



Institute of Environment and Sustainable Development in  
Agriculture, Chinese Academy of Agricultural Sciences

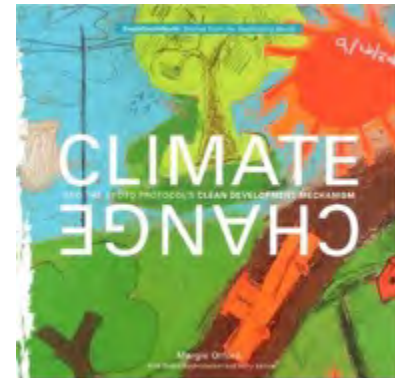
IEDA, CAAS

# Increasing cropland soil carbon sequestration, China is in action

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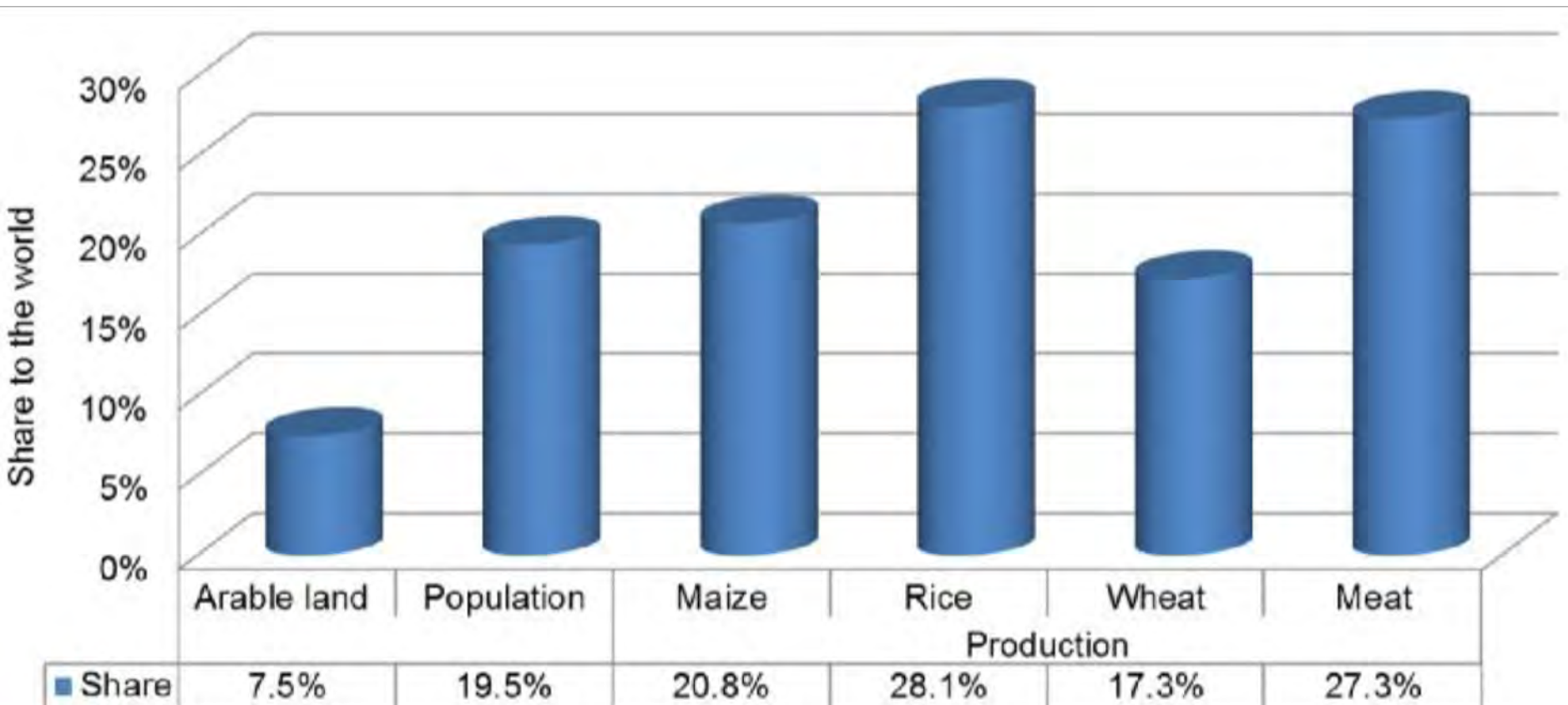


