

**“ Developing scholarly excellence across the aquatic-terrestrial interface understanding the hydro-bio-geo-chemistry of extreme events”
FY14 Water Center Multi-Investigator Award awarded to EK Hall et al.**

This is the final report for the water center award titled “Developing scholarly excellence across the aquatic-terrestrial interface understanding the hydro-bio-geo-chemistry of extreme events” FY14 Water Center Multi-Investigator Award. Our working group consisted of students, and research and tenure-line faculty from multiple departments and colleges. This included: myself (Ed Hall), Francesca Cotrufo, Claudia Boot, Tim Covino, Peter Nelson Mazdak Arabi, Stephanie Kampf, Michael Lefsky, Lee MacDonald, Sara Rathburn, Sandra Ryan-Burkett, Michelle Haddix, and Chuck Rhodes, Codie Wilson, Dan Brogan, Sarah Schmeer, and Aaron Havel. This was a first time collaboration for many of the participants and resulted in a series of products and additional ongoing collaborations beyond what was anticipated when the award was funded. Our group was charged with two principal tasks. First, we had set out to create an active and mobile (e.g. rapidly ready to respond to request for proposals for various awards) collaborative working group that bridged the physical and biological science for water related research. Second, to do this we proposed to link large data sets on the High Park Fire in the Cache La Poudre (CLP) Watershed from two previously funded NSF RAPID award (one to PI Cotrufo and one to PI Lefsky). The goal of that synthesis was to determine the production, transport and fate of black carbon (burned non bio-available biomass) in the CLP watershed. To date we have several tangible products and a series of ongoing collaborations that we anticipate will lead to further products including future funded research projects.

Using the funding provided by this award we held a single one-day symposium bringing together the participants of the NSF RAPID proposals to collate and advance the understanding of the High Park Fire on black carbon dynamics within the CLP watershed. This included the synthesis of data from the High Park Fire RAPID project for: black carbon contents in plant litter, soils at two depths, riverbank sediment layers and particulate and dissolved organic carbon in main stem Poudre River water. In addition, with funding from this proposal we collected new data on black carbon contents of surface sediment (Kampf’s group), deposition layers (Rathburn’s and Nelson’s group), and additional particulate organic carbon over 5 dates from the South Fork of the Poudre River (Rathburn’s group). The publication containing these data is currently being written and slated for submission to Nature Geoscience in October. This publication will be the largest synthesis on how wildfire produces black carbon and the first to address how physical processes impact the fate of black carbon in time and space. We think this will be of interest to a wide range of researchers as it defines for the first time: a) the physical variables and environmental drivers that contribute to the transport of black carbon in a montane watershed b) the spatial and temporal resolution required for predicting movement at the watershed scale, and c) the impact of retention versus export of black carbon on an ecosystem. Given the increasingly recognized significance of black carbon to the global carbon cycle and the predicted increase of wildfires this will make a unique and important contribution to the scientific literature with important management

implications for a wide range of watersheds.

In addition, to the publication the data synthesized from this effort will be made publically available as a curated (i.e. will continue to grow additional data in and around the CLP watershed is collected and synthesized) database.

