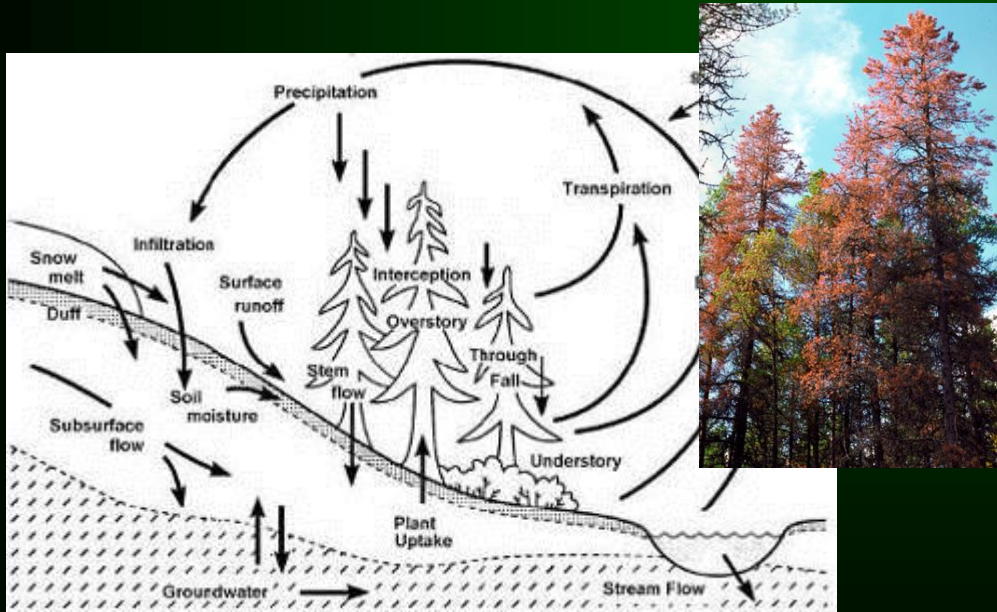
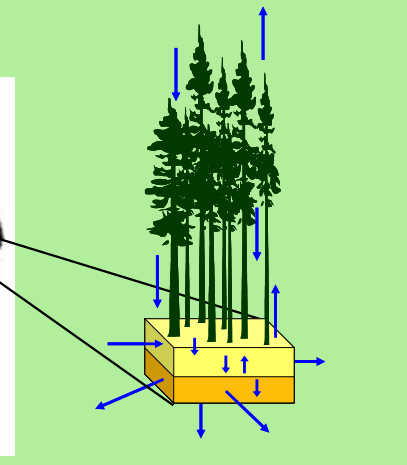
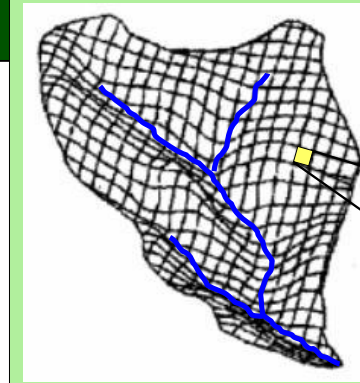
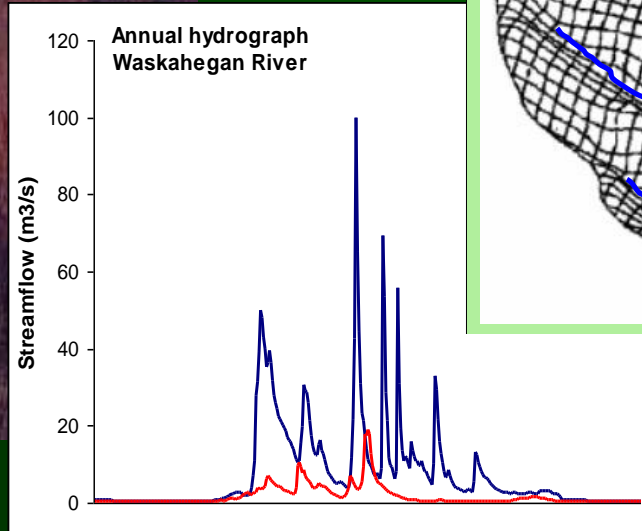
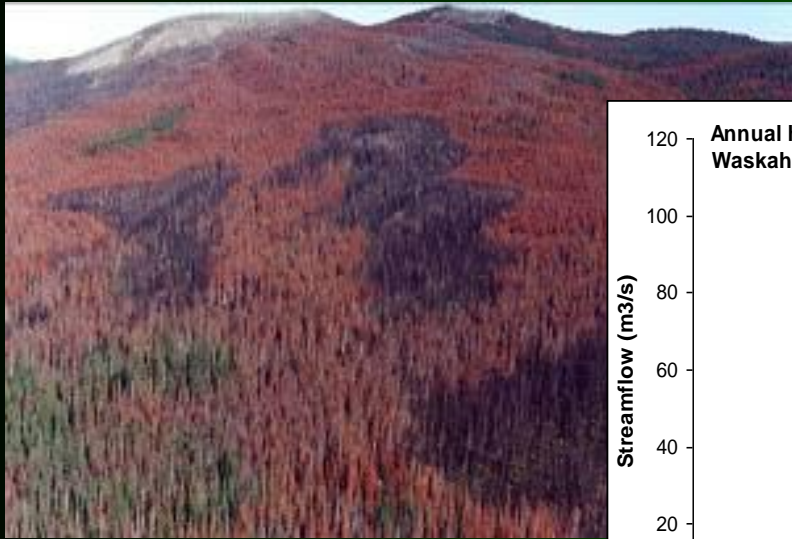


# Effects of MPB on hydrology and post-attack vegetation dynamics

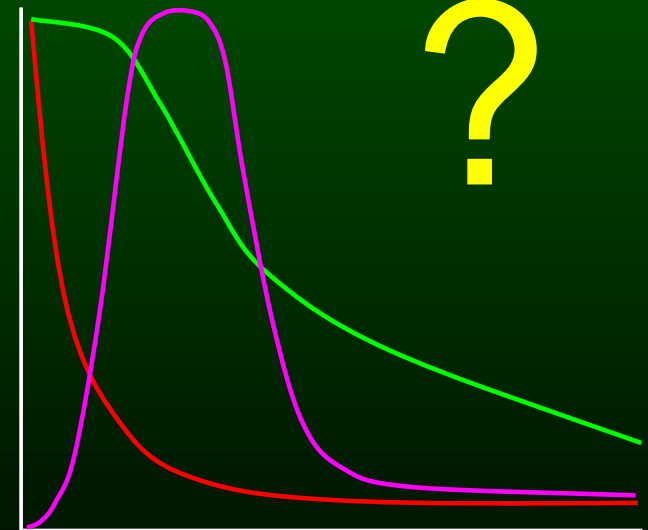
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**Principal investigators:** *Uldis Silins and Ellen Macdonald,*  
**Ph.D. projects:** *Anne McIntosh and Pablo Piña*  
**Lead field technician:** *Pete Presant*



Relative impact



Time

# Approach

- Don't wait for MPB (issue of "control"; B.C.)
- Simulate MPB attack – variable density herbicide treatment
- Stand level research – processes affected by MPB
  - Forest water balance – how much extra water is produced ?
  - Short term vegetation responses – potential for compensation, recovery
- Combination of
  1. Before-After: Treatment:Control approach: *Water balance research*
  2. Replicated stand level: *Understory vegetation dynamics research*



	Before	After
Treatment		
Control		





- Pure pine 120 yrs.
- Medium site index
- 24-26 m height



2007			2008			2009			2010			2011			2012																	
Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Surveying-layout, set up - instrumentation						Pre-Treatment year						Post-Treatment Year 1						Post-Treatment Year 2						Analysis, write-up								



2007				2008				2009				2010				2011				2012																																							
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Surveying-layout, set up - instrumentation				Pre-Treatment year				Post-Treatment Year 1				Post-Treatment Year 2				Analysis, write-up																																											

# Post-attack hydrologic response

*How much extra water is produced after different levels of “red attack” ?*

1. Changes in overstory rainfall interception.
2. Changes individual tree & stand level transpiration
  - *Can surviving trees compensate (use more water)*
3. Changes in forest floor and soil moisture storage
4. Changes in water table level, groundwater



