

China's Agricultural Water Scarcity and Conservation Policies



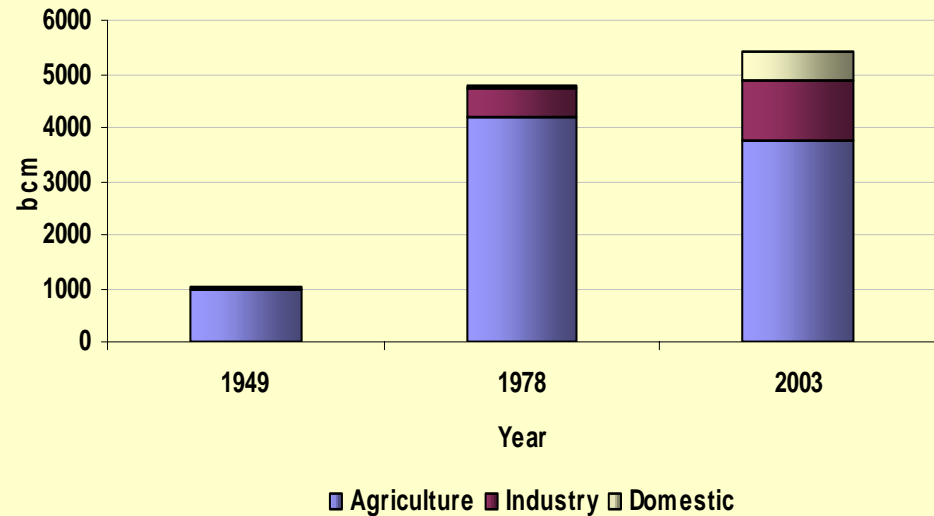
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Water Problems in China

- **Increasing water demand**

- Non-agricultural
- Agricultural



- **Signs of depleted water resources**

- Centered in northern China
- Dry surface systems
- Falling water tables
- Acute pollution

The Debate Over How China's Water Problems May Affect Agriculture

The Dark Side

China will be confronted with a severe water crisis that will significantly reduce irrigated acreage and agricultural production

The Bright Side

China has the capacity to adapt and adjust to the lower water supplies while maintaining or even increasing irrigated acreage

Future Agricultural Production will Depend on New Policies and Institutions

- Past focus of policies and institutions was to exploit water as a cheap resource to boost agricultural and industrial production
- Current changes emphasize more rational water allocation and water conservation

