Catchment Area Treatment

Experience of DVC



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Sedimentation: Process

WEATHERING

Breaking down of rocks, soil mass into smaller pieces called Sediments.

Result of exposure to **environment**. Also, triggered by **human interventions**.

EROSION

Transportation/ movement of sediments broken down by weathering process.

Erosion agents include Water, Wind, Gravity…

DEPOSITION

Dropping off the sediments that were weathered and eroded.

Usually takes place at a location where energy of the eroding agents reduces like confluence of rivers with sea or reservoirs.

SOIL CONSERVATION aims to reduce the two actions through **CATCHMENT AREA TREATMENT**

Intervention at the source to reduce sediment generation before it reaches reservoirs.



Soil Conservation in DVC

Meets obligations enshrined in Section 12 (1) & (2)(e) of **DVC Act, 1948**

12(1): It shall be the duty of the Corporation to promote by such measures as it thinks fit the **agricultural**, industrial, economic & public health development of the area with its operation.

12(2)(e): The Promotion of **Afforestation & Control of soil erosion** in the Damodar Valley.

A multi disciplinary Soil Conservation Department came into existence in the year **1949** with objectives that include:

- Checking **soil erosion** in Damodar-Barakar catchment to prolong reservoir life.
- **Prevent land degradation** through Afforestation, upland and wasteland treatment.
- **Harvest rainwater** to create micro-water pockets for irrigation, improve productivity and soil moisture regime.



General problems in the catchment

LANDSCAPE CHARACTERISTICS

- Undulating terrain
- Fragile uplands
- Intensive runoff generation

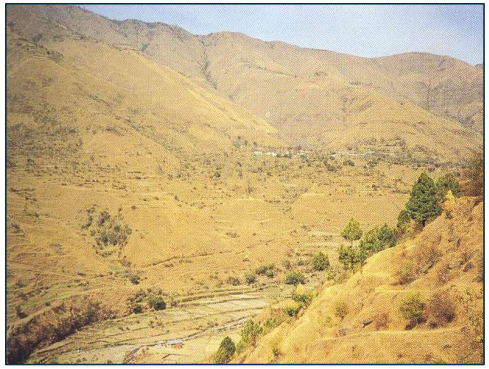
MAJOR PROBLEMS

- Sheet erosion
- Gully formation
- Land degradation
- Sediment delivery to reservoirs

