Richard P. Thompson, PhD, RPF
Natural Resources Management Department
California Polytechnic State University
San Luis Obispo, CA 93407

March 2, 2011

Mr. Patrick O'Neill
HDR, Inc.
8690 Balboa Avenue, Suite 200
San Diego, CA 92123

Re: Comments regarding the ECO Substation, Tule Wind, and ESJ Gen-Tie Project Draft EIR/EIS, Section D.15, Fire and Fuels Management

Dear Mr. O'Neill:

Thank you for the opportunity to provide the following comments on the Draft Environmental Impact Report/Environmental Impact Statement for the East County Substation/Tule Wind/Energia Sierra Juarez Gen-Tie Projects (Draft EIR/EIS).

I. INTRODUCTION AND STATEMENT OF QUALIFICATIONS

My name is Richard Thompson, Ph.D., and I am a Professor of Natural Resources Management at the California Polytechnic State University, San Luis Obispo, where I also serve as the Director of the Urban Forest Ecosystems Institute. My resume is attached to this letter.

I am submitting the following analysis at the request of HDR Engineering, Inc., which is the prime consultant employed by Tule Wind, LLC for the Tule Wind Project.

The following analysis is relevant to the evaluation of fire risk associated with the Tule Wind Project's wind turbines, as discussed in Section D.15, Fire and Fuels Management, of the Draft EIR/EIS.

II. CALCULATING THE RISK OF WILDFIRE FOR FIRE SUPPRESSION-EQUIPPED WIND TURBINES

Question: What is the annual probability of a fire occurring in a turbine nacelle, escaping suppression and containment systems in the nacelle, and escaping initial firefighting attack efforts?

Assumptions:

1. A wind energy facility in eastern San Diego County performs in a similar fashion as the average of such facilities statewide.
2. All probabilities are based on averages reported by the National Fire Protection Association (NFPA) and the National Institute of Safety and Technology (NIST), and Iberdrola Renewables, Inc.
3. Only mechanical failure and lightning strikes are the causes of turbine fires. A fire in one turbine does not increase the probability of an ignition in adjacent turbines.
4. All the various risk factors have been identified and quantified, except arson or sabotage.
5. Fire service response time is sufficient for such a facility.

Analysis:
Note that the analysis below is based on a number of assumptions based on the information provided to me, which appears after my own review to be the best data available at this time. No conclusions can be made with statistical certainty. This assumes no interaction between the variables used in this analysis, and presents simple probability estimates based on means with no variances. The following analysis makes predictive observations that are offered for consideration to the fire agencies and decision-makers evaluating the Tule Wind Project in eastern San Diego County, California.

1. Probability of a fire starting in the nacelle.
   Between 2008-2010, there was an average of 1.3 fires per year in a population of approximately 11,000 operating turbines in California (Iberdrola Renewables, Inc. 2010). Based on information available, this rate would include fires started from both lighting strikes and/or mechanical failure. This statistic averages a wide range of turbine ages and facility designs.

   a. The probability of lightning-caused fires should be a relatively constant risk over many years.
   b. The probability of fire starts from mechanical failure should be an accumulating risk. This should be estimated using a Poisson probability function, e.g., it should be similar to failure analysis of a light bulb. To estimate a Poisson probability requires data from the manufacturer, assuming that such failure experiments were conducted.

      Lacking the information, I'm assuming a constant risk of mechanical failure annually. Such an assumption is reasonable since the wind turbine manufacturer recommends a maintenance cycle to ensure wind turbine reliability, thereby diminishing the cumulative nature of mechanical failure risk, and is based upon an overall average of wind turbine performance across the State over multiple years. The result is a much higher probability estimate than by using the Poisson pdf. Assuming that the incident rate during 2008-2010 period studied above is reflective of the probability of a fire over any given period, then the probability of a fire occurring in the future is:

      prob{fire starting in a nacelle} = 1.3/11000 = .000118 or **0.0118% per year**

2. Probability of the nacelle fire suppression system failing

   National Fire Protection Association (Hall 2010) studied the effectiveness of water-based sprinkler systems and concluded that they are highly effective. Their effectiveness depends upon being functional (turned-on) and their capacity to contain the fire within the housing of ignition. There appears to be no scientific evidence on the effectiveness of alternative suppression systems such as the gas-pressurized ("clean" system) in this project.