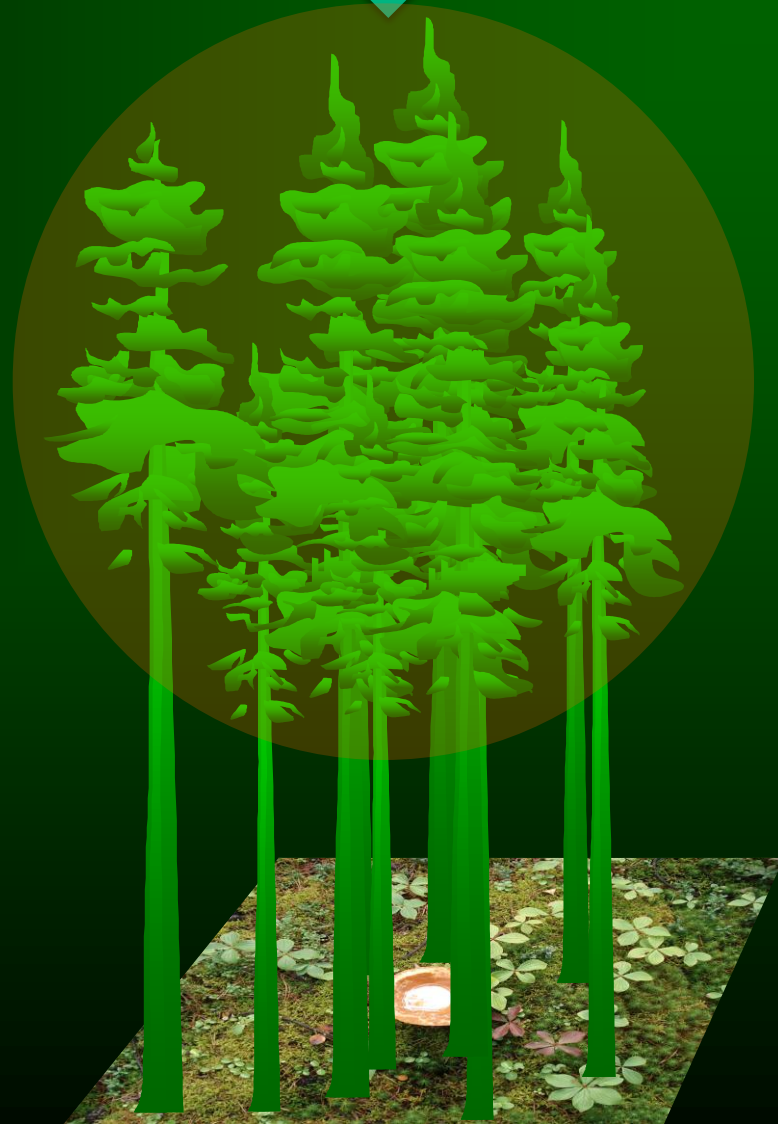


Gross precipitation + Evaporative demand



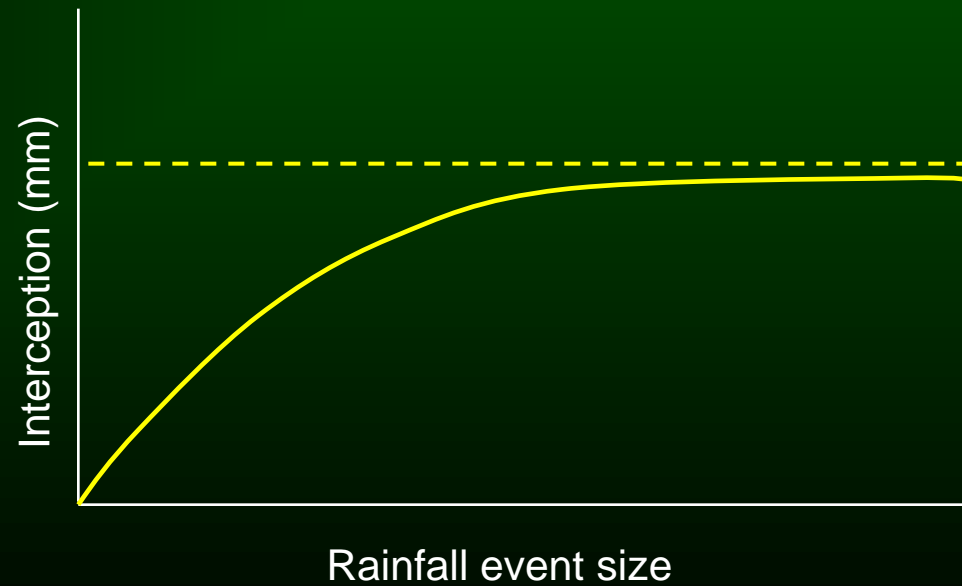
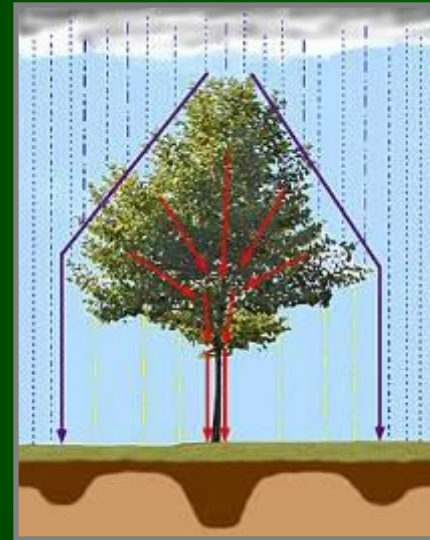
Canopy interception

