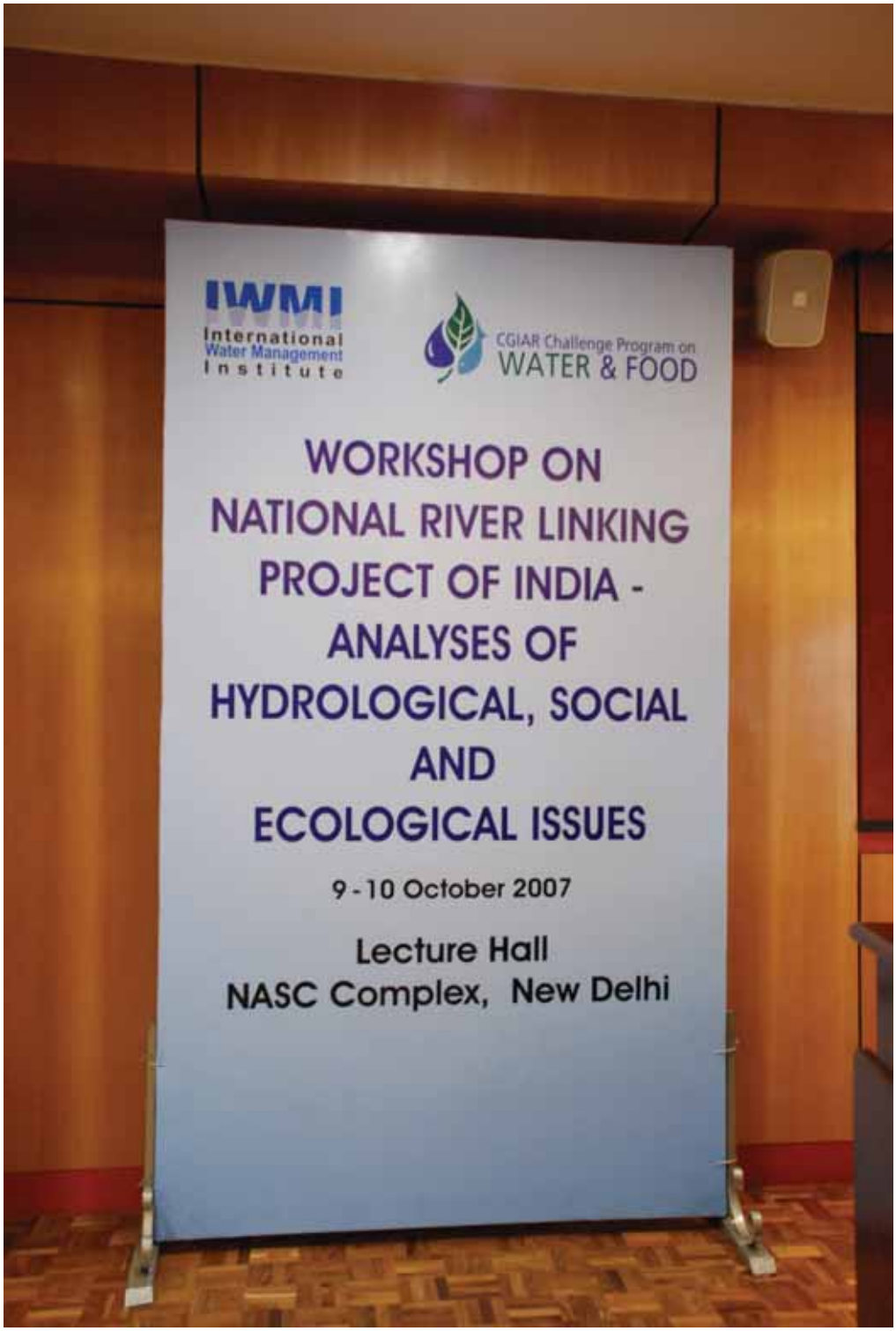
Annexes


IWMI
International
Water Management
Institute
CGIAR Challenge Program on
WATER & FOOD
WORKSHOP ON
NATIONAL RIVER LINKING
PROJECT OF INDIA -
ANALYSES OF
HYDROLOGICAL, SOCIAL
AND
ECOLOGICAL ISSUES
9 - 10 October 2007
Lecture Hall
NASC Complex, New Delhi

Dr. Madar Samad, Head IWMI South Asia, welcoming the participants.

Prof. M.S. Swaminathan, the Chairman of the Advisory Committee, delivering the key-note speech.

Mr. Suresh Prabhu, former chairman of the government task force for the River Linking Project, giving a special invitee address.

Dr. Tushaar Shah, Principal Researcher, IWMI, explaining what is encompassed in the IWMI-CPWF project 'Strategic Analysis of National River Linking Project of India'.

Dr. Tushaar Shah, making a strong point!

Dr. Peter G. McCornick, Dircetor, IWMI Asia Region, responding to questions.

Section of the participants.

Section of the participants.

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Presentation 1

National River Linking Project and Perspectives on Indian Irrigation

Perspectives from Track II Research

Tushaar Shah
Principal Researcher, IWMI, Anand, India

NRLP – Phase II

- Original Proposal

– Conduct a detailed SCBA of NRLP

– But, data scarcity is a major constraint

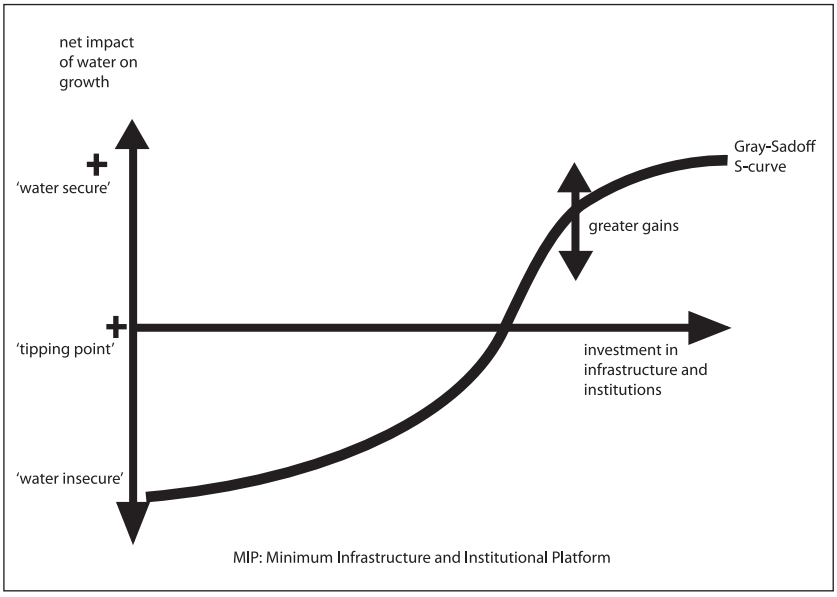
- Revised Plan – Track II Objectives

– Make a realistic assessment of past investments in public irrigation vis-à-vis IRR, food production, livelihoods, poverty;

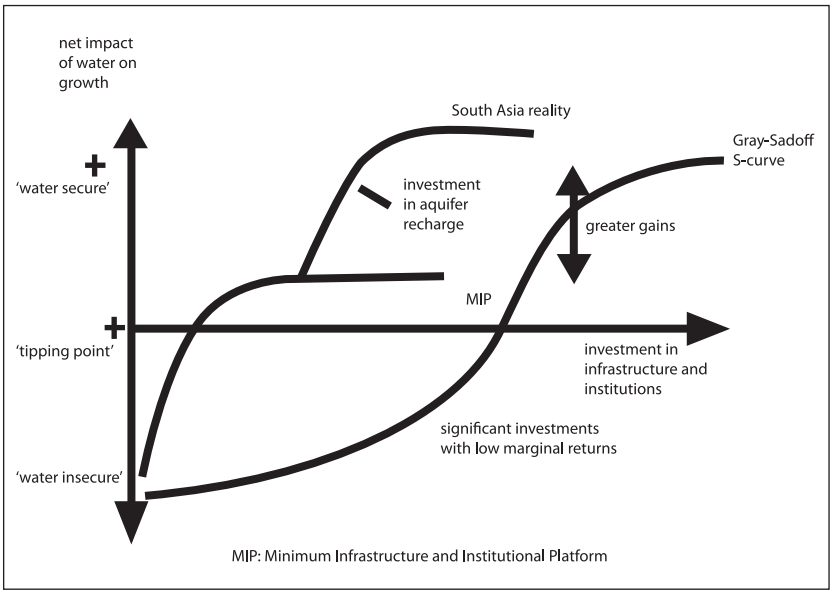
– Assess present state of Indian irrigation;

– Assess whether NRLP as an idea/concept that makes overall socioeconomic, environmental and political sense.

The dominant view about the relationship between public irrigation investments, and water security: The Gray-Sadoff Model



Reality of Indian Irrigation Circa 2000

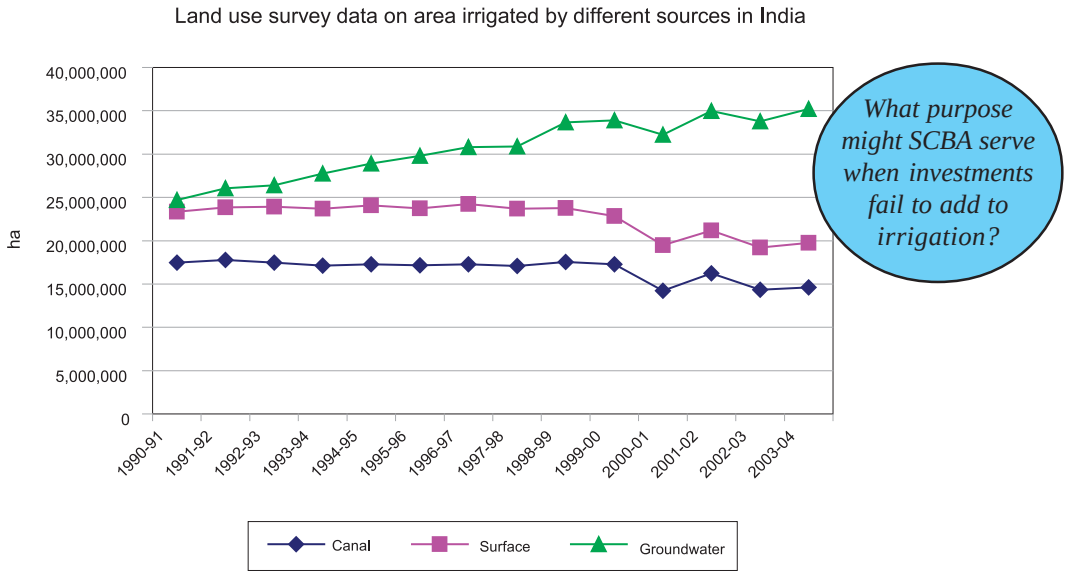


Canal commands and tank *ayacuts* are shrinking throughout South Asia

	Net irrigated area under surface irrigation (000'ha)			Net irrigated area served by groundwater (000' ha)		
	1993-4	2000-1	% change	1993-4	2000-1	% change
Key Indian states	15,633	11,035	-29.4	17,413	21,760	+25
Pakistan Punjab	4,240	3,740	-11.8	8,760	10,340	+18
Sindh	2,300	1,960	-14.8	140	200	+42.9
Bangladesh	537	480	-10.7	2,124	3,462	+63
All areas	22,709	17,215	-24.2	28,437	35,762	+25.8

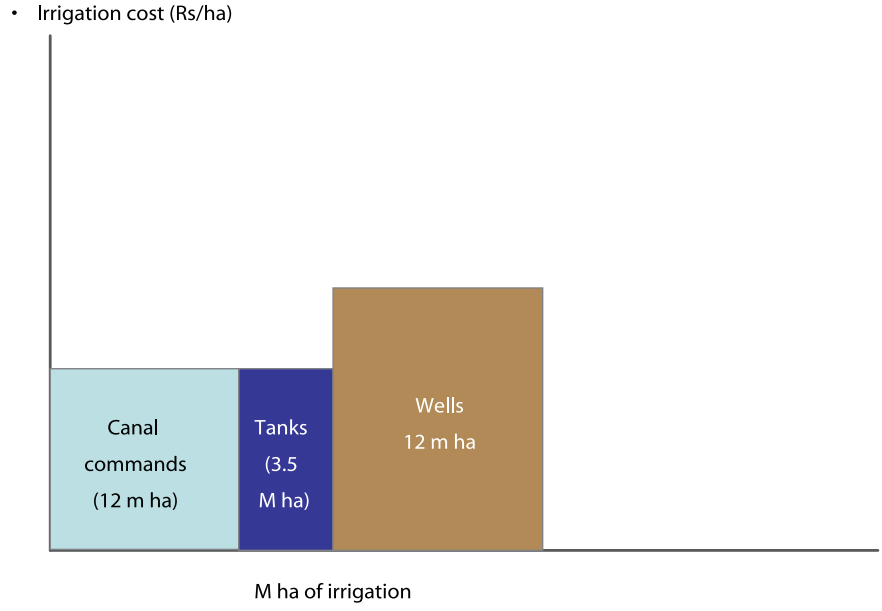
Note. India and Pakistan lost 5.5 m ha of canal irrigated areas during 1993-4 to 2000-1