   NFPA estimates show that water-based sprinkler systems operate 91% of the time. However, 64% of the 9% failures resulted from the sprinkler system being turned-off, for whatever reason. Therefore, operational water-based sprinkler systems appear to be at least 96% reliable to operate (1.0 - (0.36 x .09) = 1.0 – 0.0324 = 0.9676).[1]

   The same fire study also reports that 96% of the time sprinklers were effective in confining the fire to the housing of origin (Hall 2010). The fire suppression system in the turbine nacelles will

[1] To account for the small percentage of systems that were turned off, but might not have operated even if they were on, I have rounded down to 96%.

not be a water-based sprinkler system. However, Fire Chief David Nissen of the San Diego Rural Fire Protection District considers the "approved alternative automatic fire suppression system" equivalent to water-based systems (Hunt 2011). Given the fact that the turbine fire suppression systems are tailored to the nacelle and are not vulnerable to any operator error, along with expert opinion, it seems reasonable to conclude that they should be more effective than sprinkler systems. Therefore, it seems reasonable to conclude that the project's suppression systems are at least as effective as water-based systems that contain 96% of fires to the room (housing) and operate 96% of the time.

So, there is a 96% probability that a fire suppression system will operate and, of those instances, there is a 96% probability that the suppression system will confine the fire to the housing. The result is that there is 92% probability that a fire igniting in the housing will not escape the housing. The probability of failure in confining a fire to the housing is calculated as follows.

prob{fire suppression system failure & escaping the housing} = 1.0 –(0.96 x 0.96) = .0784 or about **8% per year**

3. Probability of an unsuppressed turbine fire

At this point in the sequence of probabilities, there is 0.0118% likelihood of a fire starting in a turbine and an 8% probability it will not be confined to the nacelle housing, giving the probability of an unsurpressed nacelle fire as:

prob{fire starting and escaping the nacelle} = .000118 x .08 = .0000094 or **0.00094% per year.**

4. Probability of an unsuppressed nacelle fire escaping containment from the vegetation-cleared turbine footprint and exceeding 10 acres in size.

Each turbine site has vegetation modification within a 200 foot radius from the base of the turbine. NIST data indicates that 3% of wildland fires escaped initial attack (Stephens and Ruth 2005), which is defined as a fire exceeding 10 acres in size. Therefore,

prob {nacelle fire starting and completely escaping the clearance and initial attack} = .000118 x .08 x .03 = .00000028 or **0.000028% per year**.

That is an effectiveness rate of 99.999972%, or put another way, **the probability of an uncontained nacelle fire is less than 1 every 3.5 million** years (28/100,000,000 = 1/x).

5. Probability of the Tule Wind Project facility having a fire start and escape both the nacelle and initial attack

Given the linear pattern of the facility, no complementary fire protection is created among the turbines. As such, the facility's risk for wildfire is the conjoint probability of a fire occurring at any 1 or more of the 128 turbines. Therefore, the final probability estimate is

prob {nacelle fire starting and completely escaping the clearance and initial attack in 1 or more of the 128 turbines in the Tule Wind Project facility} = 1 – [(1-(.000118 x .0784 x .03)^{128}] = .000036 or **0.0036% per year.**

That's 99.9964% effective, or a likelihood of less than 1 uncontained turbine-caused wildfire every 27,000 years (36/1,000,000 = 1/x).

Conclusions:
The final probability of a fire occurring and escaping containment of 0.0033% should remain fairly stable over the life of the project, since the original estimate of nacelle fires (1.3 fires/11,000 turbines) was based on a wide range of facility ages and designs.

These are simple probability estimates based on means with no variances. No statistical inference statement can be made, such as I am 99.9% confident that there's a 1% chance of a fire escaping the wind energy facility in the next 30 years. Such a statement requires annual data on the number of incidents for many years to calculate a mean and sampling error.

III. CLOSING

The preceding comments are submitted with the objective of providing information regarding wind turbine-related fire risk to help the Draft EIR/EIS preparers and reviewers to better understand and quantify the potential net fire risks associated with the Tule Wind Project. Please do not hesitate to contact me with any questions.

Respectfully submitted,

Richard P. Thompson, PhD, RPF
Enclosure

References

Hall, John. U.S. Experience with Sprinklers and Other Automatic Fire Extinguishing Equipment. National Fire Protection Association, Fire Analysis and Research Division. September 2010.

Hunt James W. personal communication with Fire Chief David Nissen. Hunt Research Corp., February 2011.