Overstory transpiration



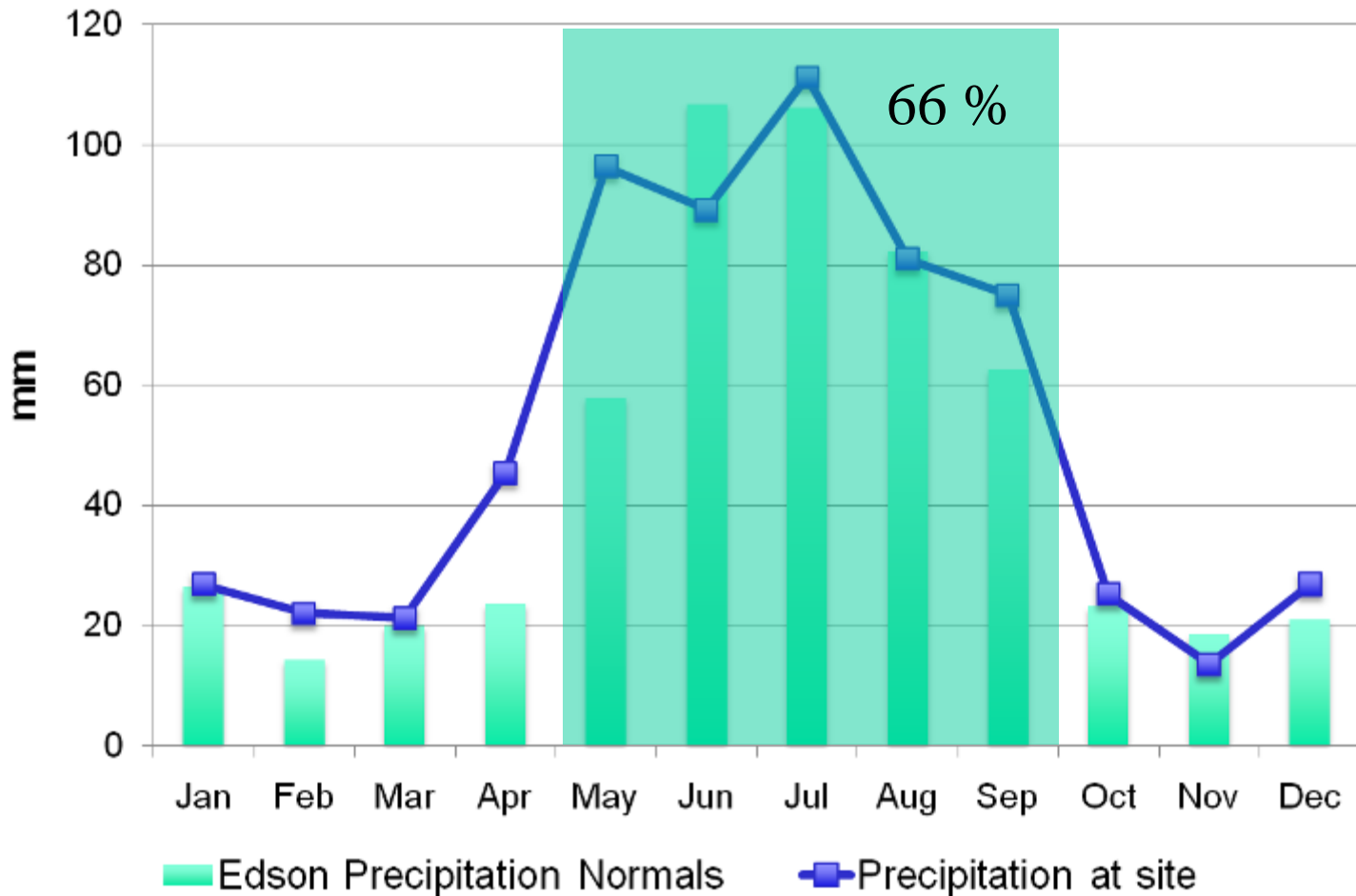
# Rainfall interception

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# Rainfall interception

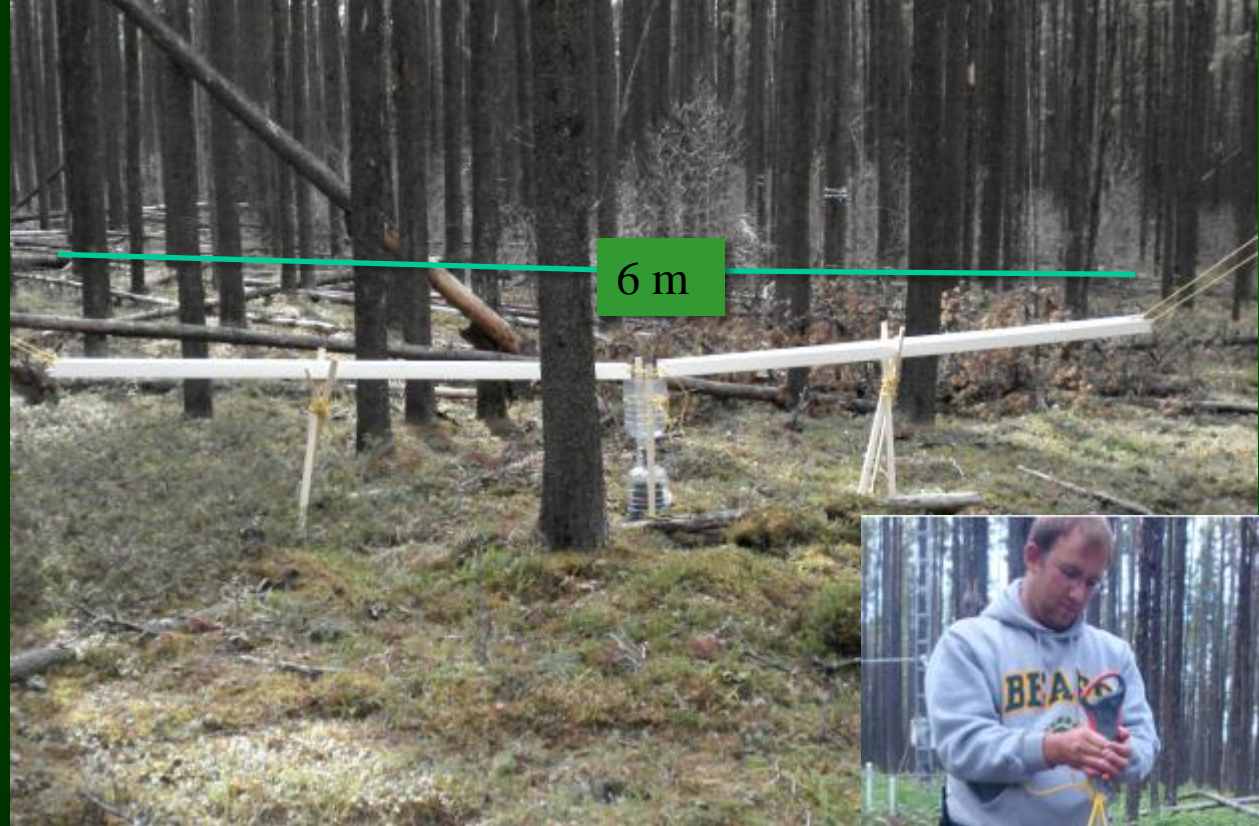
Annual Precipitation = 633 mm



# Rainfall interception



Stemflow



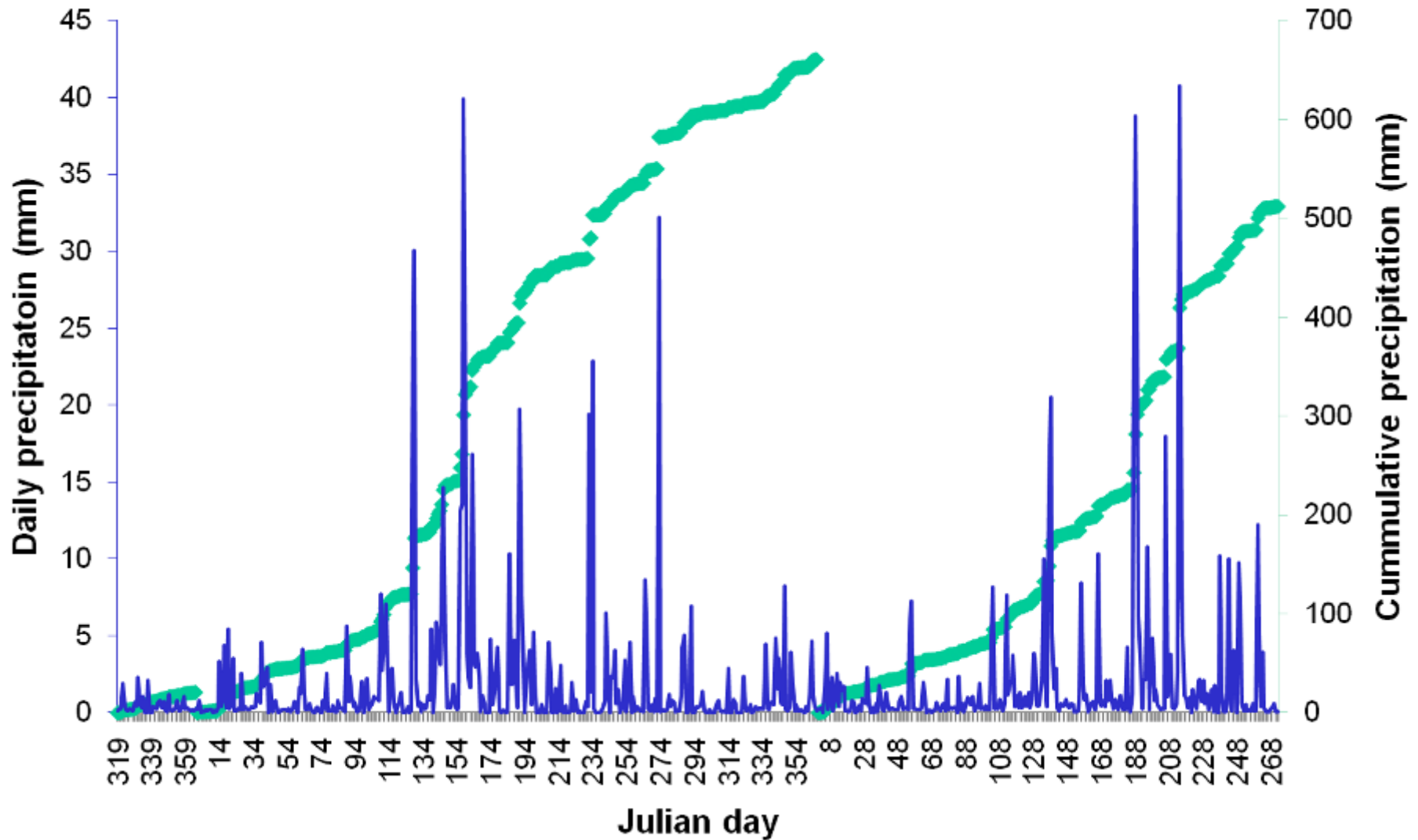