# In this talk

- **Agricultural production and challenge**
- **Carbon stock of Chinese cropland**
- **Action: Application of organic material**
- **Action: Land use rights transfer**

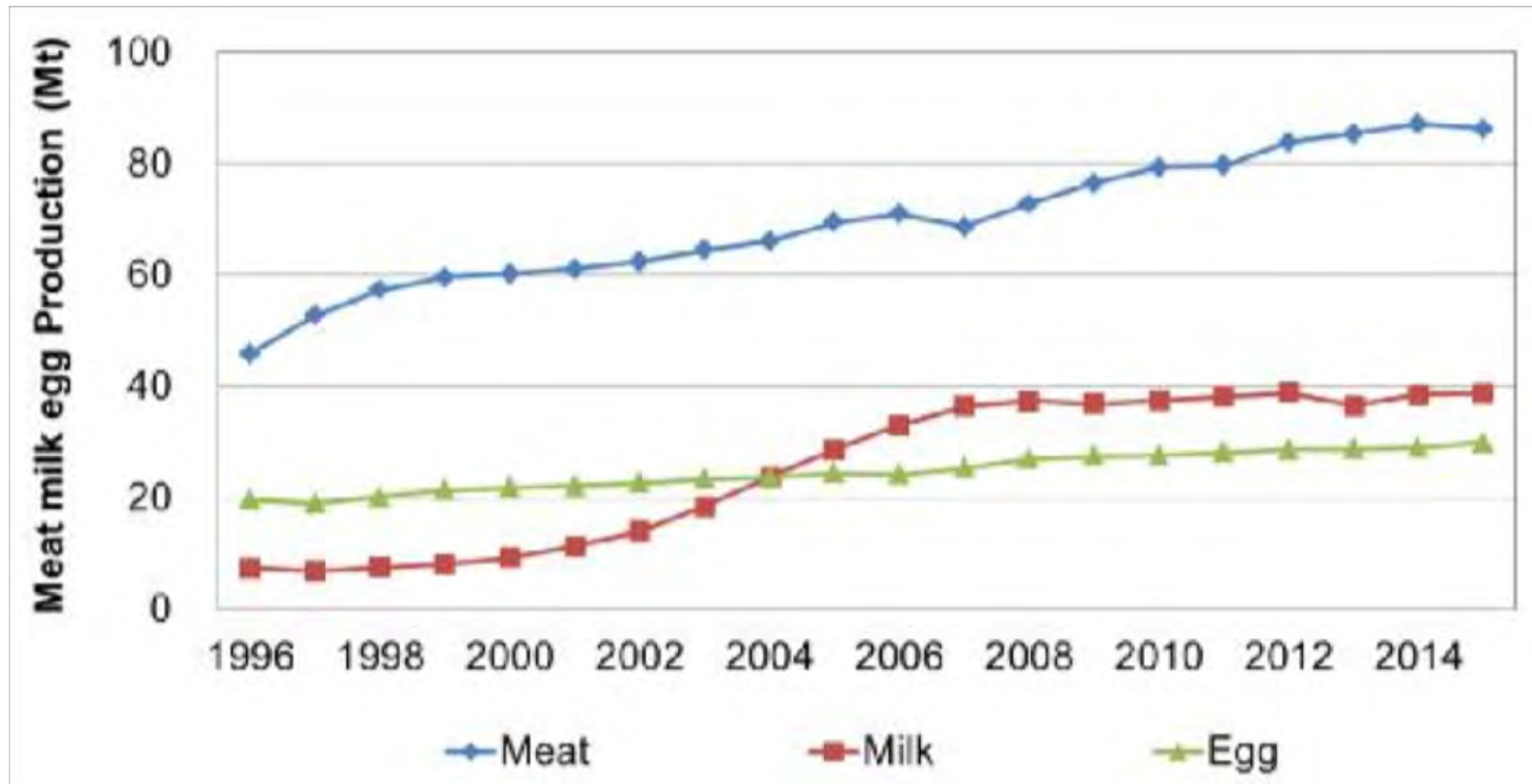


# Agricultural production



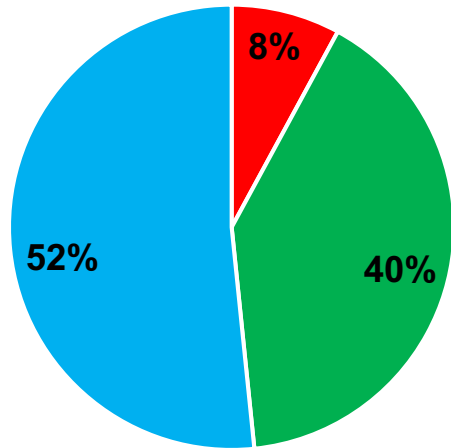
**China provides food and meat for 1/5 of the world population**

# Agricultural production



**Grain yield increased 122% since 1980. Rice, wheat, and maize increased 49%, 136% and 259%, respectively. It continuously increased in recent 12 years Meat, milk and egg production have increased 88%, 426% and 53% from 1996 to 2015**