McDonald Harley, K. Disproving Alleged 35 Turbine Fires Per Year Statistic Cited in International Association of Electrical Inspectors News Magazine, memo to James Pine, San Diego County Fire Marshall, Iberdrola Renewables, 25 October, 2010.

RC Biological Consulting, Inc. Fire Protection Plan for the Tule Wind Project, prepared for HDR Engineering, Inc., Environmental Review Number 3910-1000001, Nov. 3, 2010.

Stephens, Scott L. and Lawrence W. Ruth. 2005. Federal Forest Fire Policy in the U.S. Ecological Applications.

Curriculum Vitae
Richard P. Thompson, PhD, RPF
2011

Natural Resources Management Department
College of Agriculture, Food and Environmental Sciences
California Polytechnic State University
San Luis Obispo

Earned Degrees

Ph.D. Natural Resources/Environmental Economics, Texas A&M University, 1990
M.S. Forest Economics, Oklahoma State University, 1978
B.S. Forest Management, Oklahoma State University, 1974

Credentials

- Registered Professional Forester, California, License No. 2455
- Registered Professional Forester, Oklahoma, License No. 118
- Professional Rural Appraiser, American Society of Farm Managers & Rural Appraisers, 1986

Honors, Awards and Certificates

- Acting Head (standing), Natural Resources Management Dept., CAFES, Fall 2006 - present
- Sunkist Sustained Excellence Faculty Award, College of Agriculture, Food and Environmental Science, 2006.
- Elected Director of the Urban Forest Ecosystems Institute, College of Agriculture, California Polytechnic State University in January 1998.
- Tenured and Promoted to Full Professor, Cal Poly, San Luis Obispo, June 1995.
- USDA Certificate of Appreciation for "Superior Contribution to the Development of the Food and Agricultural Education Information System", signed Secretary of Agriculture, 1989
- Certificate of Appreciation for teaching, College of Agriculture, Cal Poly, Feb., 1991, 1992, 1994
- Xi Sigma Pi, National Honorary Society of Forestry
- Gamma Sigma Delta, Honorary Society of Agriculture

Thesis and Dissertation

Thompson, R. P. Demand for Higher Education in the Agricultural and Natural Resource Sciences. Ph.D. Dissertation. Texas A&M University, Aug., 1990, College Station, TX.

Thompson, R. P. Forest Management Characteristics, Attitudes, and Objectives of Private Non-industrial Landowners in Eastern Oklahoma. M.S. Thesis. Oklahoma State University, July 1978, Stillwater, OK.

Professional Affiliations

- Association of Environmental Professionals, member since 2006
- American Agricultural Economics Association, member since 1993
- Society of American Foresters, member since 1972
- Forest Products Society, 1987 - 1990
- American Society of Farm Managers and Rural Appraisers, member 1987 - 1991
- American Forests, member 1998- 2004
- California Urban Forest Council, member since 1998

- California Licensed Foresters Association, member 1993-1994
- Western Forest Economics Workshop Group, member since 2004
- Southern Forest Economics Workshop Group, member since 1978

Areas of Expertise

- Natural Resource/Environmental Economics & Finance
- Statistical Analysis & Econometrics
- Non-market Valuation Theory and Methodology
- Environmental Damage Valuation
- Rural Land Appraisal - certified Professional rural appraiser, American Society of Farm Managers and Rural Appraisers, 1986

Professional Education and Training

- Appraisal Theory and Practice Courses, American Society of Farm Managers and Rural Appraisers (ASFMRA)
- Production Management Training, Weyerhaeuser Co., 1981
- Chemical Applicator Training, Weyerhaeuser Co., 1980
- Human Resources Management Training, Weyerhaeuser Co., 1980.

Professional Experience

Program Coordinator, FNR and ENVM Degree Programs, 2007 to present

Director, Urban Forest Ecosystems Institute, CAFES
Polytechnic State University, 1997 to present

Professor, Natural Resources Management Department, CAFES, California Polytechnic State University, September, Assoc. Prof. 1990 to 1995, Prof. 1995 to present

Research Associate, Department of Forest Science, Texas A&M University, October 1986 to August 1990.

