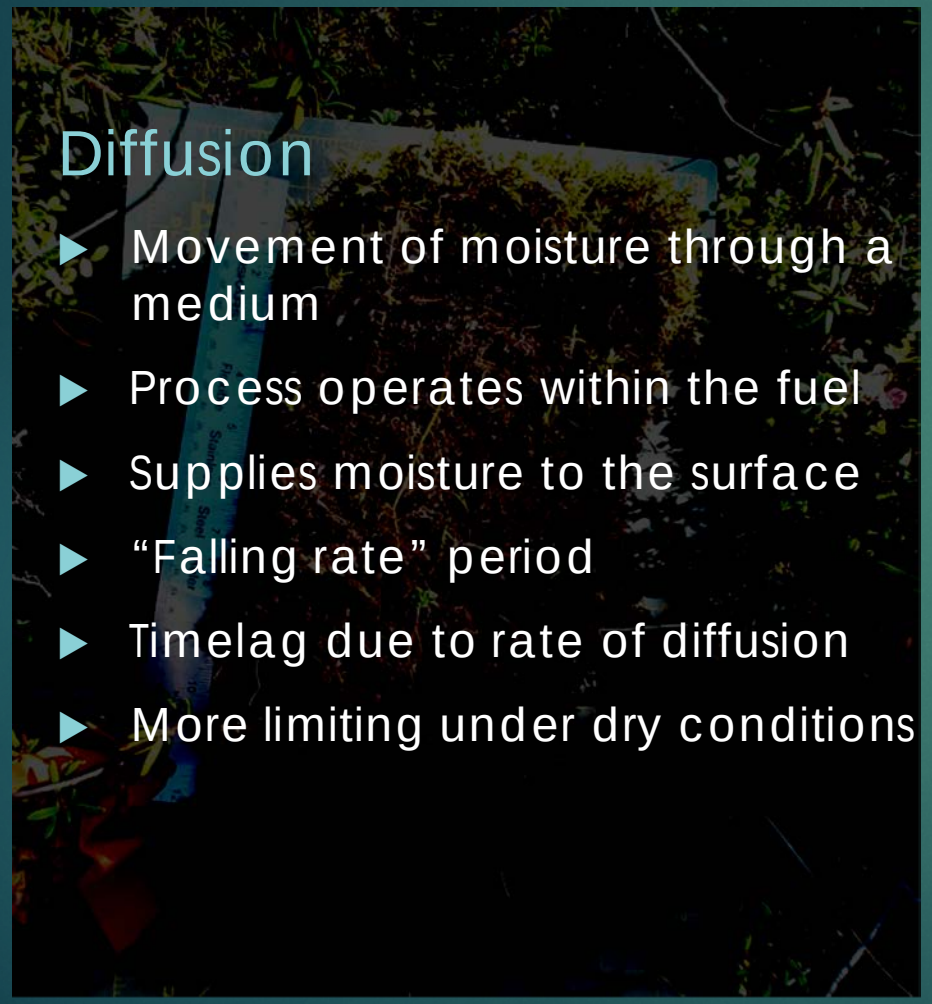
What is the Drought Code?

Quiz

This?