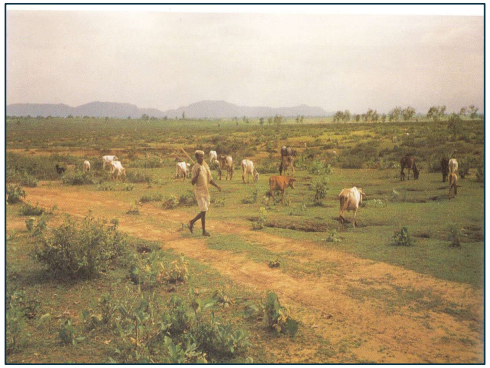


GULLIES





BARREN UPLANDS



OVERGRAZING

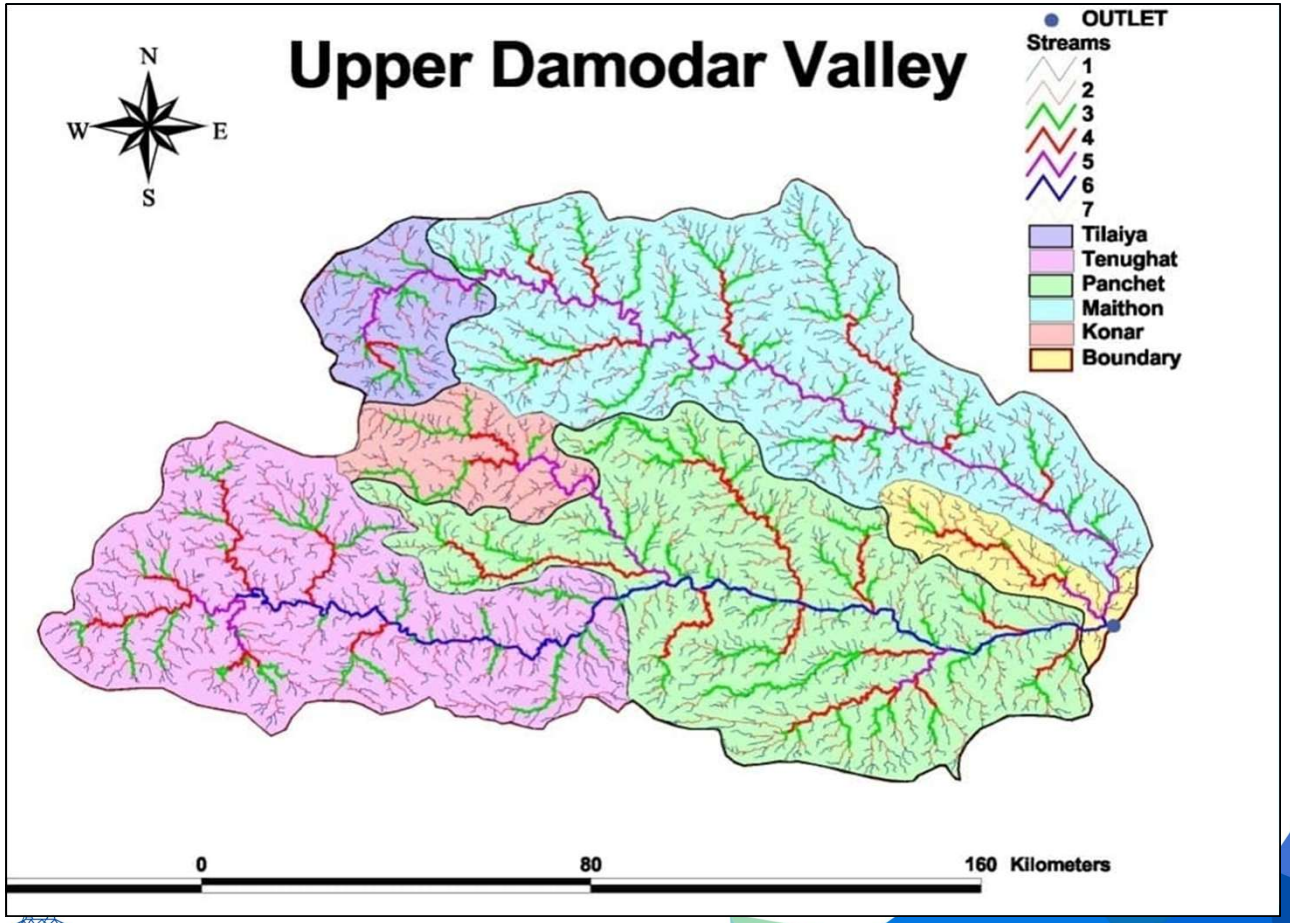
Catchment Area Treatment (CAT)

Work started from **1950**

Component	Value
Upper Valley Area	17,510 km²
Critical Area	11,470 km²
Micro Watersheds	716
No. of Districts	11

Hazaribagh, Giridih, Dhanbad, Bokaro, Koderma, Jamtara, Chatra, Latehar & Ramgarh districts of **Jharkhand**

