

# **China's biomass availability and potential: Is it possible to rescue food security from its predicament?**

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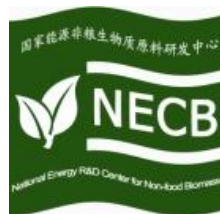
**National Energy R&D Center for Non-food Biomass**

**College of Agronomy and Biotechnology**

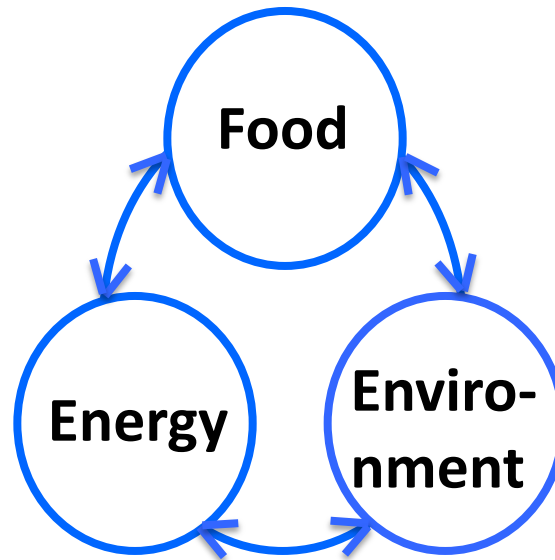
**China Agricultural University**

**国家能源非粮生物质原料研发中心**

**中国农业大学农学与生物技术学院**



# China biomass development faces the challenge of Food-Energy-Environment complexity



# Biomass potential from organic wastes

## Forest residue

**200 Mt**

- Competitive usage
- High cost

(Xie et al. , 2012)

## Crop residue: **750 Mt** (Wang et al. , 2013)

- 88% field residue, 12% process residue
- 73% from maize (23%), rice (30%), wheat(20%)
- **42% (314 Mt)** potentially available for biofuel
- High collection and logistic cost

## Livestock excreta:

**220-280 Mt** (dry)

Waste dead animal:

**2.2 billion pigs**

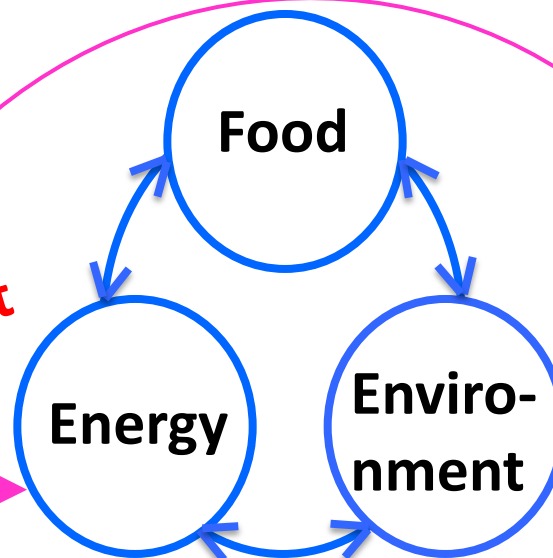
Municipal solid

waste: **221Mt**

Organic waste water:

**48 billion ton**

**National and local  
policy measurement**



# Distribution of crop residue by county

2740 counties in total

0 ~3.1 Mt (0.34 Mt on average) in each county

1.0 ~ 3.1 Mt: 174 counties (5.4%)

0.5 ~ 1.0 Mt: 407 counties (17.3%)