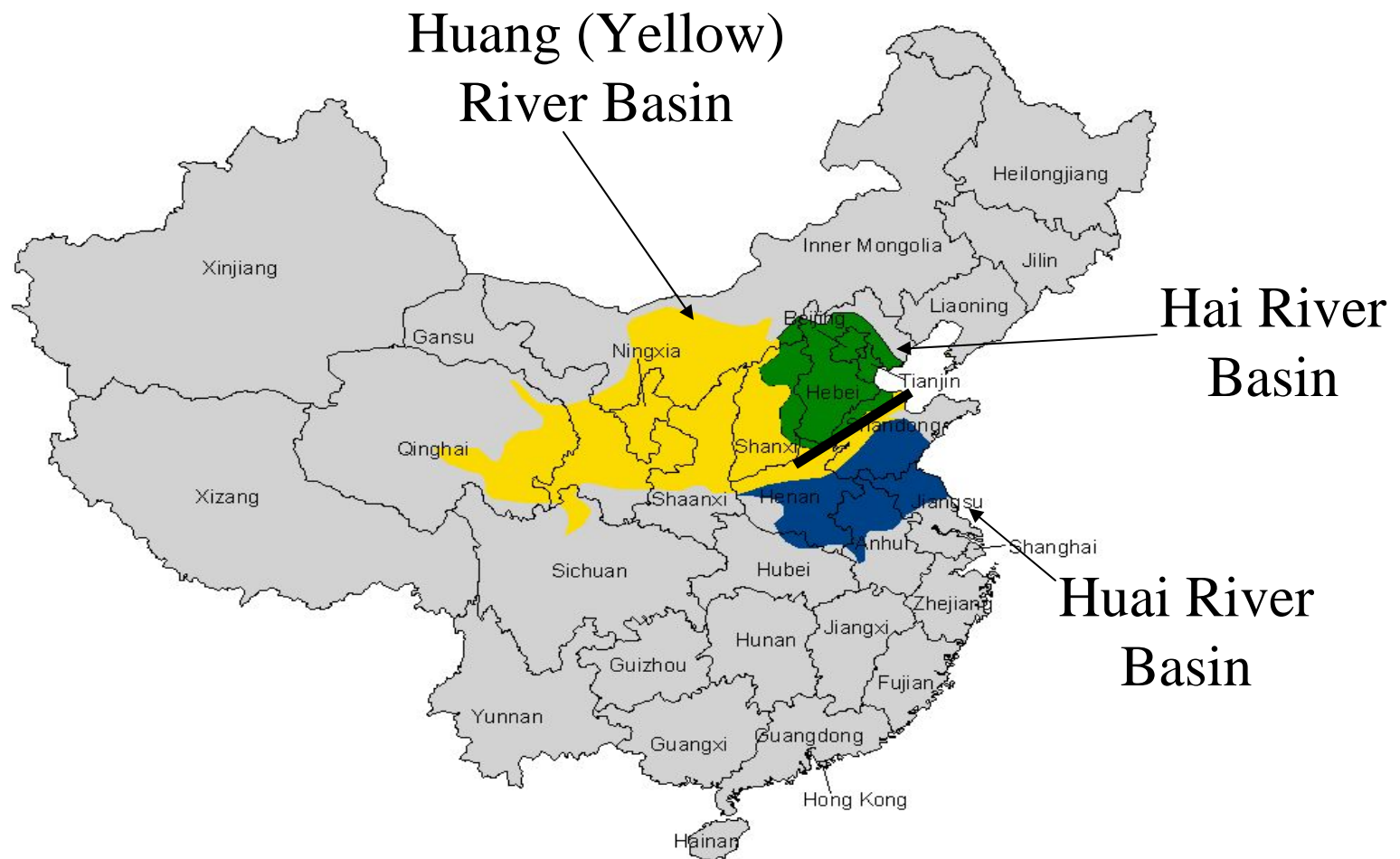
Today's Presentation

- Introduce water shortage problems in China
- Provide an overview of our findings:
 - Ground water issues
 - Surface water issues
 - Water pricing and conservation incentives
- Discuss implications for agricultural production, rural incomes, and trade

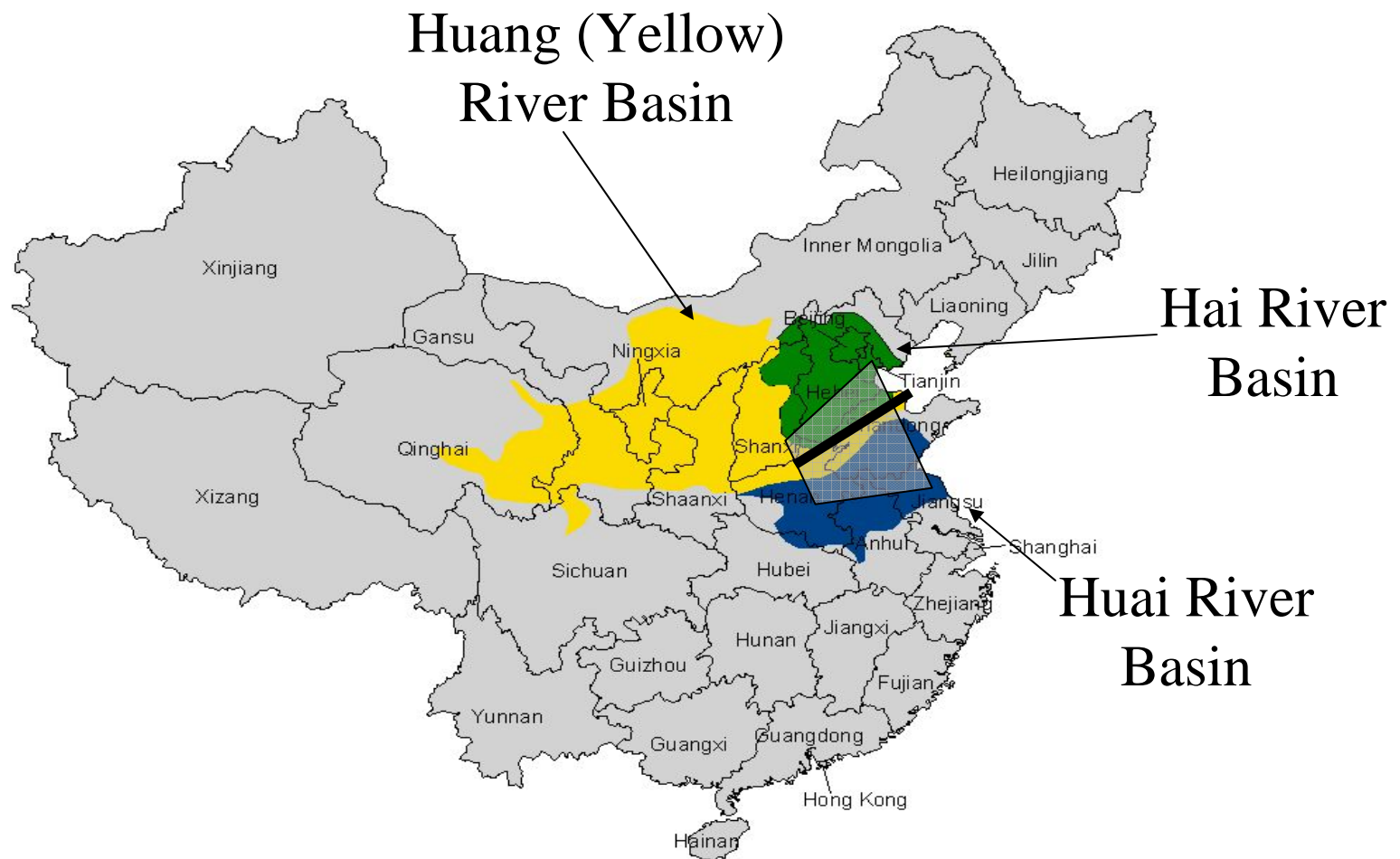
Water Scarcity is Centered in Northern China



