ICARDA

Science for resilient livelihoods in dry areas

Smart Farming Systems for Inclusive Agriculture in Egypt

Dr. Chandra Biradar, Dr. Atef Swelam, Dr. Usman Awan and Dr. Jacques Wery

Workshop: Leveraging Investment for improving the efficiency of the agriculture and agribusiness sectors in Egypt

Session 3: Natural Resource Management – Addressing the Key Challenges Identified in Egypt's Agriculture and Agribusiness Sectors

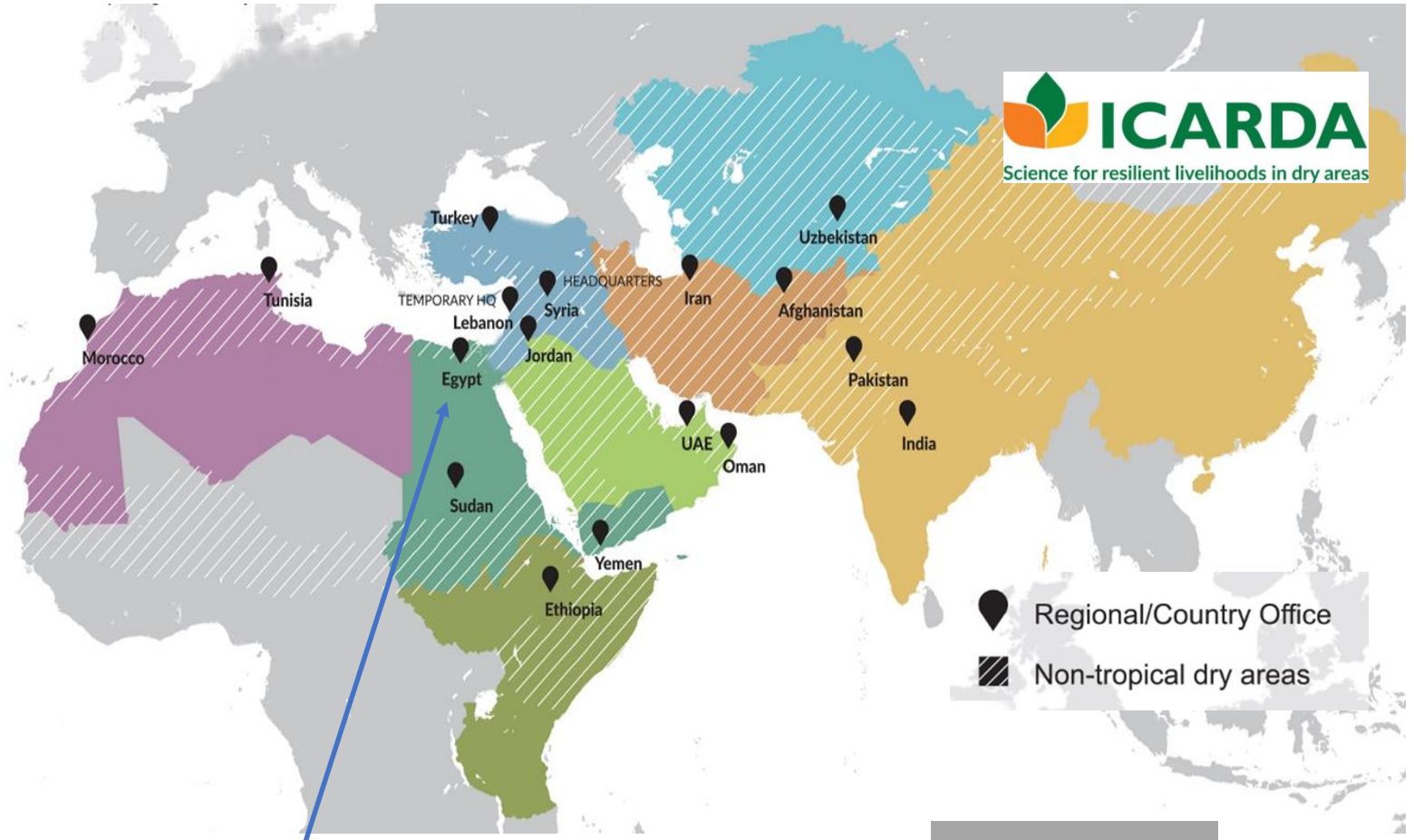
December 13, 2018 – Cairo

ICARDA is an **international** and **decentralized R4D** institute for **Dryland Agriculture** combining **component** and **systems** research in **collaboration with NARS**