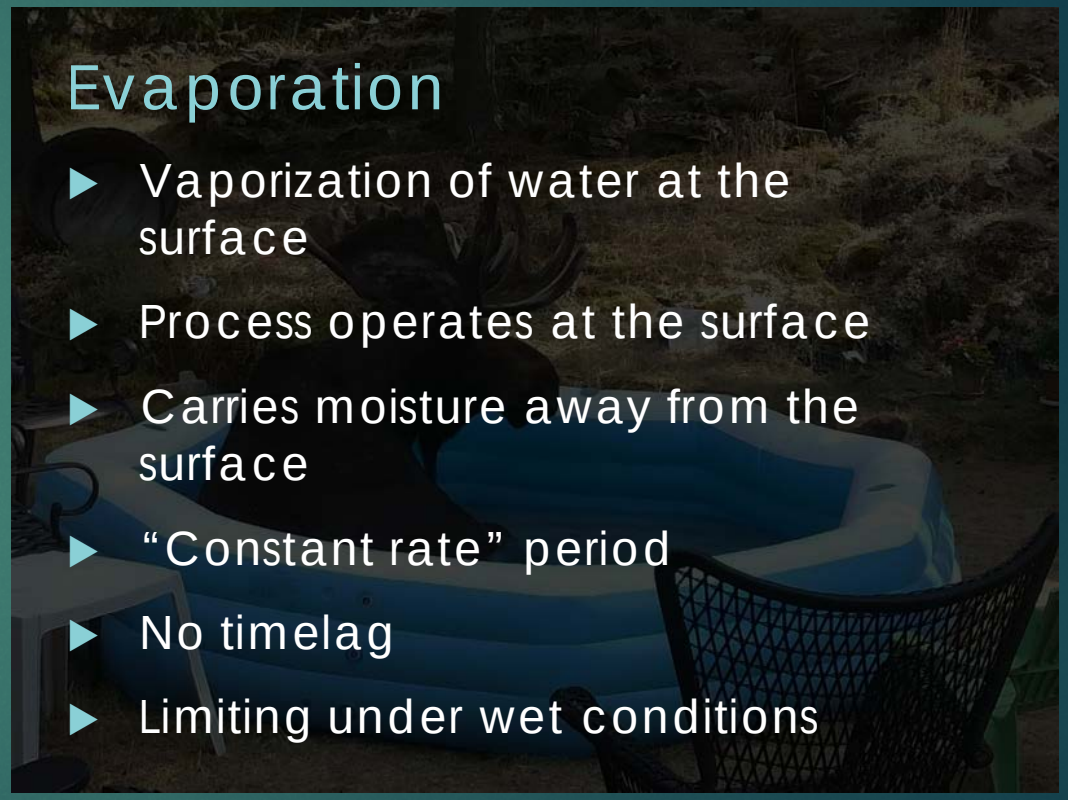
Or this?

Drying Processes



Diffusion

- Movement of moisture through a medium
- Process operates within the fuel
- Supplies moisture to the surface
- “Falling rate” period
- Timelag due to rate of diffusion
- More limiting under dry conditions



Evaporation

- Vaporization of water at the surface
- Process operates at the surface
- Carries moisture away from the surface
- “Constant rate” period
- No timelag
- Limiting under wet conditions

Background: The Journey

- Modelling moisture dynamics in feathermoss I came across the Finnish Forest Fire Index (FFI).
- FFI is an evaporative model.
- Most FDR models are diffusive (FFMC, DMC), AKA the “logarithmic drying equation”

Background: The Journey

- Got the FFI code from the Finns and began comparing it to the Canadian Moisture Codes.
- Stopped short by the Drought Code.
- Could not understand what it is.
  - Conceptual hybrid (both diffusive & evaporative, sort of)
  - Mathematics abstruse
  - Attributes unclear (assigning soil to soil-less model)
- Looked to the literature. Became clear that few people in the last several decades really understand what the DC is.
- Perpetuation of misunderstandings

Code Smackdown

“Normal Code or Index”

- Diffusive
- Assumes soil or fuel present
- Unit: Moisture Content (%)
- Driver: Gradient in free moisture