# Agricultural production

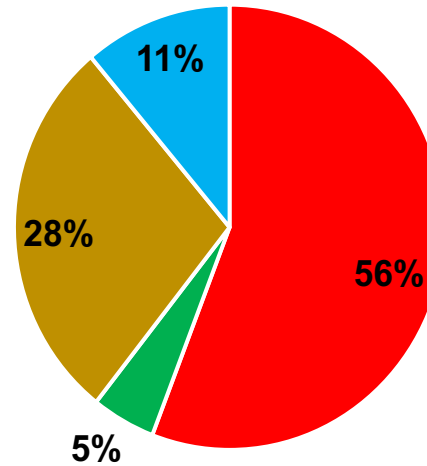


Composition of GDP

■ Agriculture

■ Industry

■ Service



Composition of agricultural

■ Farming

■ Forestry

■ Animal husbandry

■ Fishery

**Agriculture: ¥6.55 Trillion in 2018, account for 7.92%**

Source: China statistic yearbook 2018



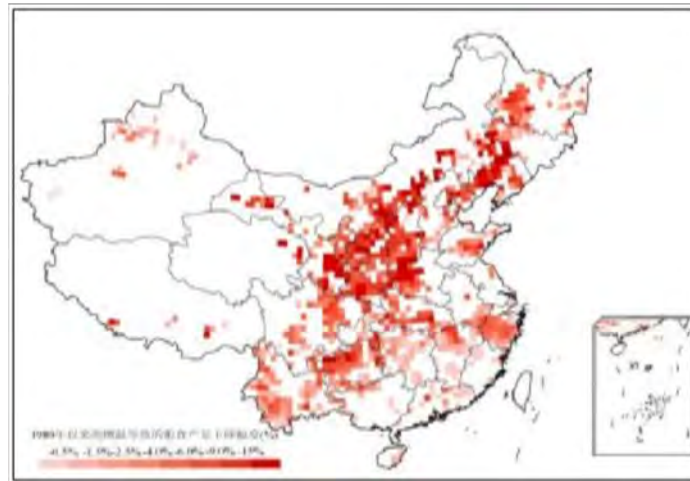
# Climate change



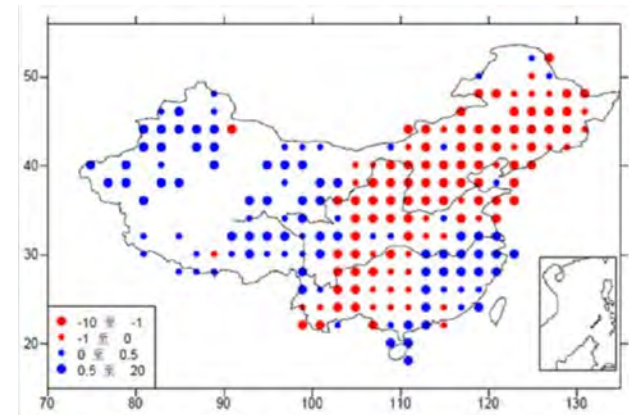
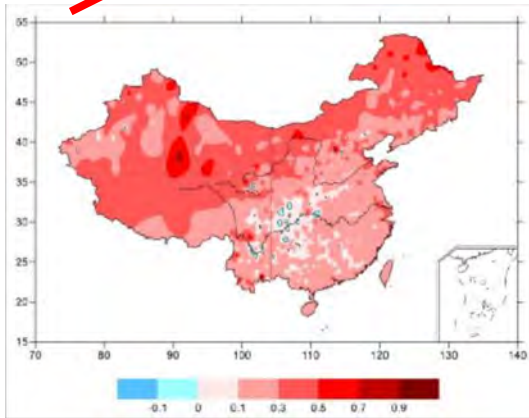
**Most vulnerable agriculture !!!**



