Intro

“Landscape hydrology is driven by the dynamics of storage and flow between surface water and groundwater systems, and connectivity between these systems control how hydrologic changes in one area impact behaviors in others>’

* Landscape hydrology is the concept of how hydrologic and biogeochemical changes in one system can cascade and reverberate across the watershed.
* The significance of these “reverberating impacts” is dependent on each regions connectedness, or how water flows, and is stored between surface and subsurface ecosystems.
* In low-relief, wet biomes, landscape hydrology is pertinent to each inland waters biogeochemical and hydrologic “fingerprint” with subsurface flow path mixing and transporting water throughout the region,
  + Homogeneous
* whereas in dry, confined watersheds, inlands water more independent from the surrounding watershed with their own hydro-biogeochemical signatures.
* Introduce isolated wetlands
  + Wetlands, specifically isolated wetlands, only cover 2-6% of the earth but are the most influential inland water in determining landscape hydrology.
  + Wetlands serve as “capacitors” for the landscape, storing water and subsequently fostering a shallow water table and buffering flow extremes.
  + It is wetlands indirectly control stream baseflow; baseflow is determined by surficial aquifer dynamics; wetlands raise the water table to giving rise to a surficial aquifer.
  + Through local groundwater exchanges, wetlands have the ability to influence downstream biogeochemistry, giving or storing water
  + GIWS regulate regional aquifer dynamics though local gw exchange, conferring hydrological services to downstream water bodies even when direct surface connection is absent
  + Baseflow is controlled by surficial aquifer dynamics
  + Connectivity between wetlands and drainage networks determine how wetlands impact, downstream flow and water quality, suggesting that these functions are strongly dependent on wetland type and setting.
  + Watershed with greater than 20% wetland coverage were more likely to be transport limited
* Wetlands and carbon
  + In addition to “constructing” the watershed transport highway, wetlands in themselves are major global pools of carbon.
  + As mentioned in previously, wetlands are highly productive owing to their productive vegetation and soils carbon storage capacity.
  + Also considered global hotspots, carbon within wetlands, due hydric soils anaerobic conditions, in addition to being stored, can be mineralized, emitted as GHG, or exported downstream.
  + Wetlands are assumed to be near infinite sources of carbon, especially low relief landscape that foster hydric conditions.
  + An important pool of C that can be stored, mineralized, and emitted as GHG, exported downstream via streams (depending on connectivity)
  + Wetlands are assumed to be a near infinte source of carbon (Ledesma) and tend to occur in low lands where connectivity..
* Knowledge gaps
  + It is well understood isolated wetlands have the potential to significantly contribute to landscape carbon budgeting , and potential carbon budgeting.
  + Although wetland carbon contributions have been explored in higher-order rivers and their adjacent wetlands, few research endeavors have explore wetland influence on lower order streams.
  + Publications that have observed low-order stream-wetland interactions have only done so in landscapes with distinct wet-dry seasons where inland waters become dry and are isolated from one another for half the year.
  + Furthermore, there has not been a publication (thus far) that has directly explored river corridor contributions with isolated wetland carbon contributions.
  + Observing wetland carbon contributions in low-order streams belonging to low relief watersheds has yet be explored.
  + The global budget as is has large carbon discrepancies likely over estimating terrestrial and groundwater contributions.
  + In order to resolves these discrepancies, more detailed oberservational studies across an array of landscape is needed
  + Wetland stream linkages have been conducted in N latitudes. In the tropics, research has focused on large rivers-wetland systems but few studies have explored the exchange of C between small wetlands and lower order streams
    - Solano looked at wetlands with low productivity (Australia- major dry periods) (wet-dry tropics)
  + Not exploring can lead to inaccuracies in C inventories, particularly the contribution of terrestrial and gw C.
  + The solution for resolving carbon budget discrepancies is conducting more detailed observational studies across many unique environments
  + Many publications have explored isolated wetland carbon contributions but few have coupled their finding with RC and internal sources of carbon
  + Laughlin et al 2014
  + Zarnetske 2018
  + Solano 2024
* Introduce chapter
  + For the third chapter of my PhD, I will quantity surface isolated, but sub-surface connected wetland contributions the flatwood, low-order streams.
  + Thus far in my project I explored stream carbon temporal dynamics, and RC carbon dynamics and fluxes.
  + Coupling results from Chapter 3 with the results from my chapter 1 and 2, will allow me to build a holistic carbon budget for BEF, mapping sources and fluxes.

Hypothesis

* I hypothesize each stream will be gaining in carbon, increasing DOC and DIC concentrations as water flows downstream.
* Although I hypothesize adjacent isolated wetlands will contribute to stream carbon, I expect the RC to nonetheless be the primary carbon source.
* However, during periods of high discharge where overland and subsurface lateral transport are its greatest, I expect nearby wetlands to contribute comparatively great loads of carbon but still less than RC inputs
* Lastly, I expect streams belonging to watersheds with greater wetland area will have higher concentrations of TC (total carbon) and have more homogenous carbon quality signatures.
* My objective of the chapter is inform management decisions within flatwood landscapes and low-relief like it, and provides evidence on how managing the landscapes hydrology is influential in managing the landscapes regional carbon budget.

Objective

An accumulation of the all the chapter to inform a BEF carbon budget

Methods

Study sites

* As mentioned, BEF low-relief topography fosters a dense cluster is depressional wetlands and numerous blackwater streams.
* BEF’s wetlands foster a shallow table that cumulates above the confining unit, separating the surface from the Upper Florida Aquifer.
* Along with overland lateral flow, this shallow water table serves as transport “highway’ between depressional, isolated wetlands and their basin’s receiving stream.
* For this chapter, I will longitudinally sample streams 5, 6 and 9. These sites were selected since they all have river corridors (RC) wells allowing us to establish a holistic carbon budget for the streams.
* Sampling locations were dependent on access and UCA analysis. Locations with high () UCA value and were easily accessible were sampled
* INCLUDE GRAPH

Sampling and processing

* Each stream will be passed during unique discharge dynamics and conditions. To avoid sampling under similar conditions the \_\_\_\_ will be used to determine…
* Each stream at every sapling location was sampled for TDC (total dissolved carbon), FDOM, and POC.
* Discuss why we are sampling POC- reference paper about more need for POC observation
* FDOM and TCD processing will followed protocols outlined in Chapter 1 and 2 Methods
* FDOM will be used to explore whether stream, RC, or wetland carbon differing signature and quality.
* Sentence on why to explore different species of carbon

Analysis:

* Characterizing concentrations and discharge across hydrologic conditions can reveal where and how carbon is produced in the watershed.
* Each concentration will QC unit dependent on the UCA results
* Apply RC results at each location. Assume RC inputs are roughly longitudinally uniform.
* Assume the remainder is groundwater.
* From these estimates, formulate a flatwood stream carbon budget