CropWatch Cloud  (http://Cloud.cropwatch.com.cn)

—Ownership and transparency

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7 Nov 2019
Outline

- Introduction
- CropWatch Cloud
- Implementation at countries
Stress to food production

- Climate variability, especially extreme heat and frost events are inducing yield depressions by more than 10%
- To mitigate the impacts, irrigation is commonly applied causing serious groundwater depletion/transboundary issue
- Pest and diseases overall impact to 10-20% of global crop harvest

Source: UNEP

Source: NASA
Crop Monitoring is essential

- Early production forecasts help policy makers to make evidence-based trade decisions.
- In season warning (stress due to drought, pest & diseases) for better farm management.
- Early warning information helps early response and actions on providing food aid to food shortage regions.
- Many countries want to use satellite data to improve food information availability and transparency.
Gaps and challenges

● **Owners**
  - Only big countries or int’l organizations have their own systems

● **Information**
  - Crop condition is main output, lack of accurate production
  - Lack of forecasting at early stage or even pre-sowing

● **Technical issues**
  - No automatic processing, manual works mainly
  - System are physical or technically difficult to access openly
  - Unable to customize the system for local
  - Rely on single or a few satellite data
  - Methodology is not well documented and
  - Difficult to participate in agriculture monitoring
Issues for developing countries

- The paucity of adequate capacity in obtaining and accessing up-to-date staple crop production information, which is essential for a country's economic governance and securing food supply.

- Over-dependence on information provided by third parties and often poses the danger of taking decisions based on delayed and not easily verifiable information.

- Constraining developing countries to set-up, operate, and maintain crop monitoring facilities.
  - Big financial input and operational cost
  - Adequate technical skills
Outline

- Introduction
- CropWatch Cloud
- Implementation at countries
CropWatch Programme

- Release first bulletin in August, 1998;
- Release first English bulletin in November, 2013
- CropWatch aims at improving food information availability, quality and transparency
  - To provide additional, reliable information for developing countries to fight against hunger,
  - To provide cloud facility to enhance the capacity of developing countries on crop monitoring
CropWatch at Alibaba Cloud

cloud.cropwatch.com.cn

CropWatch-Pro
• An online tool for people to produce crop monitoring products at any time and anywhere.

CropWatch-Explore
• An online interface for people to explore and analysis all the crop information data easily.

CropWatch-Project
• An online platform for people to create and write the crop bulletin.

CropWatch-Bulletin
• A webpage for people to read CropWatch bulletin.

February 2019 CropWatch Bulletin

This bulletin features the latest production outlook for the major producers in the southern hemisphere and some isolated northern hemisphere countries where crop development is sufficiently advanced. Focusing on the months of October 2018 to January 2019, chapters cover global, national, and regional agro-climatic conditions and the condition of crops that were growing or harvested during this time. For China, the bulletin presents crop condition for each of seven key agro-ecological zones. The focus section reports on recent disaster events with an impact on agriculture and the possibility of an El Niño event.

CropWatch Sub System

CropWatch Pro
CropWatch Explorer
CropWatch Analysis
CropWatch Bulletin

CropWatch is China’s leading crop monitoring system. Using remote sensing and ground-based indicators the system assesses

Each quarter, CropWatch findings are published in the CropWatch bulletin. The bulletin is issued in English and Chinese.

The CropWatch system and methodologies are described in various articles published in international and Chinese journals.
Data converging and preprocessing

Auto converting

Auto preprocessing

Data processing

- Chart
- Image
- Table
- Map

Advanced products
- Database
- User

Customize

Advanced products
- Database
- User

Data from cloud
- Automatic chain
- Data storage on cloud

Data converging and preprocessing

USGS
- GSOD
- ECWMF
- ESA
- Other

Auto download

Data storage on cloud
- Database

Standard algorithm
- Temperature
- Rainfall
- PAR
- Biomass
- Sunshine hour
- Aerosol
- PET
- Other global products

Advance algorithm
- Agro-climatic risk
- CALF
- VCIx
- VHImin
- Cropping intensity
- From other sources

Interactive component
- Clustering
- Crop condition
- Crop mapping
- Crop yield

Models
- IDL
- python
- arcgis

Charts
- Map services
- Table
- Image

User

Tables
- Figures

Map services

Auto converging

Auto preprocessing
CropWatch Processing offers an auto-processing chain from pre-processing of raw data to production outlook.

