

Watershed Valuation Using MWSWAT Model

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Outline

- Hydrological model (ArcSWAT and MWSWAT)
- Watershed valuation: The Da Nhim case

Soil Water Assessment Tool (SWAT)

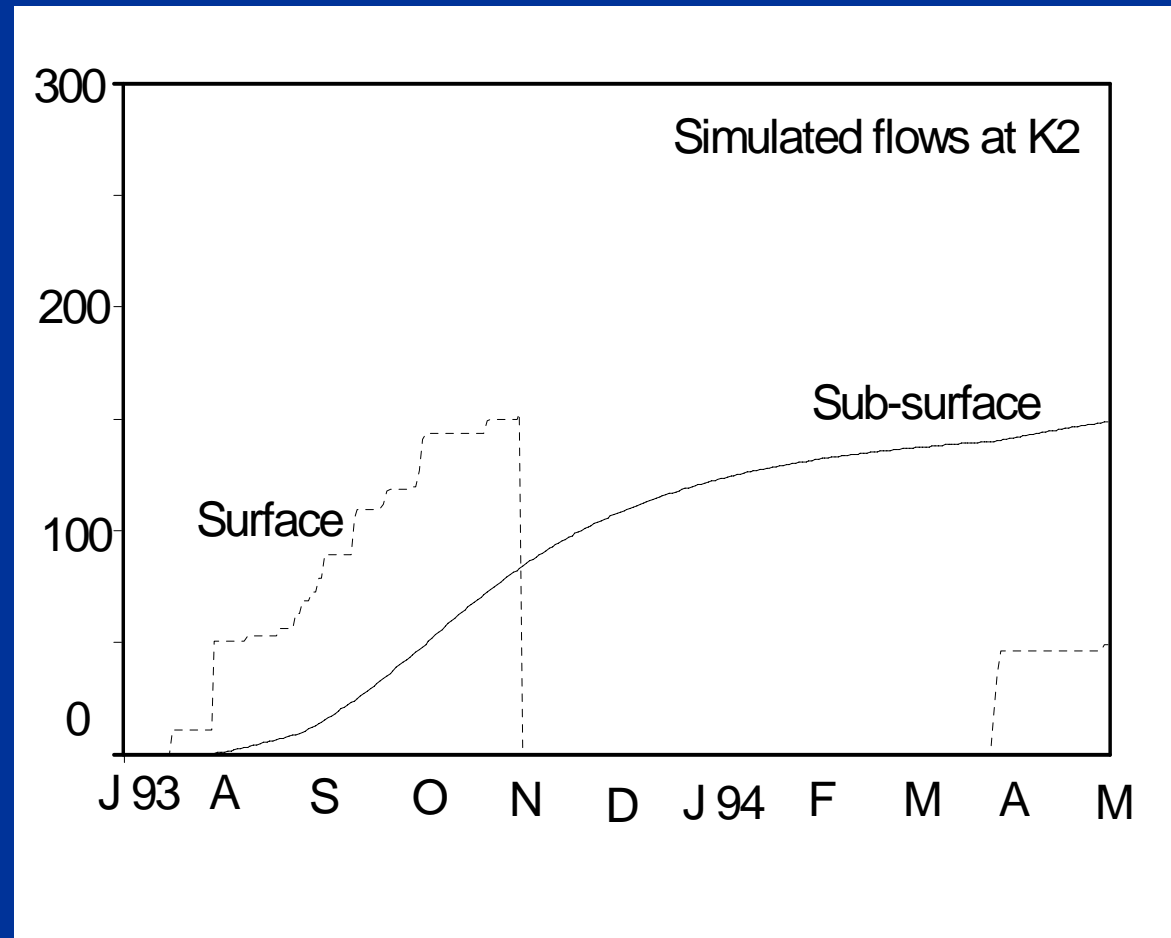
- Long-term, continuous watershed simulation model (Arnold et al, 1998)
- Daily time steps
- Subdivided into grid cells or natural sub-watersheds (Santhi et al., 2001), consist of homogeneous land use, management, and soil characteristics.
- Assesses impacts of climate and management on yields of water, sediment, and agricultural chemicals
- Physically based, including hydrology, soil temperature, plant growth, nutrients, pesticides and land management

