IUCN : World Conservation Congress
Global Synthesis Workshop on River Basin Management

Balancing the Water Uses in River Basins
How do we address the Challenge?

M.Gopalakrishnan, Secretary General, ICID

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Reaction on the Statement

- **Optimisation of River Basin Management will not lead to the improvements for the Environment?**
  - Question is framed in a tricky manner !
  - Answer is Yes if constrained optimisation is used after a fair assessment of interests unquantifiable and No if a purely mathematical solution is proposed! Indicators for Environmental attributes are to be more scientific ….?
- What we need is some quick tools for shaping future policies when river basin management is to be tackled.
- Integrate all aspects of relevance which is fairly well known in such an exercise; land, water & livelihood…

Global Challenge on Water Use

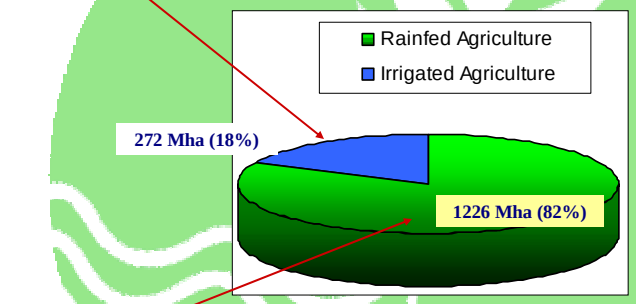
- Water for food
- Water for People
- Water for Nature

The Dialogue addresses mainly the issue of addressing the water for Food Security and Environmental Sustainability but People Sector is also important; we can factor them

WHERE IS THIS FOOD COMING FROM?

World Irrigated Area and Crop Production

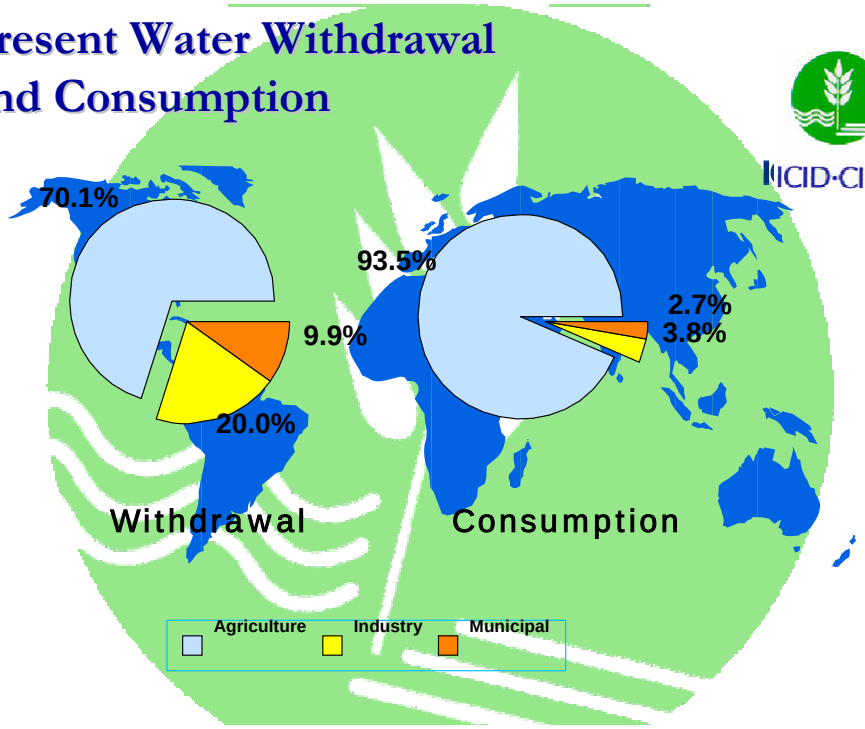
Contributes 40% Crop Production and Employs 30% of Population in Agriculture



Contributes 60% of total Crop Production and Employs 70% of Population in Agriculture

Total Arable and Permanent Cropped area of the world = 1497 Mha
Area irrigated in ICID Member Countries = 262 Mha

Present Water Withdrawal and Consumption



Challenges in the 21st Century

- Water use and energy efficiency
- Most arable land is already under cultivation
- Waterlogging and soil salinity
- Climate change
- Water scarcity
- Globalization, world food trade and agriculture subsidies
- Deterioration of water quality
- Decline of public financial allocations
- Fragmentation of management of water
- Lack of incentives in water savings & drawals - farmers

Broad areas identified by TF 2 ICID – action..

