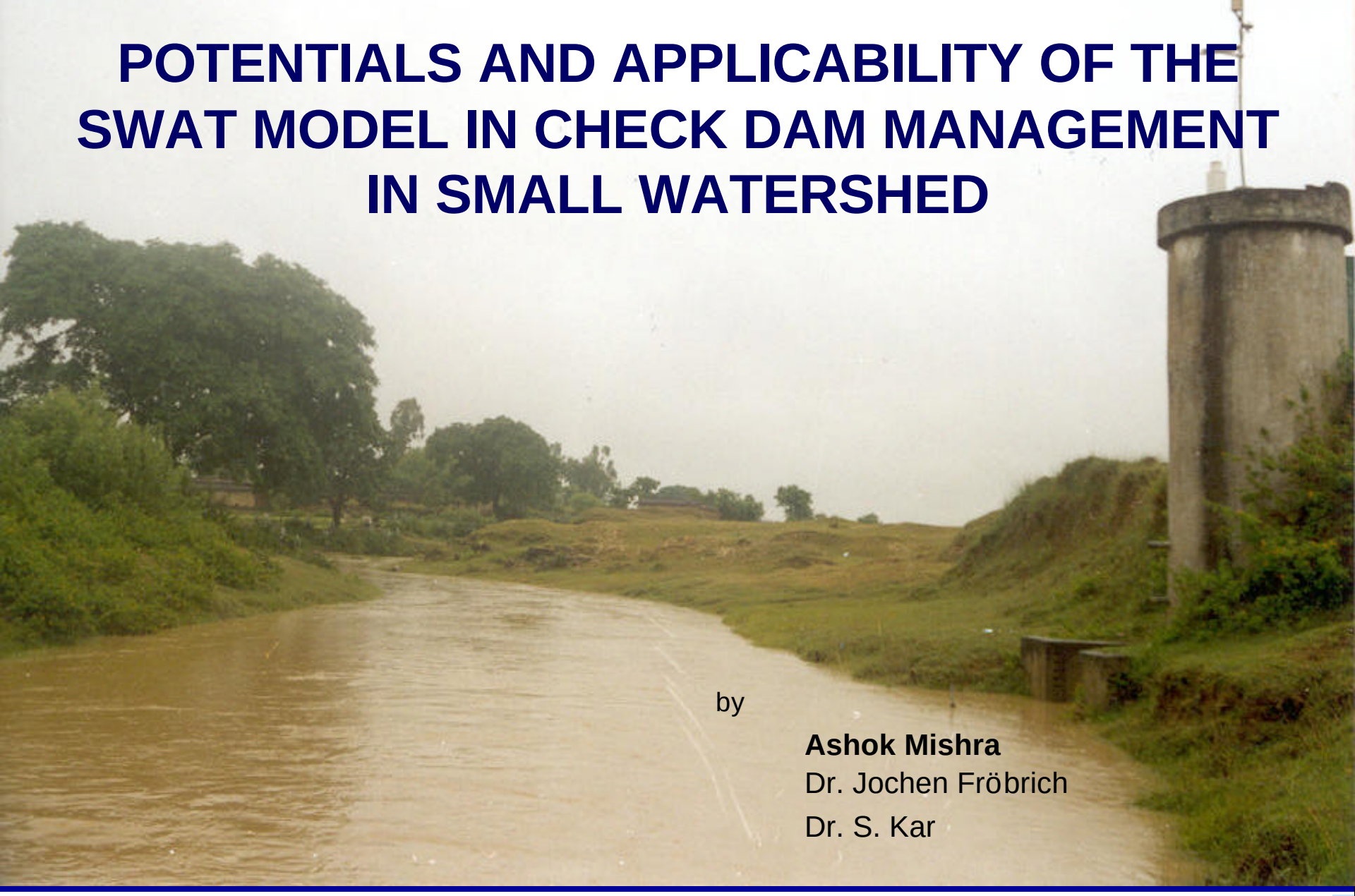
POTENTIALS AND APPLICABILITY OF THE SWAT MODEL IN CHECK DAM MANAGEMENT IN SMALL WATERSHED