Rs.100,000 crores spent since 1991, but no additional benefits. There has been no addition to Canal Irrigated areas for 14 years

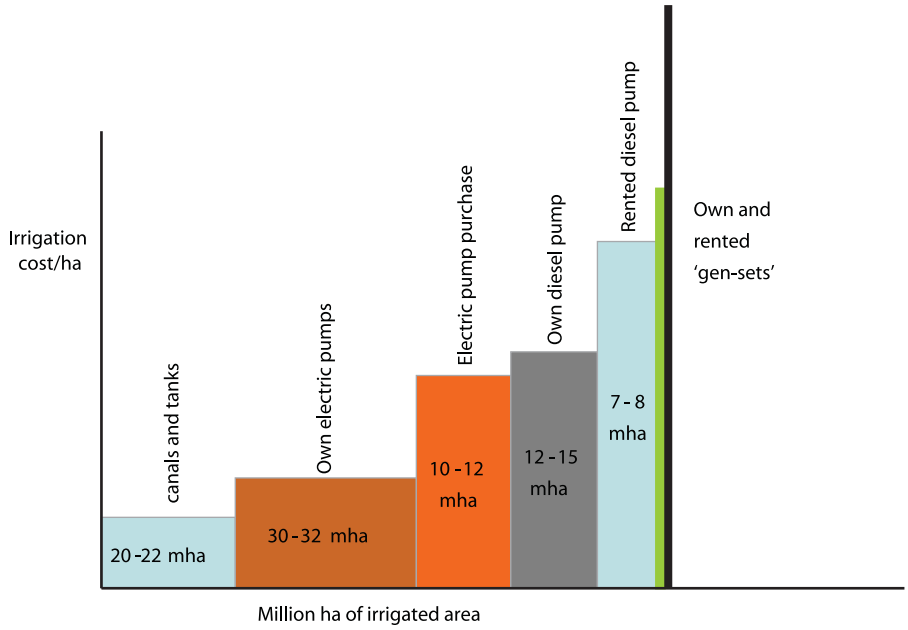


Sources: 1. CWC annual year books, various years
2. Ministry of Agriculture, agricultural statistics, various years
3. Website of Ministry of Agriculture, Government of India, http://agricoop.nic.in/Agristatistics.htm

Indian Irrigation c 1970



Classes of Irrigators in India-c2000



Key Ideas and Conclusions from Track II Research

- Post-1991, canal irrigated area has stopped responding to public investments; 99,000 crore invested has added nothing to command areas;
- The way India plans irrigation is divorced from the way Indian irrigation actually functions. The challenge of irrigation management lies in the groundwater economy;
- Declining areas under gravity flow irrigation indicate a fundamental shift in the patterns of agricultural water use in South Asia;
- Investments in large irrigation systems are questioned on environmental and social grounds—but now questions are arising on whether they generate any irrigation benefits at all;
- The real agricultural water management issues are around the energy-irrigation nexus; and little is being done on these.

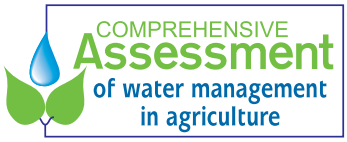
Presentation 2

Future Global Water Challenges:

Insights from the Comprehensive Assessment

Peter G. McCornick, Director, Asia
International Water Management Institute, Colombo, Sri Lanka.

STRATEGIC ANALYSIS OF INDIA'S NATIONAL RIVER LINKING PROJECT
NATIONAL WORKSHOP. OCTOBER 9-10, 2007. NEW DELHI, INDIA.



Co-Sponsors

- Critically evaluated past developments, challenges faced and solutions developed
- Enable better informed investment and management decisions in water and agriculture
- Broad multi-institutional partnership of more than 700 practitioners, researchers and policymakers

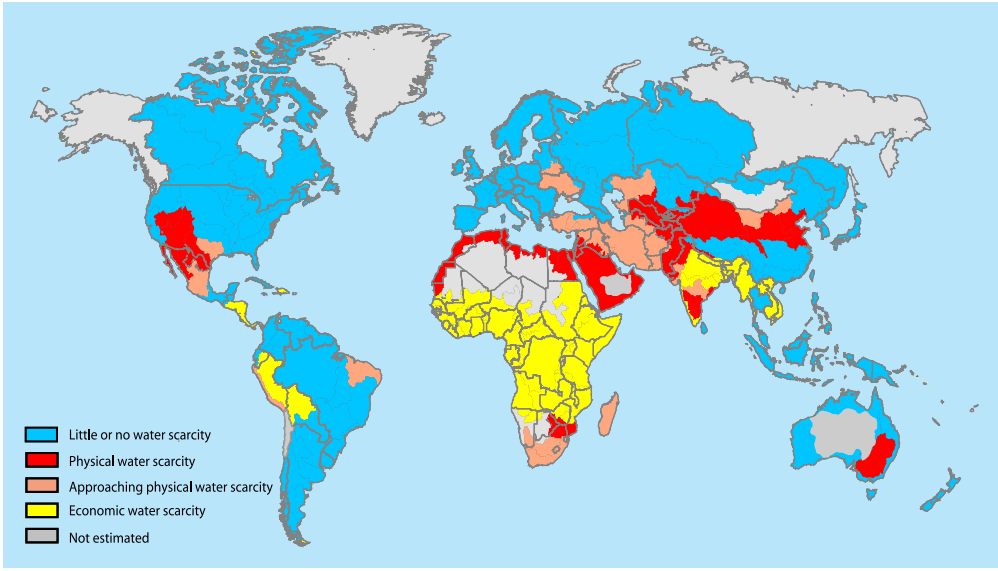
Main Assessment Book Now On-line!!

- Summary for Decision Makers
- Section 1- intro
  - Introduction
  - Conceptual Framework
- Section 2 –
  - Impacts and Challenges
  - Scenarios
- Section 3 – Cross-cutting
  - Water Productivity
  - Ecosystems
  - Policies and Institutions
  - Poverty
- Section 4 - Sectoral
  - Rain-fed
  - Irrigated
  - Groundwater
  - Low-quality Water
  - Fisheries
  - Livestock
  - Rice
  - Land
  - Basins

Will There be Enough Water to Grow Our Food?

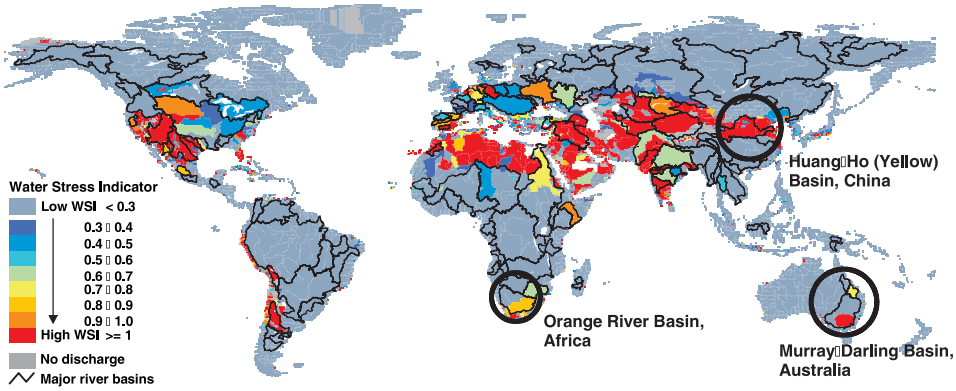
- Yes, if ...
- No, unless ...

