collaboration, shared funding, and research opportunities for our undergraduates, graduate students and postdocs. There are a number of scientists who we already interact with who would be ideal candidates: *N. Sugihara*, lead fire ecologist for the USFS; *H. Safford*, Chief Ecologist for US Forest Service, Region 5 (California, Hawaii, Guam); *P. Stine*, Director of the Sierra Nevada Research Center; *M. Nechodom*, both the senior social scientist and the lead scientist for energy policy in the Pacific Southwest Research Station – USFS Region 5; *J.*

*Cloern* of USGS, one of the most experienced aquatic ecologists and modelers working in the Bay-Delta System, *G. Erickson*, the Chief Biologist for Caltrans, *T. Keeler-Wolf*, California Department of Fish and Game – the lead vegetation ecologist for the State of California; *A. Muller-Solger*, Dept. of Water Resources; *T. Sommer*, Dept of Water Resources; and *L. Brown*, USGS, three aquatic ecologists who are key members of the IEP and POD teams. These top agency scientists would have synergistic benefits through interacting with our new Global Environmental Change Initiative faculty hires. In particular, new interdisciplinary linkages are likely to arise, which would be attractive to top agency personnel and enhance research and problem-solving opportunities. One partnership is already being formalized with the NOAA Alaska Science Center, whose non-market valuation specialist (*D. Lew*) will be doing a two-year visitation with *Sanchirico*. Additional partnerships are being developed as part of the marine ecology, economics, and policy training program.

- **Synergies with other units:** Our College contains unparalleled expertise in areas relevant to conservation biology and biological diversity, including in animal, plant and microbial ecology, systematics, biogeography, ecosystem processes, population genetics, environmental genomics and environmental informatics. There is already considerable interaction among our faculty and others elsewhere in the university who have common interests (e. g. WFCB, EVE). In addition to these and to forming linkages with agency scientists as indicated above, we see opportunities to interact more closely with PLS and LAWR where some of the new hires for the initiative reside. We also want to maintain our synergistic linkages with the Natural Reserve System (NRS) which has been invaluable in providing field sites for research in Conservation Biology.
- **Synergies among the five areas of strength:** Consistent with our interdisciplinary culture, strong synergies have developed among our five areas of strength as well as with other research units in the college and the university as a whole. Examples include the following:
  - Researchers in Environmental Policy and Water and Watersheds have collaborated to address water quality issues at Lake Tahoe. This collaboration is essential because once the reasons for water quality decline are identified, an understanding of multi-stakeholder partnerships is required for implementing policy changes to correct the problem.
  - Researchers in Environmental Informatics and Conservation Biology have collaborated to identify and target biodiversity hotspots and corridors providing wildlife migration and genetic exchange among the hotspots in California for conservation. Once the species in different taxonomic groups are identified and mapped, multiple land use values need to be considered and reconciled in order for a realistic conservation plan to be developed, a perfect job for experts in GIS and other informatics techniques.
  - Resource economists in the Environmental Policy area and theoretical ecologists in the Conservation Biology area have collaborated to determine the efficacy of marine reserves for fisheries management. Ecological theory is used to predict the effects of various preserve configurations on fisheries yield, and bioeconomic modeling is used to analyze the socioeconomic impacts of the reserves. The two approaches complement

one another and can result in more realistic decision-making for the establishment of sustainable fisheries.

- Regional Planning faculty specializing in transportation issues and Environmental Informatics faculty are exploring the relationships between transportation and land use including the impact of land use on travel behavior and the impact of transportation investments on land development patterns. The regional planning specialists use the spatial data and modeling techniques brought to the table by the informatics specialists to explore various planning scenarios and their social, environmental, economic and health impacts.
- Researchers in Water and Watersheds and Environmental Informatics are conducting a regional assessment of Sierra Nevada water resources and hydroinformatic-based modeling of changing runoff conditions under several warming scenarios. Not only does this research provide direct insight to future vulnerabilities in our aquatic ecosystems, but also provides the necessary information to assess impacts on drinking water protection, hydropower generation, water resource policy, and recreation.

In our teaching, research, and outreach, ESP plays a unique role in bring together the natural and social sciences, the two essential components to finding sustainable solutions to environmental challenges. The above are just a few examples of the research synergies that have developed from this nexus. With our new hires from the Global Environmental Change and Conservation Initiative we expect the opportunities for additional synergies to multiply rapidly.

