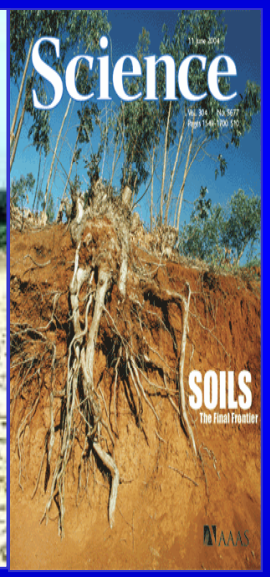
Water Availability and Traditional Knowledge based Adaptation to Climate Change



Pradip Dey

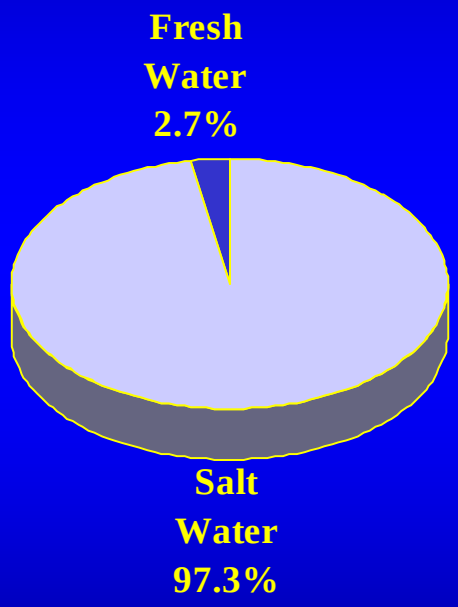
pradipdey@yahoo.com

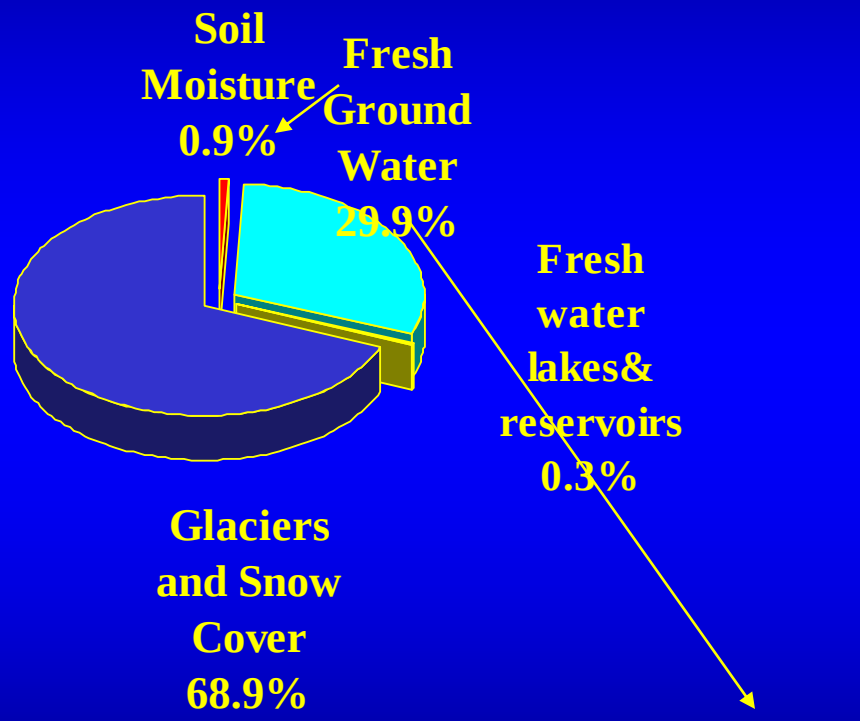
IISS, Bhopal

Climate change

- Climate change is a defining moment of our time with major negative implications on ecology, human culture, livelihoods and food security.
- The IPCC advocates to search local solutions for climate change adaptations; however, its report does not recognize the breadth and strength of century tested traditional knowledge in combating climate change.