Drought Code

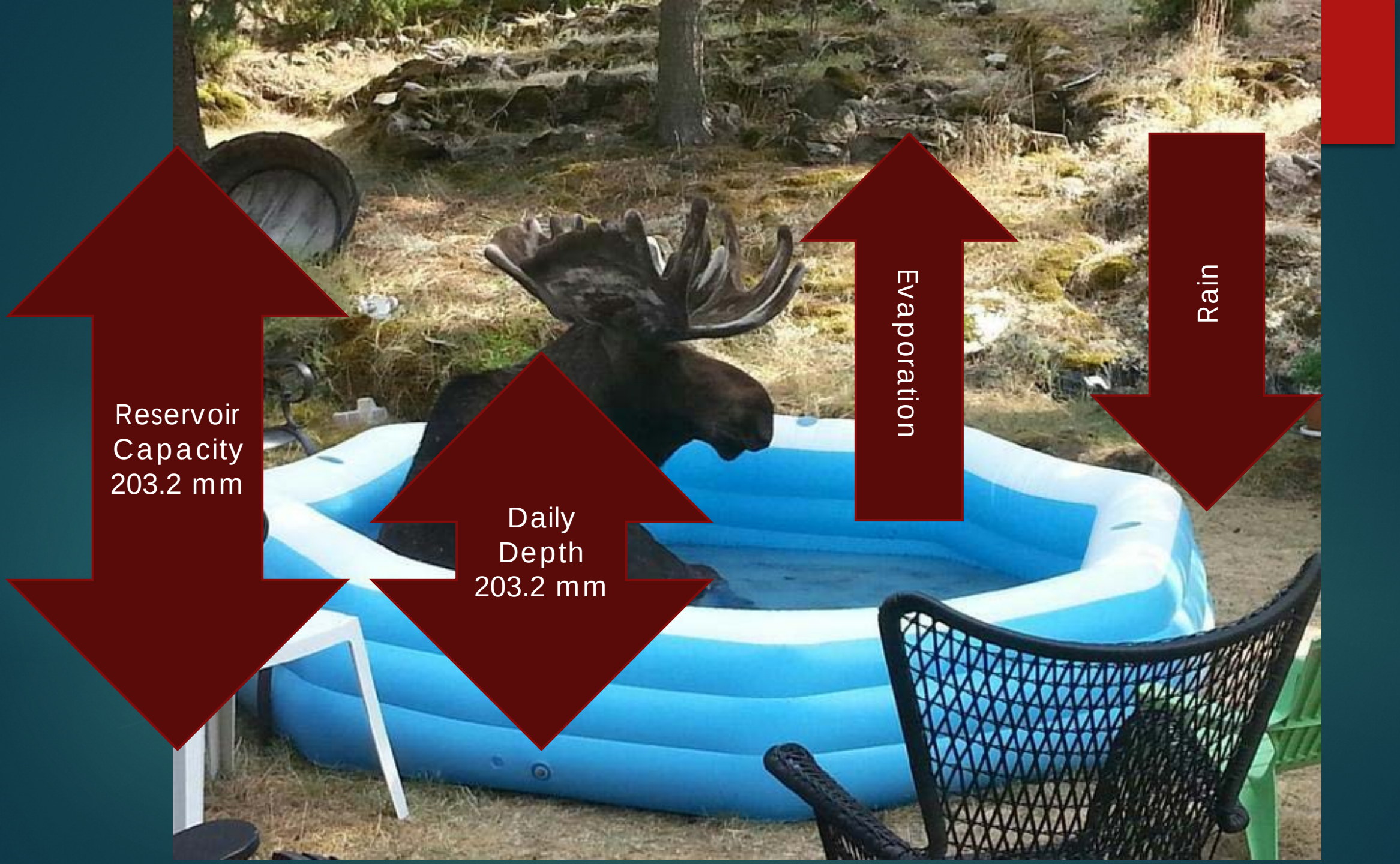
- Evaporative (Sort of)
- No soil required
- Unit: Soil water reservoir depth (mm)
- Driver: Scaled evaporative loss