(A) ROLE OF WATER RESOURCE

(B) INTERVENTIONS FOR FOOD SECURITY

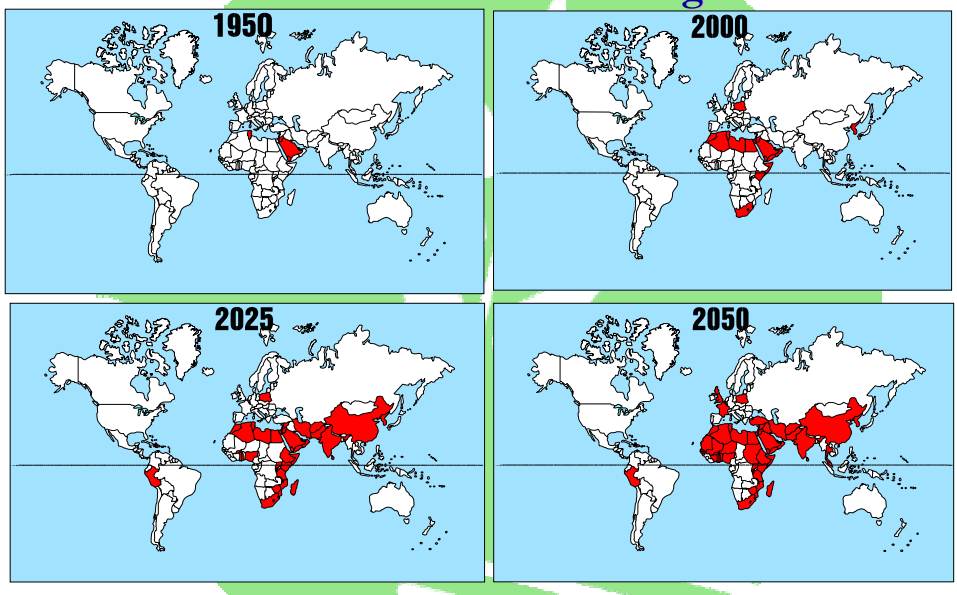
(C) COUNTRY ISSUES

(D) ROLE OF RESEARCH & DEVELOPMENT

(E) ROLE OF BIOTECHNOLOGY & GM FOODS

(F) WTO & FOOD SECURITY