SWAT data input

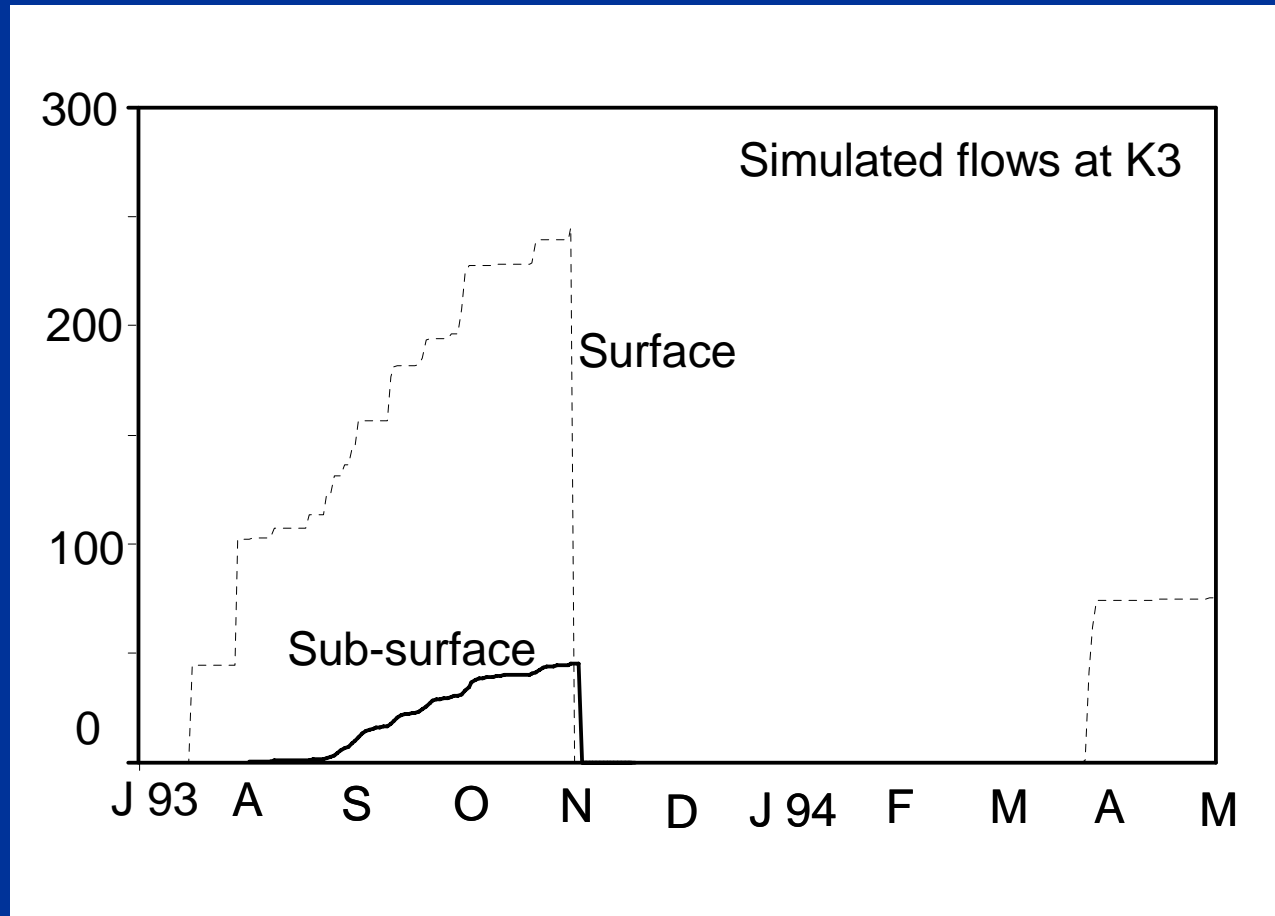
- Digital Elevation Model to define HRU (Hydrological Response Unit)
- Slope classes
- Soil map and **attributes**
- Land uses
- **Weather data**

SWAT Outputs

Simulated flow at K2 (Hill-evergreen watershed)



Simulated flow at K3 (Agricultural watershed)



