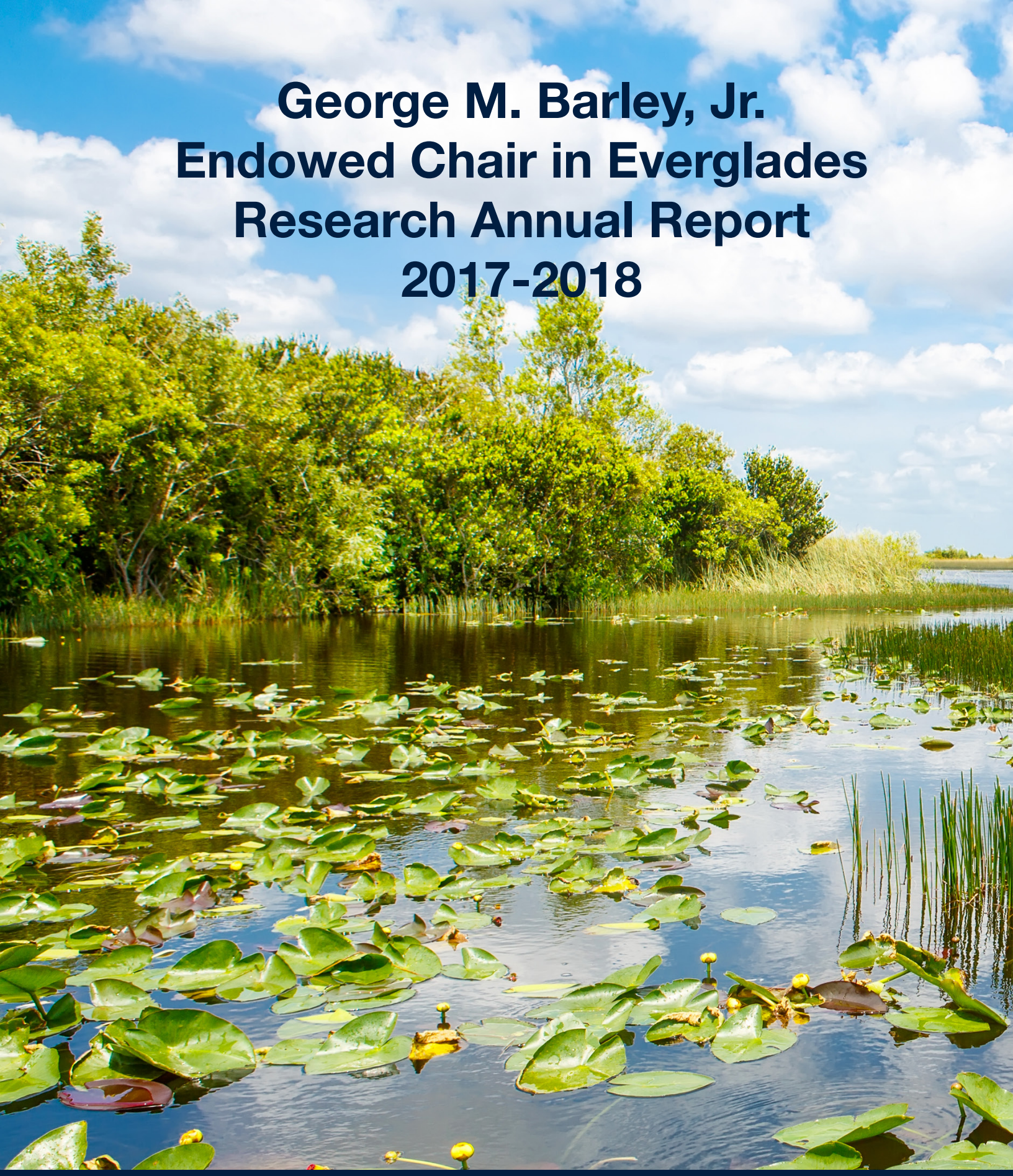
George M. Barley, Jr. Endowed Chair in Everglades Research Annual Report 2017-2018



FIU Institute of Water and Environment

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Miami, August 29th 2018

Dear Mrs. Mary Barley,

May this letter serve as an acknowledgment of my great appreciation for the support provided through the George Barley Chair, which I was awarded nearly 10 years ago. This financial support has significantly incremented the productivity of my research group and thus of FIU over the years. As a result, my research group has had another highly productive year, with eighteen publications (see listing). Most of these publications are directly related to the larger Everglades ecosystem, but some are related to other general science questions focused on the importance and cycling of organic matter in aquatic environments. The Barley Chair partially or fully supported these research activities, and in some cases students, post docs and visiting scientists who participated in the research. Specifically, we got heavily involved in and also published novel information regarding land-use and hydrological connectivity as environmental drivers of organic matter composition in river systems and else. A significant portion of our work continued to evolve around the sources, transport and fate of dissolved and particulate black carbon, resulting in an invited review article in the journal Limnology & Oceanography Methods.