Fresh Water Resources – 2.7 %





Global Water Availability

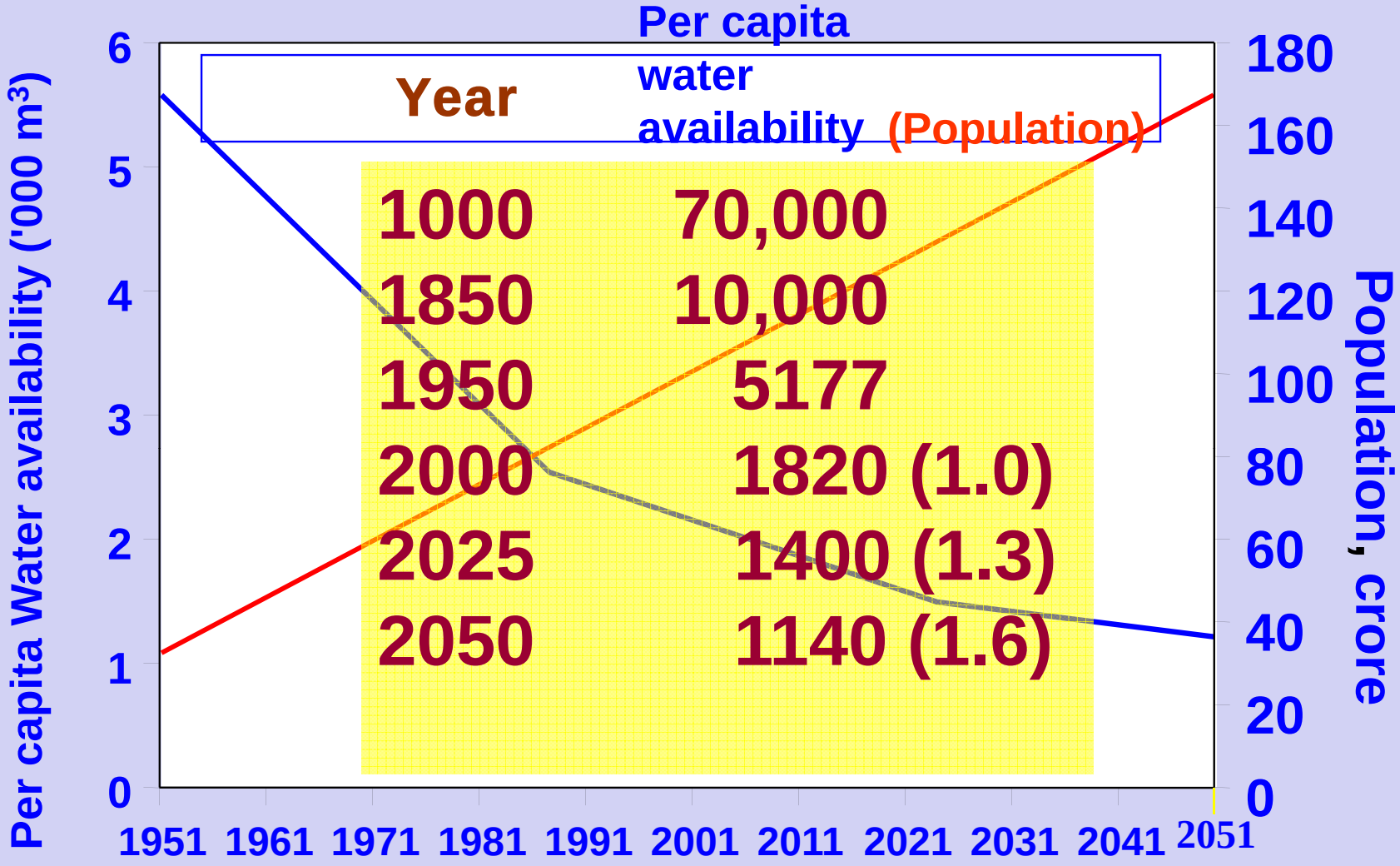
Water: Major concerns

- Most critical resource for Indian agriculture
- The resource is shrinking
- Increased competition from other sectors
- Decline in water table
- Water-logging and salinity
- Increased pollution
- Environmental change to affect availability
- Reduction in river flow

Decreasing per capita water availability in India

1955	- 5300 m^3
1990's	- 2200 m^3
World Average	- 7400 m^3
Asia Average	- 3240 m^3
Projected for 2025	- 1465 m^3
Projected for 2050	- 1235 m^3

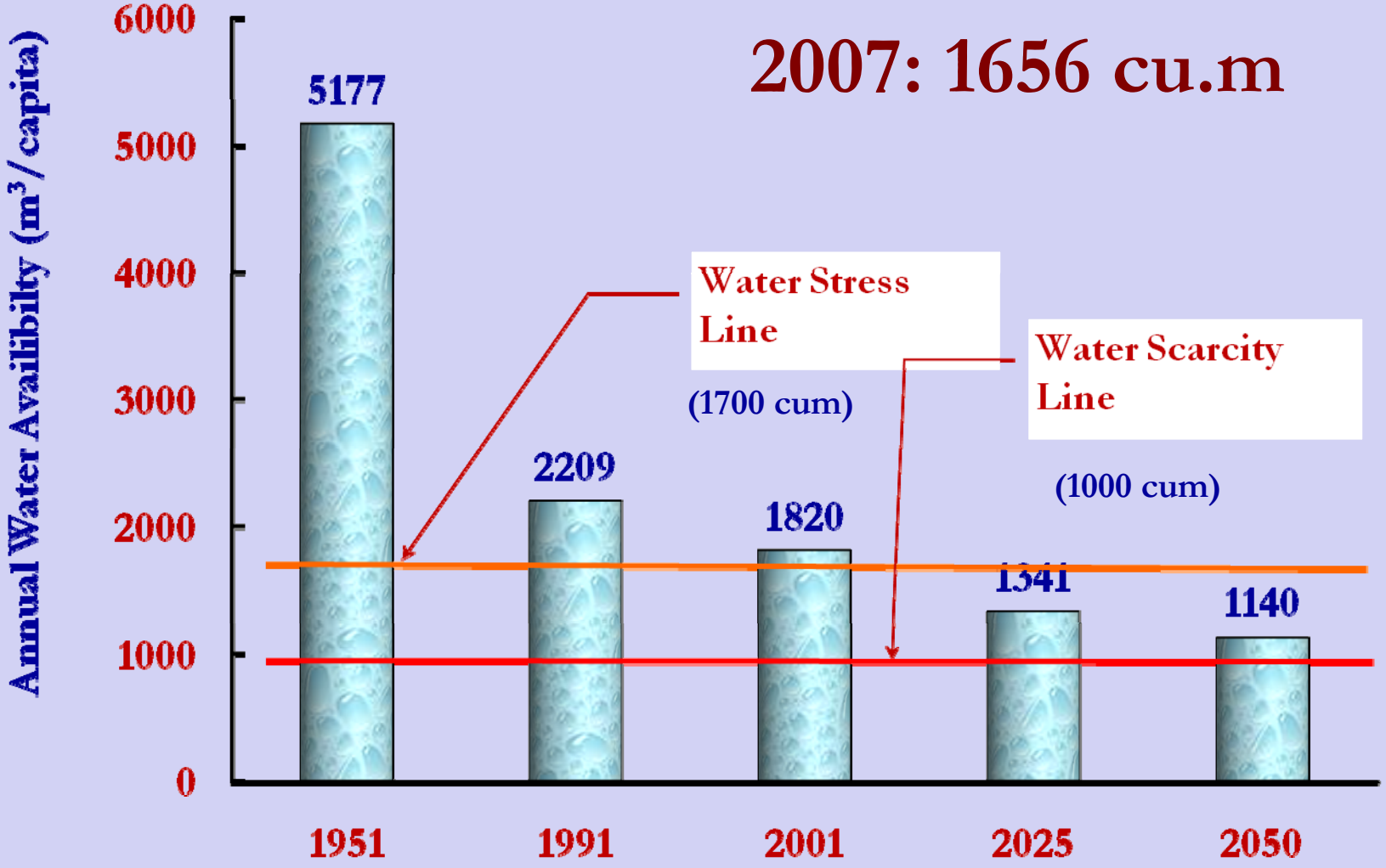
P. Dey: Presented in International Conf. 2013, Bangaluru, India



