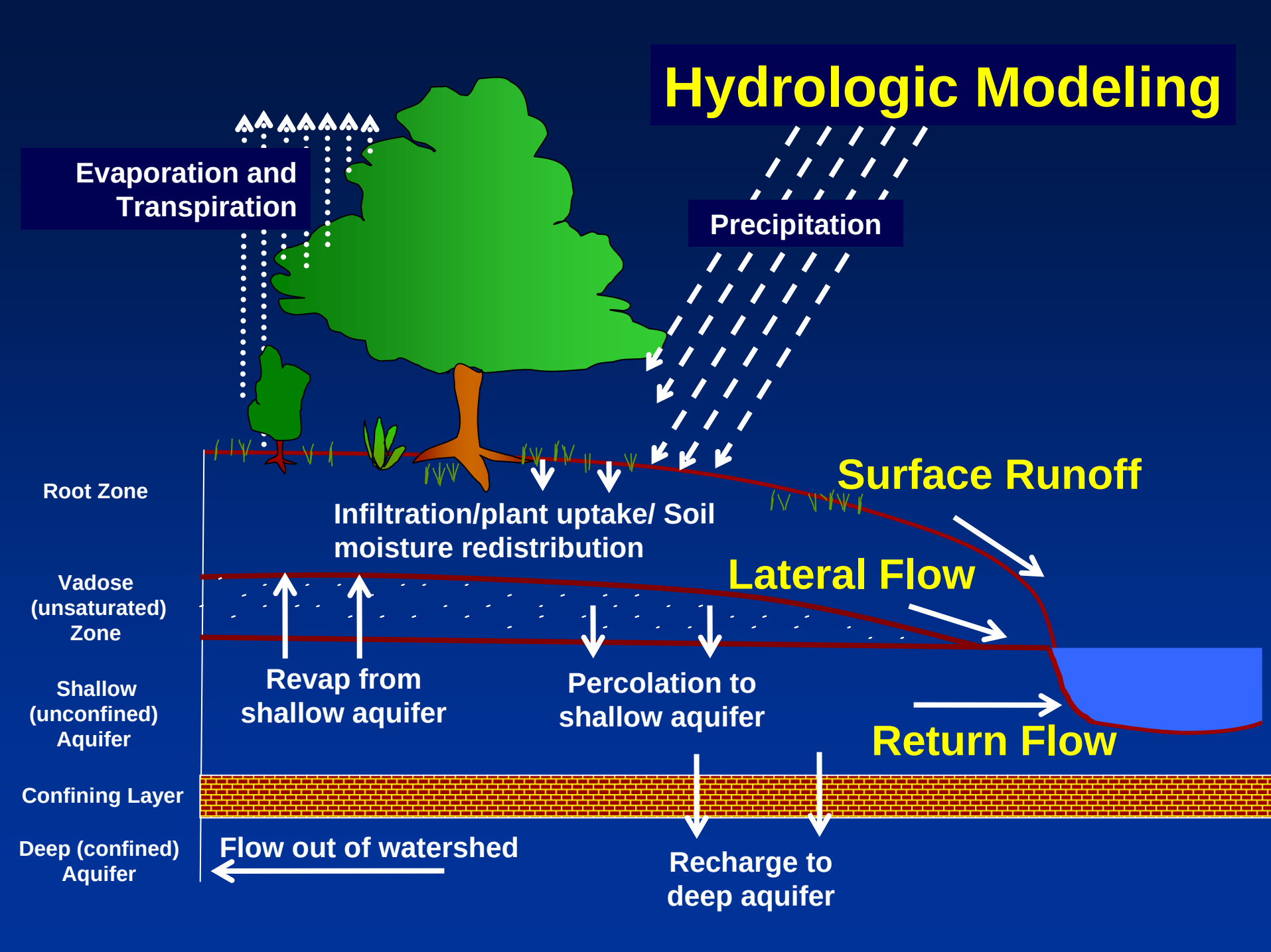