The Hydrology of the North China Plain - 1



The Hydrology of the North China Plain - 2



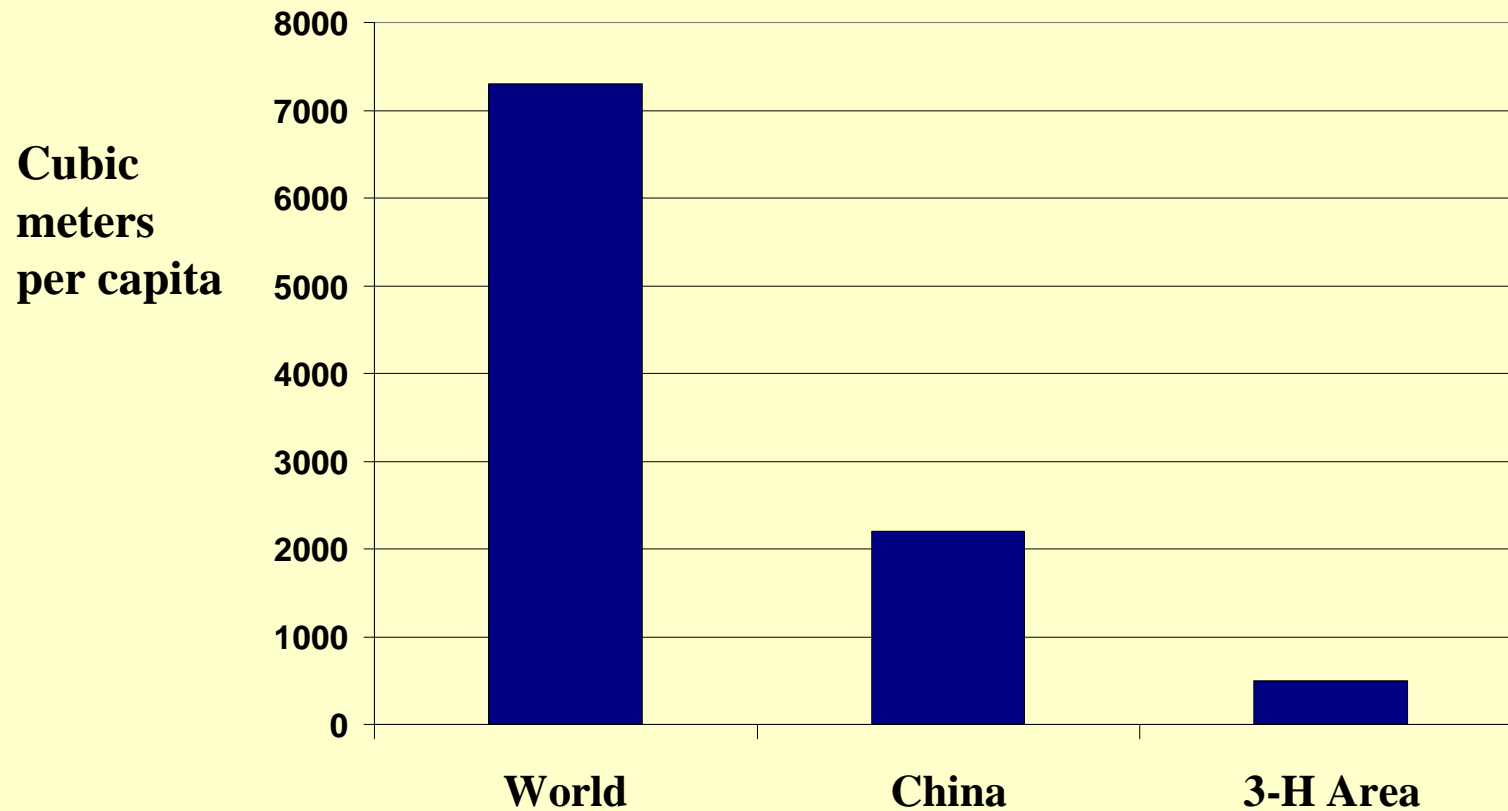
The Hydrology of the North China Plain - 3



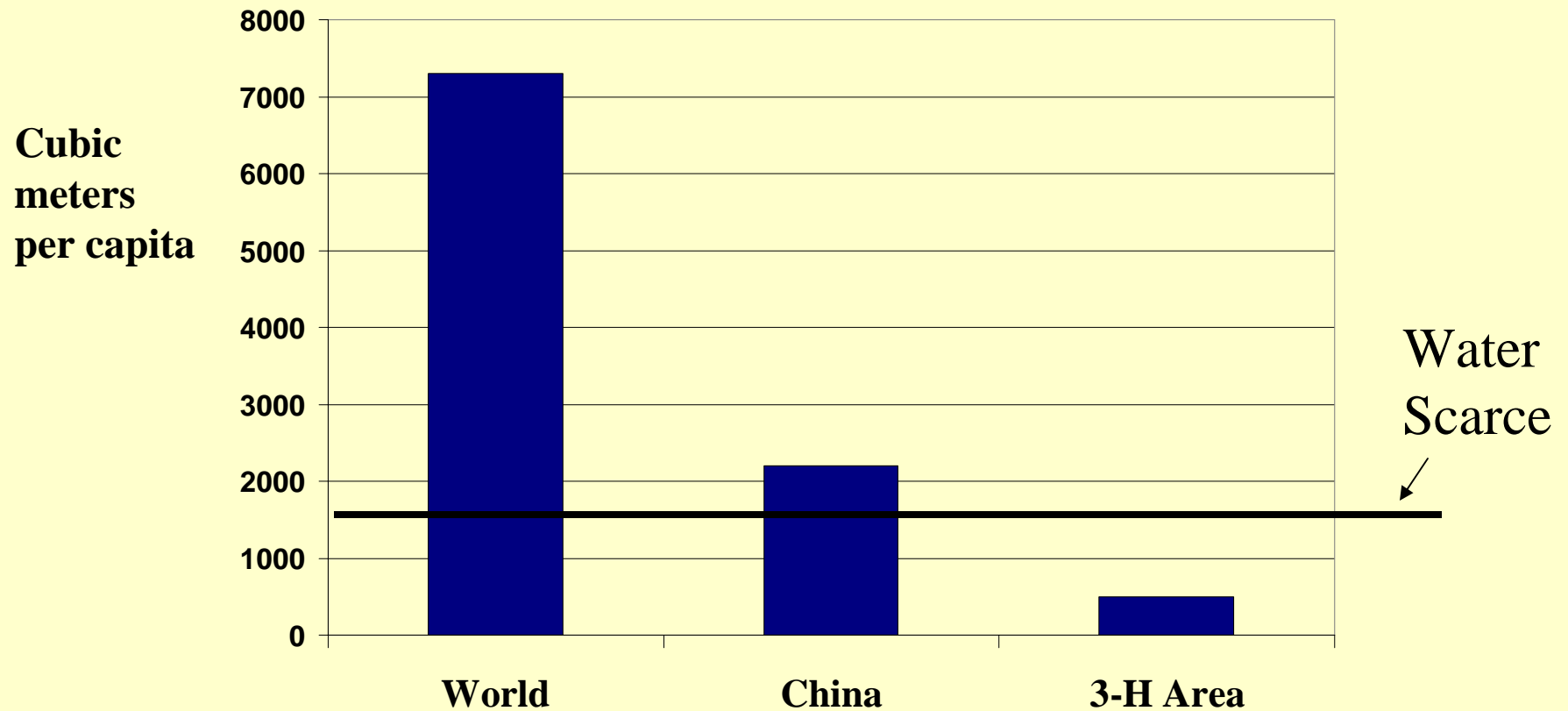
The Hai, Huai and Huang Basins are Major Industrial and Agricultural Areas

