Supporting Information:

Addressing China's Grand Challenge of Achieving Food Security Whilst Ensuring Environmental Sustainability

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Methods

Integrative approach. In this paper, an integrative approach was used to consider food production as part of an environmental system (soil, air, water, biodiversity) and not independent from it. The major viewpoints were discussed at the "Joint UK-China Summit on Food Production and Environmental Sustainability" held in Beijing on 5-6 March 2014, with 40 leading scientists, administrators and business people from UK and China participated. Valuable comments were also provided by the representatives from the Ministry of Agriculture, Ministry of Environmental Protection, State Council Development Research Centre and other relevant ministries and organizations.

Statistical analyses were performed with SPSS Statistics V20.0 (SPSS Inc. Quarry Bay, HK). Multiple regressions were used to determine the increase in anthropogenic reactive nitrogen emissions in China since 1980. Spatial distributions of water resources, water pollution and grain yield were performed with the Arcmap module in ArcGIS V10.0 software (ESRI, Redland, CA).Social network analysis was made of the relationships among the relevant governing bodies for ensuring food security.

Dataset. Data were collected from the following sources: (1) a number of national and provincial statistical databases, including "China Statistical Yearbook," "China Water Resources Bulletin", "China Agricultural Statistical Yearbook," and "China Environmental Status Bulletin" ; (2) national

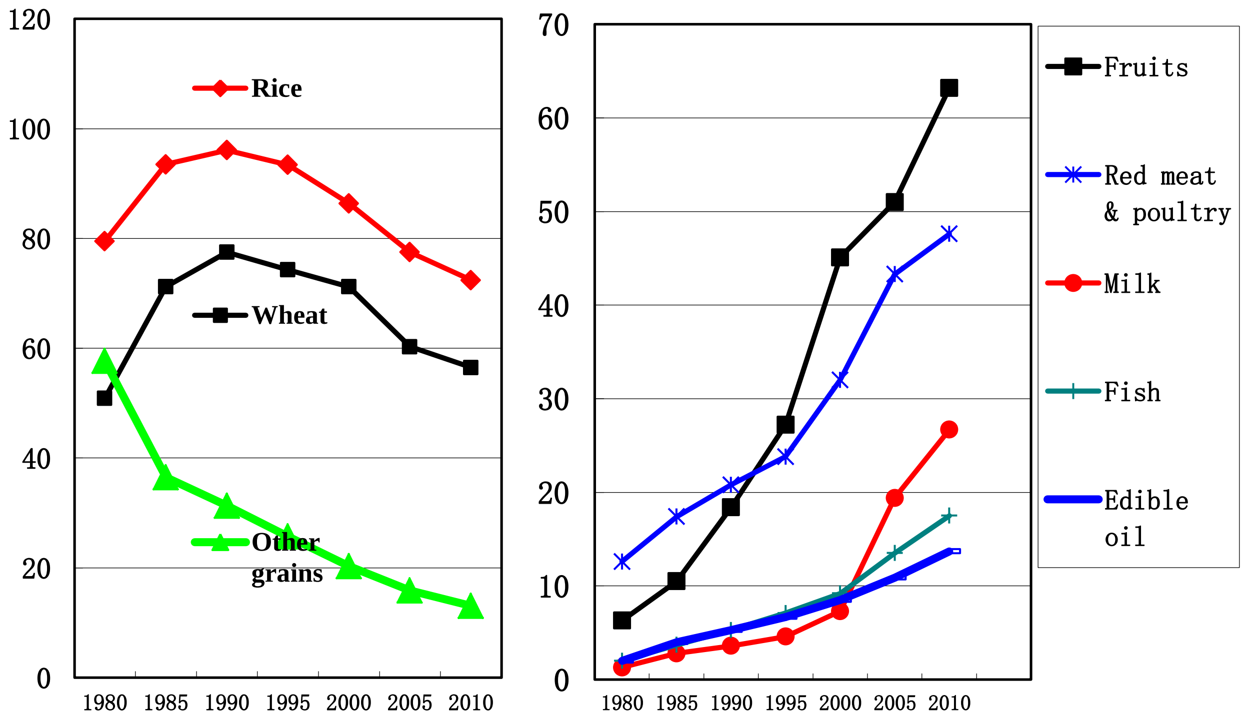

Figure S4. Per capita food consumption (kg/person) in China since 1980. This shows a significant fall in food grain but significant increase in non-food grain since 1990.

Source: CAPSiM database, 2013. Center for Chinese Agricultural Policy, Chiense Academy of Sciences.