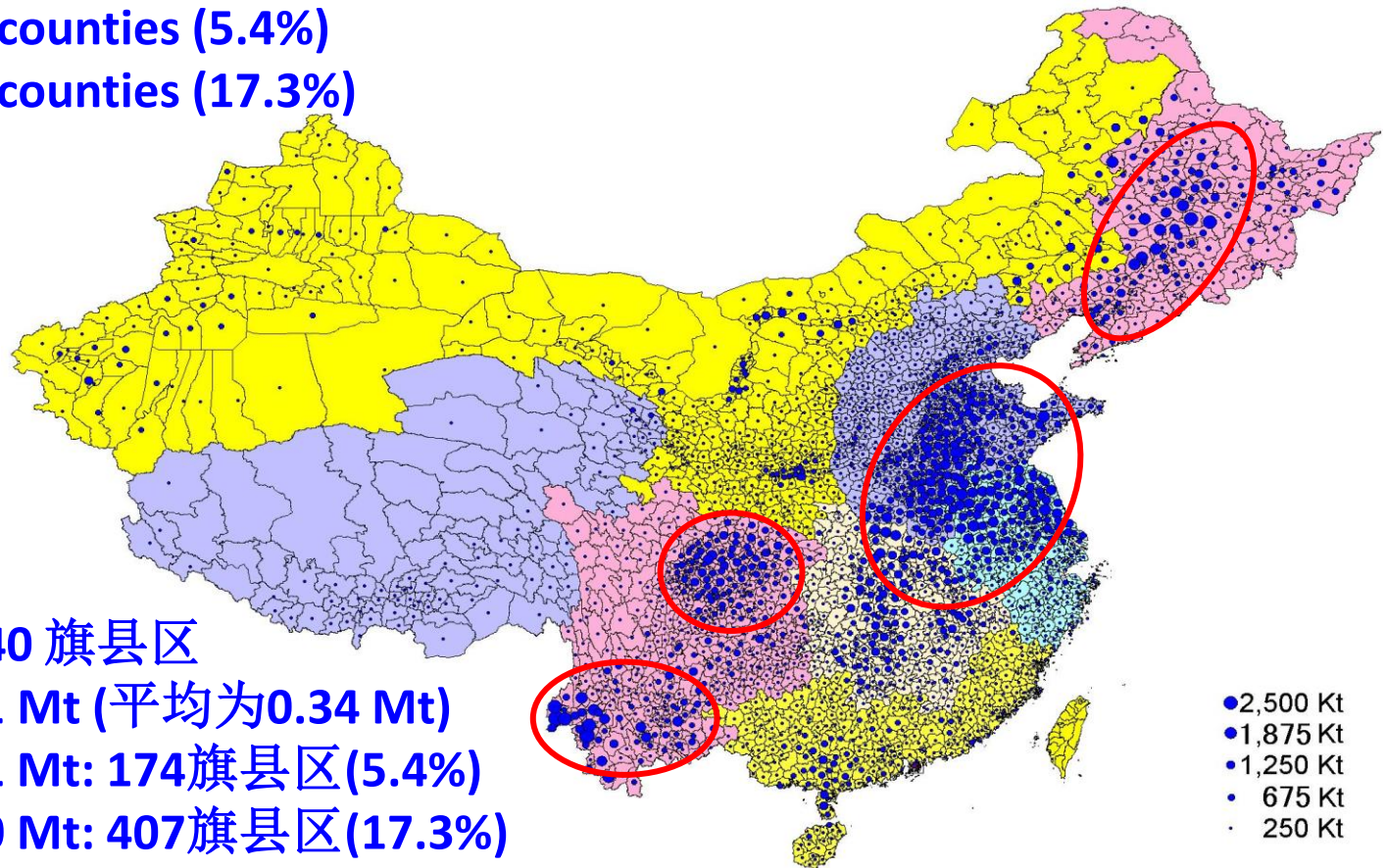
## 县级作物秸秆产量分布

全国总县数：2740 旗县区

每县秸秆：0 ~3.1 Mt (平均为0.34 Mt)

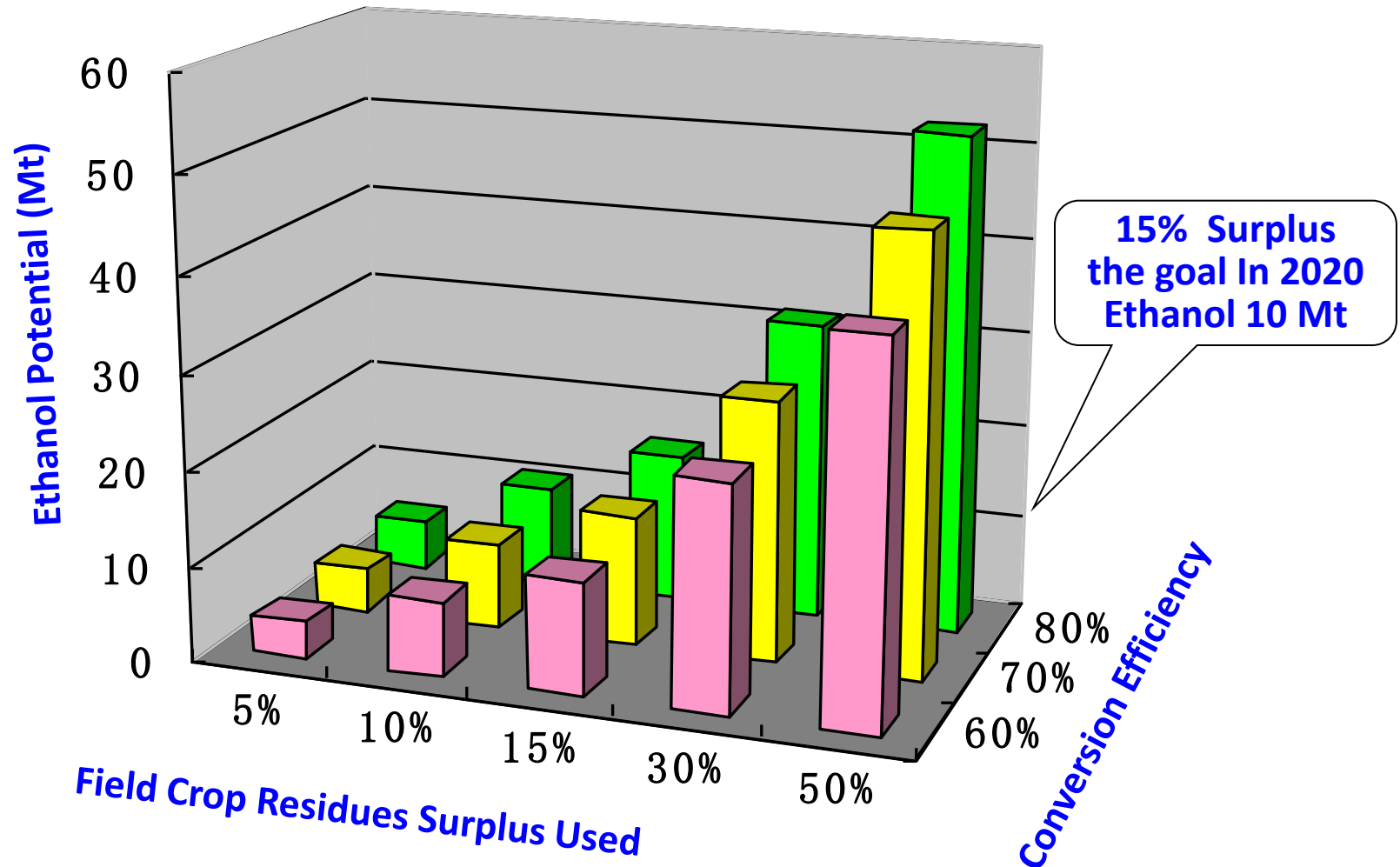
秸秆产量1.0 ~ 3.1 Mt: 174旗县区(5.4%)

