

Achieving Groundwater Use Efficiency in Northern China

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History

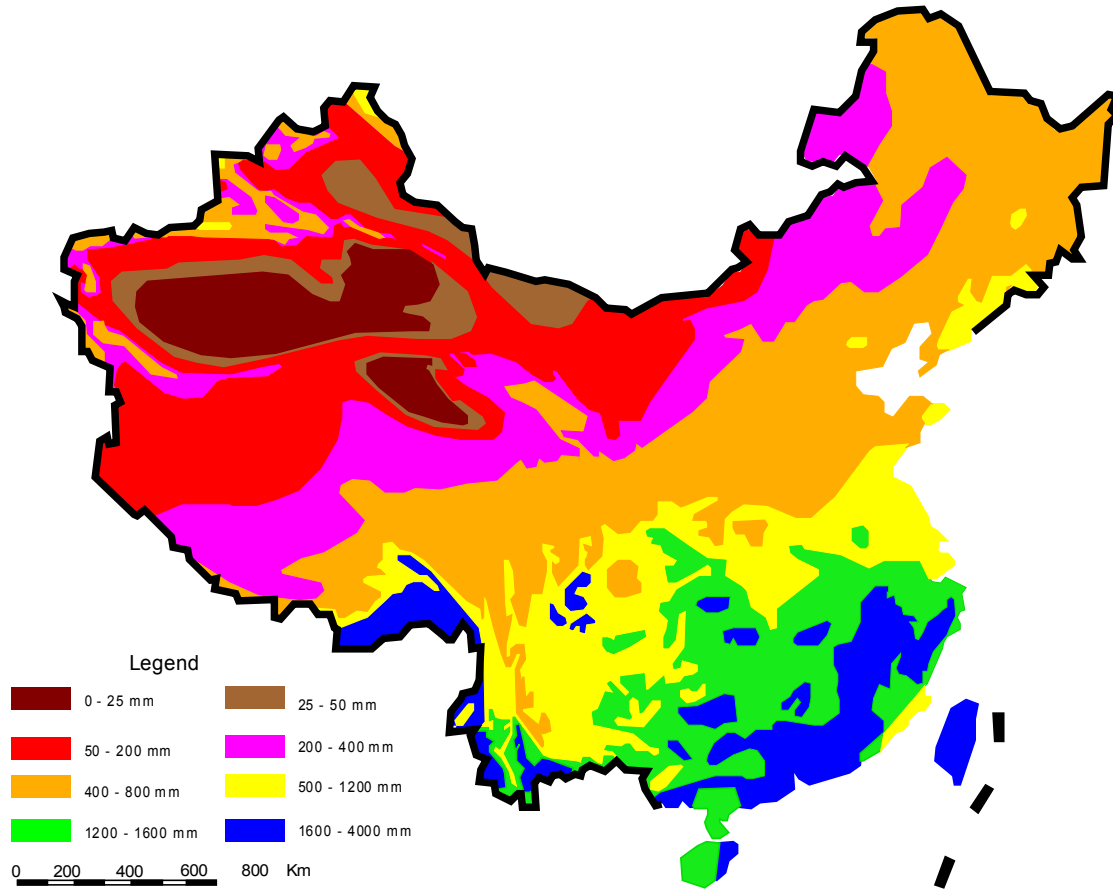
1950 About 600 million people

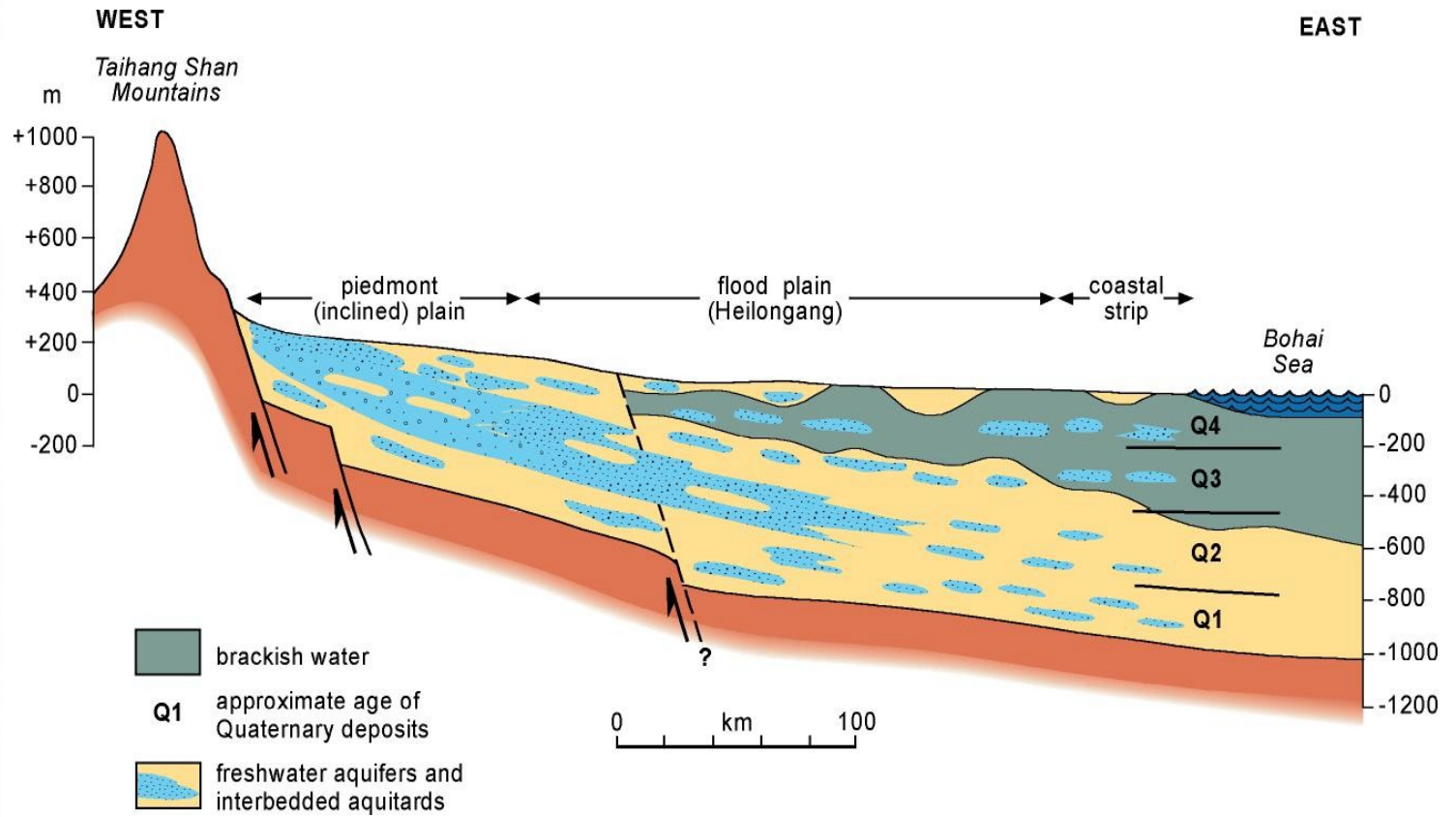
One crop/a, corn, dryland, low yields

2000 1.3 billion people

Two crops/a, wheat & corn, irrigated largely with groundwater in northern China.

Future Totally predictable disaster ?





Resource Over Exploitation

→ Falling shallow and deep groundwater levels over vast area:

- Shallow aquifers: 0.5 m/year decline
- Deep aquifers: 1-5 m/year decline

→ Shallow aquifers - 75% usage

→ Deep aquifers - 25% usage

Groundwater Issues

- **Bores inoperable**
- **Subsidence**
- **Sea Water Intrusion**
- **Groundwater Quality Deterioration**

How to Achieve Sustainable Groundwater Use?

→ **This paper - Real Irrigation Water Savings**

Other Big Strategies

- S-N Grain Transfer
- S-N Water Transfer
- Crop Changes - Where Markets Exist
- Artificial Recharge
- Industrial Water Savings
- Urban Water Savings
- Use of brackish/saline groundwater
- Use of wastewater

Mitigation of Groundwater Resource Depletion

- **DEMAND-SIDE MEASURES**
 - ‘real water-saving’ in agricultural irrigation **likely to make bigger contribution than**
- **SUPPLY-SIDE MEASURES**
 - aquifer artificial recharge and water harvesting **but more difficult to promote and enforce**
- **Applicability/effectiveness of measures will vary with HYDROGEOLOGICAL SETTING**

Water Conservation Project

- Massive irrigation water saving effort
- Identification of Non Beneficial Evapo-
transpiration (NBET)
- Agricultural Water Savings of 100-
150mm: Will stabilise falling shallow
groundwater levels



Reducing Water Use for Irrigation

Techniques for Agricultural Real Water Saving

→ AGRONOMIC MEASURES

- plastic and greenhouses
- deep ploughing, seed types
- wheat stalk shredding, straw mulching
- drought resistant strains and agents

