2019 Envirothon Workshop

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2. What is a Watershed?

- From Merriam Webster Dictionary:
  - 1 : a crucial dividing point, line, or factor : TURNING POINT
  - 2a : a region or area bounded peripherally by a divide and draining ultimately to a particular watercourse or body of water
- Let's get technical: USGS Definition:
  - "A watershed is an area of land that drains all the streams and rainfall to a common outlet such as the outflow of a reservoir, mouth of a bay, or any point along a stream channel. The word watershed is sometimes used interchangeably with drainage basin or catchment….The watershed consists of surface water--lakes, streams, reservoirs, and wetlands--and all the underlying ground water."

3. Water Budget

- Not all precipitation that falls in a watershed flows out
- In order to calculate what your watershed actually captures, you would use a water balance equation
- The Michigan Water Resources Division offers a great resource to learn more about water budgets and how to calculate. https://www.michigan.gov/documents/deq/wrd-water-budget_565040_7.pdf

Essentially:

$$\Delta S = P - E - ET \pm SRO \pm GF$$

- Where Change in Storage (**ΔS)** equals
  - Precipitation (P) (minus)
  - Evaporation (E) (minus)
  - Evapotranspiration (ET) (plus or minus)
  - Surface runoff (SRO) (plus or minus)
  - Groundwater flow (GF)
- Precipitation is readily available data and surface runoff is pretty easy to measure.
- Evaporation can be roughly determined with temperature and humidity
- Groundwater can also be roughly determined based on infiltration rates
- Evapotranspiration is extremely hard to calculate!

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4. Find your Watershed

- Go to https://water.usgs.gov/wsc/reg/12.html
- This tool allows you to search what watershed you are in
- The government uses Hydrologic Unit Codes (HUCs) to name watersheds.
    - 2-digit HUCS- region
    - 4-digit HUCs – subregion
    - 6-digit HUCs- basin
    - 8-digit HUCs – sub-basin
    - 10-digit HUCs – watershed
    - 12-digit HUCs – sub-watershed
    - The larger the number, the more localized your watershed is.
    - Each set of numbers correspond to the parent watershed or basin it's located in.
        - For example, the city of Nacogdoches is located in the 4 digit HUC, 1202 (Neches Watershed). Locally, it's located in the 8 digit HUC, **1202**0005 (Lower Angelina).

5. Stream Order vs. Stream Type

- Watersheds are completely dependent on carrying and collecting water based on RIVERS.
- Stream Order refers to the different segments of a stream
    - The headwaters are labeled stream order 1
    - When two 1's combine, that forms a 2. When two 2's combine, that forms a 3, and so on and so forth.
    - The mouth of your river will be your largest stream order number.
- You have 3 types of streams
    - Perennial- streams that flow year round; permanent and well-defined boundaries
    - Intermittent – streams that flow for part or most of the year, but they do not always carry water during the dry season; seasonally driven
    - Ephemeral - small streams with channels that are usually dry the majority of the year; they only fill up during rain events
- Typically your headwaters are going to be either ephemeral or intermittent, as they are driven by rainfall events. '

6. Healthy vs. Unhealthy Streams

- All streams exhibit some form of erosion. That's NORMAL. The thing to look for is whether it's being deposited downstream.
- A healthy stream will have equal amounts of erosion and deposition.

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- Meandering channels exhibit this behavior; straight and narrow channels with steep banks will have more erosion and less deposition.
    - Over time, straight channels are more susceptible to headcuts and degradation.
- Rivers and stream naturally meander and when left untouched, will always try to revert back to a meandering channel.

7. Oxbow Lakes

- Streams take the past of least resistance
- As streams continue to erode on their bends, they eventually connect. This forms a straight path for water to flow and it's outer bend is no longer used, cutting it off from the main stem. This disconnected bend is called an oxbow lake.