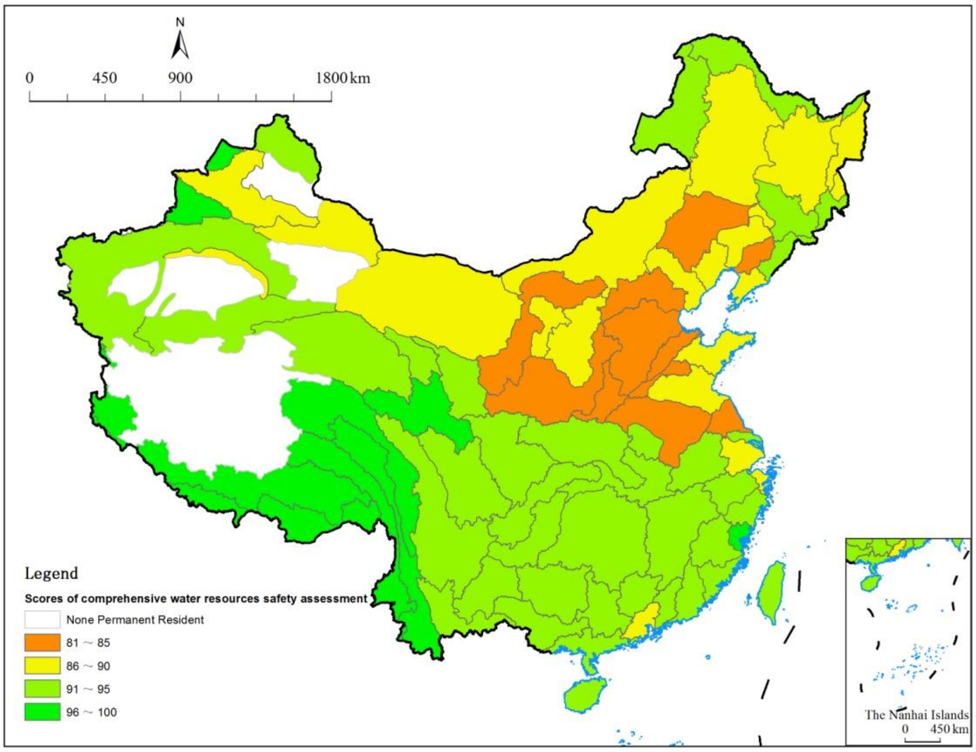

Figure S5. Water availability index for China. Stressed areas (orange and yellow) are mainly under pressure from agricultural use.

Note: Here water security index is scored between 0 and 100 according to water demand satisfaction ratio for different water uses. A score higher than 90 means very secure, 80-89.9 means secure, 70-79.9 means relatively secure, 60-69.9 means relatively not secure, while score lower than 60 very unsecure.

Sources: Water demand and supply data, water resources change data：Water Resources and Hydropower Planning and Design General Institute，Ministry of Water Resources. Comprehensive Water Resources Planning of China, 2009.

Water Quality data: Ministry of Environmental Protection, Report on the State of Environment in China, 2010, 2011, 2012;

Ministry of Water Resources, Water Resources Bulletin of China, 2010, 2011, 2012.