Evolution of World Water Shortage in 100 Years



Food Surplus and Deficit at a glance

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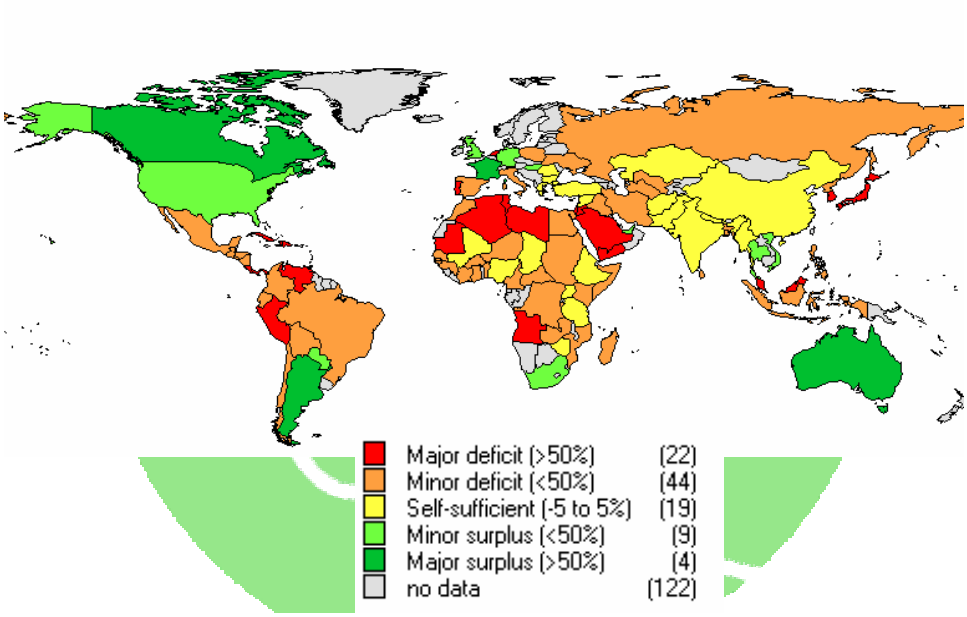
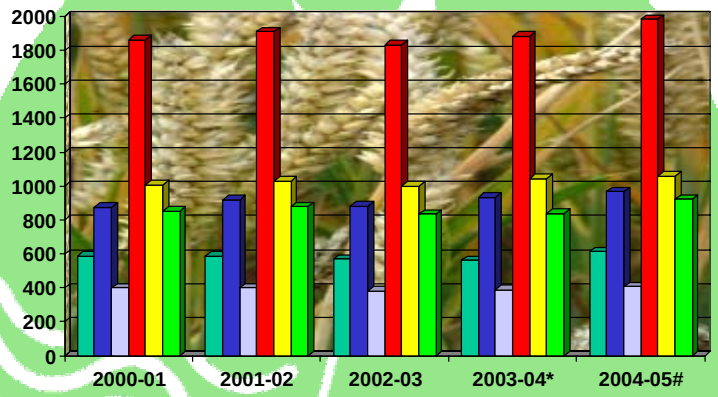
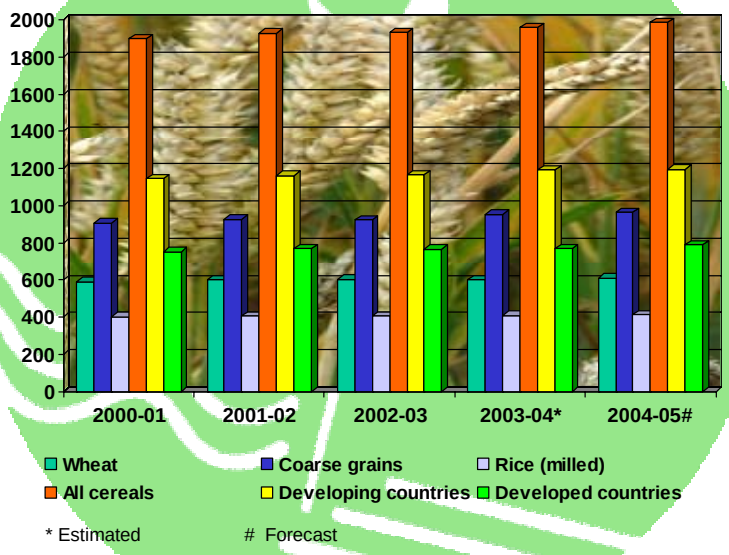


