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Institute of Remote Sensing and Digital Earth (RADI), Chinese Academy of Sciences

P.O. Box 9718-29, Olympic Village Science Park

West Beichen Road, Chaoyang

Beijing 100101, China

This bulletin is produced by the CropWatch research team at the Institute of Remote Sensing and Digital Earth (RADI), Chinese Academy of Sciences, under the overall guidance of Professor Bingfang Wu, Division Head of Digital Agriculture of RADI. Contributors are Sheng Chang, Bo Chen, Xueliang Feng, René Gommès, Jiratiwan Kruasilp, Zhongyuan Li, Anna van der Heijden, Nana Yan, Hongwei Zeng, Miao Zhang, Ning Zhang, Yang Zheng, and Wentao Zou.

English version editing was provided by Anna van der Heijden; the Chinese version was edited by Ning (Lydia) Zhang.

Corresponding author: Professor Bingfang Wu

Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences

Fax: +8610-64858721; E-mail: environ@irsa.ac.cn, wubf@irsa.ac.cn

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Foreword

Food security is essential for national security. For many years, agriculture and food security have been a key focus of China's national economic and social development plans as well as its science and technology research programs. Over the last twenty years, a team of scientists led by professor Bingfang Wu at the Chinese Academy of Sciences' Institute of Remote Sensing and Digital Earth (RADI) has developed unique satellite remote sensing based methodology and a system—CropWatch—for operational monitoring of crop conditions and crop production at both national and global levels. As one of its key outputs, the team issues a periodic crop assessment bulletin, which is a vital source of information about crop conditions and production for decision makers and planners in China's government, as well as researchers and analysts in China.

With technological advances, a wider range of satellite remote sensing data, from both China and abroad, is becoming accessible and affordable. In China, high quality data from the Chinese meteorological (FY-3) and environmental (HJ-1) satellites is now available for crop condition assessments, increasing China's contributions to the international community. Taking advantage of the opportunities provided by these data, the CropWatch team set out to use these new data sources and develop new hierarchical indicators and operational methodology for global crop monitoring. The bulletin in front of you is a product of this effort and the first of its kind since the CropWatch bulletin was launched more than a decade ago. The bulletin presents the latest comprehensive results of the team's work, covering assessments of global main crop producing zones and major producing countries, as well as sub-national crop conditions in large countries, including China.

For the first time also, this CropWatch bulletin is presented in both Chinese and English at the same time. I am confident the bulletin will not only provide a solid assessment of the current global major crop conditions, but also serve as a science-based Chinese voice on global food security perception, contribute to the global effort to provide more reliable, transparent, and up-to-date information on agricultural production to fight against hunger and ensure sustainable agricultural development across the world.

I hope that this bulletin—the result of an exciting and ambitious undertaking by the team—will not only be well-received by China's domestic readers, but also have a strong impact on the broader international user community.



Guo Huadong, Professor

Director General of RADI

Member of the Chinese Academy of Sciences (CAS)

Fellow of The World Academy of Sciences (TWAS)

Abbreviations

| | |
|------------------|--|
| 5YA | Five-year average (2008-12), or 'medium term', 'recent past' |
| 11YA | Eleven-year average (2002-12), or 'long term' |
| 12YA | Twelve-year average (2001-12), or 'long term' |
| AMIS | Agricultural Market Information System |
| CAS | Chinese Academy of Sciences |
| CPSZ | Crop production system zone |
| EI | Environmental index |
| IGBP | International Geosphere Biosphere Programme |
| JRC | European Commission Joint Research Centre |
| kHa | Kilohectares (thousand hectares) |
| kkm2 | Thousand square kilometers (million acres) |
| kT | Kiloton (thousand metric tons) |
| NCDC | National Climatic Data Center |
| NPPP | Net primary productivity potential |
| PAR | Photosynthetically active radiation |
| Ton | Thousand kilograms |
| W/m ² | Watt per square meter |
| FAO | Food and Agriculture Organization of the United Nations |
| G20 | Group of 20 |
| GAUL | Global Administrative Units Layer |
| GEO | Group on Earth Observations |
| GeoGLAM | GEO/GEOSS Global Agricultural Monitoring |
| GEOSS | Global Earth Observation System of Systems |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| GSOD | Global Surface Summary of the Day |
| GVG | GPS, Video and GIS data |
| MPZ | Major crop production zones |
| PBR | Potential biomass ratio |
| RADI | Institute of Remote Sensing and Digital Earth |
| TRMM | Tropical rainfall measuring mission |
| UAL | Uncropped arable land ratio |
| UN | United Nations |
| VASCLimO | Variability Analysis of Surface Climate Observations |
| VHI | Vegetation Health Index |

Introduction

All major food producers and consumers crucially depend on timely and accurate information on production and markets. For this and a variety of other commercial, statistical, governance and humanitarian reasons, many countries and intergovernmental as well as international organizations actively monitor national, regional, or global crop production.