Financial support from the Barley Chair was primarily provided through salary for graduate students and partial summer salary for me, support for travel to present our results at national and international conferences, and for the acquisition of laboratory equipment and supplies. But more importantly, we have been able to pursue research projects for which funding was otherwise limited or unavailable. For example, studying the effect of land-use and hydrology on the composition and reactivity of dissolved organic matter (mainly soil derived) and dissolved black carbon (fire derived) in a large watershed (Altamaha River, GA) was only possible with the support of the Barley Chair, and collaborations with the University of Georgia and the University of Oldenburg in Germany. The Altamaha River project represents a major portion of the dissertation of Alan Roebuck, a Ph.D. student in the Environmental Track at FIU's Department of Chemistry & Biochemistry.

The above-described on-going research activities are expected to further enhance our knowledge on human effects of the biogeochemistry of aquatic ecosystems, including the Greater Everglades. As such, we are immensely thankful for the nearly 10-year support from the George Barley Endowment to my laboratory, which has had significant impact on the productivity and quality of research of my group and for SERC/InWE.

Thanking you again for your continued support, I remain sincerely yours,

Dr. Rudolf Jaffé
George Barley Endowed Professor
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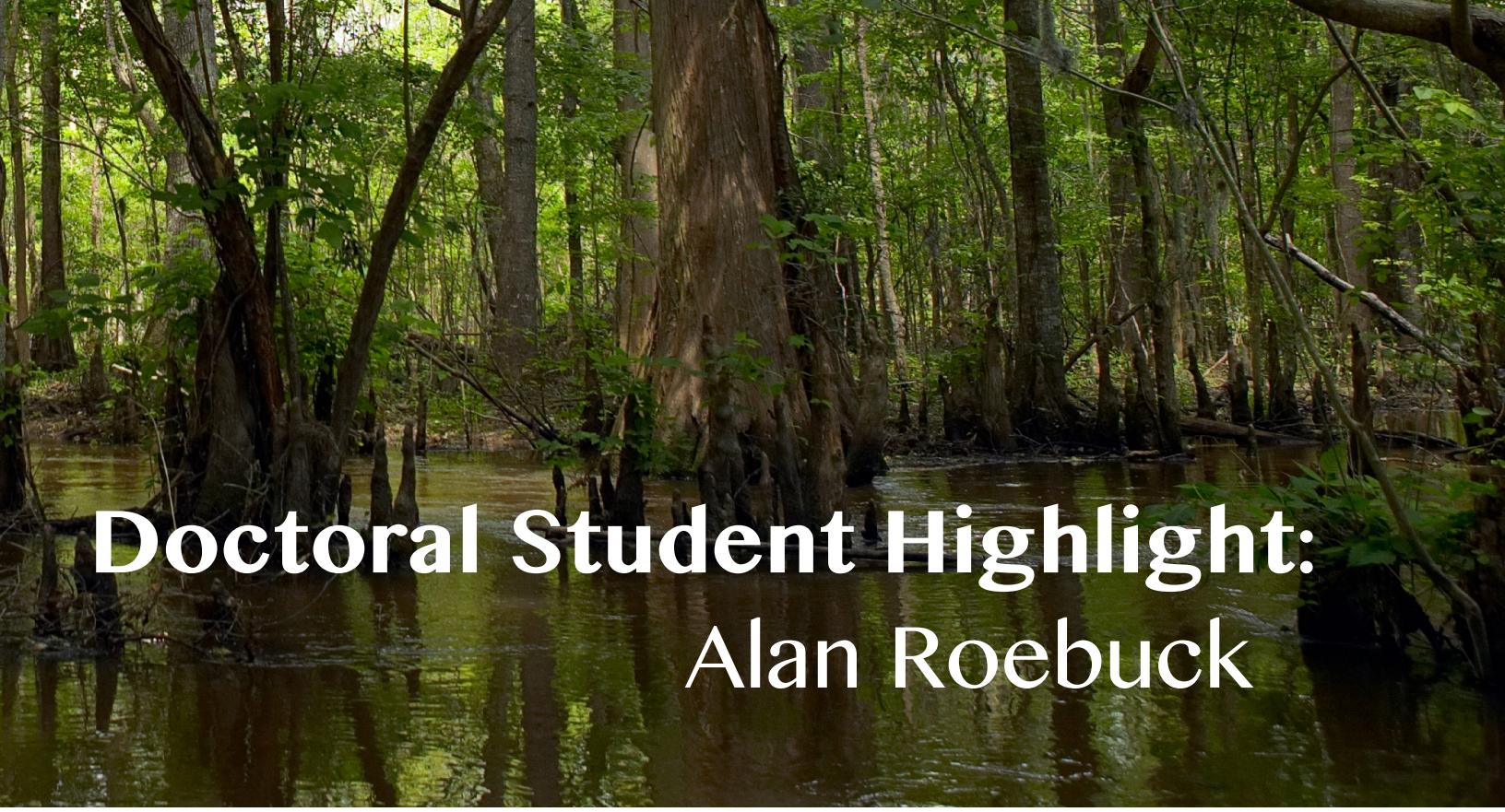
Restoring and Protecting our Florida Everglades