WORLD PRODUCTION TREND - RECENT



WORLD CEREAL UTILIZATION – RECENT TREND

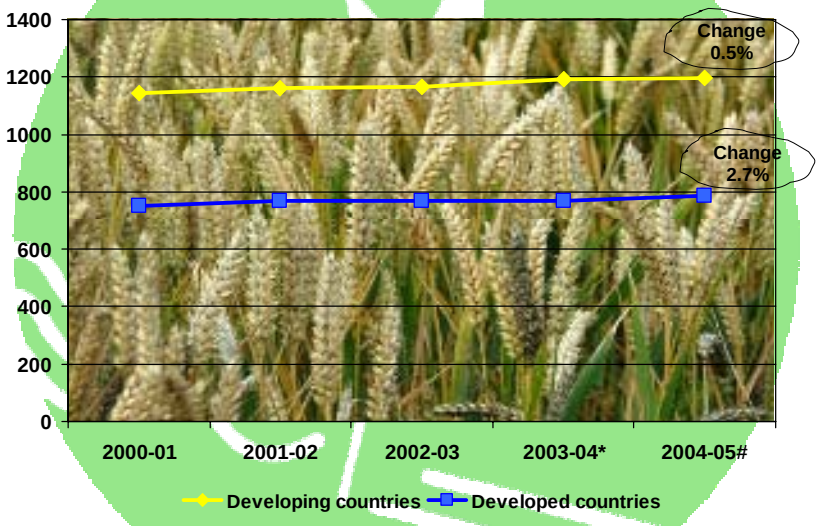


TREND IN WORLD CEREAL UTILIZATION

	2000-01	2001-02	2002-03	2003-04*	2004-05#	
Wheat	589.5	599.2	604.5	599.3	609.4	
Coarse grains	904.1	926.1	921.4	951.1	962.6	
Rice (milled)	402.9	404.5	406.1	407.1	412.5	
All cereals	1896.5	1929.8	1931.9	1957.5	1984.5	1.4%
Developing countries	1145.5	1162.7	1165.5	1190.8	1196.9	0.5%
Developed countries	751.1	767.1	766.4	766.7	787.6	2.7%

* Estimated # Forecast

WORLD TREND IN CEREAL UTILIZATION



* Estimated # Forecast

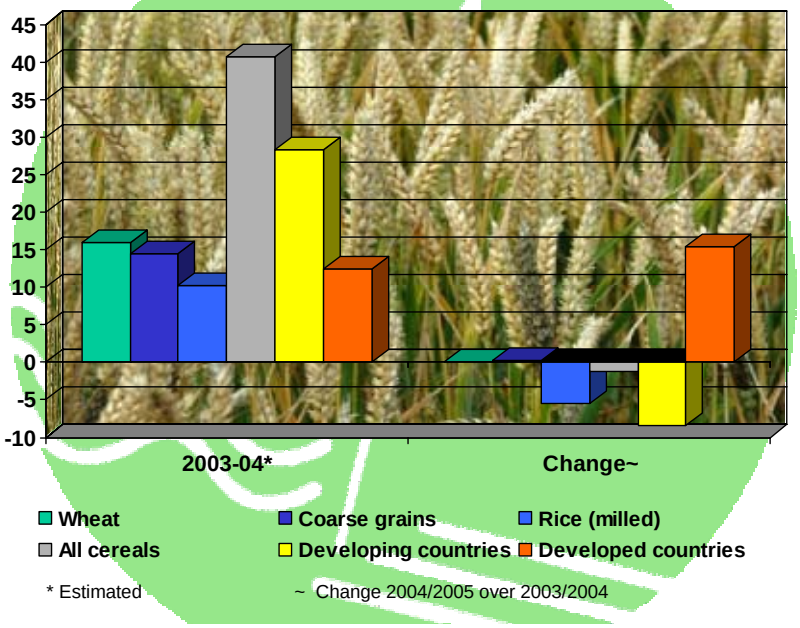
TREND IN WORLD CEREAL STOCK

	2000-01	2001-02	2002-03	2003-04*	2004-05#	Change~
Wheat	243.5	233.9	199	159.7	160	0.1%
Coarse grains	207.8	197.1	161.8	144.9	145.1	0.2%
Rice (milled)	147.9	141.5	117.5	102.7	97	-5.5%
All cereals	599.2	572.5	478.3	407.3	402.1	-1.3%
Developing countries	437.2	404.4	336.6	283.5	259.5	-8.5%
Developed countries	162	168	141.7	123.7	142.7	15.3%