- 10 percent of China's water resources
- 1/3 of China's population and industry
- Major agricultural region
 - 40 percent of China's cultivated land and produces
 - 67 percent of China's wheat
 - 50 percent of China's cotton
 - 40 percent of China's corn

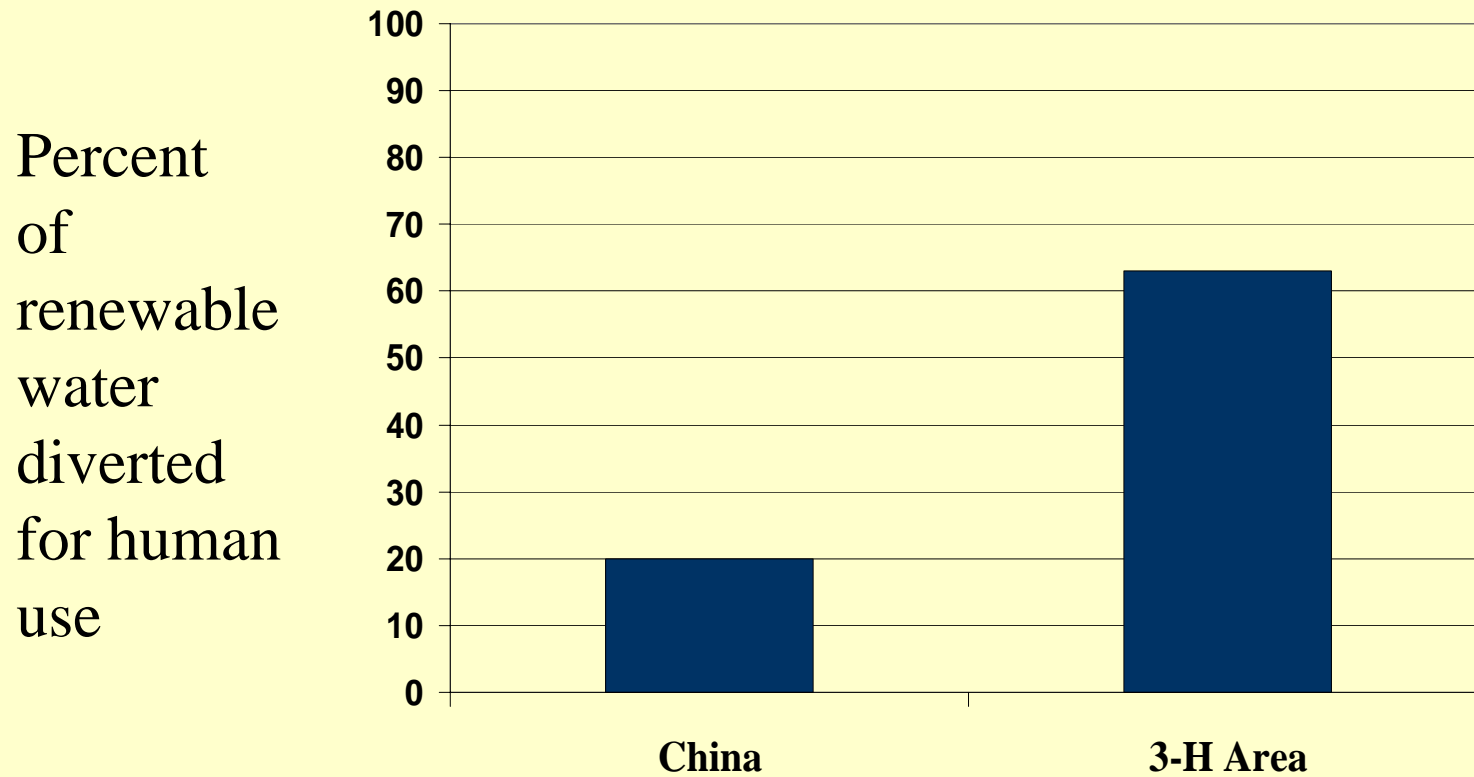
Water Per Capita in the Hai, Huang, Huai Basins is Well Below the Standard for Water Scarcity



