



Basin Development Plan Programme Phase 2

Impacts on water quality and sediment transport

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Environmental objectives of the BDP

- Maintain water quality and acceptable flow conditions
- Manage salinity intrusion in the Mekong Delta
- Minimize channel effects on bank erosion

Primary Objectives	Assessment Criteria Specific development objective	Issue	Indicator Description
1 Economic development	1.1 Increase irrigated agricultural production	Irrigable area, production tonnage and value	Incremental area Incremental crop production Net incremental economic value
	1.2 Increase hydropower production	Hydropower capacity, power generated and value	Incremental installed capacity Incremental power generated Net incremental economic value
	1.3 Improve navigation	River transport	Incremental navigable days by class Net incremental economic value
	1.4 Decrease damages by floods	Eident and duration of annual flooding by class	Average area flooded annually to max 0.5-0.9m depth Average area flooded annually > max 0.9m depth Incremental net economic value of flood damage
	1.5 Maintain productivity of fishery sector	Capture fisheries and aquaculture production Impact of flow and sediment transport changes on deep pools	Incremental annual average capture fish availability Incremental annual average aquaculture production Net incremental economic value Sediment loads at specified locations on mainstream Water levels at specified locations on mainstream Net incremental economic values
2 Environmental protection	2.1 Maintain water quality and acceptable flow conditions	Water quality Flow characteristics Protection of forests around Tonle Sap	Water quality incl. sediment in transport in mainstream Key flow characteristics (to be defined) Forest flooded for specified depth duration at Tonle Sap Net incremental economic values
	2.2 Maintain wetland productivity and ecosystem services	Productivity of wetland ecosystems	Incremental wetlands with required depth-duration Net incremental economic value
	2.3 Manage salinity intrusion in the Mekong delta	Impact of salinity intrusion on land use potential	Area within delta within thresholds of salinity levels Net incremental economic value
	2.4 Minimize channel effects on bank erosion	River bank erosion	Incremental area at risk to erosion Vulnerability to bank erosion Net incremental economic values
	2.5 Conservation of biodiversity	Impacts of flow management changes on endangered species	Incremental area of suitable habitats Estimated number of species affected Incremental net economic value of habitat areas
3. Social development	3.1 Maintain livelihoods of vulnerable resource-users	Health, food and income security	No. of people affected Severity of impact on health, food and income security
	3.4 Increased employment generation in water related sectors	Incremental sustainable employment from water resource interventions	Incremental number of people engaged in: Agriculture Fisheries Water-related service industries Tourism
4 Equitable development	4.1 Ensure that all four LMB countries benefit from the development of water and related resources	Aggregate benefits by country	Summation of incremental net economic benefits Summary of non-quantifiable impacts

Causes of impact

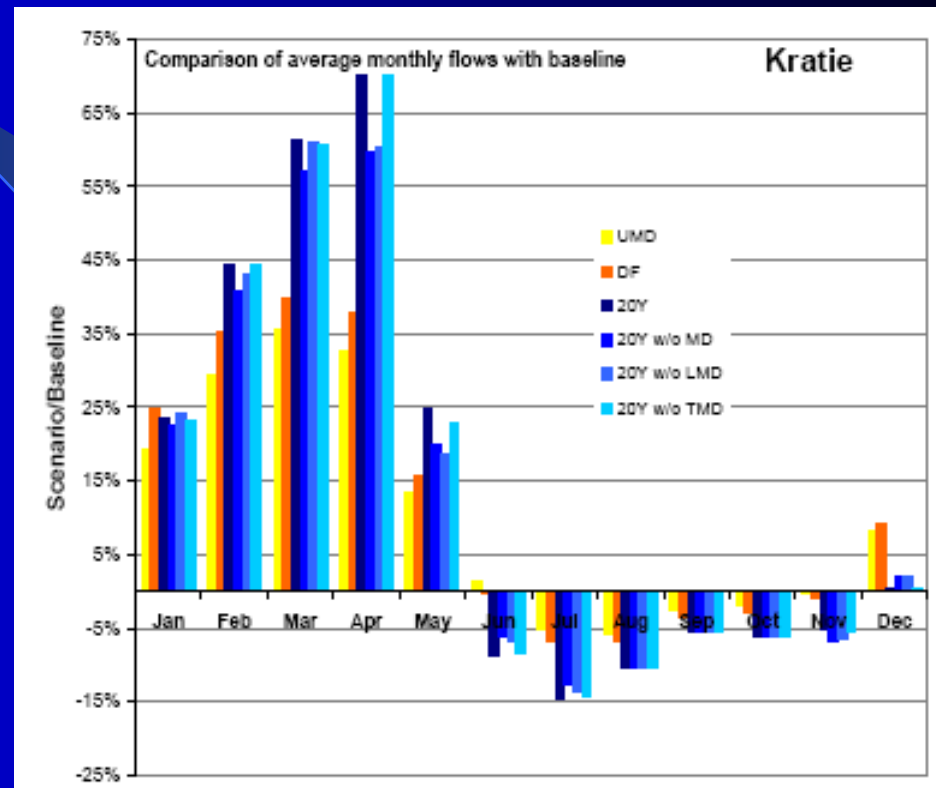
- Change in flow characteristics
- Change in loads:
 - Sediment trapping in reservoirs
 - Agricultural development: increase in irrigated area and discharge of nutrients (N and P) and pesticides
 - Population growth: waste water discharges



