

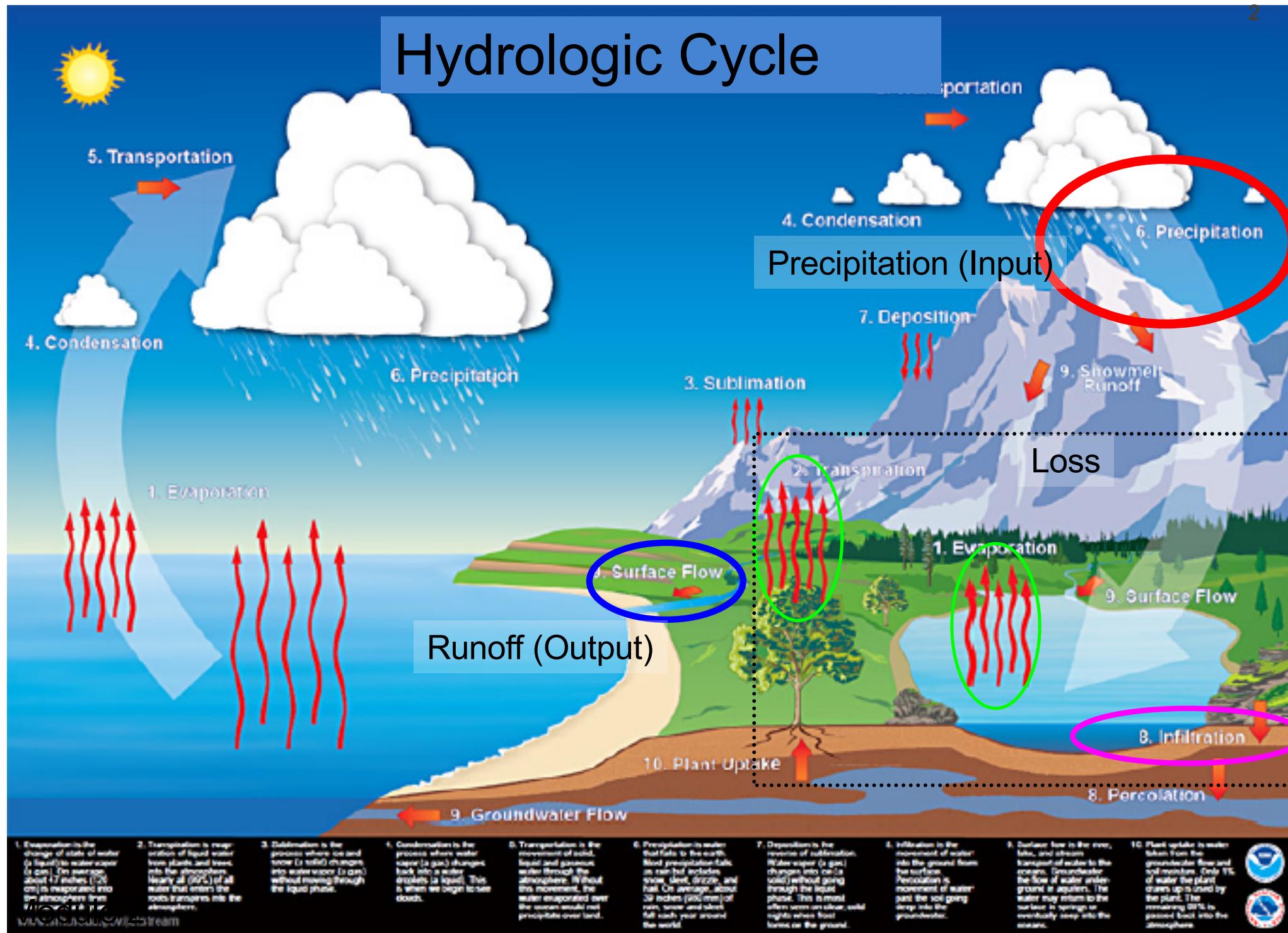


CE 3354 SURFACE WATER HYDROLOGY

WATERSHED PROCESS: DEPRESSION AND CANOPY STORAGE



Hydrologic Cycle



STORAGE