The Everglades provides water to over eight million South Florida residents and is home to hundreds of species. It is a unique wetland spanning more than 800 square miles at the tip of South Florida, and is constantly threatened by our changing climate and, sometimes even, the water management decisions meant to protect it. Support from the George Barley Jr. Endowed Chair in Everglades Research (Barley Chair) has been instrumental in driving the continued success of important research by Dr. Rudolf Jaffé for restoring and protecting the Florida Everglades.

Jaffé and his team work on dissolved organic carbon (DOC) dynamics in the greater Everglades, as associated with the Florida Coastal Everglades Long-Term Ecological Research Program, in order to ensure the continued protection of the wetland. The flow of water in the Everglades and transport of DOC impact the ecosystem functions of the wetland. Jaffé uses long-term data to identify connections between climatic conditions and water management as environmental drivers of DOC movement and composition. He then uses what he learns from these comparisons to model future scenarios, providing these to water managers to inform and improve water management decisions in the Everglades. Jaffé and his team collaborate with the South Florida Water Management District (SFWMD) in assessing the effects of enhanced water flow in Everglades marsh environments, specifically regarding how organic particles are transported within the wetland by applying molecular biomarker techniques. This research helps in determining the water flow conditions necessary to restore the ridge and slough landscape in the Everglades, which have been severely degraded over time.

Barley Chair support has also made it possible for Dr. Bernd Simoneit, Professor Emeritus from Oregon State University, and Dr. Kaelin Cawley from NEON, Colorado, to visit Florida International University. Both researchers are long-time collaborators with Jaffé's lab, assisting in some of the lab's research regarding organic matter cycling and Everglades restoration.

Students collecting samples in the Everglades for research.



Doctoral Student Highlight: Alan Roebuck

Thanks to the generous support provided through the Barley Chair in Everglades Research, Dr. Rudolf Jaffé is also able to bolster graduate student research and education. Over the last 2 years, Dr. Jaffé has been supporting Alan Roebuck with his doctoral research.

Support from the Barley Chair has contributed to the success of Ph.D. student Alan Roebuck's research. Roebuck's research is focused on quantifying how concepts in stream ecology and land-use influence the flux and composition of DOC in the Altamaha River watershed in Georgia. Roebuck has found that stream order and land-use contributed to about 20% and 30% respectively to the DOC composition, leaving 50% to other, at this point undetermined environmental drivers, being investigated as this work continues. Understanding how much of DOC is shaped by natural vs. anthropogenic influences can help determine how to manage waterbodies to better protect and conserve them.

A significant portion of Alan's research is focused on both dissolved and particulate black carbon (DBC & PBC). These important forms of organic matter, believed to be derived from fire activity, represent a significant portion of the DOC and POC pool, but remain to some degree mysterious and unconstrained to the organic biogeochemistry community. As such, many questions remain regarding their importance and ecological function. Alan's research on this subject in the Everglades, the Amazon and Altamaha river basin will improve our understanding and enhance our knowledge on this subject, thanks in large part to the generous support from the Barley Chair.

Doctoral student, Alan Roebuck, shows off his samples after a day of fieldwork.

2017-2018 Publications

1. He D., Rivera-Monroy V., and Jaffé R. (2018). Species-specific variations of leaf δ13C and leaf wax n-alkane δ13C values in three dominant mangrove species along salinity transects in a sub-tropical estuary. J. Geophys. Res. Biogeosciences. Submitted.