A Third of the Population Has Already Suffered from Water Scarcity in 2000



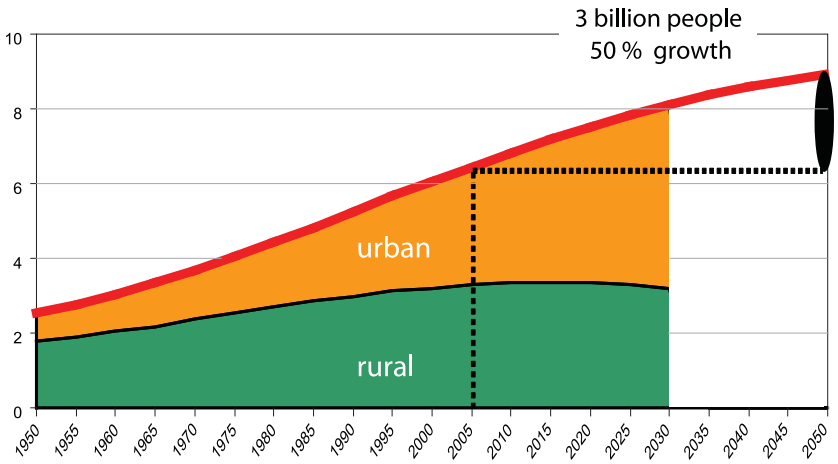
Source: *De Fraiture et al. IWMI*

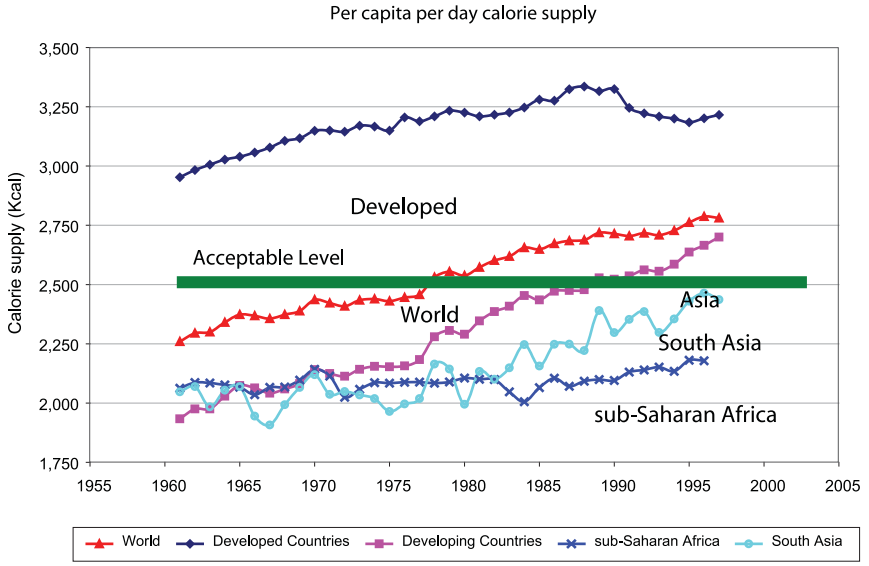
Environmental Scarcity



Source: *Smakhtin et al. 2004 International Water Resources Association*

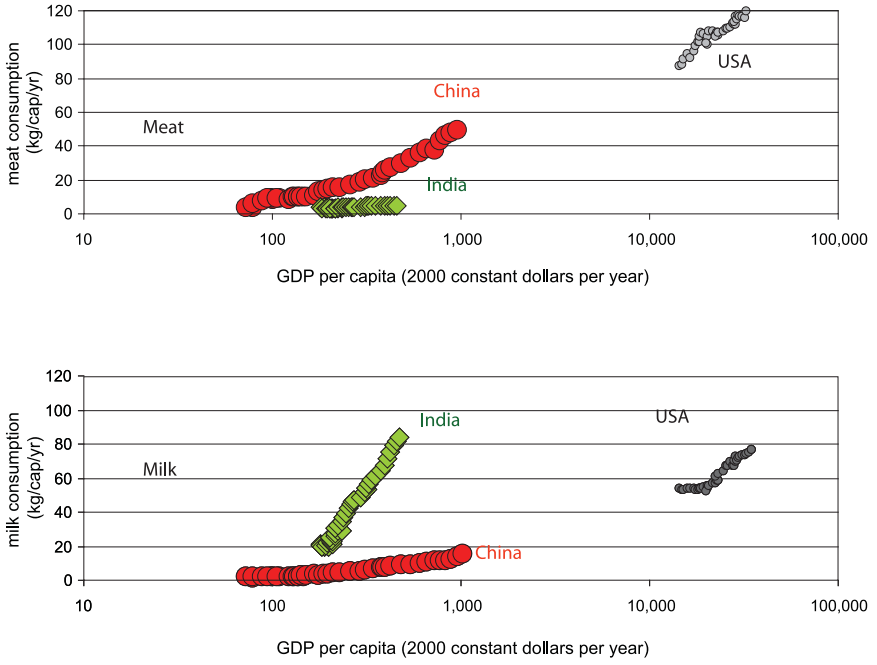
Drivers of Changing Food Demand





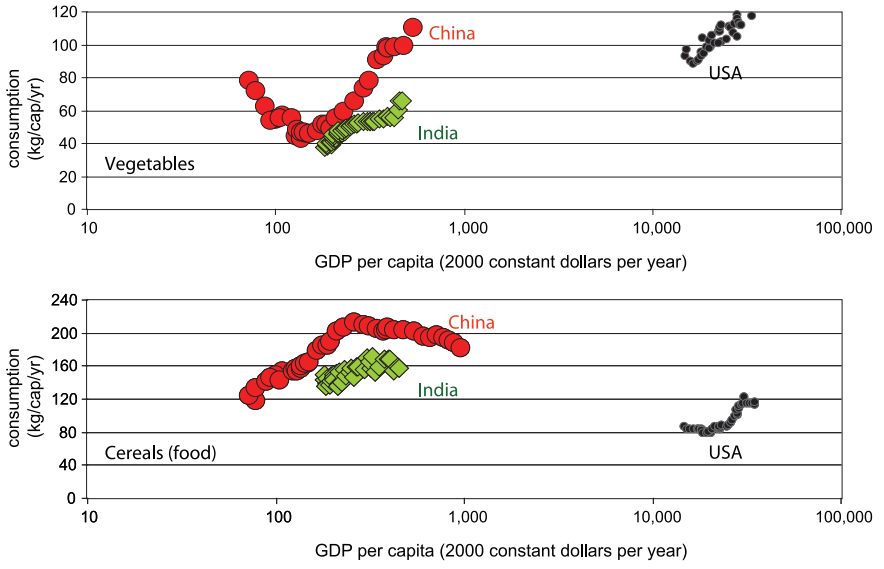
Source: FAOSTAT, 2001

Consumption and Income 1961-2000

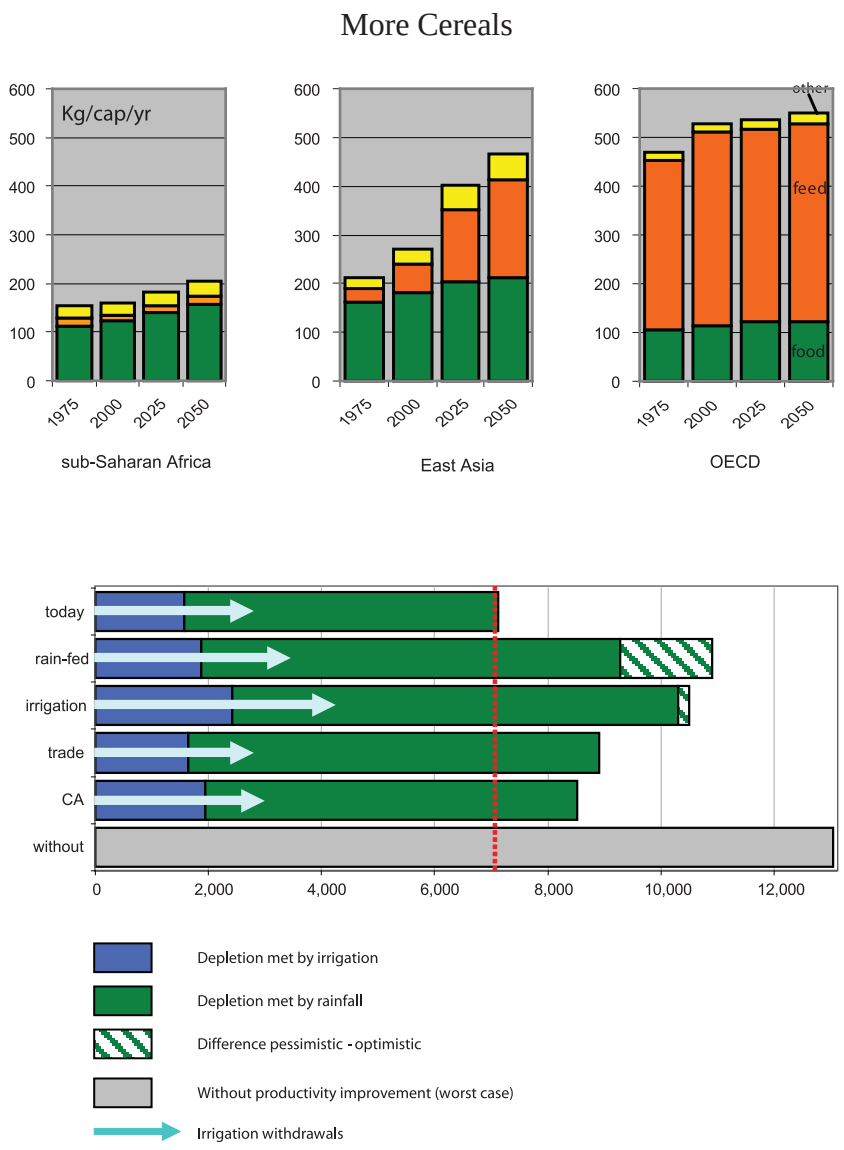


Source: De Fraiture, 2007

Consumption and Income 1961-2000



Source: De Fraiture, 2007



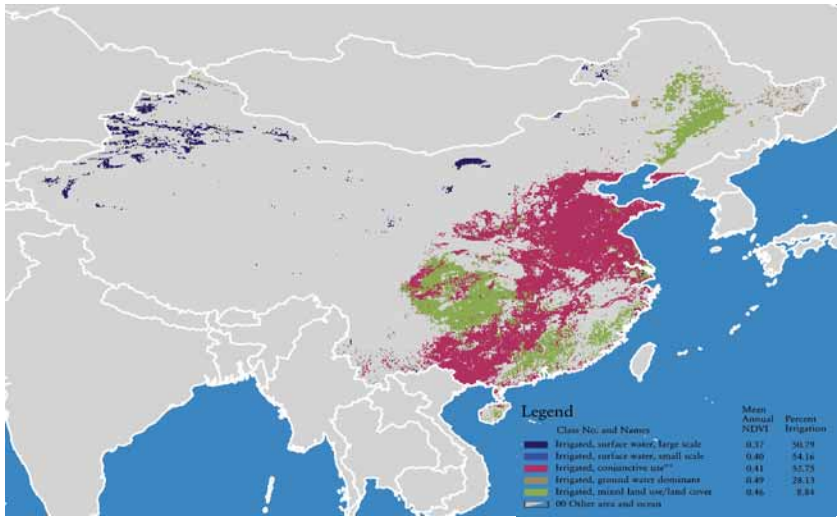
Source: WATERSIM simulations

Broad Conclusions from the CA

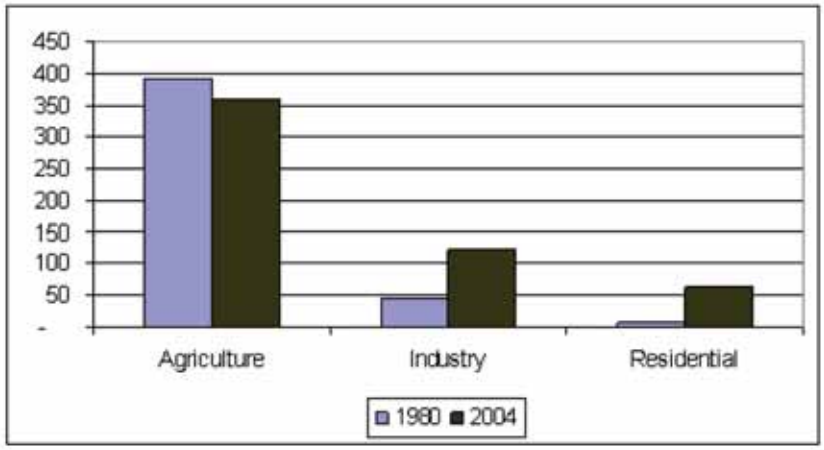
- More water is needed to grow our food, how much depends on what we do now;
- Food demand doubles by 2050, and under business-as-usual water demand will double;
- Major external drivers affecting the challenges;
- A third of the world population is already water scarce;

- Feeding the world and maintaining ecosystem services will require radical change;
- One-third of world's population live in basins which are already over-allocated, have less environmental flows and more pollution;
- New development means taking water from current users downstream.

China
Exporting and Importing "Virtual" Water

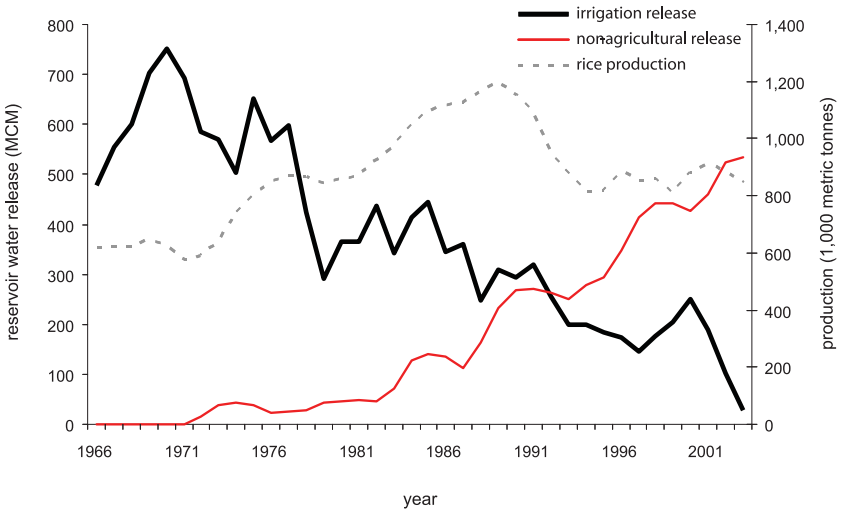


Water Use by Sector in China



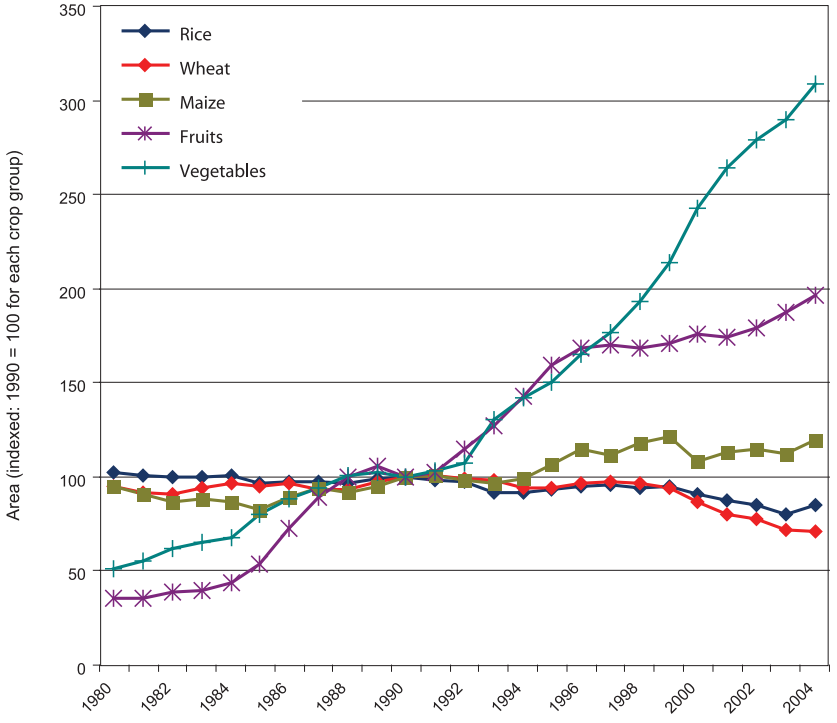
Source: Modified from Roland-Holst and Kahrl, 2007

Zhang He Irrigation System, Hubei, China



Source: IWMI, IRRI, CSIRO (L&W), Wuhan University, ZIS and LIS

Fruit and Vegetable Production Accelerating in China



Shifting to higher value crops for export and importing staple crops

Series of Issue Briefs Now being Produced

1. Reaping what we sow: Acting now to reduce the negative environmental consequences of agriculture
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8. Integrating livestock and water management to maximize benefits
9. Sustaining inland fisheries: Synergies and tradeoffs with water for agriculture
10. Managing water by managing land: Why addressing land degradation is necessary to improve water productivity and rural livelihoods

Will There be Enough Water to Grow Our Food?

– Yes, if ...
– No, unless ...

Presentation 3

What Components of NLRP will work given the Present Trends of Water Demand?

Anil D. Mohile
Former Chairman of Central Water Commission (CWC), New Delhi

The Overview of the Presentation

The Situation under which the "National Perspective Plan" of Water Transfers was Planned in late 1970s to early 1980s

- What changes have occurred, since then, in the situation?
- How do the changes affect the concept?

The detailing?

- What are the prospects of some components being implemented?
- Food insecurity;
- Largely agriculture-based economy;
- Unbalanced international trade;
- Total lack of individual initiative in water development;
- Lack of energy in rural areas;
- No serious pollution or water quality problems;
- Ecologic concerns on the backstage;
- Strong national viewpoint, regional or state viewpoints to be accommodated within; and
- More stable governments.

What Changes have Occurred, and are Occurring, since then, in the Situation?

- Changes in Indian agriculture;
- Changes in agricultural water technology and practices;
- Changes in concerns and objectives, with regard to water development;
- Changes in the world economic order;
- Changes in the Indian political order;
- Shrinking role of governments, worldwide;
- Growing concerns about climate change.

Changes in Indian Agriculture

- Agriculture remains an important, but not a leading sector of the economy;
- A recognition that the population depending on agriculture, needs to be reduced in a planned way;
- Shift in development objectives from "providing significant benefits from low investments to the 'poor' farmers," to "bringing farmers and the farm sector in the economic mainstream through large investments"
- Adjusting to the fact that 'pure' rain-fed agriculture is, and needs to vanish. All agriculture would involve sheds of irrigation.

