
WETLAND WATER
BUDGETS IN THE MEKONG
RIVER BASIN
MEKONG RIVER COMMISSION
MRC
FOR SUSTAINABLE DEVELOPMENT

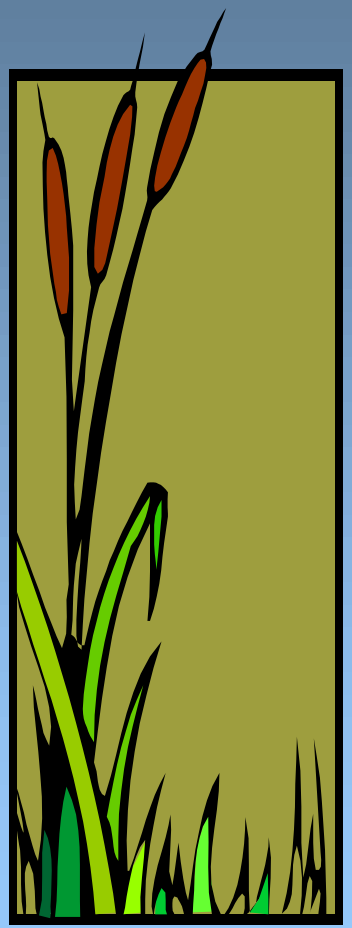
Lesson Learning Goals

At the end of this lesson you should be able to:

- ➔ Identify critical wetland functions
- ➔ Explain how to calculate a wetland water budget
- ➔ Define ‘groundwater’ and identify threats to groundwater quality
- ➔ Discuss the concept of nutrient cycling using examples from the Mekong River Basin

Hydrology of MRB Wetlands

- The wetlands of the Mekong River Basin are transitional ecosystems between the upland terrestrial areas and the open water aquatic habitat of the river itself
- Wetlands represent the aquatic edge of many terrestrial plants and the terrestrial edge of many aquatic plants



Hydrology of MRB Wetlands (Cont'd)

- When human disturbances cause hydrologic changes to a wetland, the ecosystem may respond with significant changes in plant and animal species composition and richness
- Ecosystem productivity is often affected by changes in wetlands hydrology

Wetland Water Budgets

- The wetland water budget is essentially the balance of the inflows and outflows of water in the wetland
- This balance of inflows and outflows is one the most significant factors affecting the type, functions, and species composition of MRB wetlands

Wetland Water Budgets (Cont'd)

The wetland water budget can be expressed as:

$$\Delta V/\Delta t = P_n + S_i + G_i - ET - S_o - G_o \pm T$$

Wetland Water Budgets (Cont'd)

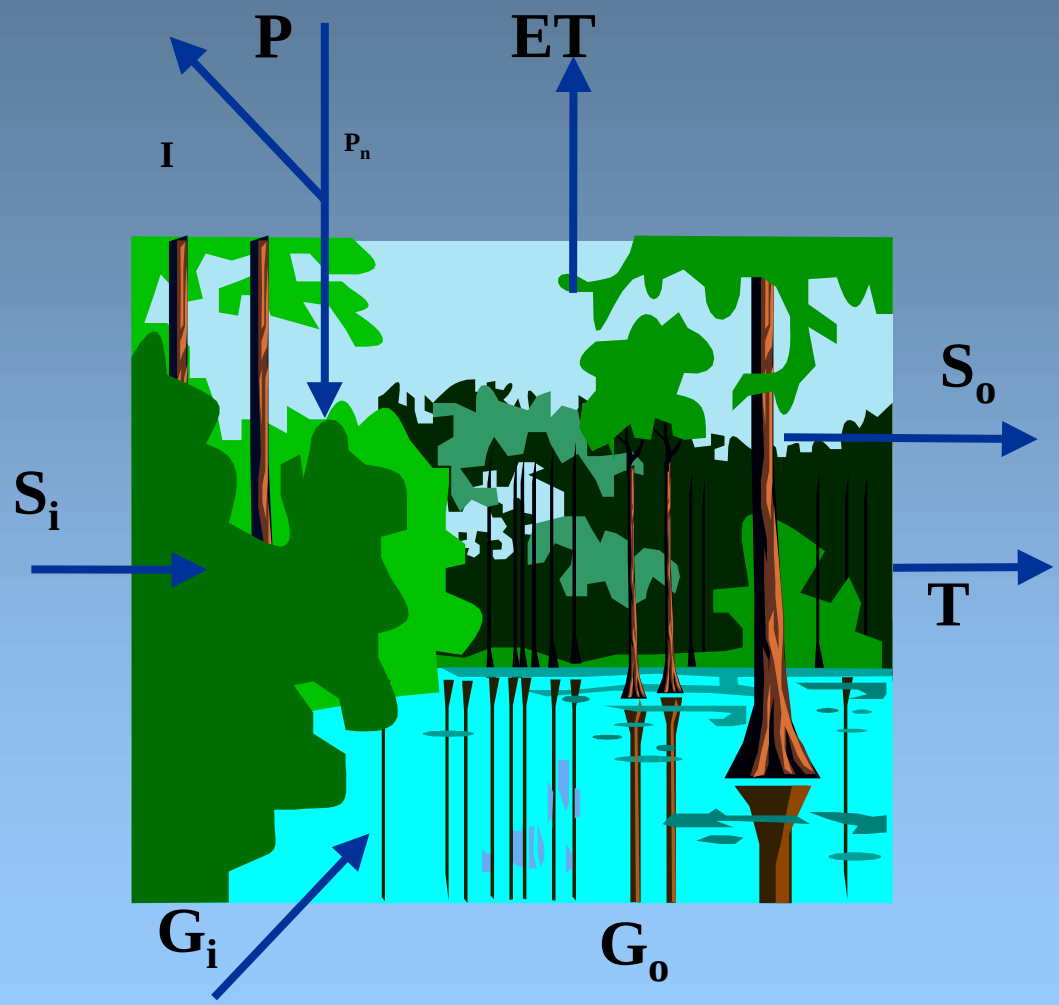
Where:

- V = the volume of water storage in the wetland (hectares/metre)
- Δt = the change in storage over time (ha/m)
- P_n = net precipitation (total precipitation - interception in mm)
- S_i = surface inflows (m^3 per storm event or unit time)

Wetland Water Budgets (Cont'd)

- G_i = groundwater inflows (volume or volume per unit time)
- ET = evapotranspiration (mm per unit time)
- S_o = surface outflows (m^3 per storm event or unit time)
- G_o = groundwater outflows (volume or volume per unit time)
- T = tidal inflow (+) or tidal outflow (-) (volume or volume per unit time)

Wetland Water Budgets (Cont'd)



Calculating a Water Budget

- A specific wetland's water budget can be calculated if necessary data are available
- Field measurement of all components of the water balance of a wetland is important to understanding the hydrological processes occurring in the wetland
- The total evaporation and groundwater components of the wetland water budget can be difficult components to measure accurately

Groundwater

- Groundwater is often a significant component of a wetland's water budget
- We cannot see groundwater, but it is extremely plentiful in the MRB and serves as an important water source for the people of the region
- Groundwater is stored in underground aquifers, which consist of gravel, bedrock or sandstone
- Wetlands can 'recharge' groundwater supplies through percolation of surface water down into the aquifer

Groundwater Pollution

- Groundwater supplies can be easily polluted through human activities, such as:
  - use of agricultural chemicals
  - urban waste water discharges
  - industrial activity

- Protection of groundwater involves identification of pollutant sources, such as industries, landfills, and waste water discharge sites

Wetland Functions

When wetlands are drained and filled, the valuable functions that they perform may need to be replaced at the expense of local villages, provincial governments, national governments, or international lending agencies

Flood Mitigation

- Wetlands intercept and store stormwater, reducing the potential for local flooding by slowing the stormwater discharge rate
- Coastal wetlands help protect inland villages from storm damage
- When wetland ecosystems are filled or degraded, society must bear the cost of stormwater retention basins and coastal breakwaters, or suffer the damages from storms and floods

Water Quality

- Wetlands can protect water quality by removing excess nutrients and toxic materials from surface inflows
- Substances such as agricultural chemicals and human or animal wastes can settle out or be absorbed into the wetland soil and plants
- The loss of wetlands due to development may require the construction of water treatment plants to replace some of the lost water quality functions that wetlands can perform

Nutrient Cycling

- Wetlands in the MRB are tremendously productive due to the high degree of nutrient cycling that takes place within them
- Nutrients are carried into wetlands through precipitation, river flooding, tides, and surface and groundwater inflows
- It is the 'openness' of wetland ecosystems that enable such high rates of productivity
- A wetland's ecosystem mass balance is a quantitative description of the inputs, outputs, and internal cycling of nutrients and chemicals

Nutrient Cycling (Cont'd)

- The mass balance of several essential elements, including nitrogen, carbon, and phosphorous, can be termed the wetland's nutrient budget
- Knowledge of the mass balance concept is important for understanding the fate and movement of an agricultural chemical or any other potentially harmful substance applied to the land or water

Nutrient Cycling (Cont'd)

- Healthy wetlands in the MRB can take up and store various quantities of a pollutant prior to its release into a river or coastal estuary
- Wetlands can function as a 'sink' for the pollutant, which means that they retain a large portion of the substance bound in the sediments and plant biomass

Concluding Thoughts

Important points to remember are:

- Wetlands are critical to the healthy functioning of MRB ecosystems
- Development activities in the Basin (e.g., use of agro-chemicals in rice growing) pose a serious pollution threat to groundwater quality
- Wetlands have a substantial but not limitless capacity to assimilate and treat potentially harmful substances through various biological processes