Throughfall



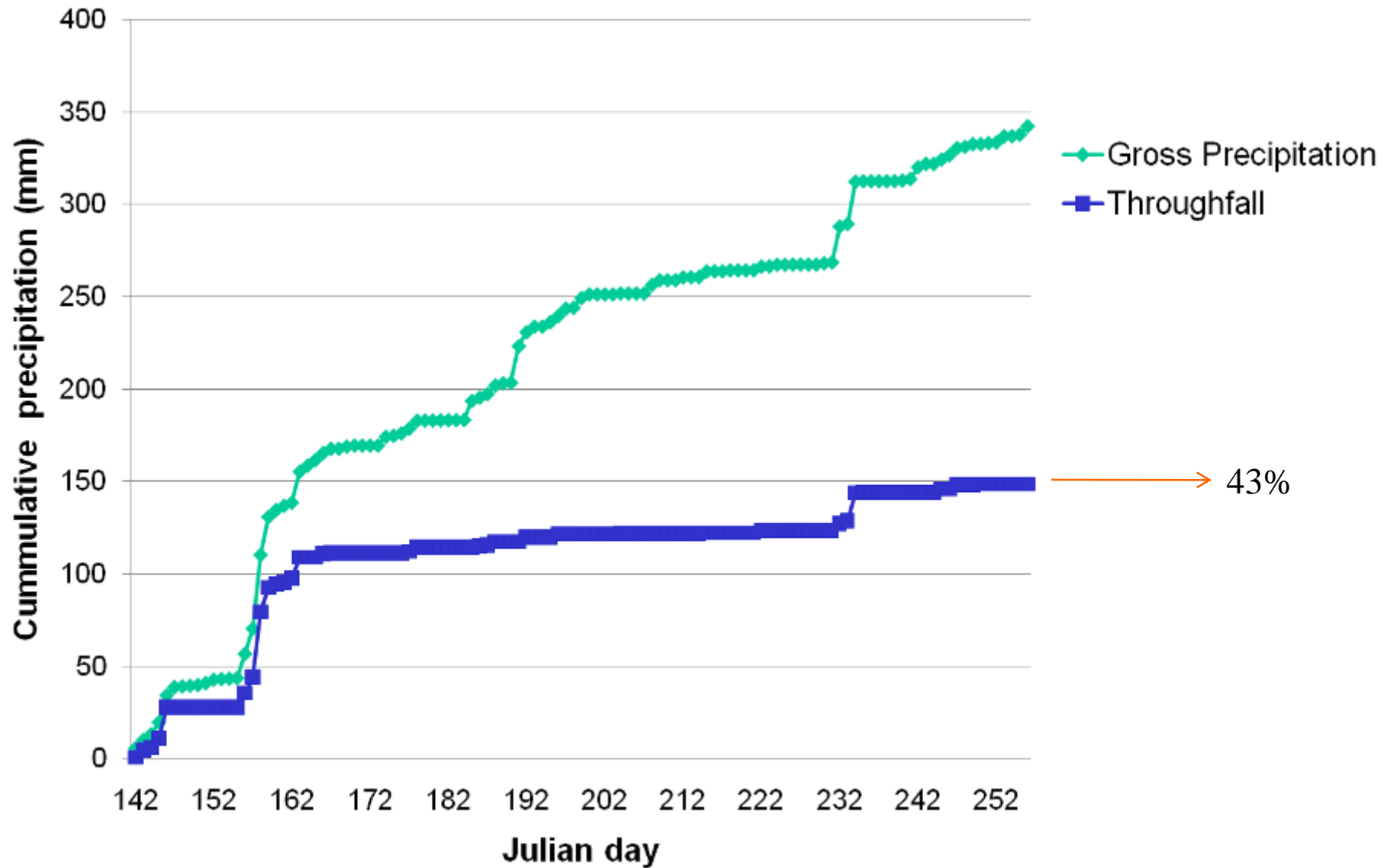
Litter interception

# Rainfall interception

Gross precipitation 2007-2009



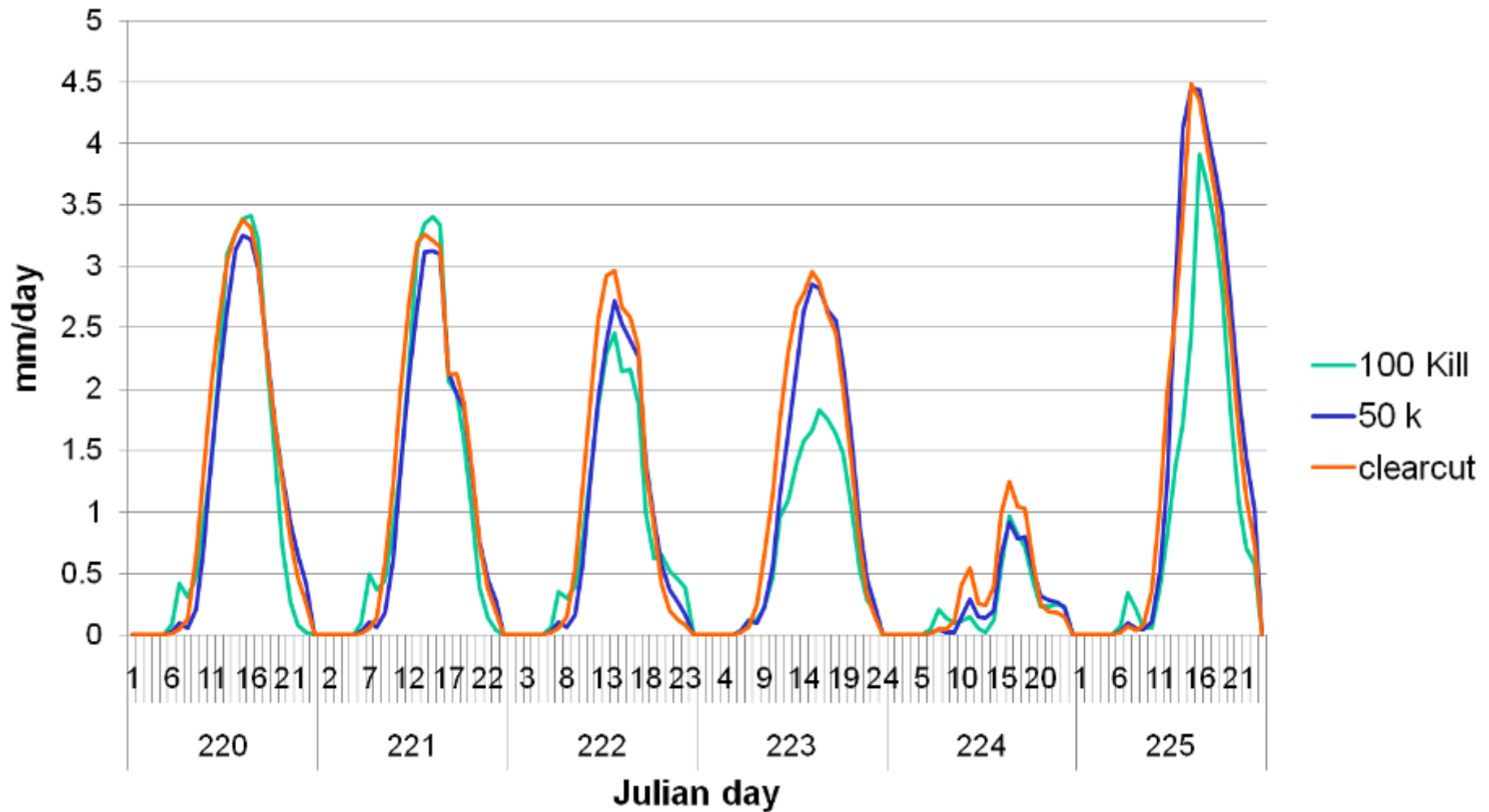
# Rainfall interception



# Individual tree & canopy transpiration



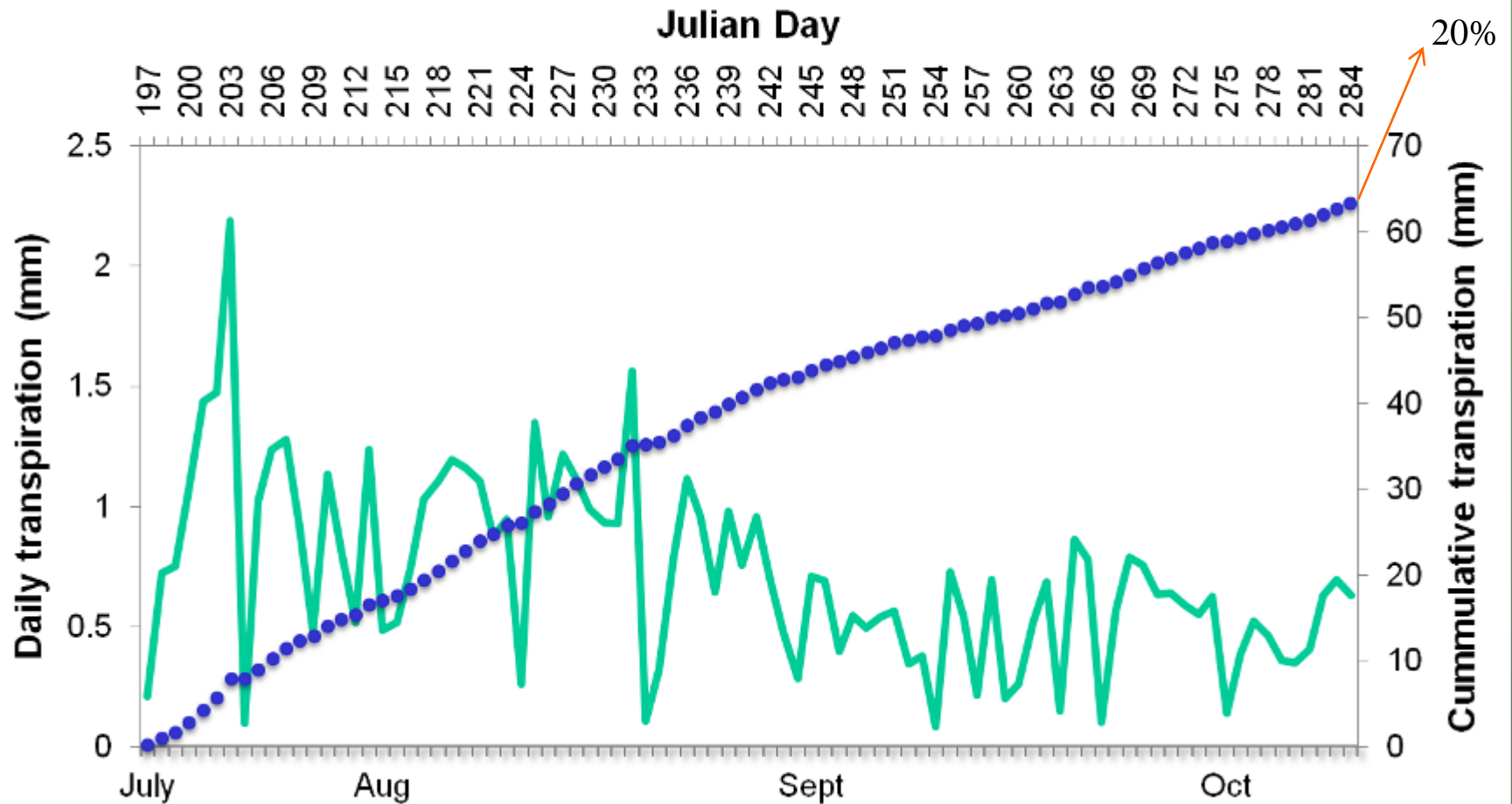
# Individual tree & canopy transpiration