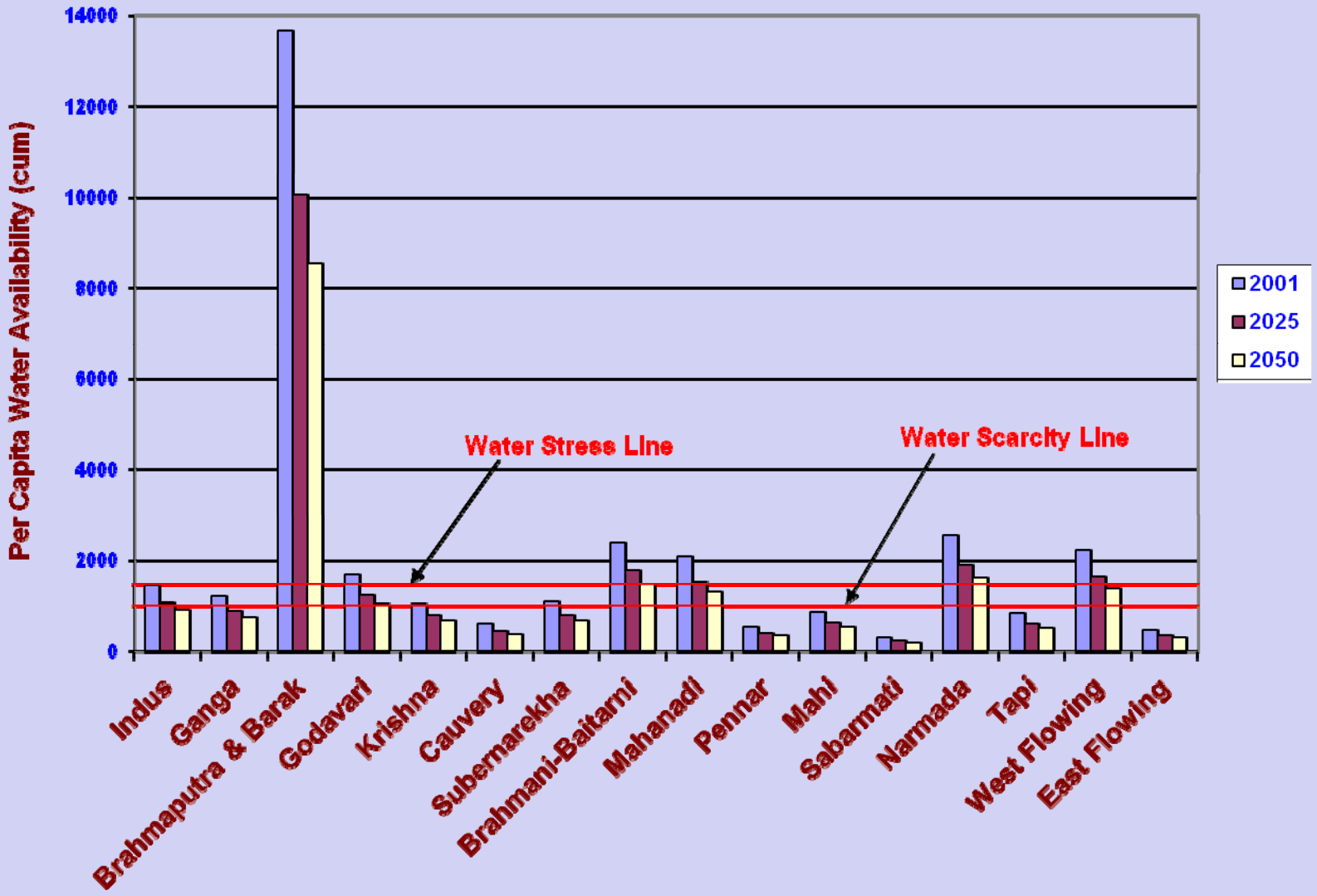
India: 2005 - 1731 cu. m
2007 - 1656 cu. m