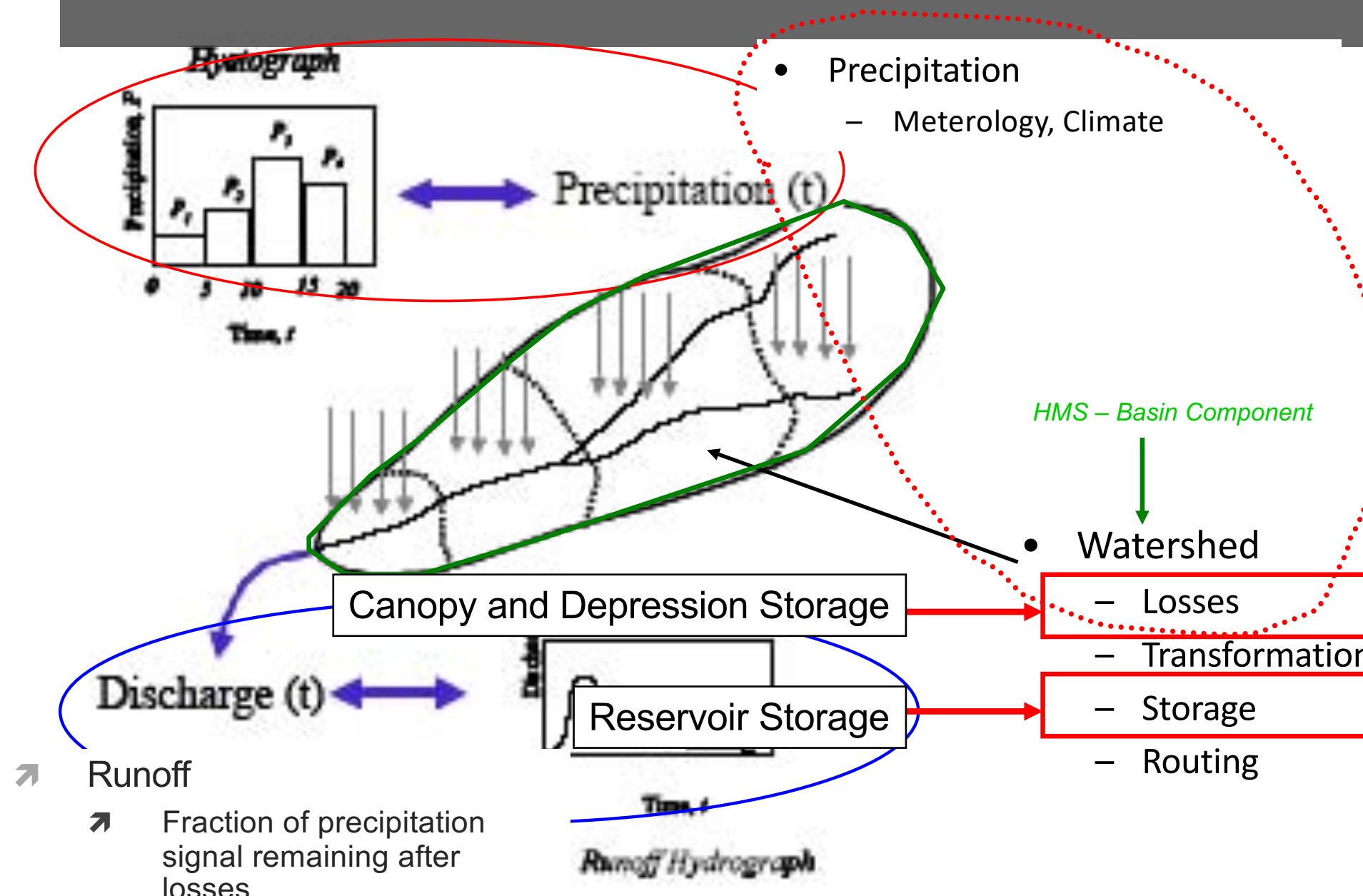
- ↗ Surface Storage

- ↗ Usually treated as abstractions:
 - ↗ Canopy (interception) storage
 - ↗ Depression storage

