Hugo A. Gutiérrez-Jurado

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EXPERTISE: Surface Hydrology, Ecohydrology, Water Resources, Ecology, GIS, Remote Sensing, Groundwater Hydrology, Hydrometeorology, Hydrogeophysics, Geomorphology, Non Equilibrium Thermodynamics of Land Surface Processes.

EDUCATION:

Ph.D. Earth and Environmental Science (Hydrology) New Mexico Inst. Of Mining and Tech. 2011
Dissertation: A holistic explanation of the ecohydrologic and geomorphic properties for a semiarid basin with contrasting ecosystems.

M.S. Interdisciplinary Studies (Env. Sciences) University of Texas at El Paso (UTEP) 2004
Thesis: Physical and ecohydrological watershed characterization of a semi-arid environment in Central Chihuahua, Mexico: A remote sensing and GIS approach.

B.S. Ecological Engineering Universidad Autónoma de Chihuahua (UACH) 2000

EXPERIENCE

Chief Investigator – DECRA Fellow, NCGRT, Flinders University, 2015-present.
Investigating the dynamics of water and energy fluxes partitioning in heterogeneous landscapes. Working on the implementation of a non-conventional model for evapotranspiration and energy fluxes partitioning in tropical ecosystems at local and regional scales. Investigating the resilience of high CO_2 assimilation ecosystems to climatic perturbations in Mexico and Australia.

Investigador (Researcher) Cátedras CONACyT, Instituto de Ingeniería, UNAM, 2014-2015.
Investigated the vulnerability of coastal aquifers to climatic perturbations in the Yucatan Peninsula. Worked in the development of a method to estimate submarine groundwater discharges from the karst regional aquifer of Yucatan, using time series of remotely sensed precipitation, thermal imagery and gravity anomaly (GRACE) data. Investigating the hydrologic and carbon assimilation dynamics of the ecosystems in the Yucatan Peninsula.

Postdoctoral Research Fellow, NCGRT, Flinders University, 2012 – 2014.
Investigated the influence of climate variability on groundwater-vegetation-atmospheric interactions of water-limited areas in Australia, through the **integration of modeling and field data** including: electrical resistivity tomography, tree water use and meteorological observations. Working on the design and testing of a thermodynamics-based method for modelling evapotranspiration and its partition under non-uniform terrain and land cover conditions. Investigating the effect of climate and physiography on the continental scale water balance of Australia. Aid in the supervision of Ph.D. students field instrumentation and data analyses.

Research Assistant. Department of Earth and Environmental Sciences, NMIMT, 2005 – 2011.
Performed hydrologic, and terrain based modeling of environmental variables of hydrologic and ecologic significance. Designed, deployed, operated and maintained a network of hydrologic sensors in an experimental basin in central New Mexico. Designed and executed high-resolution topographic surveys of an experimental basin using geodetic positioning systems. Designed and led summer field campaigns to collect extensive soils, hydrologic, and ecologic data in different locations (one in Sonora, Mexico, and two in New Mexico, USA). Main activities included: data collection, analysis and synthesis. Published and presented scientific results in peer-reviewed journals and at professional meetings.

Research Assistant. Department of Geological Sciences, UTEP, 2002 – 2004.
Designed and implemented a field reconnaissance campaign to collect soils, geologic and vegetation data, to verify the results of a supervised classification map for potential groundwater recharge zones using remote sensing and geographic information systems.

Information Management Coordinator, Department of Strategic Planning and Institutional Development, UACH 2000-2001
Responsible of the coordination and compliance of the colleges and departments strategic plans to the goals and mission of the University.

TEACHING EXPERIENCE

Lecturer
Taught a graduate class in Hydrology, UNAM, 2015.
Co-Taught a graduate class in Hydrogeochemistry, (Principal instructor: Dr. Rob Bowman) NMIMT, 2008.

Teaching Assistant
Organized and taught Quantitative Methods in Hydrology laboratory, NMIMT, 2010
Assisted with laboratories and lectures for a graduate class in Advanced Geographical Information Systems, NMIMT, 2006.
Organized and taught Surface Water Hydrology laboratory, NMIMT, 2005.
Organized and taught Introduction to Environmental Science laboratory UTEP, 2002-2003.
Organized and taught Environmental Geology and Geophysics laboratory UTEP, 2003-2004.

AWARDS AND HONORS

Investigador Nacional Nivel I, Mexican Science and Technology Council (CONACyT), 2015
Discovery Early Career Researcher Award, Australian Research Council, 2014
Outstanding Student Paper Award in Hydrology American Geophysical Union, 2009
Meeting of Young Researchers in Earth Sciences Delegate, 2008
New Mexico Geological Society Grants in aid recipient, 2008
NCALM Student Award, 2007
Chihuahua State Government – UTEP Fellowship, 2002-2004

PROFESSIONAL MEMBERSHIP

American Geophysical Union
Geological Society of America
Society for the Advancement of Chicanos and Native Americans in Science

LEADERSHIP

Student Representative for the Hydrology Program, NMIMT, 2009-2010
Member and founder of the Environmental Sciences Advocates Association, 2003-2004
Member of the Government Council of the School of Zootecnia y Ecología, UACH, 1998-1999
President of the Student Government Association of the School of Zootecnia y Ecología, 1999-2000
President of the Council of the Student Government Associations, UACH, 1999-2010
Coordinator for the XI Week of Sciences and the 2nd fair of entrepreneurs for the School of Zootecnia y Ecología, UACH, 1999-2000

General Coordinator of the main science fair of the Universidad Autónoma de Chihuahua, (ExpoUACH 2000), 1999-2000.

SKILLS

Bilingual in Spanish and English
Mathematical Software (Matlab, Maple, R)
Hydrologic Software (tRIBS, HYDRUS 1-3D, HEC-RAS, MODFLOW)
Geographic Information Systems (ArcGIS, ArcInfo, ArcView)
Remote Sensing Software (ENVI and ERDAS)
Web and Graphic Design (Dreamweaver, Adobe Illustrator)
Hydrologic and meteorologic instrumentation (Datalogger programming)
Topographic and Geodetic positioning systems (DGPS Topcon, Trimble)
Electrical Resistivity Tomography (Syscal-pro, IRIS instruments)

ADVISING EXPERIENCE

Jorge M. Uuh Sonda, 2015 – continuing (Ph.D. student)
Jose Alberto Zamora, 2015 – continuing (M.S. student)
Hailong Wang, Remote Sensing and Watershed studies, 2012-2014.
Robert Andrews, Hillslope Hydrology studies, 2012
Carlos Ramirez, Ecosystem and Geomorphic studies, 2009-2011
Christina Hernandez, Watershed and Ecosystem studies, REU-Summer 2008
Rhonda Trujillo, Watershed and Ecosystem studies, REU-Summer 2008
Frederick Ennin, DGPS Surveying, Summer 2007
Phillip Turner, Watershed instrumentation, Summer 2006

PUBLICATIONS

Peer reviewed:

1. Shanafield M., Cook P., Gutiérrez-Jurado H.A., Faux R., Cleverly J., Eamus D. 2015. Field comparison of methods for estimating groundwater discharge by evaporation and evapotranspiration in an arid-zone playa, *Journal of Hydrology* 527, 1073-1083.
2. Wang H., Guan H., Gutiérrez-Jurado H.A., Simmons C.T. 2014. Satellite-based water budget over Australia and its relation with climate and topography. *Journal of Hydrology,* 511, 546-554.
3. Gutiérrez-Jurado H.A., Vivoni E.R., Cikoski C., Harrison, J.B.J., Bras R.L., and Istanbulluoglu E. 2013. On the observed ecohydrologic dynamics of a semiarid basin with aspect-delimited ecosystems. *Water Resources Research* 49, 8263–8284, doi:10.1002/2013WR014364.
4. Gutiérrez-Jurado H.A. and Vivoni E.R. 2013. Ecogeomorphic expressions of an aspect-controlled semiarid basin: II. Topographic and vegetation controls on solar irradiance. *Ecohydrology*, doi: **6**, 24-37, 10.1002/eco.1263.
5. Gutiérrez-Jurado H.A. and Vivoni E.R. 2012. Ecogeomorphic expressions of an aspect-controlled semiarid basin: I. Topographic analyses with high resolution datasets. *Ecohydrology,* **6**, 8-23, doi:10.1002/eco.280.
6. Vivoni, E.R., Rinehart, A.J., Méndez-Barroso, L.A., Aragón, C.A., Bisht, G., Cardenas, M.B., Engle, E. Forman, B.A., Frisbee, M.D., Gutiérrez-Jurado, H.A., Hong, S., Mahmood, T.H., Tai, K. and Wyckoff, R.L. 2008. Vegetation controls on soil moisture distribution in the Valles Caldera, New Mexico, during the North American monsoon. *Ecohydrology*, 1: 225-238, doi: 10.1002/eco.11
7. Istanbulluoglu E., Yetemen O., Vivoni E.R., Gutiérrez-Jurado H.A. and Bras, R.L. 2008. Eco-geomorphic implications of hillslope aspect: Inferences from analysis of landscape morphology in central New Mexico. *Geophysical Research Letters,* 35, L14403, doi:10.1029/2008GL034477
8. Gutiérrez-Jurado, H.A., Vivoni, E.R., Istanbulluoglu, E. and Bras, R.L. 2007. Ecohydrological response to a geomorphically significant flood event in a semiarid catchment with contrasting ecosystems. *Geophysical Research Letters,* 34, L24S25, doi:10.1029/2007GL030994.

9. Vivoni, E.R., Gutiérrez-Jurado, H.A., Aragón, C.A., Méndez-Barroso, L.A., Rinehart, A.J., Wyckoff, R.L., Rodríguez, J.C., Watts, C.J., Bolten, J.D., Lakshmi, V. and Jackson, T.J. 2007. Variation of Hydrometeorological Conditions along a Topographic Transect in northwestern Mexico during the North American Monsoon. *Journal of Climate*, 20(9): 1792-1809.
10. Gutiérrez-Jurado, H.A., Vivoni, E.R., Harrison, J.B.J. and Guan, H. 2006. Ecohydrology of root-zone water fluxes and soil development in complex semiarid rangelands. *Hydrological Processes*. 20(15): 3289-3316.

Manuscripts in review:

11. Gutiérrez-Jurado H.A., Guan H., Wang H., and Wang J., Bras R.L., Simmons C.T. 2015. Monitoring evapotranspiration and its partition over heterogeneous land surface using the Maximum Entropy Production model. *Geophysical Research Letters* (in a second review).

Manuscripts in preparation:

12. Uuh-Sonda J., Gutiérrez-Jurado H.A., Mendez-Barroso L., Breña-Naranjo J.A. 2016. Water use and Carbon intake dynamics of deciduous and evergreen tropical forests of the Yucatan Península under climatic extremes, (to be submitted to *JGR-Biogeosciences*)
13. Gutiérrez-Jurado H.A., Guan H., Vivoni E.R., and Wang J. 2016. Topographic controls on water fluxes in a semi-arid catchment with vegetation contrasts. *Ecohydrology* (In preparation for re-submission).
14. Gutiérrez-Jurado H.A., Guan H., Wang H., Zhou X., and Simmons C.T. 2016. Ecohydrology of an eucalyptus woodland with terrain induced variations in vegetation cover and microclimate. *Agricultural and Forest Meteorology* (In preparation for re-submission).

Invited talks:

1. **Gutierrez-Jurado H.A.** 2015. Determinación y partición de flujos y balances hídricos en microcuencas: nuevas técnicas, viejos problemas. Instituto Tecnológico de Sonora, México, ***Invited.***
2. **Gutierrez-Jurado H.A.** 2015. Determinación y partición de flujos y balances hídricos en microcuencas: nuevas técnicas, viejos problemas. Unidad Academica Sisal, Universidad Nacional Autónoma de México, México, ***Invited.***
3. **Gutiérrez-Jurado H.A.** 2014. Determinación y partición de flujos y balances hídricos en microcuencas: nuevas técnicas, viejos problemas. Instituto de Ingeniería, Universidad Nacional Autónoma de México, México, ***Invited.***
4. **Gutiérrez-Jurado H.A.** 2014. Untangling the Eco-Hydro-Geomorphic knot: Insights from experiments seeking to explain patterns, processes and feedbacks at the catchment scale. University of Texas at El Paso, USA, ***Invited***.
5. **Gutiérrez-Jurado H.A.**, Vivoni E.R., and Harrison, J.B.J. 2010. Understanding the ecohydrology of a semiarid catchment with topographic induced vegetation constrasts: observations and modeling, Sevilleta LTER Research Symposium, Sevilleta, NM, ***Invited***.

Conference Presentations:

1. Uuh-Sonda J., Gutiérrez-Jurado H.A., Mendez-Barroso L., Breña-Naranjo J.A. 2016. Evapotranspiration and Carbon intake dynamics of the Yucatan Península under climatic extremes, 2º Congreso Interamericano de Cambio Climático (CICC 2016 / México), Ciudad de México.

2. Gutiérrez-Jurado H.A., Guan H., Wang H., and Wang J., Bras R.L., Simmons C.T. 2015. Maximum Entropy Production Modeling of Evapotranspiration Partitioning on Heterogeneous Terrain and

Canopy Cover: advantages and limitations. Fall meeting, American Geophysical Union, San Francisco, E.U.A.

3. Gutiérrez-Jurado H.A., Medellin Mayoral G., Cerezo Mota R., Ojeda Casillas E., Torres Freyermuth A. 2015. Observatorio Costero para estudios de resiliencia al cambio climático. Primer Reunión Anual de Cátedras CONACYT, Ciudad de México.

4. Guan H., Wang H., Gutiérrez-Jurado H.A., Yang Y., Deng Z. 2014, Visualisation of Ecohydrological Processes and Relationships for Teaching Using Advanced Techniques, American Geophysical Union, San Francisco, USA.

5. Gutiérrez-Jurado H.A., Guan H., Wang H., Wang J., Bras R.L., Simmons C.T. 2013, Quantifying evaporation and transpiration fluxes of an Eucalyptus woodland in complex terrain with varying tree cover using the Maximum Entropy Production model for ET, American Geophysical Union, San Francisco, USA.

