

# University of Houston Coastal Center

## Annual Report 2011-2012

Submitted 10/18/2012

### Context

Drs. Steven Pennings (Biology and Biochemistry) and Barry Lefer (Earth and Atmospheric Sciences) assumed responsibility for administration of the UHCC in September 2010, with Pennings serving as Director and Lefer as Assistant Director. A five-year plan for the UHCC was developed in 2010 with Dr. Birx, who was Vice President for Research at the time. Subsequent broad funding cuts at UH made this plan impractical. Dr. Bose, the current VP for research, has provided temporary baseline funding for the UHCC (sufficient to support the research, staff and maintenance costs for 2011-2013), and indicated that he wishes administration of the UHCC to transition to NSM. We have not yet had meetings to plan this transition.

### Structure and Function

The primary mission of the UHCC is to support environmental research on the Texas coast by providing researchers with access to field sites, equipment and facilities. A secondary mission of the UHCC is to conduct service and educational activities related to the environment.

The UHCC has a single full-time staff person (Mr. Tim Becker) who is responsible for maintenance, security, grounds-keeping, janitorial duties, and providing logistical support to research operations. The UHCC physical plant consists of a portion (ca. 1,000 acres) of a former army base, Camp Wallace. This includes approximately 300 acres of coastal prairie, which is a highly-endangered habitat, with less than 0.1% remaining nationwide. Additional facilities include two micrometeorology towers, a greenhouse, a laboratory building, and a maintenance building.

In 2011-2012 the UHCC Advisory Committee consisted of George Guillen, Environmental Institute of Houston; Dan Wells, Biology and Biochemistry Chair; Jack Casey, Earth and Atmospheric Sciences Chair; Chris Milligan, Office of the Vice President for Research. The UHCC Advisory Committee meets annually.

### Activities in 2010-2011

In 2010-2011 we maintained ongoing research strengths in 1) micrometeorology and 2) coastal ecology, 3) continued to develop a prairie research program, 4) supported educational and outreach programs, 5) maintained a service mission

supporting research by faculty inside and outside UH, and 6) held a meeting of our Advisory Committee.

1) Micrometeorology and Air Quality. Multiple funded projects (see below) use the UHCC micrometeorology tower, sonar and other instrumentation at the UHCC to conduct research and monitoring in micrometeorology and air quality. The UHCC serves as an undeveloped, “control” location for comparison with other stations in the Houston metropolitan area.

2) Coastal Ecology. Multiple funded projects (see below) use the UHCC for logistical support. Postdoc Hongyu Guo transitioned from interim support from the UHCC to funding from a Sea Grant proposal that he helped write. Guo is studying the ecological consequences of the rapid expansion of mangroves on the Texas coast.

3) Prairie Ecology. There has long been an active prairie ecology research program at the UHCC, but until recently it was conducted mostly by researchers from Rice University. In 2011 we hired a postdoc to work with Pennings to develop the UH prairie research program. The postdoc, Dr. Chelse Prather, has been very active in gathering new data, forging connections with prairie ecologists at Rice, Texas A&M and elsewhere, developing connections with prairie restoration stakeholders in Texas, and writing grant proposals. In addition, Pennings has been working with Dr. Marc Garbey, Department of Computer Science, to seek funding for mathematical models of prairie vegetation.

In addition to these three research programs, the UHCC has agreed in principle to provide a location and logistical support for a research program in green airports under development by Dr. Max Shauck, Department of Earth and Atmospheric Sciences.

4) Education and outreach. In the summer of 2011, the Earth and Atmospheric Sciences department offered a field course at the UHCC. This course, taught by Drs. Barry Lefer and Shuhab Khan, exposed students to field methods in Earth and Atmospheric Sciences. Normally, such courses are taught at remote field camps, entailing additional expense and inconvenience for students and faculty. Offering the course at the UHCC eases these financial and logistical constraints, and is of considerable benefit to the EAS department. Other education and outreach activities include: field trips for the ecology and evolution laboratory course and the introductory biology course (Dept. of Biology and Biochemistry), field trips for the remote sensing course, the geophysical data acquisition course and the borehole geophysics course (Earth and Atmospheric Sciences), prairie restoration activities with the Texas Master Naturalists, support of restoration projects by the Galveston Bay Foundation, support of restoration projects by the Katy Prairie Conservancy, field trips in association with the

2011 State of the Prairie Conference, and provision of prairie seed for restoration activities through Native American Seed.