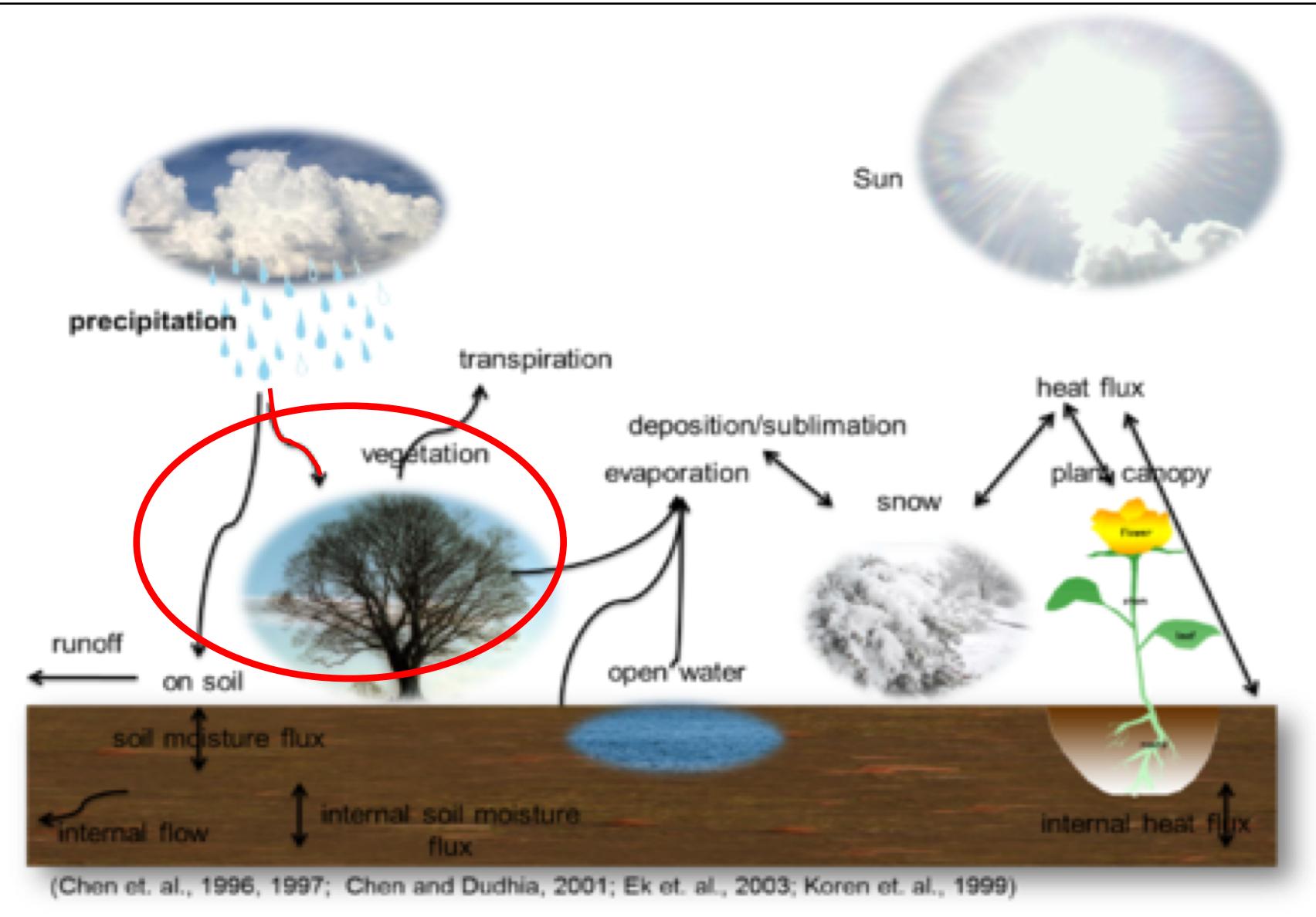
- ↗ Reservoir Storage

- ↗ Usually treated as hydrologic/hydraulic elements
 - ↗ Reservoirs (regulated and unregulated)
 - ↗ Detention basins
 - ↗ Certain stormwater BMPs