Parts of Purulia district of **West Bengal**



Strategies

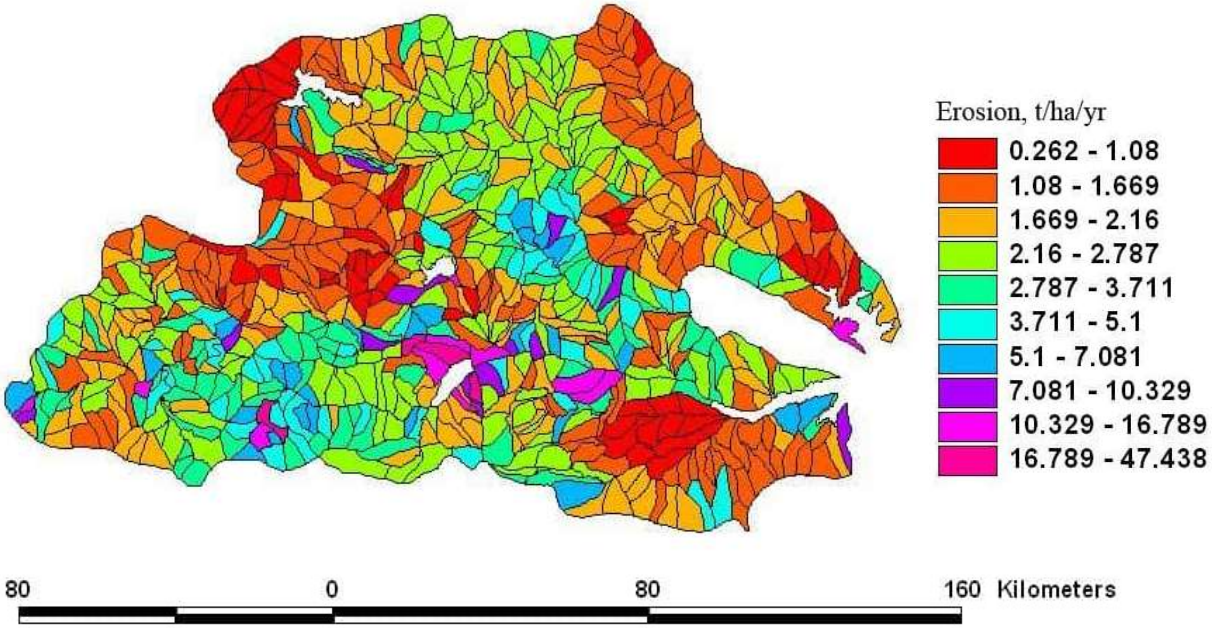
1950-61	1961-74	1974-92	1992 onwards	2008 onwards
Land reclamation & rehabilitation.	39 **sub-catchments** 20 priority sub-catchments Integrated catchment treatment plans	130 **mini-watersheds** 55 priority watersheds	716 **micro-watersheds** 397 priority watersheds – **7270 sq. km** Categorization by Soil and Land Use Survey of India (SLUSI)	Micro-watershed treatment shifted to **State Govt.** by MOA. Restoration and renovation of rainwater bodies continued by DVC

Treatment involve both **STRUCTURAL** (Water harvesting structure with spillway, terracing, contouring, etc.)

and BIOLOGICAL MEASURES (Afforestation, Horticulture plantation, Pasture development)



716 Micro-Watersheds (each having area < 4000 Ha)



Category	Number	Area (km^2)	Problem Area (km^2)
Very High	219	5,150	4,210
High	178	4,150	3,060
Medium	180	4,810	2,410
Others	139	3,400	1,790
Total	**716**	**17,510**	**11,470**

Structural Treatment

Water harvesting structure with spillways

Help conserve water by reducing runoff and recharging groundwater.



Terracing

Involves **constructing ridges and channels across a slope** to create a series of level steps, slows runoff, helps groundwater recharge.



Structural Treatment

Contour / Field bunds with vegetation cover

Typically, **1-1.2 meters wide** and **0.6-0.7 meters high**, stabilized using **vegetative measures,** slows runoff, facilitates groundwater recharge.



Drainage Line Treatment

Built in gullies, streams, or nalas

Interventions can include **Loose boulder structures, Vegetative and mechanical measures** (bamboo/brush wood check dams), **Masonry drop spillways, etc.**





Other Treatments

Renovation of Farm ponds

Involve activities to address issues like Silt accumulation, Damaged embankments, Improper inlet/outlet structures, etc.



Land Reclamation

Techniques like replanting vegetation, soil stabilization, and drainage control.