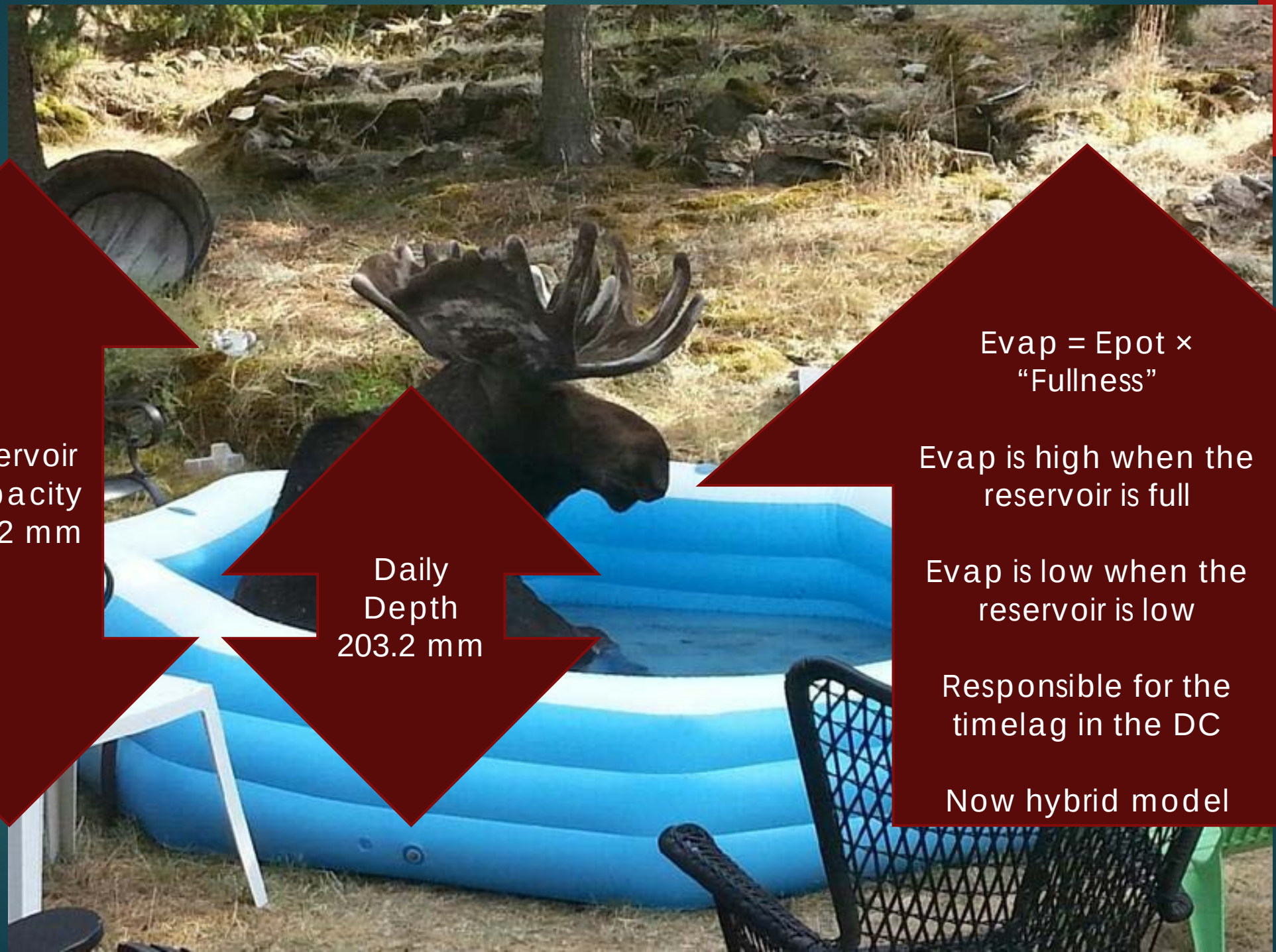
Misunderstandings of the DC

- What is the soil water reservoir depth? 8”? 203.2 mm? 100 mm?
  - Problem arises in assigning soil to a soil-less model
- Input of Potential Evaporation
  - Actual Evaporation
- Misnomers and ambiguities
- Conversion between MC (%) and Reservoir depth (mm)
- Abstruse mathematics
- Mixture of English and metric units

New Objective: Reconstruction

- Deconstruct the DC
- Expose all the inputs
- Metric-ize
- Define its attributes
- Put it back together in a way that is understandable
- Separates hydrological model from the abstraction equation
- Wrote a paper with hydrological approach because the DC is a hydrological model


Reservoir Capacity 203.2 mm
Daily Depth 203.2 mm
Evaporation
Rain



Reservoir Capacity 203.2 mm

Daily Depth 203.2 mm

Evap = Epot × “Fullness”