Changes in Population and Per Capita Water Availability Over Time

Per Capita Water Availability



Basin-wise Per Capita Water Availability

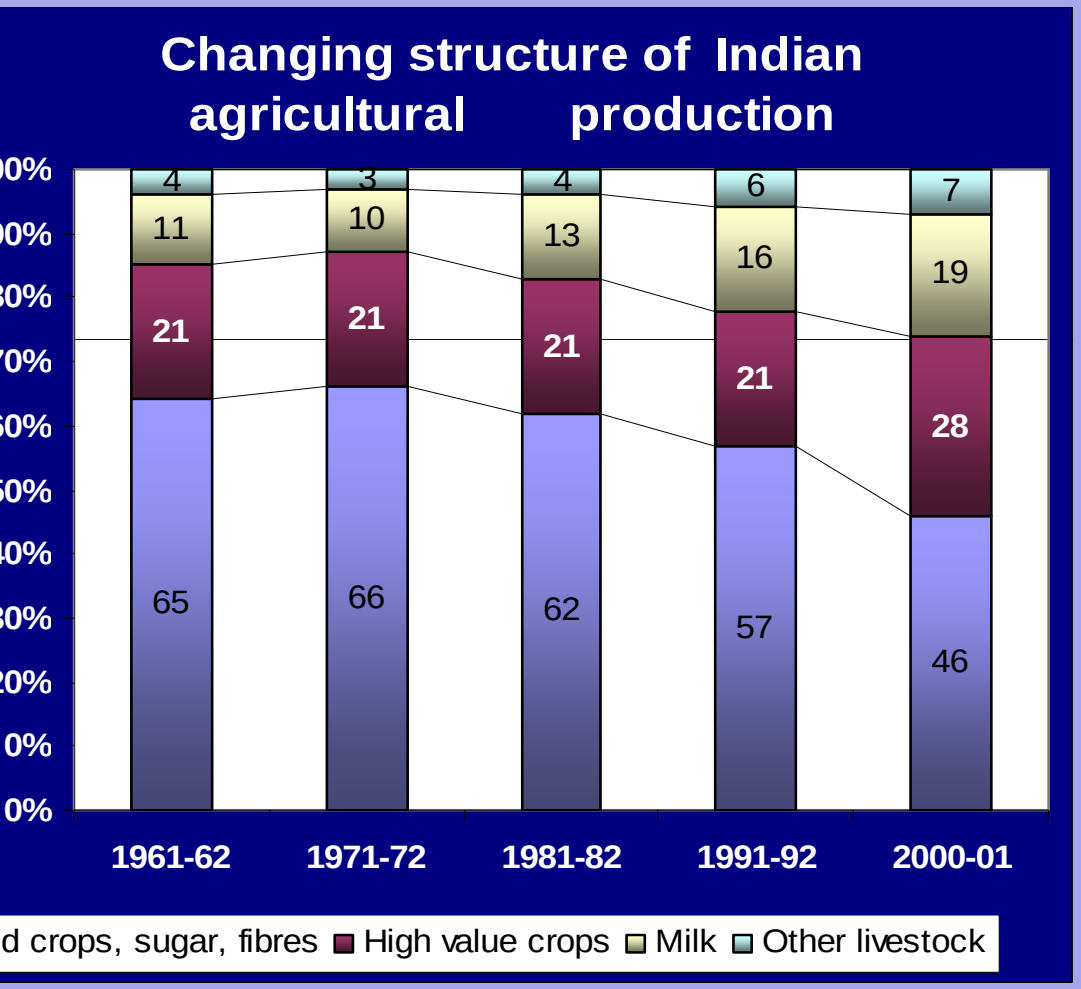


Per capita storage (cu.m.)

ys of average flow (which reservoirs can store)

orado (US)	850-900
ray Darling s)	85-900
nge (S. Africa)	500
hna	220
mada	180
very	160
ga	40
namaputra	Below 10
ndia	below 20

dian farmer is diversifying



This diversification is occurring outside Command areas (IFPRI).

Diversification requires year-round, on-demand irrigation.