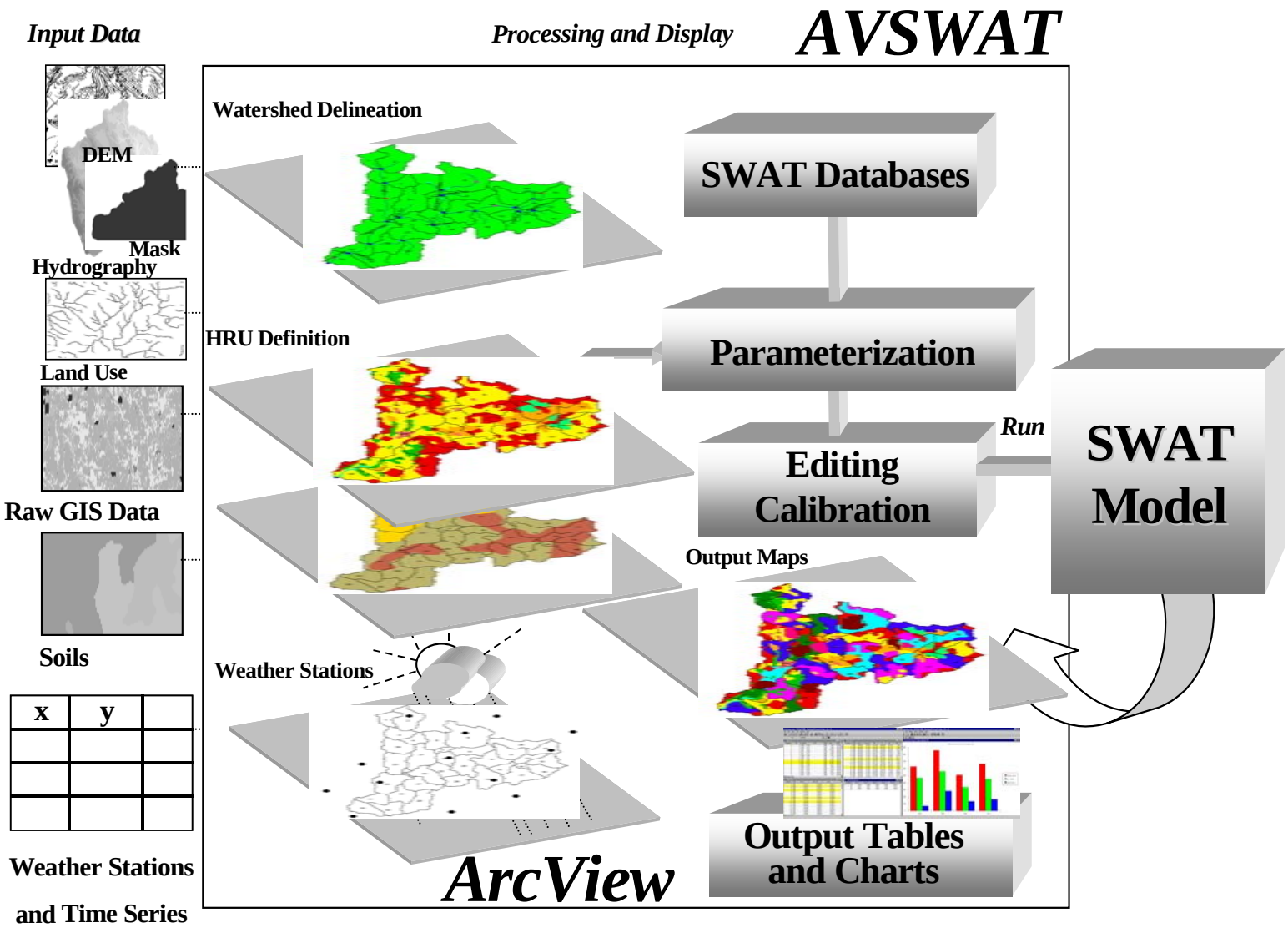
The Soil and Water Assessment Tool