2. Roebuck JA, Gonsior M, Du Y, Schmitt-Kopplin P, Enrich-Prast A, and Jaffé R (2018). Biogeochemical controls on the fate and transport of dissolved black carbon in the Amazon River. Aquat. Sci. Submitted.

3. Regier P, Cawley K, Wang W, and Jaffé R (2018). Linking hydrology and long-term dissolved organic matter compositional dynamics in the Florida Everglades. J. Geophys. Res. Biogeosciences. Submitted.

4. He D., Simoneit B.R.T., Cloutier J.B., Jaffé R. (2018). Early diagenesis of triterpenoids derived from mangroves in a subtropical estuary. Organic Geochemistry. Submitted.

5. Du Y., Zhang Q., Roebuck J.A., Liu D., Chen F., Chen Y., Shi B., Zeng Q., Liu Z., Jaffé R. (2018). Watershed controls of dissolved organic matter variation in lakes affected by intensive anthropogenic activities. Sci. Total Environ. Submitted.

6. Roebuck J.A., Medeiros P.M., Letourneau M.L., and Jaffé R. (2018). Hydrological controls on the seasonal variability of dissolved and particulate black carbon in the Altamaha River, Georgia. J. Geophys. Res. Biogeosciences. In press.

7. Regier P., He D., Saunders C., Jara B., Hansen C., Newman S., Coronado-Molina C., and Jaffé R. (2018). Sheetflow effects on sediment transport in a degraded ridge-and-slough wetland: insights using molecular markers. J. Geophys. Res. Biogeosciences, In press.

8. Troxler T., Fuentes J., Jaffé R., et al. (2018). Florida Coastal Everglades Long Term Ecological Research – Synthesis: Carbon Cycling and Related Cycles at a Multitude of Scales. In press. (Book chapter)

9. Rehage J., et al. (2018). Florida Coastal Everglades Long Term Ecological Research – Synthesis: Fragmentation, Connectivity, and Teleconnections – Legacies and Future Implications. In press. (Book chapter).

10. He D., Simoneit B.R.T., and Jaffé R. (2018). Biomarker co-occurrence of three different races of Botryococcus braunii (A, B and L) in a subtropical freshwater wetland. Scientific Reports. 8, 8626. DOI:10.1038/s41598-018-26900-9.

11. Roebuck J.A., Seidel M., Dittmar T., and Jaffé R. (2018). Land Use Controls on the Spatial Variability of Dissolved Black Carbon in a Subtropical Watershed. Environ. Sci. & Technol. doi.org/10.1021/acs.est.8b00190.

12. Tose L.V., Benigni P., Leyva D., Sundberg A., Ramírez C.E., Ridgeway M.E., Park M.A., Romão W., Jaffé R., and Fernandez-Lima F. (2018). Coupling Trapped Ion Mobility Spectrometry to Mass Spectrometry: TIMS-TOF MS vs TIMS-FT-ICR MS. Rapid Commun. Mass Spec. 32, 1287-1295 (10.1002/rcm.8165).

13. Du Y., Ramirez C., Jaffé R. (2018). Fractionation of DOM by coprecipitation with Fe: effects of composition. Environmental Processes 5, 5-21. DOI: 10.1007/s40710-017-0281-4.

14. Wagner S., Jaffé R., Stubbins A. (2018). Dissolved black carbon in aquatic ecosystems: A review. Limnology & Oceanography Methods. DOI: 10.1002/lol2.10076.

15. Pisani O., Gao M., Maie N., Miyoshi T., Childers D.L. and Jaffé R. (2018). Compositional aspects of herbaceous litter decomposition in the freshwater marshes of the Florida Everglades. Plant & Soil. 423, 87-98. DOI: 10.1007/s11104-017-3495-3.

16. Wagner S., Ding Y., and Jaffé R. (2017). A new perspective on the apparent solubility of dissolved black carbon. Frontiers in Biogeochemistry. doi: 10.3389/feart.2017.00075

17. Santos F., Wagner, S., Rothstein, D., Jaffé, R., and Miesel, J. (2017). Impact of a historical fire event on pyrogenic carbon stocks and dissolved pyrogenic carbon in spodosols in Northern Michigan. Frontiers in Biogeochemistry, DOI: 10.3389/feart.2017.00080.

18. Shang P., Lu Y., Du Y., Jaffé R., Wynn A. (2017). Climatic and Watershed Controls of Dissolved Organic Matter Variation in Streams across a Gradient of Agricultural Land Use. Science Total Environ. 612C, 1442-1453.

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