by

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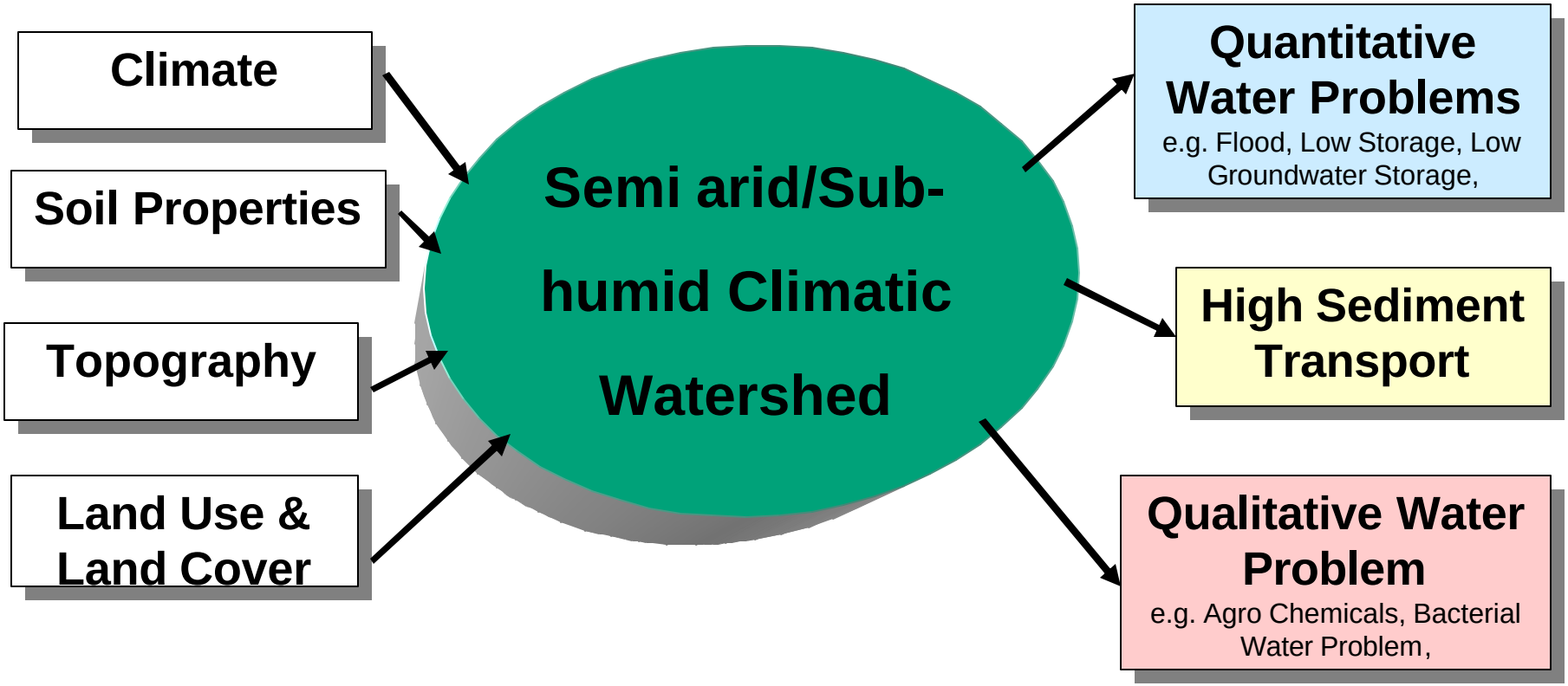
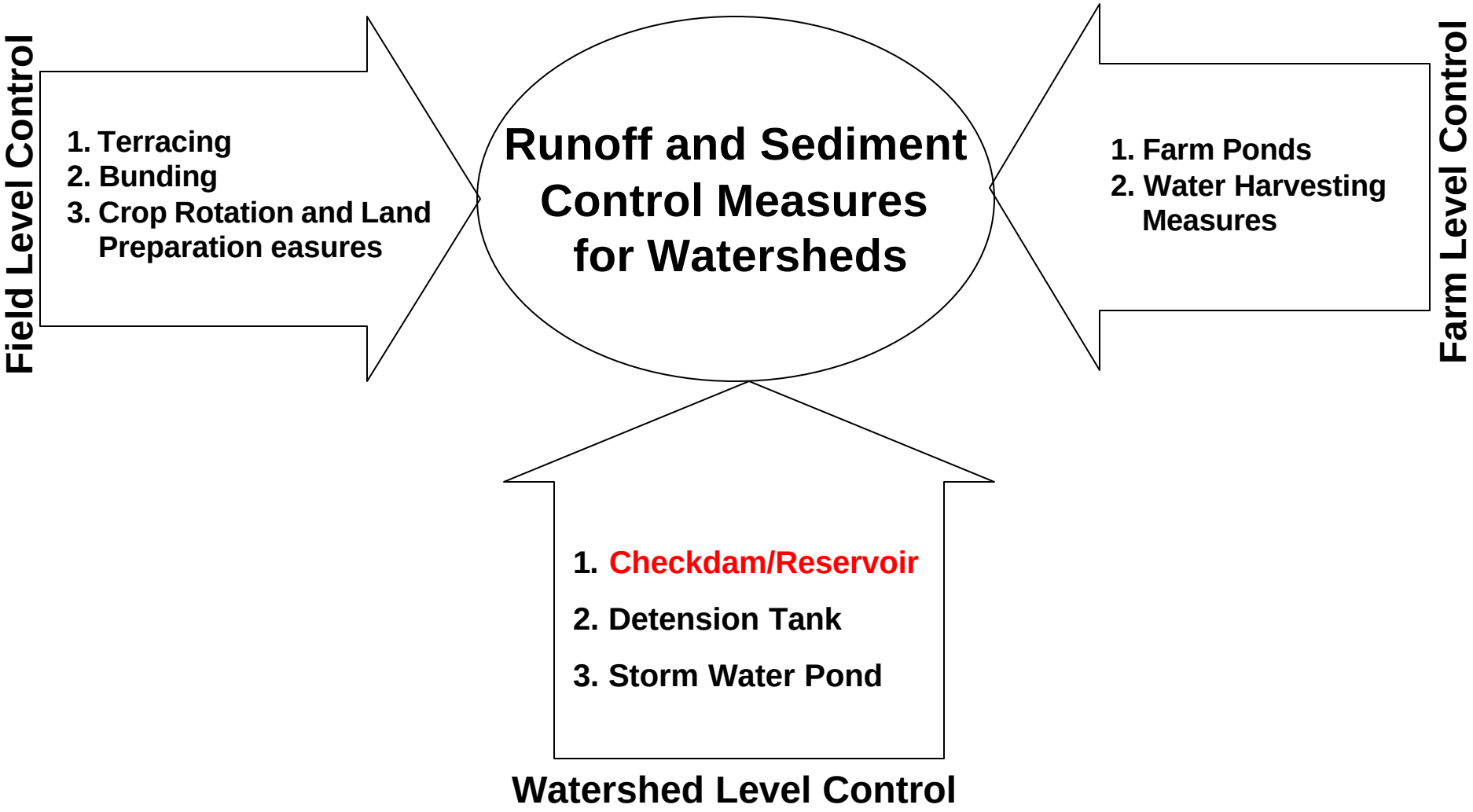
Watershed Interaction Processes




Field Level Control
1. Terracing
2. Bunding
3. Crop Rotation and Land Preparation easures
Runoff and Sediment Control Measures for Watersheds
1. Farm Ponds
2. Water Harvesting Measures
Farm Level Control
1. Checkdam/Reservoir
2. Detension Tank
3. Storm Water Pond
Watershed Level Control

SWAT potential in runoff and sediment management from Watershed

Relevant Process/ Approach	Management Option	Potential/usefulness of SWAT	Remark
High sediment yield from subbasin	Changing from the conventional to **conservation tillage practice**,	Option to decide better tillage practice to control the sediment	Field Level Approach
Soil and water conservation in sloppy fields	**Bunding** (graded as well as contour) and **terracing** of the area to conserve moisture	**Control Practice factor** „P“ can be managed to control the Runoff and Sediment	Farm Level Approach
More sediment transport by runoff from area	Better land cover and maintaining a **crop cover** to reduce direct runoff and increased infiltration,	Modified **SCS curve number** and a better **Overland Flow** „n“ value	Field/Farm Level Approach
More sediment yield due to high rains	Increase **initial crop residue** on soil surface, more erosion control practices,	Identification of suitable crop type	Farm Level Approach
To control sediment from high slops (mountanious areas)	Instaling small **check dams**, water control **structures** and bunds against high slope and channels to control the slope length for subbasin,	Identification of optimal slope lenth (LS) for the area by SWAT	Watershed Level Approach
To control channel erosion with runoff	Reduced/safer water flow velocity in channels	Channel roughness, Cover and erodibility factor	Watershed Level Approach
To reduce sediment discharge from watershed	Increasing the **storage capacity** in the watershed to settel the suspended sediment from the runoff water	**Reservoir/Pond** options of the SWAt model can be used in quantitative studies	Watershed Level Approach
Less groundwater storage recharge	Increase oportunity time in subbasin,	Identification of technical and management options for prolonging runoff and retention in ponds	Watershed Level Approach