DaNhim Case:
SWAT Applications
for PES

Watershed Valuation Dimensions

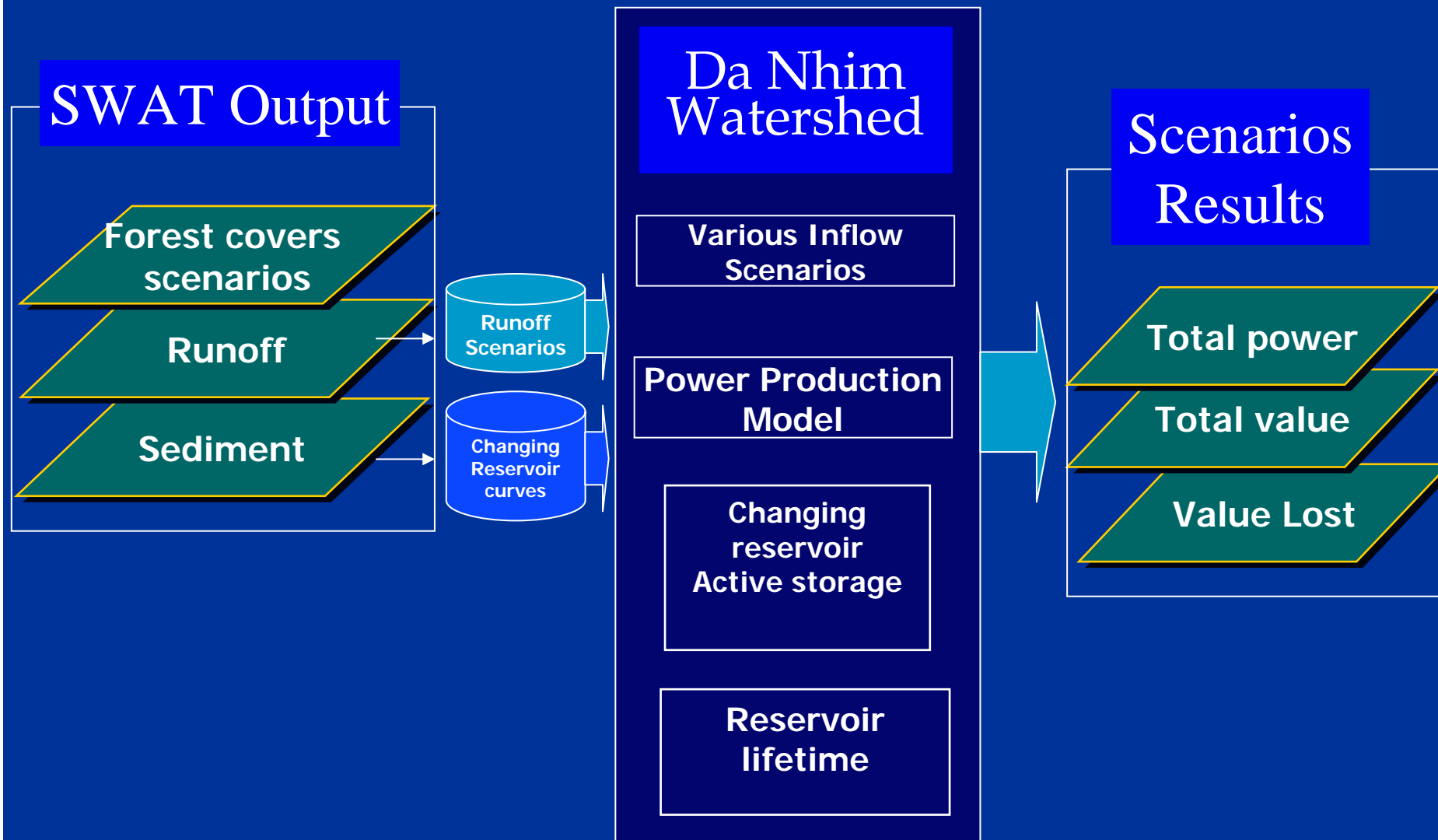
- Direct values

- Timber
- Fire wood
- NTFPs

- Indirect values

- Water conservation
- Water erosion control (silt deposited in reservoir)
- Carbon stored and sequestered