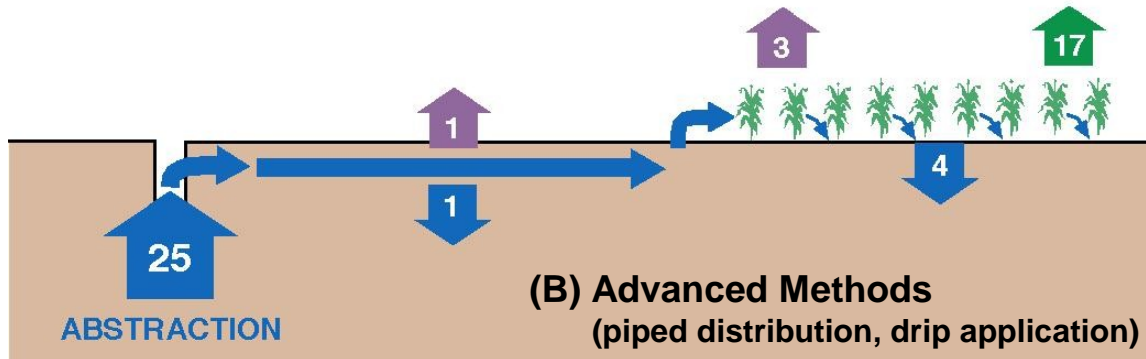
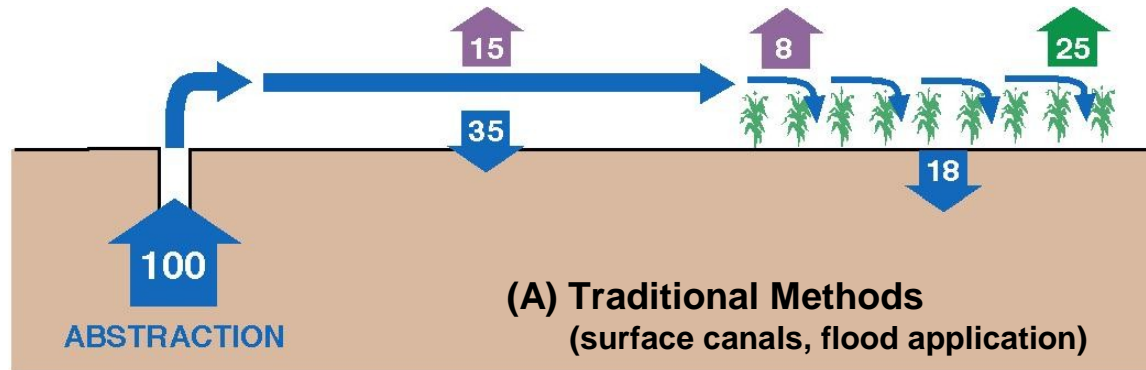
→ ENGINEERING MEASURES

- low-pressure distribution pipes
- drip and micro-sprinkler application technology
- channel lining
- phase out flood, sprinklers

→ MANAGEMENT MEASURES

- improving irrigation forecasting and scheduling
- refining soil moisture control
- develop groundwater management plans

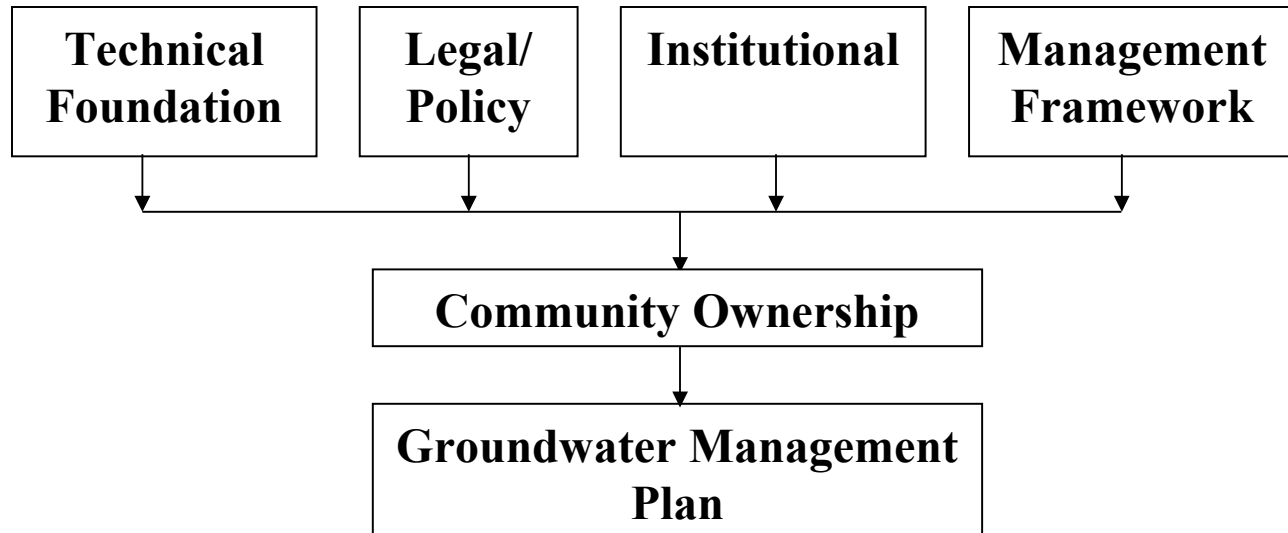
Benefits of Improved Irrigation Methods on real water-saving and energy conservation