8. & 9. Types of Streams

- Good resource to learn more about Stream Types and Stream Succession, heavily researched and written about by Dave Rosgen.
    - See https://wildlandhydrology.com/resources/ for an abundance of Rosgen's work.
- Stream types fluctuate based on their topography and location on the landscape. Any climatic or man-made influences can make streams alter their types.
- Scenario 10 is an example of a typical stream over 100s of years (think Grand Canyon) - a meandering channel (E) straightens and deepens from fast flowing water (A). The fast water eats away at the banks (G) and eventually widens with stable banks and wide base (F). Eventually the channel wants to wind and bend again (C) and creates a meandering channel, now with higher banks (E). This succession repeats itself over and over again throughout the years until you get something like the Grand Canyon.
- Scenario 9 are your main streams- the Mississippi River, San Jacinto, Colorado River, BIG water movers and very stable.
- (D) and (DA) are examples of delta regions; flat, virtually no topographic features where a stream eventually spreads out with no banks. (D) will turn into (DA).

10. & 11. What is a Wetland?

- Wetlands are an outcome of rivers
- They are Depressional areas found primarily in the floodplains of rivers and streams that can be either flood or rainfall driven.

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- When a channel spills over its banks, its water enters the floodplain where the water dissipates and slows down. Heavy sediments will fall out of the water column (your sands and silts) initially. This creates your sand levies and banks. The remainder water either drains out, or remains trapped in the floodplain, creating wetlands (See slide 11 for diagram).
- They come in many variations and occur in virtually every ecosystem: forested, herbaceous, vernal pools, Midwest prairie potholes.
    - Go by many names: swamps, bogs, potholes, marshes
- Wetlands must requires hydrology, hydric soils, hydric vegetation
- USACE 1987 Wetland Delineation Manual is the guidelines to professionally delineate a wetland and to determine whether it is a jurisdictional Waters of the United States or not.
    - There is also a supplement to further help you ID wetlands in your region. We are located in the Atlantic and Gulf Coastal Plains Region

12., 13., 14. Wetland Indicators

- These slides are your wetland indicators laid out in the 1987 Manual. You can access that manual and its supplement using the following links
- https://usace.contentdm.oclc.org/digital/collection/p266001coll1/id/5479
- https://usace.contentdm.oclc.org/utils/getfile/collection/p266001coll1/id/7594
- USACE classifies wetland plants based on their water tolerance (below sourced from: http://forestandrange.org/new_wetlands/wetland_delineation_3.htm)
    - Obligate (OBL) Plants that occur almost always (estimated probability >99%) in wetlands under natural conditions, but which may also occur rarely (estimated probability <1%) in non-wetlands. Examples: smooth cordgrass, bald cypress
    - Facultative Wetland (FACW) Plants that occur usually (estimated probability >67% to 99%) in wetlands, but also occur (estimated probability 1% to 33% in non-wetlands). Examples: green ash, Red-osier dogwood
    - Facultative (FAC) Plants with a similar likelihood (estimated probability 33% to 67%) of occurring in both wetlands and non-wetlands. Examples: honey locust, common greenbrier
    - Facultative Upland (FACU) Plants that occur sometimes (estimated probability 1% to <33%) in wetlands, but occur more often (estimated probability >67% to 99%) in non-wetlands. Examples: red oak, tall cinquefoil
    - Upland (UPL) Plants that occur rarely (estimated probability <1%) in wetlands, but occur almost always (estimated probability >99%) in wetlands under natural conditions. Examples: shortleaf pine, soft brome

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- A full list of our regional wetland plants and their classification can be found at: https://mfburchick.files.wordpress.com/2016/05/reg_agcp_2016v1.pdf

15.-20. Native Vegetation

- All information pulled from Harris County Flood Control District field books.
    - https://www.hcfcd.org/media/1974/wetland-guide-final.pdf
- Also a good forestry tool
    - https://www.hcfcd.org/media/1973/reforestation-guide-final.pdf
- **GREAT TOOLS. USE THEM!**

21. Benefits of Wetlands

- Wetlands serve a multitude of purpose in both the natural environment and local communities. They:
    - Filter water
    - Slows storm surge
    - Provide flood control by providing storage and retention
    - Recharge our aquifers (water percolates through the soil columns instead of runoff)
    - Provide habitat for multiple migratory species and critically endangered species (Both flora and fauna)
    - Provide recreational activity (canoeing, kayaking, fishing, hunting, hiking, bird watching, etc).