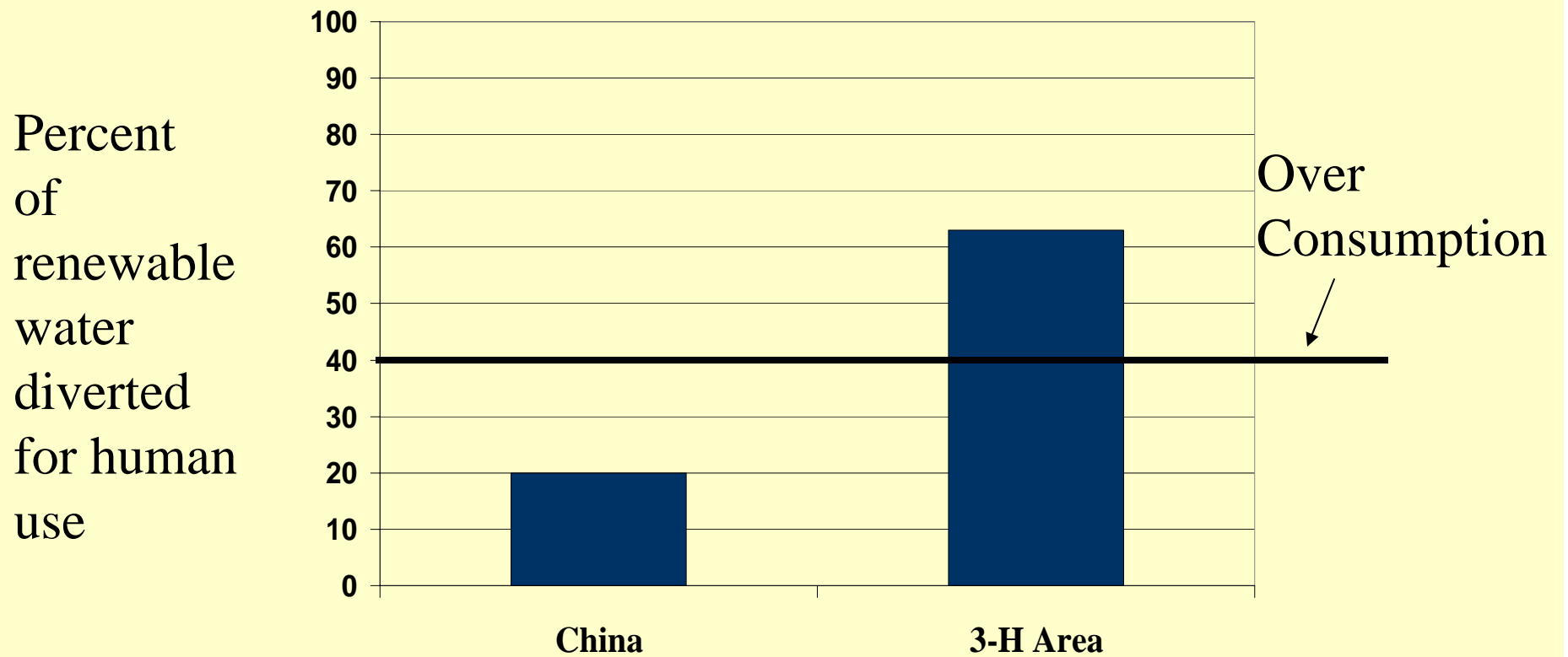
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Exploitation of Renewable Water in 3-H Area is well Above Standard Ceiling



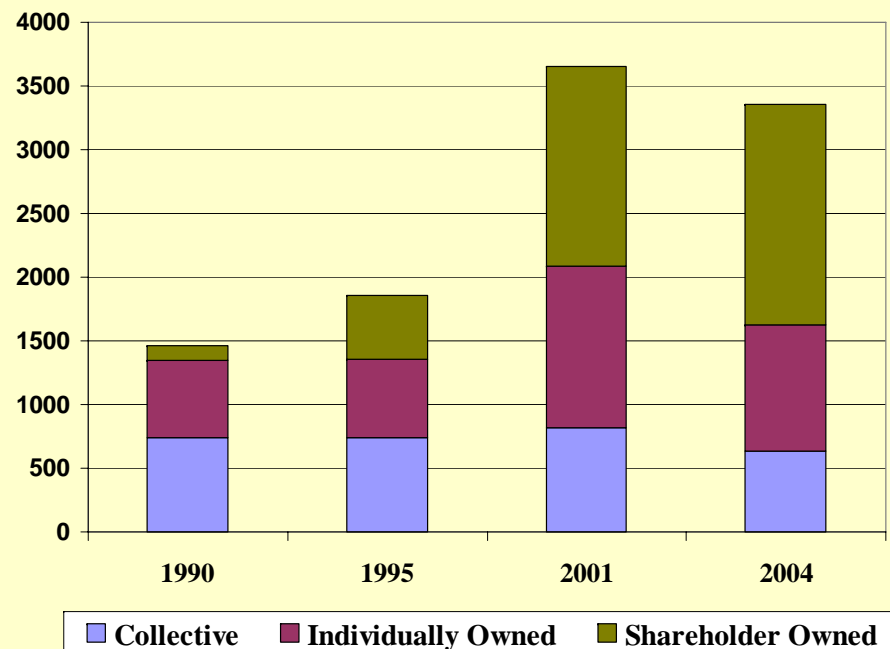
Exploitation of Renewable Water in 3-H Area is well Above Standard Ceiling



Ground Water is an Increasingly Important Source of Irrigation Water in North China

- Over 2 million wells established since the 1960s
- Currently nearly 70 percent of irrigated area uses groundwater
- Recent trends show private interests taking over operations of ground water delivery assets

Rapid increase in privately run wells





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Regulations Are Not Commonly Enforced

