CBAS: A New International Platform of TFM for SDGs
China will set up an International Research Center of Big Data for Sustainable Development Goals to facilitate the implementation of the 2030 Agenda for Sustainable Development.

-- President Xi’s speech at 75th UN GA
Congratulations to the Chinese Academy of Sciences on the new International Research Centre of Big Data for the Sustainable Development Goals.

This Research Centre will work side-by-side with the Regional Hub for Big Data to support the UN Global Platform. Together, we can mobilize scientific and technological communities to help achieve the SDGs.

--UN Secretary-General's video message for the Inauguration of CBAS
• My Department, stands ready to work with the Centre to strengthen global partnership for the SDGs. --UN Under-Secretary-General for Economic and Social Affairs

• I’m very pleased to see UNEP and the Chinese Academy of science is working together to bridge the data gaps for the SDGs and to improve our effectiveness in using environmental data. --UN Under-Secretary-General and Executive Director of UNEP

• We have a vision in the UNCCD of having a public UNCCD Data Portal. The UNCCD looks forward to cooperating with the CBAS. --UN Under-Secretary-General and Executive Secretary of UNCCD
The Center provides a range of services essential for addressing the most challenging problems such as lack of data and technology barriers in the implementation of the SDGs, including data sharing, technology solutions, decision-making support, as well as capacity building for developing countries.
Develop SDG data infrastructure and information and data products

Provide new knowledges for SDG monitoring and evaluations

Develop and launch a series of SDG Satellites

Capacity development for SDGs in developing countries
A research team with extensive domestic capacity

33 CAS Institute

96 Participating Organization

>1200 Scientist
The extensive international cooperation platform provides a prerequisite for the international expansion of SDGs achievements.

- 57 countries, international organizations and plans
- Covering 4 continents
- 9 international working groups
- 8 international research centers of excellence
- 6 UN SDG goals
## SDG Big Data Platform

### Tailored services up to now for

**Scientists**
- 4 online indicator calculation (6.6.1; 11.3.1; 15.1.1; 15.3.1)

**Decision makers**
- SDG data products
  - (Surface Water, Forest Cover, Land Productivity)

**Public users**
- Latest news

Combing multiple sources of data in geography, remote sensing, ground monitoring, and social statistics, the **SDG Big Data Platform** provides tailored services for SDGs research by integrating over a hundred popular algorithms and tools on the unified platform.

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<th>Scientists</th>
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<td>Latest news</td>
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Each year, about 3PB will be updated on the Platform.

Data sharing service system was released on 15, Jan, 2019. As of September 2021, more than 280,000 users in 174 countries have accessed the system, and the total online traffic has exceeded 57.97 million times.
China’s Earth Observation Satellites

**Meteorological Satellites:**
- FY-1 series: polar orbit satellites; FY-2 series: stationary orbit satellites; FY-3 series: polar orbit satellites; FY-4 series: stationary orbit satellites.

**Resource Satellites:**
- CBERS series: developed jointly by China and Brazil;
- ZY3-01/02: surveying, mapping and resource investigation.

**Ocean Satellites:**
- HY-1A/B: ocean color satellites; HY-2A: ocean dynamics and environment satellite; CFOSAT: surface wave.

**Disaster Reduction and Environmental Satellites:**
- HJ-1A/B: optical sensors; HJ-1C: S-band SAR sensor.

**High-resolution Satellites:**
- GF series: construction period: 2010-2020; including optical and SAR Satellites.

**BeiDou Navigation and Positioning Satellites:**
- BeiDou series: including 35 satellites; global coverage.
SDG Satellite Launched on 5 November 2021

- Thermal infrared + nighttime-light + multi-spectral
- Wide scale (300 km)
- High-resolution (10 m)

Explore new methods to sense Earth's environment

Data will be accessible during the second half of 2022
Chinese Government released the Reports at 74th, 75th UN GA

Focusing on six SDGs, including Zero Hunger (SDG 2), Clean Water and Sanitation (SDG 6), Sustainable Cities and Communities (SDG 11), Climate Action (SDG 13), Life below Water (SDG 14), and Life on Land (SDG 15), the Report showcased the results of research, monitoring and evaluation of relevant SDGs and their indicators at local, national, regional and global scales.
China moved toward a more sustainable food supply. The environmental intensity of all five indicators declined across 18% of cropland and increased on just 2%.