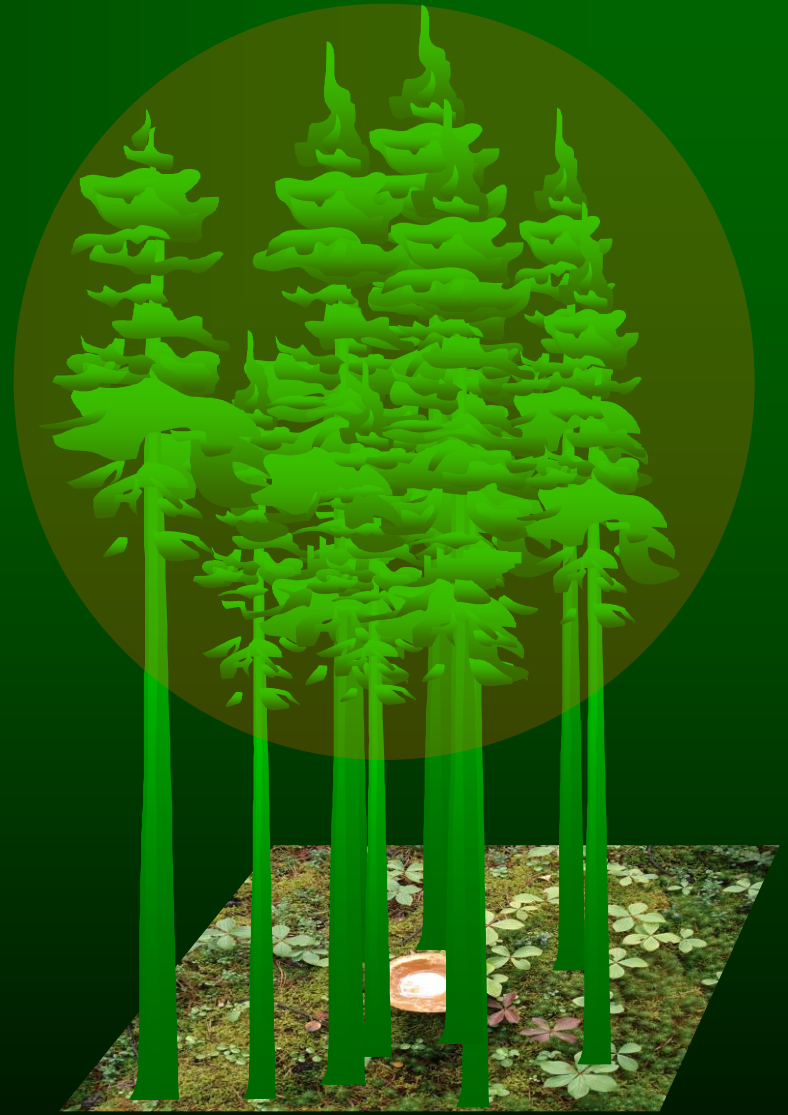
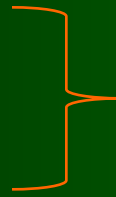
# Individual tree & canopy transpiration

Stand transpiration in mm



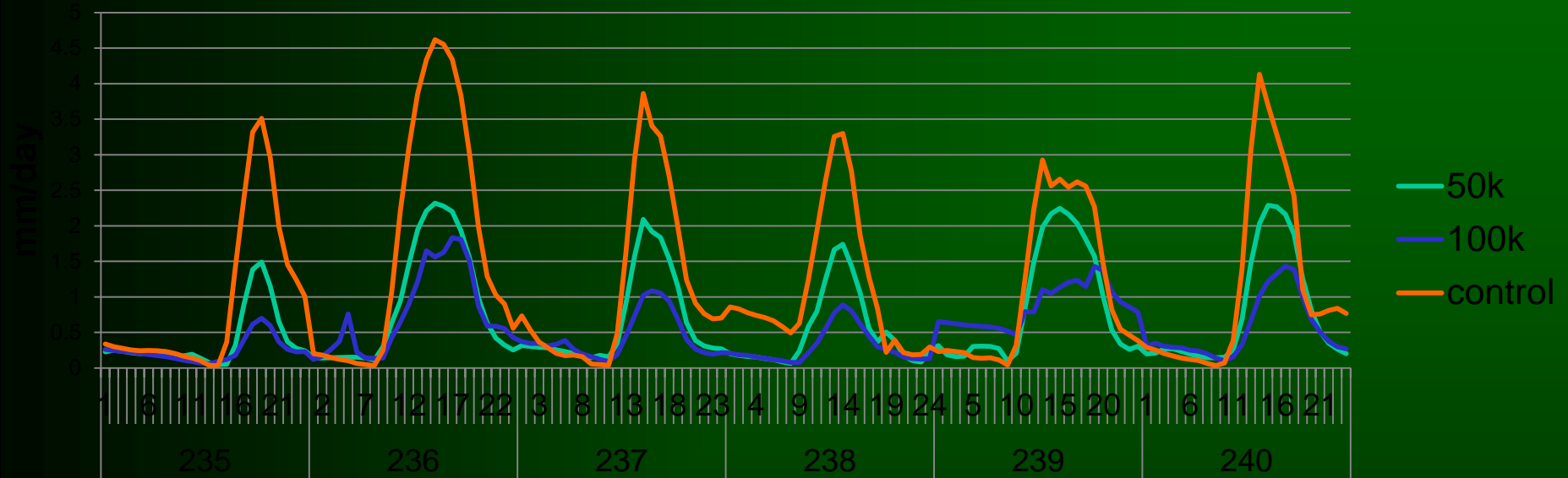
On a daily basis an average tree transpires 5.5 liters, that is about 0.7 liters per ground square meter.  
During the growing season:

- $\approx 57\%$  of precipitation is intercepted by the canopy
- 20% of precipitation leaves as transpiration
- Forest floor interception?
- Understory evaporation?
- Soil moisture storage?

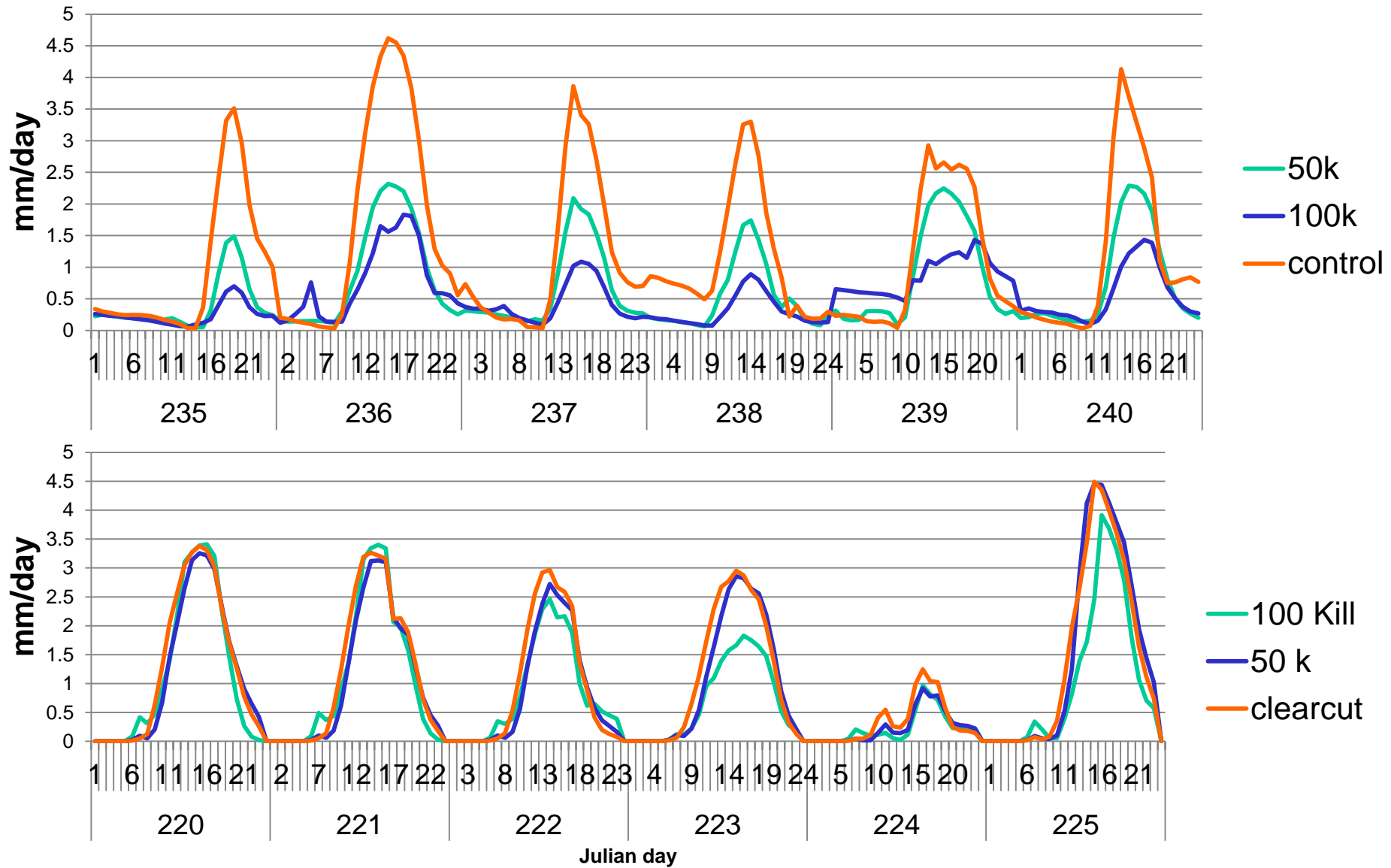


What will happen when the MPB kills the trees?

# Stand level (canopy) transpiration



# Stand level (canopy) transpiration



# Post-attack vegetation response

*What is the early trajectory of post-attack response (advanced growth, understory vegetation) after different levels of “red attack” ?*

1. Changes in overstory forest structure.
2. Changes in understory plant community composition (shrubs, seedlings, vascular plants, bryophytes).
3. Recruitment of downed woody debris (DWD).
4. Changes in below-ground processes (nutrient availability, microbial community, decomposition).