Consultant , Duck Creek Associates, Stillwater, Oklahoma, February 1983 to October 1986. As Co-Director and Corporate Secretary, I was responsible for numerous projects for clientele such as the U.S. Department of Justice, U.S. Internal Revenue Service, U.S. Forest Service, U.S. Department of Indian Affairs, and numerous large and small firms and individuals. Major projects included (1) economic analysis of the old-growth redwood resource relating to the expansion of the Redwood National Park, (2) industrial timberland appraisals throughout the South for tax purposes, (3) timber inventories of the Cibola and Mark Twain National Forests, and (4) rural land and environmental damage appraisals. See Part I, Section I - "Consultant Reports".

Instructor and Research Associate, Department of Forestry, Oklahoma State University, February 1982 to February 1983.

Plans and Operations Forester, Oklahoma-Arkansas Region, Weyerhaeuser Company, Wright City, Oklahoma, July 1979 to February 1982.

Research Associate, USFS/OSU Cooperative Research Project, Department of Forestry, Oklahoma State University, September 1978 to July 1979.

Intern, USDA Forest Service, Forest Resource and Economics Research Staff (FRER), Washington Office, June 1978 to September 1978.

Peer-Reviewed Publications and Papers

Thompson, R. P. “State of the California Urban Forest – Status and Trends 1998 to 2003.” Urban Forest Ecosystem Institute, Technical Report No. 13, July 2006.

Thompson, R. P. and C.A. Dicus. THP Costs, in Proceedings of Western Forest Economists Convention, May 2-4, 2005, Welches, OR.

Thompson, R. P. and C.A. Dicus. The Impact of California's changing Environmental Regulations on Timber Harvest Planning Costs, California Institute for the Study of Specialty Crops, Cal Poly, San Luis Obispo, March 2005.

Thompson, R.P., J.E. Noel, and S.P. Cross. Oak Woodland Economics: A Contingent Valuation of Conversion Alternatives. Proceedings of the Fifth Symposium on Oak Woodlands: Oaks in California's Changing Landscape, Oct. 22-25, 2001, p. 501-510.

Thompson, R.P., J.E. Noel, R. Hanna, and D.D. Piirto. 1999. "Hedonic Valuation of Forest Aesthetics on Small Urban-Interface Properties" *J. of Arboriculture*, 25(5): 225- 234.8.

Thompson, R.P. and J. Ahern. "State of the California Urban Forest – Status and Trends since 1998." Urban Forest Ecosystem Institute, Technical Report No. 9, March 2000.

Shelly, J. R. and R. P. Thompson. Woody Waste to Value-Added Product in California. National Conference on Wood Waste Utilization, The National Arbor Day Foundation, Nebraska City, NB. May 4-5, 2000.

Dietterick, B.C., R.Strohman, R.P. Thompson. Threading GIS throughout a Forestry and Natural Resources Curriculum. *Proceedings for ESRI International User Conference*, San Diego, July 26-30.

Pillsbury, N.P. R. P. Thompson and J. Reimer, "Tree Volume Equations for Fifteen Urban Species in California." Urban Forest Ecosystems Institute, Tech. Report No. 7. California Polytechnic State University, San Luis Obispo, 45 pp., June 1998.

Pillsbury N.P, R.P. Thompson, W.R. Mark, 1998. "Design and Implementation of an Ecosystem Management Based Curriculum: a Case Study." presented to the Academic Program Section Summer Conference, Board of Agriculture, Commission on Food, Environment, and Renewable Resources, San Luis Obispo, CA, June 27-29, 1998.

Piirto D.D., R.P. Thompson, and K.L. Piper, 1997. "Implementing Uneven-Aged Redwood Management At Cal Poly's School Forest." presented to the International Union of Forest Research Organizations (IUFRO), September 1997.

Thompson, R. P. "Summary of the Economics, Policy and Planning Technical Session." *Proceedings of the Fourth Symposium on Oak Woodlands: Ecology, Management, and Urban Interface Issues*, March 19-22, 1996, California Polytechnic State University, San Luis Obispo.

Kruger, B. S. and R. P. Thompson. "The Effect of Sociological Factors, Attitudes, and Beliefs on Private Oak Woodland Management." *Proceedings of the Fourth Symposium on Oak Woodlands: Ecology, Management, and Urban Interface Issues*, March 19-22, 1996, California Polytechnic State University, San Luis Obispo.

Noel, J. and R. P. Thompson. "California Oak Woodlands Management: Uncertainties and Modeling." *Proceedings of the Fourth Symposium on Oak Woodlands: Ecology, Management, and Urban Interface Issues*, March 19-22, 1996, California Polytechnic State University, San Luis Obispo.