Often involves **planting native species** to restore the natural ecological balance



Scale of Interventions

17,000+
Water Harvesting Structures

12,036
Check Dams

305,400 ha
Upland Treatment

214,963 ha
Afforestation

67,225 ha
Irrigation Potential

25,701 Ha-m
Storage Capacity Created

4744
Villages Benefitted

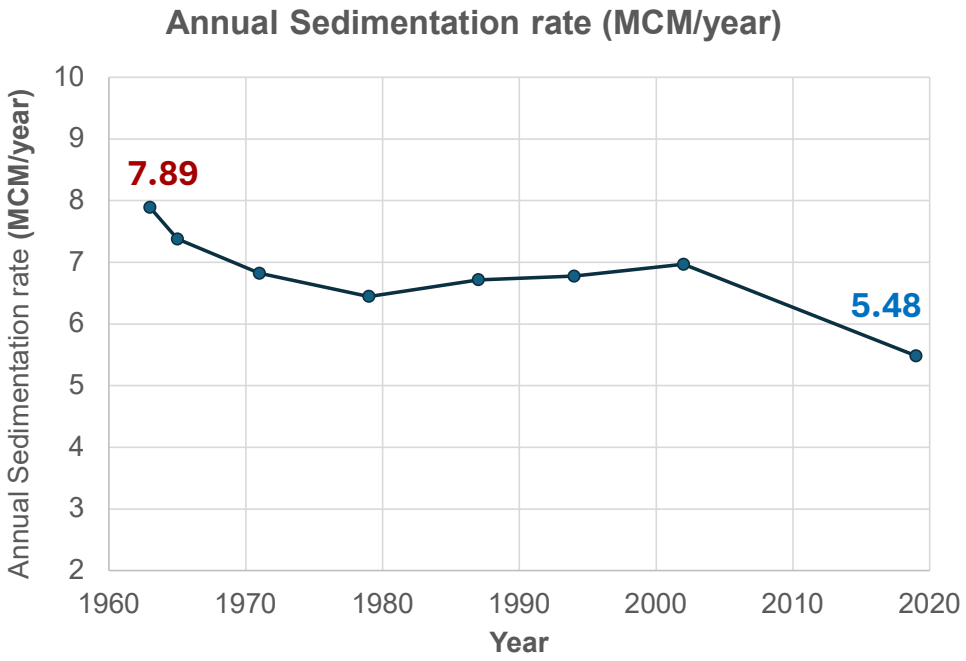
Interventions ensured:

- Reduced Sediment Inflow into reservoirs,
- Reduced **Peak Inflow** into the reservoir,
- **Availability of water** for local utilization, and
- **Ground water recharge.**

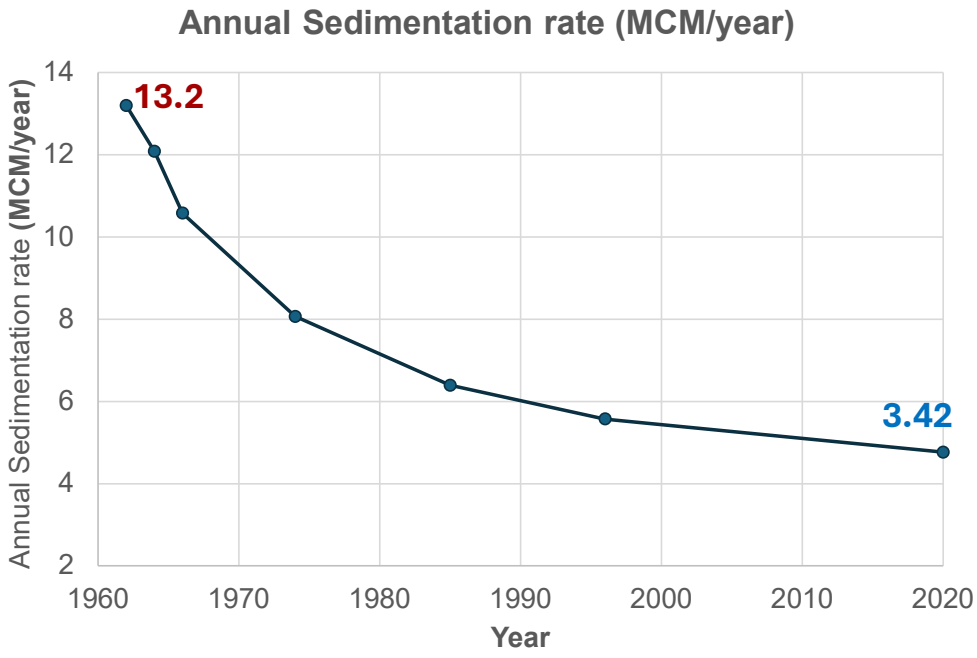


Impacts on Reservoir Sedimentation

Maithon Reservoir



Panchet Reservoir



Values shown are based on results of Sedimentation survey carried out over the years.