Changes in Agricultural Water Technology and Practices

- An understanding, even at grass root level, of the essential unitary nature of the world's waters;
- A recognition that direct use of rain is also a water use;
- A definite shift from 'Integrated River Basin Management' to 'Integrated Water Resources Management'. Basins remain as important hydrologic units, but do not provide bounds to planning and management;
- An increasing recognition that agricultural water use includes the use for fish farming, animal husbandry, irrigated fodders, plantations and social forests, energy plantations etc.;
- A recognition that private groundwater use, if sustainable, has large advantages over public groundwater use and public surface water use;
- A recognition that in today's India, agricultural uses need not necessarily have a priority over other economic uses, and environment-related non-uses;
- A much wider energy availability in the rural settings;
- An unprecedented growth of private groundwater exploitation;
- In surface irrigation, a slow redundancy of the concept of command based on gravity flow.

The Changing Objectives of Water Transfers

- Equitable distribution of water remains a valid objective;
- Food security continues to be of some relevance, even under WTO regime;
- Rural poverty reduction through irrigation would be an important strategy. There are limits to urban migration and to in situ changes in rural livelihood patterns;
- Sustaining larger groundwater exploitation through a conjunctive use of surface water, and recharge, is a new objective;
- Enabling a larger industrial use and larger ecologic flows, along with increasing agricultural use, is an emerging objective.

What are the Prospects of Some Components Being Implemented?

Links	Attributes					
	International concerns	Inter-state concerns	Water for priority use	Water for severely water short areas	Important other benefits as concurrent products	Remarks
Ganga-Yamuna to Punjab? Haryana Rajasthan	Low	Medium		Yes		
Sarda-Ghagra towards west	High	Medium		Medium	Yes-Hydropower	
Gandak-Kosi to west	High	Low			Hydropower navigation and salinity control	
Bramhaputra-Ganga	Serious	Medium			Hydropower, navigation in lower Ganga	
Ganga-southern basins	Serious	Medium		Yes		
Southern tributaries of Ganaga	Low	Low		Yes		
Par-Tapi and west flowing to Mumbai	None	Low	Yes	No		
West flowing to Krishna Cauvery, and T.Nadu	None	High		Yes	Pumped storage in some	
Mahanadi Godavari to southern rivers	None	High	Yes	Yes		

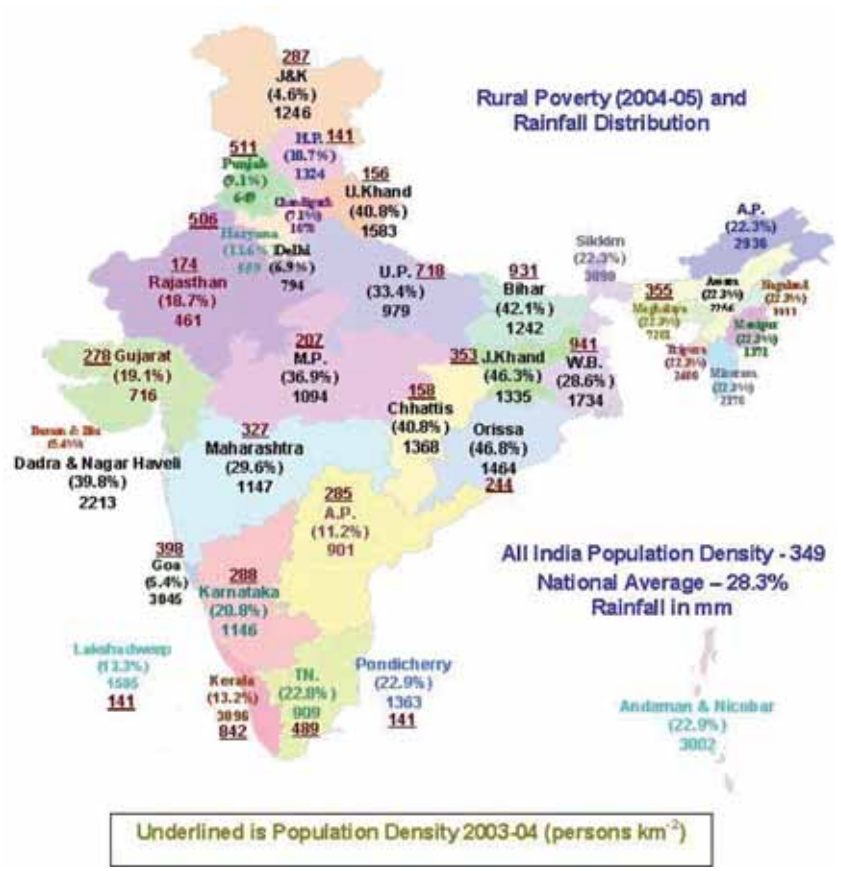
Presentation 4

Policy Directions

National Rain-fed Area Authority (NRAA)—Policy Directions

J. S. Samra, CEO
National Rain-fed Area Authority, New Delhi

- 60 % of Indian and 80 % of world agriculture is un-irrigated;
- It is risky, uncertain, complex, diverse, fragile and under invested area;
- A broad spectrum of all 34 listed crops of India are grown as compared to very narrow range of Rice-Wheat or Rice-Rice in irrigated areas;
- In India 87 % of pulses, 77 % of oil seed and 50 % of cereals are contributed by rain-fed area. Livestock rearing, agro-forestry and outsourcing of income are also important;
- Capital intensive agriculture is distress prone like Bt cotton cultivation.



The Aim

- Rainwater, soil and vegetation conservation;
- Enhancing and sustaining productivity, income and employment;
- Perspective plans, prioritization, innovative institutions, schemes or projects, emerging policies, managing risks, inputs, monitoring and evaluation etc.

Three Tiers of Elected Representatives Institutions (PRI) Policy

- Granted constitutional status to the general body of adults of (Gram Sabha) of a village or a group of hamlets- The 73rd Constitutional Amendment Acts 1993;
- This is an act of empowerment, decentralization and participatory development of villages;
- Out of 29 listed matters, 10 are related to agriculture, rainwater management and allied subjects;
- Haryali guidelines of Ministry of Rural Development proposes them to be Project Implementers (PI);
- Most of them lack capacities and technical expertise;
- 2.5 million elected representatives of all three tiers, about 10 % only get re-elected and sensitization or training is a challenge of repeated nature.

Social and Human Capital Related Policy

- Poverty, social backwardness, landless, assetless, out and in-migration is a common feature of rain-fed regions;
- US$ one billion (INR 46 billion)/ yr. Backward Region Grant Fund- untied (flexibility)- rain-fed area can access to these resources;
- The National Rural Employment Guarantee Act (2005) has become applicable to the entire country since October, 2007. Self-employment generation by creating assets is an overall aim;
- NREGA's annual budget is expected to be around US$ 6.5 billion (INR 300 billion), 80 % activities are related to managing land, water and agriculture.

Right to Information Act (RTI)

- Transparency, prevention of leakages (if any), building confidence and enlisting communities participation are essential for quality output;
- Common guidelines of watershed management, operating joint accounts, maintaining records by villagers' nominee, public display of financial status on a board etc., are important instrumentalities;
- Re-enacted Agricultural Products and Market Committees (APMC) Act is leading to demand, supply and market-driven pricing structure MSP will cover risks.

Managing Risks and Distress

- Socioeconomic specific and regionally differentiated technological package;
- Special credit of longer period for entire income range and not crop specific;
- Deferment or waiving of interest or principal or both partially or entirely should be provided in the policy;
- Weather-based insurance derivatives;
- IT-based calamity relief for objectivity and quick delivery;
- More comprehensive assessment of drought losses including perennials, drop in livestock fertility, groundwater depletion and more power consumption for extracting groundwater etc.

Responding to Impacts of Climatic Changes

- Greater demand of bio-fuels and bio-energy is likely to shift cropping and farming systems;
- International prices of vegetable oils may escalate. India imported 4.1 million tonnes of edible oil in 2006-07 with an approximate import bill of US$ 2 billion;
- High international prices will trigger crop diversification and re-allocation of re-sources;
- Re-distribution of rainfall and water supplies will further compound the cropping and farming patterns.

Migration and Outsourcing

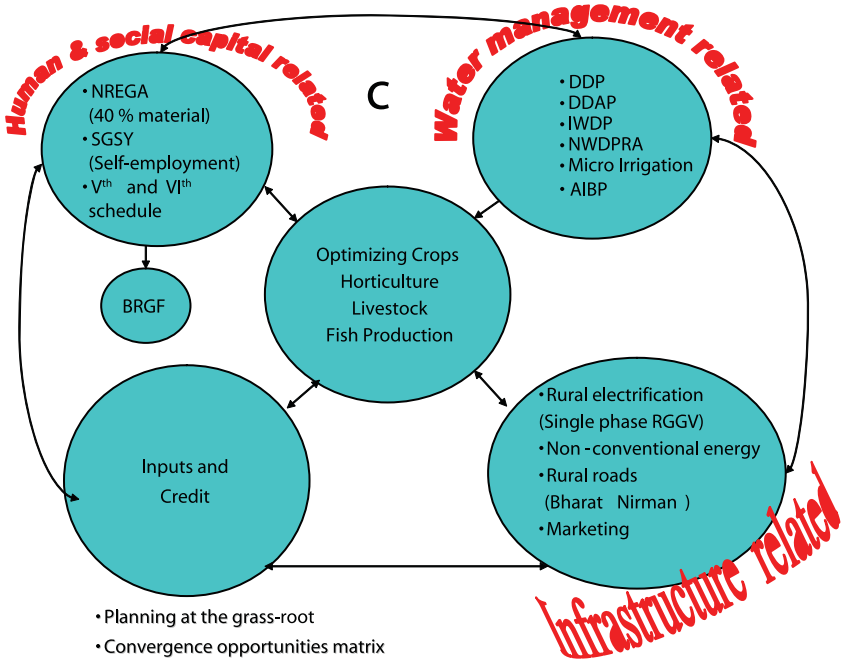
- Herders and graziers out- and in-migrate seasonally over long distances;
- Value addition by processing is not practical. They trade or sell live animals and raw primary products of wool, milk, meat etc. Negotiation of prices is restrictive.

Marketing

- There are endemic seed spices, gums, herbals and medicinal products;
- Their prices are highly volatile;
- Bulky and low-value commodities like pearlmillet (Bajra) etc., do not have much alternative uses, demands or value addition;
- Monoply purchase of cotton by the State Govt. of Maharashtra for 30 years was also one of the factors of distress;
- MSP should be determined as per input costs while procurement price should be market driven;
- Future trading by changing APMC acts;
- Local prices to be guarded against high subsidy in Europe and USA.

Benchmarking and Irrigation/Audit

- Lot of investments have gone into this sector;
- Regulatory authority set up in Maharashtra;
- Audit report is being printed after benchmarking;
- Half of the projects of Maharashtra had less than 50 % of performance;
- P I M (16 % area is covered in Maharashtra);
- Needs expansion to other states and irrigation systems.


Human & social capital related
• NREGA
(40 % material)
• SGSY
(Self-employment)
• Vth and VIth
schedule
BRGF
C
Water management related
• DDP
• DDAP
• IWDP
• NWDPRA
• Micro Irrigation
• AIBP
Optimizing Crops
Horticulture
Livestock
Fish Production
Inputs and
Credit
• Rural electrification
(Single phase RGGV)
• Non - conventional energy
• Rural roads
(Bharat Nirman)
• Marketing
Infrastructure related
• Planning at the grass-root
• Convergence opportunities matrix

Presentation 5

Sustainable Agriculture and Trade

Yojindra K. Alagh
Former Union Minister of Science and Technology, Ahamadabad, Gujarat

Issues

- 'The Agro-climatic Paradigm' in India was meant to adjust agriculture to soil, water and climate (temperature; rainfall, level and variation);
- Self-sufficiency was to give way to trade: for a region, for India;
- Trade would ease the non-renewable resource constraint, but It did not happen;
- Global Agricultural Markets are highly distorted;
- The Asian meltdown was a blow to diversification and trade in agriculture;
- Indian policies were not very agriculture-friendly in a WTO-dominated trading world;
- Hopefully the worst is behind us.

The Agro-climatic Paradigm

- Inaugurating the Indian Society of Agricultural Economics meeting at Rahuri in Dec.1998 on 'Agricultural Trade and Sustainable Development' (Y.K.Alagh, 1999), the present author spoke of "15 agro-climatic zones taking into account soil, climate and water availability…127 agro- ecological ones…"
- "There is an imperative need for conservation" (Ibid., pp.1-2)

The Global Context

- It has been argued by the present author and others that agricultural diversification in India is basically driven by domestic demand (Y.K. Alagh, Shastri Memorial Lecture, reprinted in ICAR, Agricultural Transformation in India , 1995.);
- However, international trade would also hasten the process(Y. K. Alagh, India's Agricultural Trade, Indian Economic Journal, First Dantwala, Memorial Lecture, 1999). This follows from trade theory and was welcomed (Y.K. Alagh, India's Agricultural Trade with the ESCAP Region, in U.N., Agricultural Trade in the ESCAP Region, Studies in International Trade, Vol.10, U.N. New York, 1995);
- It has been argued that the trading between agricultural agro-climatic regions were also those that had more often than not, followed sustainable land and water

development policies (Y.K. Alagh, Inaugural Address, Indian Society of Agricultural Economics, Parbhani 1998; IJAE 1999);

- There was, therefore, considerable synergy in trade, diversification and sustainable development. Economists supported the recommendations of studies like the CII-Mckinsey Report on diversification and agricultural markets.

