Water in the landscape

NGEA09, 2017

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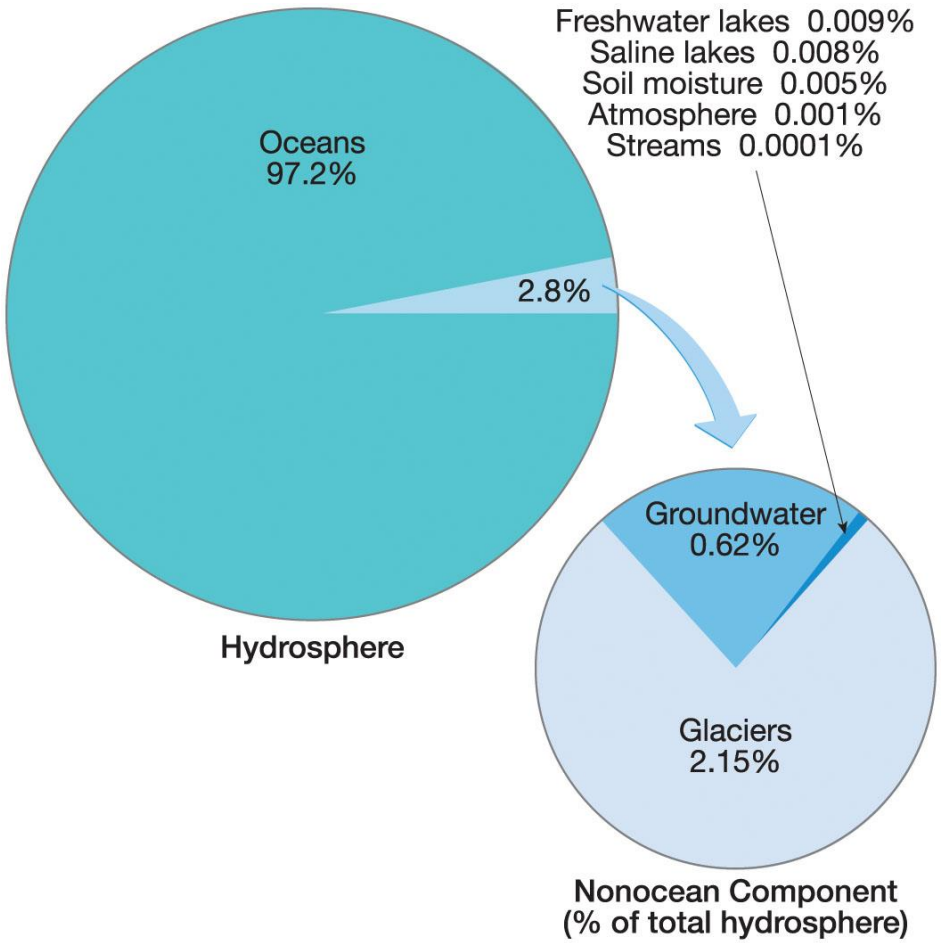
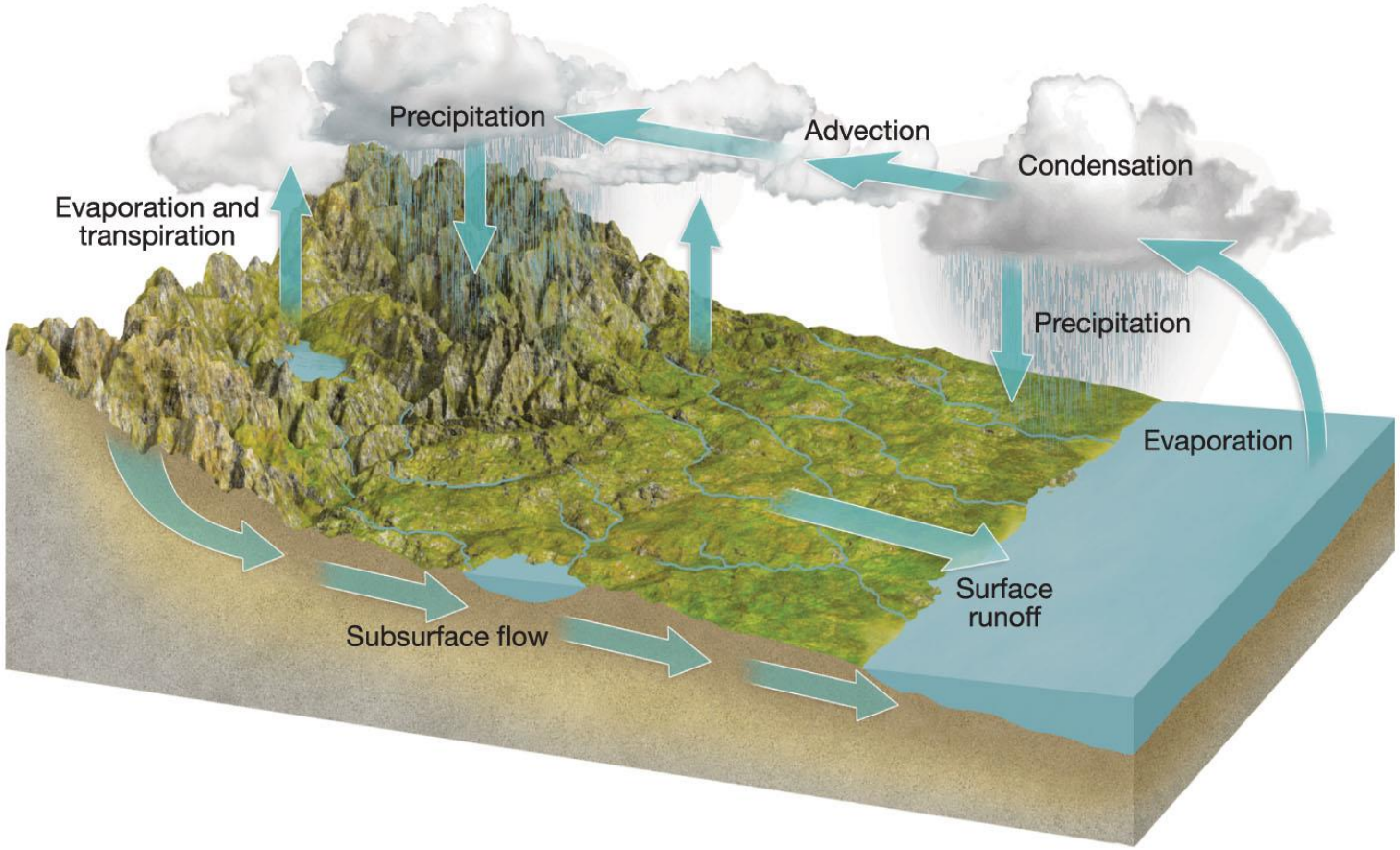
Water in different reservoirs on earth



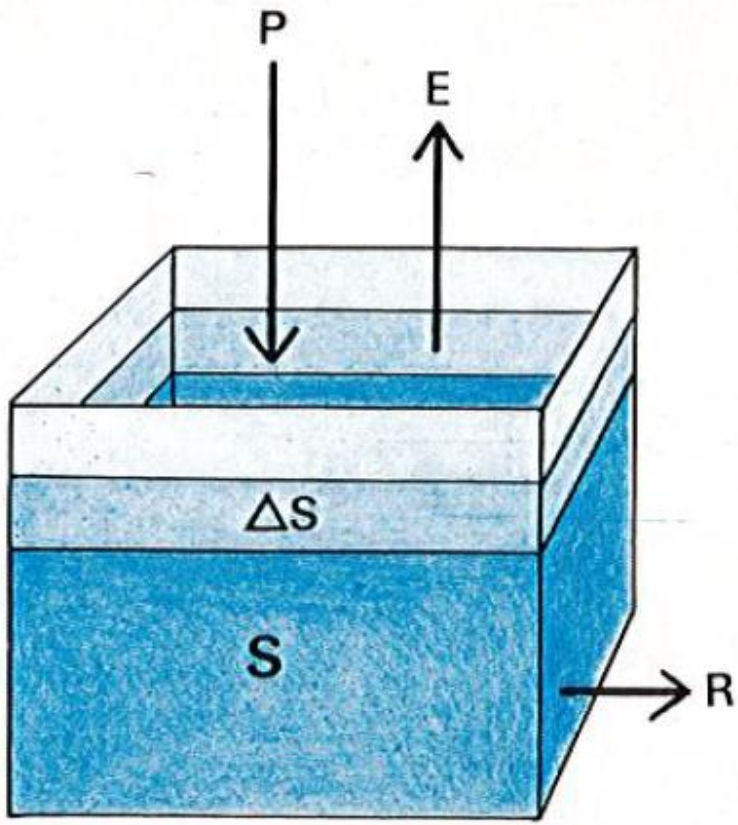
(From Hess, 2013)

The hydrologic cycle



(From Hess, 2013)

$$P = E + R + \Delta S$$



(From Grip & Rohde)

P=precipitation
E=evapotranspiration
R=runoff
ΔS=Change in storage

Why is water important?