**Pre-processing**
- Data conversion
- Projection and transformation
- Vector to Raster
- Merge
- Clip
- Resample
- Band-combination
- Spectral-merge
- Temporal and spatial merge

**Agrometeorology**
- PAR
- Temperature
- Rainfall
- Biomass

**Agronomic indicator**
- CALF
- CI
- VCIx
- VHI

**Crop condition**
- NDVI development
- Real Time development
- Cluster

**Production Forecast**
- Yield
- Area
- Production
CropWatch generates 32 agro-climatic, agronomic, early warning indicators, and crop production (area, yield)

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**NDVI**
Normalized Difference Vegetation Index

**NDVI**
Normalized Difference Vegetation Index

**PASG**
Percentage of Average Seasonal Greenness

**FAPAR**
Fraction of absorbed photosynthetically active radiation

**SDVI**
SDVI in the standard deviation of the NDVI value

**VCI**
VCI = (NDVI - NDVI_min)/(NDVI_max - NDVI_min)

**SASSI**
Standardized Areal Slope Index (SASI)

**SPI**
Standardized Precipitation Index (SPI) expresses the actual rainfall as a standardized departure with respect to rainfall probability distribution function and hence the index has gained importance in recent years as a potential drought indicator permitting comparisons across space and time.

**VHI**
Vegetative Health Index (VHI) is a vegetation health index, which is used to assess the condition of vegetation. It is calculated using the actual growing season vegetation index (ASI) and the standardized NDVI (SNDVI). The VHI is a ratio of the NDVI and the SNDVI, and it ranges from 0 to 1, with 1 being the healthiest vegetation and 0 being the sickest. A VHI value of 0.5 or lower indicates a significant decline in vegetation health, while a value of 0.7 or higher indicates a healthy vegetation.
1. Define the language
2. Define the region of interest
3. Define the name of region of interest
4. Give a name for your system
5. For writing any remarks
6. For selecting which components the user want to be keep.
NDVI Anomaly Model selection Parameter Setting Submit task Task finished Thematic Product

Parameter Setting

Queue in task list

Task status updating/finished

Preview thematic product and output to database
Component 2: CropWatch Explore

CropWatch-Explore provide a web service for users to conveniently explore and visualize our data.

CropWatch-Explore

Visual Type
- Vector
- Raster
- Cluster

Scale Type
- MPZ
- MRU

Crop Type
- Country
- Sub-Country

- Wheat
- Maize
- Rice
- Soybean

- RAIN
- TEMP
- PAR
- BIOMASS

- NDVI
- VCIx
- VHI
- CALF
- CI

- Area
- Yield
- Production
- Early warning
- Price
Component 3: CropWatch Analysis

CropWatch Analysis is cloud based participatory tool for the CropWatch teams or invited people from over the world analyzing their CropWatch indicators anywhere. It provides create document, allocate and manage tasks, monitor schedule and publish the document online functions which let people over the world finish their documents together on the cloud platform.
### Author assignment

#### Executive summary

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#### Global agroclimatic patterns

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#### Crop and environmental conditions in major production zones

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#### Main producing and exporting countries

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Joint Analysis from over the world

Joint analysis by 37 experts from 11 countries
CropWatch Hierarchical approach

Global: homogeneous crop mapping and reporting units
Using CropWatch Agroclimatic Indicators (CWAIs) for rainfall, air temperature, photosynthetically active radiation, and potential biomass

Regional: Major production zones
In addition to CWAIS, Vegetation health index, uncropped arable land, cropping intensity, and maximum vegetation condition index

National
In addition to previous indicators, crop cultivated area, time profile clustering

Sub-national for large countries
Crop type proportion (some countries)

Increasing level of detail, from environmental-climatic to agronomic; from 25 km resolution to 10m
Global: 65 MRUs

- PAR departure
- Temperature departure
- Precipitation departure
- Biomass departure
Hotspots for MPZs

- North America: shortage of rainfall and above average temperature resulted in drought.
- Drought was confined to Manitoba (RAIN, -20%) and Saskatchewan (RAIN, -23%). The temperature was 2 to 3°C above average July to late August.
Food security early warning

- Cropped arable land fraction (CALF) represents the total cropping proportion at early growing stage.
- Agro-meteorological risk index (AMRI) considering meteorological suitability for crops at different growing stage is used for yield alarming.
Early outlook