Is Trade Water Saving?

- "Dry land horticulture, dairying products and spices are all fast growing exports.
- They are also grown in dry land areas, where water management and land development programs have succeeded.
- A typical pattern or example is to switch over from a low-yielding mono-crop cereal to a short duration high-yielding cereal, followed by a non-cereal food or non-food crop.
- Alternately it may move to fodder, to tree crops, or in some areas to horticulture." (Y.K. Alagh 1999, p.4).

1998

- In 1998, the East Asian meltdown was known to Indians, but the Government did not notice it;
- In the Dec. 1998 address to the ISAE, I argued that in 96/97 growth of agriculture trade fell to around 1 %. "In1998,the floor just fell out from agricultural trade." Growth was minus 6 % in Jan-Mar 98 and minus 16 % in Apr/Jun 98;
- I pointed out that as a minister attending the Hong Kong World Bank IMF meeting "They were all clear that that the meltdown would last. Back home none of the dream merchants would bite."(Y.K. Alagh 1999, p.2).

The Meltdown

- The East Asian slowdown led to a slowdown in the diversification of the agrarian economies of the NIEs. We developed a simple indicator of diversification namely the change in the index of livestock production in a country divided by the index of agricultural production;

- According to the World Development Indicators, the long-term annual GDP growth rate through 1997 was 7 to 8 % for Indonesia, Malaysia, Thailand and the Republic of Korea, respectively. In these countries;
  - Between 1984 to 1994, the incremental livestock to agricultural production ratio was 2.12, 2.18, 2.59 and 2.56, respectively, for these countries; and the GDP growth of these countries went down to 4.7 %, 2.9 %, 0.3 % and 4.4 %;
  - Between 1994 and 1999, incremental livestock to agricultural production ratio went down to minus 1.79, 1.01, minus 1.61 and minus 0.72; and
  - Data on vegetable and fruit production is available only for the 1990s (FAOSTAT), and the incremental vegetable to cereal production ratio is minus 1.14 in Indonesia, minus 2.58 in Malaysia, minus 0.3 in Thailand and minus 1.43 in South Korea from 1994 to 1999.
- The Indian story was different;
- At a FAO/UNDP seminar at Seoul country papers showed the price paid; A fast growing country like Vietnam saw a decline in agricultural growth, inequality and reversal of diversification. (see, Son, Que, Dieu,Trang of IAE and D Beresford 2006; also Y. Alagh 2006).

Edible Oil Import

Year	% of Import/ Production
• 1991-92	14.50
• 1992-93	21.96
• 1993-94	72.12
• 1994-95	06.27
• 1995-96	18.83
• 1996-97	22.94
• 1997-98	25.11
• 1998-99	44.59
• 1999-2000	84.71
• 2000-01	90.49
• 2001-02	75.02
• 2002-03	95.08

Tarrifs

Name of items 04 applied	Rate of Tariff	Bound Rate of Tariff
• Soybean Oil (crude)	45 %	45 %
• Soybean Oil (refined)	45 %	45 %
• Crude Palm Oil	65 %	300 %
• RBD Palmolien and Refined Palm Oil	75 %	300 %
• Rapeseed / Mustard Oil (crude)	75 %	75 %
• Rapeseed / Mustard Oil (refined)	75 %	75 %
• Sunflower and Safflower Oil (crude)	75 %	300 %
• Sunflower and Safflower Oil (refined)	85 %	300 %
• Other Edible Oils including Coconut Oil (crude)	75 %	300 %
• Other Edible Oils including Coconut Oil (refined)	85 %	300 %
• Oilseeds	30 %	100 %

Cotton Imports/Exports

Year	Production	Import	Export	Availability*	% of Import to Availability	% of Import to Production
1990-91	1,672.80	0.00	497.14	1,175.66	0.00	0.00
1991-92	1,650.70	0.00	160.34	1,490.36	0.00	0.00
1992-93	1,938.00	138.13	63.74	2,012.39	6.86	7.13
1993-94	1,825.80	3.82	312.56	1,517.06	0.25	0.21
1994-95	2,021.30	80.80	70.75	2,031.35	3.98	4.00
1995-96	2,186.20	69.62	33.28	2,222.54	3.13	3.18
1996-97	2,419.10	2.92	269.58	2,152.44	0.14	0.12
1997-98	1,844.50	9.97	157.53	1,696.94	0.59	0.54
1998-99	2,089.30	57.40	41.96	2,104.74	2.73	2.75
1999-2000	1,960.10	237.40	15.91	2,181.59	10.88	12.11
2000-01	1,618.40	212.36	29.7	1,801.06	11.79	13.12
2001-02	1,700.00	387.04	8.23	2,078.81	18.62	22.77
2002-03	1,482.40	233.85	10.8	1,705.45	13.71	15.78

Sugar

- There are a number of years in the 1990s when sugar imports were around a million tonnes or more; 94/95,98/99.99/00 (MOA 2004, p.1,480);
- The Nerlovian nature of the sugarcane economy is known (APC, 82 Report);
- High imports exaggerated the cane cycle. Tariffs, earlier low are now at 60 % +.

Indian Biases?

- "We report less disprotection of Indian agriculture in the 1990s than in earlier studies." (See K. Mullen, D.Orden and A.Gulati, IFFPRI 2005);
- The context is going to be difficult for India. It has to be recognized that;
    1. India does not discriminate against agriculture as much as it did in the past;
    2. In the case of rice and wheat a new playing field is there;
    3. India subsidizes agriculture. Indian subsidies will be up for discussion in the next round. Its reform process will have to be WTO compatible.

A Kafkaesque World

- In fact, while India was importing low-water consuming crops like cotton and oilseeds, it was exporting high-water using crops like rice and sugarcane, and in the first half of the this decade its grain exports were high;
- No one could complain, because their subsidies were much higher;
- It's an amazingly distorted world.

Counterfactuals

- The percentage of import of edible oils to domestic production was 95 % in 2002-03. Natural cycle of 18 months in case of sugarcane crop, for instance, has been distorted by imports of sugar during the second half of the decade of 1990s. Cotton imports of a sixth to a fifth of demand are seldom seen as a problem;
- Counterfactuals (Alagh 2005) have shown that achievable targets in instruments like tarrifs, taxes, reduced effective interest rates and better marketing support can be integrated with pricing recommendations, which are alternates with MSP

increases. These should become the standard practice. This integration would be market-friendly and WTO-compatible in the sense that it would not show in AMS calculations and would serve the purpose of policy;

- A roadmap for principal crops not based on historical costs but opportunity costs at the margin will have to be developed so that technological progress and India's competitive advantage such as bright sunshine and cheap labor are given a free reign to play The farmer must be given incentives of a pricing and non-pricing nature to internalize costs of transition for a well defined and limited period. Higher level policies of support have to be implemented to meet the costs of a competitive agriculture in the medium term of 3 to 5 years.

Regional Aspects

- Since the early 1990s, economic policy in India has neither the intention, nor the werewithal to determine or significantly influence sectoral and regional aspects of economic development. The Structural Adjustment Program in 1992, was on the explicit basis that the purpose of economic policies would be to replace quantitative interventions with fiscal and financial policies. Also tax and tariff rates were to be reduced in level and spread. Regional and sectoral selectivity like special concessions or exemptions were, therefore, to be rationalized. The objective would be to raise the aggregate growth rate, remove hindrances to business enterprises and expect the benign role of the market to also trigger growth in backward regions;

- In the 1990s there was higher growth in crops, which grew in the rain-fed regions as the former 'Green Revolution States' showed growth fatigue. But overall growth in agriculture fell. Hence, in spite of comparatively faster growth in rice as compared to wheat and as compared to earlier periods, the poorer regions did not do very well. This was accentuated by a distinct anti-grain bias in economic and technology policy that hurt the growth prospects of the predominantly poor rice growing regions. Also oilseeds, the main crop into which farmers diversified in these regions, suffered on account of large imports with low tariffs. Successful diversification into oilseeds in the 1980s in backward regions, particularly in the Central and Eastern region suffered. Raw cotton is not a big crop in the East, but it is in Central India, and large imports again led to shrinkage in area in the dry poor areas of the Deccan.

Policy Needed

- IWMI may consider a work program of delay of WTO agreements on sustainability issues in large water-scarce countries like China and India;

- There is an urgency about this since, the agricultural slump is over and conditions are perking up;

- A Monitoring and Early Warning Mechanism may be a beginning.

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Presentation 6

Groundwater Irrigation in India

Future Directions and Policy Issues

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Central Groundwater Development Board, New Delhi

Groundwater Irrigation

Facts

- Over the past 50 years, expansion of groundwater irrigation globally has played a lead role in food security;
- More reliable water delivery and declining extraction costs due to advances in technology and, in many instances, government subsidies for power and pump installation encourages private investment in groundwater irrigation.

Global Scenario

- Among the major countries, India has over 50 % of its area irrigated from groundwater, followed by the USA (43 %), China (27 %) and Pakistan (25 %);
- According to a report of the World Commission for Water, aquifers are being mined at an unprecedented rate;
- About 10 % of the world's agricultural food production depends on using mined groundwater. However, this should not be encouraged.

Indian Scenario

- In India, the area irrigated by groundwater rose from nearly 6.5 Mha in 1950 to around 70 Mha at present;
- Development of groundwater to meet irrigation requirements has led to the over-exploitation of groundwater resources in many areas where water tables have been falling at an alarming rate—often one to three meters a year;
- One of the world's major grain producing areas ('breadbaskets') i.e., Punjab is now suffering from groundwater scarcity;
- The unreliable power supplies combined with weak management of groundwater resources greatly constrained the growth of irrigated agriculture;
- Excess use of pumps for irrigation, domestic and industrial use is degrading ground-water resources;
- The point has been reached in some areas that the overexploitation is posing a major threat to the environment, health and food security.

Groundwater Availability:

vis-a-vis Utilization

- The occurrence and distribution of groundwater in space and time is highly variable due to the diversified hydrogeologic conditions;
- Broadly two group of water bearing rock formations have been identified depending on characteristically different hydraulics properties, viz:
  - i. Porous formations, which can be further classified into unconsolidated and semi-consolidated formations having primary porosity; and
  - ii. Fissured formations or Consolidated formations, which have mostly secondary or derived porosity.

Estimation of Groundwater (GW) Resources

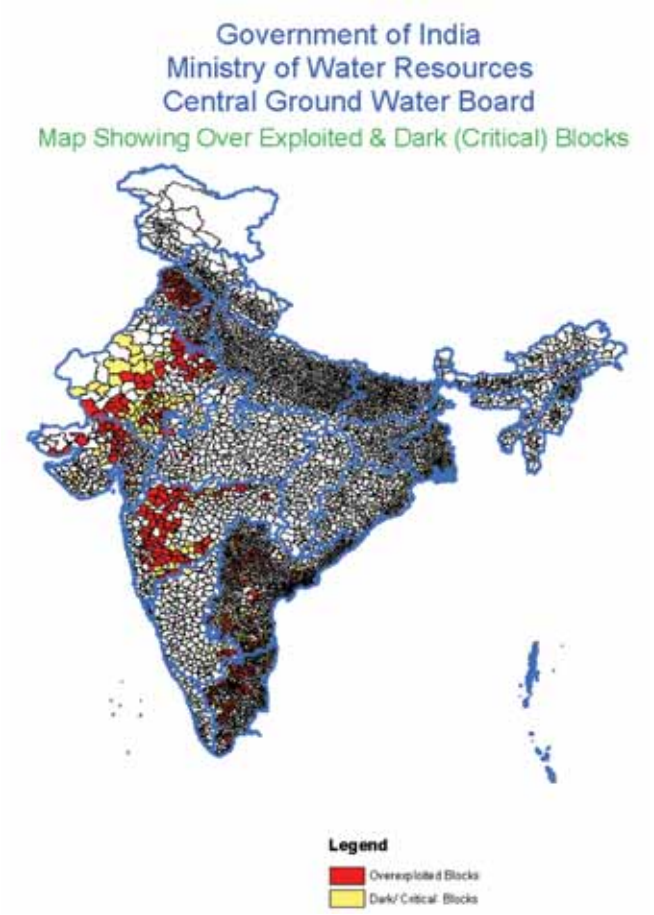
- Replenishable GW resources estimated jointly with the State Depts. and NABARD as per GEC 1997 norms:
- Present estimation of GW Resources (as on March, 2004)
  - Total Annually Replenishable GW Resource – 433 bcm
  - Net Annual GW Availability – 399 bcm
  - Net Annual GW Draft – 231 bcm
  - Out of which 92 % draft is for irrigation
- In-storage GW Resources (below zone of fluctuation) – 10,800 bcm