- Essential to life
- Transports nutrients (e.g. N, P, Ca, Mg, K)
- Transports pollutants (e.g. H^+, Hg, N, P)

(From Hess, 2013)

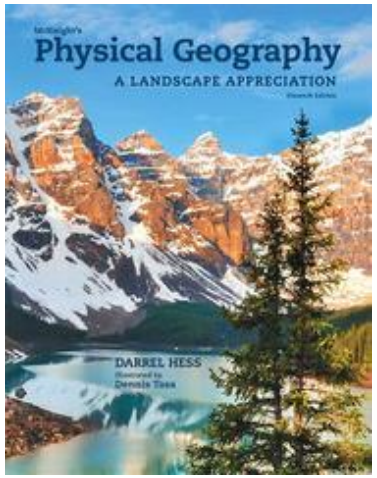
Today´s lecture

- Water contents and movement in soil
- Water in catchments
- Catchments in Sweden – from water districts to subcatchments
- Chemical processes and transport by water
- Modelling water flow

Litterature

Mc'Knights Physical Geography - A landscape appreciation, av D. Hess

Vattnets väg från regn till bäck, av H. Grip och A. Rodhe



Parts of chapters:
"Hydrosphere" &
"Fluvial processes"

Water content and movement in soils

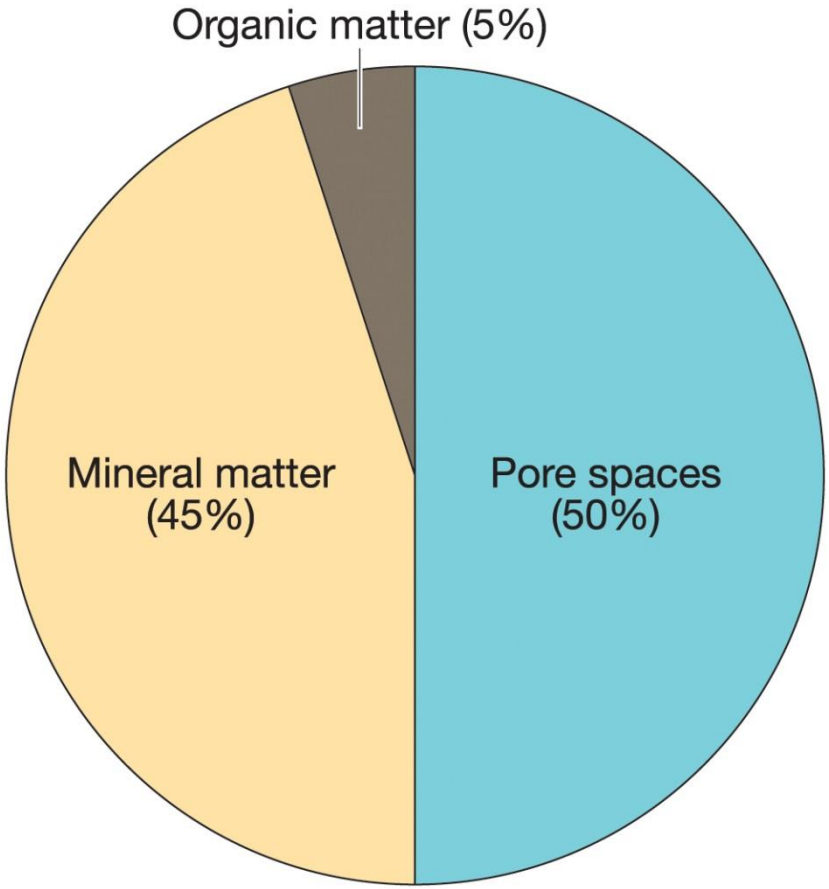
Soil components

-Inorganic materials

-Organic matter

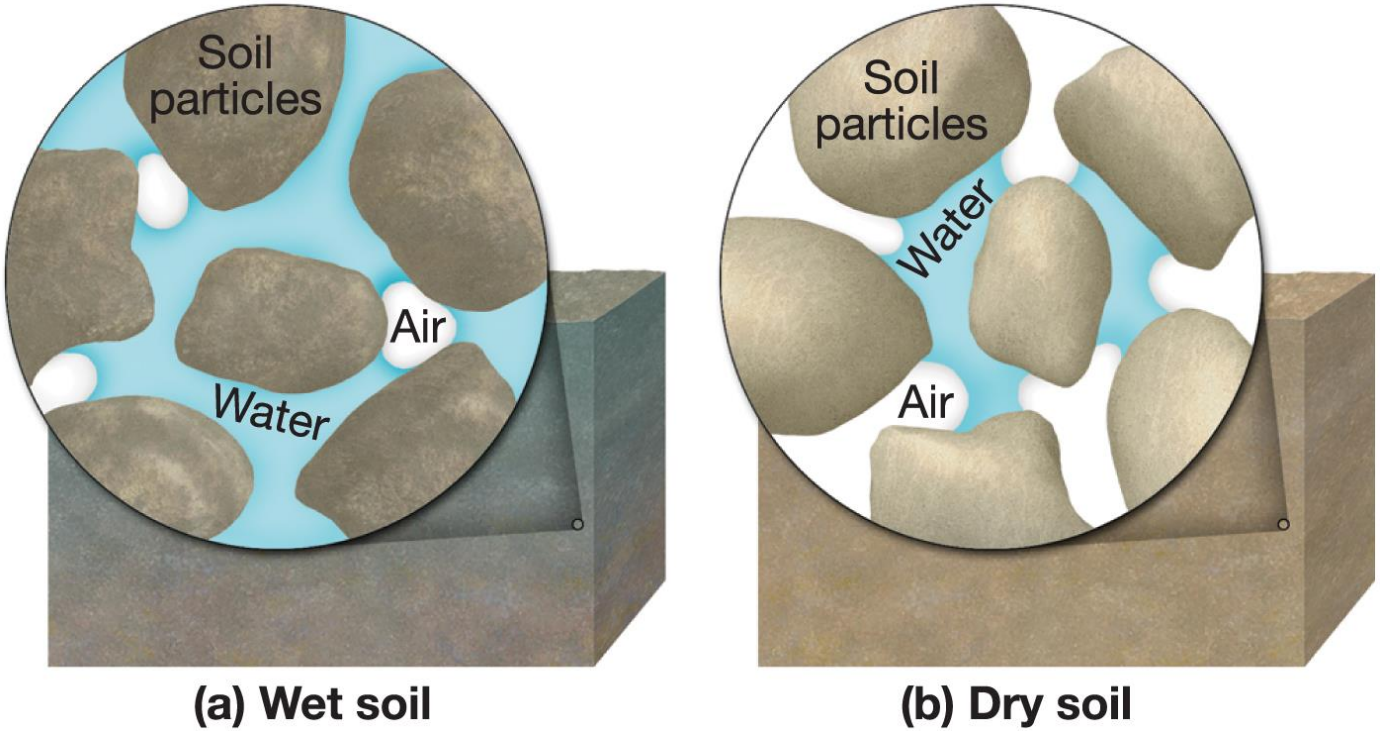
-Soil air

-Soil water



(From Hess, 2013)

Soil Air



(From Hess, 2013)