5) Service to other researchers. The UHCC contains one of the highest quality stands of coastal prairie in Texas. Coastal prairie is a highly endangered habitat, with less than 1% of the original habitat remaining. The open-air greenhouse at the UHCC is a valuable facility for conducting outdoor mesocosm experiments. In addition, the extensive open spaces at the UHCC provide a location for storage of large samples and for research activities requiring space that is not available on campus. In 2011-2012 the UHCC hosted or supported research projects by Dr. Jon Snow (UH, Arctic Hard Rock Sample Collection), Dr. Evan Siemann (Rice University), Dr. Ken Whitney (Rice University), Dr. Anna Armitage (Texas A&M Galveston, collaborating with Pennings), Dr. Charles Criscone (Texas A&M), and graduate students from Rice University and Texas A&M University. A major new research initiative on fire micrometeorology is scheduled to begin in late 2012, under the direction of Dr. Craig Clements, San Jose State University, in collaboration with Lefer.

6) Advisory Committee. The UHCC advisory committee met on April 19, 2012. Present were Pennings, Lefer, Wells, Milligan and Guillen. The committee discussed recent activities at the UHCC, mechanisms for charging user fees, and mechanisms to increase research, education and outreach activities at the UHCC. Minutes of the meeting are attached.

## **Funding to UH (Since September 2010: \$4,149,645)**

### **State and other Funding**

Title: Climate effects on ANPP of saltmarshes of the North American Atlantic coast—a hierarchical model approach. (Postdoctoral proposal for Kazik Wieski). Project period: 2012-2013. Total Award: \$37,648.

Title: HGB Ozonesonde Launches and Vertical Ozone Profiled in Eastern Texas 2010. Award number: 582-5-64594-FY10-11. PI: Barry Lefer, Co-PI: Bernhard Rappenglueck. Sponsor: Texas Commission on Environmental Quality. Project Period: 02/24/10 – 07/08/11. Total Award: \$135,000

Title: HGB Ozonesonde Launches and Vertical Ozone Profiled in Eastern Texas 2010-Extension. Award number: 582-5-64594-FY10-11. PI: Barry Lefer. Sponsor: Texas Commission on Environmental Quality. Project Period: 07/09/2011 – 09/31/2011. Total Award: \$67,000

Title: Ozone and Carbon Monoxide Monitor Operation, University of Houston Sites. Award number: 582-5-64594-FY10-12. PI: Barry Lefer, Co-PI: Bernhard Rappenglueck. Sponsor: Texas Commission on Environmental Quality. Project Period: 03/16/10 – 02/28/12. Total Award: \$210,000.

Title: Improving the Characterization of Pollution Transported into Texas. Award number: 582-5-64594-FY10-13. PI: Dr. Xun Jiang, Co-PI: Barry Lefer. Sponsor: Texas Commission on Environmental Quality. Project Period: 05/07/10 – 01/31/11. Total Award: \$150,000.

Title: University of Houston Study of Houston Atmospheric Radical Precursors (SHARP) Data Analysis. PI: Bernhard Rappenglueck, Co-PI: Barry Lefer. Sponsor: Texas Commission on Environmental Quality. Project Period: 06/07/10 – 06/30/11. Total Award: \$290,534.

Title: SHARP Data Analysis: Radical Budget and Ozone Production. PI: Dr. Barry Lefer. Sponsor: Air Quality Research Program - University of Texas at Austin. Project Period: 11/15/10 – 08/14/11. Total Award: \$199,368.

Title: Quantification of industrial emissions of VOCs, NO<sub>2</sub> and SO<sub>2</sub> by SOF and mobile DOAS. PI: Dr. Bernhard Rappenglueck, Co-PI: Barry Lefer. Sponsor: Air Quality Research Program - University of Texas at Austin. Project Period: 11/15/10 – 08/14/11. Total Award: \$258,198.

Title: Dallas Measurements of Ozone Production. PI: Dr. Barry Lefer. Sponsor: Air Quality Research Program - University of Texas at Austin. Project Period: 02/15/10 – 08/14/11. Total Award: \$195,054.

Title: Surface Measurements and One-Dimensional Modeling Related to Ozone Formation in the Suburban Dallas-Fort Worth Area. PI: Dr. Barry Lefer. Sponsor: Air Quality Research Program - University of Texas at Austin. Project Period: 02/15/10 – 08/14/11. Total Award: \$98,134.

Title: HGB Ozonesonde Launches and Vertical Ozone Profiled in Texas 2010 extension. Award number: 582-5-64594-FY10-11ext. PI: Barry Lefer. Sponsor: Texas Commission on Environmental Quality. Project Period: 02/08/11 – 09/01/11. Total Award: \$106,316.