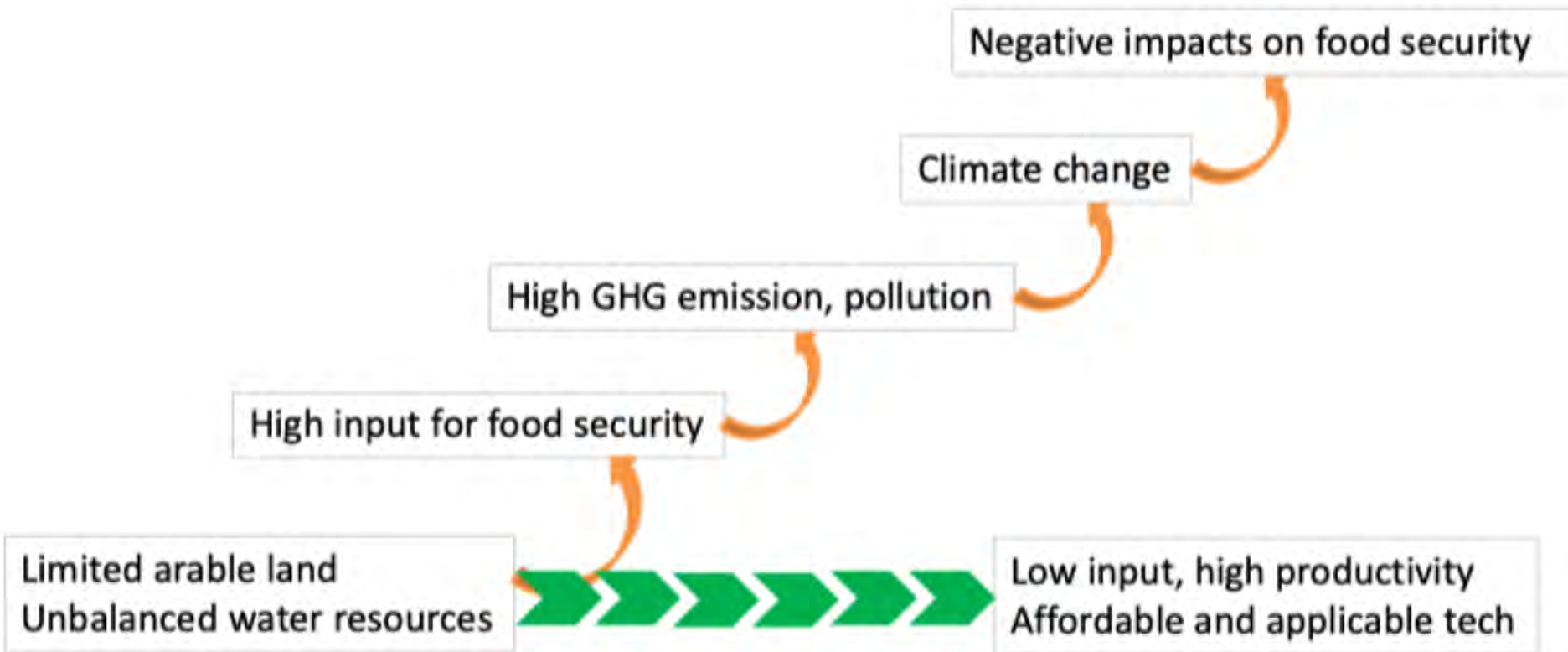
**Higher temperature**



**Decreased precipitation**



# Challenge



# SOC stock in Chinese cropland

Method	Target year	Area (Mha)	Soil depth (cm)	SOC change rate (Tg C a <sup>-1</sup> )	Reference
DNDC model	1990	130	30	-95	Li et al., 2003
DNDC model	1998	96.8	30	-78.89	Tang et al., 2006
Meta analysis	1980~2000	118	20	15.6~20.1	Huang et al., 2006
Meta analysis	1980s~2000s	155.76	Soil profile	23.61	Xie et al., 2007
Meta analysis	1980~2000	130	30	21.9 (16.6~27.8)	Sun et al., 2010
Meta analysis	1985~2007	138.7	20	25.5	Pan et al., 2010
National soil census	1980~2007	130	20	9.6	Yan et al., 2011
Agro-C model	1980~2009	130	30	24.3 (11~36.5)	Yu et al., 2012
DNDC + Century	1980~2008	130	20	17.8	Zhao et al., 2015

**SOC change rate (1980 ~ 2010): -78.89 ~ 36.5 Tg C a<sup>-1</sup>**



# SOC stock in Chinese cropland

Method	Process	Area (Mha)	Soil depth (cm)	carbon sequestration potential
Deduced from long-term field monitor	Statistical model + scenarios of fertilization, straw residue return and no till (Qin et al., 2013)	60.7	-	5.96~34.4 Tg a <sup>-1</sup>
	Saturation level statistical model (Sun et al., 2010)	140	30	2.7 Pg
Empirical formulation	Empirical model + NPP acceleration/straw return/scenarios of no till (Zhang et al., 2018)	130	30	2~2.5 Pg (2000~2005)
Process based ecological models	Agro-C + yield/straw return/scenarios of no till (Yu et al., 2013)	130	30	20.3~88.4 Tg a <sup>-1</sup> (~2050)
	Century + DNDC + no till/straw return/scenarios of organic manure (Zhao et al., 2015)	130	30	0.12~0.71 Pg (2009~2028)

**Soil carbon sequestration potential**

# National policies & action plans

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## ● State Council

- 2017, “Opinions on Accelerating the **Resource Utilization** of Livestock and Poultry Breeding Waste”