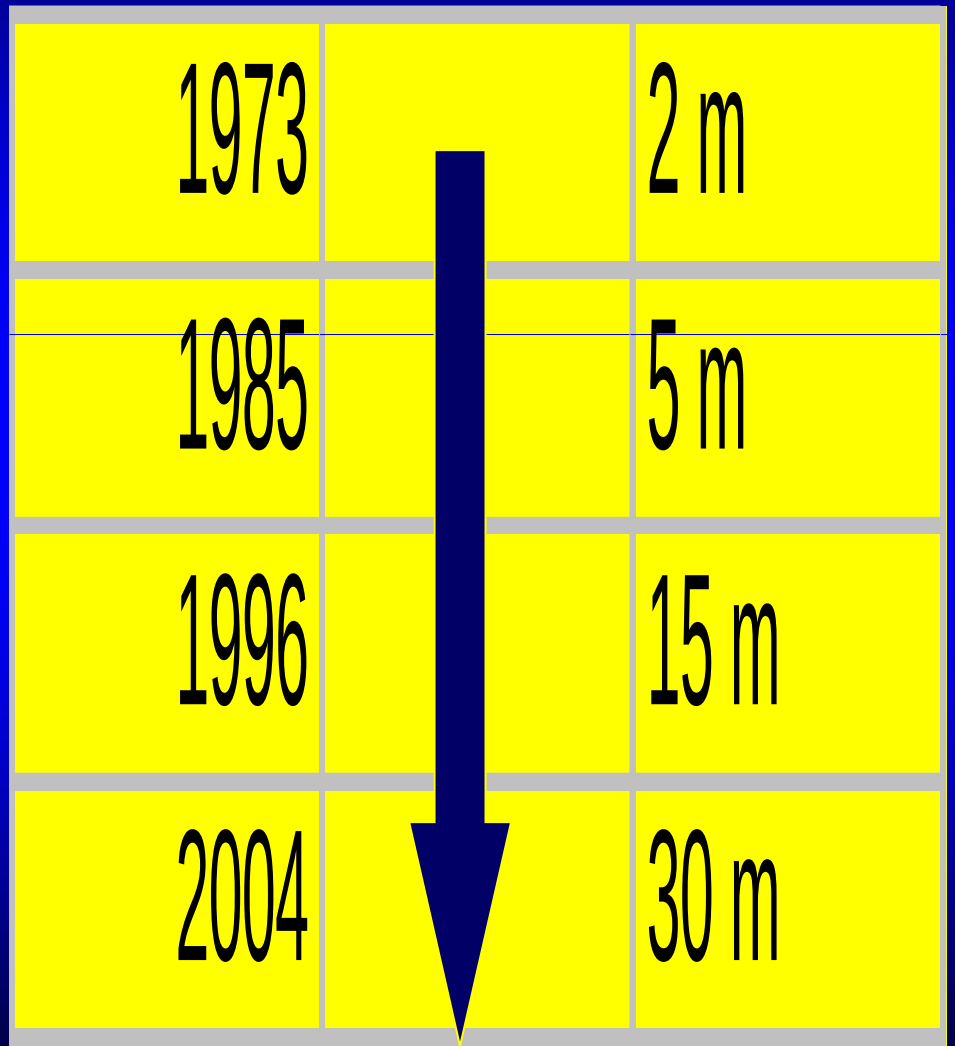
Value added farming

Annual Requirement of Freshwater
(Billion Cubic Meters - BCM)

User Sector	2008-09	2025	2050	Ratio
Irrigation	501	910	1072	2.1
Domestic	30	73	102	3.4
Industries	20	22	63	3.1
Thermal Power	20	15	130	6.5
Others	24	72	80	3.3
Total	605	1092	1447	2.4

Source: National Commission on Integrated Water Resources

Status of groundwater level in Delhi



ater Resources and Liabilities in India

resh Water Resources	4 % (1/25)
and	2.3 % (1/44)
opulation	17 % (1/6)
ivestock	11 % (1/9)
ainfall	117 cm

~ Global Average – 110 cm

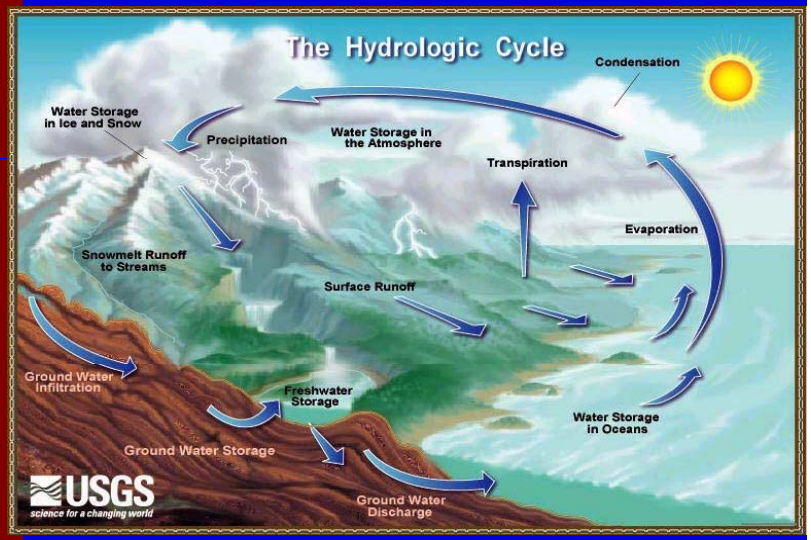
Global Water Cycle

ceans contain about 98% the earth's water.

ound 1.8% is ice found the two polar ice caps nd mountain glaciers.

nly 0.5% is in the water ble and ground water.