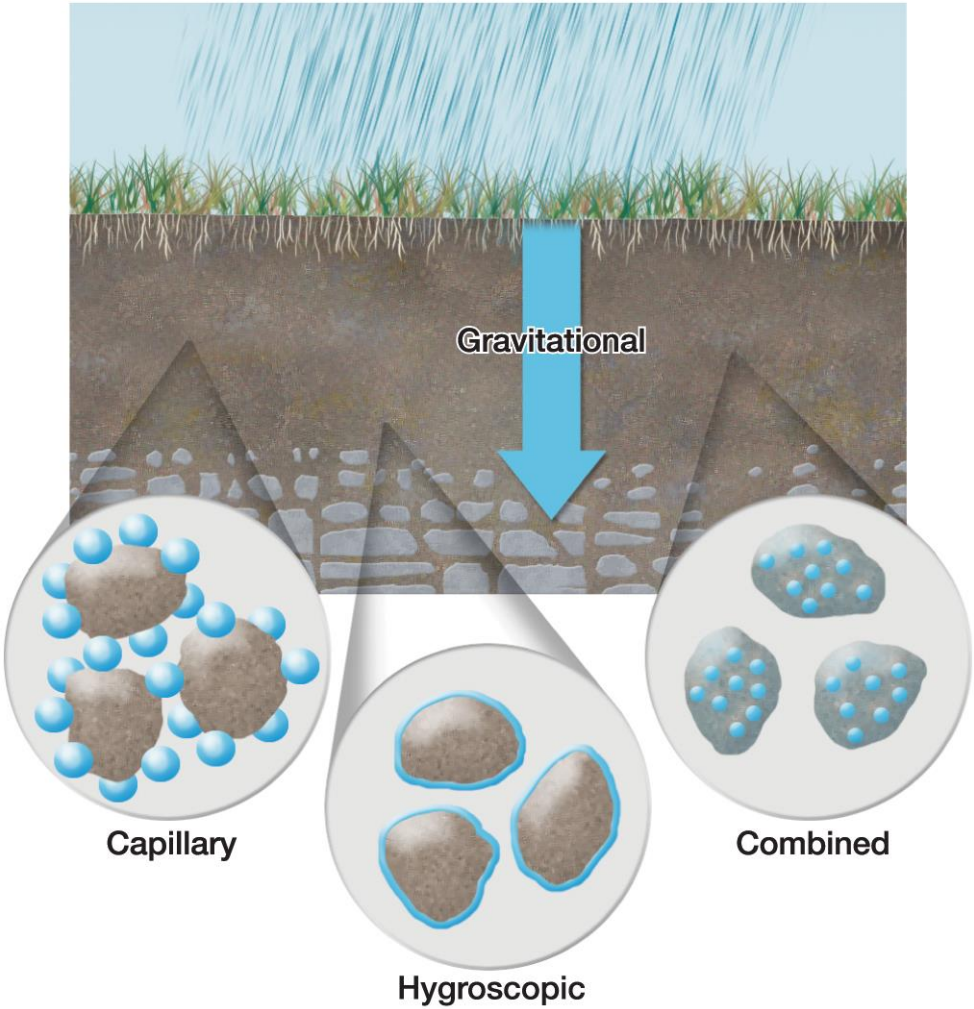
Soil water – different forms

-Gravitational water

-Capillary water (surface tension)

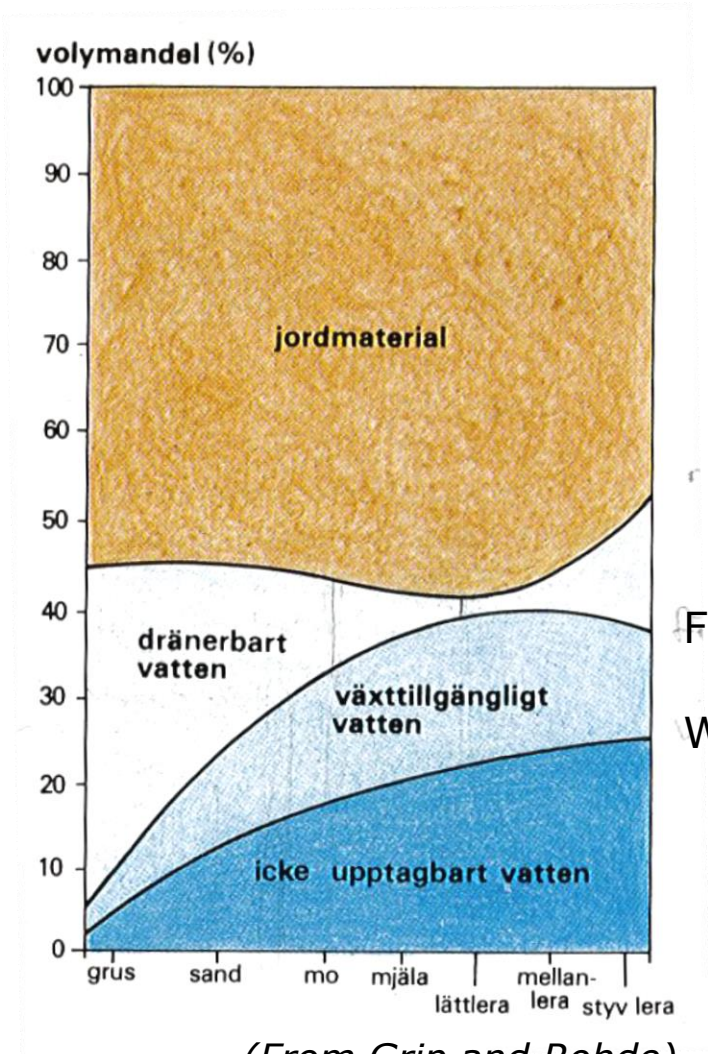
-Hygroscopic water (adhesion)

-Combined water (chemical bounds with soil minerals)



(From Hess, 2013)

Field capacity and wilting point

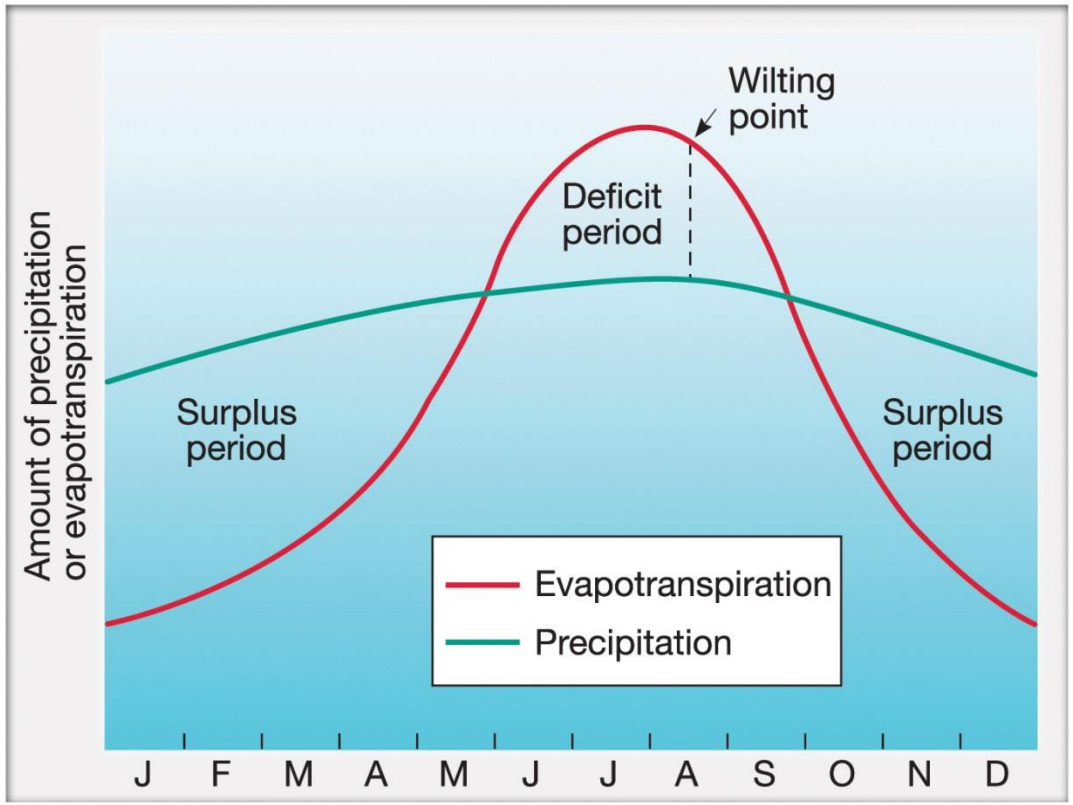


Field capacity

Wilting point

(From Grip and Rohde)