Title: HGB O<sub>3</sub> Sonde Launches 2010-08 and Vertical Ozone Profiled in Eastern Texas 2010-10\_extension. PI: Dr. Barry Lefer. Sponsor: Texas Commission on Environmental Quality. Award number: 582-5-64594-FY10-11ext. Project Period: 09/02/11 – 09/31/12. Total Award: \$142,000.

Title: Ozone and Carbon Monoxide Monitor Operation, University of Houston Sites. PI: Barry Lefer. Sponsor: Texas Commission on Environmental Quality. Project Period: 03/01/12 – 09/30/12. Total Award: \$185,000.

Title: Implementation and evaluation of new HONO mechanisms in a 3-D Chemical Transport Model for Spring 2009 in Houston, PI: Barry Lefer, Sponsor: Air Quality Research Program, Project Period: 09/01/2012– 08/30/2013, Total Award: \$117,446.

Title: Mobile Lab Measurements of PM, VOCs, and photochemically relevant gases in support of DISCOVER-AQ, Project Period: 10/01/2012 – 12/31/2013, Sponsor: Air Quality Research Program, Total Award : \$116,903.

Title: Ozonesonde launches from the University of Houston and Smith Point, Texas in support of DISCOVER-AQ, PI: Barry Lefer, Sponsor: Air Quality Research Program, Project Period: 09/01/2012 – 12/31/2013, Total Award : \$19,845.

Title: Quantification of industrial emissions of VOCs, NO<sub>2</sub>, and SO<sub>2</sub> by SOF and mobile DOAS during DISCOVER-AQ, PI: Barry Lefer, Sponsor: Air Quality Research Program, Project Period: 01/01/2013 – 12/31/2013, Total Award: \$48,506.

## Federal Funding

Title: Operations of the Radar Wind Profiler at the UHCC. PI: Dr. Barry Lefer. Cooperative Agreement: M05AC12284. Sponsor: Bureau of Ocean Energy Management, Regulation, and Enforcement. Project Period: 10/15/10 – 12/31/11. Total Award: \$35,835.

Title: RAPID Deepwater Horizon Oil Spill: Insights into Salt Marsh Food Webs from the Deepwater Horizon Oil Spill. PI: Steven Pennings. Sponsor: National Science Foundation. Project Period: 7/2010-6/2011. Total Award: \$131,115.

Title: Marsh Platform Dissection as a Response to Sea Level Rise: Eco-Physical Mechanisms of Sediment Erosion. PI: Steven Pennings, Duncan FitzGerald (Boston University). Sponsor: National Institute for Coastal Climate Research, Project Period: 4/2010-8/2011. Total Award: \$125,000.

Title: GCE II: Georgia coastal ecosystems. PI: Meryll Alber and Steven Pennings. Sponsor: National Science Foundation. Project Period: 2006-2012. Total Award: \$4,920,000. This is a multi-investigator project, with about 15 participating scientists. UH subcontract was \$487,403 over 6 y.

Title: Collaborative Research: Biophysical alteration of wetland geomorphology in response to rising sea level. PI: Steven Pennings, Duncan FitzGerald (Boston University), Amala Mahadevan (BU). Sponsor: National Science Foundation. Project Period: 9/2011-9/2014. Total Award: ~\$650,000. \$105,854 to UH.

Title: Integrating Consumer-Resource Theory into Density-Dependent Mechanisms for Limiting Population Growth and Overexploitation in a Pollinating Seed-eating Mutualism. PI: Julian N. Holland, Donald L. DeAngelis (USGS). Sponsor: National Science Foundation. Project Period: 7/2011 - 8/2013. Total Award: \$219,540.

Title: Mangroves invading Texas salt marshes: does it matter? PI: Steven Pennings, Anna Armitage (Texas A&M Galveston). Sponsor: Texas Sea Grant. Project Period: 6/2012-5/2014. Total Award: \$300,000.

Title: GCE III: Georgia coastal ecosystems. PIs: M. Alber and S. Pennings. Sponsor: National Science Foundation. Project Period: 2012-2018. Total Requested: \$5,880,000. This is a multi-

investigator project, with about 15 participating scientists. Project period: 2012-2018. \$367,946 to UH.