Impacts on Reservoir Sedimentation

Are all the reductions in Sediment yield attributable only to Catchment Area treatment?

Reduction in the sediment yield within a RESERVOIR, can occur from:

a) Catchment area treatment.

b) Consolidation of sediment due to water impoundment.

c) Consolidation of sediments on periodic drawdown and considerable exposure.

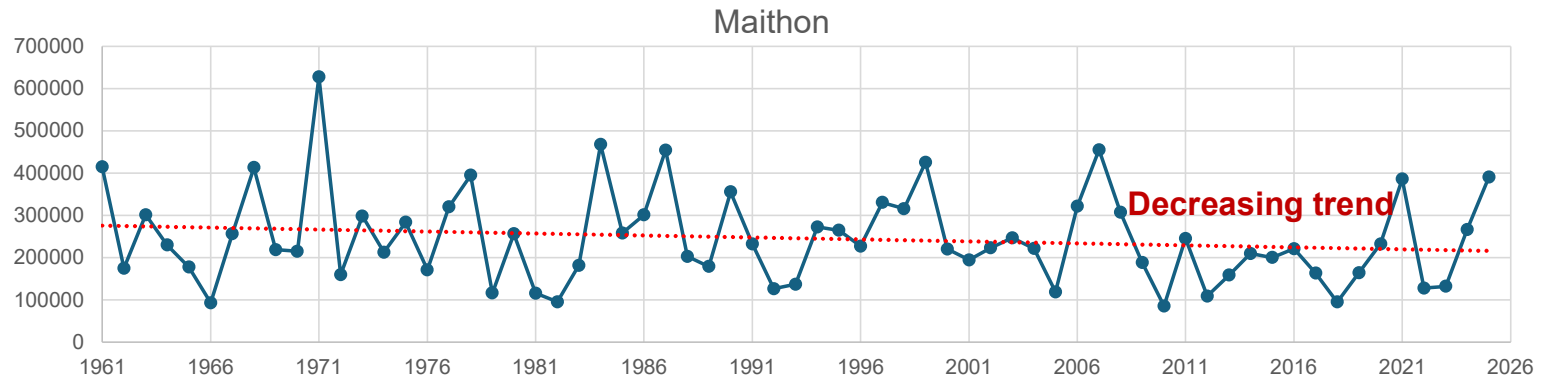
d) Building up of delta in the head reaches of the reservoir.

e) Reduction in **Inflow into the reservoirs**.

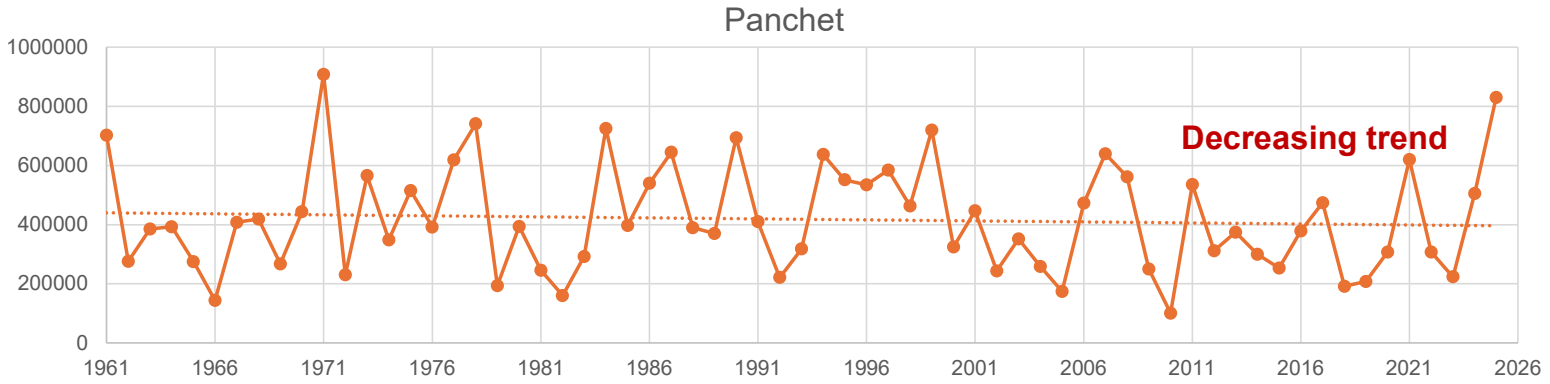


Impacts on Reservoir Sedimentation

Yearly inflow into Maithon reservoir



Yearly inflow into Panchet reservoir



Impacts of Catchment Area Treatment (CAT)

