1. Discussion of Riparian Buffers
2. Lab next week - indoors
3. Test – due next Friday 12 noon
American Beaver
*Castor canadiensis*

Habitat: riparian areas with permanent water.

Diet: exclusively vegetarian willow, aspen, birch, poplar maples, alder, corn.

Bark, cambium, small twigs

Store branches under water near lodges.

Have bacteria that can digest about 30% of cellulose

Reproduction: Females breed @ 2.5 years
2-4 kits born April – July gestation 128 days
Kits furred with eyes open at birth, incisor teeth erupted.

30-65 lbs; 24-36 in + 12-18 in tail

Largest rodent in N America
Front paw

Back paw

Water-proof & Insulated fur

Incisors – grow constantly

When underwater:
- Thin membranes protect eyes
- Ear & nose valves close
- Lips seal tightly around incisors

Tail:
- Used for support when standing
- Rudder when swimming
- Warning device
- Fat stored – provides winter energy
Colony:

- 4-8 related animals
- Dominated by adult female
- Monogamous mates
- Young dependent 6 weeks – 3 months
- Stay in colony until second year
- Young move up to 6 mi from home
- Active year round – mainly nocturnal
Dens in stream banks – often under tree roots – multi-level

Lodge in lakes & ponds – dry chamber – several entrances
Pros and Cons of Beaver Activity

Cons
• Build dams
• Cut stream side trees
• Harvest crops for dams
• Flood crop fields & other property
• Back up tiles
• Dams inhibit fish movement
• Pool temperatures warmer than stream

Pros
• Raised water levels stabilize banks
• Pools provide sediment storage
• Pools provide flood storage – desynchronize floods down stream
• Keystone Species – provide habitat for others
• Flooded area provides habitat for riparian vegetation
• Flooded area provides habitat for water fowl, fish, animals
Beaver Deceiver
Calculating discharge in m³/s & cfs
\[(m^3/s \times 35.31 = cfs) \text{ (cfs } \times 0.028 = m^3/s)\]
\[(1 \text{ ft } = 0.3 \text{ m) (1 m } = 3.3 \text{ ft)}\]

\[Q = w_1D_1v_1 + w_2D_2V_2 + \ldots + w_nD_nV_n\]

Where: \(Q\) = discharge (cfs or cms)
\(w\) = unit width (ft or m)
\(D\) = depth (ft or m)
\(V\) = velocity (ft/s or m/s)

Bear Creek Measurements
Mean width = 14 ft, 4.2 m
Mean depth = 10 in, 0.25 m
Mean velocity = 20 ft/10 sec

Calculate Discharge (cfs & cms)
14 ft x 0.83 ft = 11.7 ft² x 2 ft/s = 23.4 cfs or 0.66 cms
The Bear Creek channel:
- 4.2 m wide
- 0.25 m deep
- 0.66 cms discharge
- 1,600 m long

How much water does the channel store? (m$^3$ and ft$^3$) (1 m$^3$ = 35.3 ft$^3$)

4.2 m x 0.25 m x 1,600 m = 1,680 m$^3$ * 35.3 ft$^3$/m$^3$ = 59,304 ft$^3$

How long would it take to drain that channel of water assuming the velocity stays constant the whole time?

1,680 m$^3$/0.66 cms = 2,545 sec/60 sec/min = 42.4 min
Given: nitrate-N content of Bear Creek averages 8 ppm or 8 mg/l

Discharge = 23.4 cfs

**How many pounds (tons) of N would be moving through the channel in a 24 hour period?**

(3.78 l per gal, 454 g per lb, 1,000 mg per g, 7.5 gal per cubic ft)

\[
23.4 \text{ cfs} \times 60 \text{ sec/min} \times 60 \text{ min/hr} \times 24 \text{ hr} = 2,021,765 \text{ cf per 24 hr}
\]

\[
X 7.5 \text{ gal/cf} = 15,163,200 \text{ gal} \times 3.78 \text{ l/gal} = 57,316,896 \text{ liters} \times 8 \text{ mg/l} = 458,535,168 \text{ mg/1000 mg/g} = 458,535 \text{ g/454 g/lb} = 1010 \text{ lbs/2000 lbs/ton}
\]

\[
= 0.5 \text{ ton/24hr}
\]
Yesterday Afternoon

Channel is 40 ft wide

Calculate:
1. Velocity of water (1 pm Sun)
2. Discharge for one hour

40 ft X 2.98 ft = 119.2 ft²
500 cfs/119.2 ft² = 4.2 ft/s velocity

500 cfs x 60 sec/min x 60 min/hr = 1,800,000 cf/hr
Group Exercise

How do buffers function?

How do these 2 differ?

Create a labeled diagram

• Cross-section to scale
• Above & below ground
• Processes taking place
  • Wildlife habitat
  • Soil quality
  • Control NPSP
  • Surface & subsurface water movement
  • Stream water quality
  • Floods
  • Human livelihood
  • Human Perceptions
**Trees**
- Vertical structure/habitat
- Improve soil infiltration/tilth
- Standing nutrient storage
- Intercept subsurface pollutants
- Carbon storage
- Strong woody roots/banks
- Stream shading/in-stream food

**Shrubs**
- Vertical structure/habitat
- Multiple-stems – trap debris
- Woody roots
- Little stream shading

**Native Grasses**
- Wildlife habitat/cover/forage
- Sediment removal from runoff
- Improve soil infiltration/tilth
- No stream shading/ detritus
- Keep out invasive species
What are the major NPS pollutants in Iowa & how do they get to streams?

- **Sediment from soil erosion**
- **N & P & pesticide runoff from crop fields (surface & subsurface)**
- **N & P runoff from feedlots, manure spills, grazing livestock**
- **Lawn fertilizers from urban areas**
- **Storm-sewer runoff with street chemicals**
- **Industrial inputs**
- **Sewage Effluent from municipal wastewater treatment facilities**
Nitrate Nitrogen – soluble leaches from soil; ammonia adsorbed to soil – moves with soil erosion

Phosphorus mainly adsorbed to soil – moves with soil erosion
Hypoxia vs Anoxia

“Hypoxia” refers to a condition that exists in a body of water when dissolved oxygen falls below healthy levels necessary to support aquatic life. (< 2 ppm O\textsubscript{2}) (5 ppm O\textsubscript{2} healthy)

“Anoxia” refers to conditions of no oxygen (0 ppm of O\textsubscript{2})
Nitrogen Contributions To Gulf of Mexico

Upper Mississippi River …38%
Ohio/Tennessee River …..32%
Missouri River …………….15%
Arkansas-Red-White River ..7%
Lower Mississippi River .....8%

Important to have some comfort with location of major watersheds in NA
**Nitrogen**
- Plant uptake & storage
- Denitrification
- Tile flow not intercepted

**Phosphorus**
- Surface soil & OM storage
- Plant uptake & storage