## Publications (Since 2010)

### In press

- Cleland, E. E., C. M. Clark, S. L. Collins, J. E. Fargione, L. Gough, K. L. Gross, S. C. Pennings and K. N. Suding. In press. Patterns of trait convergence and divergence among native and exotic species in herbaceous plant communities are not modified by nitrogen enrichment. *Journal of Ecology*.
- Guo, H. and S. C. Pennings. In press. Post-mortem ecosystem engineering by oysters creates habitat for a rare marsh plant. *Oecologia*.
- Holland, J.N., Y. Wang, S. Sun, and D.L. DeAngelis. Dynamics of indirect interactions in a mutualism-parasitism food web module. *Ecology* (in review).
- Holland, J.N. and F. Molina-Freaner. Multi-factorial conditionality of plant facilitation: Hierarchical effects of rainfall, nurse plants, granivory, and seed banks on cactus recruitment. *Journal of Vegetation Science* (in press).
- S.Malek and M.Garbey, Improving Volunteer Computing Scheduling for Evolutionary Algorithms, to appear in *Future Generation Computer Systems*, Vol 29 Issue 1:pp1-14, 2013.
- McCall, B. D. and S. C. Pennings. In press. Geographic variation in salt marsh structure and function. *Oecologia*.
- Pennings, S. C. In press. Forging collaborations between ecology and historical ecology. In V. Thompson (ed.), *The archaeology and historical ecology of small scale economies*. The University Press of Florida.

### 2012

- A.K.Bittebiere, C.Mony, B.Clement and M.Garbey, 2012. Modeling competition between plants using an Individual Based Model: Methods and effects on the growth of two species with contrasted growth forms, *Ecology Modelling* 234: pp 38-50.
- A. El Hamidi, M. Garbey and N. Ali, 2012. A PDE model of clonal plant competition with nonlinear diffusion, *Ecology Modelling* 234: pp. 83-92.
- A. El Hamidi, M. Garbey and N. Ali, 2012. On Nonlinear Coupled Diffusions in Competition Systems, *Nonlinear Analysis: Real World Applications* volume 13, issue 3, pp. 1306 – 1318.
- Carrillo, J, Wang, Y, Ding, J, Klootwyk, K, and Siemann, E. 2012. Decreased indirect defense in the invasive tree, *Triadica sebifera*. *Plant Ecology* DOI: 10.1007/s11258-012-0055-z
- Carrillo, J., Wang, Y., Ding, J., and E. Siemann. 2012. Induction of extrafloral nectar depends on herbivore type in invasive and native Chinese tallow seedlings. *Basic and Applied Ecology*, 13: 449-457. <http://dx.doi.org/10.1016/j.baae.2012.07.006>
- Ewers, C., A. Beiersdorf, K. Wieski, S. C. Pennings, and M. Zimmer. 2012. Predator/prey-interactions promote decomposition of low-quality detritus. *Wetlands*. DOI 10.1007/s13157-012-0326-4.
- Gabler, C.A. and E. Siemann. 2012. Environmental variability and ontogenetic niche shifts in exotic plants may govern reinvasion pressure in restorations of invaded ecosystems. *Restoration Ecology* 20(5):545-550.
- Guo, H. and S. C. Pennings. 2012. Mechanisms mediating plant distributions across estuarine landscapes in a low-latitude tidal estuary. *Ecology* 93:90-100.

- Gough, L., K. L. Gross, Cleland, E. E., C. M. Clark, S. L. Collins, J. E. Fargione, S. C. Pennings and K. N. Suding. 2012. Incorporating clonal growth form clarifies the role of plant height in response to nitrogen addition. *Oecologia* 169:1053-1062.
- Haman, C. L., Lefer, B. L. and Morris, G.A., Seasonal Variability in the Diurnal Evolution of the Boundary Layer in a Near Coastal Urban Environment, *Journal of Oceanic and Atmospheric Technology*, JTECH-D-11-00114, 2012.
- Holland, J.N. 2012. Population Dynamics of Mutualism. *Nature Education Knowledge* 3(6): 2. .
- Huang, W. Carrillo, J., Ding, J., and E. Siemann. 2012. Invader partitions ecological and evolutionary responses to above- and belowground herbivory. *Ecology*, <http://dx.doi.org/10.1890/11-1964.1>
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- Jimenez, J. M., K. Wieski, L. B. Marczak, C.-K. Ho, S. C. Pennings. 2012. Effects of an omnivorous katydid, salinity, and nutrients on a planthopper-Spartina food web. *Estuaries and Coasts* 35:475-485.
- McCall, B. D., S. C. Pennings. 2012. Disturbance and recovery of salt marsh arthropod communities following BP Deepwater Horizon oil spill. *PLoS ONE* 7 (3) e32735. DOI. 10.1371/journal.pone.0032735.
- McCluney, K.E., J. Belnap, S.L. Collins, A.L. González, E.M. Hagen, J.N. Holland, B.P. Kotler, F.T. Maestre, S.D. Smith, B.O. Wolf. 2012. Shifting consumer-resource interactions in response to altered water availability in dryland systems. *Biological Reviews* 87:563-582. .
- Pennings, S. C., M. Alber, C. R. Alexander, M. Booth, A. Burd, W.-J. Cai, C. Craft, C. B. DePratter, D. Di Iorio, C. Hopkinson, S. B. Joye, C. D. Meile, W. S. Moore, B. Silliman, V. Thompson, J. P. Wares. South Atlantic Tidal Wetlands. 2012. In A. Baldwin and D. Batzer (eds.), *Wetland Habitats of North America: Ecology and Conservation Concerns*. University of California Press.
- Rico-Gray, V., Díaz-Castelazo, C., A. Ramírez-Hernández, P.R. Guimarães Jr., and J.N. Holland. 2012. Abiotic factors shape temporal variation in the structure of mutualistic ant-plant networks. *Arthropod-Plant Interactions* 6: 289-295.
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- Wong, K. W., Tsai, C., Lefer, B., Haman, C., Grossberg, N., Brune, W. H., Ren, X., Luke, W. and Stutz, J., Daytime HONO vertical gradients during SHARP 2009 in Houston, TX, *Atmos. Chem. Phys.*, 12, 635-652, doi:10.5194/acp-12-635-2012, 2012