China's global crop monitoring began in 1998 with the development of CropWatch, a system designed to assess national and global crop production and related information using remote sensing and ground based indicators. CropWatch is also one of the global components in the GeoGLAM (GEO/GEOSS Global Agricultural Monitoring) initiative set up by the G20 in 2011 (1) to improve access to consensual global information about the worldwide availability (production and trade) of major cereals and soybean. The present bulletin is China's first systematic contribution to GeoGLAM and the G20 Agricultural Market Information System (AMIS); it focuses on maize, rice, wheat, and soybeans.

This bulletin is prepared by the CropWatch research team in the Institute of Remote Sensing and Digital Earth (RADI), Chinese Academy of Sciences. It is in fact Vol. 13, No. 7, or the 91st installment in the series of CropWatch bulletins that have been published in the Chinese language in a variety of formats (ten-day updates as well as monthly bulletins) since 1998. In a departure from previous issues, the bulletin from now on will be published in both English and Chinese, and change from a monthly publication to a quarterly. Moreover, additional data not covered in the report will be available online on the CropWatch Website (<http://www.cropwatch.com.cn/en>).

Over the years, the CropWatch bulletins have been updated regularly as new data or methodologies became available and matured. The current issue again takes advantage of multiple new remote sensing data sources and presents new hierarchical indicators and an operational methodology for global crop monitoring. A methodological brief is provided in chapter 6, along with descriptions of—mostly national—sources of crop information. Because of the relative newness of some of the methods and data, further adjustments of the methodologies are expected for future bulletins, to incorporate ongoing research on the data and experimental methodologies, as well as feedback on these initial approaches.

The bulletin provides assessments of global main crop producing zones and major producing countries, as well as sub-national crop conditions in large countries, including China. The bulletin also pays a lot of attention to environmental and agricultural trends, which will contribute to the understanding of the global food security situation.

This being the first English language edition, the bulletin attempts to cover a rather long time period of about one year, while subsequent issues will focus on shorter time intervals to cover recent and ongoing cropping seasons. The current bulletin is based mostly on historical information starting in 2001, with the cut-off time for the ongoing season at the end of September 2013.

The report is organized in six chapters to present the results for different spatial scales as well as necessary background information. Following the executive summary, the first chapter (chapter 1) presents prevailing environmental conditions—essentially rainfall, temperature and solar radiation—for 60 Crop Production Systems Zones that were identified based on climate, ecological zones, and cropping patterns. The main indicators are satellite-based environmental indices.

In chapter 2, a more detailed analysis of cropping activities is presented for four major crop production zones (MPZ), paying attention to the environmental indices along with a focus on cropping intensity, biomass, and a measure of non-cropped arable land.

Chapter 3 zooms into the thirty major producer countries that account for 80 percent of global production and exports, starting with a section (3.1) that provides the CropWatch estimate of current 2013 production. Section 3.2 provides information of cropland use intensity, starting with cropping intensity (the number of times land is used per year), uncropped arable land, and the potential biomass ratio, i.e., an indicator of the performance of the current season's plant biomass accumulation compared with optimal conditions.

Section 3.3 constitutes a major part of this report as it describes, by country grouped by continent, several major indicators of the recent cropping season. It starts with a reference map showing average NDVI, together with the areas where the crops of interest (maize, rice, soybean and wheat) are cultivated, as well as major irrigated areas. In addition, two sets of information are provided to assess crop condition in each of thirty countries. In the first, a map shows crop condition by comparing the current NDVI with the average of the previous five years, at a time that is meaningful for the local crop calendar. Whenever a crop is currently growing, the crop condition map is presented for September 2013. In other cases, a time period just before the harvest of the main crop was selected. This crop condition map is accompanied by a graph showing the development of the season over time, together with a comparison with the previous year and the five previous years. While these crop condition maps and profiles show average national behavior over time at a detailed pixel-resolution, in the second set of information, another map shows spatial NDVI clusters, i.e., areas that underwent similar growing conditions, together with the profiles themselves. To maintain some balance between countries of very different sizes, the largest ones have been analyzed at the scale of the first sub-national administrative unit.

While the previous chapters rely a lot on remote sensing and ground data, chapter 4 discusses two subjects by providing overview information mostly based on international databases and general information, with less systematic reference to remote sensing indicators. The first section focuses on rice in Southeast Asia and the second on extreme factors that have affected the countries of interest, more specifically crops, over the last year.

Chapter 5 focuses on China, where CropWatch experience is greatest and where data sources are most easily available. The structure largely follows the one adopted in chapter 3, starting with section 5.1 which provides the CropWatch estimate of the 2013 production. Section 5.2 similarly provides information of cropland use intensity, but also adds cropping structure, i.e., the relative share of cropland cultivated under various crops. Section 5.3 makes up the bulk of the chapter: it provides an overview of recent crop performance and conditions for China's provinces, grouped into six geographic zones.

The last chapter of the report, chapter 6, is technical and presents relevant background information for the results presented in the previous chapters. Section 6.1 describes the spatial units of analysis, in particular the Crop Production System Zones adopted for chapter 1 and the Major Production Zones described in chapter 2. Chapter 6 also gives a detailed account of the raw data used (6.2) as well as other methodological details (6.3). In the final section of the report, the annexes contain a number of maps and tables that complement those shown in other parts of the bulletin.