GW Development Scenario

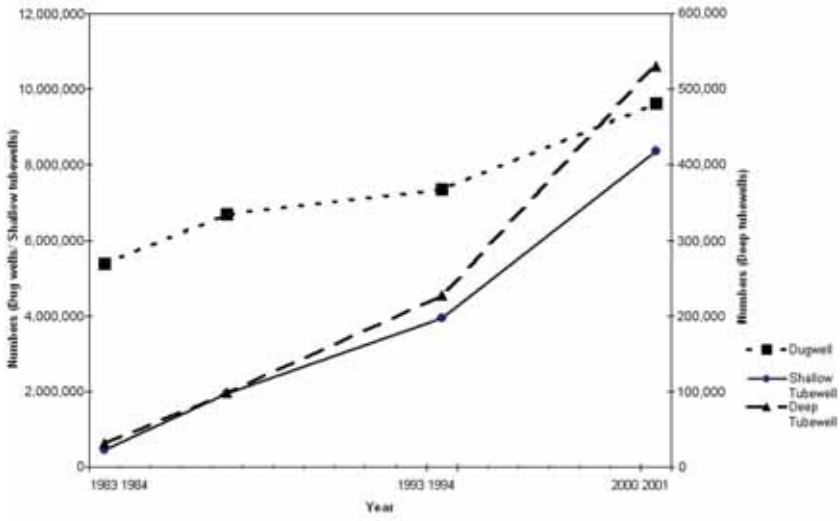
- Delhi, Haryana, Punjab, Rajasthan, Gujarat, Tamil Nadu

Groundwater Development Scenario

- Total Assessment Units (Blocks / Mandals/ Talukas) – 5,723
- Overexploited Units – 839
- Critical Units - 226
- Semi-critical Units – 550
- Safe Units – 4,078

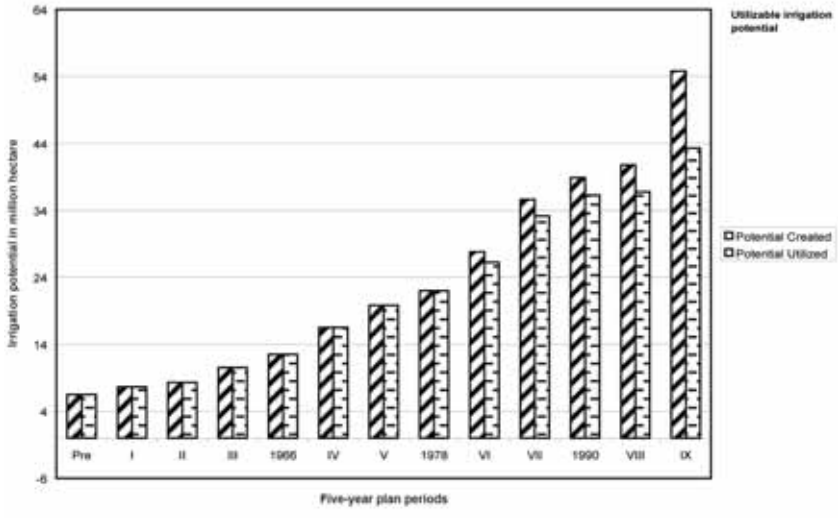


Growth of Groundwater Abstraction Structures in India



Source: Minor Irrigation Census, 2001

Irrigation Potential Created/ Utilized through Groundwater in the Country over Plan Periods



Source: Ministry of Water Resources website

Future Strategies:

Management Options

Groundwater Development in Alluvial Plains of Eastern and North-Eastern India

- Scientific studies have proven that ample reserve of groundwater is available in the areas underlain by Indo-Gangetic and Brahmaputra alluvial plains in the Eastern and North-Eastern parts of the country;
- One of the management measures could be to adopt the concept of ***Virtual Water.***

Groundwater Development in Flood Plain Aquifers

- Flood plains of rivers are normally good repositories of groundwater and offers excellent scope for development of groundwater;
- A planned management of water resource in these tracts can capture the surplus monsoon runoff, which otherwise goes waste;
- The strategy involves controlled withdrawal of groundwater from the flood plains during non-monsoon season to create additional space in the unsaturated zone for subsequent recharge/infiltration during rainy season.

Groundwater Development in Coastal Areas

- Many parts of the coastal areas of India have thick deposits of sediments ranging in age from Pleistocene to recent, which have given rise to multi-aquifer systems of good potential;
- However, development of groundwater from such aquifers needs to be done with caution, and care should be taken to ensure that overexploitation of resources does not lead to saline water intrusion.

Groundwater Development from Deep Aquifers

- The stage of groundwater development is rather high in the States of Haryana, Punjab and Rajasthan, and a large number of overexploited and critical assessment units are found in these states;
- Studies by CGWB in the Indo-Gangetic Basin in Punjab, Haryana, Uttar Pradesh, Bihar and West Bengal have revealed the existence of deep-seated aquifers storing voluminous quantity of groundwater.

Groundwater Development in Hard Rock Areas

- The hard rock areas are characterized by considerable heterogeneity and anisotropy and the aquifers are normally discontinuous and of limited groundwater potential;
- In spite of their limited potential, these aquifers play an important role in meeting the drinking, agricultural and industrial needs in the peninsular shield areas of the country.

Groundwater Development in Waterlogged Areas

- Surface and groundwater should be viewed as an integrated resource and should be developed conjunctively in a coordinated manner and their use should be envisaged right from the project planning stage.

Rainwater Harvesting and Artificial Recharge to Groundwater

- Rainwater harvesting and artificial recharge are effective methods for augmenting groundwater resources and for arresting/reversing the declining trends of groundwater levels.

Regulation of Groundwater Development

- Groundwater regulatory measure is an effective mechanism to check overexploitation of groundwater under extreme situations;
- Regulatory measures in India are implemented both at the Central and State level;
- The Central Groundwater Authority, constituted under Environment (Protection) Act of 1986 is playing a key role in regulation and control of groundwater development in the country;
- Ministry of Water Resources has prepared and circulated a Model Bill to all States and Union Territories in 1970, which was re-circulated in 1992, 1996 and 2005 for adoption.

Water Saving Measures

- Water saving practices like adoption of micro irrigation, sprinklers and drip systems can save a substantial quantity of water;
- Less water intensive crops , sharing of water and rotational operation of tubewells can provide viable solutions for balancing agro-economics with environmental equilibrium;
- Cultivation of salt-tolerant crops in areas underlain by brackish/saline water with mixing can be a viable solution.

Policy Issues

The Country Faces A Paradoxical Situation With

- Overexploited areas resulting in decline in groundwater level while;
- vast areas with sub optimal development.

The Policy Issues Should Include

- Implementation of effective regulation/ augmentation measures in groundwater stress areas with priority in OE/critical assessment units;
- Implementation of exhaustive groundwater development plans in areas having low stage of groundwater development.

Energization and Pricing Policy in the Irrigation Sector

- The overall pricing structure in groundwater irrigation is mainly dependant on power tariff;
- An economically as well as environmentally viable pricing policy in this sector needs to be evolved at the earliest.

Ownership and Sectoral Allocation of Groundwater

- A judicious mechanism in this regard is required to be developed at an early date;
- Various steps have been taken by the MOWR to address the issue of ownership and sectoral allocation;
- The expert committee report of the planning commission in this regard. has been submitted recently.

Challenges

- The increasing dependence on groundwater necessitated a reorientation of the strategies of groundwater management to ensure its long-term sustainability;
- The emphasis on management does not imply that groundwater resources in India are fully developed;
- Focus on development activities must now be balanced by management mechanisms for sustainability;
- The power tariffs need to be revised keeping socioeconomic considerations;
- The time has come, that we must realize the dependency on groundwater for our varying requirements and take necessary steps to avert the crisis.

Presentation 7

Restoration of Livelihoods of Involuntarily Displaced Communities:

Perspectives from Ujjani and Sardar Sarovar Projects

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The Problem

Due to deficiencies in the resettlement and rehabilitation process a significant number of displaced families are more impoverished than before displacement.

Key Question

Why is resettlement and rehabilitation (R&R) of involuntarily displaced population continues to be a difficult problem, despite the vast national and international experiences in R&R, and the existence of several guidelines on resettlement management?

- **Saifuddin Soz Committee Report: "***due to* ***defects in policy*** *and* ***prescribed procedures (i.e., institutional defects)*** *there are many failures in the rehabilitation effort, and is also not in accordance with the supreme court order"* (The Hindu, April 17, 2006)

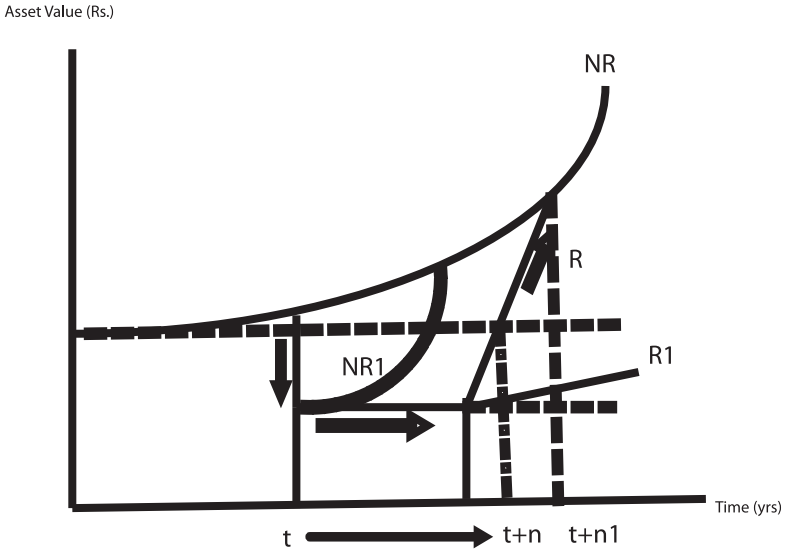
Past Scholarship

- Many of past studies make broad generalizations on informed opinions or supported with limited data;
- Assessments of short impacts i.e., in the immediate period after resettlement and do not assess longer term impacts;
- Most studies are based on the premise that displacement leads to impoverishment, and fail to adequately take into account new livelihood opportunities offered in the relocated sites.

Objectives

- To assesses the short- and long-term impacts of resettlement and rehabilitation on the living standards of Project Affected Families (PAFs);
- To determine the extent to which national/state policies and procedures have enabled PAFs to restore and improve their livelihood;
- To determine whether PAFs have taken advantage of non-project related opportunities, if any, to restore and improve their standard of living.

Post Displacement Livelihood Restoration Pathway

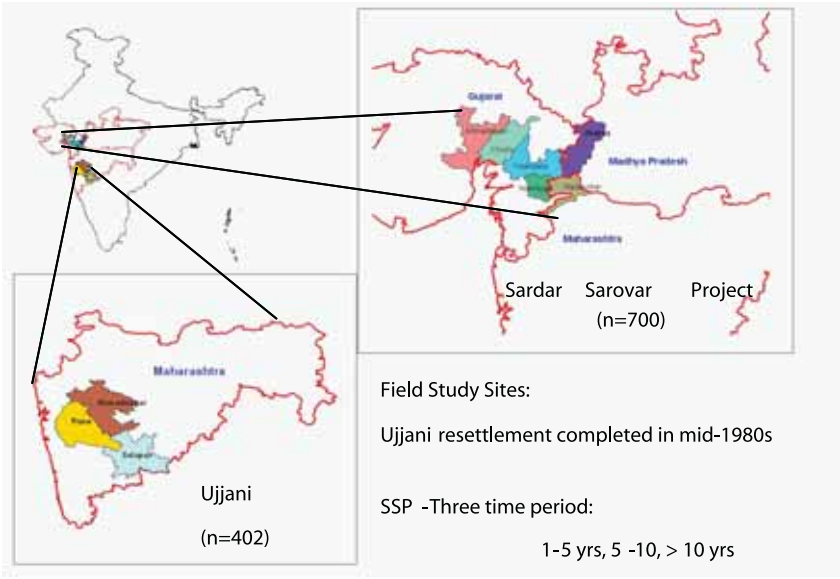


Hypothses

Hypothesis 1: Negative short-term consequences of displacement are compensated by the longer-term benefits generated from enhanced socioeconomic opportunities created in the newly developed relocation site.
Hypothesis 2: With proper counter risk policy and approaches, short-term adverse effects can be largely arrested, and some even fully prevented, while others considerably mitigated, and thus people's livelihood are restored much earlier.