# Objective 1: Overstory

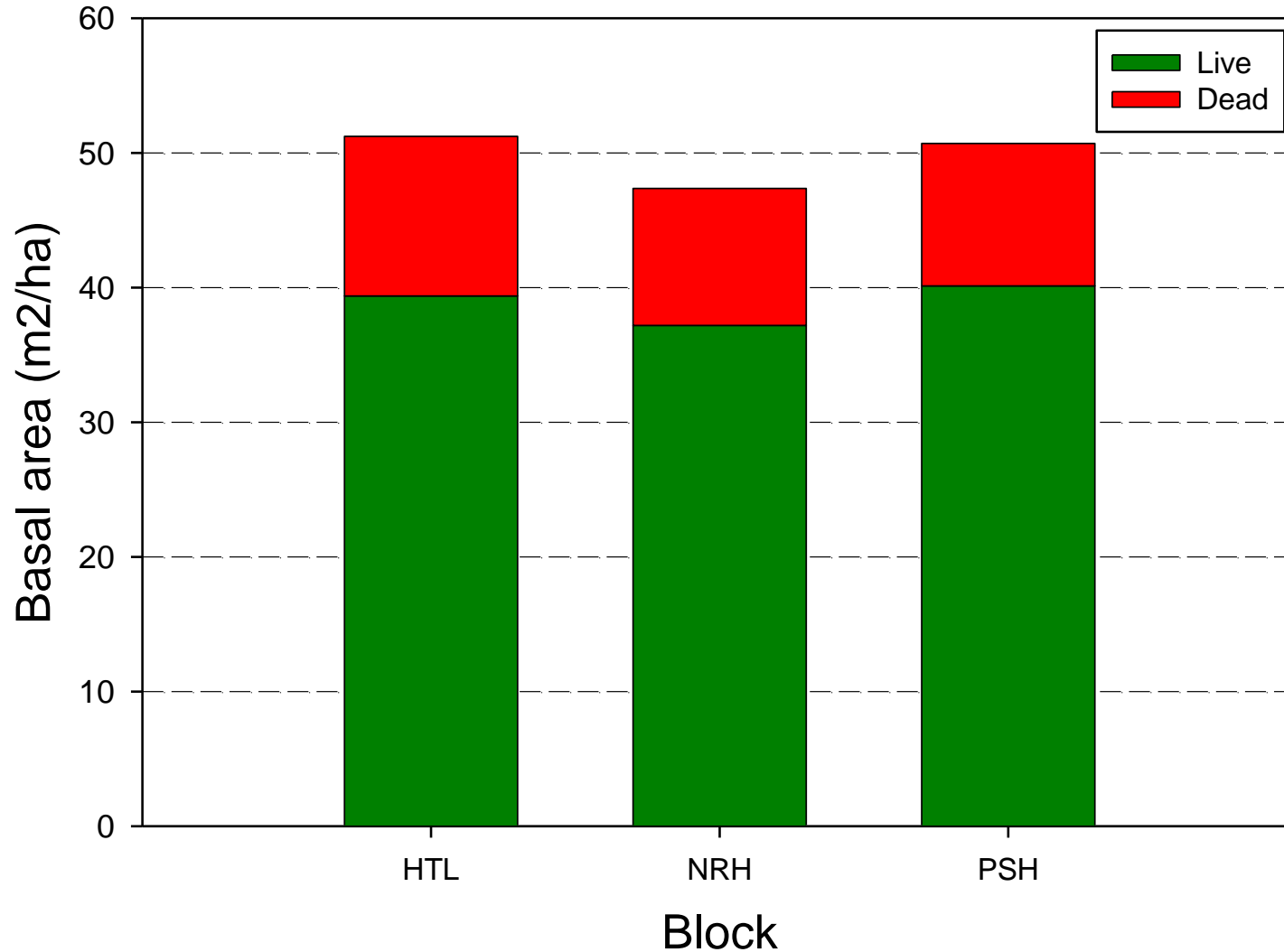
Characterize the overstory forest structure (0.02 ha plots)

- Species
- Live status
- Dbh
- Height
- Crown Vigor
- Cover (hemispherical photos)