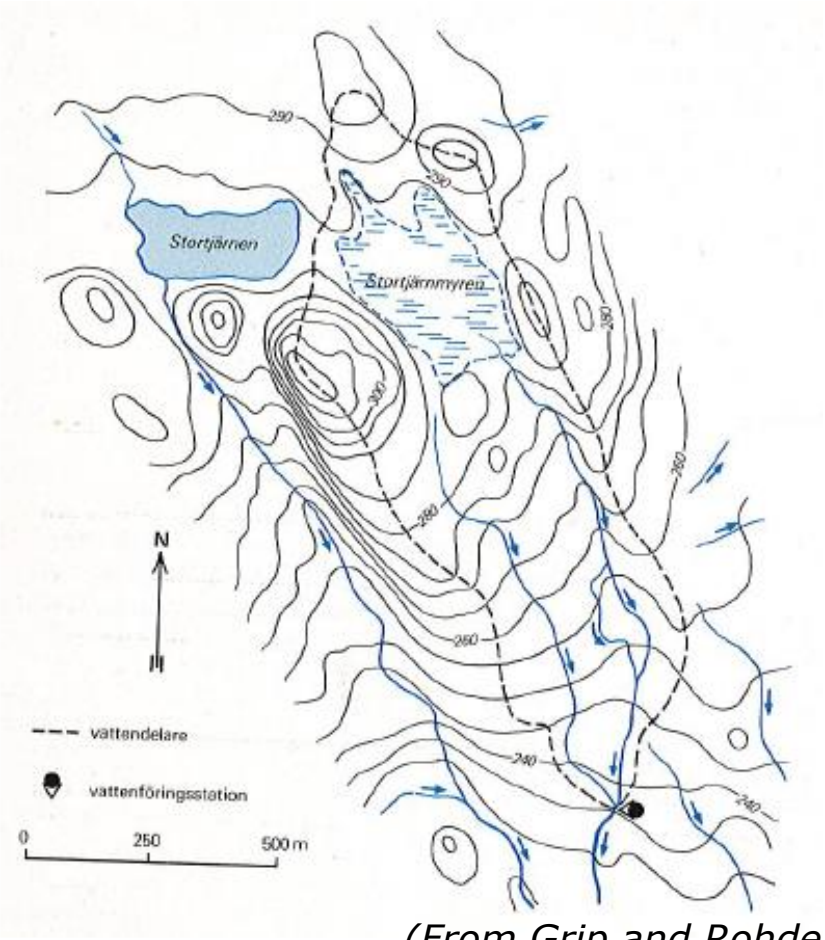
The soil water budget:



(From Hess, 2013)

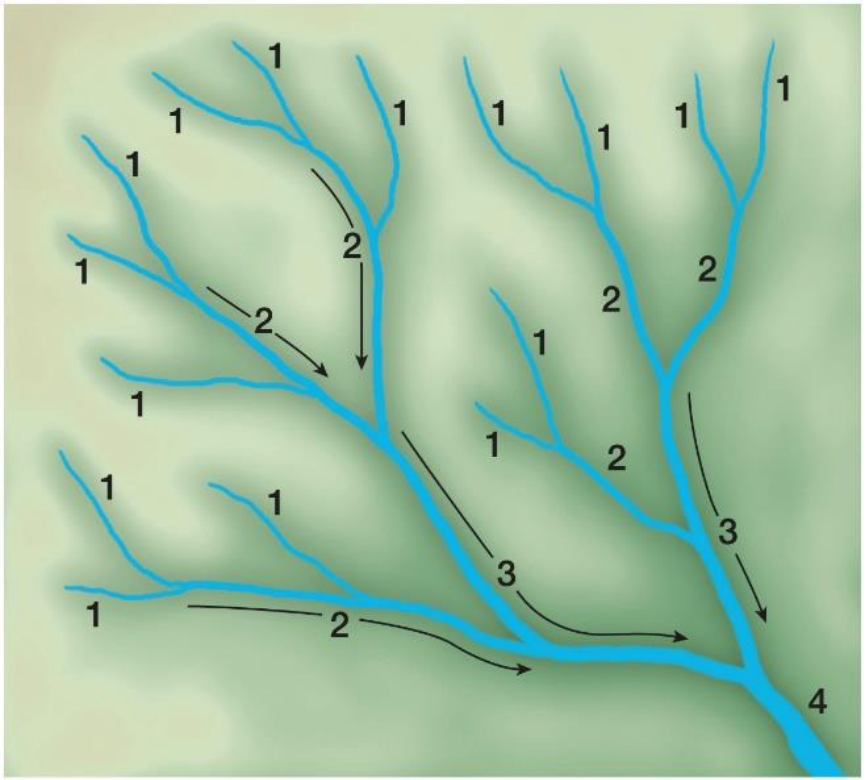
Water in catchments

Catchments (avrinningsområden) are defined by a water divide (vattendelare)



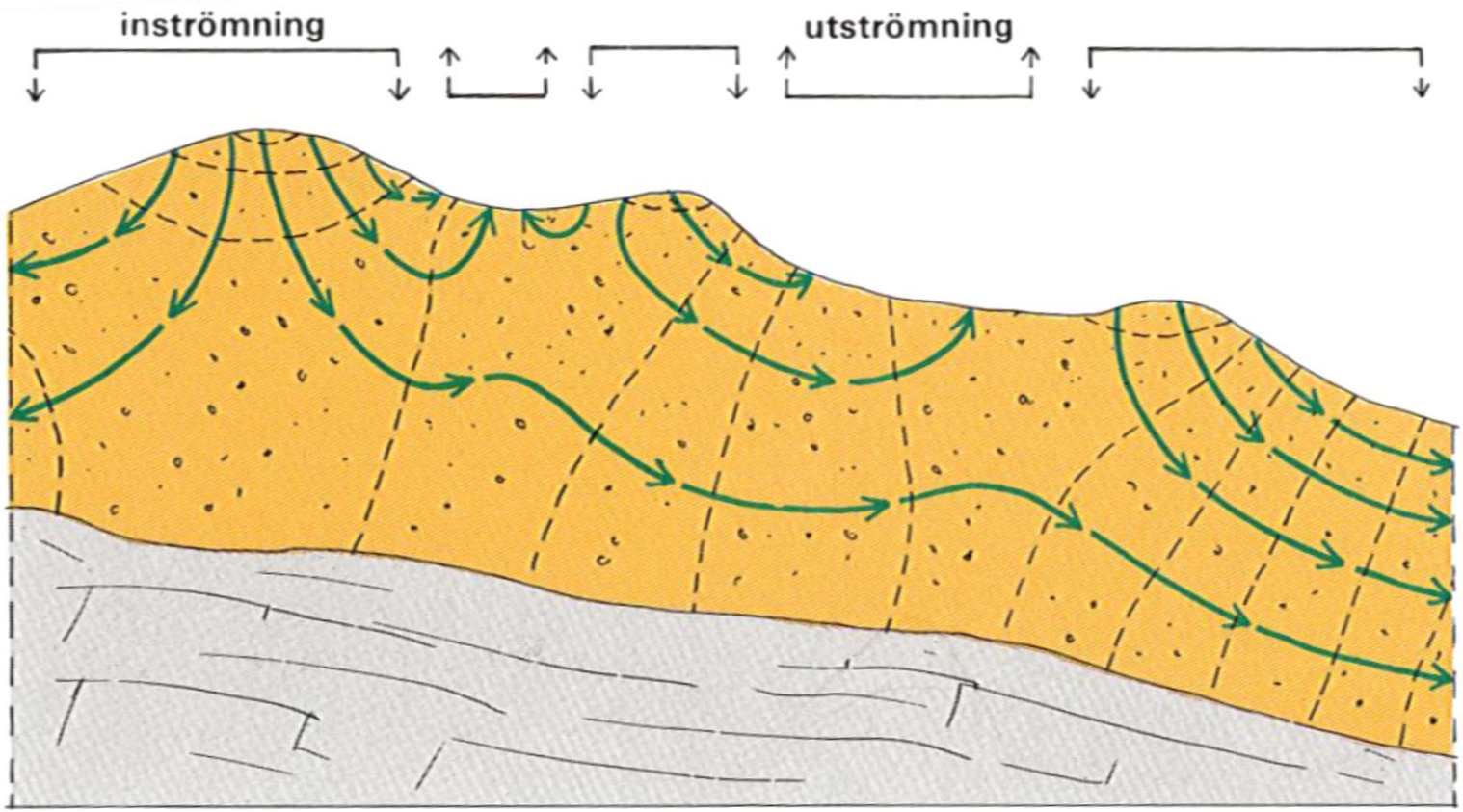
(From Grip and Rohde)