Method of Study

- Policy Reviews: National and State
- Analysis of litigations and petitions filed by PAFs
- Field Survey



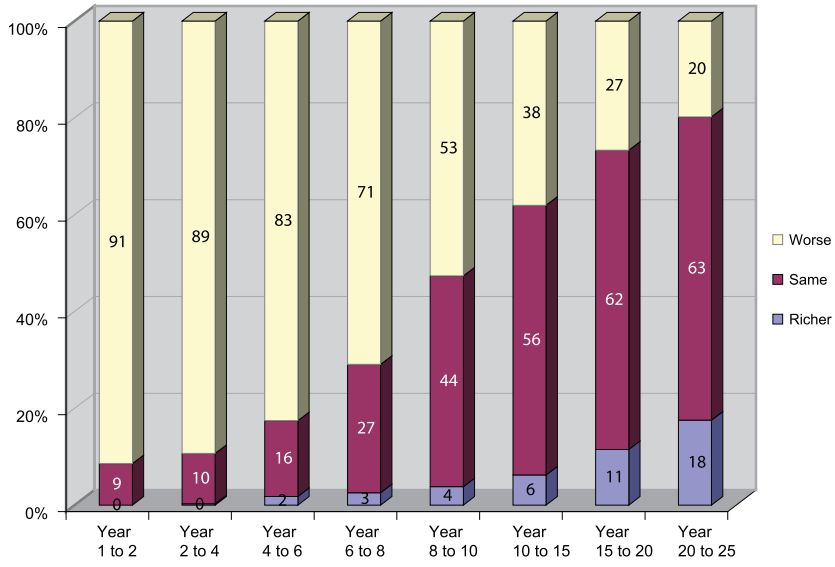
Field Survey

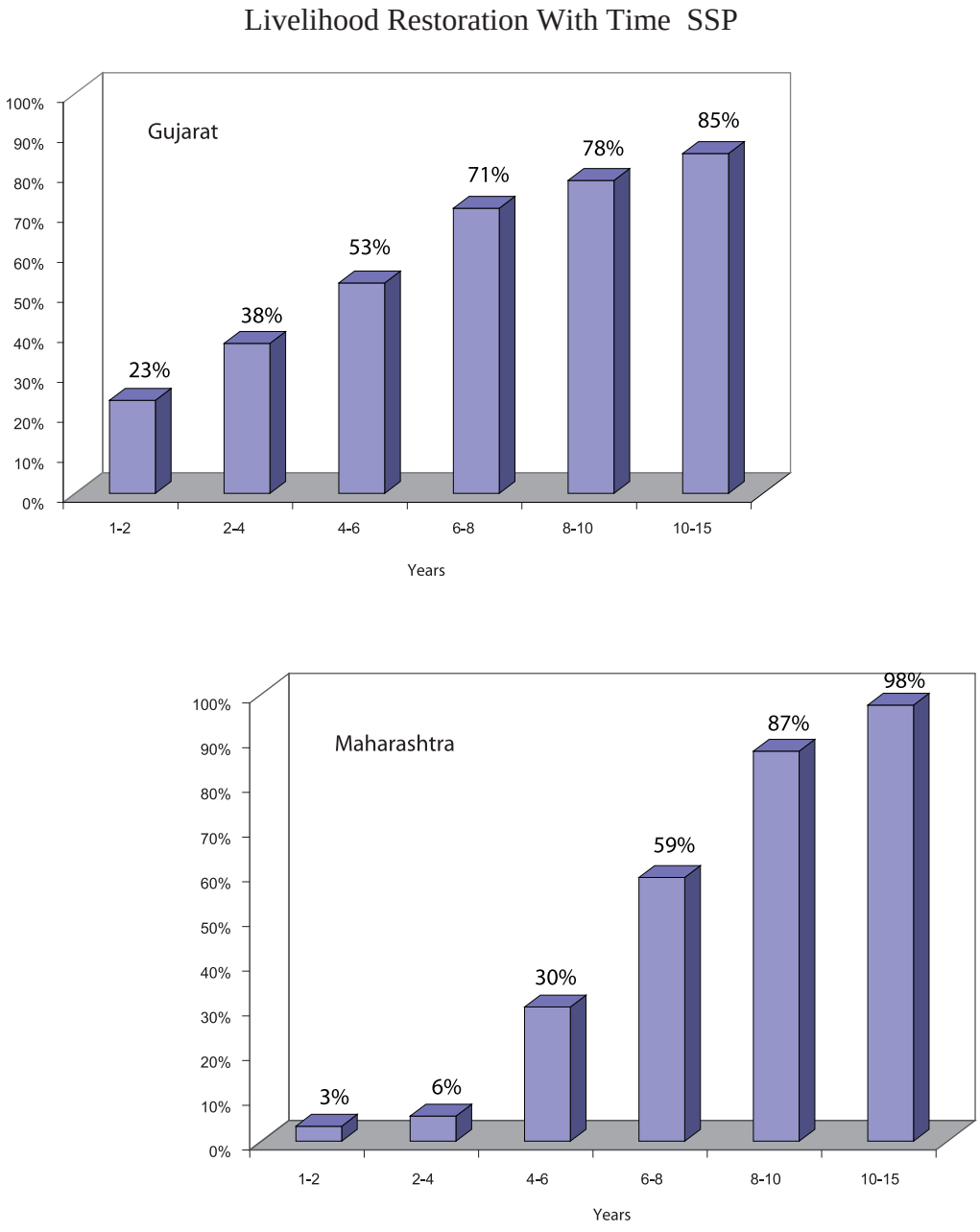
Research Question:

How have PAFs in Ujjani and SSP fared over time?

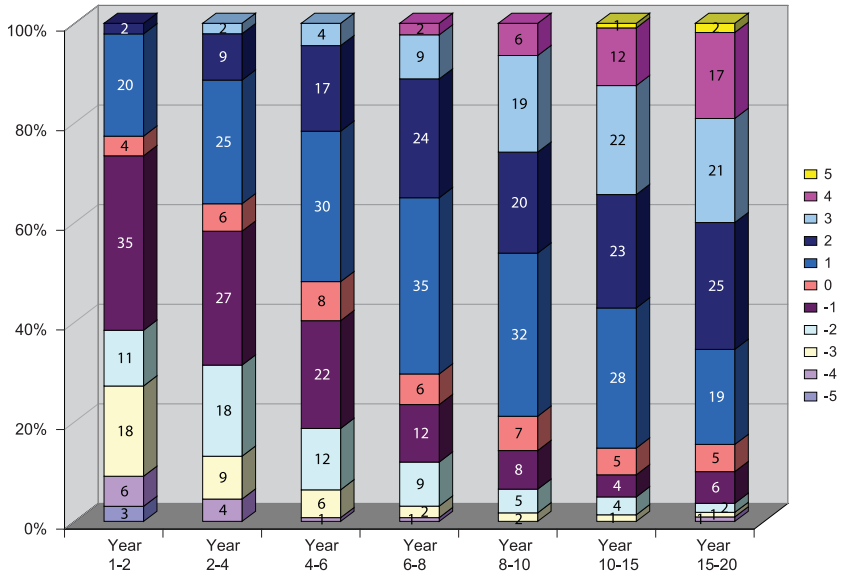
- Are they better-off than before displacement?
- Worse-off than before displacement?
- No change?

Ujjani-Restoration of Livelihoods of Displaced Population with Time

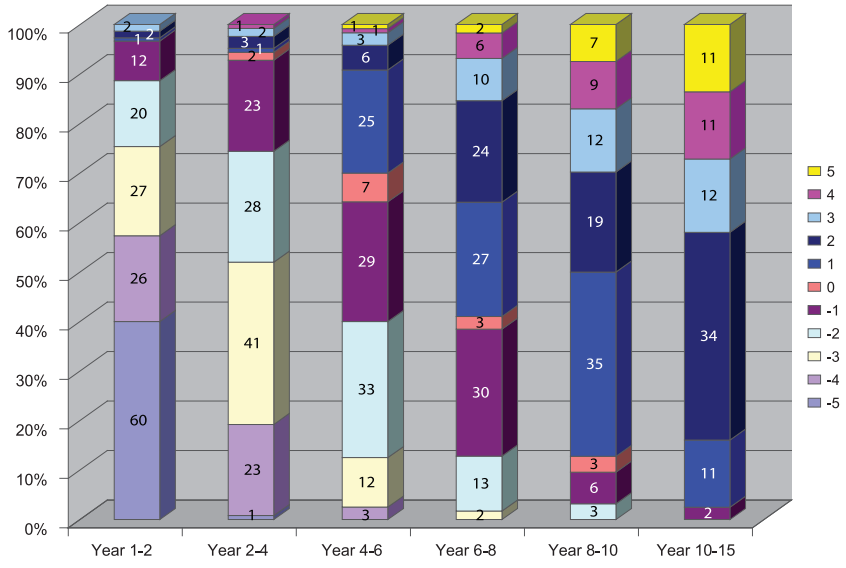



Livelihood Restoration With Time SSP
Gujarat
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
23%
38%
53%
71%
78%
85%
1-2
2-4
4-6
6-8
8-10
10-15
Years
Maharashtra
3%
6%
30%
59%
87%
98%
1-2
2-4
4-6
6-8
8-10
10-15
Years

Restoration of Livelihoods of Displaced Population with Time in SSP-Gujarat



Restoration of Livelihoods of Displaced Population with Time in SSP- Maharashtra



Reasons Given by the Household for the Negative Outcome. Ujjaini

Reasons	Year 1-2 (N=291)	Year 2-4 (N=158)	Year 4-6 (N=64)	Year 6-8 (N=39)	Year 8-10 (N=20)	Year 10-15 (N=13)	Year 15-20 (N=13)
Water Problems	16	9	25	10	35	31	8
Allocated Degraded Land	15	21	15	0	10	23	0
Crop Failure	2	3	3	0	10	0	0
Poor Housing	29	10	9	0	0	8	15
Social Disarticulation and Despair	4	3	3	0	0	8	8
Lack of Wage Employment	5	12	20	0	10	8	23
Lack of Basic Facilities	24	37	17	0	30	0	46
Others	4	6	7	0	5	23	0

Reasons Given by the Household for the Positive Outcome. Ujjaini

Reasons	Year 1-2	Year 2-4	Year 4-6	Year 6-8	Year 8-10	Year 10-15	Year 15-20
Received and Land Compensation	28	11	6	4	5	4	1
Improved Access to Social Facilities	30	7	24	20	36	45	59
Better Living Conditions	21	25	13	23	18	18	20
Improved Housing	5	29	27	20	14	12	1
Good Incomes from Cultivation	16	28	30	34	28	21	19

Reasons Given by the Household for the Negative Outcome – SSP Maharastra

Reasons	Year 1-2 (N=131)	Year 2-4 (N=65)	Year 4-6 (N=34)	Year 6-8 (N=22)	Year 8-10 (N=3)	Year 10-15	Year 15-20
Water Problems	2	3	0	9			
Allocated Degraded Land	27	24	16	16			
Crop Failure	3	8	0	0			
Poor Housing	8	5	0	0			
Social Disarticulation and Despair	44	30	28	25			
Lack of Wage Employment	1	6	12	9			
Others	4	9	6	3			
Lack of Basic Facilities	11	34	62	64			

Reasons Given by the Household for the Positive Outcome – SSP Maharastra

Reasons	Year 1-2 (N=17)	Year 2-4 (N=49)	Year 4-6 (N=66)	Year 6-8 (N=71)	Year 8-10 (N=68)	Year 10-15 (N=59)	Year 15-20 (N=8)
Received Land as Compensation	29	4	12	4	3	2	0
Improved Access to Social Facilities	24	8	47	54	47	53	25
Better Living Conditions	12	10	15	25	35	42	75
Improved Housing	18	41	5	4	4	2	0
Good Incomes from Agriculture	18	37	21	13	10	2	0

Reasons Given by the Household for the Negative Outcome – SSP Gujarat
Percentage of Households

Reasons	Year 1-2 (N=291)	Year 2-4 (N=158)	Year 4-6 (N=64)	Year 6-8 (N=39)	Year 8-10 (N=20)	Year 10-15 (N=13)	Year 15-20 (N=13)
Water Problems	16	9	25	10	35	31	8
Allocated Degraded Land	15	21	15	0	10	23	0
Crop Failure	2	3	3	0	10	0	0
Poor Housing	29	10	9	0	0	8	15
Social Disarticulation and Despair	4	3	3	0	0	8	8
Lack of Wage Employment	5	12	20	0	10	8	23
Lack of Basic Facilities	24	37	17	0	30	0	46
Others	4	6	7	0	5	23	0

Reasons Given by the Household for the Positive Outcome – SSP Gujarat
Percentage of Households

Reasons	Year 1-2 (N=61)	Year 2-4 (N=111)	Year 4-6 (N=167)	Year 6-8 (N=164)	Year 8-10 (N=163)	Year 10-15 (N=164)	Year 15-20 (N=75)
Received Land and Compensation	28	11	6	4	5	4	1
Improved Access to Social Facilities	30	7	24	20	36	45	59
Better Living Conditions	21	25	13	23	18	18	20
Improved Housing	5	29	27	20	14	12	1
Good Incomes from Cultivation	16	28	30	34	28	21	19

Assessment of Impoverishment

Cernea's Impoverishment Risks and Reconstruction Model:

- Landlessness ✓
- Joblessness ✓
- Homelessness ✓
- Marginalization
- Increased Morbidity and Mortality
- Food Insecurity
- Loss of Access to Common Property ✓
- Social Disarticulation ✓

Note: ✓ denotes issues that were addressed

Landlessness

- Both in Ujjani and SSP no reported cases of landlessness among original 'oustees'.
- All reported received land as compensation
  - Ujjani: landlessness reported among second generation
- Ujjani and SSP Maharashtra – poor land quality reported
- But a reduction in the size of land owned/operated by the household

Changes in Land Size per Household Before and After Displacement - Ujjani

Land Size Class	Percentage of Household			
	Original Village		Present Location	
	Irrigated	Rain-fed	Irrigated	Rain-fed
<=5	34	22	82	86
<=6-10	22	22	12	11
<=11-20	24	26	4	1
<=21-30	8	14	1	1
<=31-50	7	10	1	1
> 50	5	6	0	0