### III. SUMMARY OF PROPOSED FACULTY POSITIONS

#### I&R/AES FTE

**Steady state:** Due to the fact that new growth FTE will be rare to non-existent in CA&ES the next five years, and in the spirit of the CA&ES Strategic Plan our FTE requests will be focused on the most critical needs for research, teaching and service in ESP. We are also aware that ESP is substantially over its FTE target. However, we expect to move much closer to our target in the next five years with the measures we are taking to increase our student/ faculty ratio (see II. Immediate Goals above). Due to the fact that we may lose at least four-six people to retirement during this period (*Cornell, Goldman, Quinn, Rejmankova, Richerson, Sabatier*), we have critical research and teaching needs that we will need to meet with replacements. We are proposing in alphabetical order five “Steady state” hires.

- 1) **Environmental Politics and Policy:** With *Sabatier’s* retirement, we will have only one member in our political science subgroup, *M. Lubell*. Having a core team of people with this expertise is essential not only for advancing an important field of inquiry whose relevance spans across all of the areas of emphasis in the CA&ES Strategic plan but also in working with natural scientists to better understand the perceptions of stakeholders and the issues concerning policymakers. While most of our faculty members are experts in modeling and quantitative analysis of environmental impacts and potential future outcomes, effective environmental policymaking also involves understanding negotiation and institutional behavior in complex politically-charged environments, managing stakeholder involvement, understanding legal and mandates and restrictions, participating in regulatory or legislative decision processes, effective communication and



advocacy of policy alternatives, etc. Employers in both the public and private sectors frequently comment that our graduates (and some of our researchers) have superb technical skills but are weak on their negotiation skills and general understanding of the policy process. Strengthening research and training in areas offered by leading policy programs like the Kennedy School is needed to increase our effectiveness in actually impacting policy. An environmental politics scholar may address any of the CAES target areas: science and policy, environment and human health, global change, or biodiversity. However, our highest priority will be a scholar who investigates the linkages between environmental science and policy decisions, which is a critical issue in all of these target areas. A researcher in science and policy can synergize with a range of different departments in CAES and campus-wide, especially given the emphasis in many grants on translating scientific knowledge into action, and the oft-expressed frustration among environmental scientists that their conclusions are not surviving in the political environment. ESP is the best home for a scholar of this type given the existence of other social scientists in the department, and also the interdisciplinary culture. We expect the start-up package for this scholar would range between \$50-75k, depending on needs.

- 2) **Evolutionary Social Scientist:** With *P. Richerson's* retirement, we will lose a critical member of our proposed Center for Evolutionary Social Sciences. *Richerson* is a world-famous scholar and one of the founders of theories of cultural evolution. Evolutionary Social Science is an exciting, growing interdisciplinary area where ESP (*Richerson, Lubell*) and Anthropology are playing a key roles on campus, and which involves using theory and experiments applying evolutionary principles to understand human behaviors that are central to key issues in the Social Sciences (including political science, anthropology, economics, psychology, sociology and others). *Richerson, Lubell* and others at UCD have already secured two NSF grants to support research in this area, and are continually submitting new proposals for extramural funding for a new graduate training grant and new computing facilities in this field. This faculty position would be an important component of the new multidisciplinary Evolutionary Center for Social Science. It would also create synergies with faculty in the Department of Anthropology. Evolutionary social science connects to broader CAES and department goals in two main ways. First, evolutionary social science directly applies evolutionary and ecological models to the study of human behavior, and there has been a large amount of intellectual dialog between social and natural scientists in exchanging theories and methods. Second, cultural and institutional evolution is a central concern in all six of the CAES study areas, where policies, attitudes, and behaviors are continually changing and influencing social, economic, and environmental welfare. We expect the startup for this position to be \$75-100k depending upon needs.
- 3) **Integrated Urban Modeling:** This position is essential for bringing in a faculty senate member to lead the urban modeling program at UCD. Research in integrated urban modeling links land use, travel behavior, urban economics, energy, and ecology to create integrated models of urban and regional activities. Such models address tradeoffs and impacts of different social and economic policies. A researcher in integrated urban modeling can synergize with all of the social science researchers and some of the ecology researchers in the department, as well as with a range of different departments across campus. This person could help to fill key curricular needs (ESP179 and 179L) and head up the development of a new graduate program in urban modeling (e.g., as a designated emphasis for students in Geography, Transportation Technology and Policy, or Ecology). ITS is very strongly committed to this position, and this also is a top priority of the Governor who is trying to get a large increase in the ITS budget specifically for this initiative. The position would solidify UCD as the leading institution in the state in this area. We expect the startup for this position to be \$75-100k depending upon needs.
- 4) **Trans-boundary Environmental and Natural Resource Policy:** Our campus does not have a trans-boundary environmental and natural resource policy scientist and ESP is a natural home for this position