- Wells drilled by permit only....**Less than 5% of villages**
- Regulation on pump spacing...**Less than 7% of villages**
- Control volume of pumping.....**2 out of 400 villages**
- Control price of water.....**Less than 10% of villages**

Source: Survey Results from 400 Villages in North China

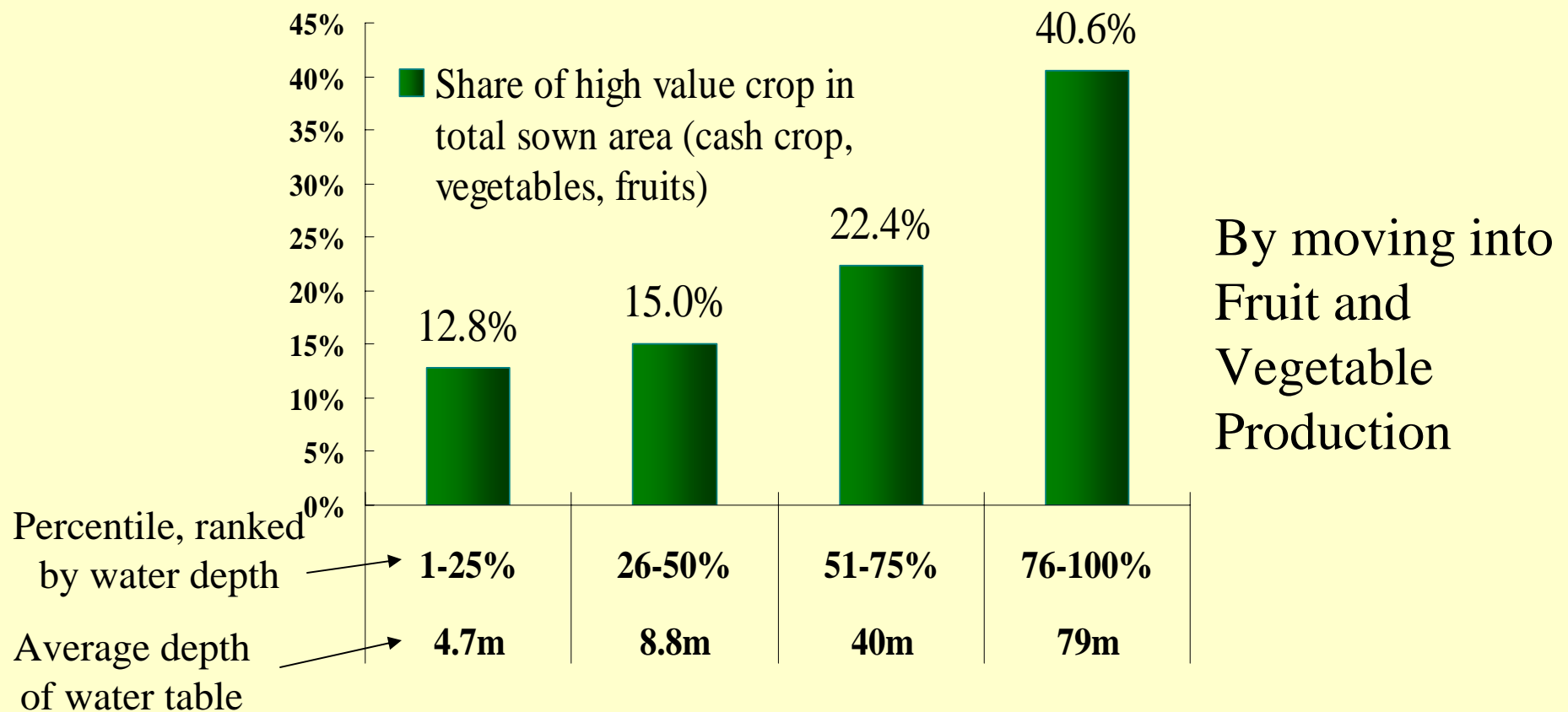
One Quarter of Hai River Basin is Witnessing Severe Ground Water Depletion

Change in Average Water Level
1995-2004

- Increased: 8%
- No Change: 17%
- Decreased 75%
- Decreased > 3 m/year: 26%

Important: Groundwater Prices Rise with Depth

How are Farmers Responding to Falling Water Tables?



Ground water: Summary

- Ground water tables falling rapidly in many parts of Hai River Basin
- Current policies to manage ground water withdrawals are not enforced at the local level
- Expansion of wells mostly from private owners and operators
- Farmers are responding to deeper water tables
 - Water tables are still well above their depth

Surface Water Management Practices

- Ministry of Water Resources
 - Manages River Basins
 - Manages Irrigation Districts at the local level
- Price Bureau
 - Sets price guidelines for water deliveries
- Local Governments
 - Administers local activity, collect and deliver fees

Surface Water Management Reform

- River Basin Management Policies
 - Potentially large gains from alternative allocations along the Yellow River Basin
 - Confounded by provincial interests
- Irrigation District Management Policies
 - Seeks to resolve cost recovery and promote water conservation

Collaboration with ABARE on River Basin Management Issues

- Yellow River Model
 - Substantial gains from allocating water to downstream users (roughly US\$1 billion/year)
 - These allocations will increase crop production but not change the structure of production
- Current research into the gains from reallocation within and between villages