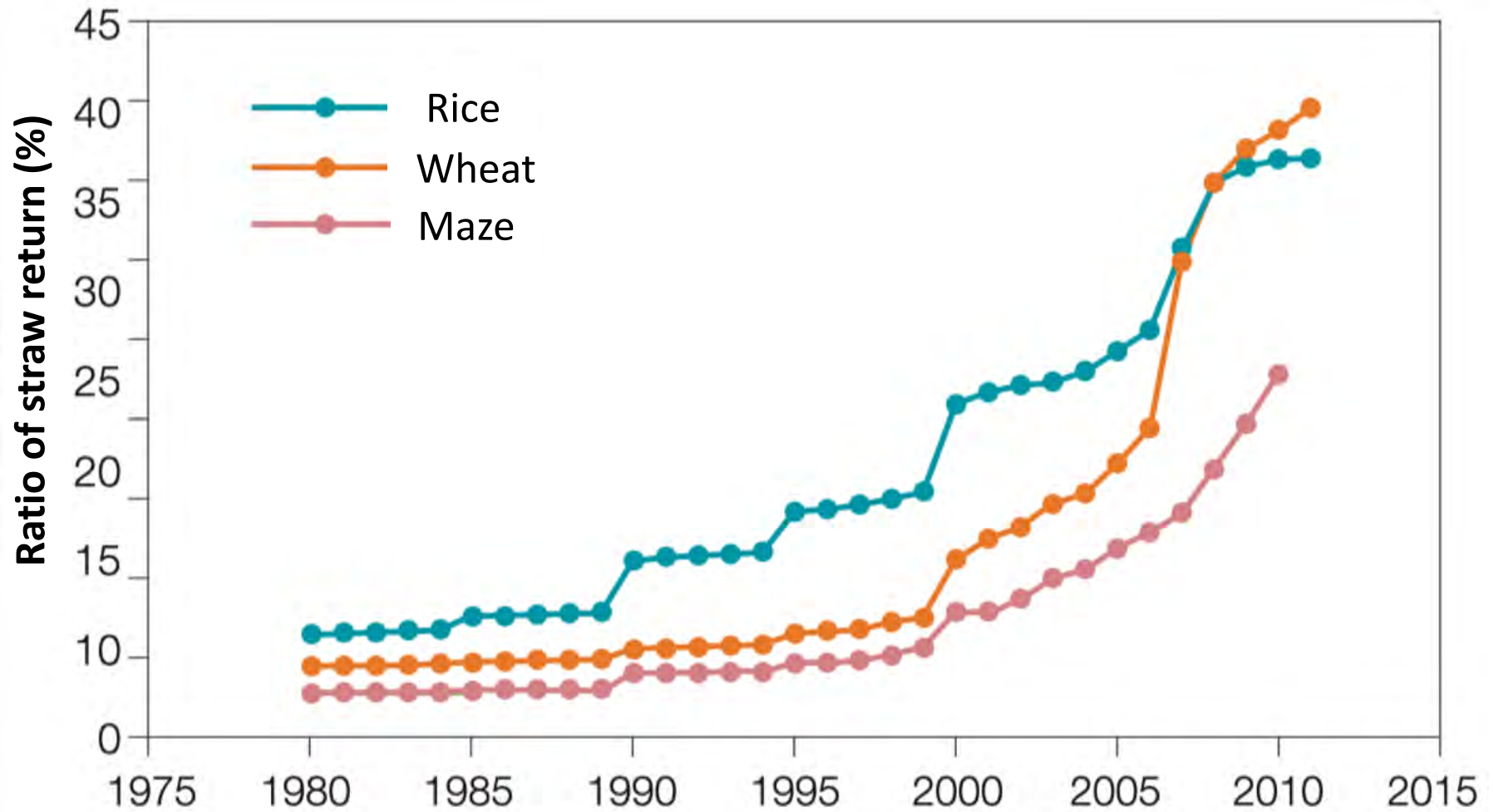
## ● Ministry of Agriculture and Rural Affairs

- 2015, “Action Plan for **Zero Growth** of Chemical Fertilizer Use by 2020”
- 2015, launched the Non-profit project “crop and **straw returning** to the field”
- 2019, “Expanding **demonstration of organic fertilizer** to replace fertilizer”
- 2019, “Accelerate the **resource utilization** of livestock and poultry breeding waste”
- 2019, “Accelerate the **green development** of agriculture and rural areas”

## ● NDRC, MOF, MARA & MOEE

- 2015, “Further accelerate the comprehensive **utilization of crop straws** and the ban on burning”