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<th>PAR accumulation (%)</th>
<th>Biomass accumulation (%)</th>
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<td>-0.3</td>
<td>1</td>
<td>33</td>
<td>-3.0</td>
<td>0.11</td>
</tr>
<tr>
<td>Indonesia</td>
<td>-2</td>
<td>-0.2</td>
<td>-2</td>
<td>-2</td>
<td>0.4</td>
<td>-0.01</td>
</tr>
</tbody>
</table>

Figure 3.1. Global map of biomass accumulation by country and sub-national areas, departure from twelve-year average (2001-13) average (percentage)

Overall, CropWatch tentatively summarizes the ongoing season as follows:

**Mostly unfavorable**: Armenia, Azerbaijan, Canada, Georgia, Philippines, Poland, Spain, Turkey, Ukraine, Moldova, Morocco, United States, and Vietnam.

**Mixed**: Argentina, Brazil, China, Denmark, Egypt, France, Hungary, Indonesia, Iran, Italy, Nigeria, Romania, Russia, South Africa, United Kingdom, and Uzbekistan.

**Mostly favorable**: Bangladesh, Czechia, Germany, India, Kazakhstan, Mexico, Myanmar, Pakistan, and Thailand.
Server drought in South Africa

- **Large production drop alert** given in November 2015 Bulletin
- **January 2016 Bulletin**: Maize production was **projected at 44.6% drop**; Server drought prevented farms sowing maize, with a reduction of 34% of maize area; yield was 16% lower than 2015
- **April 2016 Bulletin**: Maize production is **revised to 32% drop**, since Feb 2016, rainfall benefited the maize in fields.

Development of NDVI profiles over maize growing areas in 2014-15 and 2015-16

Relative distribution of maize in 2014-15 and 2015-16

- **34% less** maize area compared with 2014-2015 season.
February 2019 CropWatch Bulletin (Vol. 19, No. 1)

Key messages from the report:

1. In general conditions over agricultural areas as monthly means were above average and temperature was below average (+1 °C). Rainfall was 1% above average, but below average rainfall areas with deficits more severe than 20% are consistent with El Niño patterns.

2. Agricultural indicators showed an increase in vegetable production, below average crop yields, and low rainfall. Middle East and Mediterranean show large increases in OA. High Maximum Vegetation Condition Index (VCI) values, indicating favorable crops, occur mainly in Asia. The situation is mixed in Afghanistan, with severe VCI at 6 out of 46 key countries, but 25% above average OA.

3. Crop agronomic conditions were generally above average with deficits of rainfall (1%) and sunshine (6%). Temperature was average, but the nationwide CAI is 3% above the average value of the previous two years.

4. Production outlook: the reporting period saw the harvest of wheat in the Southern Hemisphere. Production of maize in Argentina and Mexico is above last year's output by 4% and 29%, respectively, but South Africa suffered a market drop (44%), production of wheat in Australia suffered a market drop as well (37%), and so did Argentina (39%).

Introduction

This CropWatch bulletin presents global crop conditions and agronomic indicators from October 1, 2018, to January 31, 2019. Through 4 pages in the global overview of agronomic indicators (Chapter 1) to detailed descriptions of crop and environmental conditions in major producers (Chapter 2), to individual country values covering 42 major producers and indicators including agronomic indicators (Chapter 3) and three (Chapter 4). A special focus section is included in Chapter 5, covering crop conditions for the 2018/2019 for countries in southern Hemisphere during winter, and an update in 13 tables. This final part of the report includes the covers, table of contents, abbreviations, a short overview of the different sections of the bulletin and executive summary.

Download

- Introduction
Component 4: CropWatch Bulletin

- Four Quarterly CropWatch Bulletins
- One annual report
Component 4: CropWatch Bulletin

- already provided information services for 149 countries, and obvious enhance the transparence of global agricultural monitoring.
Features

- Analysis-ready products
  - 32 Indicators ready in CropWatch Cloud considering most indicators used in existing system
  - Indicators customizable, easy to include new national or regional specific indicators

- Cloud computing improves efficiency of data processing
- Customized for local condition
- Joint work promotes confident and transparency
Outline

- Introduction
- CropWatch Cloud
- Implementation at countries
  - Monitoring on Cloud
  - Cloud services
  - Handover
CropWatch for Mozambique

- Customize CropWatch for Mozambique
  - Portuguese Interface
  - Including all provinces and districts
  - Crop phenology
  - Portuguese version of GVG tools
CropWatch for Mozambique