6. Guan H., Cook P.G., Simmons C.T., Brunner P., Gutiérrez-Jurado H.A., Wang H. 2013, A Moisture-limited ET Upper Bound and Its Application in an Evaporation Pan Based Complementary-relationship Model for ET Estimation, American Geophysical Union, San Francisco, USA.

7. Gutiérrez-Jurado H.A., Wang H., Guan H., Cook P., Villalobos-Vega R., & Eamus D. 2013, Investigating the spatio-temporal extent of vegetation-vadose zone-groundwater interactions using ER tomography, tree water use and meteorological observations. International Association of Hydrogeologists, 40th International Congress. Perth, WA (Australia)

8. Wang H., Guan H., Gutiérrez-Jurado H.A., Simmons C.T. 2013. Satellite-based water balance examination over Australia, International Association of Hydrogeologists, 40th International Congress. Perth, WA (Australia)

9. Gutiérrez-Jurado H.A., Vivoni E.R., Bras R.L., Cikoski C., Harrison, J.B.J., Guan H., and Istanbulluoglu E. 2012. Untangling the Eco-Hydro-Geomorphic knot: Insights from an experiment that seeks to explain feedbacks, patterns and processes. American Geophysical Union, Fall Conference, San Francisco, CA.

10. Ramirez C.F., Harrison J.B.J., Gutiérrez-Jurado H.A., and Cikoski C.T. 2011. Runoff and sediment yield in contrasting vegetated hillslopes of a first order basin in central New Mexico. New Mexico Geologic Society, Spring Meeting, Socorro, NM.

11. Gutiérrez-Jurado H.A., Vivoni E.R., Bras R.L., Cikoski C., Harrison, J.B.J., and Istanbulluoglu E. 2009. On the Observed Ecohydrologic Dynamics of a Semiarid Catchment with Topographic Induced Microclimatic Controls. American Geophysical Union, Fall Conference, San Francisco, CA.

12. Gutiérrrez-Jurado, H.A. 2009. Can topographic analyses with high resolution data reveal ecohydrologic and hydrogeomorphic processes and feedbacks? NMIMT-E&ES Seminar Series, Socorro, NM.

13. Gutiérrrez-Jurado, H.A., and Vivoni, E.R. 2009. Topographic and Vegetation Feedbacks on the Ecogeomorphic and Radiation Properties of a Semiarid Basin with Contrasting Ecosystems, American Geophysical Union, Chapman Conference on Examining Ecohydrological Feedbacks of Landscape Change Along Elevation Gradients in Semiarid Regions, Sun Valley, Idaho.

14. Gutiérrrez-Jurado, H.A., Harrison J.B.J., and Vivoni, E.R. 2008. Vegetation-Soil-Aspect Modulated Hydrologic Dynamics on Semiarid Hillslopes of Central New Mexico, Geological Society of America, Fall Conference, Houston, Texas.

15. Trujillo R.V., Hernandez C., Gutiérrrez-Jurado H.A., and Vivoni E.R. 2008. Ecohydrological dynamics in semiarid hillslopes. Society for the Advancement of Chicanos and Native Americans in Science (SACNAS), Salt Lake City, UTAH.

16. Gutiérrrez-Jurado, H.A., Vivoni, E.R. 2008. Analysis of catchment hydrogeomorphology, vegetation patterns and incoming solar radiation based on sequentially-improved terrain datasets: IFSAR, dGPS

and ALSM. Studying Earth Surface Processes with High-Resolution Topographic Data Workshop, Boulder, Colorado.

17. Gutiérrrez-Jurado, H.A., Vivoni, E.R. 2008. Multi-resolution analysis of vegetation and hydrogeomorphic interactions of a semiarid catchment with contrasting ecosystems. Meeting of Young Researchers in Earth Sciences (MYRES), New Orleans, Louisiana.
18. Gutiérrrez-Jurado, H.A., Vivoni, E.R. and Ennin, F. 2007. Analysis of catchment hydrogeomorphology and vegetation patterns based on a differential GPS and interferometric SAR. American Geophysical Union, Fall Conference, San Francisco, CA.
19. Gutiérrez-Jurado, H., Vivoni, E.R., Istanbulluglou, E. and Bras, R.L. 2007. Ecohydrological response to a geomorphically significant flood event in a semiarid catchment with contrasting ecosystems. GSA Graduate Student Research Conference, New Mexico Tech, Socorro, NM.
20. Gutiérrez-Jurado, H.A. and Vivoni-Gallart, E.R. 2007. Ecohidrología como estrategia de investigación sobre los recursos hídricos en zonas semiáridas. VI Congreso Internacional y XII Nacional de Ciencias Ambientales. Universidad Autonoma de Chihuahua, Chihuahua, MX.
21. Vivoni, E.R. and Gutierrez-Jurado, H.A. 2007. Advances to Catchment Theory from Ecohydrological Patterns and Feedbacks in Complex Terrain. XXIV IUGG General Assembly, Perugia, Italy.
22. Istanbulluoglu E., Vivoni E.R., Gutiérrez-Jurado H.A., Yetemen O., and Bras, R.L. 2006 On the topographic imprint of vegetation: Results from field observations and DEM analysis of small semiarid basins in New Mexico. American Geophysical Union, Fall Conference, San Francisco, Ca.
23. Gutiérrez-Jurado, H.A., Vivoni, E.R., Harrison J.B.J., Turner P., Bisht G., Istanbulluoglu E., and Bras, R. L. 2006. Analysis of an extreme monsoon event on the ecohydrologic and geomorphologic conditions in a semiarid basin based on field instrumentation and reconnaissance. American Geophysical Union, Fall Conference, San Francisco, Ca.
24. Méndez-Barroso, L.A., Rinehart, A.J., Aragón, C.A., Bisht, G., Cardenas, M.B., Engle, E., Forman, B.,Frisbee, M.D., Gutiérrez-Jurado, H.A., Hong, S-H., Tai, K., Wyckoff, R.L., Vivoni, E.R. 2005. Spatial and Temporal Analysis of Hydrometeorological Conditions in the Valles Caldera, New Mexico during the North American Monsoon. American Geophysical Union, Fall Conference, San Francisco, CA.
25. Gutiérrez-Jurado, H.A., and Vivoni, E.R. 2005. Aquifer Recharge Assessment from Surface Ecohydrological Conditions: A Spatial Analysis along an Ecotonal Gradient in New Mexico. American Geophysical Union, Fall Conference, San Francisco, Ca.
26. Gutiérrez-Jurado, H.A., Goodell P.C., Vivoni, E.R., and Gebremichael M. 2005. Temporal and Spatial Rainfall Variability Analysis of The Peña Blanca, Uranium District, Chihuahua, Mexico. Geological Society of America, Fall Conference, Salt Lake City, UTAH.
27. Rinehart, A.J., Vivoni, E.R., Frisbee, M., Aragón, C.A., Bisht, G., Cardenas, M.B., Forman, B., Gutiérrez-Jurado, H.A., Hong, S-H, Mendez, L.A., Tai, K., Wyckoff, R.L. 2005. Design and Implementation of a Hydrometeorological Field Campaign in the Valles Caldera, NM. New Mexico Water Research Conference. Socorro, NM.
28. Gutiérrez-Jurado, H.A., Vivoni, E.R., Harrison, J.B.J. and Guan, H. 2005. Ecohydrology of root zone water fluxes and soil development in a small drainage basin in central New Mexico. New Mexico Water Research Conference. Socorro, NM.
29. Gutiérrez-Jurado, H.A., Ivanov, V.I., Vivoni, E.R., and Bras, R. L. 2005. Integrated approach to ecohydrology of semi-arid sites in areas of complex topography and biome transitions. American Geophysical Union, Spring Conference, New Orleans, LA.
30. Gutierrez-Jurado, H.A. and Vivoni, E.R. 2004. Preliminary Geospatial Assessment of Ecohydrological Variations in a Semiarid Catchment in the Sevilleta National Wildlife Refuge. SAHRA 4th Annual Conference, Albuquerque, NM.