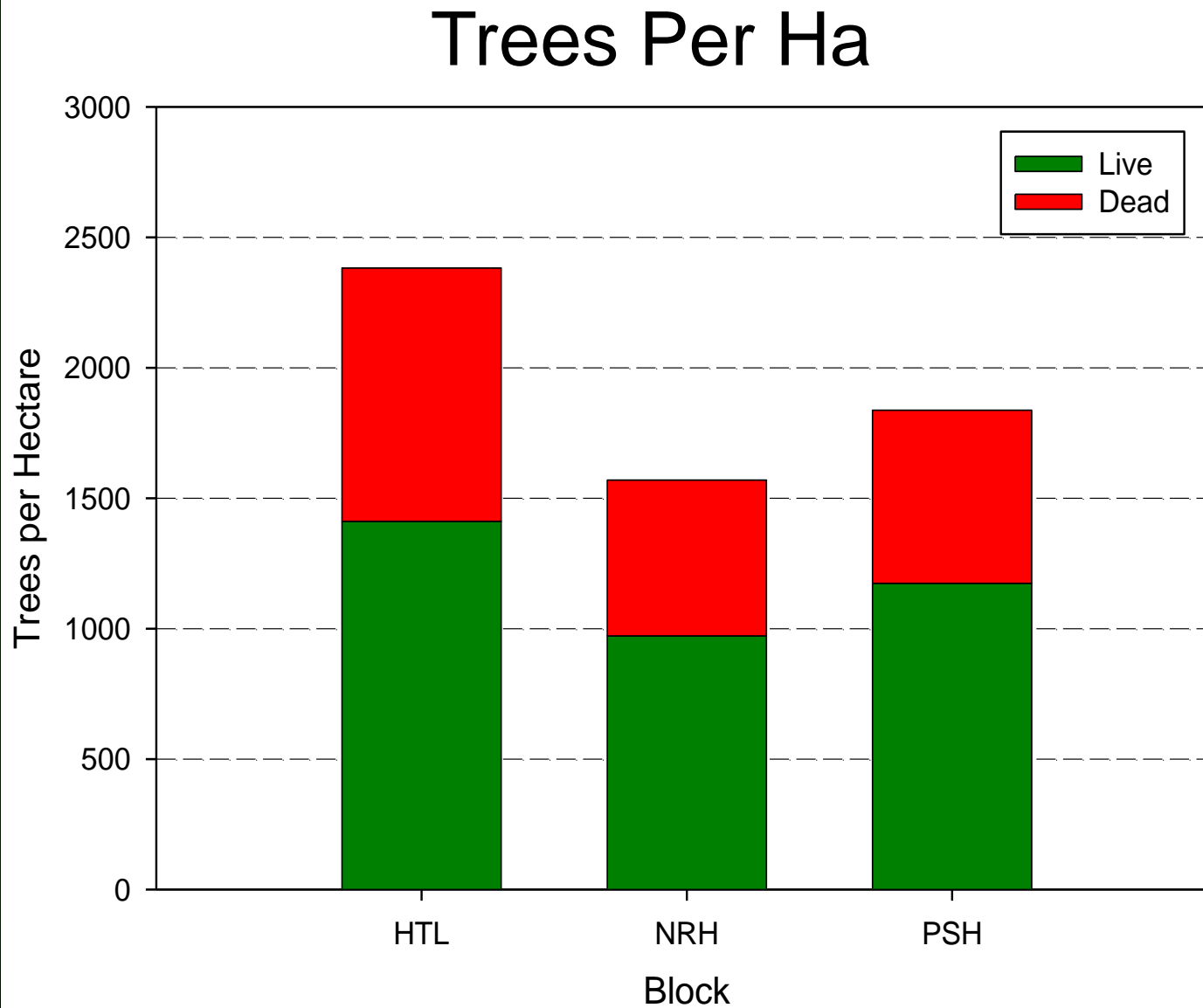
# Pre-treatment - Overstory

## Basal Area

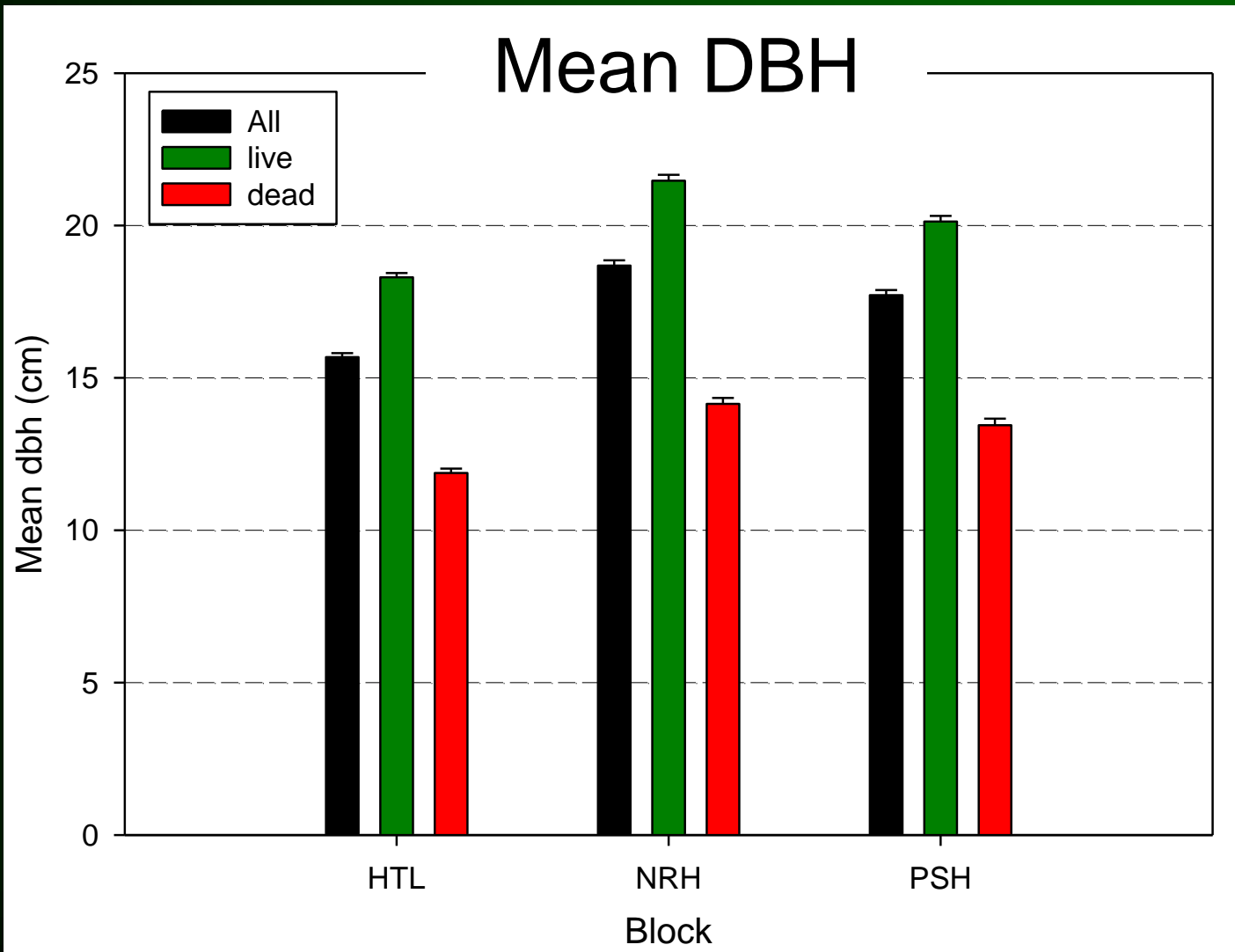




# Pre-treatment - Overstory



# Pre-treatment - Overstory



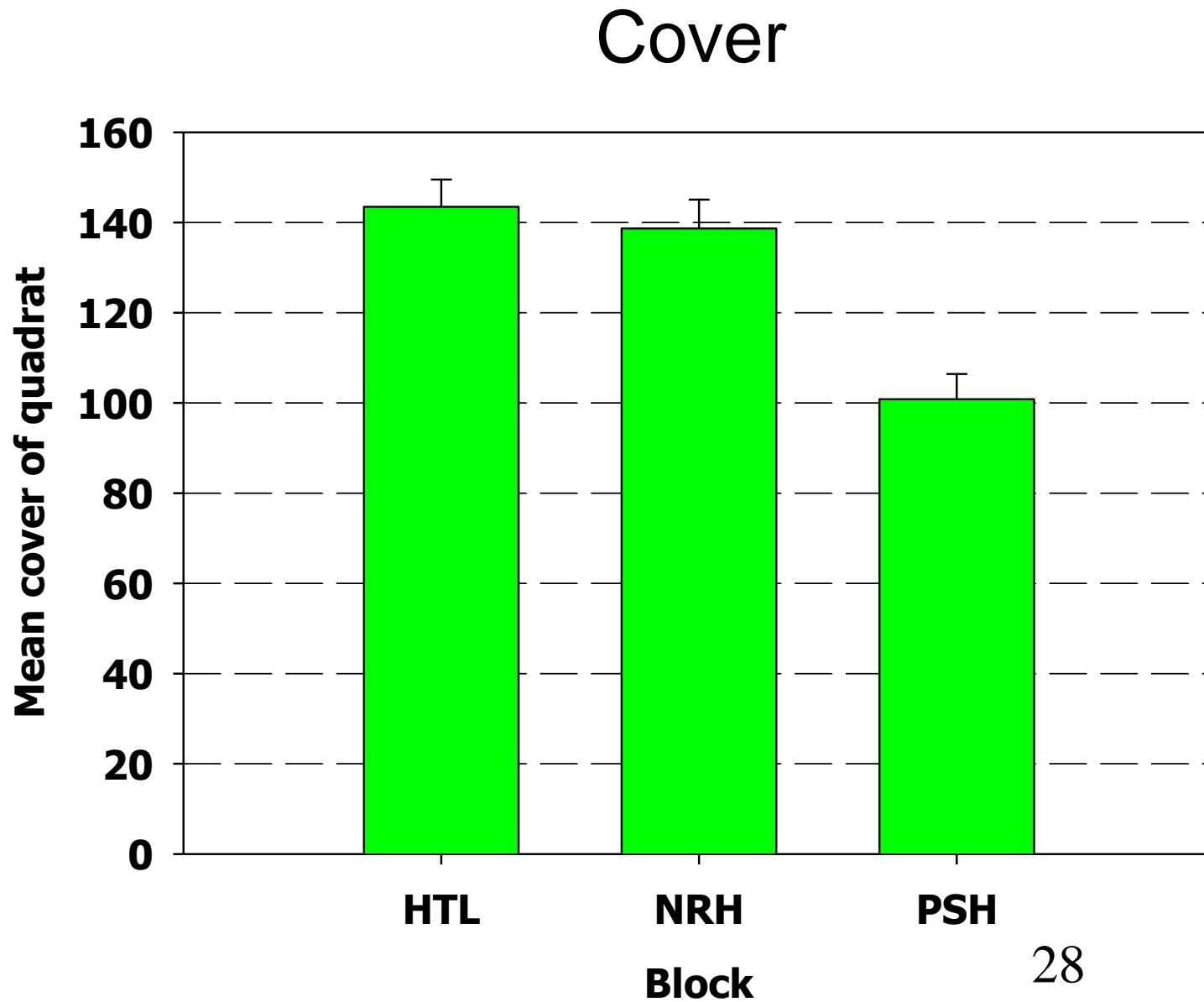
# Objective 2: Understory

Quantify differences in the understory plant community composition

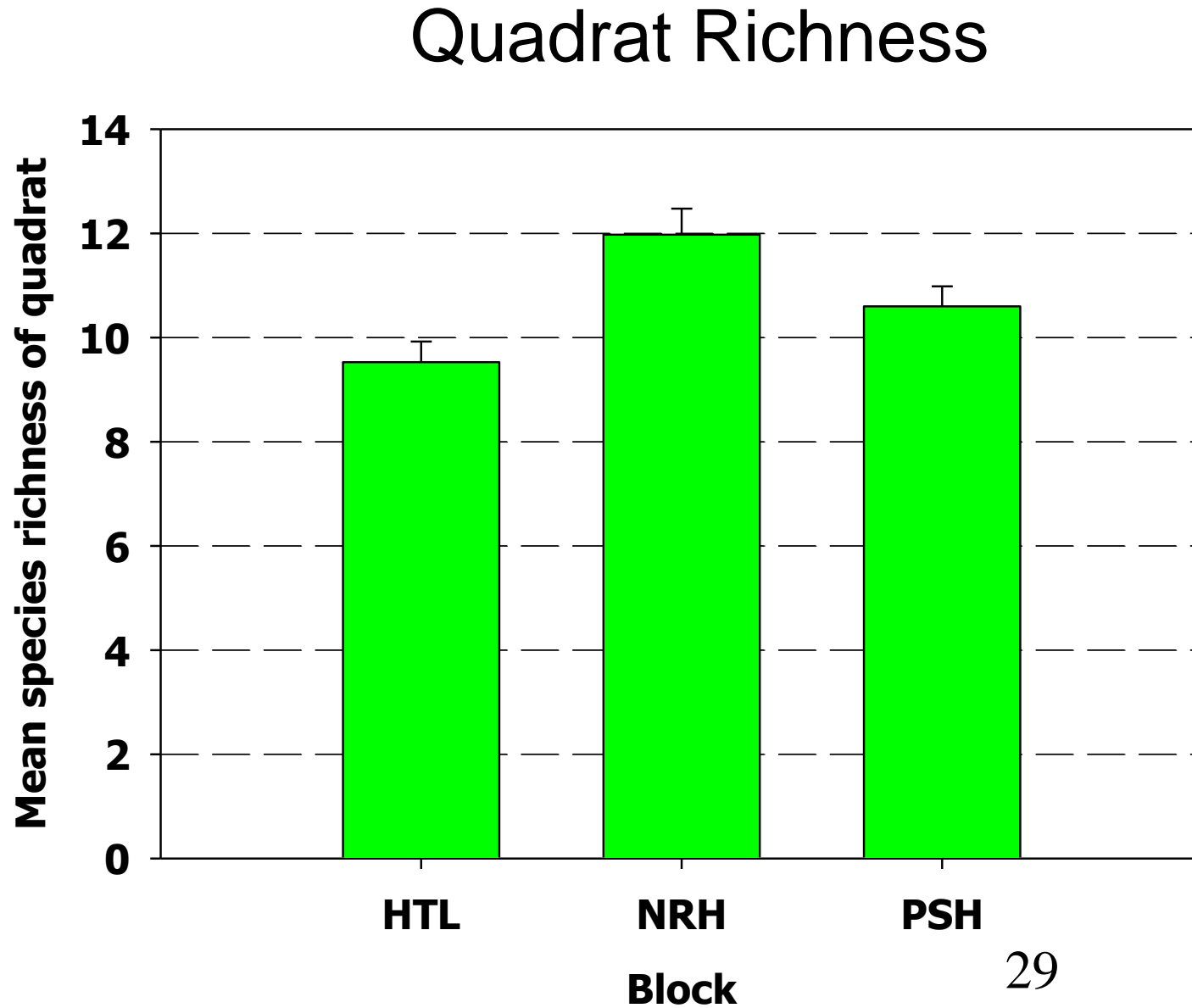
- Seedlings/Saplings (pine)
- Vascular plants (shrubs, forbs, graminoids)
- Non-vascular plants (bryophytes, lichens)
  - Abundance (% cover) and richness by species