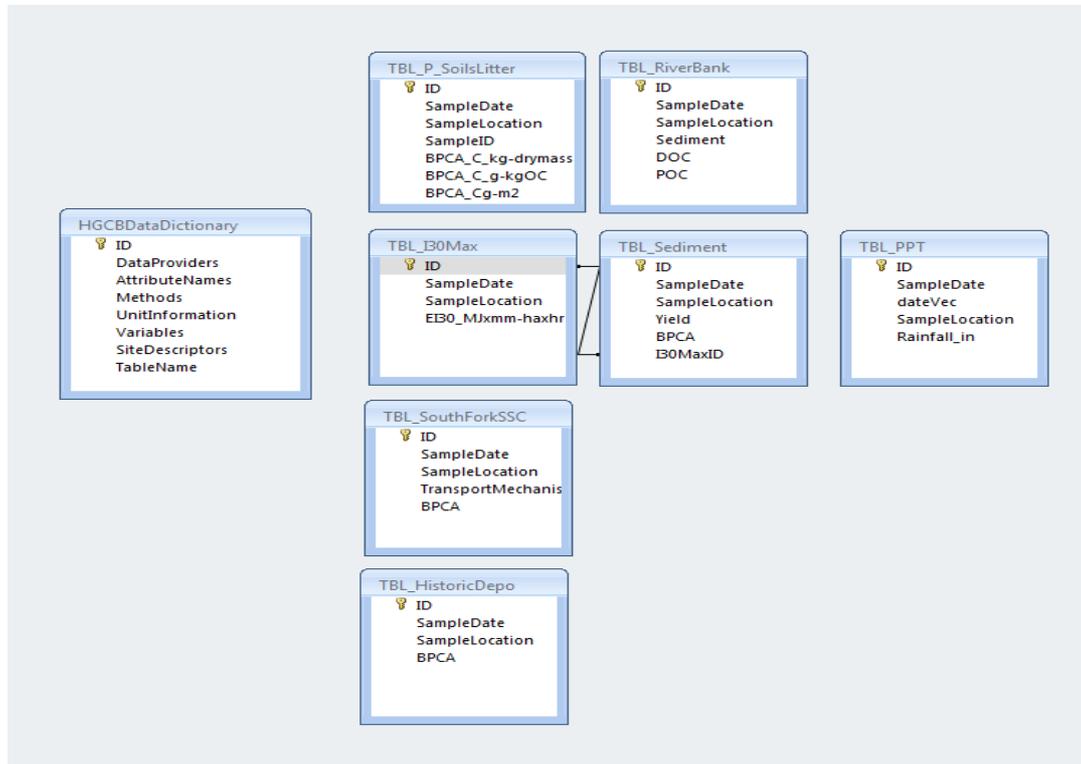


Figure 1. The RDBMS serves to integrate data for synthetic research. Data in the system include: biogeochemical measurements of soil, litter, river bank and river water, precipitation, sediment yield, erosivity, suspended sediment load in snowmelt and storm runoff, and location and analysis of historic fire layers.

The synthesis visualization tools and relational database management system (RDBMS) afford researchers the opportunity to access data and information about the data efficiently. Standardization of attribute names and definitions and re-organization of data into normalized format allows data to be queried and merged quickly to facilitate analysis and data packaging for archival purposes. Data packages will be archived within the Colorado State University institutional repository (CSU IR) to meet open access expectations of publishers and research sponsors. Metadata and data tables will be compressed and ingested into the CSU IR Digitool system and associated with the Water Archives Collection. Spatial layers will be incorporated into the CSU GeoSpatial Centroid Map Server, for which there are plans to link with non-spatial data within the CSU IR in the near future. Metadata will be configured in Qualified Dublin Core as implemented within Digitool and to ensure appropriate attribution for all contributing authors or data providers. The “landing page” for the metadata and data download in Digitool will be assigned a persistent URL as a registered Handle with www.Handle.net. This Handle can serve to satisfy publishers’ requirements that data supporting any

findings to be published, be made open and accessible online. The Handle can also be embedded in web pages of individual researchers or the HBG community.

In addition, to the above synthesis project to address our first principal tasks we have created a public face for research at the intersection of the physical and biological sciences in water related science at CSU. Currently this face exists as a webpage (<http://ibis.colostate.edu/cwis438/websites/hbg/Index.php?WebSiteID=6>). While this is still a work in progress we will continue to grow the page and include links to products as they develop (e.g. the black carbon publication or future funded projects in this area) and additional collaborators as they arrive.

The interaction among these researchers has led to several other additional collaborations and projects as well, which have or will result in a series of additional tangible products. These include:

I. A second manuscript defining the need for cross-disciplinary approach to studying both the evolution of watersheds and their response to extreme events such as floods or fire. This manuscript has include some of the original group (Tim Covino, Stephanie Kampf, Francesa Cotrufo and Hall) as well as additional collaborators (LeRoy Poff, Ellen Wohl and Chris Funk). We envision this effort being a sort of a mission statement for the CSU HBGC working group and defining how we can advance our understanding of important dynamics at the intersection of these traditionally separated disciplinary approaches.

II. In June of 2014 members of the HBGC group Covino, Hall and Wohl developed a proposal that was submitted to NSF Hydrology to study the effects of active and legacy beaver dams on the hydrology, geomorphology and biogeochemistry of watersheds along the Colorado Front Range.

III. PIs Hall, Kampf and Covino are in the progress of organizing a special session for the Fall meeting of the American Geophysical Union in San Francisco, December 2014 titled "Feedbacks among geomorphology, hydrology, and biology across terrestrial and aquatic ecosystems". We currently have invited speakers who have accepted and may merge with a second session making for a very large and collaborative session.

IV. PI Kampf is leading a new effort on coordinated monitoring within the CLP watershed with many members of the HBGC working group. This has resulted in additional funding from the City of Fort Collins and synthesis work with the newly formed non-profit Coalition for the Poudre River Watershed. These efforts include measurements of:

- Precipitation: Add rain gauges at two locations
- Stream stage: Add stage measurements in 3 watersheds within the CLP watershed
- Turbidity/ISCO: 4 turbidity sensors and a series of ISCO sediment load automated samplers at multiple places with the CLP ws

-Water quality: weekly sampling and 3 summer storm event samples at two of the ISCO sites
one synoptic sampling in two of the sub-watershed.
monthly sampling along South Fork and in the mainstem of the Cache la Poudre.

In summary, funding from the initial WaterCetner FY14 has provided salary for one soft money researcher (Co-PI Boot), a data manager (Nicole Kaplan), a PhD student (Dan Brogan) all involved in the black carbon data synthesis project. The funding has also or will result in two publications and one or more proposal prepared and submitted. We have created a public face for hydro-bio-geo-chemistry at CSU and an increasing ongoing collaboration across the interface of the physical and biological sciences consisting of researcher from multiple departments and multiple colleges.