Objective of the study

- Applicability of SWAT Model in sediment quantification in the on stream constructed checkdams in a small watershed

- The possible management for their sustainable, long time use

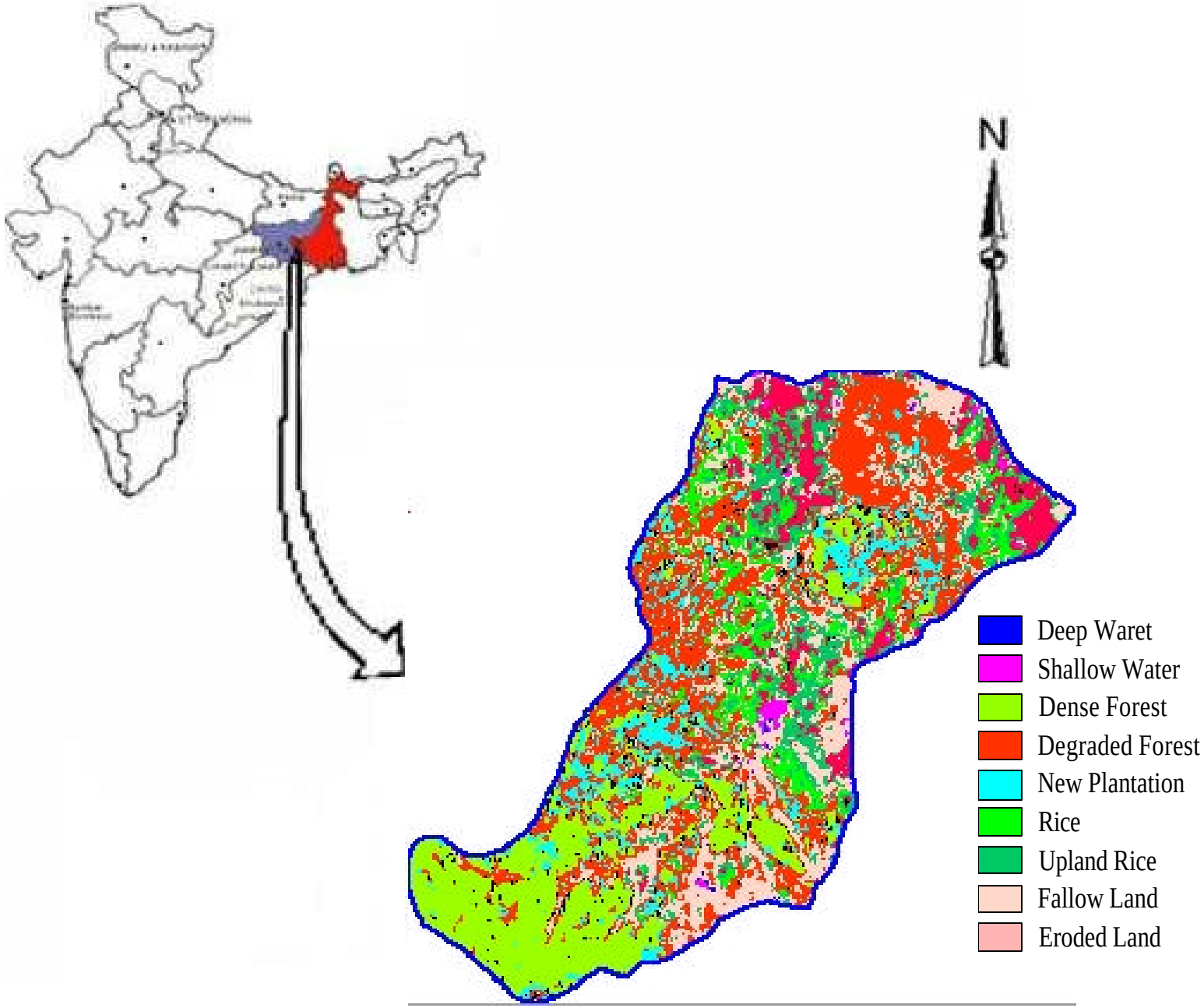
Study area

BANHA Watershed of DVC command at Hazaribagh, Jharkhand, India

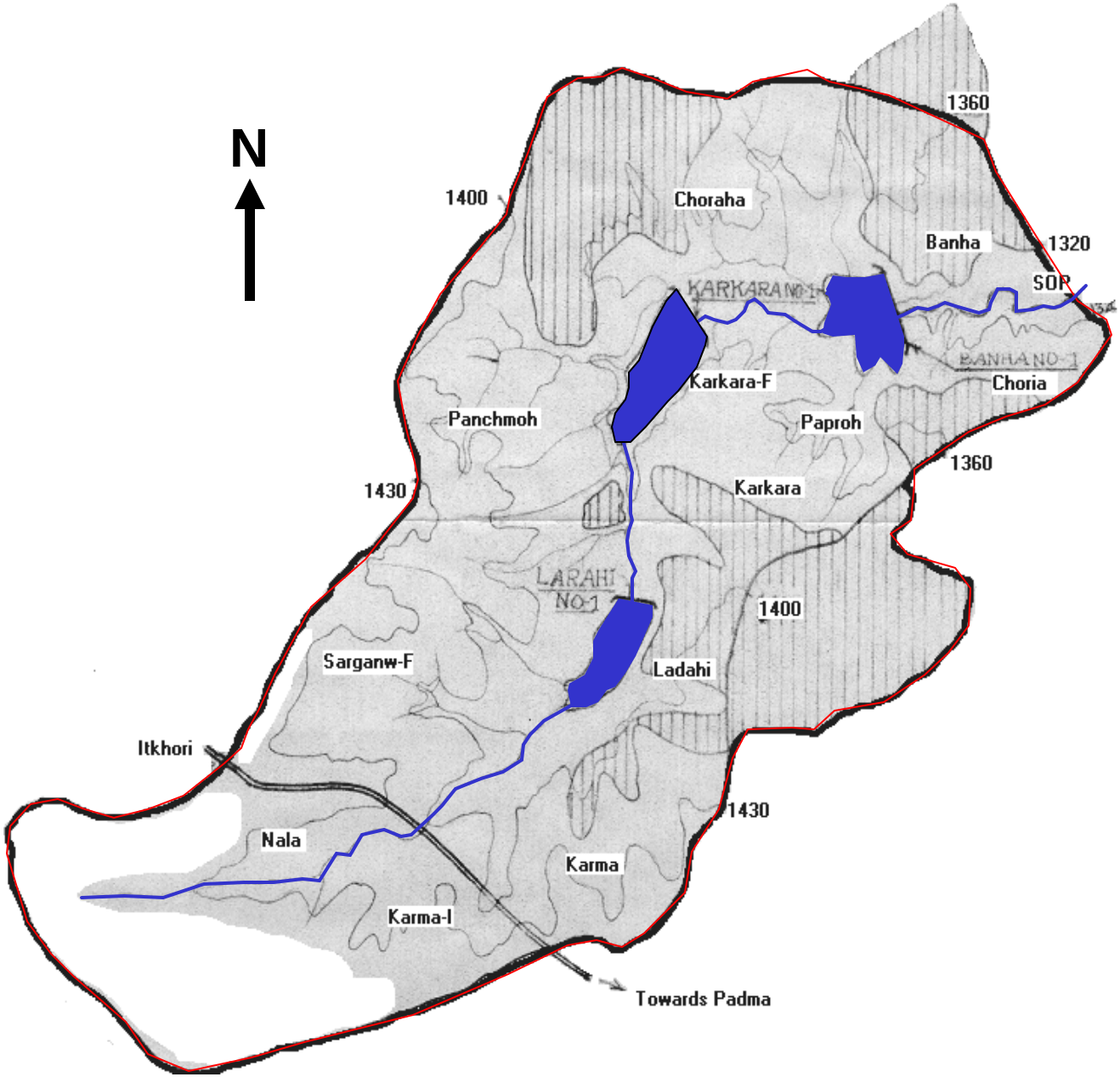
Latitude	**: 24^0 13’ 30’’ N to 24^0 17’ N**
Longitude	**: 85^0 13’ 50’’ E to 85^0 16’ E**