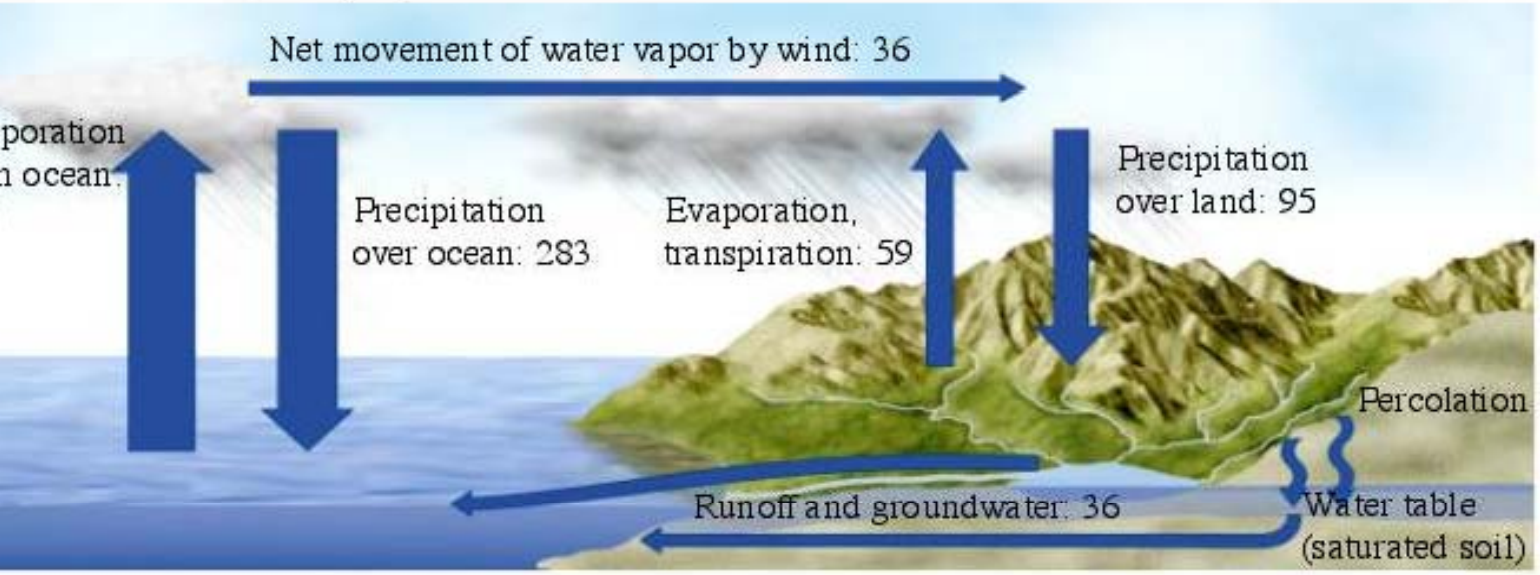
he atmosphere contains nly 0.001% of the earth's ater, but is the major



Global Water Cycle

HE GLOBAL WATER CYCLE

ll values in 10^{18} grams per year

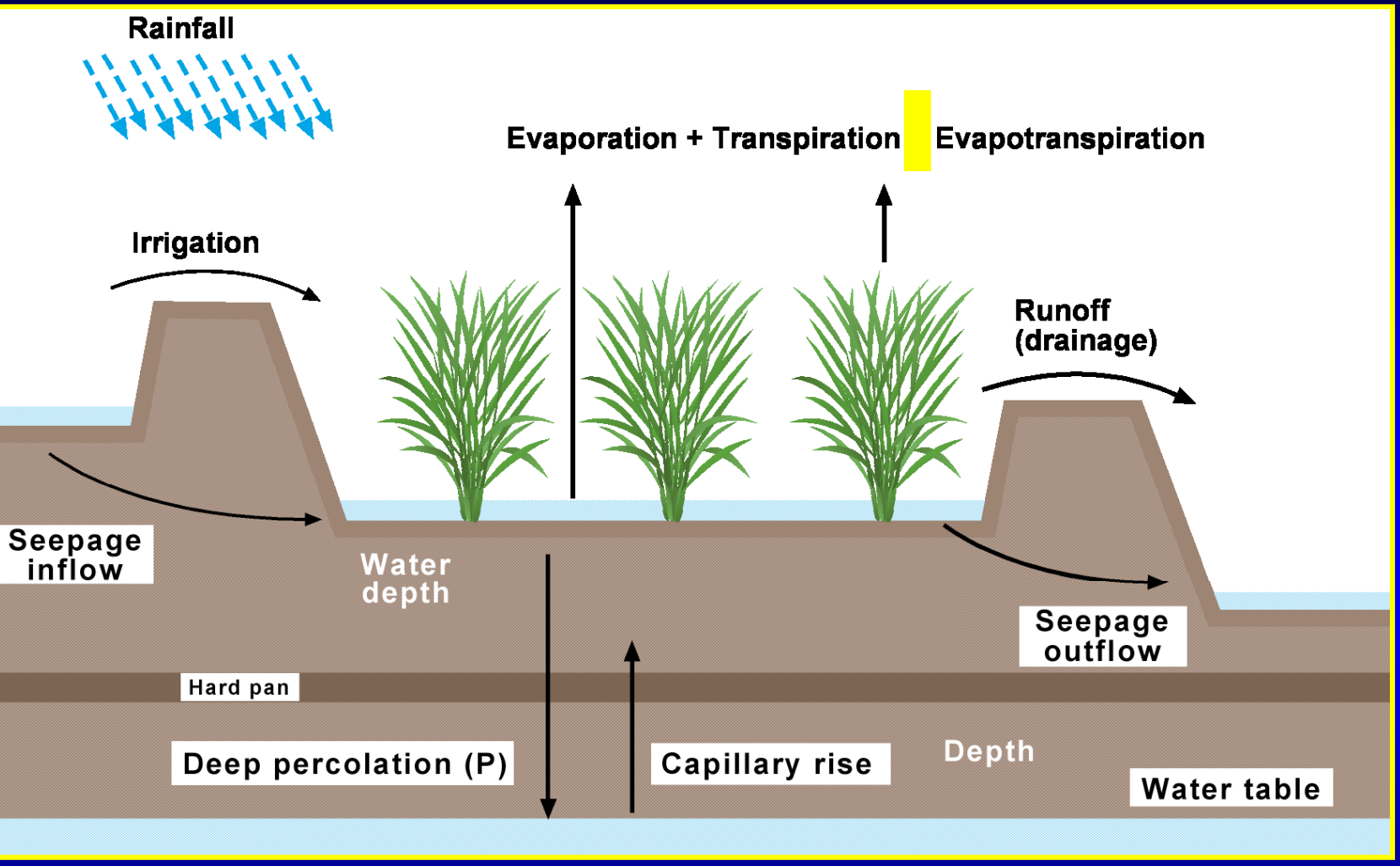


vaporation exceeds precipitation over the oceans; thus ere is a net movement of water to the land.

arly 60% of the precipitation that falls on land is her evaporated or transpired by plants; the mainder is runoff and ground water.