Watershed valuation using SWAT

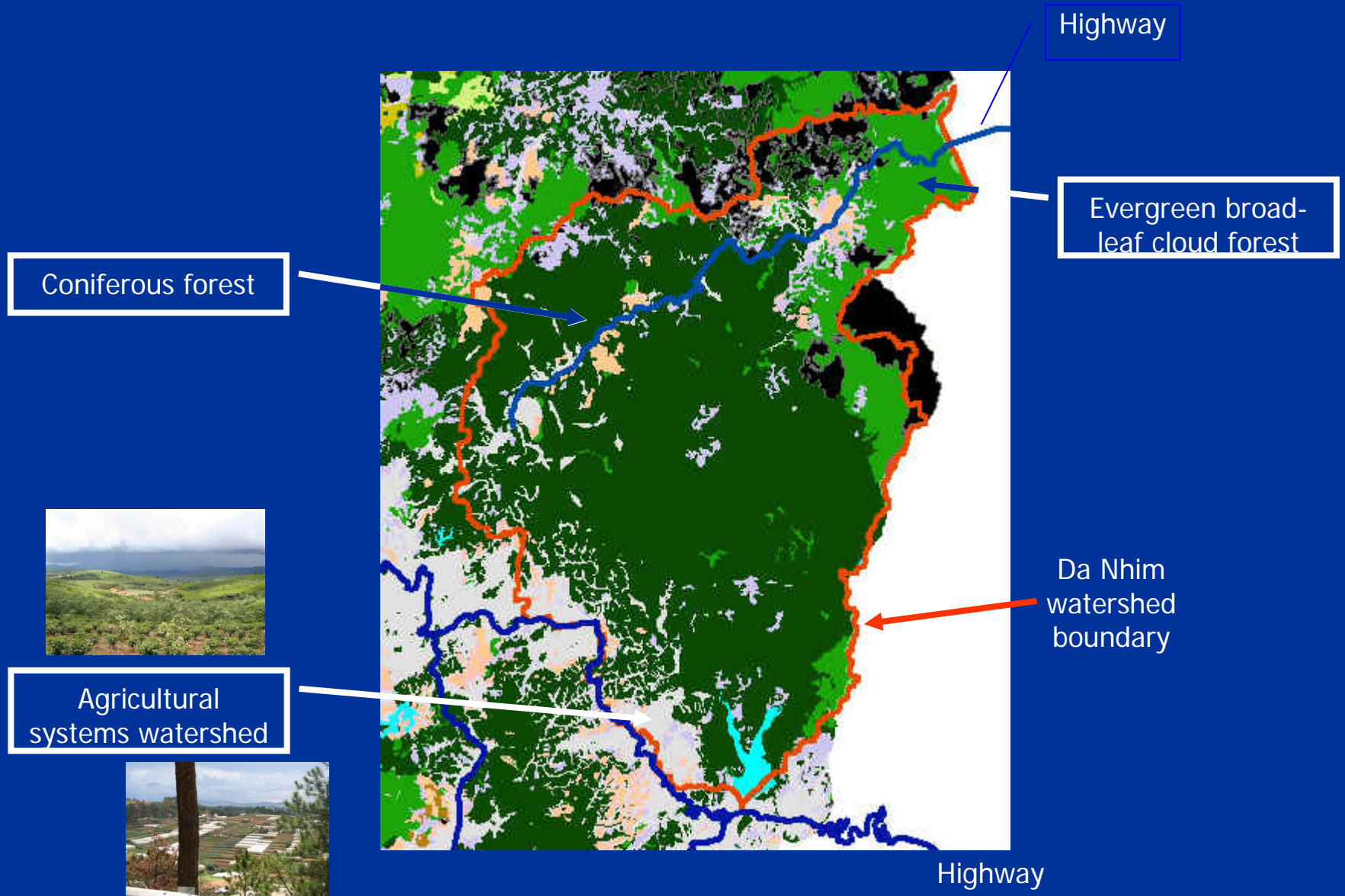


Da Nhim watershed land covers

Land cover types		Area (ha)	Percent
Broad leaf forest	Evergreen forest	8,257	11.01
Pine forest	Coniferous forest	47,994	63.99
Mixed forest (broad leaf + pine)	Mixed evergreen and coniferous	4,911	6.55
Planted forest		1,907	2.54
Bare land	Grassland and scrub	3,435	4.58
Agriculture and settlement	Agricultural land and settlement	7,526	10.03
Don Duong reservoir	Water body at HWL	970	1.29
TOTAL		75,000	100

Source: Winrock, Da Nhim LULC2005

Three major land uses in Da Nhim Watershed



Watershed Valuation under 2 LU x 2 Values

Scenario 1: Current land cover

Scenario 2: Convert 45,000 ha of pine forest to agriculture + Timber

Value 1: Water regulation

Value 2: Reduction of suspended sediment to the reservoir

Simulated values on water regulation

Value of forest on water regulation

Wet year

Items	Energy (mil kWh/y)	Total Value (mil \$/y)	Value (US\$/ha/year)
Scenario-1	1,272.35	50.8839	-
Scenario-2	1,266.00	50.6300	-
Changes	6.35	0.2539	5.64

Dry year

Items	Energy (mil kWh/y)	Total Value (mil \$/y)	Value (US\$/ha/year)
Scenario-1	939.6	37.5738	-
Scenario-2	913.0	36.5100	-
Changes	26.6	1.0638	23.64

Simulated total soil lost (ton) under 2 LU scenarios

Year	Current LU	45,000 ha removal
1997	152,188	340,436
1998	47,870	230,582
1999	40,470	197,493
2000	67,658	321,148
2001	34,884	174,823
2002	52,725	279,735
2003	50,853	263,991
2004	37,606	223,725
2005	49,581	286,774
2006	45,983	249,748

Values of forests

	<u>USD/ha/year</u>
Total benefit	69.07
Water regulation	14.64 (2-15)
Reduction of sediment into the reservoir	54.43 (14-120)

Summary

- ArcSWAT and MWSWAT tools may be used to generate small watersheds variability of stream-flow, sediments, and crop yields
- Calibrating and validating of models in various ecosystems is needed, interdisciplinary teams.
- Relationships of stream-flow and crop yields to weather conditions might change in future scenario climates

Thank you for
your attention