Changes in Land Size per Household Before and After Displacement - SSP Gujarat

Land Size Class	Percentage of Household			
	Original Village		Present Location	
	Irrigated	Rain-fed	Irrigated	Rain-fed
<=5	37	36	92	92
<=6-10	37	24	6	5
<=11-20	20	25	2	2
<=21-30	4	9	0	1
<=31-50	2	6	0	0

Changes in Land Size per Household Before and After Displacement - SSP Maharashtra

Land Size Class	Percentage of Household			
	Original Village		Present Location	
	Irrigated	Rain-fed	Irrigated	Rain-fed
<=5	45	32	85	82
<=6-10	33	36	15	6
<=11-20	11	25	0	2
<=21-30	11	7	0	10

Occupational Changes

SSP:

- No open unemployment
- 33% household head changed their primary occupation
- 78% reported as current employment is more remunerative

Ujjani:

- No open unemployment
- Substantial number change to non-remunerative employment, especially those who were engaged in non-land-based livelihoods

Homelessness

- Insignificant in all locations
- Improved housing in SSP – Gujarat
- Poor housing in SSP – Maharashtra
- No significant improvement in Ujjani

Quality of Housing Before and After Displacement – SSP Gujarat

Nature of Housing	Percentage of Households	
	Original Village	Present Location
Homeless	2	1
Katcha	84	5
Semi-Pucca	7	15
Pucca	7	78
Modern House		2

Quality of Housing Before and After Displacement – SSP Maharashtra

Nature of Housing	Percentage of Households	
	Original Village	Present Location
Homeless		
Katcha	92	91
Semi-Pucca	7	5
Pucca	1	4
Modern House		

Quality of Housing Before and After Displacement – Ujjani

Nature of Housing	Percentage of Households	
	Original Village	Present Location
Homeless	2	1
Katcha	31	21
Semi-Pucca	31	48
Pucca	36	28
Modern House	0	1

- Access to Common Property
  - a problem in all three locations, especially for livestock grazing
  - curtailed access to forests not a major problem
- Social Disarticulation:
  - A major constraint in the immediate years of resettlement, especially in Ujjani due to conflicts with host communities
- Relatively Successful R&R in SSP – Gujarat
- The first time where such high standards of R&R had been applied to a project in India (WB 1998)
- This project has been the source of many improvements in R&R policies and implementation, especially in Gujarat

Comparison of Rehabilitation and Resettlement Policy in the Three SSP States

Article	NWDT Award	Madhya Pradesh	Gujarat	Maharashtra
Definition of oustee	a. Residing/trade at least for one year prior date of notification of land acquisition	Same as NWDT Cultivating land for 3 yrs	Same as NWDT	Same as NWDT
Family	Defined	Same as NWDT	Same as NWDT	Same as NWDT
Land Allotment	Minimum of 2 ha per family	Same SC/ST needs specified	Same as NWDT	Same as NWDT
Encroacher oustees	No land allotments	Treated as landed oustees subject to two conditions. i. Encroachment must be on or before 13.4.87. Allotment of agricultural land will be 1 ha. or 2 ha. ii) Encroachers will be entitled to get compensation for land under submergence.	i. Encroachers prior to 1 year of notification entitled for 2 ha. of land ii.Compensation for the balance encroached land as exgratia payment	2 ha of land and compensation as exgratia payment for the balance land encroached upto 31/3/78. Later encroachers will be treated as landless and will get 1 ha. agricultural land
Landless oustees	No land allotments	No land cash payment to agricultural labor and SC/ST	2 ha of land to landless agricultural labor only	1 ha land if oustee moves with the other
Rehab Grant	Rs. 750 per family	Small and marginal farmers, agricultural labor and SC/ST	Subsistence allowance NWDT award	Yes
Land Compensation	As per Land Acquisition Act	Same NWDT	Rs. 10,000 per ha	Rs.3,750-4,500 per ha

(Continued)

(Continued)

Article	NWDT Award	Madhya Pradesh	Gujarat	Maharashtra
Rehab grant and subsidies	R&R Grant of Rs. 750 per family Grant-in-aid of Rs. 500	R&R Grant-SC/ST, laborers, marginal farmers at Rs.11,000 each others at Rs.5,500	Generous: subsistence allowance. Grant to buy assets Housing grant	Subsistence allowance and other benefits as specified by NWDT
Other facilities	Transport, civic amenities	Yes	Yes	Yes

SSP - Investment in R&R per PAF by States (as at 31/12/06)

Investment Details	Gujarat	Maharashtra	Madhya Pradesh	Total
Subsistence Allowance (Rs. - Crores)	2.07	0.3	1.91	4.28
Productive Assets (Rs. - Crores)	2.29	0.34	1.89	4.52
Resettlement Grants (Rs. - Crores)	0.59	0.05	0.03	0.67
Total	4.95	0.69	3.83	9.47
PAFs resettled	4,726	802	5,974	11,502
Investment per PAF (Rs)	10,474	8,603	6,411	8,233

Source: Estimated from Sardar Sarovar Punarvasavat Agency Data.

- On the implementation side, Gujarat developed a unique mechanism for acquiring replacement agricultural land, at market prices through Land Purchase Committees;
- Gujarat : Special agency for implementation and well-developed R&R units with central monitoring cells were established.

Concluding Remarks

- Results indicate that SSP (Gujarat) the oustees are not adversely affected to the extent claimed;
- Oustees do encounter initial stress and there is a fall in standard of living
- SSP - majority of oustees restored their livelihoods to the original level in 4-6 years;
- Data suggests that oustees in Madhya Pradesh and Maharashtra are worse-off than those in Gujarat;
- Hypotheses hold true partially in SSP;
- Ujjani ?
- Not to attempt to justify displacement;
- Forced displacement of population should be avoided where feasible.

National River Linking Project Analyses of Hydrological, Social and Ecological Issues

National Workshop: International Water Management Institute and Challenge Program for Water and Food Project on "Strategic Analysis of India's National River Linking Project"

October 9-10, 2007. Conference Room, NASC Complex, New Delhi, India

Agenda

Session I	Introduction Chair: Prof. M.S. Swaminathan	
09:00-09:30	1. Registration	
09:30-09:40	2. Welcome	Dr. Madar Samad
09:40-09:50	3. Workshop inauguration	
09:50-10:05	4. NRLP- A concept for meeting India's future water demand	Shri. Suresh Prabhu
10:05-10:20	5. NRLP- In the context of future global water demand	Dr. Peter G. McCornick
10:20-10:35	6. NRLP and perspectives on Indian irrigation: IWMI- CPWF project	Dr. Tushaar Shah
10:35-10:55	7. Inaugural speech	Prof. M.S. Swaminathan
10:55-11:00	8. Vote of thanks	Dr. Upali A. Amarasinghe
11:00-11:15	Tea/Coffee	
Session II	India's Water Future - Scenarios and Issues Chair: Prof. Y. K. Alagh	
11:15-13:00	1. Global water future - Scenarios and issues. Outlook from the Comprehensive Assessment of Agriculture	Dr. Peter G. McCornick
	2. India's water future - Scenarios and issues. Results from the analysis of phase I.	Dr. Upali A. Amarasinghe
	3. Water supply and demand in the Godavari (Polavaram)-Krishna (Vijayawada) link	Dr. Luna Bharati
	4. Discussion	
13:00:14:00	Lunch	

Session III	Hydrological feasibility of large-scale water transfers in India Chair: Eng. N.K. Bhandari	
14:00-15:30	1. What components of NRLP will work given the present trends of water demand?	Shri. Anil D. Mohile
	2. Hydrological and environmental issues of inter-basin water transfers in India: A case of Krishna River basins feasibility of some links- New perspectives	Dr. Vladimir Smakhtin
	3. In the midst of dam controversy: Objectives and criteria for assessing impacts of large dams in developing economies	Dr. Dinesh Kumar
	4. Discussion	
15:30:15:45	Tea/Coffee	
Session IV	Cost and benefits of irrigation water transfers Chair: Prof. Kanchan Chopra	
15:45-17:15	1. Public irrigation investments in India 1950-2000: An ex post facto economic analysis	Dr. Arlene Inocencio
	2. NRLP irrigation water transfers- benefits Case studies from Godavari-Krishna/ Ken-Betwa/ IGNP	Drs. Anik Bhaduri/ Upali A. Amarasinghe
	3. Impact of irrigation water transfers on gender and equity	Ms. Samyuktha Verma
	4. Discussion	
Session V	Future of rain-fed agriculture – Implication for NRLP water transfers Chair: Shri. B.M. Jha	
17:15-18:15	1. Rain-fed agriculture authority of India – Policy direction	Dr. J. S. Samra
	2. Rain-fed agriculture in India – Potential for productivity improvements	Dr. Bharat Sharma
	3. Discussion	

Day 2.		
Session VI	Contingencies that could justify large-scale water transfers Chair: Prof. B.G. Verghese	
09:30-11:30	1. To what extent can international trade contribute to manage India's future water demand?	Prof. Y. K. Alagh
	2. Biofuel as an energy source: Will India's irrigation demand need re-estimation?	Dr. C. de Fraiture
	3. Pricing out smalholder irrigation in South Asia?	Dr. Tushaar Shah
	4. Groundwater recharge opportunities with large water transfers- Case study from Godavari (Polavaram)-Krishna (Vijayawada link)	Drs. Bharat Sharma/ K.V.G.K. Rao/ Massuel Sylvain
	5. Potential in water harvesting in Indian river basins	Dr. Dinesh Kumar
	6. Discussion	
11:30-11:45	Tea/Coffee	
Session VII	Groundwater irrigation- Future directions for India Chair: Dr. J. S. Samra	
11:45-13:15	1. Groundwater irrigation in India- Future directions and policy issue	Shri. B.M Jha
	2. Decentralized recharge movements in India: Potential and issues	Dr. R. Sakthivadivel
	3. Real time co-managing of electricity and groundwater	Dr. Tushaar Shah
	4. Discussion	
13:15-14:15	Lunch	

Session VIII	Rehabilitation and resettlement management in large dam projects in India. The lessons for future water development projects Chair: Prof. V.S. Vyas	
14:15-15:30	1. Rehabilitation and resettlement issues in India	Dr. Ramaswamy Iyer
	2. Rehabilitation and resettlement issues Ken-Betwa Project	Dr. Vandana Shiva
	3. Assessment of rehabilitation and resettlement experiences in large dam projects: Case study results and lessons for the NRLP	Dr. Madar Samad
	4. Discussion	
Session IX	Transboundary conflicts Chair: Prof. Ramaswamy Iyer	
15:30-16:30	1. International experiences of transboundary water transfers: Lessons for NRLP	Dr. Francis Gikuchi/ Dr. Peter G. McCornick
	2. Linking rivers in the Ganges-Brahmaputra River basin: Exploring the transboundary effect	Dr. Anik Bhaduri
	3. Discussion	
16:30-16:45	Tea/Coffee	
Session X	Meeting future water demand through NRLP Chair: Dr. Peter G. McCornick	
16:45-18:00	1. Civil society perspectives of NRLP	Dr. Ashok Kosala
	2. The present status of inter-basin water transfers in India	Eng. N.K.Bhandari
	3. Phase III research plan- A water sector perspective plan for India	Dr. Upali A. Amarasinghe
	4. Meeting increasing water demand in India	Open discussion
18:00-18:10	Vote of thanks	Dr. Upali A. Amarasinghe

List of Participants

No.	Participant	Designation/Institute affliation
1.	Prof. M. S. Swaminathan	Chairman, M S Swaminathan Research Foundation, Chennai, Tamil Nadu.
2.	Mr. Suresh Prabhu	Chiar GWP-SA and Member of Parliament, Former Chiarman of the Task Force for Interlinking of Rivers, New Delhi.
3.	Prof. Kanchan Chopra	Director, Institute of Economic Growth, New Delhi.
4.	Prof. Y. K. Alagh	Former Union Minister of Science and Technology, Ahamadabad, Gujarat.
5.	Prof. V. S. Vyas	Professor Emeritus, Institute of Economic Growth, New Delhi.
6.	Mr. Anil D. Mohile	Former Chairman of Central Water Commission (CWC), New Delhi.
7.	Dr. J. S. Samra	Chief Executive Officer, National Rain-fed Area Authority, New Delhi.
8.	Mr. B. M. Jha	Chairman, Central Ground Water Development Board, New Delhi.
9.	Mr. A. D. Bhardwaj	Director General, National Water Development Agency (NWDA), New Delhi.
10.	Mr. N.K. Bhandari	Chief Engineer (HQ), NWDA, New Delhi.
11.	Mr. R.K. Jain	Director (Tech.), Ministry of Water Resources, New Delhi.
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13.	Mr. S. Sinha	Chief Engineer, Central Water Commission, New Delhi.
14.	Mr. R.K. Khanna	Chief Engineer (EMO), Central Water Commission (CWC), New Delhi.
15.	Dr. Alok Sikka	Director, ICAR-RCER & Basin Coordinator, Patna, Bihar.

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17.	Dr. P. K Katiha	Senior Scientist, Central Inland Fisheries Research Institute (CIFRI), Calcutta.
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