31. Gutiérrez-Jurado, H.A., Vivoni, E.R., Aragón, C.A., Rinehart, A., Wyckoff, R., Watts, C.J., Rodríguez, J.C. and Jackson, T.J. 2004. Landscape Controls on Monsoon Soil Moisture Distribution in Northern Sonora, Mexico. American Geophysical Union, Fall Conference, San Francisco, CA.
32. Vivoni, E.R., Gutierrez, H. A., Brooks, B., Aragón, C. A., Rinehart, A., Wyckoff, R., Watts, C. J.,Rodríguez, J. C. and Jackson, T. 2004. Topographic and Ecosystem Controls on Soil Moisture Distribution in the SMEX04-NAME Transect Study, Northern Sonora, Mexico. 85th American Meteorological Society Meeting. San Diego, CA.
33. Gutierréz-Jurado, H.A., Aragón, C., Meier, D., Vivoni, E.R. and Granados-Olivas, A. 2004. Ecohydrological watershed characterization of semi-arid environments in New Mexico and Chihuahua, Mexico: A remote sensing and GIS approach. Second International Symposium on Transboundary Waters Management. Tucson, AZ.
34. Gutierréz-Jurado, H. A., Goodell, P., Hurtado, J. M., Granados-Olivas, A., 2003, Physical and Eco-Hydrological Watershed Characterization of a Semi-Arid Environment in Central Chihuahua, Mexico. SACNAS 2003 Annual Meeting. Albuquerque, NM.

Peer review service for the following journals:

Geophysical Research Letters, Water Resources Research, Journal of Hydrology, Advances in Water Resources, Journal of Arid Environments.

GRANTS

Co-PI – Project Title: **Creación del Laboratorio Nacional de Resiliencia Costera (LANRESC) –** (Awarded) Fondo de apoyo para la creación de Laboratorios Nacionales, approx. **1,500,000.00 US Dollars,** with 750,000.00 from UNAM-ITSON-CCGSS and 750,000.00 in matching funds from CONACyT.

PI - Project title: **Investigating water and energy fluxes partitioning under non-uniform terrain and plant cover conditions** – (Awarded) ARC Discovery Early Career Researcher Award, **530,000.00 Aus Dollars**, with 350,000 from ARC and 180,000 from Flinders University.

PI - Project title: **Thermodynamics of land surface properties in semiarid areas: Integrating field observations, remote sensing and fully distributed ecohydrologic modeling** - (Awarded) New Mexico Geological Society, **2000.00 US Dollars**

PI - Project title: **Can Airborne Laser Swath Mapping quantify the impact of vegetation differences on semiarid landscape form?** - (Awarded) NCALM, in kind contribution (estimated in ~ **15,000.00 US Dollars**)

REFERENCES

Prof. Enrique R. Vivoni
Arizona State University
vivoni@asu.edu

Prof. John L. Wilson
New Mexico Institute of Mining and Technology
jwilson@nmt.edu

Prof. Huade Guan
Flinders University of South Australia
& National Centre for Groundwater Research and Training
huade.guan@flinders.edu.au

1. Description of teaching interests

1.1. Teaching statement

As an earth science lecturer, I will have the principal goal of conveying my students a set of skills covering mainly three aspects: 1) a solid conceptual understanding of the physical processes involved in land surface phenomena; 2) the necessary tools and practical training for them to use in their own research projects and professional activities; and, 3) a solid understanding of the scientific method as an effective approach to solve complex real life problems.

1.2. Teaching style

To accomplish the objective stated above, I will try to develop courses with balanced theoretical-quantitative contents by means of well designed lectures, homework, and laboratory work in which the students will be able to put in practice the concepts learned in the classroom. In addition, I will try to complement the class work with field visits and class projects where the students can experience first hand with actual instruments in real settings. In this regard, I am an advocate of the premise that learning by doing is learning for life. Therefore, I would put a significant emphasis on the practical aspects of classes. I will try to make the classes as interactive as possible, by involving the students with class projects, presentations and discussion exercises during class time, to stimulate their reflexive thinking and improve their communication skills. Reinforcement of the scientific method will be made through class projects, and repeated exercises in homework and laboratories where the student will be presented with a dataset and will be asked to reject or accept a given hypothesis after careful analyses of the results and the arrival of a well supported conclusion.

By the end of the classes the students should be able to incorporate the scientific method in their problem solving skills, they should be able to recognize the major driving processes involved in the topics covered in class, and should have attained a working knowledge of the theoretical and practical methods for implementing solutions to real life problems in the earth sciences.

1.3. Proposed Courses

With this background my teaching plans include developing the following courses:

Field methods in hydrology

This will be an advanced undergraduate/graduate course covering a wide variety of field methods employed in the study and practice of both-surface and groundwater hydrology. The class will be 60% hands-on-instruments and field laboratories and 40% class work covering the theoretical aspects of the field methods. During the class, the students will have opportunities to operate a diverse set of instruments to characterize and quantify aquifer properties and processes (e.g. specific yield, head and water level, water quality, transmissivity) as well as surface hydrology processes such as evapotranspiration, water infiltration, catchment runoff, and flow gauging of open channels and rivers. Examples of the instruments expected to be used (depending on availability within the department) are: electrical resistivity meters, electromagnetic-induced polarization probes, piezometers, relative humidity and temperature probes, infiltrometers, lysimeters, weather station systems (including net radiometers, ground heat flux meters, anemometers, raingages), river-flowmeters, weirs and pressure transducers, geodetic systems, among others. By the end of the class the students should be familiar with the use of equipment that is standard in the practice of hydrology.

GIS and Remote Sensing tools in the Earth Sciences

This course will consist of an overview of geographic information systems and remote sensing techniques applied to problems in the earth sciences and will cover a wide variety of relevant water resources and geology topics. The emphasis of the course will be on practical applications and the attainment of a working knowledge of basic GIS and Remote sensing techniques. The class will include hands-on use of the software during lectures with example applications and interactive contents. In addition, the mathematical concepts behind a series of current modeling approaches within GIS and Remote Sensing platforms will be discussed and used in homework and laboratory assignments. The course will address the use of Remote Sensing for natural resource assessment issues and will provide examples of current applications in hydrologic and environmental science related problems. The class will cover a comprehensive array of GIS and remote sensing topics; from the essentials of remote sensing physical principles, to the variety of current and past platforms and their products, to a series of digital image processing techniques for information extraction and spatial data analysis.