Way-forward

The emerging scenario from different parts of the globe suggests that neither the scientific technologies alone nor the traditional knowledge exclusively can completely solve the threats of food and nutritional security challenges emanating from climate change--however, a fusion of the two can.



Water dynamics in lowland rice soil

Key Water Issues

- Uneven fields
- Flood irrigation
- Low quality supply-driven irrigation systems
- Rain water management
- Puddling

Solving the Water Crisis

- dentification of input use efficient crop
- ntegrated use of rain, surface and ground waters
- Judicious use of polluted and poor quality waters
- Development and transfer of cost effective and eco-friendly technologies
- Awareness among farmers about value and scarcity of water and negative fallouts of improper use
- Operation and maintenance charges
- Equitable distribution of water
- Participatory water management (WUA) – key
- Recharging the ground water aquifers
- Multiple uses of water – Enhancing income per unit quantity of water consumed
- Use of modern tools e.g. RS, GIS, DSS, Biotechnology

Improvement in surface water use

- On-farm irrigation hydraulics:
  - land leveling, methods, design
- Micro-irrigation systems:
  - Hardware components
  - Software components: Soil, Crop, ET
- Cropping pattern / diversification:
  - Rice to non-rice
- Drainage

Improvement in groundwater use

- Recharge, water harvesting
- Adjusting the pumping rate
- Multiple well point
- Reuse of drainage water

and preparation and rice transplanting

Some New Techniques

Water Saving Technologies

Laser land leveling - A Precursor technology

Raised bed planting

Development and Management Options

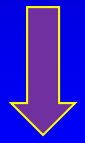
- **Evaluatory measures:** Assessment and monitoring
- **Corrective measures:** Artificial recharge, water harvesting, sub-surface drainage, conjunctive use
- **Protective measures:** Effluent treatment and safe disposal of pollutants
- **Regulatory and legislative measures:** Formulation of water resource development and use policy

Traditional Knowledge

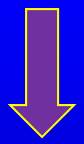
Traditional Knowledge can be defined as the collectively owned non-formal intellectual property comprised wisdom, knowledge and teaching developed by local and indigenous communities over time in response to the needs of their specific local environment and integral to the cultural or spiritual identity of the social group in which it operates, preserved and many-a-time orally transmitted for generations.

Methodology

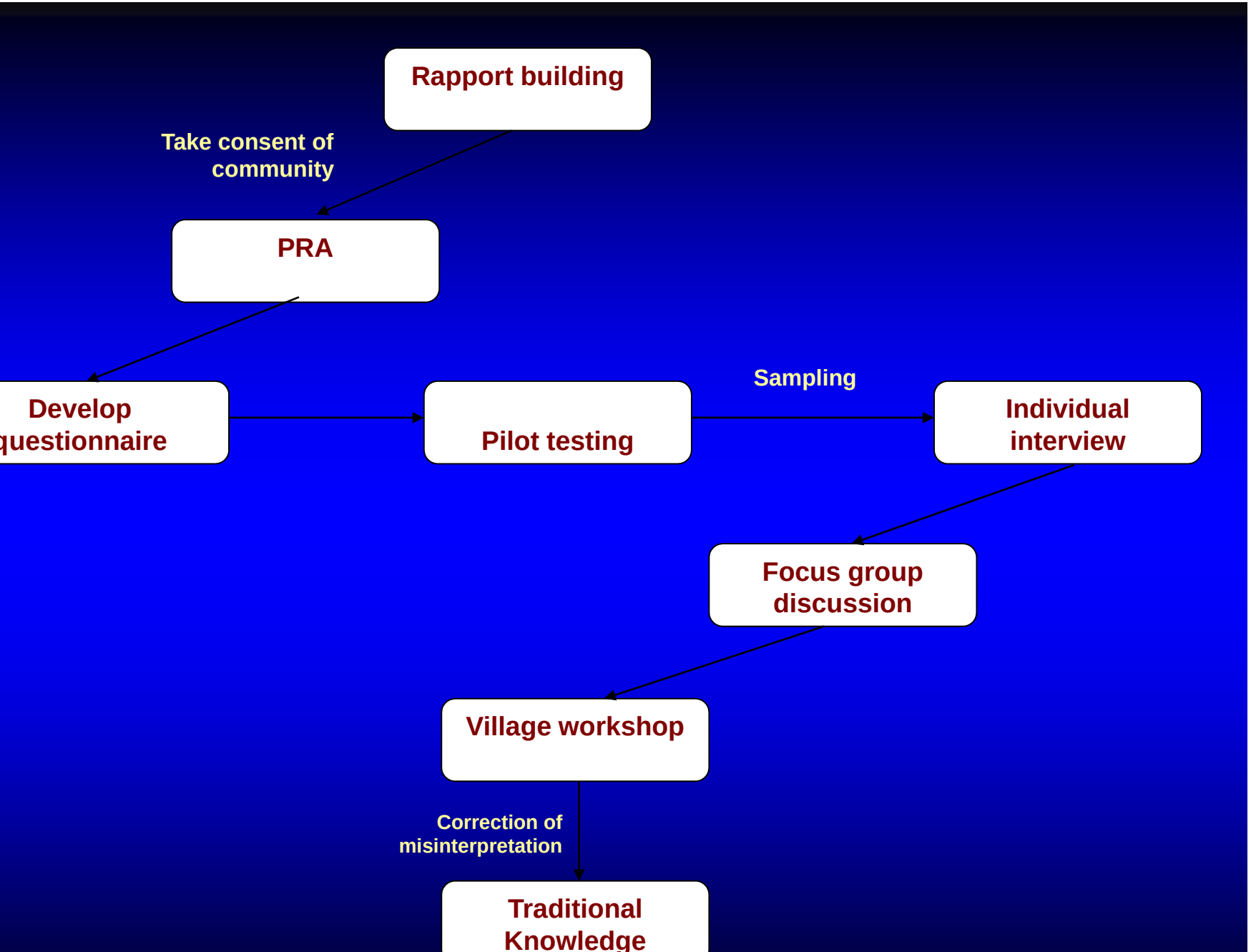
Selection of tribes- Ho, Santhal, Munda, Oraon, and Lohra