Environmental Consequences of Reforestation on the Upper Tana River Basin


Hydrologic Modeling
Evaporation and Transpiration
Precipitation
Root Zone
Infiltration/plant uptake/ Soil moisture redistribution
Surface Runoff
Lateral Flow
Vadose (unsaturated) Zone
Revap from shallow aquifer
Percolation to shallow aquifer
Shallow (unconfined) Aquifer
Return Flow
Confining Layer
Deep (confined) Aquifer
Flow out of watershed
Recharge to deep aquifer

The Soil and Water Assessment Tool



The Tana River Basin

- **Disruption of wildlife habitat**
- **Increased soil erosion**
- **Disruption of hydrological cycles**
- **Lack of forest products**
- **Destabilization of local and global climate patterns**

Inadequate water for domestic use and irrigation

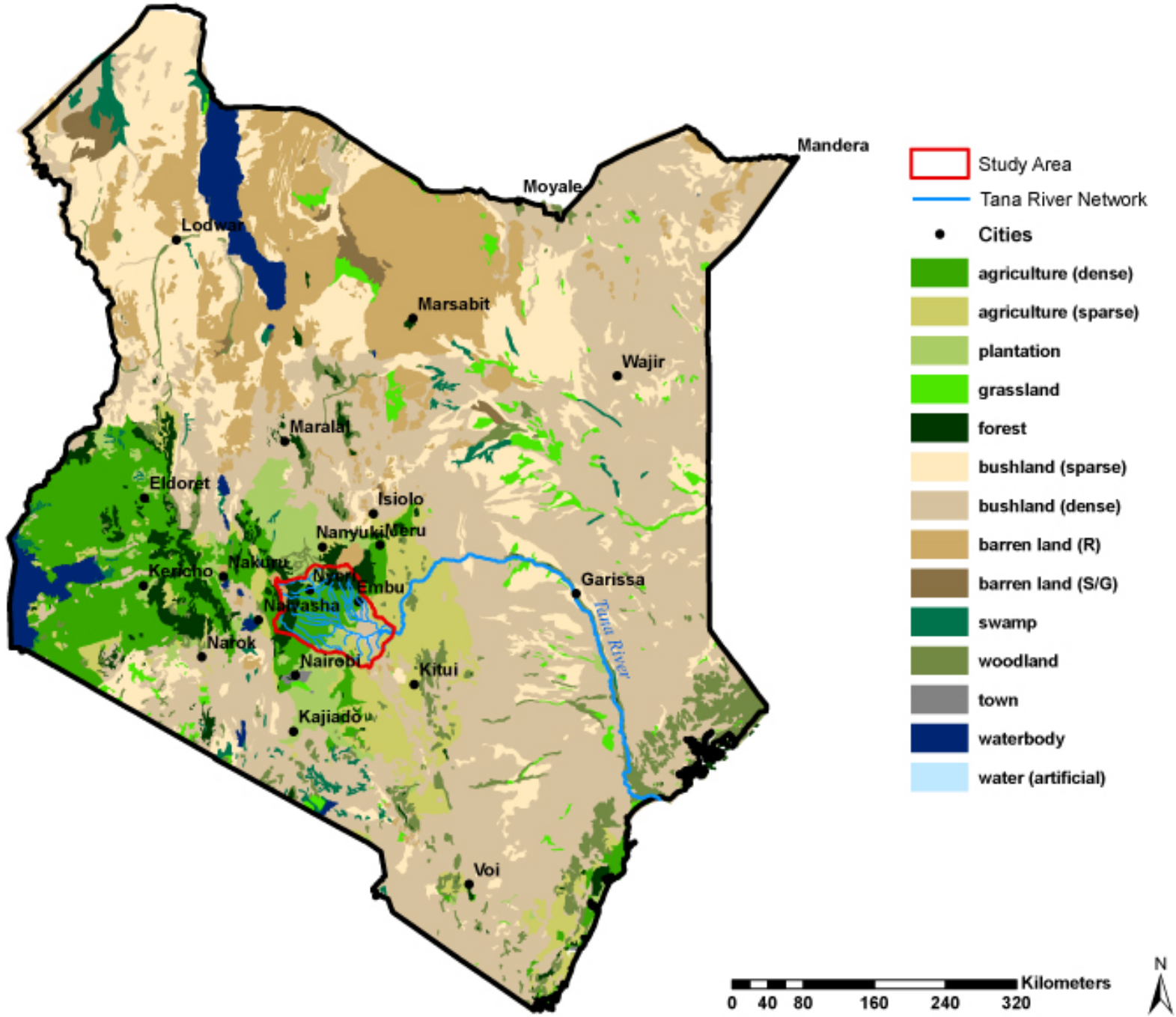
- **Nairobi Water supply**
- **Horticulture and irrigation schemes**