Rainfall-Runoff Process

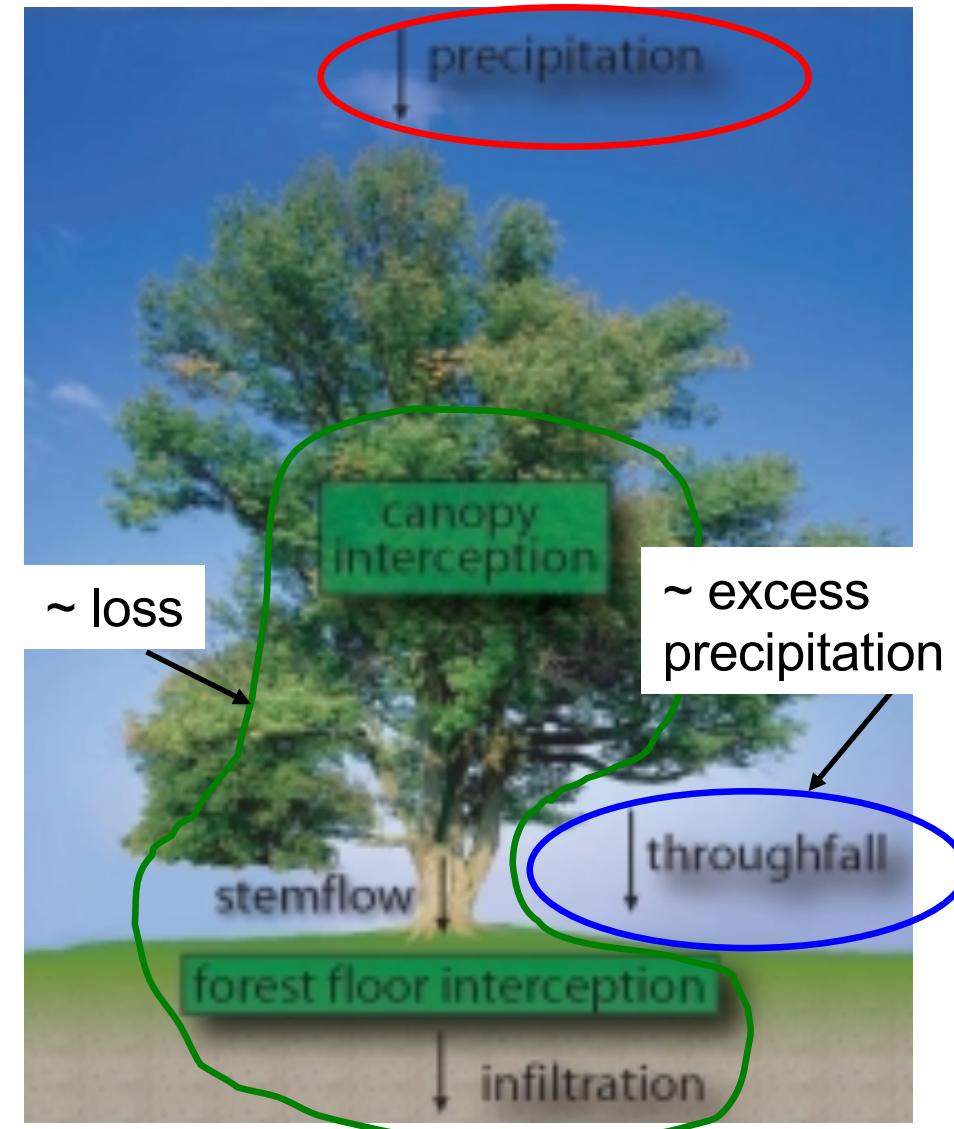


Canopy (Interception) Storage



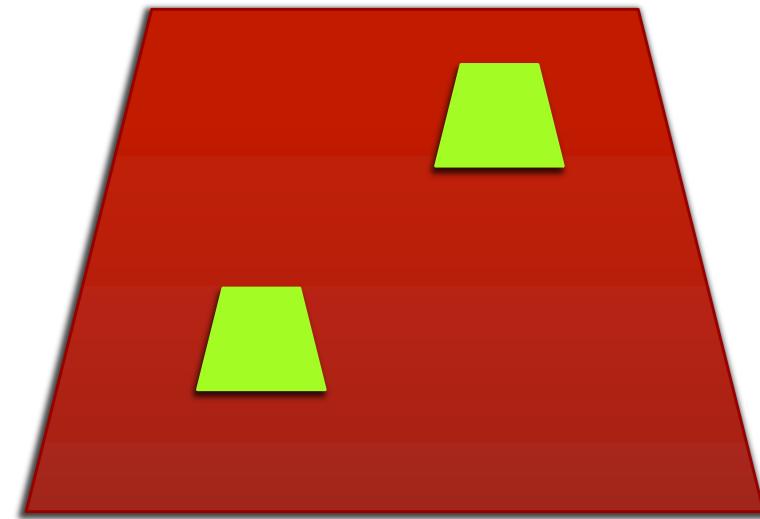
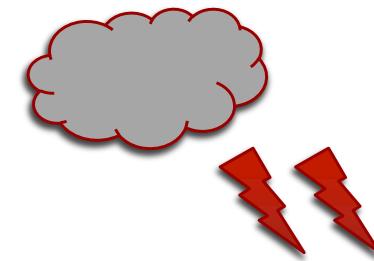
Canopy (Interception) Storage

- ↗ Interception is precipitation that does not reach the soil, but is instead intercepted by the leaves and branches of plants and the forest floor.
- ↗ The intercepted water generally evaporates and leads to loss of that precipitation for the drainage basin.