Ecohydrology of Drylands

I will develop an advanced graduate course on Ecohydrology of water limited landscapes. This class will focus on providing the students with an in depth knowledge of the interrelations between the water cycle and the ecosystems in arid and semiarid areas. The course will address on detail the physical processes and mechanisms involved in the movement of water through the soil-vegetation-atmosphere continuum, and the potential feedbacks of water distribution to the components of the continuum. Within this class we will discuss current advances in ecohydrologic theory and relate these to the explanation of observed landscape phenomena. This class will be half conceptual and half quantitative based with practical examples using numerical modeling and data analyses techniques. A special emphasis of this class will be on the use of ecohydrology theory to understand climatic driven changes on the water cycle and the hydrologic regime of water scarce regions.

Physical Hydrology

This will be a graduate course intended to provide the students with both, a solid conceptual understanding of the physical processes involved in the study of the hydrologic cycle, and an adequate training in mathematical methods to quantify these processes. The class will include a laboratory with field visits where the students will be exposed to the use of hydrologic equipment for measuring variables of interests, such as: soil moisture, stream level and discharge, water table depths, etc. This will be an advanced course that will require previous training in GIS, remote sensing and some mathematical fundaments so that the students can take advantage of these tools for use in their homework, laboratory exercises and class projects.

2. Research interests

My research activities have been focused on the study of terrain-vegetation-climate couplings and the resulting landscape patterns and processes emerging from those interactions. To investigate the hydrologic dynamics of vegetation terrain couplings, their connections, and implications to local and regional surface and groundwater fluxes, I employ a combination of modeling and field experiments. Some of the methods I have used and/or I am currently using include: terrain analyses and modeling using high resolution (e.g. submeter) surface elevation models derived from airborne LiDAR surveys, tree water use and hydro-meteorological measurements along microclimatic gradients in a series of experimental locations within Australia, Mexico, and the USA, for the measurement of water, energy and carbon fluxes. This body of research addresses fundamental and pressing questions in contemporary hydrology and I consider it to be at the forefront of both the geosciences and biogeosciences communities. This work I believe will nicely complement the efforts of Drs. Lin Ma and Lixin Jin's on the critical zone, but could also find potential avenues for collaboration with Dr. Hurtado's geomorphology studies, Dr. Doser studies on the use of near surface geophysics for groundwater investigations, and Dr. Brunner's biogeochemistry studies. I believe with my work I could strengthen the Earth System Geochemistry and the Geospatial Research focus areas of the department. Moreover, I will be occupying an important missing piece (at least in my opinion) in the current geoscience spectrum of the department, which is the part concerning to hydrology in general and surface hydrology in particular. In the following, I provide more detailed descriptions of the different facets of my current work and the foreseeable direction of my research.

2.1. Investigating water partitioning on semiarid, temperate and tropical landscapes using a thermodynamics-based model for Evaporation and Transpiration

Terrestrial water fluxes within the hydrologic cycle are dominated by evapotranspiration (ET), from which the largest portion comes from plant transpiration. However, the varied types, distribution and relative cover of vegetation and soils across a catchment, and the highly variable (in space and time) rates of plant water use make accurate and long-term quantification of ET and its partition extremely difficult. In the recent years, a large body of my work has been focused on the development, validation and implementation of a method that quantifies and partition evapotranspiration fluxes for patchy vegetated areas and locations with complex terrain, where fetch constraints limit the use of traditional techniques such as the Eddy Covariance method. At this stage, I have successfully designed, implemented and tested a field monitoring technique capable of producing high temporal resolution data on the transpiration of different vegetation functional types (e.g. trees, shrubs, grasses), and soil evaporation under non-uniform terrain and vegetation cover conditions. The functionality of this method will help to measure and partition evapotranspiration where there are not uniform land cover and terrain conditions upwind of the instruments. Improvements made with this technique will provide valuable data to better validate land surface models for regions with patchy vegetation and complex topography, which characterizes some of the arid and semi-arid regions that are most vulnerable to the effects of climate change. Results from these developments are summarized in a manuscript that is currently under a second review (re-submitted) in *Geophysical Research Letters* with expected high impact on the wide hydrologic and biogeosciences communities. Continuing work involves the testing of the model under different climatic and land cover conditions, and its implementation at regional scales (>1km) using remote sensing and reanalysis datasets as inputs, and field measurements from observational networks for validation.

2.2. Integrating remote sensing and field measurement techniques to upscale ecohydrological properties and dynamics from tree to the catchment scale

Studying the ecohydrologic dynamics of variably forested catchments is essential to understand the role of native vegetation on the partition of water in temperate, arid and semiarid landscapes around the globe. To address this challenge, I am working on an experimental catchment using detailed and punctual ground-based measurements of vegetation traits (Leaf area, sapwood area, crown cover) and processes (sapflow, water potential dynamics) obtained at the tree scale. Using high resolution (~20 cm^2) surface elevation data from airborne LiDAR, I derive a detailed map of the vegetation cover for the entire catchment that is used to upscale the individual tree properties. Finally, using a detailed spatially explicit map of the tree parameters in conjunction with sap flow, water potential and micrometeorological measurements the relationships between vegetation stand properties and tree water use and partitioning in the catchment are developed to explore the effect of a number of terrain and climatic properties on these relationships. The results of this study will be used to parameterize process-based fully distributed hydrologic models (i.e. tRIBS and tRIBS-VEGGIE) to investigate the effects of climate variability on the water resources of the regions encompassing the experimental sites in Australia and the US southwest. Further work will include the setting up of a coupled hydrologic-land evolution model to investigate the effect of energy and water-partitioning differences within a catchment on erosion rates of preserved and disturbed catchments.

2.3. Evapotranspiration and Carbon intake dynamics of tropical forests under a changing climate

Evapotranspiration (ET) and gross primary productivity (GPP) are tightly coupled processes that determine both, the rate of water transfers from the land into the atmosphere, and the ability of ecosystems to sequester atmospheric CO2. These two processes are sensitive to the natural climatic variability and particularly to perturbations from extreme events such as droughts and cyclonic storms that are becoming more frequent and intense in tropical areas around the globe. It is in these regions where most of the global intake of CO_2 occur, and in some places like the Peninsula of Yucatan, the interaction of these 2 processes determine to a large extent the net recharge of the karst aquifers underneath. Hence, affecting the availability of water, and the resilience of the ecosystems of the region. Understanding the dynamics of these phenomena is crucial to inform policy makers and stakeholders about the importance of preserving these vital zones of the planet. To investigate these relations, I focus my work in the Peninsula of Yucatan try to assess the spatio-temporal dynamics of ET and GPP under above average dry and wet conditions using remotely sensed data from the MODIS-Terra and TRMM satellites, and field data collected through Eddy Covariance Flux stations measuring water and carbon fluxes and a network of micrometeorological instruments. I will continue working in this project collaborating with my Mexican colleagues on a long term basis.