Siltation and water levels in the Masinga Dam

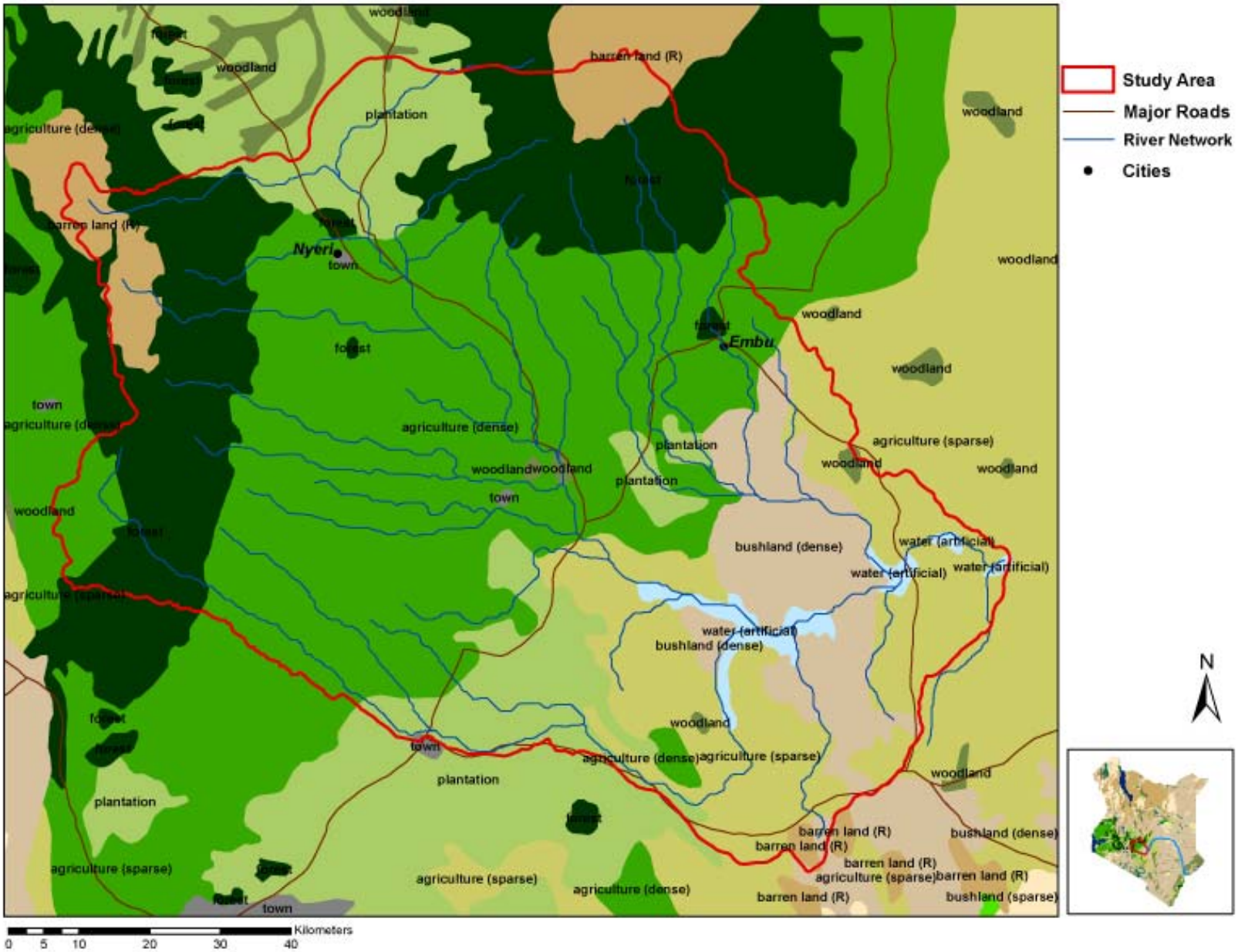
- **Storage water reservoir effects**
- **Effect on power generation**
- **High fluctuation of shorelines**

Study Objective

Explore the hydrologic impacts on the Masinga reservoir in response to land use interventions in the Upper Tana River catchment with a focus on varying levels of reforestation.