秸秆产量0.5 ~ 1.0 Mt: 407旗县区(17.3%)



# Potential of ethanol from crop residues

Assuming that cellulose+hemicellulose=60%



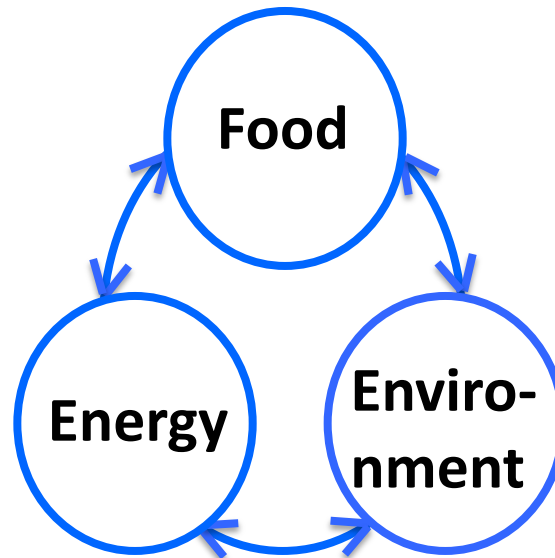
# Potential of biomass from marginal land

Arable land in total:  
**137 Mha**

≈

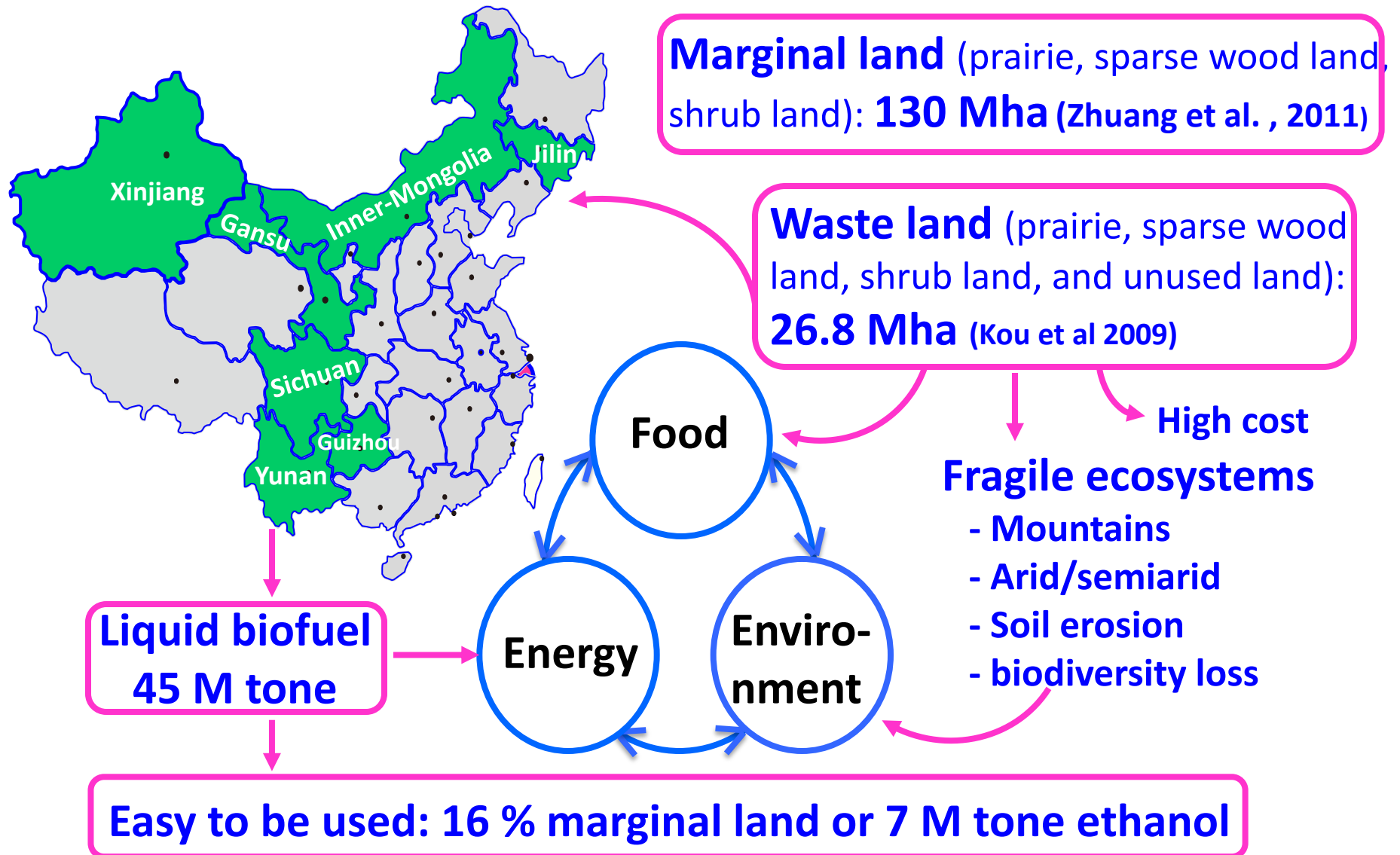
**Marginal land** (prairie, sparse wood land, shrub land): **130 Mha** (Zhuang et al. , 2011)

Most researchers (Yan et al, 2008; Tang et al., 2010 ; Shi, 2011) over-estimated marginal land (**110-164 Mha**) for biomass in China