Hanna, R. J., R. P. Thompson, D. D. Piirto and J. Noel. "Economic Contribution of Stand Characteristics to Property Value." *Proceedings of the Fourth Symposium on Oak Woodlands: Ecology, Management, and Urban Interface Issues*, March 19-22, 1996, California Polytechnic State University, San Luis Obispo.

Piirto, D. D. and R. P. Thompson. "Practical Implications of Implementing Uneven-aged Coast Redwood Management at Cal Poly's School Forest." *Proceedings of the 1996 Redwood Symposium*, Arcata, CA, March 1996.

Pillsbury, N.P. and R. P. Thompson, “Tree Volume Equations for Fifteen Urban Species in California.” Urban Forest Ecosystems Institute, Interim Report. California Polytechnic State University, San Luis Obispo, 45 pp., 1995.

Thompson, R. P. “Benefit-Cost Analysis Methods in Sustainable Urban Forestry” paper presented to the “One California Forest” Workshop, April 1995, San Jose, CA.

Thompson, R. P. “Benefit-Cost Analysis in Urban Forestry Sustainability” paper presented to the “One California Forest” Workshop, March 1995, Anaheim, CA.

Thompson, R. P., N. H. Pillsbury, R. Hanna. "The Elements of Sustainability in Urban Forestry." Urban Forest Ecosystems Institute for the California Department of Forestry and Fire Protection, Technical Report No. 1, 56 pp., July 1994.

Thompson, R. P., O. Capps Jr., and J. G. Massey. 1994. "Demand for an Agricultural Education." *American Journal of Agricultural Economics*, 76(2): 303-312.

Thompson, R. P. 1993. "Compensated Takings and Negotiated Solutions." feature article *J. of Forestry*, 91(4): 14-18.

Thompson, R. P. "Forestry Education in California: Is it Needed Anymore?" paper presented to the NorCal SAF Society Symposium on Forestry Education, June 1993, Quincy, CA.

Piirto, D. D. and R. P. Thompson. 1992 Integrated Resource Management at Swanton Pacific Ranch--A Beginning. Presented at the USDA Forest Service Silvicultural Workshop held on June 3, 1992 in Sacramento, California.

Massey, J. G., R. P. Thompson, R. P., and C. N. deHoop. 1989. "The Utility of Knowledge Based Systems to the Forest Products Industry." *Forest Products Journal*, 39(11/12): 37-40.

Thompson, R. P. and J. G. Massey. 1989. "Trends in Baccalaureate Graduates." *NACTA Journal*, 33(1): 3-6.

Massey, J. G. and R. P. Thompson. "The Value of Expert Systems in the Forest Industry: the Hype and the Reality." *Proceedings of the 1989 Southern Forest Economics Workshop*, March 1989, San Antonio, Texas.

Thompson, R. P. "FAEIS ON-LINE: An Interactive Version." Invited Paper/Demonstration at the National Association of State Universities and Land Grant Colleges Convention. November, 1988, Washington, D.C.

Olson, K. W., R. L. Moomaw, and R. P. Thompson. 1988. "Redwood National Park Expansion: Impact on Old-Growth Redwood Stumpage Prices." *Land Economics*, 64(3): 269-275.

Olson, K. W., R. L. Moomaw, and R. P. Thompson. "Redwood National Park Expansion: Did Anticipation Enhance Stumpage Prices?" *Proceedings of the 1987 Western Economic Association Conference*, July 1987, Vancouver, British Columbia.

Thompson, R. P. "Income Taxes and Timber." Paper presented to the Oklahoma Chapter of the Society of American Foresters, April 1986, McAlester, Oklahoma.

Jones, J. G. and R. P. Thompson. "Characteristics, Attitudes and Objectives of Nonindustrial Private Forest Owners in Eastern Oklahoma." Oklahoma State University Agricultural Experiment Station, Research Report P-816, August 1981.

Thompson, R. P. and J. G. Jones. 1981. "Classifying Nonindustrial Private Forestland by Tract Size." *J. of Forestry*, 79(5): 288-291.

Consultant Reports

Thompson, R.P. and M.D. Shelton. “Information Gathering Phase” for Sustainable Agriculture and Forestry on the East-West Ranch, Cambria for the Coastal Resources Institute, January, 1998.

Thompson, R.P. An Environmental Study on the Culture and Stocking of Trout in California, Coastal Resources Institute, April 1996, 101 p.