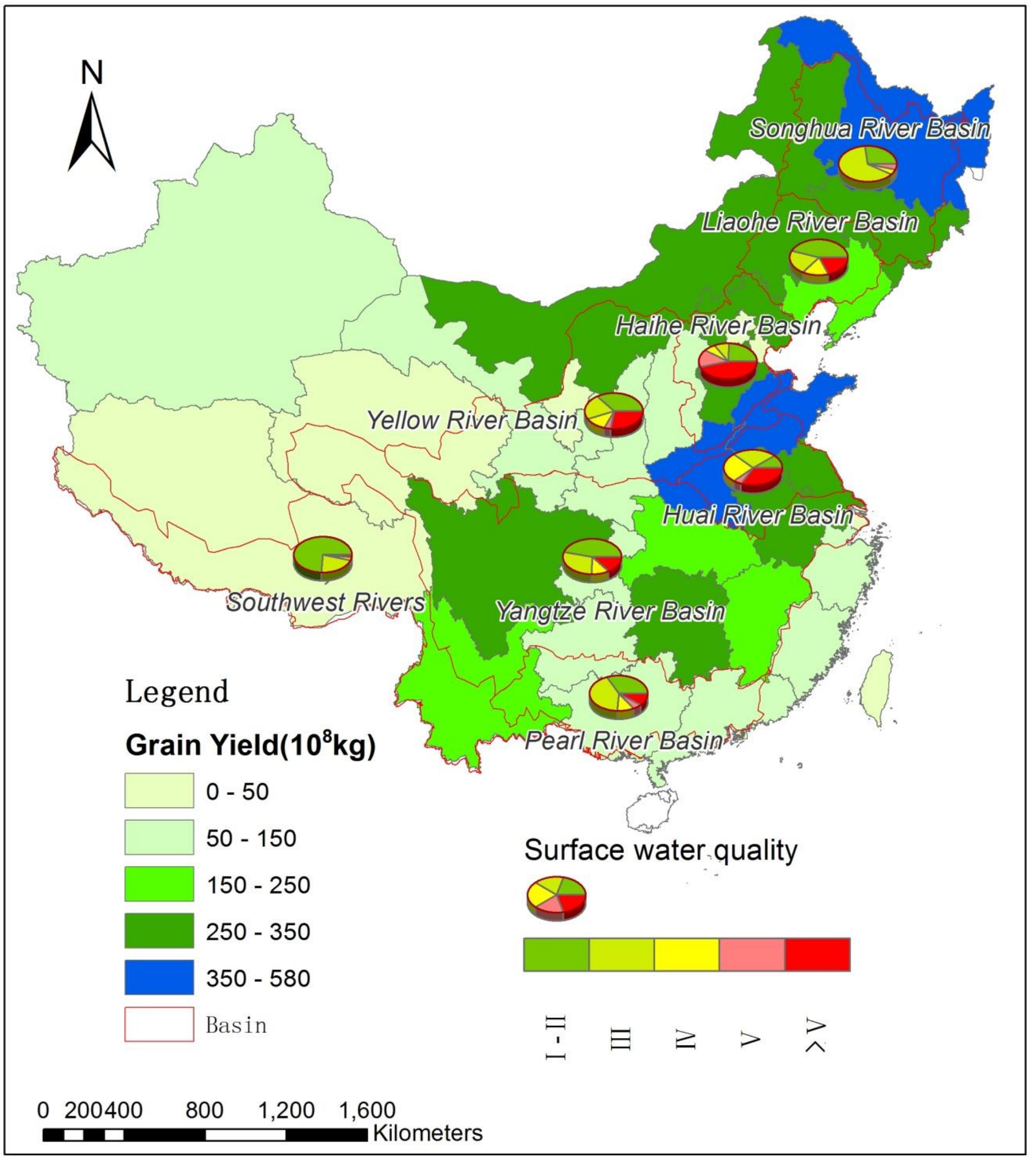

Figure S6. Surface water pollution and grain yield in 2010

Sources: Distribution of water quality (1) and grain yield (2) in 2010. Water quality classification based on the Environmental Quality Standards for Surface Water (1, 3)

1. Water Resources Bulletin for Haihe River Basin (http://www.hwcc.gov.cn/pub/hwcc/static/szygb/gongbao2010/main4.htm);
Yellow River Basin (http://www.yellowriver.gov.cn/other/hhgb/) ;
Songliao River Basin (http://www.slwr.gov.cn/szy2011/);
Huai River Basin(http://www.hrc.gov.cn/detail?model=00000000000000006575&documentid=41221);
Yangtze River Basin(http://www.cjw.com.cn/zwzc/bmgb/szygb/); and
Pearl River Basin(http://www.pearlwater.gov.cn/xxcx/szygg/).

2. National Bureau of Statistics of the People's Republic of China
http://data.stats.gov.cn/english/easyquery.htm?cn=C01

3. Environmental Quality Standards for Surface Water.
http://english.mep.gov.cn/SOE/soechina1997/water/standard.htm

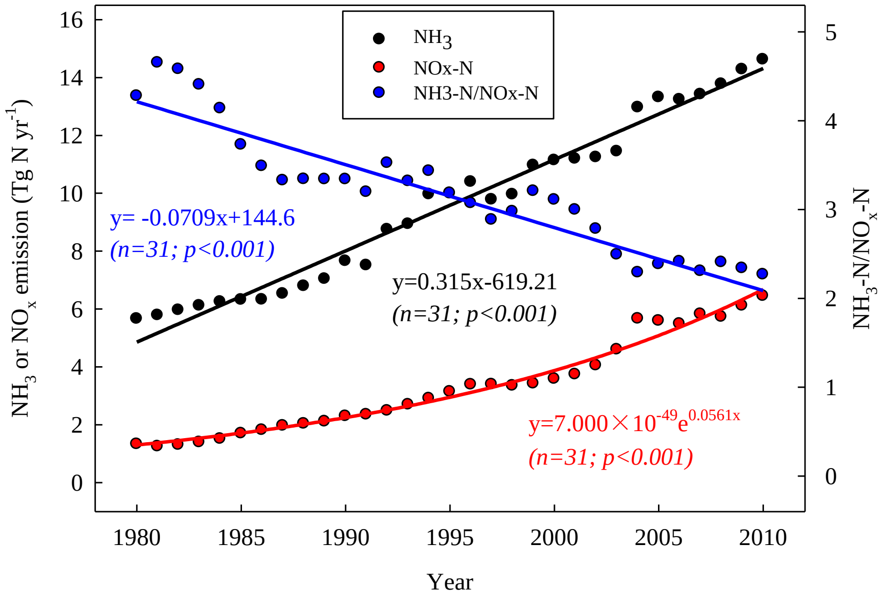

Figure S7. The increase in anthropogenic reactive nitrogen emissions in China since 1980

Source: Data adapted from Liu et al., 2013. Nature 494, 459-462.

