

Assaad Mrad  
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## **Education**

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**Nicholas School of the Environment**, Duke University – Durham, NC

2016-                      Ph.D. student, Environment  
                                 Advisor: Gabriel G. Katul

**Faculty of Engineering and Architecture**, American University of Beirut –  
Beirut, Lebanon

2012-2016              Bachelor of Engineering, Mechanical Engineering  
                                 GPA: 3.98/4

## **Research Interests**

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My research interest is in the mathematical representation of ecological systems with the goal of unfolding relations between the animate and inanimate. Such relations open up vistas into ‘engineering solutions’ derived from natural systems as they cope with environmental stresses. The ultimate goal would be to use such research to tackle societal problems that benefit from innovative engineering solutions. Clearly, progress here requires cross-fertilization between multiple branches of science and engineering. A case in point is my research work on improving understanding of the traits, functions, and trade-offs that influence plant hydraulics and their drought response. Second, my work on plant hydraulics helps advance theories on how water use strategy controls photosynthesis, especially optimal control theory. Finally, a common theme in my research is how individual elements like conduits, stomates, branches, and whole trees interact to emanate collective and complex behaviours.

## **Peer-Reviewed Publications**

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1. **Mrad, A.**, D. Levia, G. Katul (2020). Interpreting lead-lag times between peak water and peak grain: a dynamical system perspective. **Submitted to Nature**

2. **Mrad, A.**, G. Katul, S. Manzoni, M. Lindh, G. Vico & R. Oren (2020). Recovering the metabolic, self-thinning, and constant final yield rules in mono-specific stands. **Submitted to *Frontiers in Forests and Global Change***
3. **Mrad, A.**, J.-C. Domec, C-W. Huang, F. Lens & G. Katul (2018). A network model links wood anatomy to xylem tissue hydraulic behavior and vulnerability to cavitation. *Plant, Cell & Environment*.
4. **Mrad, A.**, S. Sevanto, Y. Liu, J.-C. Domec, M. Nakad & G. Katul (2019). A dynamic optimality principle for water use strategies explains isohydric to anisohydric plant responses. *Frontiers in Forests and Global Change*.

### **Conference Presentation and Seminars**

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1. **Mrad, A.**, J-C. Domec, F. Lens, G. Katul. Sept 2019. “Upscaling plant anatomical traits to organ-scale vulnerability to embolism.” 4<sup>th</sup> Xylem International Meeting
2. **Mrad, A.**, Y. Liu, M. Liu, S. Sevanto, G. Katul. Dec 2018. “A dynamic optimality principle for water use strategies explains isohydric to anisohydric plant responses.” American Geophysical Union Fall Meeting 2018
3. **Mrad, A.**, J-C. Domec, C-W. Huang, G. Katul. Dec 2017. “A Revised Similarity Law in Botanic Describes the Genesis of the Vulnerability Curve Shape in Vascular Plants.” American Geophysical Union Fall Meeting 2017.

### **Honors, Scholarships, and Travel Grants**

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2019	Nicholas School of the Environmental - Dean’s award for outstanding student manuscript
2018	Assisted in writing and drawing figures for the successful NSF proposal “The dynamics of embolism formation and repair in xylem conduits: from bubble scale to loss in plant hydraulic transport capacity”
2019	Financial support by the Federation of European Societies of Plant Biology (FESPB) to attend the 4 <sup>th</sup> Xylem International Meeting in Padova, Italy
2012-2016	Faculty of Engineering and Architecture Dean’s Honor List

## **Teaching**

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- 2017 & 2018      Teaching assistant for Dynamical Systems: Office hours, lectures on Mathematica and Matlab and ordinary differential equations, and homework evaluation
- 2016                Teaching assistant for Watershed Hydrology: office hours and homework evaluation

## **References**

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Gabriel Katul: [gaby@duke.edu](mailto:gaby@duke.edu)  
Jean-Christophe Domec: [jc.domec@duke.edu](mailto:jc.domec@duke.edu)  
Sanna Annika Sevanto: [sanna@lanl.gov](mailto:sanna@lanl.gov)  
Delphis Levia: [dlevia@udel.edu](mailto:dlevia@udel.edu)  
Ram Oren: [ramoren@duke.edu](mailto:ramoren@duke.edu)  
Amilcare Porporato: [aporpora@princeton.edu](mailto:aporpora@princeton.edu)

## **Other Interests**

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- 2018-2019      Fellow, *Building Outdoor Leadership at Duke*
- 2014-2016      Committee member, *American University of Beirut Astronomy Club*
- 2012-2014      Volunteer, *Lebanese Red Cross Emergency Medical Services*
- 2012-2014      Volunteer, *Lebanese Red Cross Blood Donation Services*

## **Languages**

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English: Professional written and oral proficiency  
French: Professional written and oral proficiency  
Arabic/Lebanese: Professional written and oral proficiency

## **Programming Skills**

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Proficient with Matlab, Python, and Mathematica  
Extended previous experience with C++ and Java