Latham, R. P. and R. P. Thompson. "The Impact of the Expansion of the Redwood National Park on Old-Growth Stumpage Prices." Prepared for Hammon, Jensen, Wallen & Associates, Oakland, CA. and the Land and Natural Resources Division, U.S. Dept. of Justice, Washington, D.C., February, 1985.

Thompson, R. P. and R. P. Latham. "An Analysis of 631(a) Claims by International Paper Company." Phase I report prepared for the Department of the Treasury, Internal Revenue Service, Washington, D.C., April, 1984.

Thompson, R. P. “Damage Appraisal of the Stubbs Property in Seminole Co., Oklahoma.” A Report prepared for Sun Exploration and Production Co., Oklahoma City, OK in the case of Martha Stubbs vs. Sun Exploration and Production Company, Case No. CIV-85-441-E, July, 1985.

Educational Materials Published

The following study guides were designed and continually updated to assist the student in progressing through the subject matter at the rapid quarterly pace.

1. Natural Resources Policy Analysis, Study Guide, 7 th Edition, El Corral Bookstore
2. Natural Resource Economics & Valuation, Study Guide, 9th Edition, El Corral Bookstore
3. Sustainable Forest Management, Study Guide, 4th Edition, El Corral Bookstore
4. Urban Forestry, Study Guide, 4th Edition, El Corral Bookstore
5. Applications in Econometrics and Biometrics (co-author), 3rd Edition, El Corral Bookstore
6. Forest and Natural Resources Valuation Study Guide, 3rd Edition, El Corral Bookstore, 1994
7. Natural Resources Economics Study Guide, 3rd Edition, El Corral Bookstore, 1994
8. Natural Resources Administration Study Guide, 2nd Edition, El Corral Bookstore, 1993
9. Forest Management and Multiple-Use Planning, (co-author), 3rd Edition, El Corral Bookstore, 1994

Significant Research Projects (Grants & Contracts)

Co-PI, Statewide Urban Forest Inventory, USDA Forest Service, FIA grant, 2010 $992,000

PI, Identification of forestland management and market conditions for profitable investment in carbon storing forestry-offset projects using the California Climate Action Registry protocols, McIntire-Stennis & ARI, 2010 $37,000

Co-PI, California Disaster & Capability Preparedness Assessment Project, California Department of Homeland Security/ Office of Emergency Services, 2007, $160,265

Consultant, Environmental damage appraisal on a wildland-urban interface forested property, Henderson & Borgeson, Attorneys at Law, Santa Barbara, 2007 $14,000

Characterizing the Regulatory Environment affecting the Forest Products Industry in California, California Forest Products Commission & the California Institute for the Study of Specialty Crops, Cal Poly, 2004 $106,196

2004 Survey of Urban Forestry in California, CDF-F, 1998 -2000, co-PI $25,000

Development of Product Standards and Internet Market Site for California Urban Solidwood Materials, System-wide ARI,CDF-F, and the California Integrated Waste Management Board, 2001 $138,272

Establishing an Uneven-aged Growth and Yield Project at Swanton-Pacific, McIntire-Stennis Grant, co-PI, 1998-2003 $62,000
Oak Woodland Policy Decision Support System, Phase IIIb, McIntire-Stennis Grant, 1997-98, PI, 1997-1998 $17,000
Integrating the FNR Upper-Division Core through Ecosystem Management. Boswell Grant, PI, 1998 $10,000
1998 Survey of Urban Forestry in California, CDF-F, co-PI, 1998 -2000 $40,000
Development of CDF-F Shortcourse on Growth & Yield, Swanton-Pacific CFI System, Cal Poly Foundation, Summer 1997 $38,000
Development of a GIS Decision Support System for Oak Woodland Policy Analysis, Phase II, McIntire-Stennis, PI, 1997-1998 $10,985
Implementing an Ecosystem Management Philosophy in the Forestry and Nat. Res. Curriculum, USDA/Higher Education Challenge Grant Program, co-PI, 1995-1997 $200,000
Development of a GIS Decision Support System for Oak Woodland Policy Analysis, McIntire-Stennis, PI, 1996 $11,000
Land Values, Homeowner Concerns and Stewardship of the Ponderosa Pine/Mixed Conifer Interface Forest of California, California Resources Agency, CDF, Urban Forest Ecosystems Institute, co-PI, 1994 $75,464
An Environmental Impact Study on the Culture and Stocking of Resident Trout and Inland Salmon in California, California Resources Agency, CDF&G through the Coastal Resources Institute, 1 of 6 co-investigators, 1994 $120,000
Urban Forest Profiles for Sustainability, California Resources Agency, CDF through the Urban Forest Ecosystems Institute, PI, 1994 $50,000
K-Career Equity Leadership Program of the Natural Resources Management Department, a proposal to theUSDA Forest Service, Soil Conservation Service, USDI Bureau of Land Management and Park Service, co-PI, 1994 $100,000

