



## How unprecedented is the current Colorado River drought? A paleo perspective

**Mr. David Woodhouse, PhD Candidate**

**Department Civil, Environmental and Architectural Engineering**

**University of Colorado, Boulder, CO**

**Wednesday, January 12, 2022 | 11:30 AM | ECCE 1B41 &**

**Zoom: <https://cuboulder.zoom.us/j/95668504496>**

**(passcode: water)**

### **Abstract:**

The on-going ~20-year long drought in the Colorado River Basin (CRB) has gained notoriety as the worst drought since modern record-keeping began over 100 years ago. Historically low reservoir levels, due to a lack of reservoir replenishing high-flow years and greater losses induced by increased temperature across the basin, the so-called “Millennium Drought” has precipitated unprecedented cutbacks to water use in the seven southwestern US states. The question on everyone’s minds is – how unprecedented is the current drought? To answer this, we seek insights from long records of paleo-flow reconstructions, which have shown that multi-decadal droughts have occurred in the CRB periodically over the last 1000 years. Some of these “mega-droughts” are estimated to be worse than the current drought in terms of both flow volume deficit and drought duration. To answer the posed question, in this study, we assess the return period of two decade long droughts in the CRB based on the paleo and modern observational record spanning over 600 years and slightly more than 100 years, respectively. We fit Hidden Markov Models (HMM) to these two data sets separately and generate long sequences of flow simulations. From these simulations, the return periods of multi-decadal drought attributes – duration and magnitude - were computed and indicate that risk of a Millennium Drought type event is nearly 10 times higher when evaluating the paleo record relative to the modern record. An optimization analysis also indicates that Upper Basin ‘firm yield’ is less than 14-MAF and a yield of 15-MAF can be met with 87% reliability according to the modern record but only 77% reliability based on the paleo record. The estimates of relative frequency of drought duration and magnitude will help place the current drought in a broader context – paleo, modern and future. This will be of great help to all stakeholders in the basin to devise efficient water management strategies.

**Speaker Bio:** David Woodson is a PhD student at CU-Boulder working under Dr. Balaji Rajagopalan and Dr. Edith Zagana. At CU-Boulder, David has contributed to projects that seek to improve projections of Colorado River flow at midterm time scales (e.g., flow forecasts 1-5 years into the future) using machine learning approaches trained on climate model projections, climate indices, etc. David earned a BS and MS in Civil and Environmental Engineering at Virginia Tech, where he worked on watershed and stormwater planning, physical H&H modeling, and quantitative precipitation estimation.