2.4. Using Electrical Resistivity Tomography (ERT) to investigate hydrologic-vegetation interactions

An Electrical Resistivity Imaging (ERI) system consisting of electrodes connected to a multichannel receiver can be deployed on a surface to generate tomographic images in 2 or 3D of subsurface electrical properties (i.e. resistivity) at varying depths (e.g. 5 to ≥ 50 m). The resistivity data can be converted into moisture values in the unsaturated zone via inversion procedures and calibration with ancillary data. Implementing the ERI in a time-lapse mode can be used to monitor subsurface water fluxes in both the unsaturated and saturated zone in a systematic manner to allow the inference of vertical groundwater recharge and/or discharge rates as affected by land surface cover (i.e. vegetation) and climatic conditions (e.g. Jayawickreme et al 2008). Despite the potential of this technology to reveal important climatic-vegetation-groundwater interactions, there are still a limited number of studies using ERT to explore the effect of climatic variability on hydrologic-vegetation dynamics and its connections and implications to local and regional groundwater fluxes. In addition to the already mentioned applications, ERT has been successfully used to map and characterize important geological features used to properly define and conceptualize groundwater models (Schrott and Sass, 2008). In Table 1 I list a number of identified applications of ERT technology and their potential uses for groundwater-vegetation-climate investigations.

I have been using a multi-channel Resistivity Imaging System in different modes to assess the impact of tree water use on the dynamics of water movement from the unsaturated zone to the water table, by capturing the progression of spatial and temporal variations in moisture after wetting events (Gutierrez-Jurado et al., 2013), and lately to help dilucidate vegetation proxies for locating the extent and characteristics of brackish and seawater intrusion on coastal karst aquifer systems.

References

Gutiérrez-Jurado H.A., Wang H., Guan H., Cook P., Villalobos-Vega R., & Eamus D. (2013), Investigating the spatio-temporal extent of vegetation-vadose zone-groundwater interactions using ER tomography, tree water use and meteorological observations. *International Association of Hydrogeologists*, 40th International Congress. Perth, WA (Australia)

Jayawickreme, D.H., Van Dam, R.L., and Hyndman, D.W. 2008. Subsurface imaging of vegetation, climate, and root-zone moisture interactions, *Geophys. Res. Lett.*, 35, L18404, doi:10.1029/2008GL034690.

Schrott L., and Sass O, 2008. Application of field geophysics in geomorphology: Advances and limitations exemplified by case studies.

Table 1. Potential applications and uses of resistivity sounding relevant to groundwater, hydrologic and ecohydrologic research (Adapted from Schrott and Sass, 2008).

Electrical Resistivity Imaging in 2and 3D	
Potential applications	Potential uses of applications
Determining sediment thickness, internal differentiation and groundwater table	Improved parameterization of vadose zone and groundwater models
Moisture distribution in rock walls	Improved parameterization of vadose zone and groundwater models
Seasonal variation in fluid content	Inference of groundwater recharge/discharge rates Effect of plants on groundwater recharge/discharge
Investigation of effective plant root depths	Proper parameterization of vegetation properties on vadose zone and groundwater models

5. Description of approach for broadening participation of underrepresented groups in the geosciences

I believe one of the main challenges in engaging underrepresented groups in the geosciences lies in the way we approach young people to showcase the advantages that studying a degree in the geosciences may bring to their lives and careers. I know from experience (being Hispanic and the first one in my family to access graduate school and a attain a Ph.D.) that typically, minority students are the first generation to attend University and that their career choices may be highly biased by mainstream culture and/or the examples they may have at hand close in their communities. The reality is that we, geoscientists, don't abound and we should make sure that however few, we are always visible to young people and especially early, at a time when they start leaning on a career path. For example, nowadays, the large majority of the information consumed by young people (>30 years of age) is conveyed through the internet and social media platforms such as Facebook. For this reason, I will try to keep an active presence in the social media through the institutional channels provided by the department (e.g. facebook page), University, and professional associations to showcase any activity, whether that is classes, field trips and research opportunities, that may be attractive to young students looking into deciding their career paths. I must confess, however, that I am not an expert on these matters, but will look advice on how to build an attractive portfolio of material to advertise for recruiting talented youngsters in the larger El Paso Border region. Other strategies that I will pursue are: (1) looking for scholarships and funding for programs such as "Research Experiences for Undergraduates" that give support to students during the summer time while they work on a research project led by a professor in a science area; (2) performing outreach in conferences with a high attendance of underrepresented groups, such as the annual meeting of the Society for the Advancement of Chicanos and Native Americans in Science, a society from which I have been an active member; (3) attending and volunteering in science fairs and science demonstrations in high-schools and getting involved with the K-12 community of science teachers of the area; (4) finally, I would take advantage of my condition as a Hispanic faculty, and will try to become an example by succeeding as a professor, I will try to become a mirror in which underrepresented students see a reflection of themselves achieving their academic goals and pursuing a career in the geosciences. In other words, **if he could do it, I can do it too!**

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January 26, 2016

Dr. Jose M. Hurtado
Chair of the Physical Geology Search Committee
Department of Geological Sciences
University of Texas at El Paso

Dear Dr. Hurtado and Search Committee Members,

I am greatly pleased to write this letter of recommendation for Dr. Hugo A. Gutiérrez-Jurado for the position of Assistant Professor in the Department of Geological Sciences at the University of Texas at El Paso (UTEP). Through this letter, I hope to convey what a valuable individual Dr. Gutiérrez-Jurado is and how he would be a perfect fit to your program, university and region, all of which I know well from many visits over the years and my own work in central and southern New Mexico. As a bit of background on myself, I am presently a Professor at Arizona State University (ASU) in the area of Hydrologic Sciences and Engineering with appointments in our School of Earth and Space Exploration that houses Geological Sciences and the School of Sustainable Engineering and the Built Environment that houses Civil and Environmental Engineering. Prior to this appointment, I was faculty at the New Mexico Institute of Mining and Technology (NMIMT) in the Department of Earth and Environmental Science within a highly-reputable program in Hydrology (as an Assistant and then Associate Professor with Tenure). Dr. Gutiérrez-Jurado received his Ph.D. under my supervision in 2011 from NMIMT. After my departure from NMIMT, he decided to complete his degree at this institution and we worked together remotely, including sporadic week-long visits to ASU where we would discuss progress and polish manuscripts.

As you can discern from Dr. Gutiérrez-Jurado CV, he received an M.S. in Environmental Science from UTEP and thus knows your institution very well. I recruited him from UTEP to the PhD program at NMIMT based on our mutual interests in ecohydrological processes in desert systems. Recruiting him was a gamble on my part that has paid off handsomely for all involved. The gamble consisted of the following: ecohydrology is by definition an interdisciplinary field that involves ecology and hydrology, two areas with dramatically different approaches. Dr. Gutiérrez-Jurado had received in-depth training in ecology through his B.S. from Universidad de Chihuahua and in environmental/geological sciences from UTEP, but he had not been exposed to the quantitative tools and methods used in field research, numerical modeling, mathematical analysis, or their combination. Also, the project for which I recruited him was the most important activity that I had envisioned in my five-year plan to start as an Assistant Professor in which we would: a) establish a new field research site at the Sevilleta National Wildlife Refuge, b) conduct long-term field observations to quantify ecohydrological processes, c) utilize the observations to test numerical models of ecohydrological processes and d) utilize observations from remote sensing and geophysical survey techniques to complement the sensor network. This was a large undertaking for any student and Dr. Gutiérrez-Jurado exceeded my expectations, as I document next.