MSL Height	**: 550 m**
Area	**: 16.95 Km^2**
Slope	**: 1.9 % (average)**
Rainfall	**: 1200 mm (annual average)**
Crops	**: Paddy, Maize & Black Gram**
Soil texture	**: Loam to loamy sand**
Bulk density	**: varies around 1.5 g/cc**
Saturated hydraulic conductivity	**: 9.7 ~ 16.8 cm/day**

BANHA Watershed of DVC Command at Hazaribagh, Jharkhand, India

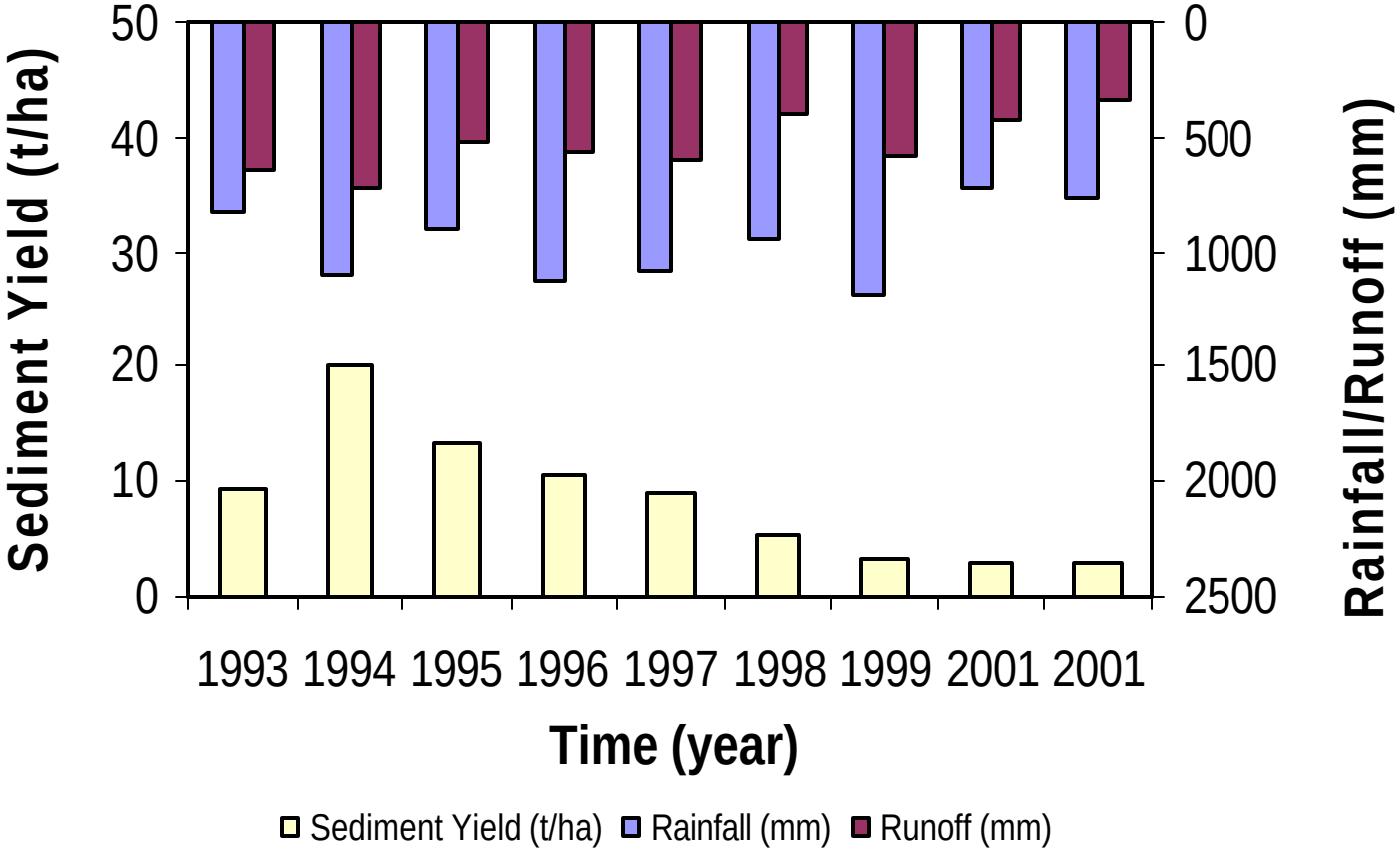
(Location and Land use for year 1996)