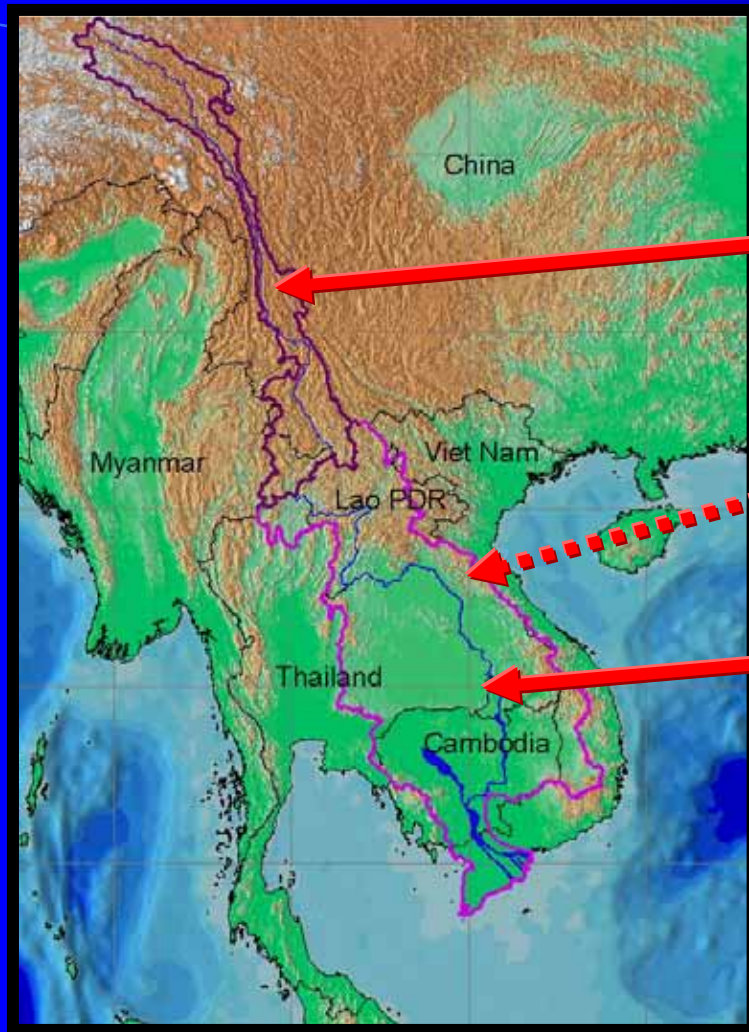
Change in flow characteristics

Of importance are the dry season flows, these increase in general:

- Dilution of pollutant loads
- 'Pushing out' salt water intrusion in the Delta



Change in loads: sediment



**‘Before China Dams’
situation:**

40% of sediment inflow

20 % of sediment inflow

40% of sediment inflow

Change in loads: sediment 2

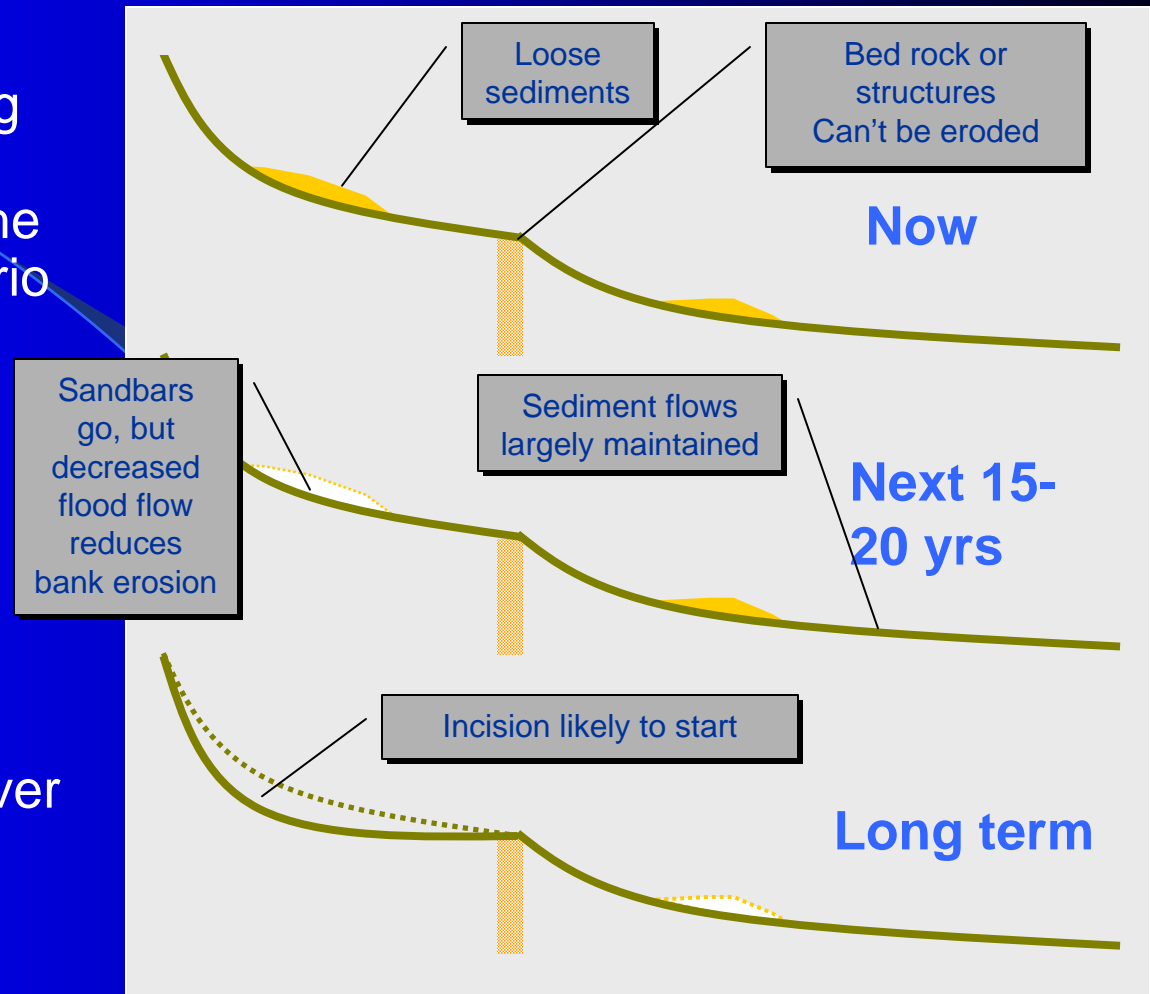
In future:

- Inflow from China reduced with 25 to 65 %
- Inflow from 3 Ss basins reduced with about 40%
- Reduced tributary inflow



Sediment load decrease: main conclusions

- Geomorphological changes in the Mekong are driven by current developments under the Definite Future scenario
- For the foreseeable Future (20 Year Plan scenarios) changes at the regional scale are likely to be small
- In the long term, the river bed will start to incise, but changes will be constrained by the presence of rock beds and any future dams



Sediment load decrease: consequences

- **Bedrock confined channels will not change but sediment will be flushed out gradually in the reaches Chiang Saen-Vientiane and Strung Treng-Kratie (due to reduced inflow from the 3 Se basins). Hardly any erosion in the reach Pakse-Strung Treng**
- **Alluvial channels are readily erodible and bed levels may begin to fall within 20 years in the reach Vientiane-Nong Khai. Further downstream there are only local impacts downstream of bedrock controlled reaches and structures**



Sediment load decrease: consequences 2

- **Sediment concentrations and yields will remain in the next 20 years**
 - **No decrease in floodplain sedimentation in Cambodia and Vietnam**
 - **No increased coastal erosion in the Delta**
- **Bank erosion will reduce due to lower flood peaks, locally bed incision may create instability**
- **Cambodian and Delta river channels: no noticeable changes**