Farm management explained >90% of changes in crop production and environmental impact.
Monitoring of Desert locust core breeding areas and migration paths in the Year 2018-2020 are conducted in Asian and African, especially in some severely damaged countries, including Pakistan, Ethiopia, Kenya, Somalia, and Yemen.

The results were adopted by FAO to support multi-country joint pest prevention and control to ensure agricultural production.
Target: 6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

Indicator: 6.3.2 Proportion of bodies of water with good ambient water quality

Target 6.4: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity

Indicator 6.4.1: Change in water-use efficiency over time

Target 6.6: By 2020 protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

Indicator 6.6.1: Change in the extent of water-related ecosystems over time

| Table 1 Water-related Ecosystem Categories and their Applicable Extent Components |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|
|                                 | Lakes           | Rivers and Estuaries | Vegetated Wetlands | Aquifers | Artificial Waterbodies |
| Extent Components               | Spatial Extent  | Quality           | Quantity          | N/A      |
|                                 | N/A             |                  |                  |          |

N/A = No requirement to monitor for Indicator 6.6.1
Spatiotemporal patterns of water transparency in China's lakes

During 2000-2019, the water transparency of China’s lakes showed a spatial pattern of “high in the west and low in the east”. Overall, water clarity was good and showed a positive trend. The proportion of Types I, II, and III water bodies with good clarity increased from 84.11% in 2000 to 92.46% in 2019.

The mean SDD values of China's large lakes during 2000-2019
Temporal and spatial distribution of the surface water transparency in the Belt and Road regions

From 2015 to 2018, the transparency of lakes generally showed a downward trend, of which 68.3% decreased and only 31.7% increased.
Cases of SDG 6 in Big Earth Data Program

Spatiotemporal distribution of China's vegetated wetlands

From 2015 to 2018 the net increase in mangrove forests of China was 22.11%, and the net decrease in invasive Spartina alterniflora was 2.59%. The mangrove forests have been significantly restored and the invasion of Spartina alterniflora was under effective control.
Cases of SDG 6 in Big Earth Data Program

Dynamic change of water body in Ramsar Sites

From 2000 to 2018, 50% of the Ramsar Sites in Asia, Europe, and Africa exhibited a trend of significant change, and most of them (58%) an upward trend.

Global water bodies dynamic datasets from 2000 to 2018, with a spatial resolution of 250 meters and temporal resolution of 8 days was used.

Seasonal fluctuation characteristics
Cases of SDG 6 in Big Earth Data Program

Changes of natural and artificial water bodies in Lancang Mekong Basin

Taking Landsat Image as data source, based on deep learning method, the 30 meter resolution natural and artificial water data sets from 2000 to 2018 were extracted and statistically analyzed.

From 2000 to 2018, the natural and artificial water areas in China, Myanmar and Laos showed an increasing trend, while in Cambodia, Vietnam and Thailand showed a decreasing trend.
Changing cities face many problems

- Migration
- City traffic
- Ecosystem
- Regional development imbalance
- Resource energy consumption
- Social and economic structural changes

SDGs focus on urban sustainability

Sustainable cities and communities

Make cities and human settlements inclusive, safe, resilient and sustainable

How to build a sustainable city?

- 10 targets
- 291 partnerships
- 80 publications
- 254 documents
Transformation for urban sustainability

13 of 15 SDG 11 indicators lack data

Interconnections between SDG11 and other SDGs

The relationship between 6 entry points and 17 SDGs
How to measure and assess urban and pre-urban sustainable development?

- Census Statistics
- Earth System Science/Urban Science
- Mobile communication/Internet of things
- Cloud computing Artificial intelligence
- Earth observation
- Spatial information
- Big earth data for sustainable development
- Urban sustainability assessment and governance
CASEarth conducts 21 typical cases centered on urban & peri-urban development and science & technology, and focuses on 8 main themes including urban public transportation, road network, open public space, heritage protection, urbanization, pollution, public health, and disaster prevention & mitigation.
Urban Public Transportation

- Producing Chinese fine population grid data with 1km resolution by sex and age for 2015 and 2018.
- The proportions of the population with convenient access to public transportation were 64.28% and 80.56 in 2015 and 2018, respectively.