Masters Thesis Advisor

- Barbara Kruger, M.S. awarded 1993
- Richard Hanna, M.S. awarded 1995, received Cal Poly Award for Best Graduate Research
- Sarah Cross, M.S. awarded 2003
- Marcello Espiritu, thesis committee member, UC Berkeley, M.S. awarded 2004
- Michael Garcia, M.S. awarded 2008
- Sarah Spann, active graduate student
- Steve Auten, active graduate student

Courses and Laboratories Taught

1. Natural Resources Management and Society (FNR 101), 92
2. Career Development in Forestry & Environ. Mgmt. (FNR 140), 04 - present
3. Intro. to Forest Ecosystem Mgmt. (FNR 201), 99 - 00
4. Natural Resources Policy (FNR 302), 90 - 97
5. Forest Mensuration, Lab Section (FNR 314), 92 - 99
6. Growth and Yield (FNR 316), 92 – 97
7. Natural Resources Economics and Valuation (FNR 326), 99 - present
8. Urban Forestry (FNR 350), 01 - 08
10. Natural Resources Economics (FNR 401), 90, 91, 93 - 98
11. Natural Resources Administration (FNR 406), 91 – 97
12. Sustainable Forest Management (FNR 414), 99 - present
13. Forest and Nat. Res. Valuation (FNR 415), 91, 92, 93 - 97
14. Forest Management and Multiple-Use Planning (FNR 418), team teach 91 - 97

15. Natural Resources Policy Analysis (FNR 435), 99 - present
16. Community Forestry (FNR 450), 99 - present
17. Ecosystem Management (FNR 465), 99 - present
18. Advanced Forest and Natural Resources Valuation (FNR 572), 93
19. Numerous special problems courses (FNR 100, 339, 400, 461, 500)
20. Community Forestry (FNR 450), 00 – present
21. Tropical Forest Ecosystem Management (FNR 503), EARTH Univ., Costa Rica, Su 2009
22. Biometrics & Econometrics (FNR 532), 99 - present
23. Social Systems in NRM (FNR 530), 99 - 07
24. Introduction to Careers in Forestry and Environmental Management (FNR 140), 06 - 08

Service

Professional Development/Service

- Treasurer, National Xi Sigma Pi Honorary Society, 2007 - 09
- Director, California Urban Forest Council, Board of Directors, 2002 – present
- Vice-Chair, Central Coast Chapter, California Urban Forest Council, 2002 - present
- Chair, Los Padres Chapter, Southern California Society, SAF, 1992 - 1993
- Central Coast Media Liaison for the California Licensed Foresters Association, 1994
- Past Vice-Chair, Los Padres Chapter, SAF, 1992
- Past Secretary-Treasurer, Los Padres Chapter, SAF, 1991

University

- Senator, Academic Senate, 2004-05
- Chair, Academic Senate, Student Affairs Committee, 1992-1993
- Student Affairs Council, Academic Senate, member 1991-1993
- Distance Learning Committee, member since Winter 1992

College

- CAFES representative to EARTH University Consortium, Costa Rica
- Curriculum Committee, 1998 - 2004
- Swanton-Pacific Innovative Curriculum Committee, member 1992; assisted in educational facilities planning
- CAGR Instructional Improvement Committee, member, 1993 - 2003
- CAGR Computer Committee, member 1992-93, 1993-94
- Ad Hoc Committee on Internships, member Fall 1990 to Summer 1991
- Open House Committee, 1990 - 02
- Assisted in the planning and evaluation of 1992 and 1994 timber harvests at Swanton Pacific

Department

- Coordinator, ENVM and FNR Degree Programs, 2006 - present
- Chair, NRM Curriculum Committee, 1994-08
- Co-Editor, FNR Accreditation Report for the Society of American Foresters culminating in accreditation in October 1994.
- Editor, FNR Re-Accreditation Report for the Society of American Foresters culminating in accreditation in October 2004.