Monitoring units: every districts and provinces
Technical training

- First round training for selected experts from national and provincial offices (3 colleagues)
- Extended training for 29 participants including local experts from 8 provincial offices attend the training
- In-situ data collection training at different major agricultural provinces
Mozambique National Meteorological Bulletin

National Meteorological Bulletin powered by CropWatch

DIReCÇÃO nAtIOnAl De AGRIcULTURA e sIlvicultura—MAsa
DEPARtamento De CULTURAS e AVIsO Prévio

Boletim Agrometeorológico

Em foco

- Registros de precipitação abaixo do normal na região Sul do país e acima do normal nas regiões Centro e Norte, no período de Outubro de 2017 a Março de 2018,
- Registros de precipitação de cerca de 37% mais húmido na região de报记者, conforme os dados da DCE da ANM,
- Boas Perspectivas de Produção de palmeiras, com tendência de redução no nível de atividade do país,
- Crescimento de práticas agrícolas, com tendência de redução no nível de atividade do país.

Precipitação Registrada e Distribuição de Outubro de 2017 a Março de 2018

- Na região Centro, as chuvas foram intensas nos meses de Outubro e Novembro, enquanto na região Norte, as chuvas foram menores nos mesmos meses.
- Na região Sul, as chuvas foram menores no período de Outubro e Novembro, enquanto na região Norte, as chuvas foram intensas nos mesmos meses.

Índice de Satisfacção Hídrica das Culturas

O índice de Satisfacção Hídrica (WSR) das culturas da 1ª época em geral foi considerado bom para a região Norte, moderado para a região Centro e ruim para a região Sul (Fig. 1).

- Na região Sul, as culturas da 1ª época foram colhidas até o mês de Maio.
- Na região Norte, as culturas foram colhidas até fim de Março.
- O WSR foi considerado bom e médio, o que pressupõe boa produtividade e produção nas principais culturas da 1ª época.

Dezembro de Precipitação Registrada de Outubro de 2017 a Março de 2018

- Em geral, a precipitação registrada entre os meses de Outubro e Dezembro de 2017 no país foi regular e abaixo do normal em regiões Sul (Mozambique, Gaza e Inhambane) e partes da região Centro (Manica, Tete e distritos de Sulf e Sofala). Aos mesmas regiões de Centro e Norte, a precipitação foi regular e acima do normal (Fig. 2).
- Entre os meses de Janeiro e Março de 2018, a precipitação esteve muito acima do normal nas regiões de Centro e Norte (Manica e Tete) e abaixo do normal em regiões Sul e da Costa (Fig. 3).

Análise de NDVI

A análise do desenvolvimento das culturas baseada no NDVI, demonstrou que as condições para desenvolvimento das culturas foram desfavoráveis desde o mês de Março, com possíveis mudanças nos futuros anos.

O gráfico abaixo (Fig. 5) mostra que os padrões de NDVI estão mais concentrados no mês de Maio, espalhando-se até Junho. Em resumo, entre os meses de Janeiro e Abril de 2018, a maior parte das áreas cultivadas (49%), estavam em condições abaixo da média dos últimos cinco anos.
Independent evaluation

- CropWatch’s yield estimation result is quite accurate when compared to real ground data collected from their district and provincial level staff.
- It is also relatively more accurate and has higher resolution than other similar technologies they used before.
- CropWatch is easy to learn and operate after several trainings.
- able to get in-time response from CropWatch team whenever he needs any troubleshooting.
- applying the tool to generate monthly agriculture bulletin during the rainy season, which informs policy making at national and provincial-level agriculture departments.
- Stressed the importance of building long-term internal capacity to understand the algorithm and the technology deeper so that maybe they can also build similar technology by themselves one day.
CropWatch for Thailand

- Using CropWatch to process the data for required indicators
- CropWatch provides API for Thailand to feed agro-climate and agronomic information to Agri-Map, which provides services to local with own data.
DroughtWatch for Mongolia
On September 17, 2018, the DroughtWatch-Mongolia was officially handed over to the Mongolian National Remote Sensing Center (NRSC).
Potential

- **Promote ownership for developing countries**
  - Customized according to the specific demand for each country and work as a national/regional system
  - After customization and training, countries will strengthen the agricultural monitoring capacity on your own
  - Promote developing countries leap-frag development

- **Cloud services for crop monitoring**
  - Cloud based system assessible from internet everywhere without investment on computing infrastructure, storage, etc
Thank you for your attention!