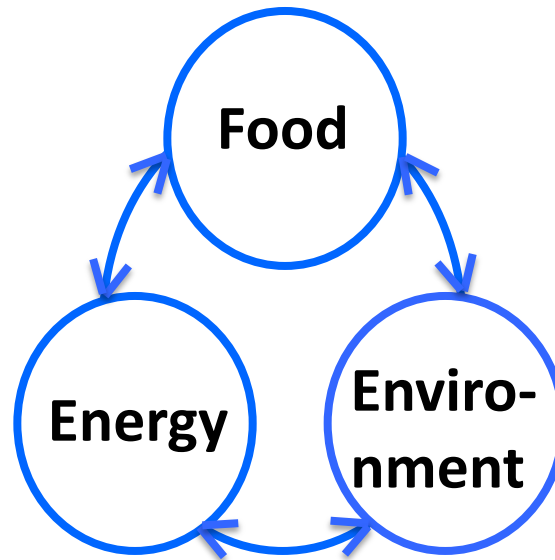




# Potential of biomass from marginal land

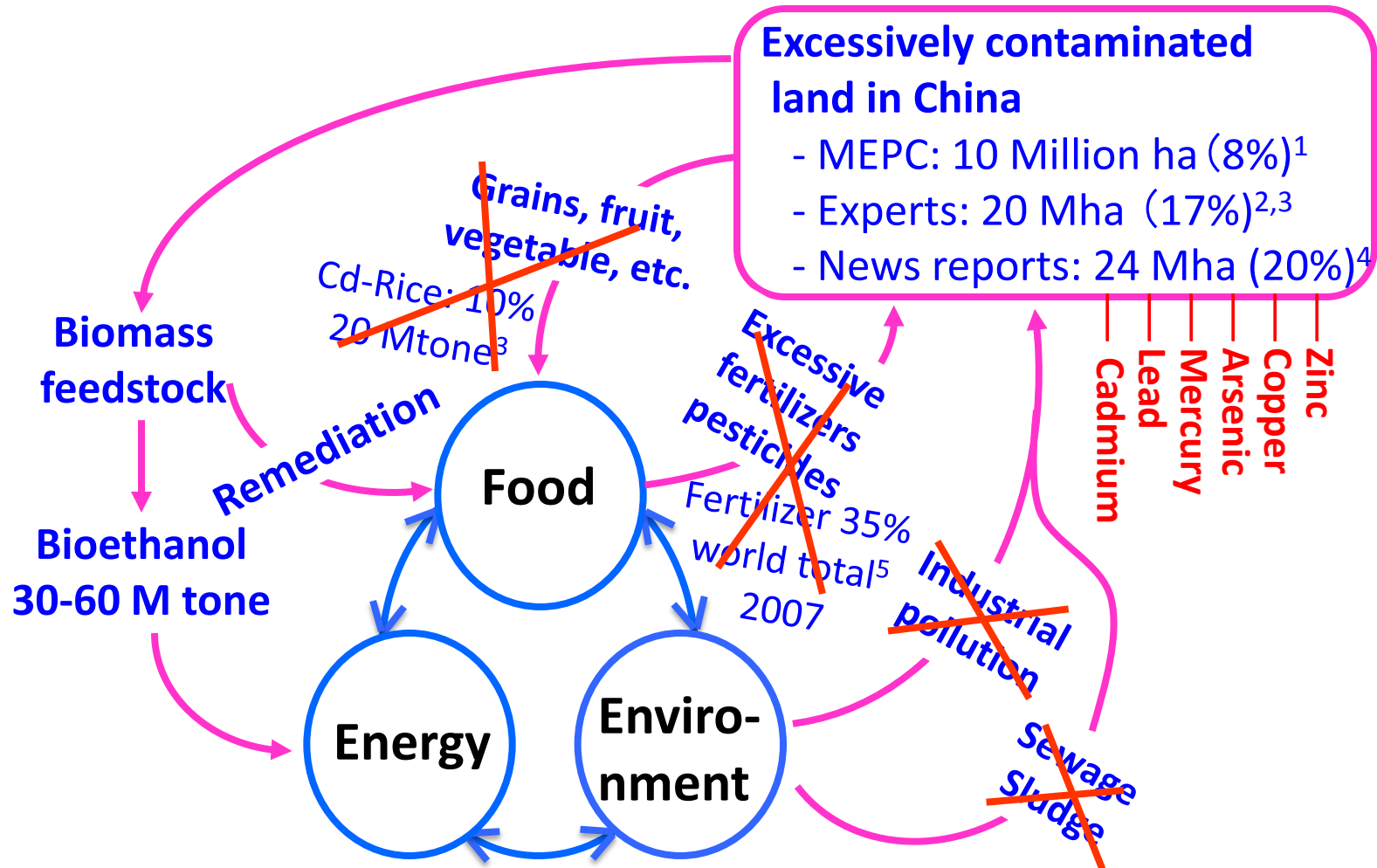


# Could biomass improve food security in China?





# Potential of contaminated arable land



(<sup>1</sup>Zhou Shengxian. 2011; <sup>6</sup> Wang Huan. 2010; <sup>3</sup> Lu Zixian; <sup>4</sup> Sun et al. 2013; <sup>5</sup> Fan 2010)

# China food security predicament

World trade liberalization

Int'l markets

Price gap: 500-800 CNY/t  
3200 CNY/t (sugar)  
**INCREASING**

Food price August 2014 (CNY/t)

|       | CIF<br>dutiable<br>price | Domestic<br>market<br>price |
|-------|--------------------------|-----------------------------|
| Rice  | 3329                     | 3800                        |
| Wheat | 2007                     | 2507                        |
| Corn  | 1767                     | 2500                        |
| Soy   | 3900                     | 4400                        |
| Sugar | 2800                     | 6100                        |

Trade  
barriers ?

Food

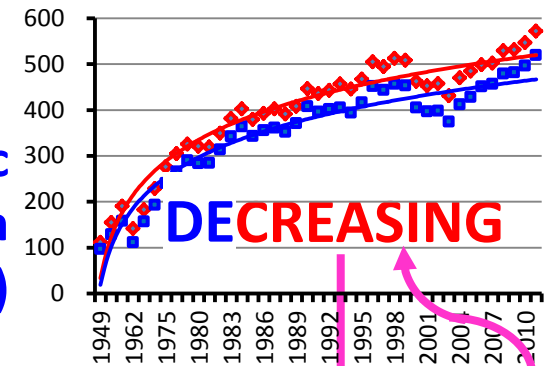
Energy

Enviro-  
nment

Domestic  
production  
grain (Mt)

