

Final Scientific/Technical Report

Project Title: "Water in the 21st Century"
Covering Period: September 1, 2008 to May 31, 2012
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Patentable Materials or Protected Data: Not applicable

Executive Summary:

This research project focused on sustainability issues in the southwest U.S. with an emphasis on water and energy. The efforts were directed through the UNLV Urban Sustainability Office with the funding used to develop a sustainability strategic plan; conduct extensive community outreach in the greater metropolitan area; provide seed money for multidisciplinary research teams to conduct studies in the areas of ecological, socio-cultural, and economic sustainability leading to community-based solutions; and to provide service-learning opportunities for UNLV graduate and undergraduate students. The research advanced understanding of urban and regional water issues with a particular focus on climate change and climate variability in the southwest. In addition, various events were held to promote discussion on energy, water, and sustainability discussions in the community. The impact of this research was broad dissemination of research through 13 peer-reviewed publications, learning opportunities for countless students as a result of class room equipment upgrades (see below for upgrade details), and new research funding for further advancement of these research efforts.

Goals and Accomplishments:

The main objectives of this research were to (1) support graduate students working on sustainability research; (2) provide seed grants to interdisciplinary research teams that are evaluating the energy/water relationships for sustainability; (3) host a regional workshop on sustainability.

The accomplishments included:

- 13 Peer reviewed publications
- 11 student workers supported
- 9 Graduate Assistants supported
- 6 interdisciplinary teams supported
- 12 part-time faculty members supported
- Classroom equipment upgrades accessible to all Solar Minor students
- Upgrades to sustainability instructional materials for Hotel College students
- Assisted in the hosting of 4 National Clean Energy Summits (2008 – 2012)
- Development of a new Solar and Renewable Energy Minor at UNLV made possible with a new \$500,000 donation.
- 4 new research proposals approved from external funding agencies

Project Activity Summary:

Research and outreach was conducted on sustainability issues in the southwest U.S. with an emphasis on water and energy. The efforts were directed through the UNLV Urban Sustainability Office with the funding used to develop a sustainability strategic plan; conduct extensive community outreach in the greater metropolitan area; provide seed money for multidisciplinary research teams to conduct studies in the areas of ecological, socio-cultural, and economic sustainability leading to community-based solutions; and to provide service-learning opportunities for UNLV graduate and undergraduate students.

Sustainability is an issue that communities in the southwest U.S. are seeking answers and creating partnerships between the public and private sectors. Addressing sustainability issues also requires interdisciplinary research that brings together scientists, engineers, social scientists, economists, architects, and decision makers. The UNLV Urban Sustainability Initiative focused on water and energy issues related to sustainability.”

Technology Transfer Activities: Not applicable

Publications: Not applicable

Website: Not applicable

Networks: Not applicable

Technologies/Techniques: Not applicable

Inventions/Patents: Not applicable

Other databases, collections, audio and video or software: Not applicable

Computer Modeling: Not applicable

Classroom Equipment Upgrades: A center to study various renewable energy technologies was developed with funds from this award. The facility is used to train graduate students and postdoctoral fellows, as well as undergraduates enrolled in the Solar and Renewable Energy Minor. This weather system provides solar radiation information that students use to design appropriate solar systems.

Publications:

1. Acharya, A., **T.C. Piechota**, G. Tootle, 2012. Quantitative Assessment of Climate Change Impacts on the Hydrology of the North Platte River Watershed, Wyoming. *Journal of Hydrologic Engineering*, 17(10), 1071-1083. (Impact Factor – 0.79, Citations - 1).
2. Miller, W.P., R.A. Butler, **T.C. Piechota**, J. Prairie, K. Grantz, G.M. DeRosa, 2012. Water Management Decisions using Multiple Hydrologic Models Within the San Juan River Basin Under Changing Climate Conditions. *Journal of Water Resources Planning and Management*, 138:5, 412-420 (Impact Factor - 1.28).
3. Miller, W.P., and **T.C. Piechota**, 2011. Trends in Western U.S. Snowpack and Related Upper Colorado River Basin Streamflow. *Journal of the American Water Resources Association*, 47(6), 1197–1210. DOI: 10.1111/j.1752-1688.2011.00565.x (Impact Factor – 1.37).
4. Tang, C. **T.C. Piechota**, and D. Chen, 2011. Relationships Between Oceanic–Atmospheric Patterns and Soil Moisture in the Upper Colorado River Basin. *Journal of Hydrology*, 411(2011), 77-90, doi:10.1016/j.jhydrol.2011.09.035. (Impact Factor – 2.51)
5. Lamb, K.W., **T.C. Piechota**, O.A. Aziz, and G.A. Tootle, 2011. A Basis For Extending Long-Term Streamflow Forecasts In The Colorado River Basin. *Journal of Hydrologic Engineering*, 16(12), 1000-1008, doi:10.1061/(ASCE)HE.1943-5584.0000153 (Impact Factor – 0.79, Citations - 1).
6. Acharya, A., **T.C. Piechota**, H. Stephen, G. Tootle, 2011. Modeled Streamflow Response Under Cloud Seeding in the North Platte River Watershed. *Journal of Hydrology*, 409 (2011), 305-314, doi: 10.1016/j.jhydrol. 2011.08.027. (Impact Factor – 2.51, Citations - 1).
7. Miller, W.P., **T.C. Piechota**, S. Gangopadhyay, and T. Pruitt, 2011. Development of Streamflow Projections under Changing Climate Conditions over Colorado River Basin Headwaters. *Hydrology and Earth System Sciences*, 15, 2145-2164, doi:10.5194/hess-15-2145-2011, (Impact Factor – 2.46, Citations - 2)
8. Tootle, G.T., **T.C. Piechota**, O. Aziz, W.P. Miller, V. Lakshmi, J.A. Dracup, C. Jerla, 2009. 2009-2010 El Niño: Hydrologic Relief for Parts of the U.S.?. *EOS Transactions*, 90(50), 481-292. (Citations – 2)
9. Tang, C., **T. Piechota**, 2009. Spatial and Temporal Soil Moisture and Drought Variability in the Upper Colorado River Basin. *Journal of Hydrology*, 279(2009), 122-135. (Impact Factor – 2.51, Citations-10)