Problems with Irrigation District Management

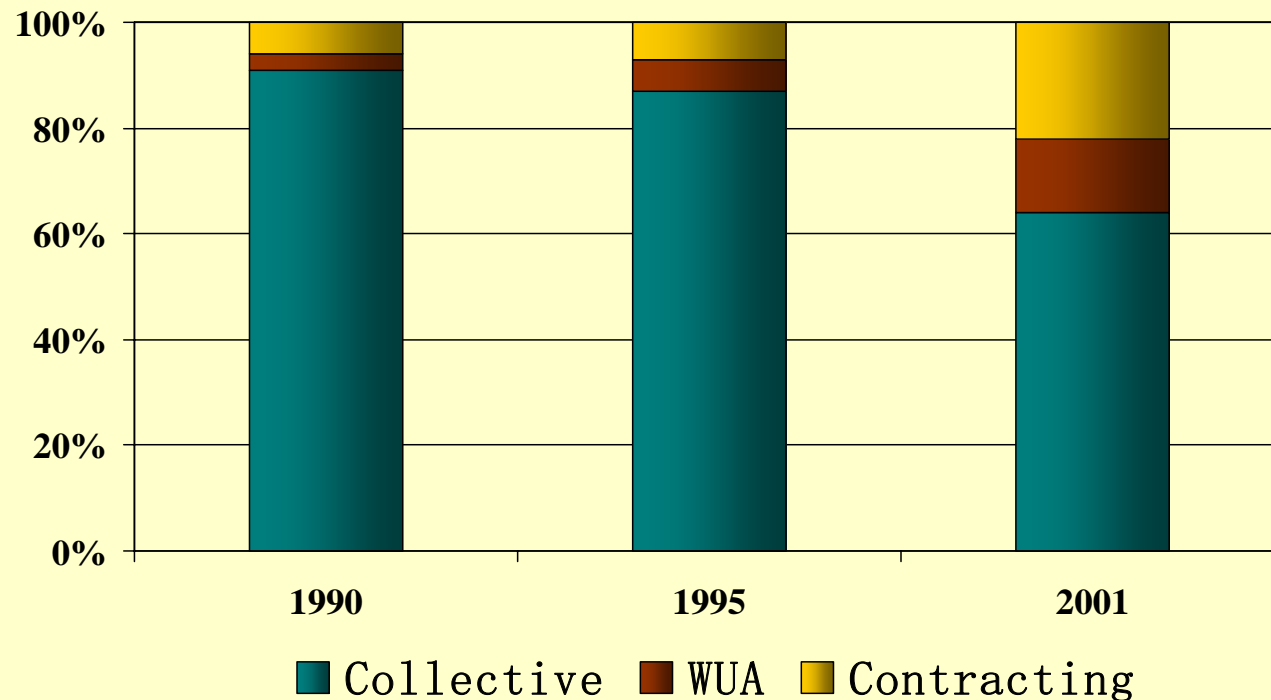
- Cost recovery and infrastructure investment
 - Prices too low to cover operating costs
 - Income insufficient to maintain infrastructure
- Lack of incentive to reduce water use
 - IDs receive too little money for improved water deliveries to make it worthwhile to monitor

ID Management Reforms

- Water User Associations (WUAs)
 - Ostensibly farmer organized groups to elect managers and make joint irrigation policy decisions
- Canal Contracting
 - Contracting the management of lateral canals out to individuals who make investments, provide delivery services and collect fees

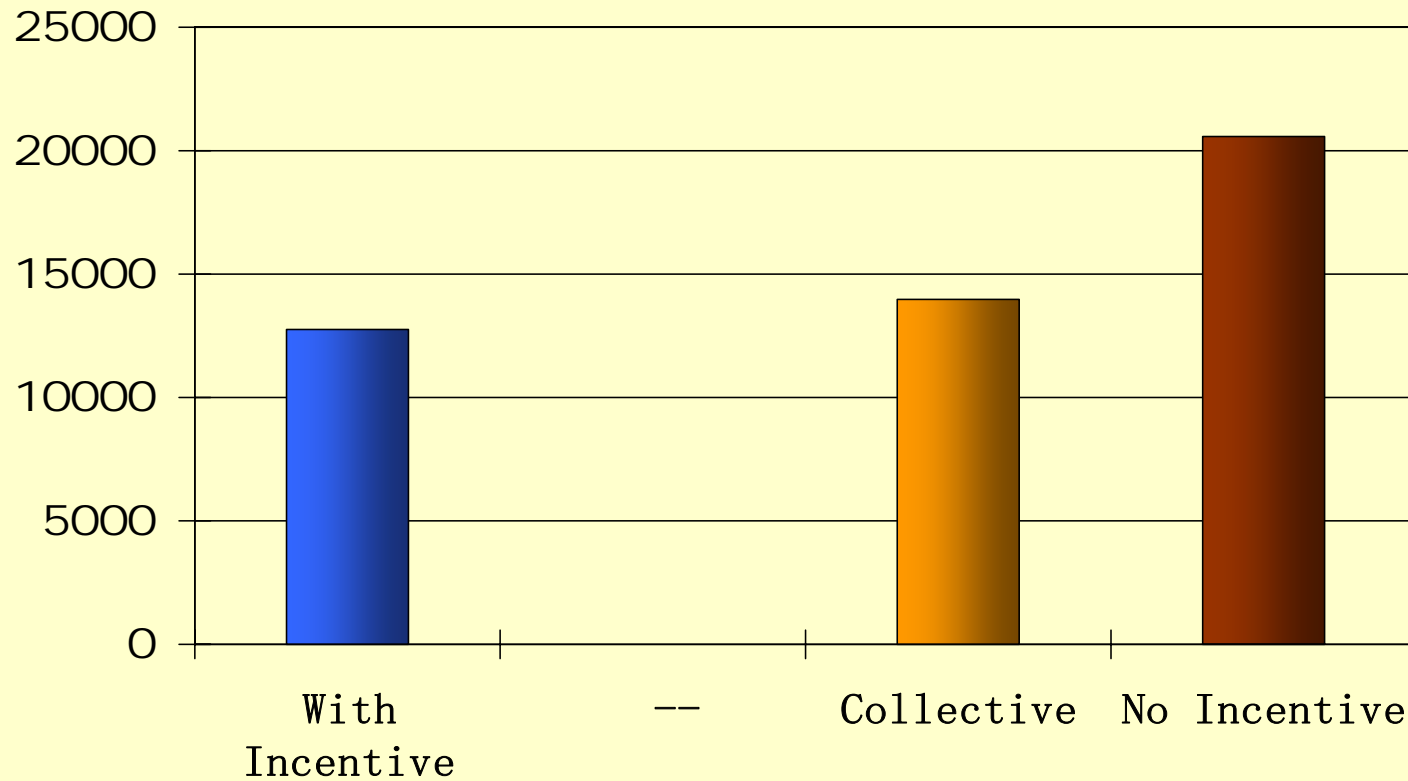
Increased Adoption of Irrigation District Management Reform in Yellow River Basin