CANOPY STORAGE

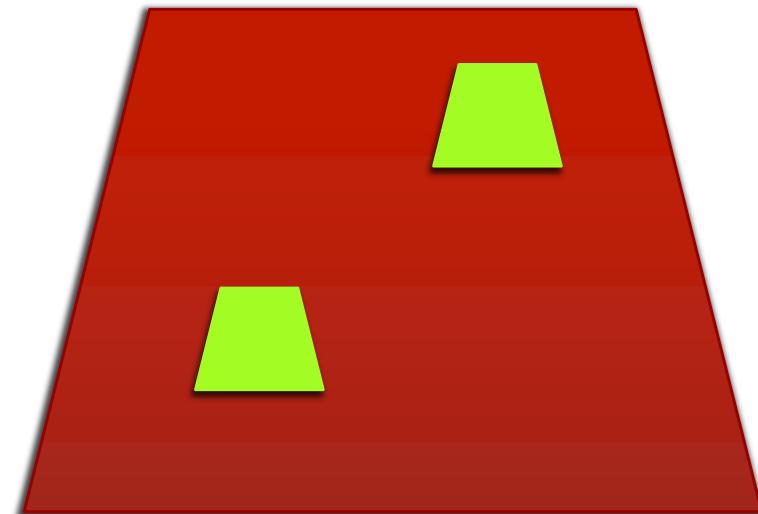
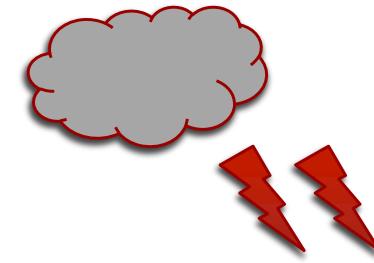
- ↗ All precipitation intercepted until storage capacity satisfied.
- ↗ Excess precipitation then directed to surface (depression) storage if any.
- ↗ Then excess to runoff component.
- ↗ Also considers potential evapo-transpiration (PET) as part of the hydrologic cycle.