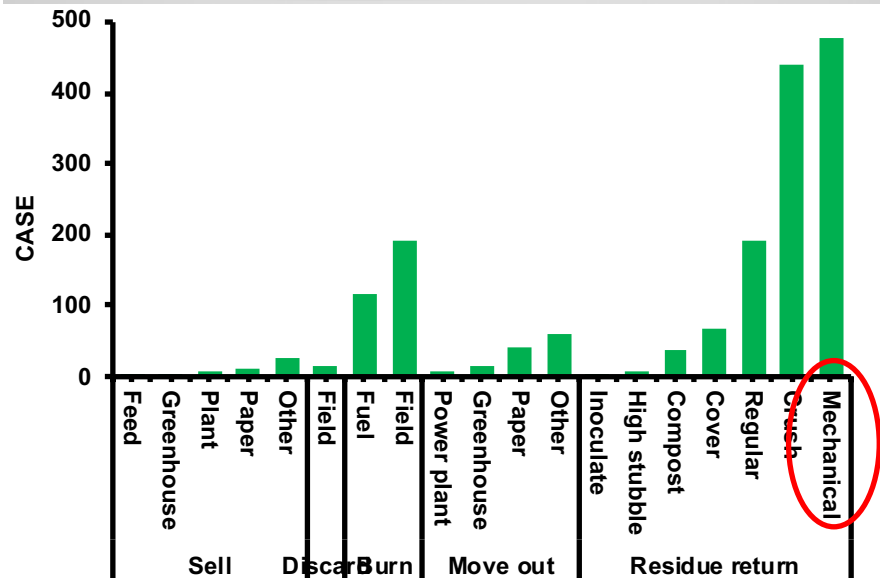
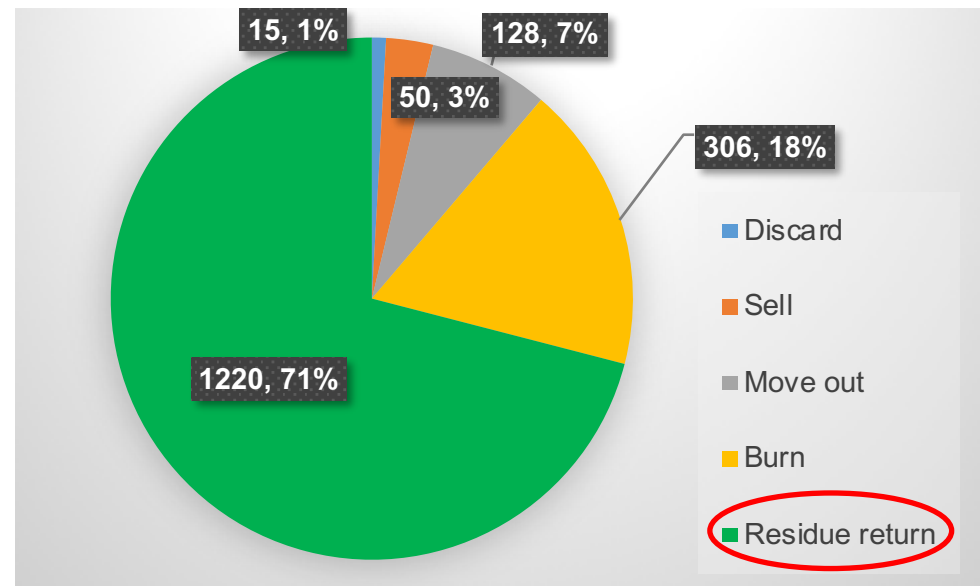
# Actions: straw residue return



Straw return rate of stable food crop of China in the recent 30 years

# Actions: straw residue return

- Household survey 2016~2017
- More than 71% of crop straw was returned to field in different forms
- Among them, mechanical turned down is the most popular one, followed by crush return



(Qin et al., 2018, unpublished)