because of its interdisciplinary natural and social science research. Such a scientist would strongly complement our recent hires from the Global Change Initiative. As part of that initiative, we hired *M. Springborn*, whose research focuses on individual decision-making and adaptive management in the context of global environmental problems. This new position focuses more on trans-boundary government policies and treaties for managing global public goods and bads. Examples of these policies include AB32 in California, the Kyoto protocol and other international treaties, and comparative analysis of global change policies across different countries, sustainably managing global marine fisheries, or the trade issues posed by policies to protect agriculture and native species from invasive pests and diseases. The position will also support the CAES strategic plan Science, Policy and Public Perception by studying citizen responses to policies that target global change problems. There are currently no classes at UCD that focus specifically on the policy, economics, and politics of continental-to-global-scale environmental changes; this is a very glaring gap given the importance of these issues. This position will expand the international reputation and importance of UC Davis research by targeting scientific and practitioner networks similar to those being built by *T. Tomich* in the ASI. There are also many other natural partnerships with existing global change natural scientists both within ESP and in other departments in CAES such as LAWR and Agricultural and Resource Economics. Understanding the development, implementation, and assessment of these policies and treaties will also inform how California responds to issues like climate change, international fishery and wildfowl treaties (e.g., the closing of Kesterson), air and water pollution issues (e.g., with Mexico), ozone depletion, exotic species in ballast water, deforestation in South Asia and South America etc. We seek a quantitative social scientist to help study and formulate innovative policy solutions to these and other global environmental problems. We expect the startup for this position to be \$50-75k depending upon needs.

- 5) **Water and Watersheds Ecosystem Scientist:** Although UCD has great overall strength in ecology and environmental analysis, the campus currently has few scientists conducting biological research on the scale of watersheds and ecoregions. Research on processes at this scale involves integrating studies of major physical drivers, human influences, and biological ecosystem responses. Quantitative analyses typically require geographically-explicit methods (e.g., remote sensing and spatial statistics) that are currently under-represented on our faculty. This position should provide an invaluable interface with scientists in a variety of public agencies, with the CESU, and with various science and policy issues at the state and regional scales. The person would also help fill key curricular needs (ESP 110, and likely courses in GIS, remote sensing or large-scale modeling for environmental problem-solving). Our campus has a long tradition of strength in biological limnology. It would be a great loss for an institution with this magnitude of investment in the environmental sciences, and this history of research excellence in this area, to lose its only biological limnologist and not replace him. Both LAWR and WFCB share a joint interest in developing a new core research program in biological limnology to continue this area of excellence. We have a number of strong opportunities for success in this area if we were to act now. Ideally we think that this position should be at the Associate Professor level to find somebody at an early but established stage in their career who has already proved his/her strengths. We strongly urge the college to act now on this position and we offer all of our help in making this replacement possible. We expect the startup for this position to be \$250-300K depending on needs.

**Modest growth:** We propose just one modest growth position with a detailed justification. However, in the event that more growth is possible over the next five years, several recommended options for new FTE in the CA&ES Strategic Plan would be appropriate for ESP. There are also additional options that we believe would

make fundamental contributions to our college's strength in environmental science and policy. Rather than offer detailed justifications for these, we simply list them for future consideration. They are listed in alphabetical order.

1) **Endowed Chair in Environmental Science and Policy:** We propose to initiate this effort with a rotating Eminent Fellows program where we will sponsor leaders in environmental policy to come to UC Davis for periods of one quarter to one year to teach courses in practical environmental management and policy. At first, we envision attracting leaders from California, many of whom are based in San Francisco or Sacramento, to spend short periods in residence. The recognition generated by the initial resident Fellows should help in raising additional endowment funds that will allow us to provide year-long, sabbatical-like fellowships to national and international leaders in the field. We will target individuals with practical experience in environmental management, for instance, directors of environmental organizations, many of whom were originally trained as scientists but who are now influential in the policy realm. This program should serve an invaluable role in developing research collaborations, enhancing undergraduate and graduate education, and in outreach to the public, bringing substantial recognition to the department, the College, and UCD.