Consider an Equivalent Projected Area of
Vegetative Cover

CANOPY STORAGE

- ↗ Sophisticated hydrologic abstraction
 - ↗ Uncommon in engineering hydrological applications, esp. because of the PET feedback.
 - ↗ Utility in “scientific investigation”
 - ↗ Measurements are practically non-existent -- relies heavily on agronomy literature



DEPRESSION STORAGE

- ↗ Depression storage.
 - ↗ The volume of water contained in natural depressions in the land surface, such as puddles.
- (After Horton, 1935, p. 2)



DEPRESSION STORAGE

- ↗ Green-Ampt model
 - ↗ water ponds at non-zero depth; hence depression storage is arguably important for such infiltration models.



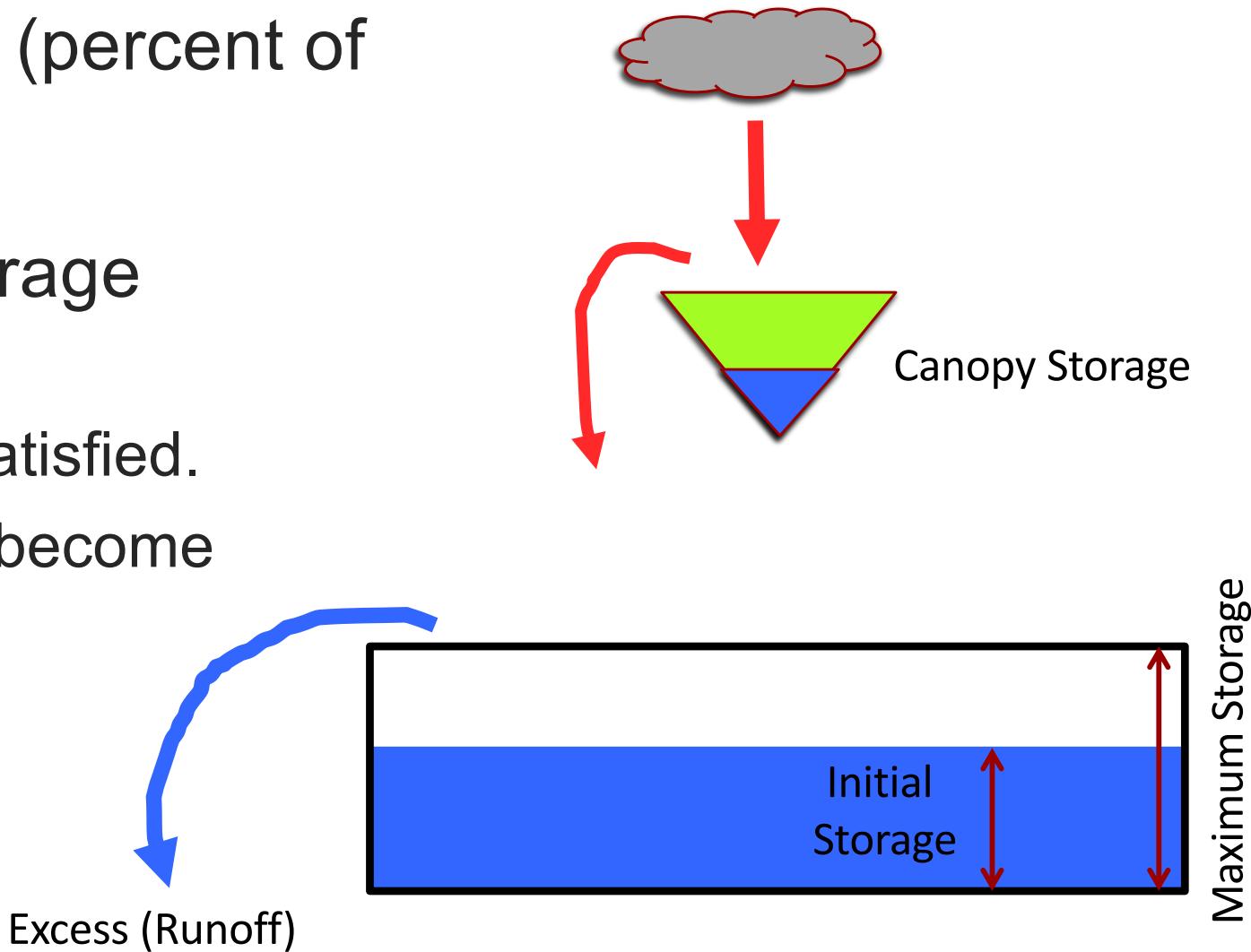
DEPRESSION STORAGE

- The interaction of depression storage and infiltration is one basis of Hortonian overland flow