Without reservation, Dr. Gutiérrez-Jurado is the most productive PhD student that I have advised to date and the most capable recent graduate in the last five years of the Hydrology program at NMIMT. This is no small feat given the quality of students in the program and where they have been hired as Assistant Professors (University of Massachusetts at Amherst, University of Texas at Austin, University of Colorado, Flinders University). The Hydrology program at NMIMT is very rigorous and students are exposed to a wide range of subjects in hydrology, geochemistry, geology, geophysics and mathematics. Dr. Gutiérrez-Jurado excelled at NMIMT due to his natural intellectual abilities, his work ethic and his capacity to present his work in oral, poster and written formats. As evidence of that, he was awarded an American Geophysical Union Outstanding Student Award, he was a delegate to the Meeting of Young Researchers in Earth Sciences, he co-taught or was teaching assistant for Quantitative Methods, Hydrogeochemistry and Surface Hydrology, he received a Student Award from the National Center for Airborne Laser Mapping and he was elected Student Representative of the Hydrology program. All of these honors and awards are reserved for the very best PhD students in the NMIMT program and across the country. Thus, he also obtained a wide background in the geological sciences (physical geology, geochemistry, geomorphology) that complements his expertise in ecohydrology and hydrology.

The work from Dr. Gutiérrez-Jurado's PhD is seminal in the field of ecohydrology. He tackled for the first time an observation that has been known for at least a century – that vegetation on different aspects can vary – through quantitative field methods and modeling. His PhD work has resulted in six published papers in top international journals: two in Geophysical Research Letters, two in Ecohydrology, one in Hydrological Processes and one in Water Resources Research. The earlier papers are widely cited and the more recent ones (three published in 2013) are expected to make a significant impact. The last work in Water Resources Research, entitled *On the Observed Ecohydrologic Dynamics of a Semiarid Basin with Aspect-Delimited Ecosystems*, elegantly demonstrates how terrain aspect sets the radiation and microclimate conditions that drive hydrological differences among opposing ecosystems. This is the closest that our community has gotten to disentangling the puzzle of climate-water-terrain-plant interactions. In addition, Dr. Gutiérrez-Jurado participated in two additional publications during his PhD based on field experiments in other sites. During his postdoctoral period at Flinders and professor position at UNAM (both described next), he has also participated in two additional publications. For his career stage, his total number of publications (10), citations (>150) and H-index (6) are impressive. In these publications, he has used the techniques outlined previously, namely environmental field sensors, remote sensing data, ground surveys, numerical modeling and mathematical analysis. In fact, the combination of methods for discerning coupled landscape processes involving geomorphology, hydrology, ecology, atmospheric science, and geophysics is the hallmark of his approach. Building geophysical data set of these integrated processes to test mathematical formulations and numerical models is where he is aiming.

With this background, Dr. Gutiérrez-Jurado accepted a postdoctoral position at Flinders University, and subsequently won Australia's Discovery Early Career Research Award, where he has diversified his research portfolio to include semiarid forest systems, observational techniques such as shallow geophysical surveys, and a mathematical framework based on maximum entropy production. During his PhD, he had been fascinated by the opportunity offered by non-equilibrium thermodynamics to offer insights on the differences between north and south facing ecosystems at Sevilleta, but had not had the chance to pursue this due to limitations in the field sensor design. Thus, in Australia, he set out to design a field experiment tailored to using this approach. This clearly demonstrates a few important qualities of Dr. Gutiérrez-Jurado: 1) an ability to translate approaches and findings across field sites; 2) tenacity in pursuing an idea from concept to completion and 3) independence as a researcher. Since I was not involved in his postdoctoral or early career award work, I cannot comment on the details of the work, but from a recent AGU presentation, it seems that he has hit upon another significant outcome and that a publication is in preparation for a major journal. Subsequently, Dr. Gutiérrez-Jurado accepted a faculty position at the Universidad Nacional Autonoma de Mexico (UNAM) through a prestigious position sponsored by the Mexican Science and Technology agency (CONACYT) to work on hydrologic problems of coastal karst regions in the Yucatan peninsula. Once again, Dr. Gutiérrez-Jurado has demonstrated his ability to adapt his skill set in geological sciences to a new set of interesting problems. Thus, I expect that Dr. Gutiérrez-Jurado will continue to excel in defining a research problem, using a diverse tool set to explore it and obtaining an important contribution to science.

While research activities are important for any Assistant Professor, the major challenges are usually related to other aspects of faculty life (teaching, advising, establishing collaborations, proposal development, etc.). In these regards, Dr. Gutiérrez-Jurado is exceptionally well prepared and has the experience of being a full-time professor at UNAM. During his PhD, postdoctoral and faculty work, he has lead a number of proposals to various funding agencies with successful outcomes; he has taught or served as a teaching assistant to a number of diverse courses; he has advised undergraduate and graduate students directly under his supervision; he has lead field experiments involving >10 students; he has collaborated widely with faculty at University of Washington, Massachusetts Institute of Technology, Georgia Institute of Technology, Universidad de Sonora, Instituto Tecnologico de Sonora, Arizona State University, and UNAM, among others; and he has given very careful thought to the type of research, teaching and service activities that he would like to pursue as a professor in the United States.

As I have hopefully conveyed, I consider Dr. Gutiérrez-Jurado as an exceptional candidate to your position, which he fits very well through his focus on geological sciences, earth surface processes and hydrology. I would be remiss if I did not comment on his character traits that will surely lead to a successful career in academia and to become a valuable faculty member at UTEP and in the greater community of El Paso and Ciudad Juarez. Dr. Gutiérrez-Jurado has always demonstrated a commitment to others, in particular to students; a high level of leadership along with a great sense of humor; the integrity and honesty to follow a path that makes others proud; and the ability to reflect on a subject that allows him to be creative while recognizing the contributions of others. Dr. Gutiérrez-Jurado is very well-liked by his peers and is a often sought out for advice. Hugo has my strongest possible recommendation for your faculty position. I believe UTEP is his 'dream job' and he will be exceptionally effective in your community of scholars for many years to come.

Please do not hesitate to contact me if further questions arise at vivoni@asu.edu or 480-727-3575.

Sincerely,

Enrique R. Vivoni
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February 2, 2016

Prof. Jose Hurtado
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Dear Dr. Hurtado:

You asked for a letter of reference regarding Dr. Hugo Gutierrez-Jurado, who has applied for a position as Assistant Professor of physical geology in your department. I have known Hugo for over ten years. I was his instructor in several grad classes and a member of his PhD Committee. Hugo has developed into a remarkable scientist and I believe that he has an exceptional future.