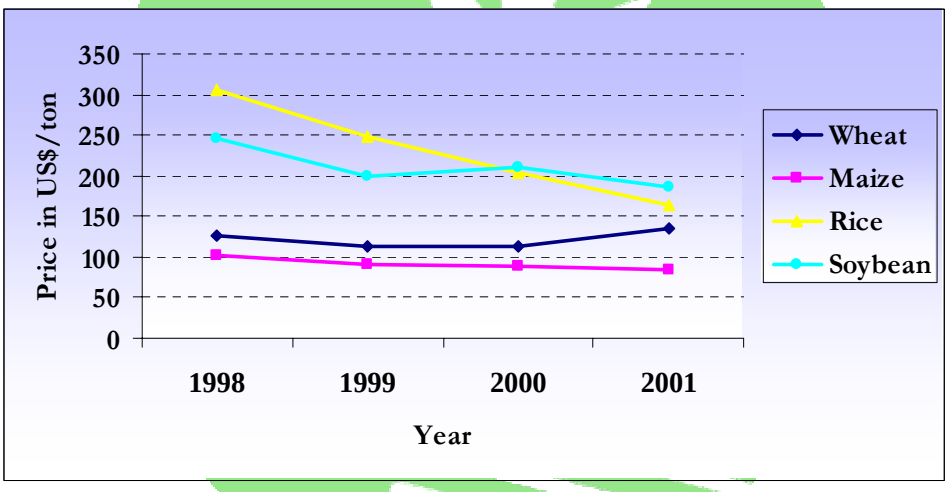
* Estimated # Forecast

~ Change 2004/2005 over 2003/2004

WORLD CEREAL STOCK



Developments in Crop Prices



ICID's BHIWA Model

Acknowledge that basically

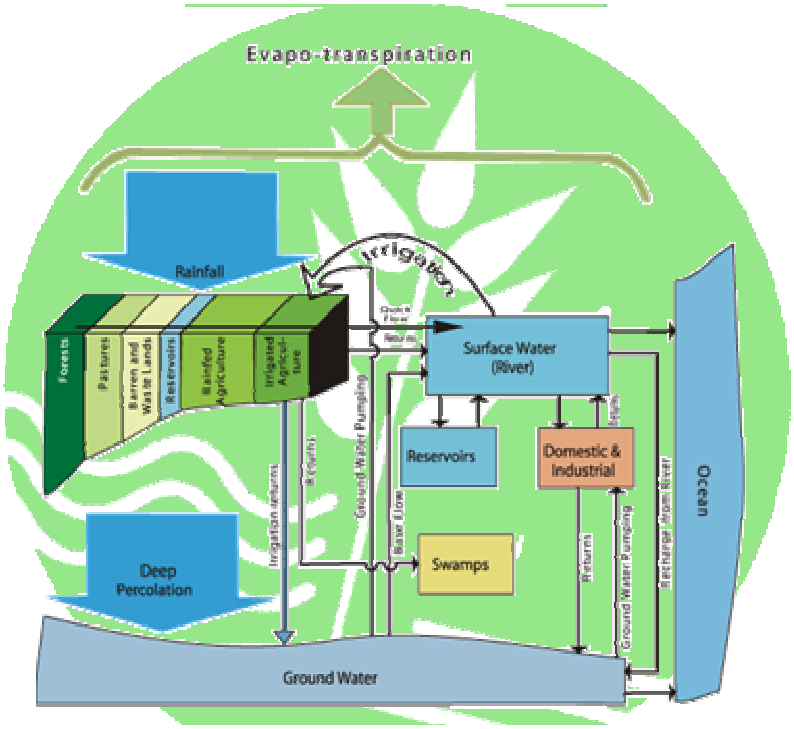
- River Basin is a better way to address the Challenges and Decision Making
- Precipitation as the main source (and not the river flow or aquifer recharge)
- capturing both land and water uses of River Basin is important; ET management is the best way to appreciate the issues
- potential development strategy through policy intervention, either for improving river flows for ecology and Scenario Development help the cause

ICID Strategies for Global Food Security

Category of Countries[1]	Food Self Sufficiency	Economic Status (GNI)	Population	Status of WRD	Governance	Strategies
Least Developed Countries	Deficient[2]	Low	High	Low	Deficient	Aid, Investment, Develop Water Resources, Improve Efficiency, Population Control
Emerging Developing Countries	Sufficient	Low and Upper Middle	High	Medium	Evolving	Investment, Develop Water Resource, Improve Efficiency, Population Control
Developed Countries	Surplus	High	Low	Adequate	Adequate	Trade-Export

1 Categories of countries arranged from Deficiency to surplus food self-sufficiency.

2 Some countries, like oil exporting West Asian countries and Japan may not be food self-sufficient but they can practice virtual water – food import, due to their high GNI and still be food secure.