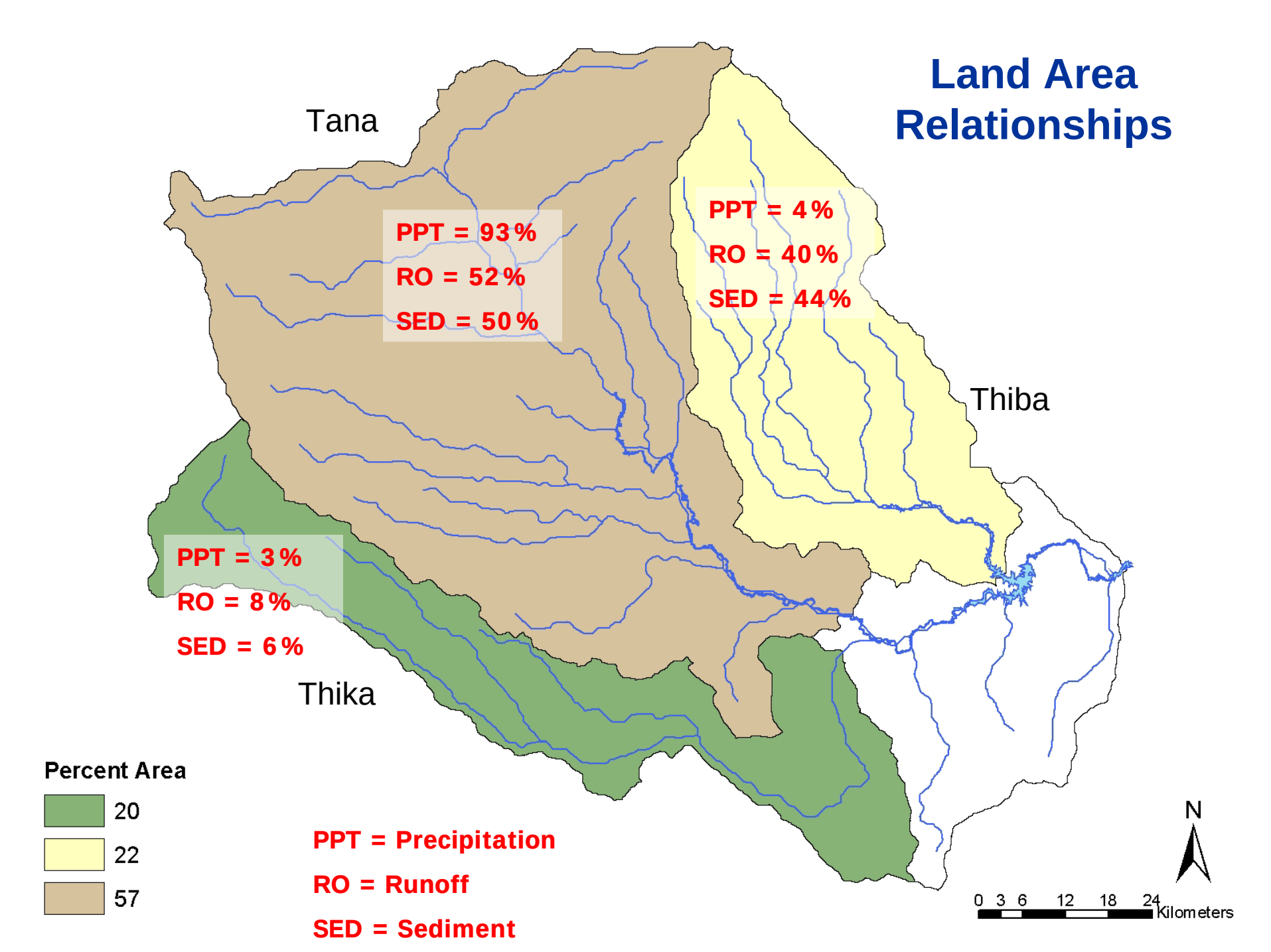

Mandera
Moyale
Lodwar
Marsabit
Wajir
Maralal
Eldoret
Isiolo
Nanyuki
Meru
Nakuru
Kericho
Nyeri
Embu
Nairobi
Garissa
Tana River
Narok
Kitui
Kajiado
Voi
Study Area
Tana River Network
Cities
agriculture (dense)
agriculture (sparse)
plantation
grassland
forest
bushland (sparse)
bushland (dense)
barren land (R)
barren land (S/G)
swamp
woodland
town
waterbody
water (artificial)
Kilometers
0 40 80 160 240 320
N