Identification of the focus group - small scale farmers



Collection of primary data (through participatory approach) related to climate change adaptation and resilience strategies


Rapport building
Take consent of community
PRA
Develop questionnaire
Pilot testing
Sampling
Individual interview
Focus group discussion
Village workshop
Correction of misinterpretation
Traditional Knowledge

Traditional water management practices

Stone Bunding

- In this practice, bunds are constructed with locally available stones across the land slope.
- Effective for soil, water and nutrient conservation in undulating terrain especially in the

Stones-cum-Earthen Bunding

- This practice involves constructing stone bunding at the base followed by earthen bunding on the top. Sometimes, in stone bunding, soil is filled in to work as a cementing agent.

Stone-cum-Vegetative bunding

- In this practice, tribal farmers residing in forest villages make stone bunds in their fields and, to stabilize these bunds, they plant some trees and sometimes hardy bushes on the bunds.
- This is done with the help of local tools and very little maintenance

Brushwood Waste Weir

- These weirs have been developed and used by the farmers for the last 10 - 15 years.
- Large runoff generated from such aberrations of rainfall due to changing climate can be effectively addressed .

Established Grassed Waterways

ese grassed water-ways provide safe guard against soil erosion by diverting excess runoff through them.

SPUR Structure

urs (temporary barrier like structures) are constructed
ter rice transplanting with the help of locally available
erials like forest woods in locations where there is runoff

Conclusion and policy implication

The study conclusively proved that planners and policy makers have yet another tool and dimension to initiate participatory action plan involving tribal farmers and their rich reserve of traditional knowledge in order to develop adoptable technology that will enable mitigation of water scarcity amd problem of climate change for financial inclusion and mainstreaming of indigenous population

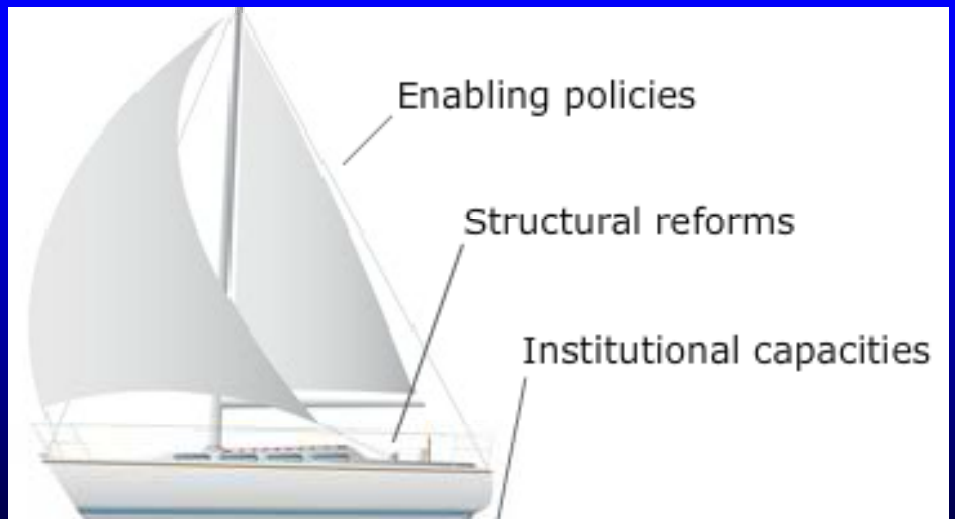
Conclusion and policy implication

Indigenous people and their knowledge are central to the adaptive changes using available natural resources essential to face the world's changing climate.

Policies should also be adopted to transform the indigenous populations to precious partaker in vigilance and enforcement enterprise with authorized establishment in order to provide a strong foundation for solving water scarcity, combating climate change and ensuring

Conclusion and policy implication

Moreover, region-specific amalgamated technological prescriptions refined with targeted policy analysis are required for effective implementation and obtaining positive outcomes within a finite time horizon.



THANK YOU