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- Marczak, L. B, C.-K. Ho, K. Wieski, H. Vu, R. F. Denno and S. C. Pennings. 2011. Latitudinal variation in top-down and bottom-up control of a salt marsh food web. *Ecology* 92:276-281.

- Marquardt, E. S. and S. C. Pennings. 2011. Diet mixing in a parasitic plant: adaptation or constraint? *Plant Ecology* 212:69-77.
- Mony, C., M. Garbey, M. Smaoui and M. L. Benot. 2011. Large Scale Parameter Study of an Individual Based Model of Clonal Plant with Volunteer Computing Ecological Modelling, Vol 222, pp 935-946.
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- Mao, J.; Ren, X.; Chen, S.; Brune, W. H.; Chen, Z.; Martinez, M.; Harder, H.; Lefer, B.; Rappenglueck, B.; Flynn, J.; Leuchner, M., Atmospheric oxidation capacity in the summer of Houston 2006: Comparison with summer measurements in other metropolitan studies. *Atmospheric Environment* **2010**, *44* (33), 4107-4115.
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## **UH Coastal Center Advisory Committee meeting minutes 4 2012**

April 19, 2012, 2-3:30 pm, 301 in SR 2

### **Present**

Steve Pennings and Barry Lefer (UHCC)

Dan Wells (Biology and Biochemistry)

Cris Milligan (OVPR)

George Guillen (EIH)

### **Minutes**

Pennings provided a review of UHCC activities and progress over the last 12 months. Current research activities in prairie ecology, coastal ecology, micrometeorology, and geology. Possible future activities in green airports and petroleum geology. The UHCC is used by field classes from Earth and Atmospheric Sciences and from Biology and Biochemistry. Uncertainty over the future of the UHCC is causing concern among the broader environmental community in Texas and is limiting our ability to pursue research opportunities. Tornado damage has largely been repaired.

The committee discussed potential user fees for the UHCC. Milligan will determine whether we need to have the fee schedule approved, and will find out what we need to do in order to set up a recharge mechanism.

The committee discussed how OVPR could help the UHCC. Helpful actions would include 1) a 10 year commitment to maintaining ownership by UH, 2) a multi-year commitment to maintaining funding (perhaps through the scope of the initial 5 year strategic plan), and 3) help in persuading the UH IT people to provide internet connectivity to the facility.

The committee discussed ways to increase use of the UHCC. Possibilities discussed included petroleum geology and engineering, green airports, the UH wind alliance, and additional field courses. There may also be possibilities for partnering with conservation and nature groups such as the Audubon Society.

### **Action items**

Milligan will follow up on user fees and recharge center.

Pennings will ask Dr. Bose about OVPR help (see above), circulate and implement approved user fee schedule for coming academic year, invite Anne Sherman to tour the UHCC, discuss the Ecology and Evolution field course use of the UHCC with Dr. Williams, discuss potential use of the UHCC by UHCL field courses with Dr. Howard, and contact the UH wind alliance to assess their interest in the UHCC as a field site.

Lefer will follow up on possible geophysics field course, and arrange meeting to discuss possible petroleum geology research at UHCC.