Impact of CAT can be fully understood in **smaller structure** or **small watersheds**, where conservation measures were administered.

Case Study of **Upper Sewani Sub-catchment** (located in Hazaribag district) of Damodar Basin:

- Catchment Area = **93.24 km^2**
- Integrated soil and water conservation measures were taken from year **1955 to 1961**.
- Area treated during the period : Around **37 km^2** (~ 40% of its Catchment area)
- Annual rate of sediment production **prior** to treatment = 904 m^3/km^2
- Annual rate of sediment production **post** treatment = **381 m^3/km^2** (**55%** reduction by treating only **40%** of the area)



Impacts of CAT

Other examples of reduction in Discharge & Sedimentation

Watershed Code	Pre-Treatment		Post Treatment		% Reduction	
	Q	S	Q	S	Q	S
Mfib	542	7.822	335	2.236	38.19	**71.41**
Mc4d	445	5.985	381	1.431	**14.38**	**76.09**
Tb2d	519	4.359	348	1.824	32.95	**58.15**
20B/10	423	3.054	311	0.743	26.48	**75.67**
Mg1j	606	4.586	486	2.662	19.8	**41.95**
Md2t, Md2r, Md2n	651	3.578	338	1.261	**48.08**	**64.76**
Pl3l	295	1.288	241	0.845	18.3	**34.39**
Pl2h	475	3.165	298	1.555	37.26	**50.87**
Pl2d	349	2.63	289	1.54	17.19	**41.44**
Ta2b	462	2.837	294	1.737	36.36	**38.77**
Mc4g,Mc4l	253	1.564	205	0.947	18.97	**39.45**

Q = Annual Discharge in mm S = Annual Silt load in Ha-m/100 sq. km/year



CAT – A Continued Service

- Since sediment is trapped at the structural interventions created in the MWS, it is imperative that these MWS will function only for a limited time and therefore need to be revived again.
- Therefore, to harness the benefits of Soil Conservation Practices both at the MWS level and at reservoir level, the soil conservation activities shall **continue to operate**, **it can not be a ONE-TIME activity.**
- Almost **90%** of the structures are more than **20-years old**. Most of them have either outlived their useful lives, silted up or have become extinct.
- After 2008 onwards (diversion of funding from DVC to State Govt.), **DVC is carrying out Restoration, Renovation & Repairs of old rainwater bodies only.** Till date, around **1700 old water bodies have been renovated, since 2008**.



CAT – A Continued Service

Such rehabilitation are **cost effective** then developing new water resources and/or desilting a large reservoir.