10. Timilsena, J., **T. Piechota**, G. Tootle., and A. Singh, 2009. Associations of Interdecadal/Interannual Climate Variability and Long-Term Colorado River Basin Streamflow. *Journal of Hydrology*, 365 (2009), 289-301. (Impact Factor-2.51, Citations-11)
11. Miller, W.P., and **T.C. Piechota**, 2008. Regional Analysis of Trend and Step Changes Observed in Hydroclimatic Variables Around the Colorado River Basin. *Journal of Hydrometeorology*, 9(5), 1020-1034. (Impact Factor-2.18; Citations – 13)
12. Kalra, A., **T.C. Piechota**, R. Davies, and G.A. Tootle, 2008. Changes in U.S. Streamflow and Western U.S. Snowpack. *Journal of Hydrologic Engineering*, 13(3), 156-163. (Impact Factor-0.79; Citations - 22)
13. Timilsena, J., and **T.C. Piechota**, 2008. Regionalization and Reconstruction of Snow Water Equivalent in the Upper Colorado River Basin. *Journal of Hydrology*, DOI 10.1016/j.jhydrol.2007.12.024. (Impact Factor-2.51, Citations - 12)

Conferences/Seminars:

- Clean Energy Summit (2008-2012) in partnership with Senator Reid and Center for American Progress
- Brookings Institute Roundtable (Oct 2008)
- Nevada “Mountain Megas” Summit (January 2009)
- North American Energy Roundtable (Mar 2009)
- EarthHour Event (Mar 2009)
- Sustainability and Climate Change Education Conference (April 2009)
- USI Fall Meeting (September 2009)
- Solar Technology Innovation Meeting (December 2009)
- Dr. Glenn Tootle, University of Tennessee on seminar related to climate change and water resources of the west. (February 17, 2011)
- North American Energy-Water Nexus Roundtable held at UNLV including presentations by industry experts from the United States, Canada, and Mexico. Event attended by approximately 125 industry and community leaders, as well as faculty members and graduate students. (April 1, 2011)

Presentations:

- UNLV freshman civil engineering students, presentation on sustainability (October 26, 2010).
- UNLV Osher Lifelong Learning Institute (OLLI) with approximately 150 senior citizens in attendance (November 16 and 18, 2010).
- Nevada National Guard, presentation on UNLV Sustainability efforts (November 30, 2010).
- Presentation to Department of Energy Facilities Information Management System/RE Workshop in Las Vegas (June 15, 2011).

- Presentation to UNLV Undergraduate Research Summer Program (June 29 29, 2011).
- Presentation to CEE 110 (Introduction to Civil Engineering) students on sustainability. March 20, 2011)
- Alvarez, C., and R. Futrell, 2012. New Urbanist Design and Community Health in Las Vegas, presented at Posters on the Hill, sponsored by the Council on Undergraduate Research.
- Piechota, T.C. Let the Sunshine: Renewable Energy, Nevada and UNLV. Presentation to Canyon Springs High School as part of Nevada Science Week. May 2, 2012.
- Piechota, T.C. A Different Kind of Green in the Desert – Energy, Water, Recycling, Sun City Anthem Life Lifelong Learning Center. May 15, 2012.

Proposals submitted:

- IGERT Interdisciplinary Education in Urban Sustainability: Managing Arid Urban Systems. Submitted in April 2008 to the National Science Foundation, Integrated Graduate Education, Research, and Training. (\$2,800,000). 23 faculty from 7 different Colleges are involved in this proposal.
- Solar Decathlon, Team Las Vegas, Department of Energy, February 2012 – November 2013. APPROVED
- Community Facilities Energy Education Program, City of Las Vegas, April 2010 – August 2012. APPROVED
- Resource Conservation and a Sustainable Las Vegas. Department of Energy, November 2009 – October 2012. APPROVED
- Nevada Infrastructure for Climate Change Science, Education, and Outreach. National Science Foundation, September 2008 – August 2013. APPROVED
- A collaborative proposal between the University of Nevada, Las Vegas and Arizona State University was submitted to the National Science Foundation related to the energy-water tradeoffs in urban areas of Phoenix and Las Vegas. (January 3, 2011)

Collaborative Research: UNLV involvement in the Southern Nevada Sustainable Communities Planning Grant supported by HUD.