Overland flow: 1st, 2nd and 3rd order streams



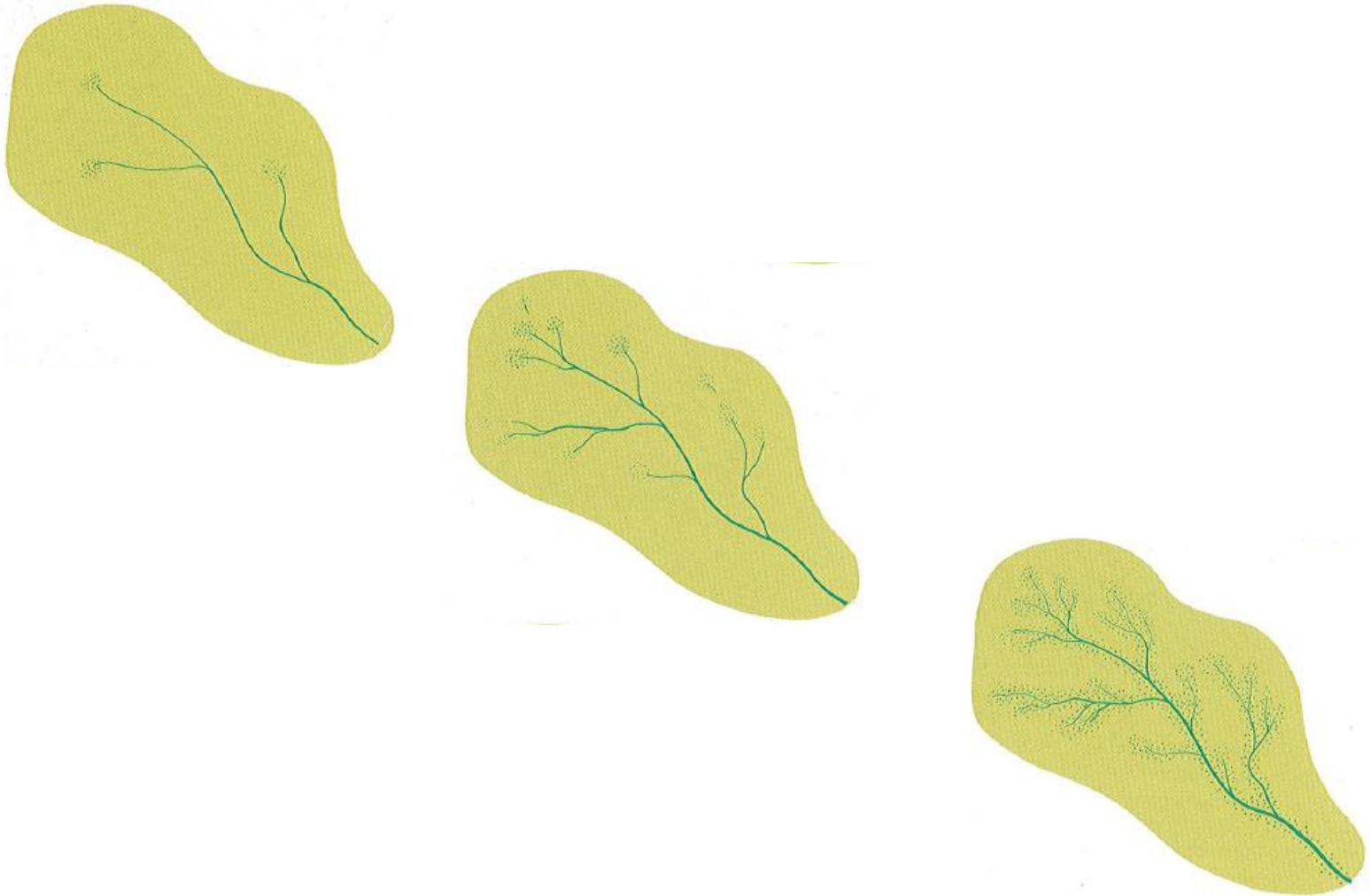
(From Hess, 2013)

Subsurface flow: recharge and discharge areas



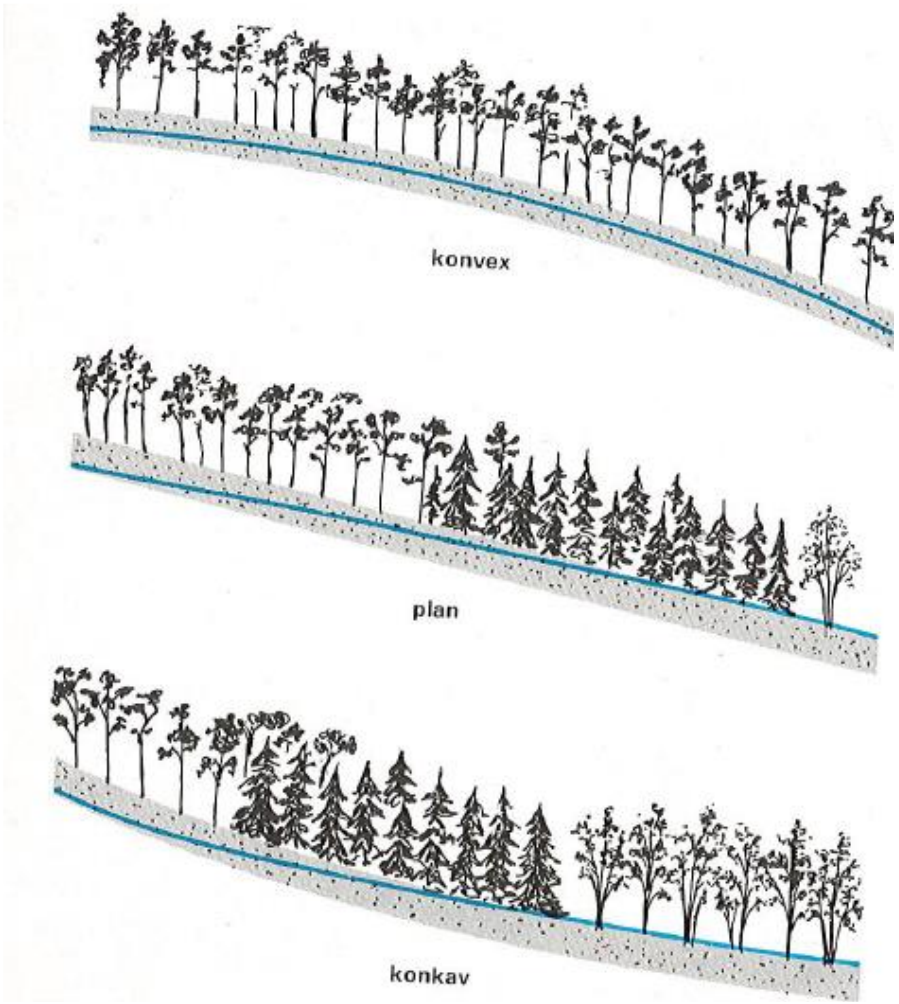
(From Grip and Rohde)

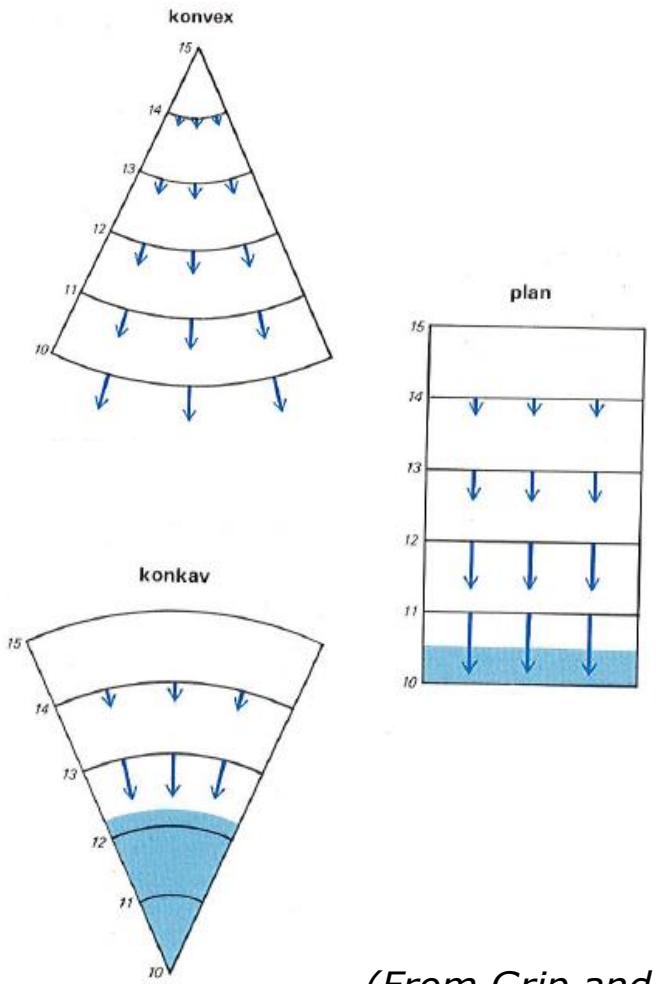
The size of the discharge area varies with the ground water level



(From Hess, 2013)