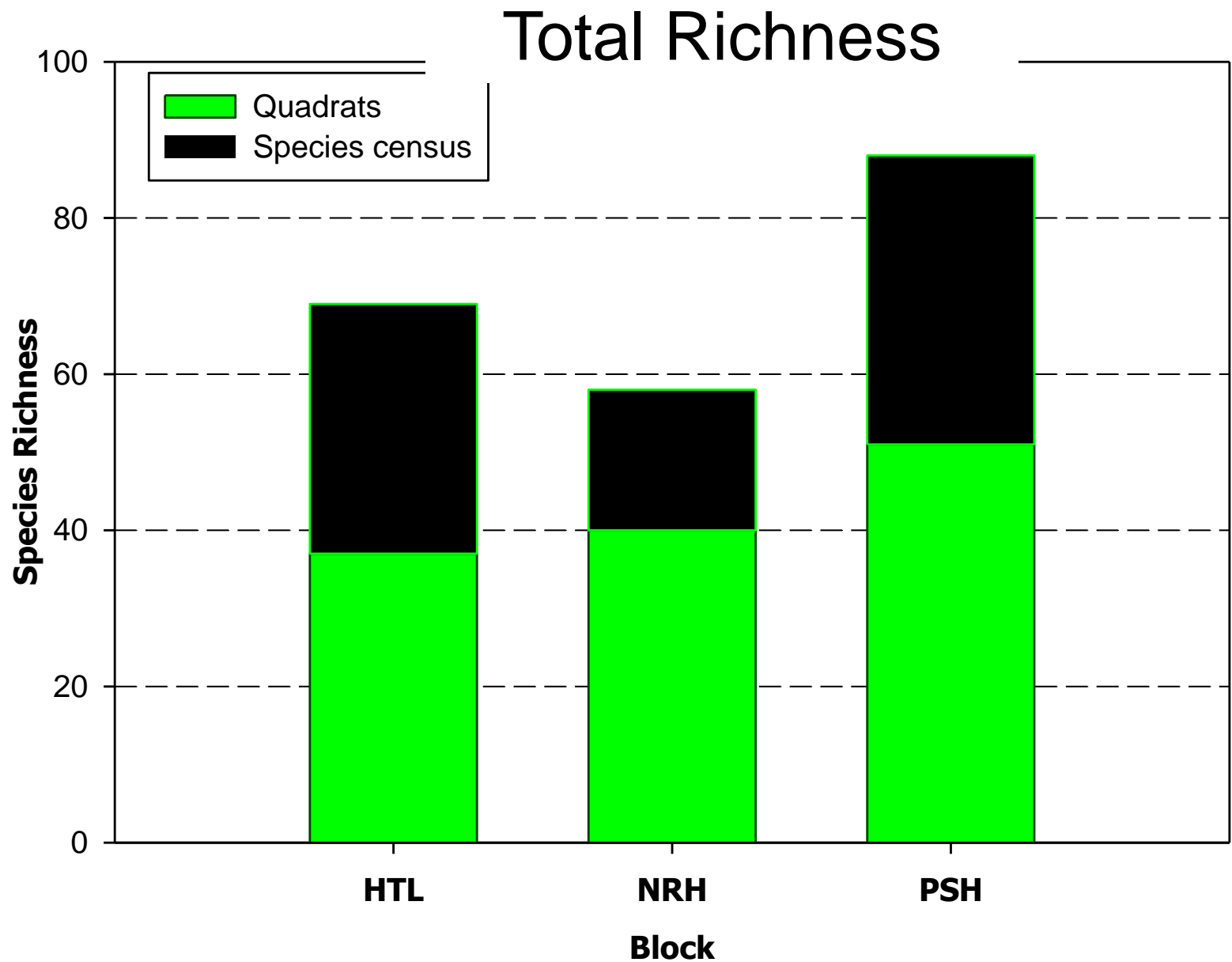
# Pre-treatment - Understory



# Pre-treatment - Understory



# Pre-treatment - Understory



# Objective 3: Downed Woody Debris

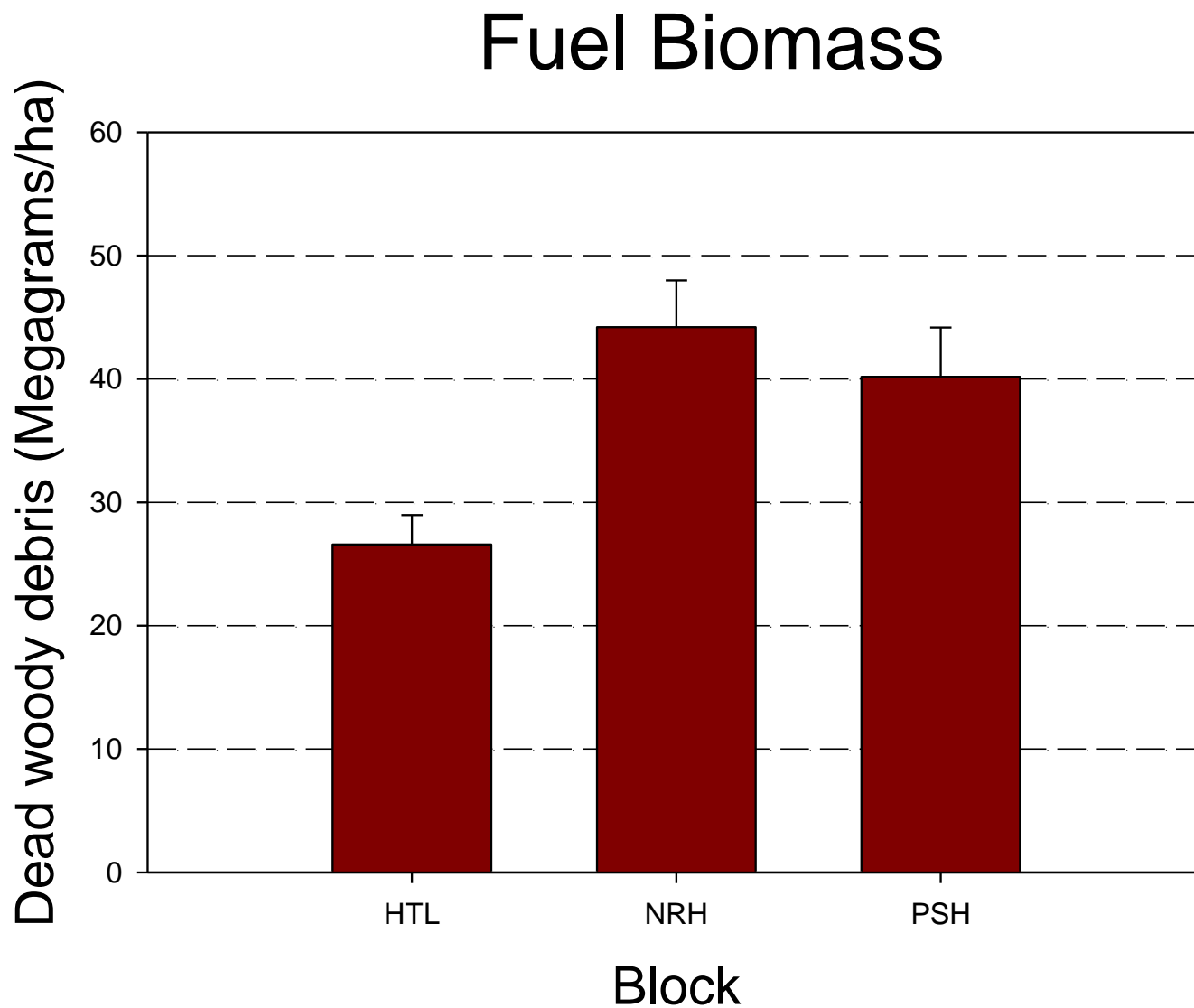


## Quantify DWD

- Transects: biomass estimates (Megagrams/ha)



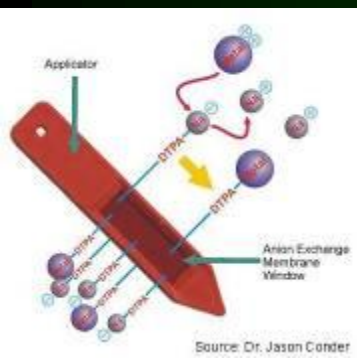
# Pre-treatment – Downed Woody Debris





# Objective 4: Below-Ground

- Quantify differences in below-ground attributes
  - Decomposition (cellulose paper in mesh bags)
  - Microbial biochemical activity & biomass
    - Community-level physiological profiles (CLPP)
    - Phospholipid fatty acid (PLFA) analysis
  - Nutrient availability (PRS probes)
  - Soil moisture (TDR)



Stay Tuned!



# The Future?



# Coming years ...

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2007			2008			2009			2010			2011			2012																	
Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Surveying-layout, set up - instrumentation			Pre-Treatment year			Post-Treatment Year 1			Post-Treatment Year 2			Analysis, write-up																				

## Support for the work

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- Foothills Research Institute
- FRIAA / AB SRD
- West Fraser Timber Co. Ltd.
- Milo Mihajlovich



**...Thank you for listening**