22. Threats to Wetlands

- There are many threats to wetlands, but they really fall under only a handful of categories.
    - Agriculture was historically a huge wetland threat. Wetlands tend to make great pasture and crop land. They are fertile and don't need substantial irrigation. You will find most wetlands are still being used for rice farms today.
    - Development is a major one- anytime someone wants to build a house, restaurant, hotel, road, etc., in a wetland, they will get a permit from USACE and fill in that wetland. On top of that, coastal marinas and beach front properties are destroying our coastal wetlands. (more on wetland permits later).
    - For areas that are still wetlands, they can be heavily exploited. Someone who wants to drain wastewater into a wetland threatens to harm wetlands or drown them (depending on the water load). They could also be used as a source of water and are ditched and threatened to be potentially drained.
    - Pollution comes in two forms. Point-source pollution and non-point pollution. Point-source are typically your permitted activities. Any facility discharge, be it animal farms,

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industry, wastewater facilities, etc. They are easy to track. Non-point pollution are those discharges that are virtually untraceable- individual dumping down storm drains, development runoff, and agriculture farms, etc. Where one person dumping may not seem destructive, when it's combined with millions of others participating, it adds up and becomes a major problem.

23. History of Wetland Protection

- In Summary, it has a complicated history. But I'll highlight the most important (and most interesting) parts.
    - In the 1800s, wetlands were viewed negatively. They were considered wastelands, housing for diseases like malaria. In the late 1800s, the US Government passed the Swamp Lands Act, and actually incentivized draining wetlands for development!
    - The Rivers and Harbors Act is a key piece of legislature that assigned the US Army Corps of Engineer jurisdiction of all major waterways in the US. This was right after the Mexican-American War, and the US was afraid of being attacked by water, so USACE become the governing body to monitor any infiltration from other countries. This Act was NOT meant to be an environmental protection act.
    - The Panama Canal was important time because the French and Great Britain weren't able to actually finish building the canal due to their crew dying from Malaria and Yellow Fever (thought to be from the proximity of wetlands "wastelands"). A cure for Malaria was found and was used on US workers who ultimately finished the Panama Canal 1914.
    - For the next 60 years, the US was in combats trying to both destroy and save wetlands. Not much environmental protection was around for wetlands, except to protect ducks to keep them from going extinct for hunting purposes.
    - Section 404 of the Clean Water Act ultimately gave wetlands their first protection, however there wasn't much known on how to do that. USACE ultimately received jurisdiction because of their proximity to rivers. The thought process being, if you are going to need a permit to impact a river, you most likely will need a permit to impact a wetland.
    - In 1989, George H. W. Bush signed an executive order claiming a "No-net loss" of wetlands. Basically, if one is to impact a wetland, that wetland must be mitigated elsewhere.
    - Wetland Mitigation was born through this no-net loss executive order, Although it was brand new and not much guidance on how to mitigate for wetlands. For a while, it was 1:1 ratio based on acres. Today, we base the ratio using a function score.
    - In 2008, USACE provided official guidance on how to mitigate for wetlands, giving mitigation banks top preference, followed by Permittee Responsible Mitigation, and finally in-lieu fee programs.

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24. What is Mitigation Banking?

- In according to the regulations, compensatory mitigation means the restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of wetlands, streams, and other aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved.
- Site where aquatic resources are established, restored, enhanced, or preserved to offset losses of aquatic resources
- A wetland is given a functional score; restoration provides an uplift, and we receive credits based on the functional uplift
- Operates like a financial institution
- The USACE deposits credits into bank ledger
- HCFCD sells those credits as mitigation for permitted impacts to aquatic resources
- Permittee Responsible Mitigation is used when there is no mitigation bank in the area, and a single project is used to offset a single impact.

25. and 26. Interim Hydrogeomorphic Model

- This tool is used to measure the function and value of a wetland. It takes into account various characteristics of a wetland and assigns them scores between 0.0 and 1.0.
- More can be read up on using the following link: **https://www.swg.usace.army.mil/Portals/26/docs/regulatory/functional%20Assessment/SWGRiverineForestediHGM.pdf**

27. Wetland and Stream Mitigation Banks Across East Texas

- See that these banks are located in (1) Heavily developed regional areas; and (2) along major waterways and floodplains.

28.-47. Greens Bayou Wetlands Mitigation Bank

- A 1000 acre bank located inside the Beltway of the Houston Area.
- Both Forested and Prairie Restoration