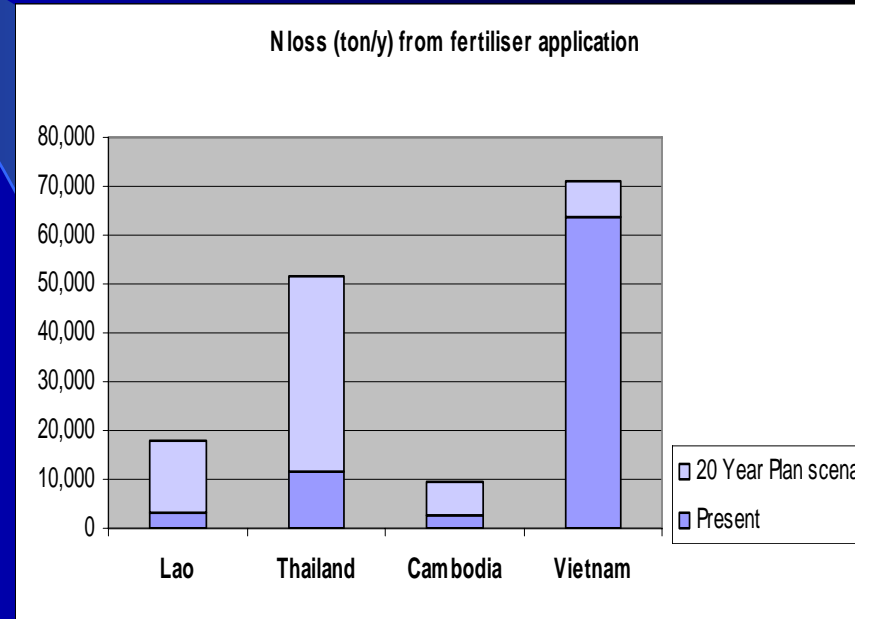


Increase in loads of agro-chemicals

Reasons:

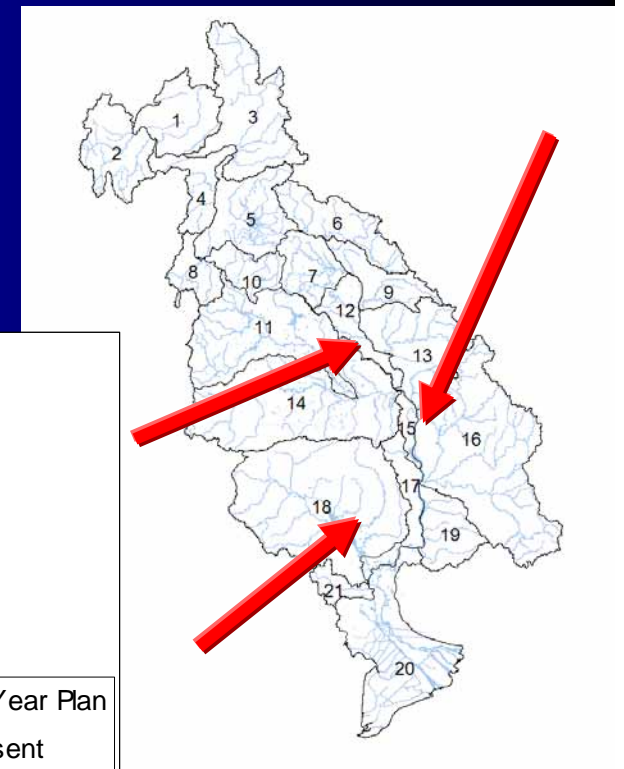
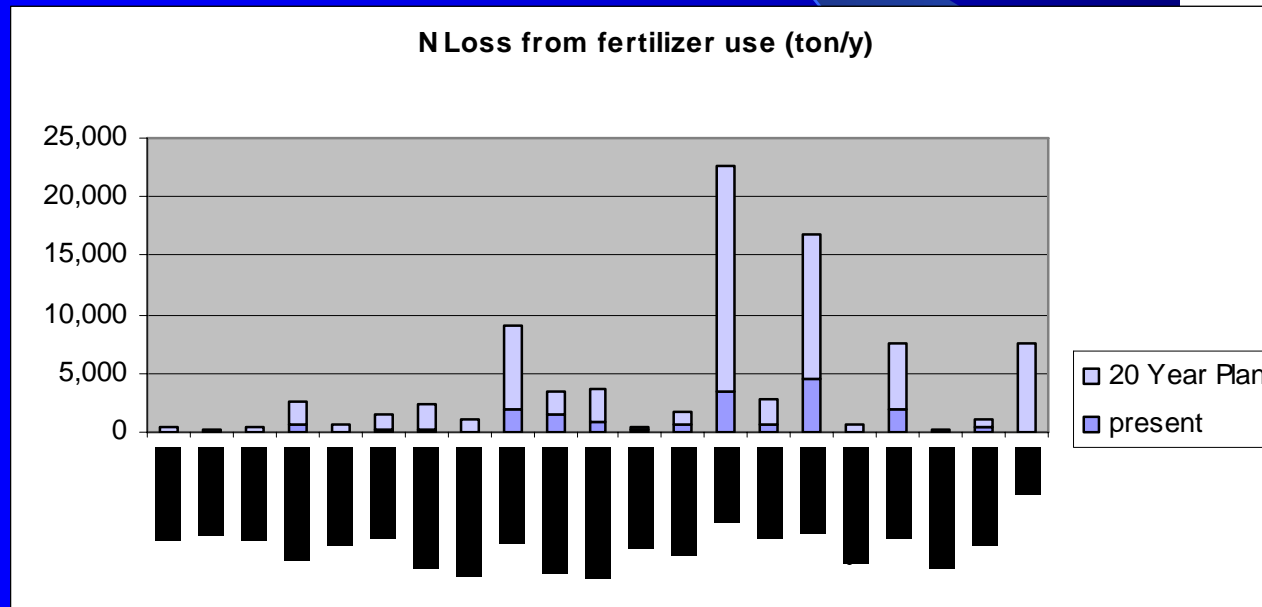
- Increase in agricultural area
- Increase in agro-chemical use