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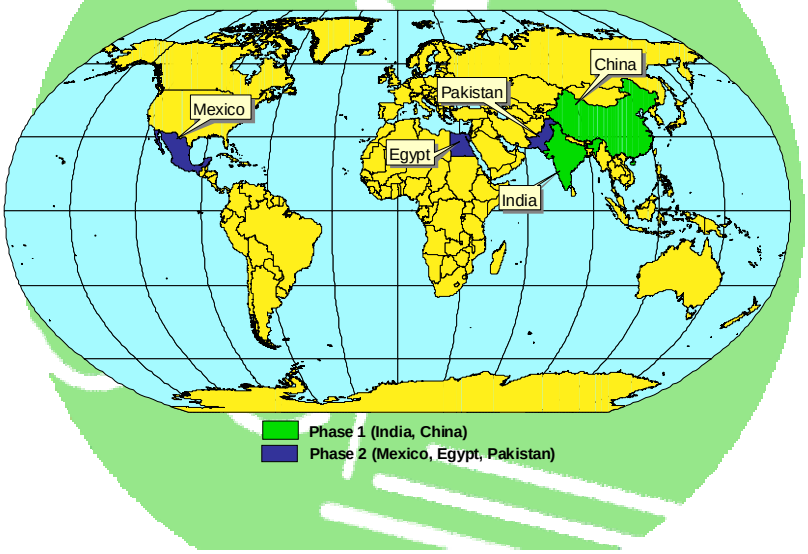
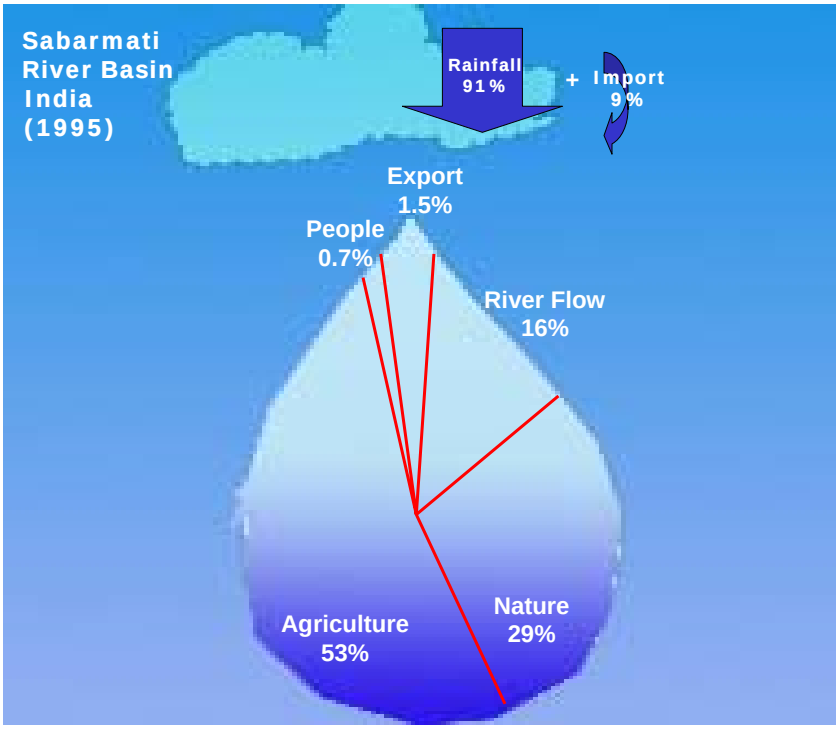
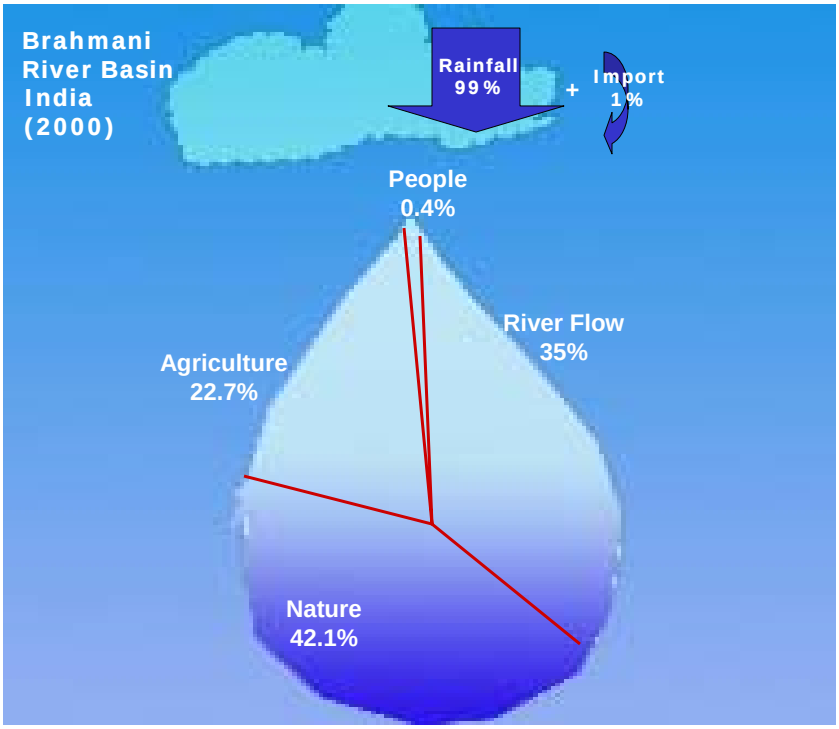
CPSP Participating Countries