Study Area


Study Area
Major Roads
River Network
Cities
Nyeri
town
Embu
forest
woodland
plantation
agriculture (dense)
agriculture (sparse)
barren land (R)
bushland (dense)
bushland (sparse)
water (artificial)
town
N
0 5 10 20 30 40
Kilometers

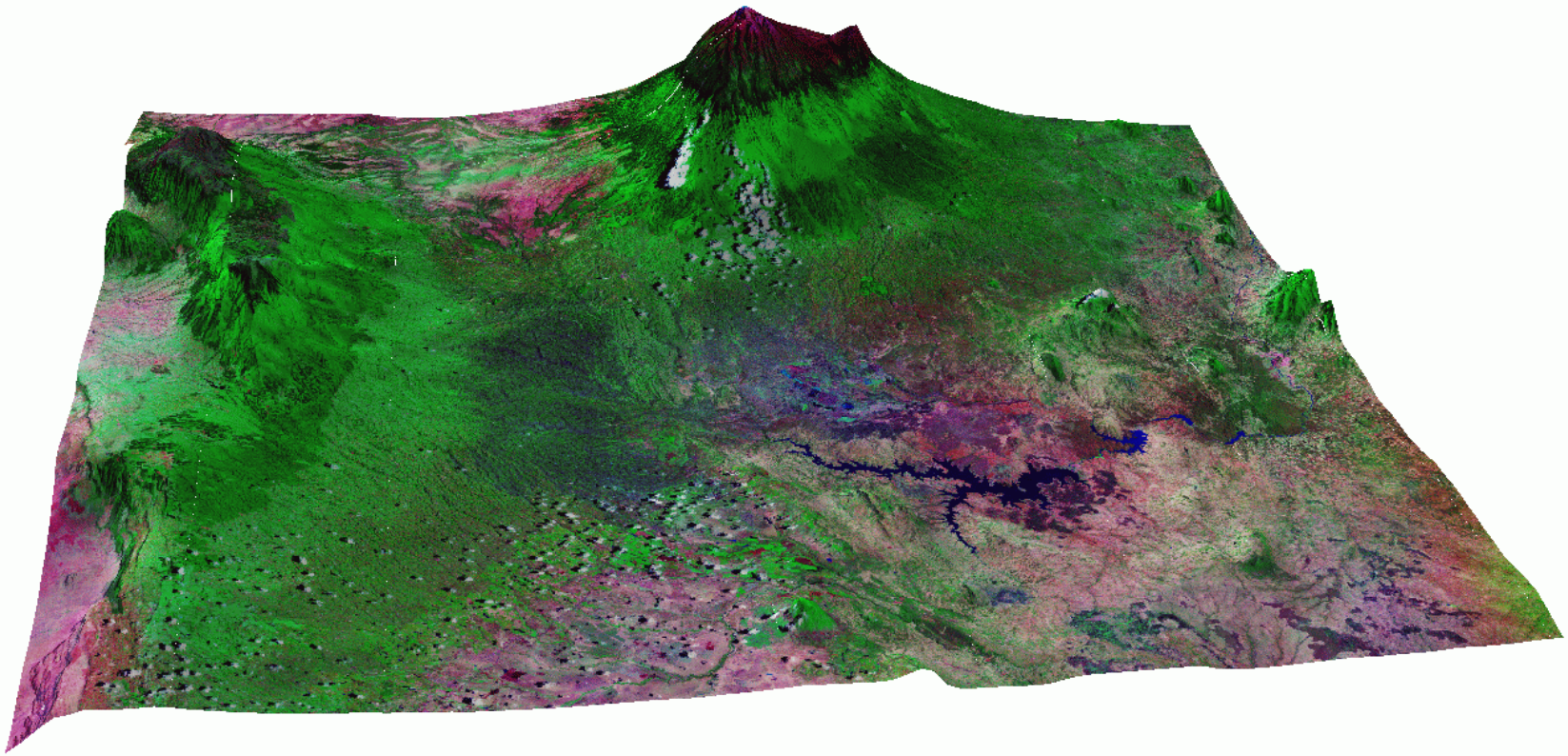
SWAT Inputs

- Soils
- Climate
- Precipitation
- Land Use/Vegetation Cover
- Topography
- Watershed or Subbasin Delineation
- Crop or Land Management
- Ponds or Reservoirs/Withdrawals
- BMPs