Hugo came to New Mexico Tech's Hydrology Program after finishing his MS at UTEP. Shortly after his arrival he became a student in several of my grad classes. In that early period it was apparent that his quantitative background was weak and Hugo initially struggled. I was concerned that a PhD degree in hydrology might be too ambitious for him, but Hugo turned the corner. After a couple of years he "got it." His quantitative as well as communication skills soon grew to the point where they were now tools to be used rather than goals themselves. Most importantly Hugo began to grasp the nature of the scientific method and the purpose of research. It was no longer as a data collection exercise, but rather the articulation and testing of hypotheses. No doubt Hugo benefited by the patient mentoring of Enrique Vivoni, his research supervisor during his period of development, and his PhD dissertation is evidence. I'll label this transition "Hugo's first epiphany."

While Hugo's PhD work was both exciting and important, it nevertheless remained somewhat immature at the time of his defense. Following the defense he addressed these issues, finalized the dissertation, and completed related papers. He also reported to his post-doc in Australia. While polishing his PhD work, and taking up new research questions in Adelaide, Hugo grew significantly. I am impressed with the science that emerged from this period. His PhD work is fully matured, as illustrated by journal papers coming out of that work (e.g., Gutiérrez-Jurado et al., 2013, *Water Resources Research*). He now has at least five journal articles based on his dissertation, three other New Mexico Tech journal papers on similar topics, and several papers related to his postdoc work in Adelaide (I have not reviewed his recent work in Mexico). I'll refer to the early part of this period, occurring in the two years or so after this PhD defense, as "Hugo's second epiphany." Hugo is now a mature and remarkable scientist.

Hugo combines field and modeling approaches (including meta-data analysis) to his research, incorporating supporting laboratory analyses and experiments. He would fit into several of your current focal areas through collaborative research including earth-system geochemistry, environmental geophysics, sedimentology, geospatial research, and professional geoscience. I also believe that he may have an interest in more general science learning and education beyond teaching at the university level, which I cover next.

My view of Hugo's teaching skills is based on a much smaller and older data set, mainly his experience as a TA for my hydrology graduate class on quantitative mathematical methods at New Mexico Tech. This class covers basic analytical and numerical solution methods to solve ordinary differential equations, and introduces similar methods for PDEs, all in the context of hydrology (mostly hydrogeology and geophysics). Hugo ran the lab for this course, which consisted of teaching Matlab and applying it to numerical solution methods, and providing a tutorial on the analytical and numerical methods introduced in lecture. Matlab was not part of my lecture. I relied entirely on Hugo to handle this topic as well as the tutorial. I sat in on every lab session and am delighted to report that the class was informative, well structured, and well taught. I even learned some new things about Matlab which Hugo also used in his own research for data analysis. In short, Hugo did a great job and received excellent teaching reviews from the students. Remember my early concern about his quantitative skills? That concern had vanished by this time.

Hugo was also the laboratory instructor for two other classes (Intro Hydro; GIS), and shared lecture duties with the late Professor Rob Bowman in another graduate class on hydrogeochemistry (low-temperature aqueous geochemistry). Together with his TA in my class this is beyond the normal teaching load of a PhD student in our hydrology program. In fact, it is not often that we ask a grad student to teach a graduate lecture; you can see by this invitation that he had our confidence. While I don't recall any details it is clear that by our repeated invitations we thought that Hugo's instruction was good for the students, while at the same time giving him the opportunity to learn more about the subject and pedagogy.

You asked about his ability to teach "introductory and undergraduate geology, geochemistry, geophysics, and/or environmental science courses, in addition to advanced and graduate courses" in his specialty. My assessment above suggests that he can handle all of these duties well (and do it in either English or Spanish). In those undergrad topical areas with which he has less training or experience I'm confident that he can pick up the additional knowledge that he needs. The only caveat is that I don't know much about his recent teaching or teaching-like experiences.

In hydrologic science we have few integrating theories at the landscape or watershed scale, other that the obvious water and energy balances. Ecohydrology, lying at the boundary of two disciplines, is an exception. Several theories have been developed, mainly for water-limited environments. Svirezhev's (2000) concepts of ecosystem entropy and dynamic equilibrium are an example. Based on energy balance principles, they can be used to categorize the ecohydrological state of a hillslope, riparian area, or other landscape unit of a watershed. Hugo applies this approach on semi-arid watersheds, using it to characterize each ecohydrological system across the landscape, and through modeling examining the sensitivity of different landscape units to changes in climate forcing. As part of his PhD he developed a very-well instrumented test watershed in central New Mexico (at the Sevilletta LTER) with different aspect, vegetation, and geomorphic dominated ecohydrologic units (see Gutiérrez-Jurado et al., 2013, *Water Resources Research*). The site was well suited to test his hypotheses and, with some exceptions, yielded easily generalizable conclusions. In Australia he worked on other well-instrumented watersheds and riparian areas as he continued to pursue these ideas (I have not reviewed his recent work in Mexico). A look at some of Hugo's co-authors, for papers for which he is senior author, demonstrate that he is working at the frontier of ecohydrology and hydrology: e.g., Rafael Bras, Huade Guan, Erkan Istanbulluoglu, Craig Simmons and Enrique

Vivoni. This also illustrates his outstanding skills in working collaboratively with others in an interdisciplinary research environment.

One way to view some of Hugo's work is that he has been seeking an index that characterizes each ecohydrological system across the landscape. If such an index can be successfully developed and applied it suggests that it can be used for more than the most of obvious of ecohydrological states. Whether causally, or simply by correlation, I suspect such an index may lead to the categorization and possibly the estimation of geomorphic states, soil development, and deep percolation and groundwater recharge. Take the recharge example. We are desperate for such categorization methods in order to spatially map recharge fluxes, to predict their response to climate forcing and vegetative change, and to detect recharge change when it occurs. If this approach is successful within its own context it opens up new research avenues that might lead to other important applications. In any event it may suggest new ideas based on the same principles and advance hydrologic science and ecohydrology along several fronts. The type of research that Hugo pursues, illustrated by this example, is fundable from a variety of local, state and federal agencies, most especially NSF, NOAA, NASA, and (even) the USGS at the federal level.

Hugo would be an outstanding fit for UTEP. He would be settled in a semi-arid part of the continent where he could continue to pursue his research topics with a wide array of nearby field sites, including some that are already instrumented. He would have nearby collaborative possibilities with NMSU, UNM, NM Tech, Texas A&M, UT Austin, Arizona State and the University of Arizona. He would be near Mexico, his home country, where he has previously worked on related field research (e.g., Vivoni et al., 2007, *J. of Climate*) with additional collaborative possibilities. He would be able to attract outstanding grad students from the south, especially from Mexico. He is an UTEP alumnus and knows something of your academic environment, the campus and the city. In short, he would not be a stranger in a strange land. He would likely make UTEP his long-term home rather than a stepping-stone to a position elsewhere.

I encourage you to give Hugo strong consideration. He is not the same young man who left you over ten years ago. He has undergone not one but two epiphanies, raising him to a level much different than you may recall from his previous time in El Paso. He is now a mature and remarkable scientist who, in an environment such as yours, is prepared to excel in both research and education.

Regards,

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