- 1) Environmental conflict resolution
- 2) Environmental impacts of agriculture and global change
- 3) Environmental policy, planning, and protection
- 4) Fire ecology
- 5) Landscape modeling
- 6) Marine policy
- 7) Planning and community change
- 8) Public health and the environment
- 9) Public policy and recreation
- 10) Wildlands management

## **CE FTE**

**Modest growth:** Our CE role within CA&ES is to provide education and outreach to help solve problems in agriculture and the environment that are facing Californians. Currently, ESP has one of the smallest CE programs within CA&ES with one CE specialist, *E. Grosholz*, devoted to the development, application, and communication of new knowledge to stakeholders concerned with invasive coastal species, their ecological and economic impacts and the restoration of managed and invaded habitats. We are seeking a partial I&R appointment for Ted to reflect his contributions to our teaching and graduate student training missions as well. We see at least three additional areas where critical statewide needs could be met with new CE specialists in ESP. These needs cannot be met by partial CE FTEs to existing faculty because stable and expert contacts for funding partners and outside consumers of outreach and education are required. In addition, the roles played by these contacts are more appropriate to Specialists with formal responsibility for liaison with agencies and stakeholder groups than they are for I&R faculty acting on an ad-hoc extramurally funded basis. Our proposals are listed in alphabetical order.

1) **CE Specialist in Environmental Informatics:** Now that we have high-level research expertise in environmental informatics, there is a parallel need for environmental informatics outreach. In the past, this need has been met by PI's and graduate students, a clearly unsustainable situation. This CE specialist's

research program will apply large environmental data sets and models to scientific assessments of environmental policy alternatives relevant to biodiversity, land use and water resources in the region. The person's outreach program will serve the needs of a broad group of regional stakeholders including university and agency researchers, public land managers, environmental regulatory and planning agencies, private landowners and NGOs. Demand and funding for such outreach has been increasing, clearly justifying a designated point-of-contact on campus. This person will provide extremely valuable support to other CE specialists and advisors in linking diverse stakeholders to public information resources. This position has potential cross-over to other CA&ES initiatives, such as Water and Watersheds and Sustainable Agriculture. We expect the startup for this position to be \$20-30k depending upon needs.

- 2) **CE Specialist in Environmental Risk Management and Communication:** The study and practice of environmental risk management and communication provides linkages between agricultural ecosystems, conservation management, environmental health, public policy, and human decision-making and behavior. The list of environmental risks in California is long and complex, with frequent discussion in international and national news, the most prestigious environmental journals, and the highest offices of government. Research on environmental risk takes data from the natural sciences, epidemiology or toxicology on risk assessment (e.g., for agrochemicals or hazardous wastes) and integrates it with information from the policy sciences on risk perception, value tradeoffs, and organizational behavior. The disciplinary background for this position would include political science, behavioral decision-theory, economics, ecology, and epidemiology/toxicology. Risk management encompasses both natural and social science expertise, and thus is a natural fit for ESP's interdisciplinary environment. There is also a need on campus for more investment in risk management and outreach. As far as we know, the only other person in the college who explicitly specializes on risk management is *C. Bruhn* in the Food Science and Technology program. *Bruhn* focuses specifically on how consumers respond to food safety risks such as irradiated food. Our CE position would focus on the much broader range of environmental risks that directly interface with agriculture, as well as many other environmental issues in California, the US, and internationally. We expect the startup for this position to be \$10-20k depending upon needs.
- 3) **CE Specialist in Transportation and the Environment:** ESP researchers (often in collaboration with ITS) have been working with municipal, county, and state planning and transportation agencies to meet these requirements for future federal transportation funding, and represent much of the applied expertise in the UC system on these issues. At the analytical end, assessments of impacts of transportation alternatives on the behavior, health, and economics of urban populations are increasingly required. On the regional scale, counties, COGS (councils of governments) and MPO (metropolitan planning organizations) are conducting "Planning Blueprint" exercises to systematically evaluate future impacts under competing scenarios and to gauge public preferences among alternatives. ICE has provided much of the technical underpinnings for Blueprint processes currently underway. Planning for connectivity among natural areas is also an increasing concern, particularly with the challenges of climate change. ESP and ITS researchers have also been lead technical partners with Caltrans and COGs in addressing these issues. All continue to be well-funded, but their effectiveness is limited by our inability to fully support policy negotiations among planners and the private sector and technical implementation at the level of metropolitan areas and regional intergovernmental initiatives (e.g., the shared Blueprint in the 8 San Joaquin Valley counties). We believe an experienced transportation policy specialist could solidify interactions among UCD and the major infrastructure planners in the state, greatly enhance the policy effectiveness of strong research group in transportation and the environment, and help institutionalize our role as the leading academic organization in California transportation policy. We expect the startup for this position to be \$10-20k depending upon needs.