**Drought Resistance/Resilience Case Studies**

Our goal is to have people do a bit of background preparation regarding the research that’s been done on drought at their LTER site. There is a template on this page, with a few examples we’ve filled out for NTL on subsequent pages.

If you have time to e-mail us (szipper@wisc.edu; ciruzzi@wisc.edu) your case studies in advance, that would be help us prepare; if not, just bring them to the meeting!

*Case Study Template*

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| **Citation(s)** |  |
| **LTER Site** |  |
| **Ecosystem** |  |
| **Overview** | This study focuses on…  The authors find… |
| **Is drought resistance quantified? If so, how? Are drivers of drought resistance discussed?** |  |
| **Is drought resilience quantified? If so, how? Are drivers of drought resilience discussed?** |  |

*Case Study Examples*

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| **Citation(s)** | Zipper, S. C., M. E. Soylu, E. G. Booth, and S. P. Loheide II (2015), Untangling the effects of shallow groundwater and soil texture as drivers of subfield-scale yield variability, *Water Resour. Res.*, n/a–n/a, doi:10.1002/2015WR017522.  Zipper, S. C., and S. P. Loheide II (2014), Using evapotranspiration to assess drought sensitivity on a subfield scale with HRMET, a high resolution surface energy balance model, *Agricultural and Forest Meteorology*, *197*, 91–102, doi:10.1016/j.agrformet.2014.06.009. |
| **LTER Site** | North Temperate Lakes (Madison Lakes Region) |
| **Ecosystem** | Corn field |
| **Overview** | These studies focus on water table depth and soil texture as drivers of evapotranspiration and yield variability in two corn fields.  The authors find that areas with shallow groundwater have high yields during dry years but yield losses during wet years, and areas with intermediate groundwater have consistently high yield across years. The optimum water table depth is shallower in coarse soils than in finer soils. |
| **Is drought resistance quantified? If so, how? Are drivers of drought resistance discussed?** | Yes. Drought resistance is defined as areas within cornfields that experience high yield in both wet and dry growing seasons. This was quantified using evapotranspiration rates (2014 study), and spatially distributed yield data and biophysical modeling (2015 study). The primary drivers are soil texture (fine-grained = more resilient) and water table depth (within root zone = more resilient). |
| **Is drought resilience quantified? If so, how? Are drivers of drought resilience discussed?** | No. |

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| **Citation(s)** | Gaeta, J. W., G. G. Sass, and S. R. Carpenter (2014), Drought-driven lake level decline: effects on coarse woody habitat and fishes, *Can. J. Fish. Aquat. Sci.*, *71*(2), 315–325, doi:10.1139/cjfas-2013-0451. |
| **LTER Site** | North Temperate Lakes (Trout Lake Region) |
| **Ecosystem** | Lake fishes (Little Rock Lake South) |
| **Overview** | This study focuses on the impacts of drought-driven lake level decline on the availability of coarse woody habitat, and the effects this has on fish.  The authors find that observed reductions in lake levels led to a >75% loss in coarse woody habitat, which coincided with decline in forage fish population and reduced growth of top predator. |
| **Is drought resistance quantified? If so, how? Are drivers of drought resistance discussed?** | No, but can be extrapolated based on the conclusions – a more drought-resistant lake would have (1) less water level change in response to drought and/or (2) coarse woody habitat spread more evenly over a larger depth range. |
| **Is drought resilience quantified? If so, how? Are drivers of drought resilience discussed?** | No. |

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| **Citation(s)** | Webster, K. E., T. K. Kratz, C. J. Bowser, J. J. Magnuson, and W. J. Rose (1996), The influence of landscape position on lake chemical responses to drought in northern Wisconsin, *Limnol. Oceanogr.*, *41*(5), 977–984.  Webster, K. E. (1998), Responses of lakes to drought: geomorphic and landscape controls, Dissertation: University of Wisconsin-Madison.  Webster, K. E., P. A. Soranno, S. B. Baines, T. K. Kratz, C. J. Bowser, P. J. Dillon, P. Campbell, E. J. Fee, and R. E. Hecky (2000), Structuring features of lake districts: landscape controls on lake chemical responses to drought, *Freshw. Biol.*, *43*(3), 499–515, doi:10.1046/j.1365-2427.2000.00571.x. |
| **LTER Site** | North Temperate Lakes (Trout Lake Region) |
| **Ecosystem** | Lake chemistry (multiple lakes). Also compares Wisconsin lakes to some lake districts in Ontario. |
| **Overview** | This study focuses on the chemical response of lakes to drought.  The authors find that, in Wisconsin, chemical response to drought is strongly controlled by the local hydrologic setting. In groundwater-dominated lakes, cation mass tended to increase during drought, and had a slow return to pre-drought conditions. In precipitation-dominated lakes, cation mass decreased during drought and had a more rapid return to pre-drought conditions. |
| **Is drought resistance quantified? If so, how? Are drivers of drought resistance discussed?** | Yes, in several ways.  Declines in lake level in response to the drought were compared amongst lakes. The authors find that lakes lower in the landscape with strong groundwater inflow had a reduced response to drought (1996 study).  Lakes with longer water residence times had a smaller chemical response to drought (1996 study). |
| **Is drought resilience quantified? If so, how? Are drivers of drought resilience discussed?** | Yes, in several ways.  Lakes with stronger groundwater inflow returned to pre-drought lake levels more quickly (1996 study).  Lakes with less groundwater inflow returned to pre-drought chemical concentrations more quickly (2000 study) |