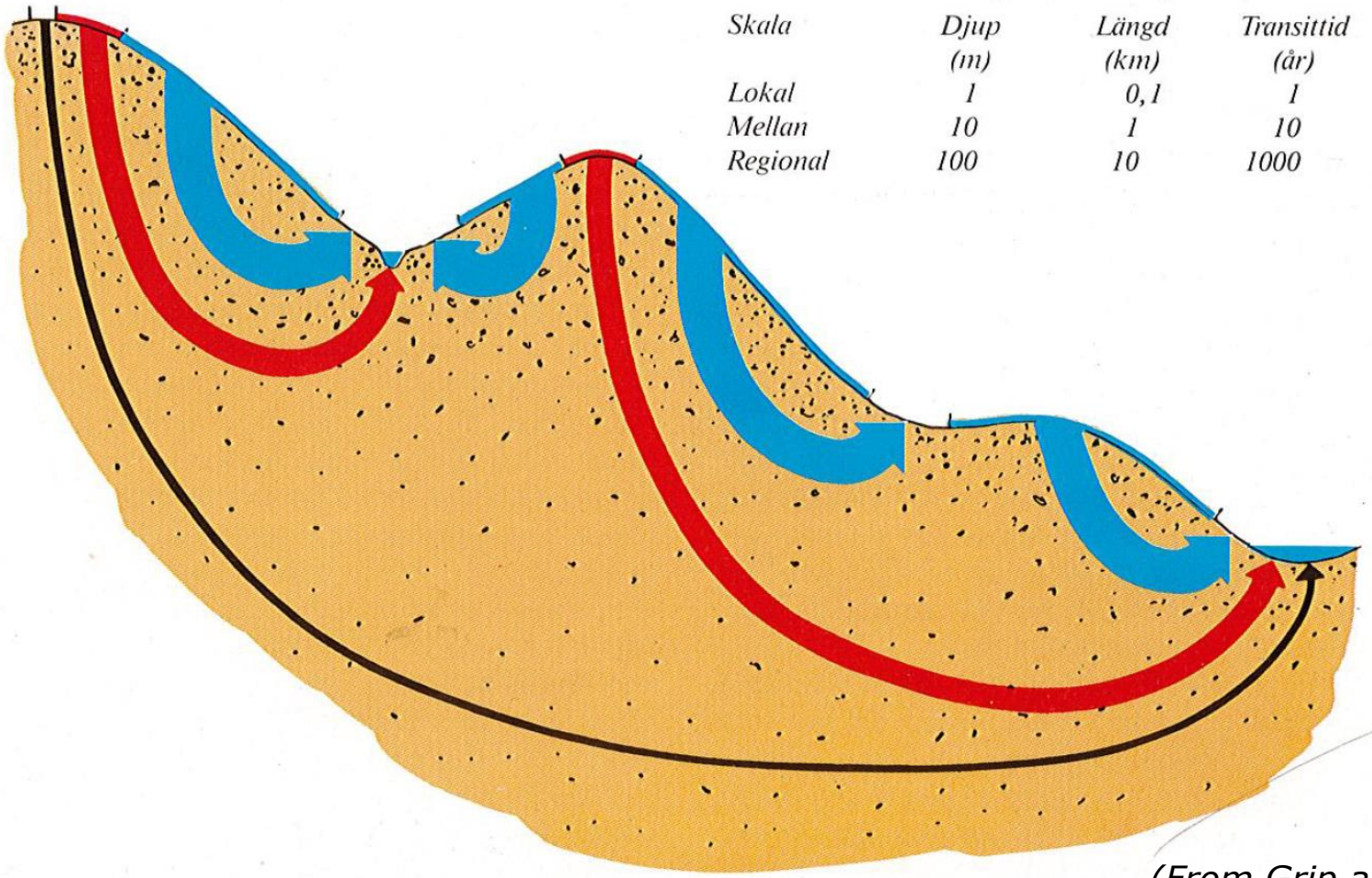
The effect of the shape of the slope





(From Grip and Rohde)

Different ages and transit times of ground water in different parts of the terrain…



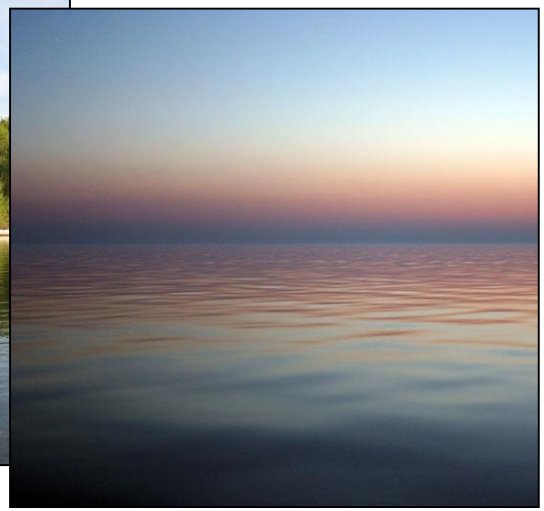
Schematisk tabell över grundvattnets flödessystem:

Skala	*Djup (m)*	*Längd (km)*	*Transittid (år)*
Lokal	*1*	*0,1*	*1*
Mellan	*10*	*1*	*10*
Regional	*100*	*10*	*1000*

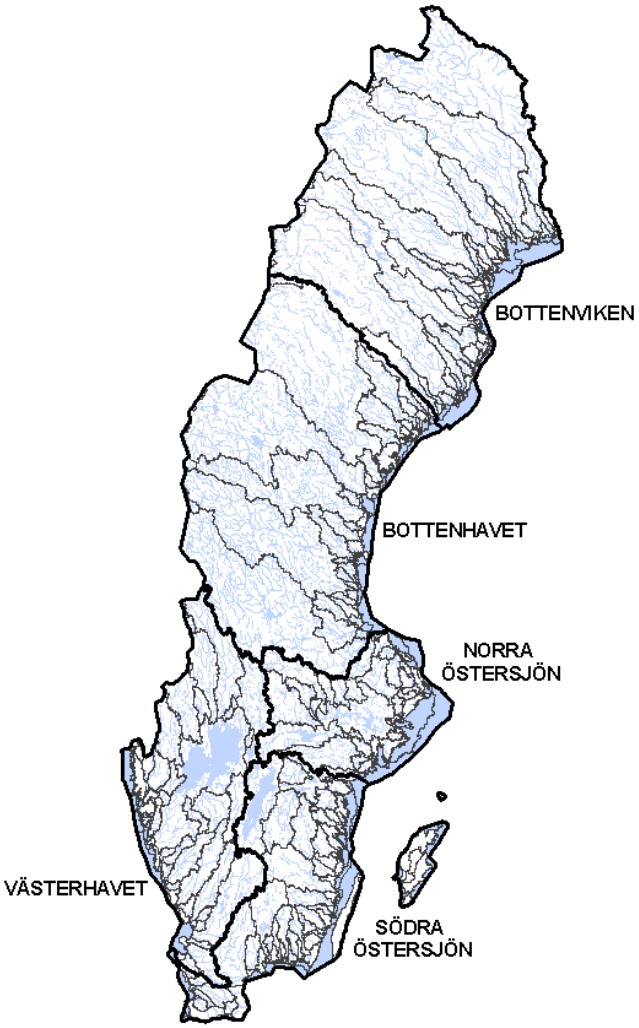
(From Grip and Rohde)