Check Dam's location in BANHA Watershed

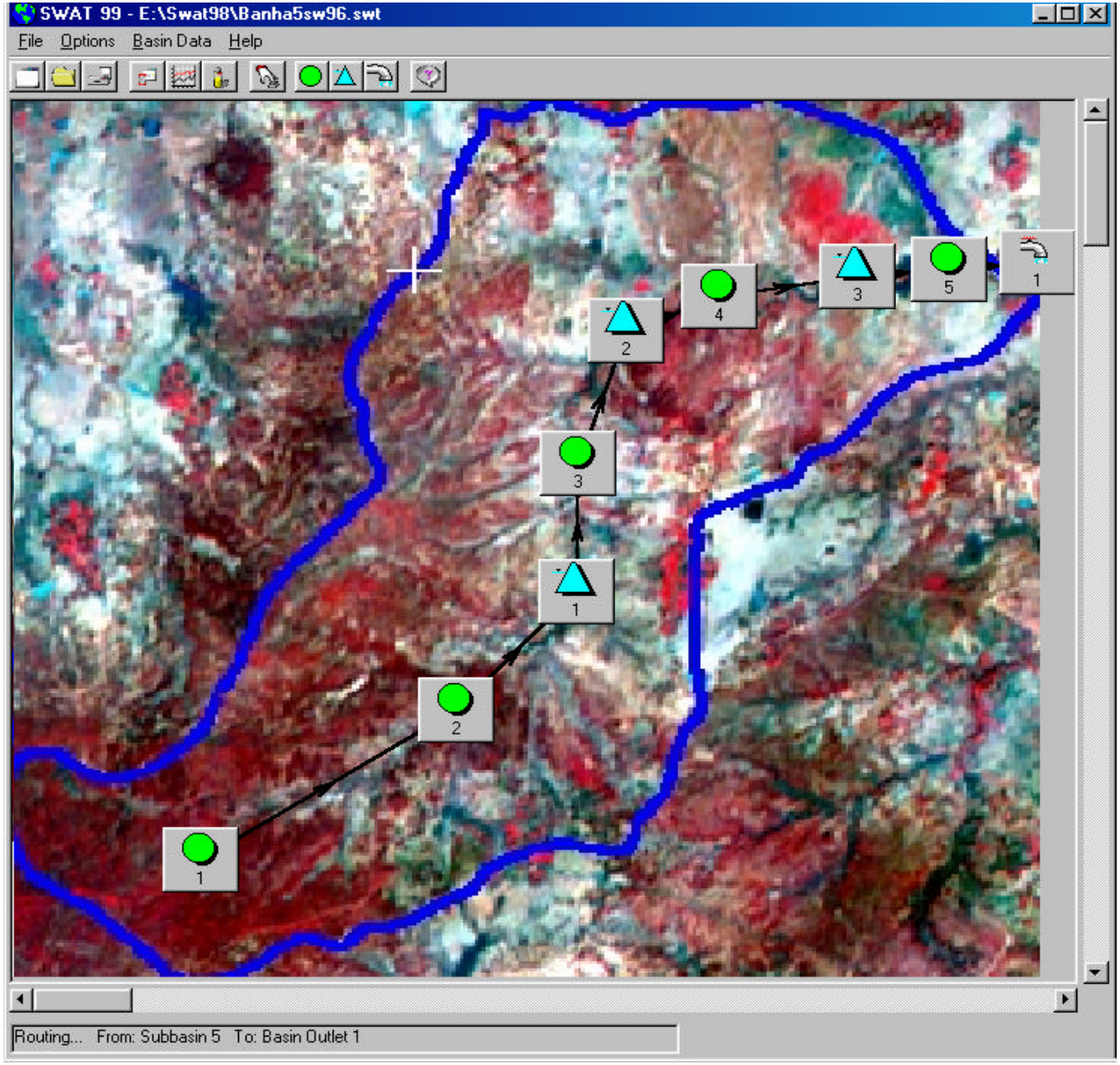


Check Dam No.	Year of Construction	Catchment Area (ha)	Height of the Dam (m)	Storage Capacity (Mm^3)
1	1995-96	567	6.405	0.18
2	1997-98	911.25	5.978	0.25
3	1996-97	1103.625	6.71	0.27



Measured rainfall, runoff and sediment from the watershed during monsoon period (June to October)