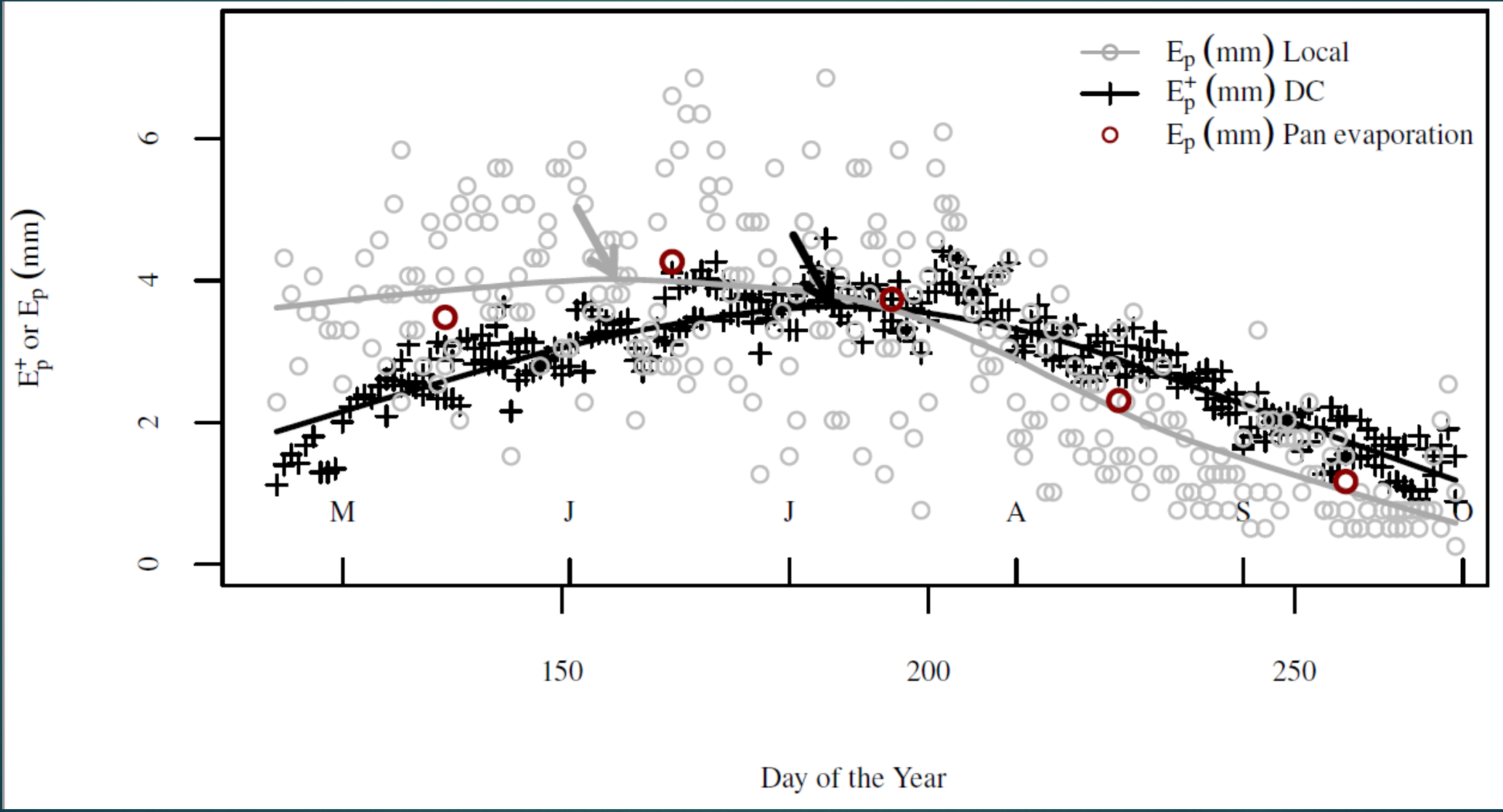
Evap is high when the reservoir is full

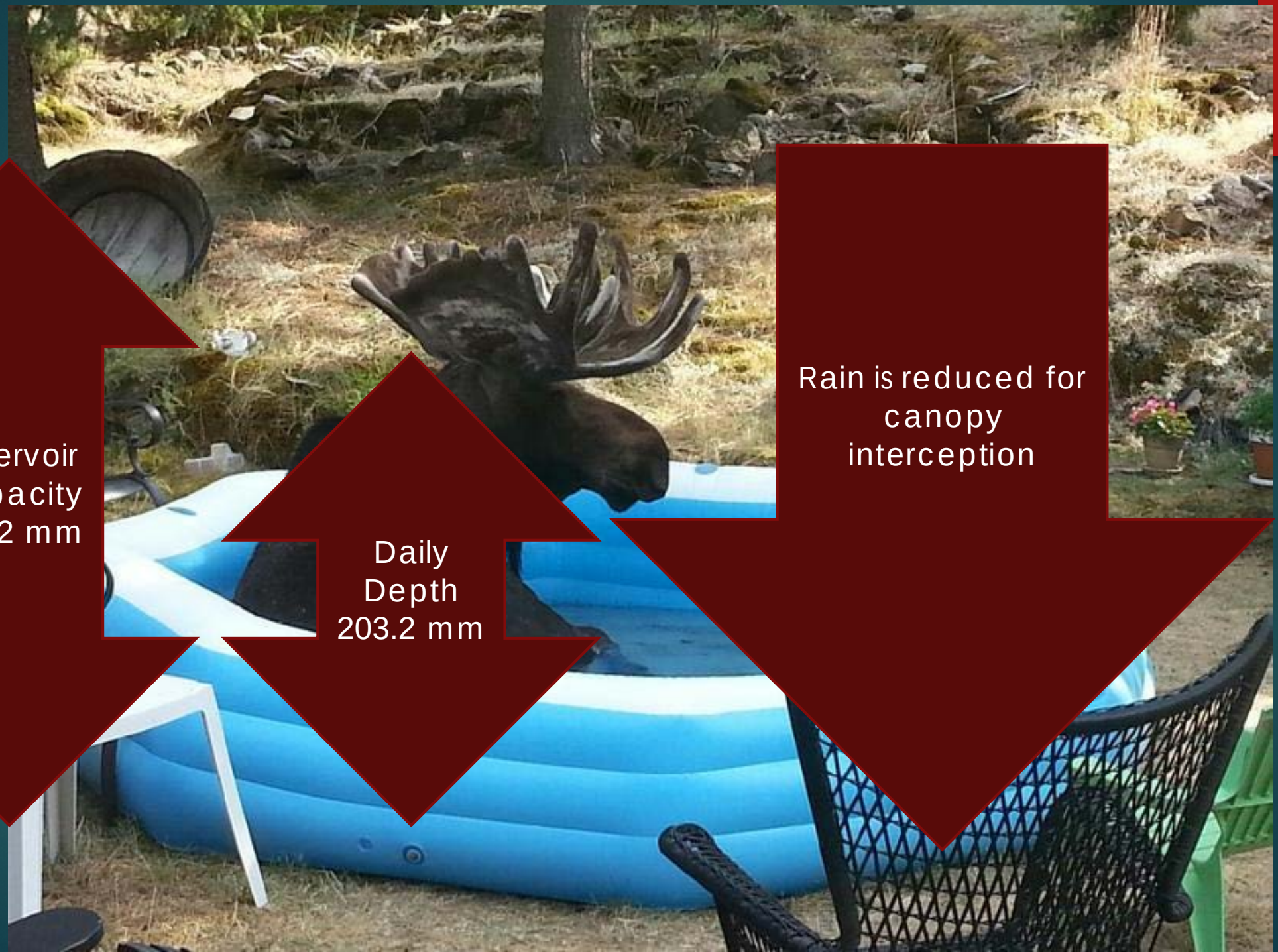
Evap is low when the reservoir is low

Responsible for the timelag in the DC

Now hybrid model

Asynchrony in Evaporation




Reservoir Capacity 203.2 mm
Daily Depth 203.2 mm
Rain is reduced for canopy interception

Unequal treatment of rainfall

- Rain is reduced by 17% due to canopy interception.
- Evaporation is not
- Summer shots of rain often do not exceed the threshold of 2.8 mm
- Drying bias exacerbates “DC departure”

Reservoir Depth 203.2 mm

- Alaska black spruce
  - 51 mm in duff
  - 152 mm in mineral soil
- Need to go 1.6 m or 5-1/4 feet deep to find 8” of water
- Wrote draft paper

New Problem: Perspective

- Review from members of the mid-1980s Canadian Fire Danger Group Members (M. Alexander & B. Lawson) suggested new perspective
- How do you compare a kiddie pool with duff?
- An evaporative model with a diffusion model?
- Timelag!
- (Tear up your draft)

So, what are the timelags?

What are the timelags?

Alaska Duff*

- Live moss: (6 hours) 0.25 days
- Upper duff: 16-30 days
- Lower duff: 47 days
- Mineral soil: 217 days

Alaska Drought Code

- 60 days

*Very preliminary numbers from dataloggers and field sampling

Asynchrony in Timelag

Month	2015 DC Timela	g
April		
May		72
Jun		61
J	46	46
Au	64	61
Sept	127	99

Empirically calibrated from British Columbia!

Ambiguities

- “Day length adjustment”. Despite appearing in authoritative documents, day length plays no mathematical part in the DC.
- Reservoir depth = 8” or 203.2 mm not 100 mm.
- “Moisture equivalent” suggests moisture content. They are not the same. Substitute “Reservoir depth”.

What is the DC? "Soap Box"

- The DC itself does not make much sense. Diffusion model masquerading as an evaporative model?
- It is just a weather thing with a timelag.
- Biased toward evaporation.
- Peak in evaporation is 30 days later than pan evaporation
- Timelag of 60 days is 2/3 of Alaska's fire season. (Overwintering has a big effect on rest of the season)

Parting Thoughts

- Think in terms of the kiddie pool.
- DC little affects BUI in the early part of the season.
- Not much sense in using the fall DC as a basis for determining the spring DC
- Consider substituting Penman Equation for E_{pot}.