Domestic markets

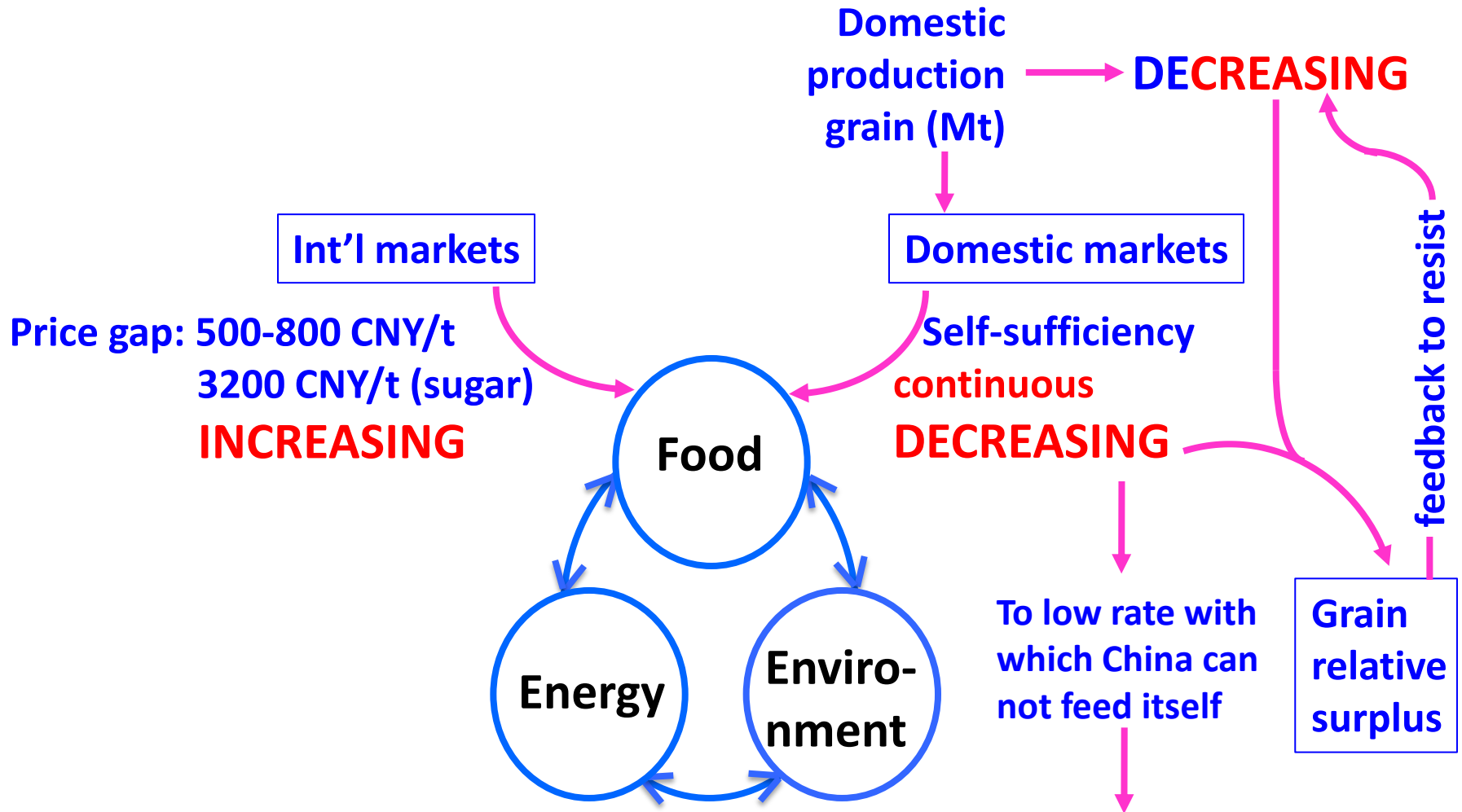
Self-sufficiency  
government:  $\geq 95\%$   
**DECREASING**  
from 100% 2002  
to 89% 2012