Schematic presentation of watershed in the SWAT Model

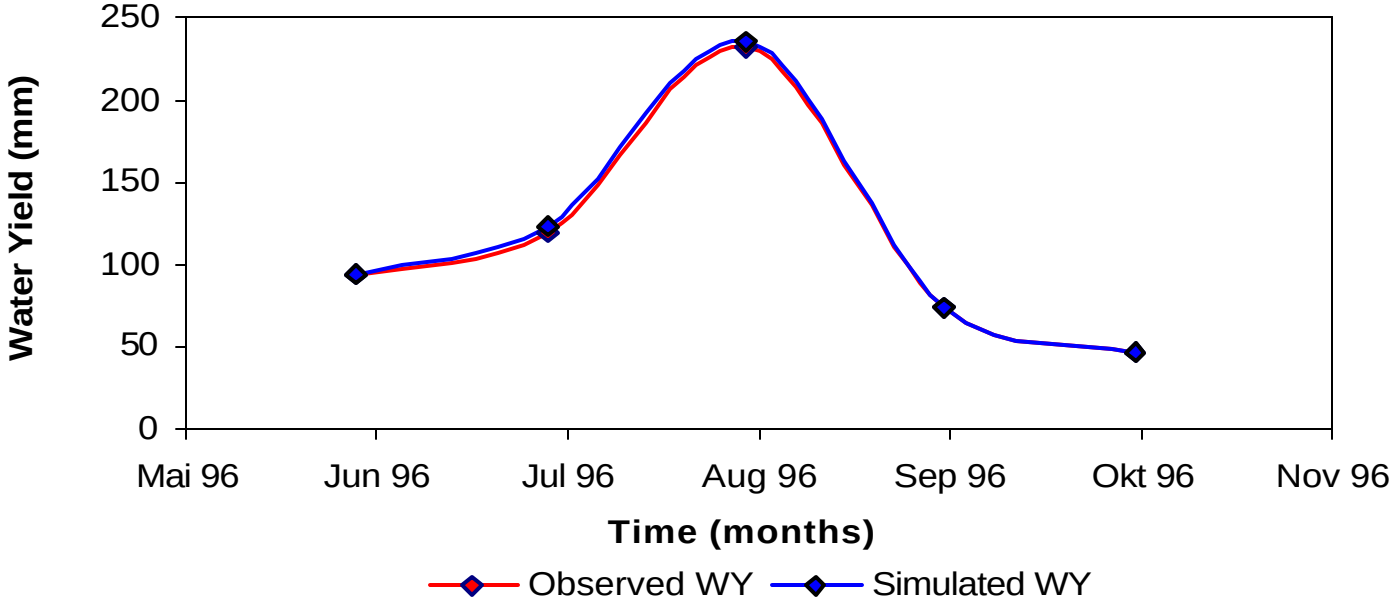


Results

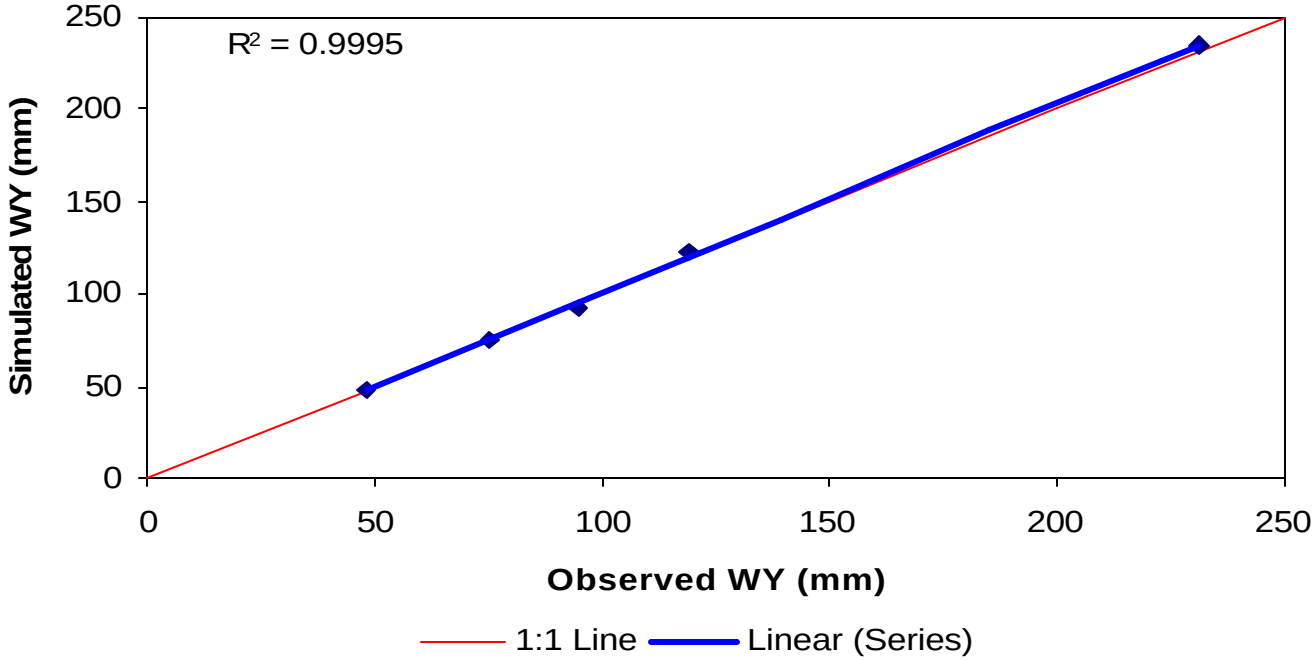
- Model has been calibrated against the observed water and sediment yield at the watershed outlet for the monsoon season (June to October) of year 1996.

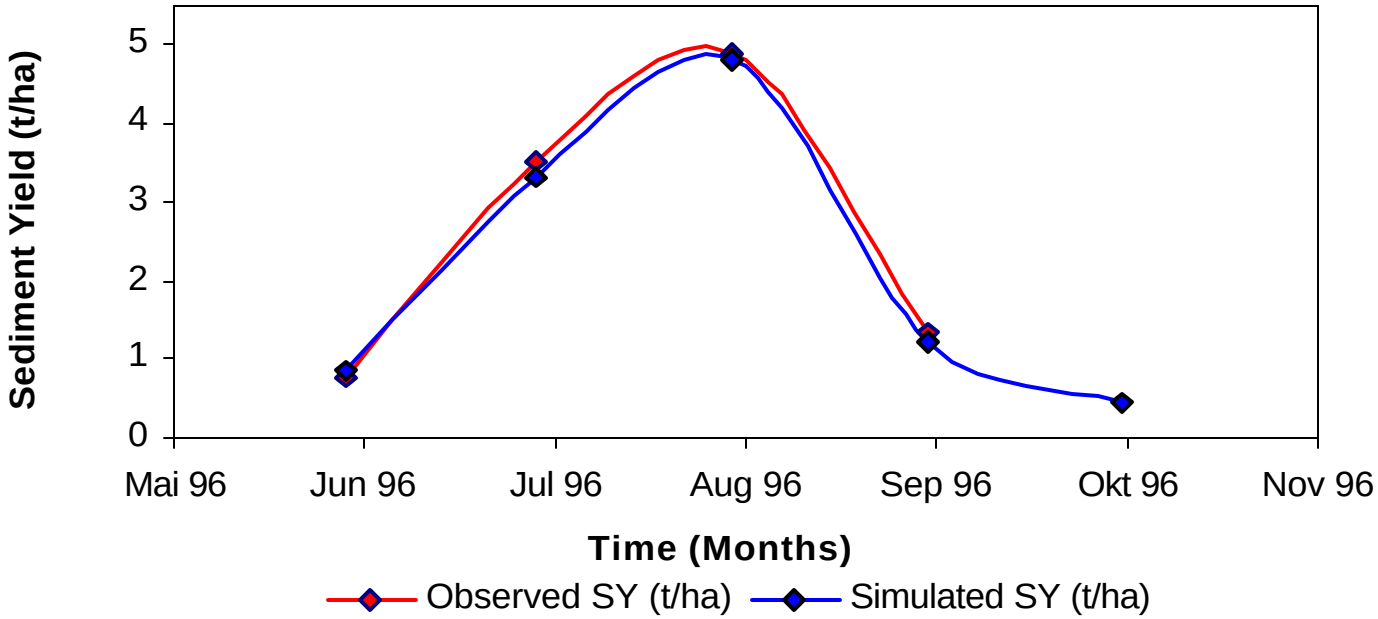
- The model then again ran for 1996 to 2001 to quantify the sediment generated from the watershed and accounting the controlled sediments by the checkdams.