 Non-beneficial evapotranspiration

 Consumptive use of crops

Groundwater Management Strategy



Objective: to reduce groundwater usage in the 3H Basins to sustainable levels of 2015

Difference between Surface Water Management and Groundwater Management

→ Surface Water - concentrated

→ Groundwater - diffuse

→ Hence effective groundwater

management must have community ownership and integration

Groundwater Management

4 Key Reforms:

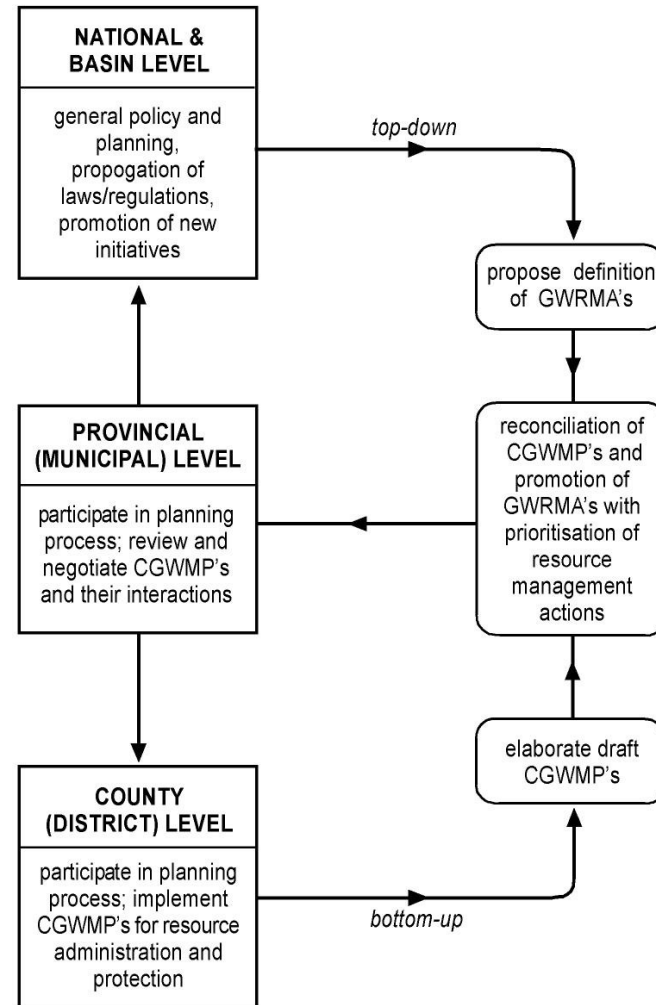
- Reform of institutional responsibility
- Development of a process for groundwater management planning
- Monitoring and licensing
- Implementing appropriate resource fees for groundwater use

Groundwater Management Planning Process

**Policy
Targets**

**Integration
Priority Setting**

**Implementation
Planning**



Groundwater Management Issues in North China

- How to ensure “real water savings” actually occur and result in reductions in abstraction
- Potential for mis-interpretation of real water savings c.f. irrigation efficiency improvement
- Pilot GMP’s developed, but scale of areas (Sub County) is too small to stop falling groundwater levels
- Making the Top Down and Bottom Up Approaches Meet
- Deep groundwater pumping must be almost completely halted - only urban use.
- Community education and ownership

Social Implications

1. Do Nothing - Hard Landing

**In 20 -30 years massive social
disruption**

2. Act Now - Soft Landing

**Hard Decisions now to sustain
food supply**