Land Area Relationships
Tana
PPT = 93%
RO = 52%
SED = 50%
PPT = 4%
RO = 40%
SED = 44%
Thiba
PPT = 3%
RO = 8%
SED = 6%
Thika
Percent Area
20
22
57
PPT = Precipitation
RO = Runoff
SED = Sediment
N
0 3 6 12 18 24
Kilometers

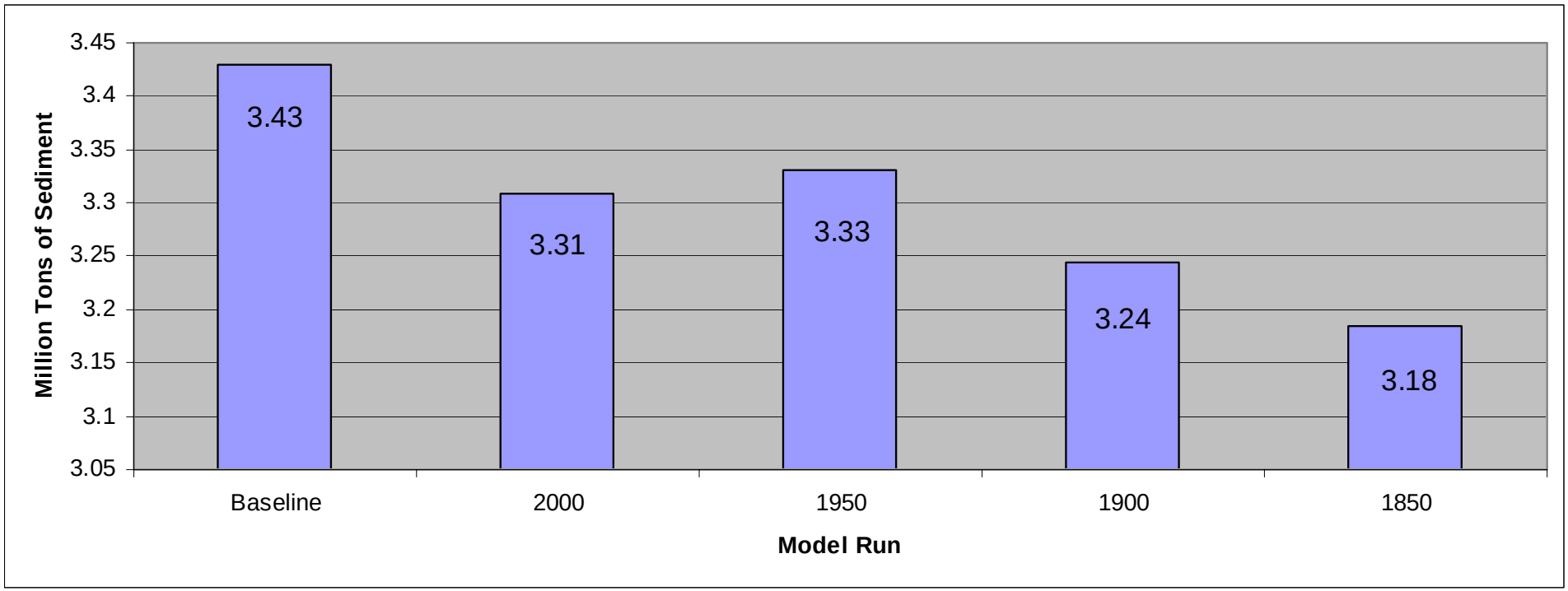
Reforestation Scenarios

- Reforestation scenarios were implemented as full replacement of land by forest above a certain elevation.
- The GIS was used to build a conditional replacement model using the land use grid and the DEM. This allowed spatial representation of the scenarios
- For the base scenario, the areas designated as forest were left intact as were all of the other land uses.



Graded reforestation scenarios were implemented at 2000, 1950, 1900 and 1850m elevation zones

Reforestation Results:
Average Annual Sediment Yield for Entire Basin



Reforestation Results: Percent Reduction in Sediment Loading into the Masinga Dam