- The outcomes then utilized to discuss the possible management options for the checkdams for their long time use.

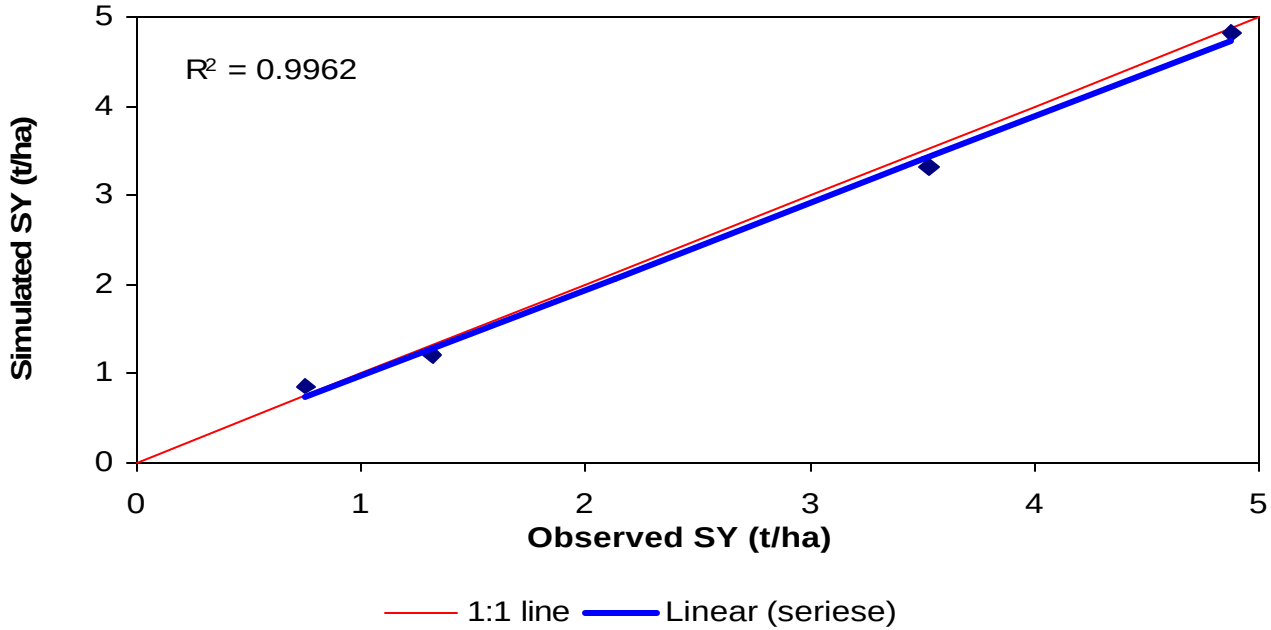


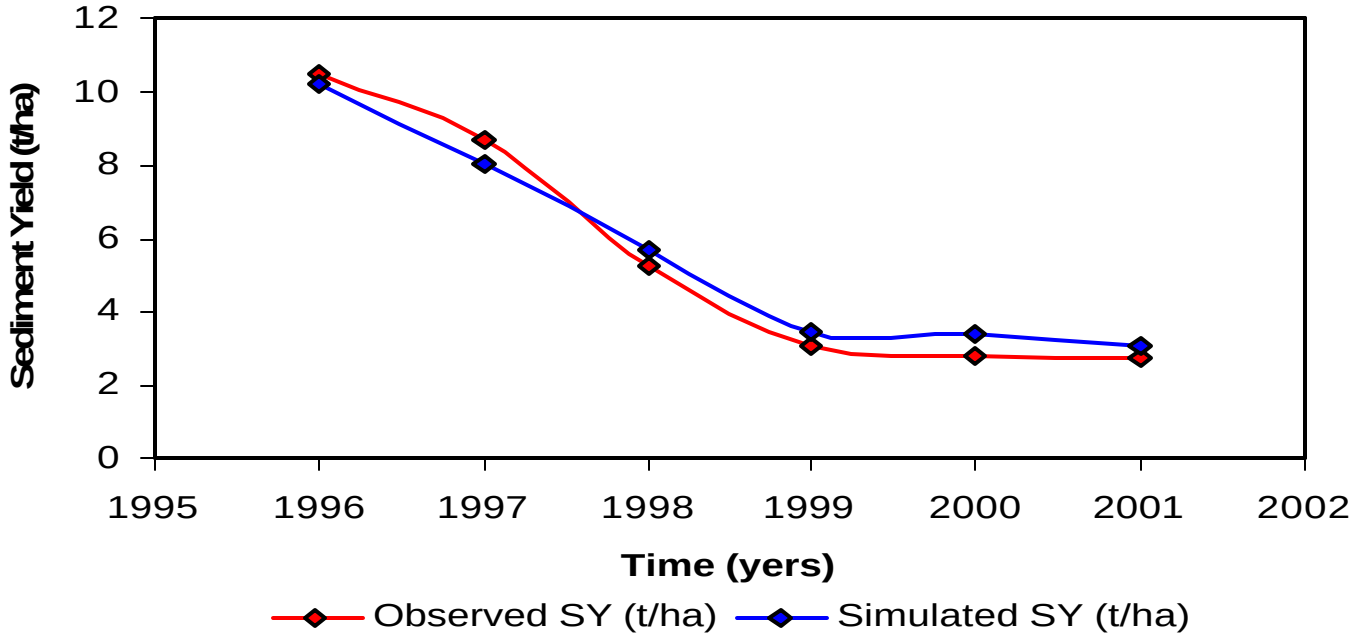
Water Yield Calibration for 1996



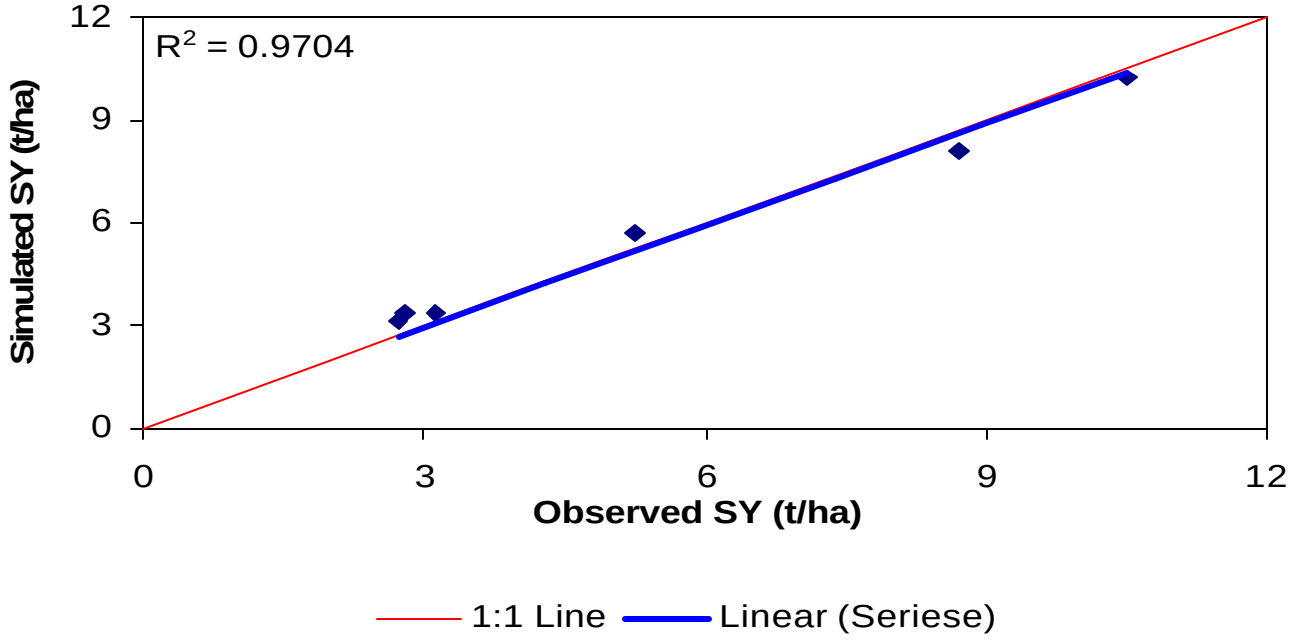


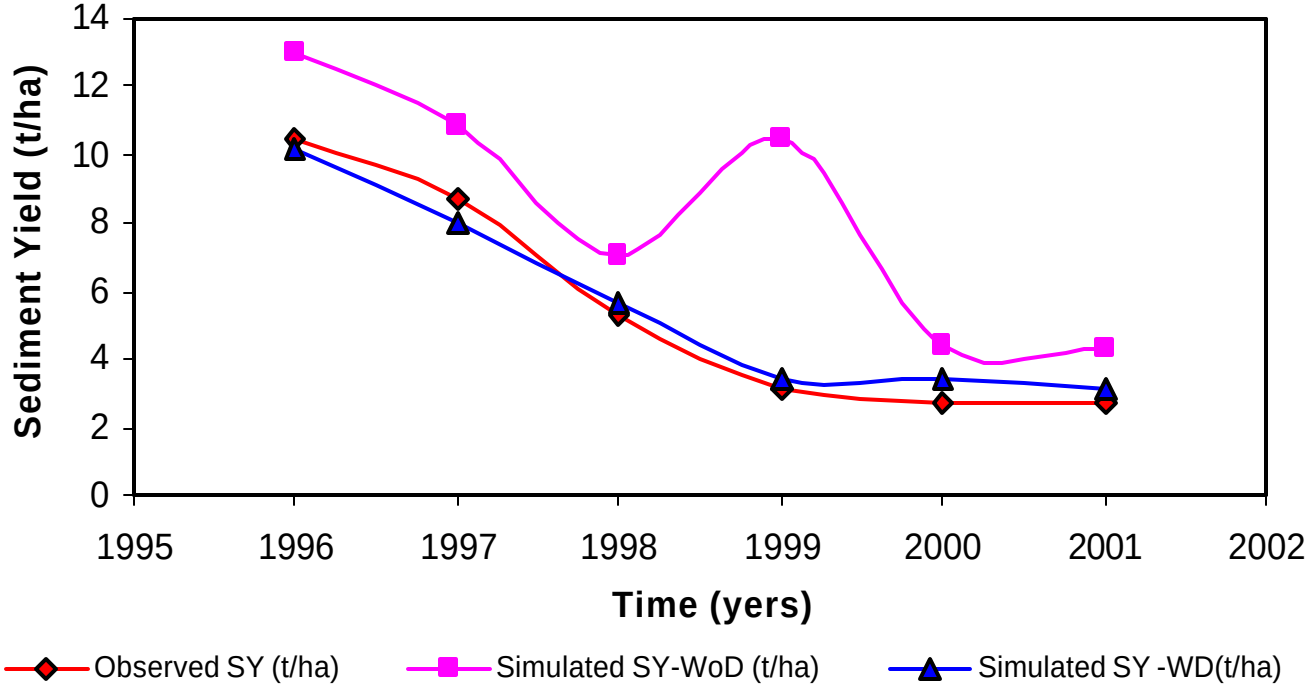
Sediment Yield Calibration for 1996





Sediment Yield Comparison during 1996-2001 in real situation





No check dam situation, Sediment Transport Comparision

Sediment yield reduction by checkdams

Year	Sediment out from Watershed (tons)	Sediment generated from watershed (tons)	Sediment controlled by checkdams (tons)	% Reduction in sediment out from watershed
1996	17780.55	22035.00	4254.45	19.33
1997	14797.35	18356.85	3562.89	19.41
1998	8898.75	11966.70	3067.95	25.57
1999	5288.40	17712.75	12475.20	70.13
2000	4729.05	7390.20	2678.10	36.18
2001	4644.30	7271.55	2627.25	36.16

Conclusions

- Check dams contribute to enormous reduction of sediment transport from the watershed,
- The simulated and observed sediment transport from the watershed compares closely and thus shows a strong applicability of the SWAT model in accounting the same from small watersheds,
- SWAT comprises the individual sub basin and reach sediment loading to account for the whole watershed and this can be utilized in site selection for the check dam construction,
- SWAT makes an accurate estimation of the deposited sediments in check dams and thus their capacity estimation for effective use by removal of depositions, can be made over time,

Other usages as e.g. cooperative fish farming by the local societies or soil reuse will benefit from a frequent sand/sediment removal from checkdams and this will be benefited from a more comprehensive, model supported check dam management.

THANKs