Percent of Villages Adopting New Reforms



Data from Fieldwork in Ningxia and Henan Provinces

Water Use Under Reforms With and Without Incentives



Summary of Findings on Irrigation District Management Reform

- When effective, ID management reform can
 - Reduce water applications significantly
 - Have little negative effect on crop production or rural incomes
- Unclear how the reforms affect
 - Cost recovery
 - Longer term investments

Water-saving Irrigation Technologies

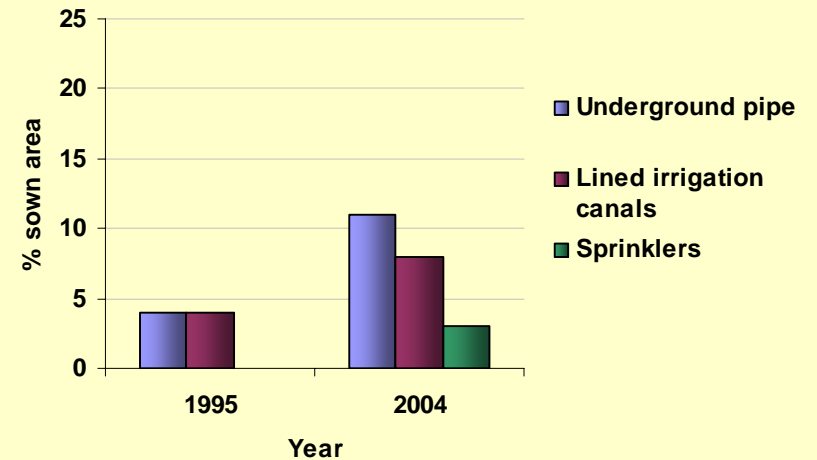
- Both the Ministry of Water Resources and the Ministry of Agriculture have been actively promoting water-saving irrigation technologies
- Incentives to adopt such technologies are not strong, but often they are profitable despite water savings

Water-Saving Technology Adoption at the Village and Household Level

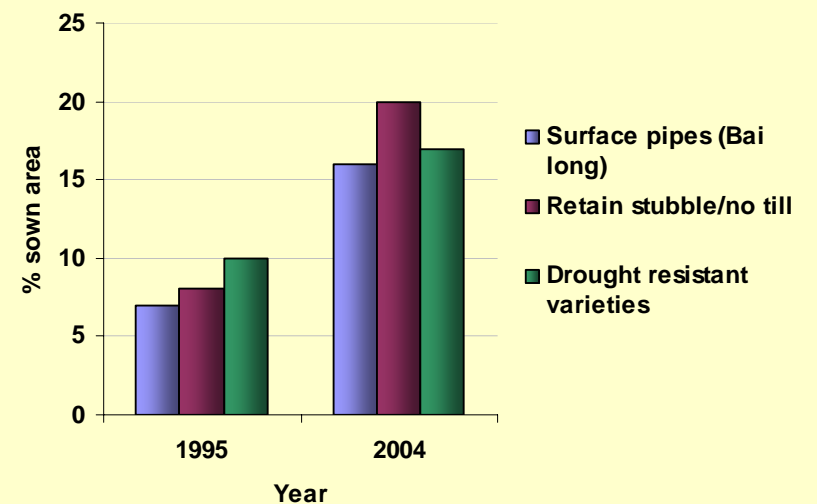
Adoption of water-saving technology increasing...

...but still room to grow

Village



Household



Determinants of Technology Adoption

- Econometric results indicate
 - Relationship to water price
 - Correlation with groundwater
 - Some technologies correlated with extension activity
 - Plastic sheeting
 - Drought resistant varieties

Pricing and Delivery Practices Present Major Obstacles to Promoting Water Conservation

- Prices are too low
 - 20-30 percent of VMP for ground water, less for surface water
- Prices are not always volumetric
 - Costly with so many small plots of land to irrigate
- Farmers do not control deliveries
 - Do not decide when or how much

Caveats to Price Policies

- Nearly all surface water is not priced volumetrically
- Price must rise significantly to induce conservation
- Raising prices runs counter to other important policy goals:
 - Raising rural incomes
 - Grain self-sufficiency

Water Quality

- Interactions within agriculture:
 - Nitrogen fertilizers
 - Pesticides
 - Salinity
 - Soil erosion
- Industrial-agriculture interactions
 - In one survey, respondents reported that 95 percent of groundwater pollution was from industry



- More work with ABARE, MWR, CAS, UC Davis
 - USDA participation supported by FAS Emerging Markets Office
- ERS China Briefing Room
 - www.ers.usda.gov/Briefing/China