Overall loss of N and P:
increases with 300 to 500%
in Lao PDR, Thailand and
Cambodia, more or less
doubles in Vietnam



Increase in loads of agro-chemicals 2

At the sub-basin level very high increases in loads from the Mun-Chi basin, the 3 Ss basins and the Tonle Sap



Increase in loads 2

- Increase in pesticide use follows same trend as fertilizer use
- Load increase due to population growth (BOD, N and P) probably limited due to improved sanitation

Overall impacts of increased loads reduced by increased flows in the low flow period





Consequences for Water quality and ecology

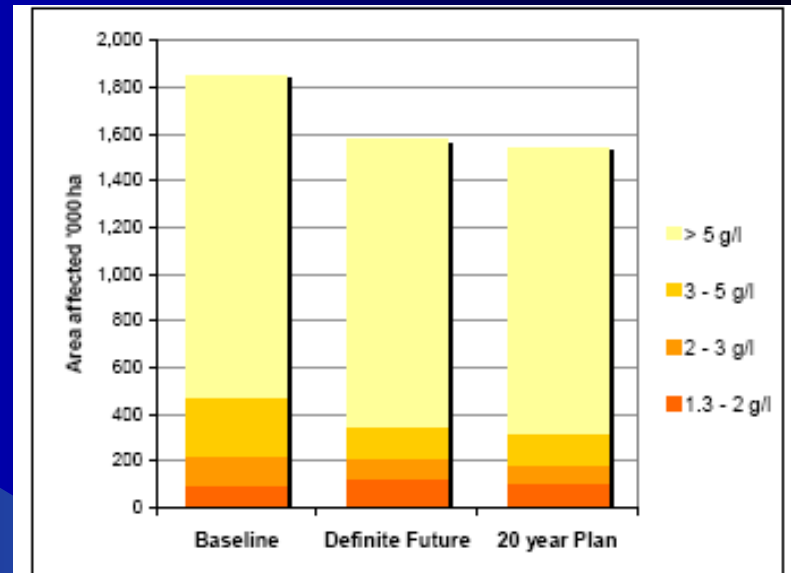
Overall increases in concentrations of N and P will probably not lead to violation of threshold values

Locally high discharges of agro-chemicals and waste water may violate standards and lead to eutrophication

Insecticide/pesticide levels at present low (below detection limit): inflow in future increases but consequences uncertain

Salinity intrusion

Decrease in area affected by saline water intrusion, again largest effect due to Definite Future scenario



Salinity intrusion concentration in Average year (1999)

	Salinity concentrations				Total area '000ha	Percent change
	1.3 - 2 g/l	2 - 3 g/l	3 - 5 g/l	> 5 g/l		
Baseline	94	129	257	1,372	1,851	0%
Definite Future	128	87	131	1,234	1,579	15%
20 year Plan	105	82	131	1,225	1,543	17%

Salinity Intrusions 2

Potential increase in rice production has been calculated by overlaying salinity maps (dry season) with summer-autumn irrigated area maps and applying a damage curve

Problem: adaptation measures (water management) not taken into account