Catchments in Sweden:
From water districts to subcatchments

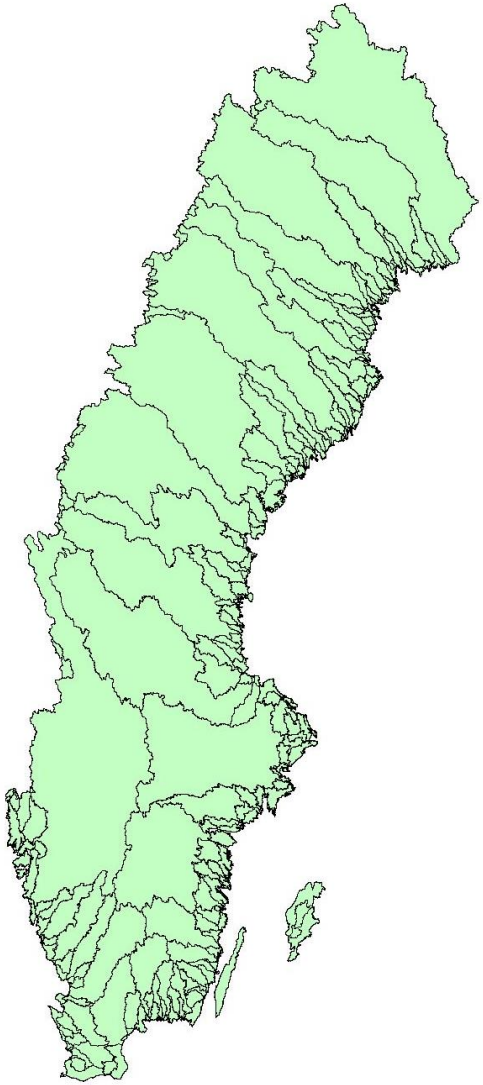




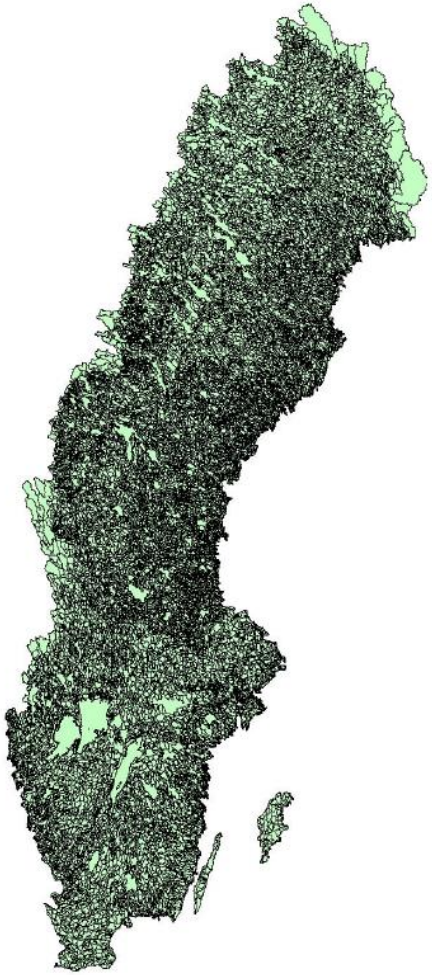
Five water districts

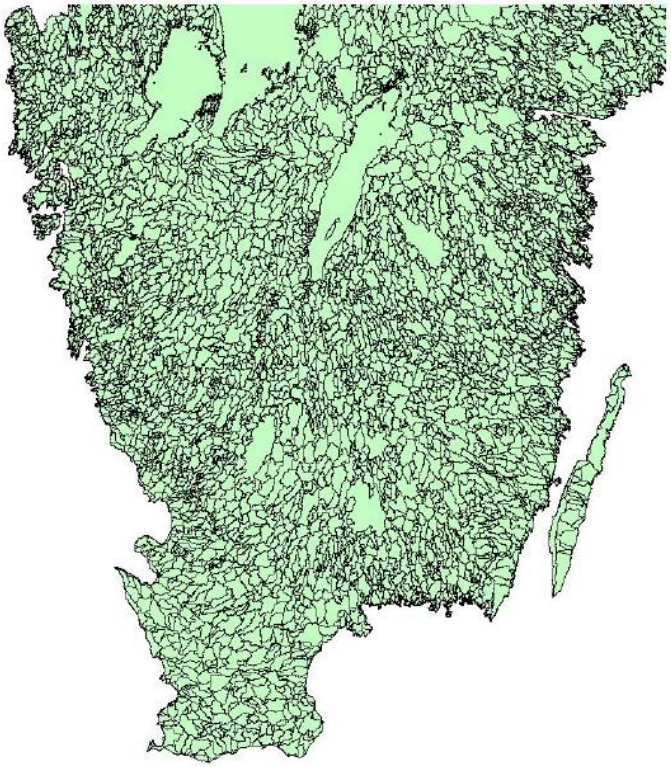


265 ”huvudavrinningsområden” (SMHI)

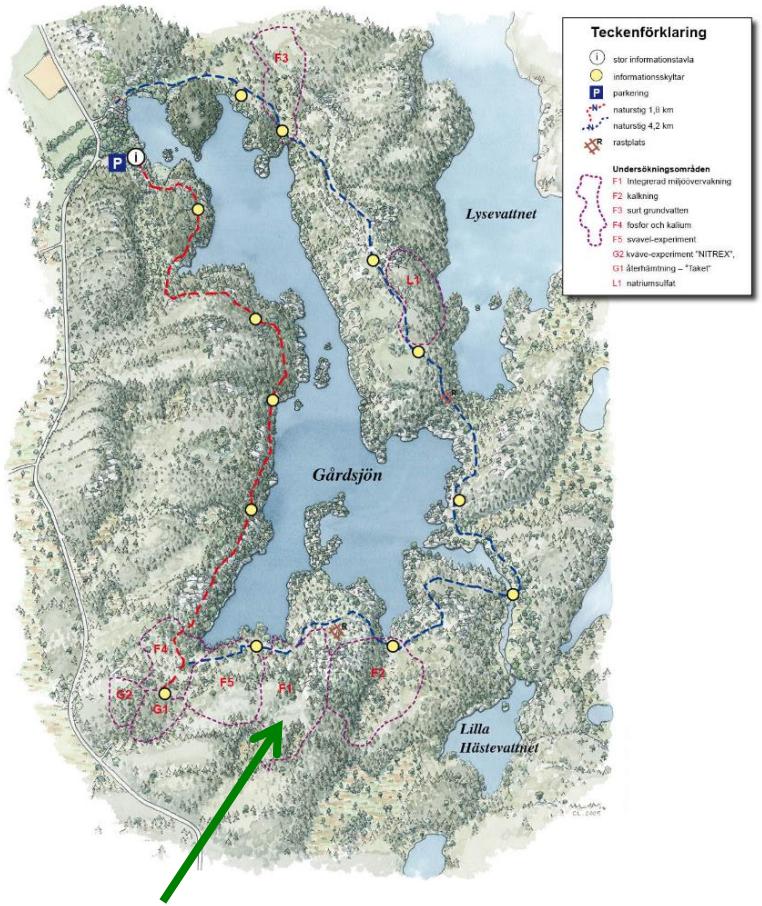


Ca 38 000 ”delavrinningsområden” (SMHI)





The catchemnts in Gårdsjön much smaller…
(less than 3,7 hectares)



(www.gardsjon.org)

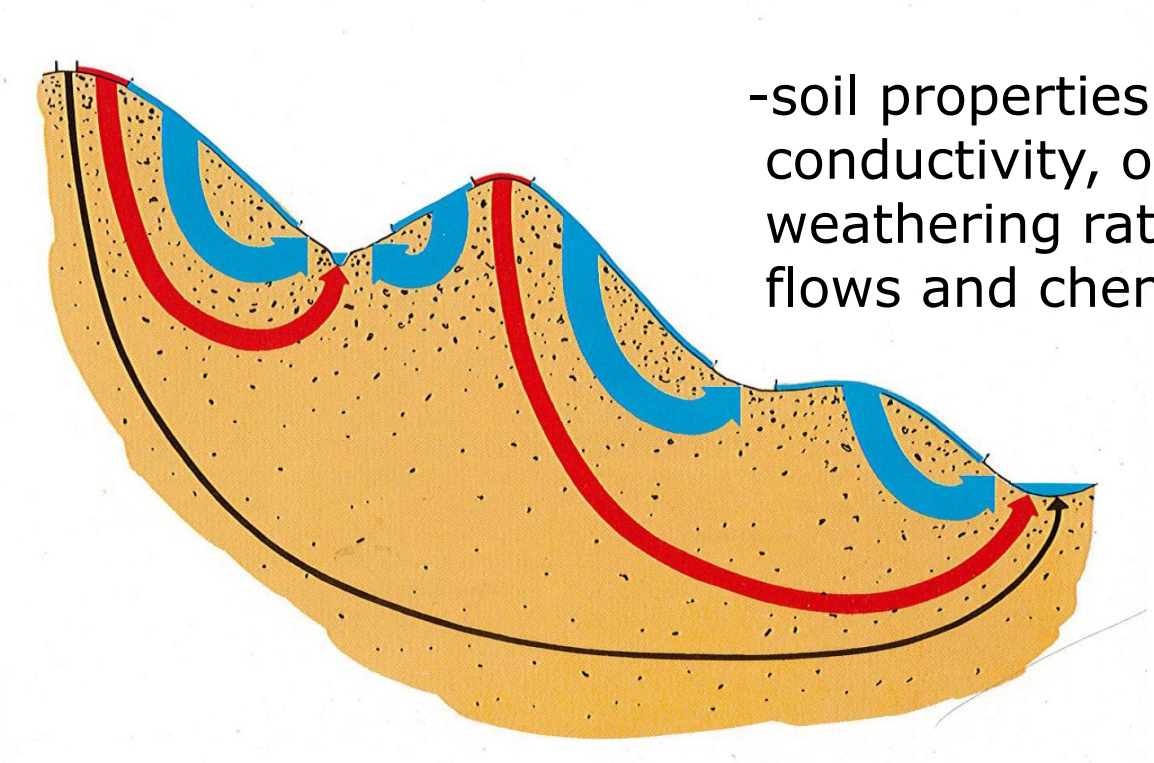
Chemical processes and transport by water

(From Hess, 2013)