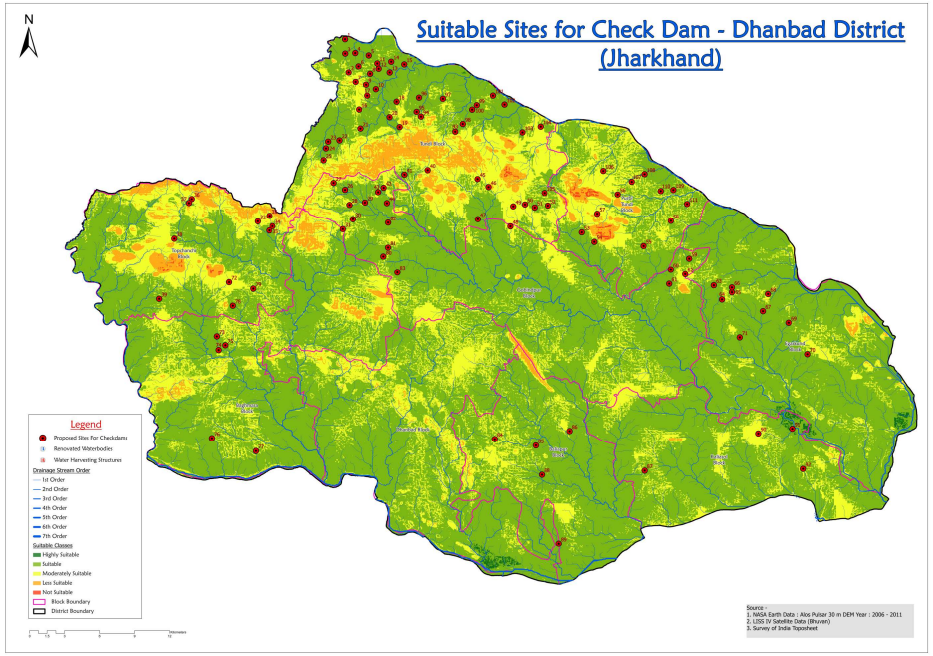
Moreover, **Excavation/Desiltation** from such small water bodies are **practical and economical** in comparison to large reservoirs, because of

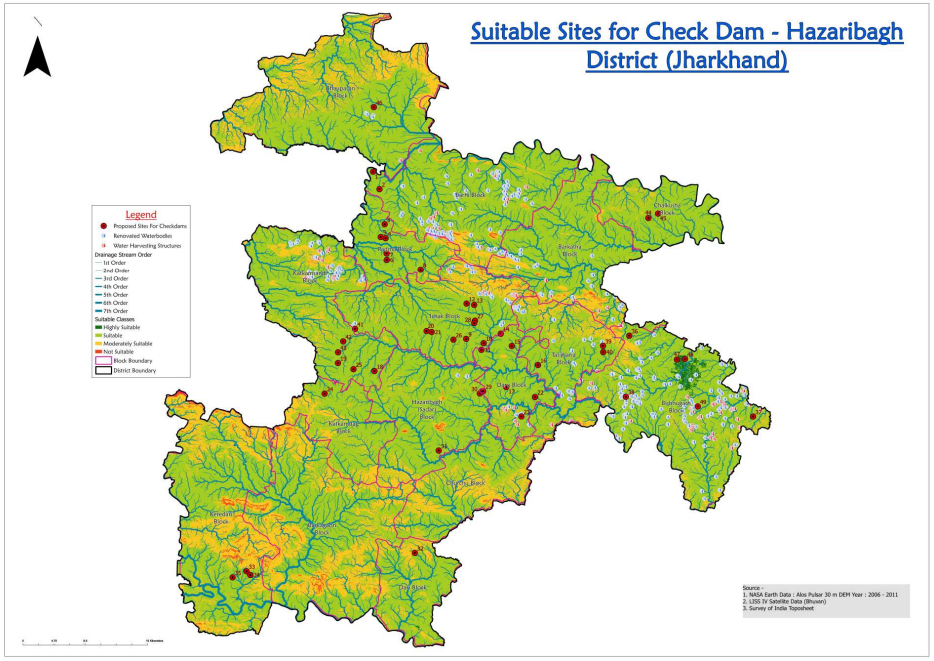
- Limited quantity.
- Such sediments can be utilized by farmers also.
- Can be excavated without any **considerable damages** to the river regime/ environment/ ecology.
- The evacuation will help restore the MWS and enabling its full functionalities.



New Initiatives

A district wise analysis were carried out by DVC for site suitability for construction of more Check dams and carrying out Afforestation work. A fund approval of around Rs. 100 cr. is being processed.





Challenges Ahead

- With ever-rise demand of land for various purposes, suitable sites for creation of **new reservoirs** are becoming increasingly difficult.
- Requirement of large pool of **trained manpower**, considering the vast land area, to effectively implement soil conservation practices.
- **Financial support (from Central Govt.)** is required to sustain the work of Soil Conservation Department as the expenditure made by DVC in soil conservation activities are not accounted for while determining either Water or Energy tariff, hence are non-recoverable by DVC. Previously, **DVC used to get fund from MOA till 2008.**



Thank You!



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