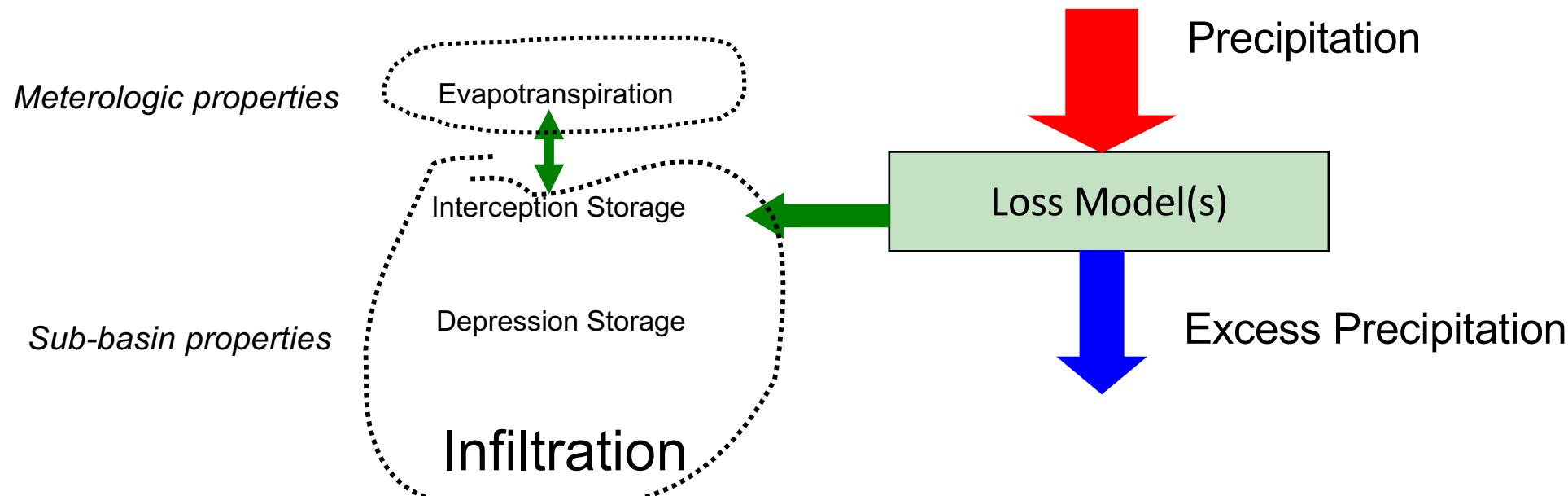
DEPRESSION STORAGE

- ↗ Initial storage (percent of maximum)
- ↗ Maximum storage (depth)
 - ↗ Storage is satisfied.
 - ↗ Excess can become runoff.



Rainfall-Runoff

↗ As a process diagram:



RESERVOIR STORAGE

↗ Reservoir

↗ A pond, lake, or basin, either natural or artificial, for the storage, regulation, and control of water.

↗ Regulated reservoir

- ↗ Outflow controlled by moveable gates and valves.
- ↗ Head, and valve settings determine outflow.

↗ Unregulated reservoir.

- ↗ Outflow controlled by fixed weirs and orifices.
- ↗ Head and constructed weir height determine outflow.

SUMMARY

- ↗ Storage types:
 - ↗ Abstraction:
 - ↗ Canopy and Depression
 - ↗ Hydrologic/Hydraulic
 - ↗ Reservoir
 - ↗ Channel
 - ↗ Abstraction storage is a sophisticated concept, hard to estimate parameters; few measurements
 - ↗ Reservoir storage is fundamental in watershed models
 - ↗ Detention facilities
 - ↗ BMPs