Chinese urban public transportation system

Urban population distribution by sex and age in China

Change of urban public transportation proportions from 2015 to 2018
Urban Road Network

- The total length of road has increased by 1.6 times, average road density increased from 0.58 to 0.78 km/km², and average road length increased from 7 m to 9 m per capita.
- Iran, Turkey, Bulgaria and China have the highest road connectivity importance among the 65 countries.

Big Earth Data
- Sentinel-1
- Sentinel-2
- Open Street Map
- World bank population

Deep Learning
- Cloud Computing
- Transfer Learning
- Deep Networks

Road Dataset
- 65 One Belt One Road countries
- 2015, 2017 and 2019
- Road length/density/connectivity

D-LinkNet
Urban Sprawl and Urbanization

Global urban impervious surface mapping in serve of SDGS

- Global 10-meter resolution urban impervious surface products acquired in 2015 and 2018 were generated from multi-source Big Earth Data.

- Assessing global urbanization progress at continental and national scale from 2015 to 2018, results reveal that Africa as well as nearly 50% nations face major challenges ahead for urban sustainable development.

- Developed online computing and processing toolkit for SDG11.3.1 based on CASEarth cloud platform.
Urban Sprawl and Urbanization

**Monitoring and assessing urbanization progress in Belt and Road (B&R)**

- Monitoring and measuring the SDG 11.3.1 indicator for 1,500 cities with populations greater than 300,000 from 1990 to 2015 at 5-year intervals in the B&R region.
- Proposed a new SDG11.3.1 indicator - the ratio of economic growth to land consumption rates (EGRLCR) in assessing China’s urbanization.
- In the B&R region, the results reveal that LCRPGR increased from 1.24 in 1990-1995 to 2.67 in 2010-2015.
- In China, the results shown that LCRPGR increased from 1.33 in 1990–1995 to 2.15 in 2010–2015 period, while EGRLCR fell from 2.96 to 1.69.
- Urban sustainability in B&R still faces major challenges.
Natural and Cultural Heritage Protection

- Improved SDG11.4.1 indicator - “increase in capital investment per unit area to protect and safeguard the world’s cultural and natural heritage”. The sustainable development of Chinese world heritage was obviously improved from 2006 to 2017.

- Proposed urbanization intensity indicator (UII). The average UII of 79 world cultural heritage sites in the “Belt and Road” region increased from 0.26 in 2000 to 0.29 in 2015.

- Proposed human comprehensive intensity indicator. About 78% of the natural heritage sites is affected by human disturbance gradually during 1993 to 2016.

The changes of improved SDG11.4.1 calculated using statistics data for 39 UNESCO designated natural protected fields from 2006 to 2017 in China.

The changes of UII for cultural heritage sites along the Belt and Road from 2000 to 2015

Distribution map of comprehensive intensity of human disturbance in the natural heritage sites
Using NO$_2$ vertical column density changes derived from satellite data to analyze the impact of COVID-19 on countries along the B&R region.

In China, NO$_2$ has shown a significant downward trend from late January to early March 2020, with a maximum decline of up to 31.76%; With the resumption of production and resumption of production, the tropospheric NO$_2$ vertical column density at the end of March returned to the level close to the same period in previous years.

Globally, since early February, NO$_2$ hotspots in Europe, the Middle East, and India have also observed a clear downward trend because of COVID-19.
Air Pollution

Monitoring and analyzing fine particulate matter (PM$_{2.5}$) in China

- Providing China’s 2010-2018 annual average PM$_{2.5}$ data products.
- The Beijing-Tianjin-Hebei, Yangtze River Delta, Pearl River Delta, and Chengdu-Chongqing regions showed an overall decreasing trend from 2010 to 2018.

Data and Computation Method

- Datasets: MODIS AOD and MODIS NDVI in the time series. Monitoring data included China’s environmental monitoring stations, meteorological data, and reanalysis by ECMWF.
- Method

$$C_{agg} = \frac{\sum(C_{nat} \cdot P_{nat})}{\sum(P_{nat})}$$

where $C_{agg}$ is the estimation at the global scale, $C_{nat}$ is the estimation at the country scale, and $P_{nat}$ is the national population.
The share of open public space (OPS) in built-up areas of Chinese cities were 17.98% and 19.50% in 2015 and 2018, respectively.

The OPS scale increases with an increase in city size and economic development level, and the economic development level, residents’ living standard, urbanization level and population size have sound explanatory powers on the scale.
Target: SDG 13.2 Strategies for climate change
Case: Global terrestrial carbon sink and its driving factors

- Carbon sinks is estimated by combining Meteorological data, land use data, soil data and vegetation LAI data from remote sensing.
- We found that about 40% of global carbon sink changes were attributed to the changes in land use/cover, and 30% of changes were attributed to climate change.