Sabarmati
River Basin
India
(1995)
Rainfall
91 %
+ Import
9 %
Export
1.5%
People
0.7%
River Flow
16%
Agriculture
53%
Nature
29%


Brahmani
River Basin
India
(2000)
Rainfall
99 %
+ Import
1 %
People
0.4%
River Flow
35%
Agriculture
22.7%
Nature
42.1%

Selection of Water Stress Indicators – Relevance ?

- Large **ground water use** as in India, rise the need for indicators for both surface and G.W resources
- WSI proposed by Alcamo based on **withdrawals** out of which a substantial part may return. Multiple re-uses possibility ? How should we address it better?
- Can an absolute and overriding priority for **environmental water** requirement (Smakhtin's) work in many water deficit basins?
- ICID attempted to address the complex issue by objective modelling and the present efforts is just a beginning in this direction…. More to follow ….

Suggested Indicators

Four indicators proposed for describing state of water resources

Indicator 1: Withdrawals/total input to surface water

Indicator 2: Returns/total input to surface water

Indicator 3: Withdrawals/total recharge to ground water

Indicator 4: Returns/total recharge to ground water

Indicators 1&3- depict quantitative stress due to withdrawals

Indicators 2&4- depict hazard to water quality

Basin grouping by selected indicators

	Class description	Value of indicator	Basin	
a)	Surface withdrawals	very high stress	Indicator 1>0.8	Pennar
b)		high stress	0.4 < Indicator 1<0.8	Cauvery
c)		Moderate stress	0.2 < Indicator 1<0.4	Indus, Ganga, Subarnarekha, Mahanadi, Tapi, Sabarmati
d)	Surface water quality	low stress	Indicator 1<0.2	Brahmaputra, Godavari, Brahmani
e)		low stress	Indicator 2 < 0.05	All basins, in good
f)		moderate stress	0.05 < Indicator 2 < 0.1	Cauvery, Tapi, Sabarmati, Pennar
g)	Groundwater withdrawals	very highly stressed through withdrawals	Indicator 3>0.7	Sabarmati
h)		highly stressed through withdrawals	0.4<Indicator3<0.7	Indus, Ganga, Subarnarekha
i)		moderately stressed	0.2<Indicator3<0.4	Mahanadi, Godavari, Krishna, Pennar, Cauvery, Tapi, Narmada, Mahi
j)	Groundwater quality	under very high threat	Indicator 4>0.8	None
k)		under high threat	0.4<Indicator 4<0.8	Indus, Ganga, Subarnarekha, Krishna, Pennar, Cauvery, Sabarmati
		under moderate threat	0.2<Indicator 4<0.4	Brahmaputra, Mahanadi, Godavari, Tapi, Narmada, Mahi, Brahmani