Water chemistry change during transport depends on…

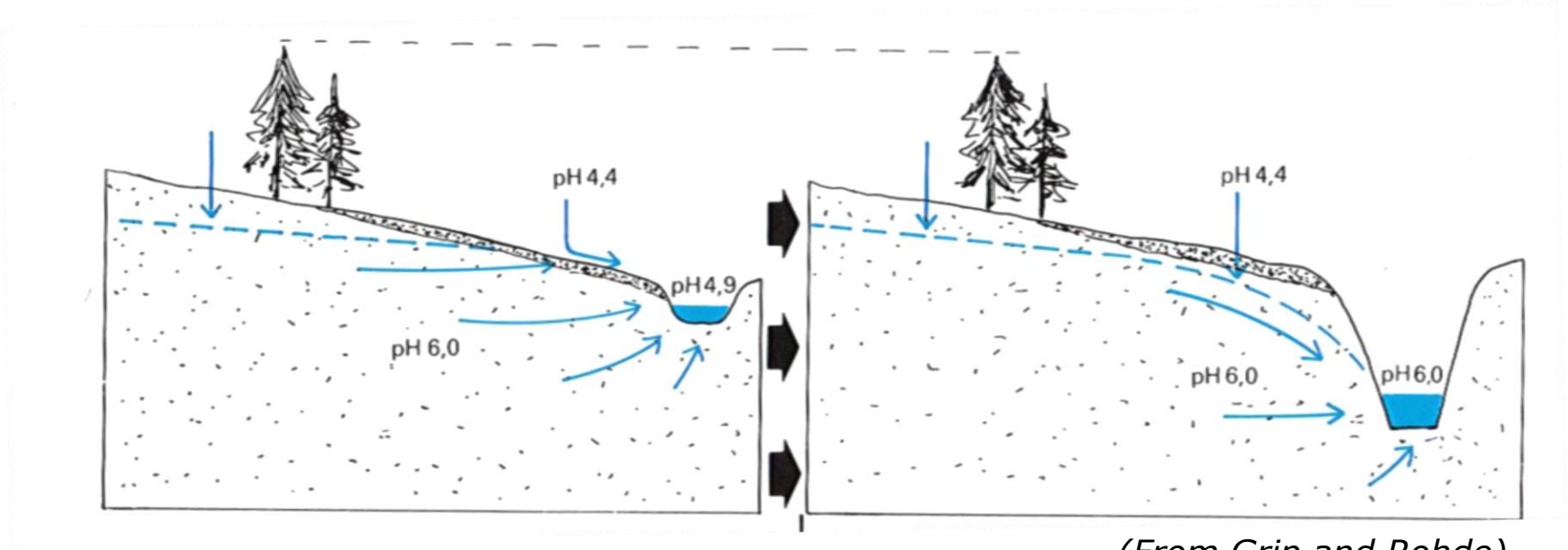
-Water balance (affects where water flows)

-soil properties in different layers, e.g. conductivity, organic material, weathering rate (affects where water flows and chemical interactions)



(From Grip and Rohde)

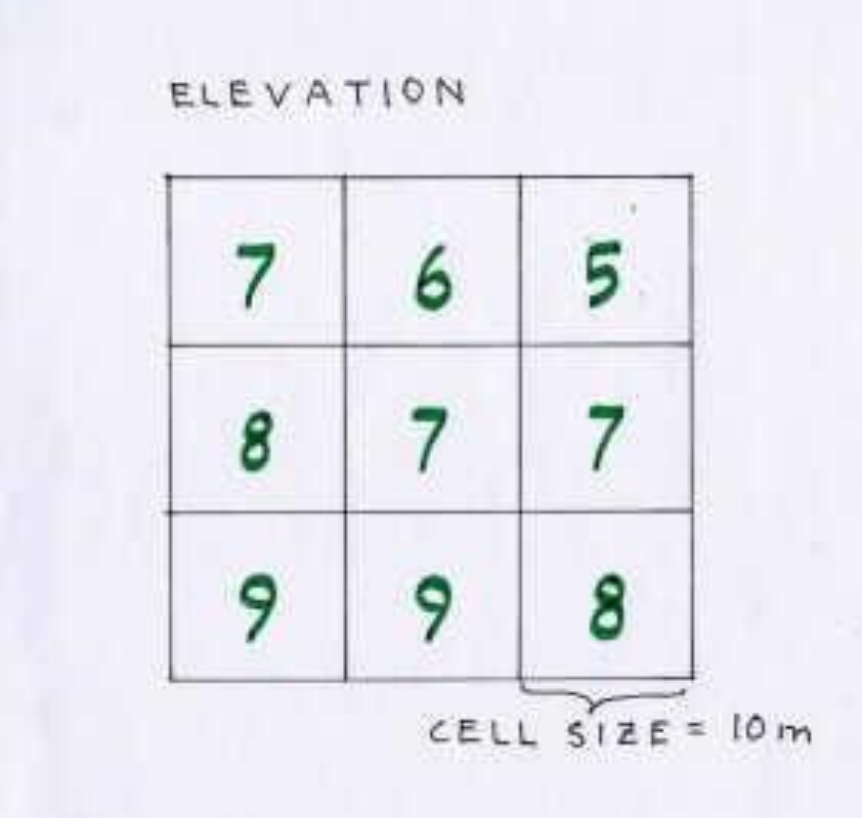
Example: pH increase after ditching



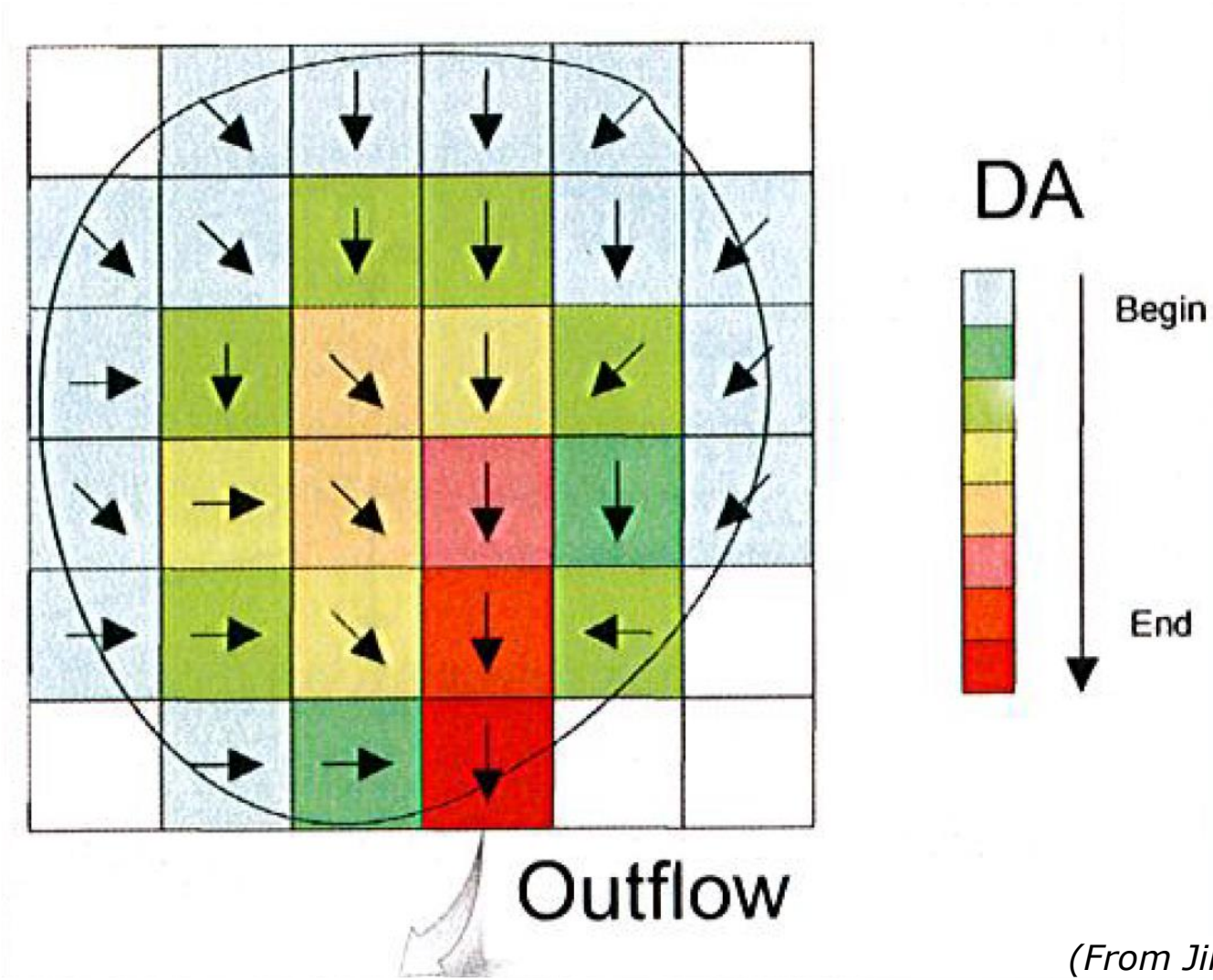
(From Grip and Rohde)

Modelling water flow

Calculating slope, aspect, flow direction, drainage area from a DEM



Drainage area



(From Jing Tang, 2014)