Grain  
relative  
surplus

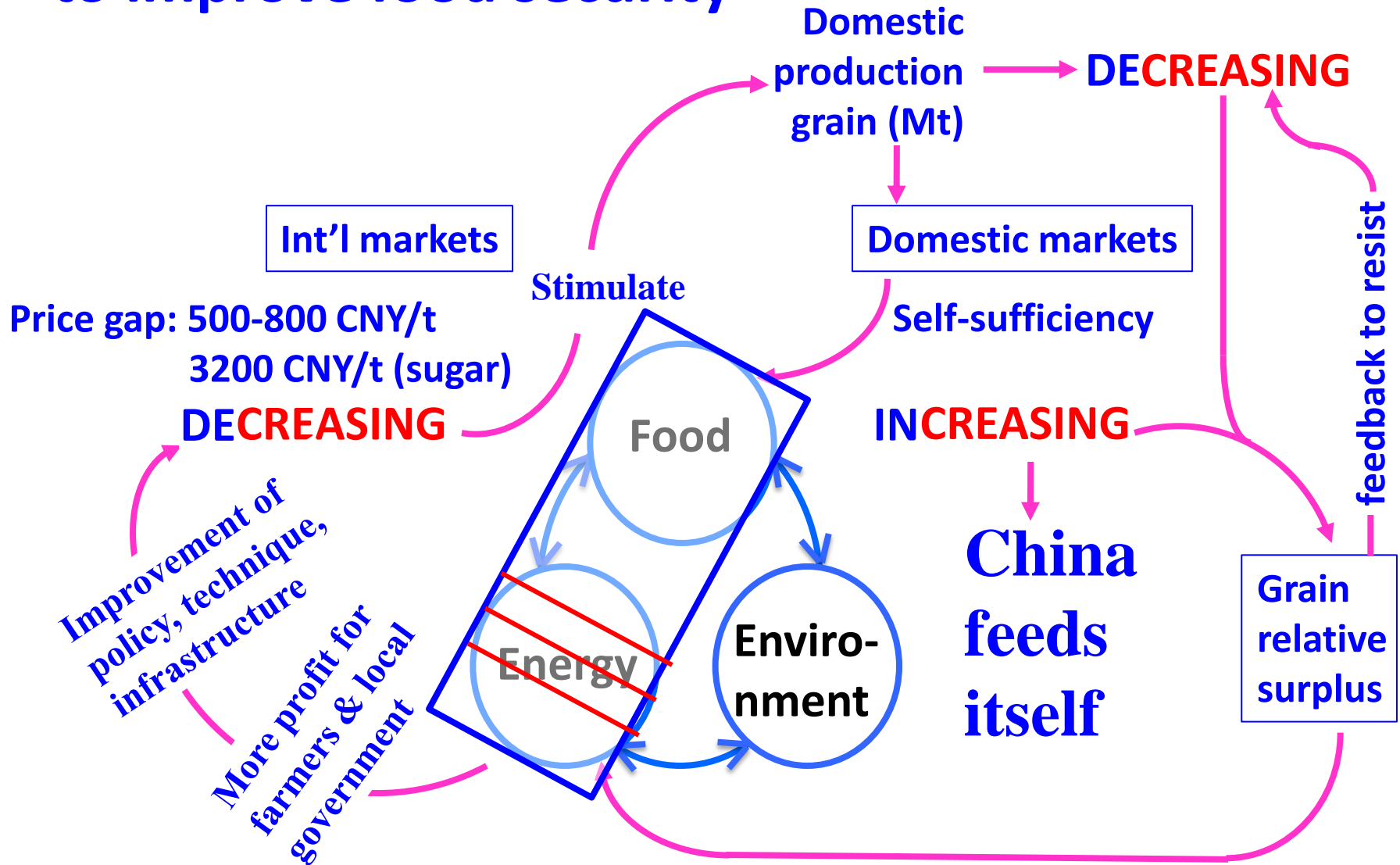
feedback to resist

# China food security predicament

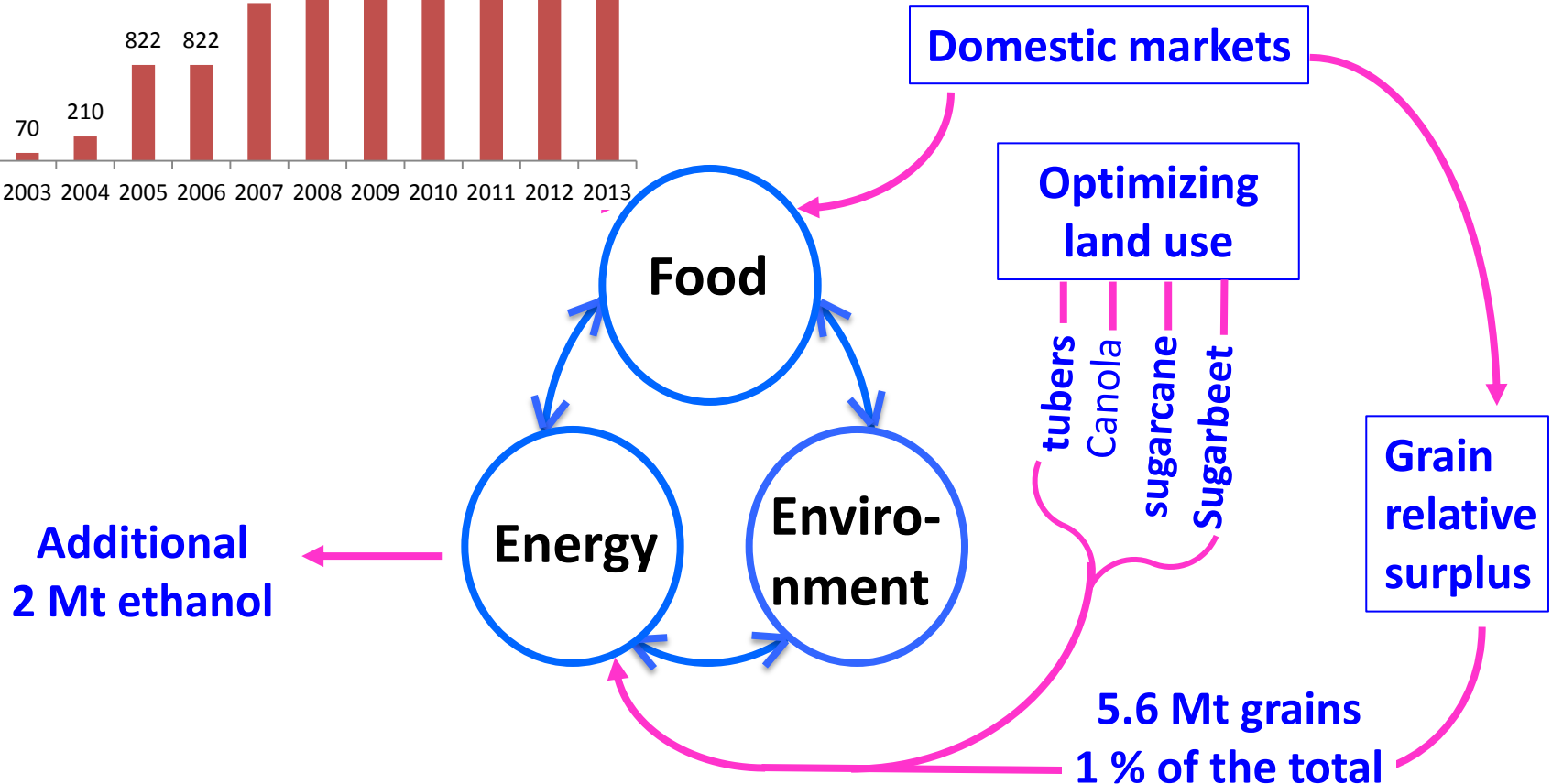
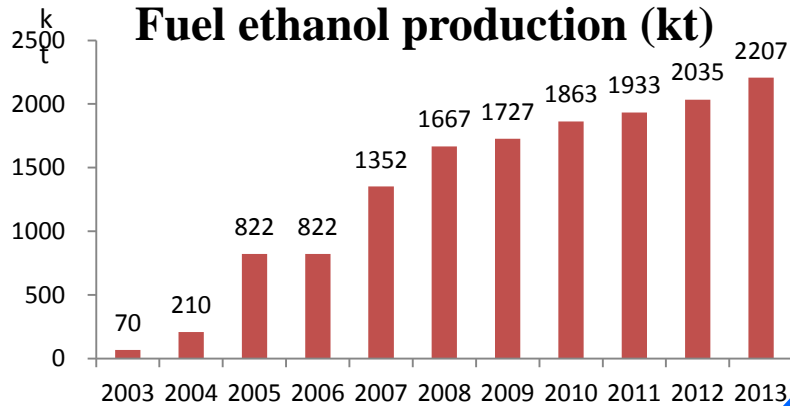


**Nightmare: Nobody can feed China !!!**

# Combine food and energy (CFE) to improve food security



# Potential of food crops for fuels??



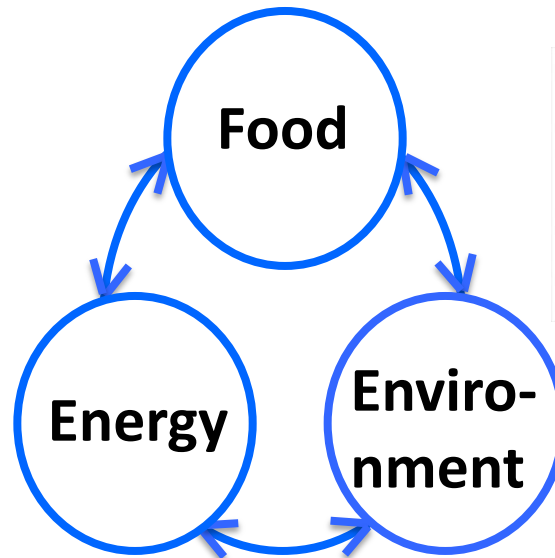
# Conclusion: biomass availability and potential

- **First largest potential organic wastes**
  - rich and diversity, recycling to improve environment
  - for diversity energy production: power, heat, biogas, ethanol, bio-oil, .....
  - high collection and logistic cost
- **Second one food crops mainly for food security improvement**
  - ethanol: 200 + 200 Mt (?? or more)
- **Last and uncertain potential is marginal land**
  - not as large as expected!!
  - evaluation for the risk of soil erosion and desertification
  - perennial grasses

# Implication: Collaboration for the complexity of Food-Energy-Environment (FEE) Integration

|             | Agriculture                                 | Forest | Energy | Environment | Society | International |
|-------------|---|--------|--------|-------------|---------|---------------|
| Governments | 😊   | 😊      | 😊      | 😊           | 😊       |               |
| Researchers | China government plays a crucial role on it |        |        |             |         |               |
| Industries  |   |        |        |             |         |               |
| Education   |   |        |        |             |         |               |

NEA



Thanks for your



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