Table S1. Aggregate wheat production loss (WPL) in the year 2000 and 2020 estimated by O_3 dose metrics (AOT40 (ppb.h), accumulated hourly ozone concentration over 40 ppb) for the top five wheat producing provinces in China as well as for whole China . The relative yield loss (RYL) is shown in parentheses (data were extracted from Tang et al., 2013).

Province	WPL (10^4 metric tons) and RYL (%) in 2000	Increases of WPL (10^4 metric tons) and RYL (%) from 2000 to 2020
Henan	185.1 (7.5%)	262.2 (10.6%)
Shandong	151.2(6.7%)	173.5 (7.6%)
Hebei	100.3(7.3%)	70.1 (5.1%)
Jiangsu	138.5(11.5%)	118.8 (9.8%)
Anhui	74.0 (8.0%)	110.2 (11.9%)
Whole China	777.9 (6.4%)	1016.3 (8.4%)

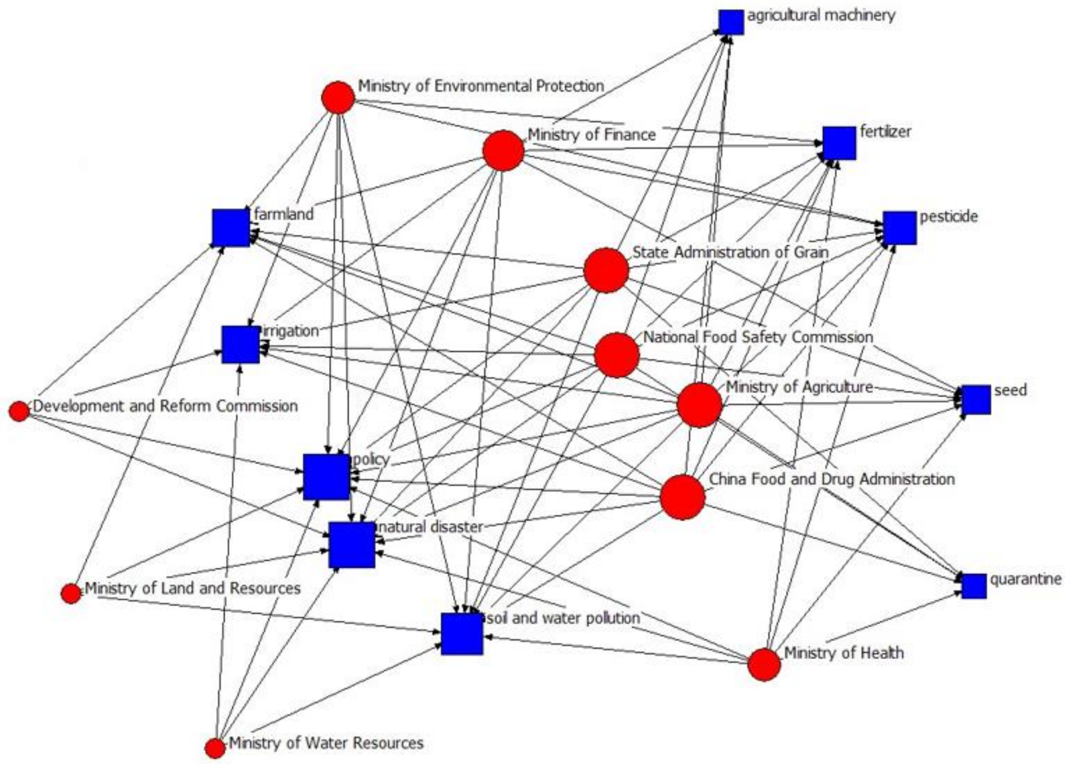

Figure S8. Governmental departments influencing food security

Acknowledgement

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Songliao River Basin (http://www.slwr.gov.cn/szy2011/);
Huai River Basin(http://www.hrc.gov.cn/detail?model=00000000000000006575&documentid=41221);
Yangtze River Basin(http://www.cjw.com.cn/zwzc/bmgb/szygb/); and
Pearl River Basin(http://www.pearlwater.gov.cn/xxcx/szygg/).

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