Integrated River Basin Planning

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- Feed the world's growing population
- Improve the standard of living and environmental conditions in the rural area
- Develop and manage land and water in a sustainable way during the coming decades especially in developing countries
- Develop links between irrigation, drainage and flood protection, and
- Links of food security, rural development and livelihood ensuring environmental protection to maximum extent possible
- Implement basin wide planning for integrated development and management
- Optimisation model + dialogue should help the best for all

India Case Study -- Indicators

- Surface water resources

S. No	Basin	Total input 109m³	Total returns 109m³	Total with-drawal 109m³	Withdrawal/ Input (I1)	Returns/ Input (I2)
1	**Indus**	185	3	42	**0.23**	**0.02**
2	**Ganga**	525	19	146	**0.28**	**0.04**
3	**Brahmaputra**	633	1	12	**0.02**	**0**
4	**Subarnarekha**	12	--	4	**0.33**	**0**
5	**Mahanadi**	50	1	13	**0.26**	**0.02**
6	**Godavari**	126	3	21	**0.17**	**0.02**
7	**Krishna**	99	3	26	**0.26**	**0.03**
8	**Pennar**	7	1	7	**1**	**0.14**
9	**Cauvery**	28	2	19	**0.68**	**0.07**
10	**Tapi**	18	1	4	**0.22**	**0.06**
11	**Narmada**	51	1	7	**0.14**	**0.02**
12	**Mahi**	13	0	2	**0.15**	**0**
13	**Sabarmati**	7	0.7	2	**0.4**	**0.09**
14	**Brahmani**	17	0.6	2	**0.14**	**0.04**

India Case Study – Indicators… contd

- For Ground water resources

S. No	Basin	Total input 109m³	Total return 109m³	Total withdrawal 109m³	Withdrawal input to (ratio)	Return to input (ratio)
1	**Indus**	48	33	29	**0.6**	**0.69**
2	**Ganga**	251	115	118	**0.47**	**0.46**
3	**Brahmaputra**	33	7	2	**0.06**	**0.21**
4	**Subarnarekha**	4	3	2	**0.5**	**0.75**
5	**Mahanadi**	23	9	6	**0.26**	**0.39**
6	**Godavari**	49	15	12	**0.24**	**0.31**
7	**Krishna**	37	17	10	**0.27**	**0.46**
8	**Pennar**	9	5	2	**0.22**	**0.56**
9	**Cauvery**	22	13	8	**0.36**	**0.59**
10	**Tapi**	9	3	3	**0.33**	**0.33**
11	**Narmada**	15	4	4	**0.27**	**0.27**
12	**Mahi**	9	2	2	**0.22**	**0.22**
13	**Sabarmati**	5	2	4	**0.87**	**0.54**
14	**Brahmani**	6	1.5	1	**0.11**	**0.3**

Findings of Extrapolation

- Inferences drawn from Sabarmati assessments are of much relevance to Pennar, Cauvery, Indus, Ganga, Subarnarekha, Mahanadi and Tapi in regard to surface water
- Ground water problems of Indus, Ganga, Subarnarekha, Krishna, Pennar and Cauvery have similarity with Sabarmati
- Problems of Brahmani resulting out of the high flows and low use of ground water have similar implications for Brahmaputra and Godavari

Assessment for Qiantang basin - Main findings

- Nature sector consumes major part of the primary resource (rain water).
- Consumptive use under nature sector is expected to increase significantly in future due to the expansion of forest area. This in turn would tend to reduce reduce river flow. Part of this decrease can however be restored through better soil and water management.
- Due to abundant surface water resources almost entire irrigated agriculture including fisheries is presently dependent on surface water resources.
- Groundwater use is presently restricted to D & I sector. There exists a huge potential for groundwater development in this basin.
- Surface withdrawals constitute a small fraction of available supplies and seems to be constrained by availability of cultivable land.


Thank you!