The importance of land use/land cover changes (LULC), Climate, CO2 and nitrogen deposition (Nd) on NEP variations during the period of 2001-2019
Target: SDG 13.3 Adaption to climate change
Case: Ocean Heat Content (OHC) increases rapidly

- A new dataset of global ocean heat content (named OPEN) for upper 2000m from 1993-2020 based on remote sensing is produced;

- The ocean has experienced a worldwide and significant warming during recent decades ($2.25 \times 10^8$ J/m$^2$/decade);

- Heat uptake occurs significantly and unevenly in different ocean basin.
SDG14-Integrated Eutrophication Assessment in Typical Coastal Waters of China

Target 14.1: By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution

The indicators of both human activity-derived pressures and ecological responses are relatively important and should all be taken into consideration.

In typical waters along China’s coast, the eutrophication problem in the inner bays and big estuaries were very serious where anthropogenic activities were dense, and the ecological responses were also serious.
Analysis of the Distribution and Variation of Marine Debris and Microplastics in China's Coastal Waters

Target 14.1: By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution

Distribution of floating debris in 22 typical coastal areas of China

The abundance of floating debris in China's coastal waters has been on a decline since 2015. The abundance of floating debris in 2018 was approximately 25% lower than the average of 3,207 pieces/km² recorded for the period 2010-2014.

The average abundance of microplastics changed little from 2016 to 2019, and the pollution situation showed an improvement trend.

Distribution of marine microplastics in China
Target 14.2: Sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans.

Monitoring the extent and dynamic change of mangrove forests along the Maritime Silk Road

Change in mangrove area along the Maritime Silk Road from 1990 to 2015

- **Asia**: 68.4% of mangroves in the Asian countries has continued to decrease.
- **Africa**: 66.4% of mangroves in the African countries has increased.
- Human activities in Asian countries have a greater impact on mangroves, while African countries have less impact.
- GDP growth has a more impact on mangroves than population growth.
Conservation and utilization of the Coastline along the Maritime Silk Road

Target 14.5: By 2020, conserve at least 10% of coastal and marine areas, consistent with national and international law and based on the best available scientific information

- From 1990 to 2015, the length of the coastline along the Maritime Silk Road showed an overall steady growth trend, especially most significantly in Southeast Asia.
- The length ratio of the natural shoreline has decreased from 95% (306,959 km) in 1990 to 92% (302,878 km) in 2015.
- The length of the artificial shoreline has increased from 5% (14,715 km) in 1990 to 8% (26,006 km) in 2015, with an average growth rate of 452 km/year.
Big species data helps to map biodiversity of China and answer where are the biodiversity hotspots, what species should be protected, and how to protect them.

- maps of >60,000 species
- >3,000,000 distribution records
- complete data quality assessment workflow
- annually updated according to research progress
- supporting species protection and hotspots research.


Big data of species distribution, human activity and gen supports research on habitat change and protection decision of primates.
AI and Citizen Science for Biodiversity

- Propose a new framework to combine ecological niche model and AI-based model for species identification.
- AI-based APPs for recognizing and recording species have been widely used in China.

NicheNet: a framework for learning niche features for species identification

Lin et al., 2021. Ecological Informatics.
Proposing an optimized Biodiversity Risk Index (BRI) that describes the risk of extinction.

In areas facing high risks and high pressures, only 4% are covered by protected areas, tailored strategies are necessary to address this gaps.
Urgency of Restoring Large Carnivore Populations

- A wide-ranging retreat of the four large carnivore species across the Giant Panda National Park.
- Opportunity to restore ecosystems that support greater trophic complexity.

Big data from 2008-2018:
- 73 protected areas across 5 mountains;
- 7,830 survey locations, 1,690,000 camera days.
China’s LDN status continues to improve. Compared with 2015, the net restored land area in 2018 increased by 60.30%, and the net restored land area accounted for about 1/5 of the world’s total, making the largest contribution to the world. From 2015 to 2018, land productivity shows significant decreasing trends in some regions.
THANKS

No.9 Dengzhuang South Road, Haidian District, Beijing 100094, China
Tel: +86-10-82178985
Fax: +86-10-82178980