Staff: 450
Scientists: 80

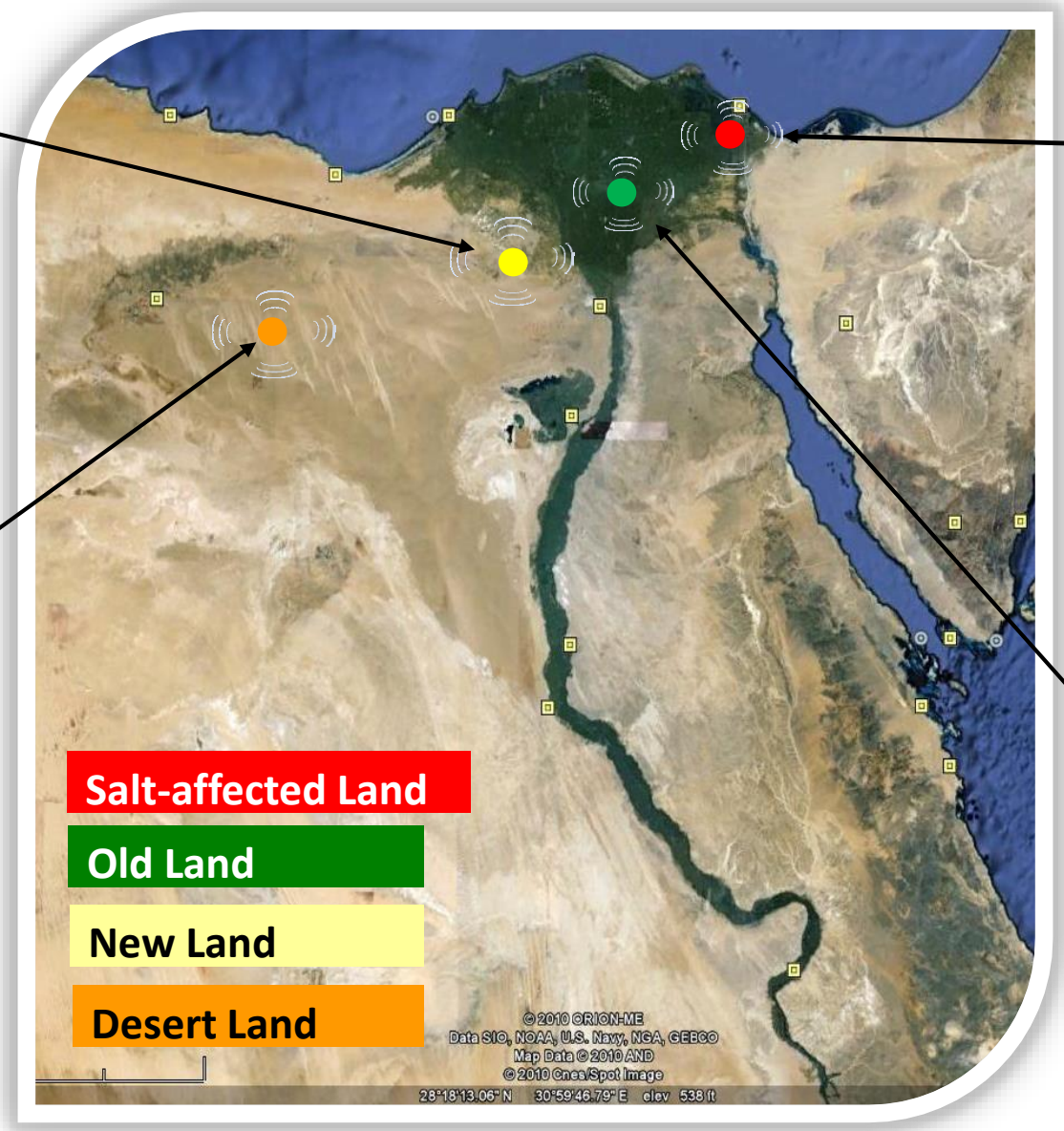
وزارة الزراعة واستصلاح الاراضي
Ministry of Agriculture and Land Reclamation
ARC
مركز البحوث الزراعية
Agricultural Research Center

Sustainable Agro-eco-socio Systems for Egypt

Improve Land and Water Productivity

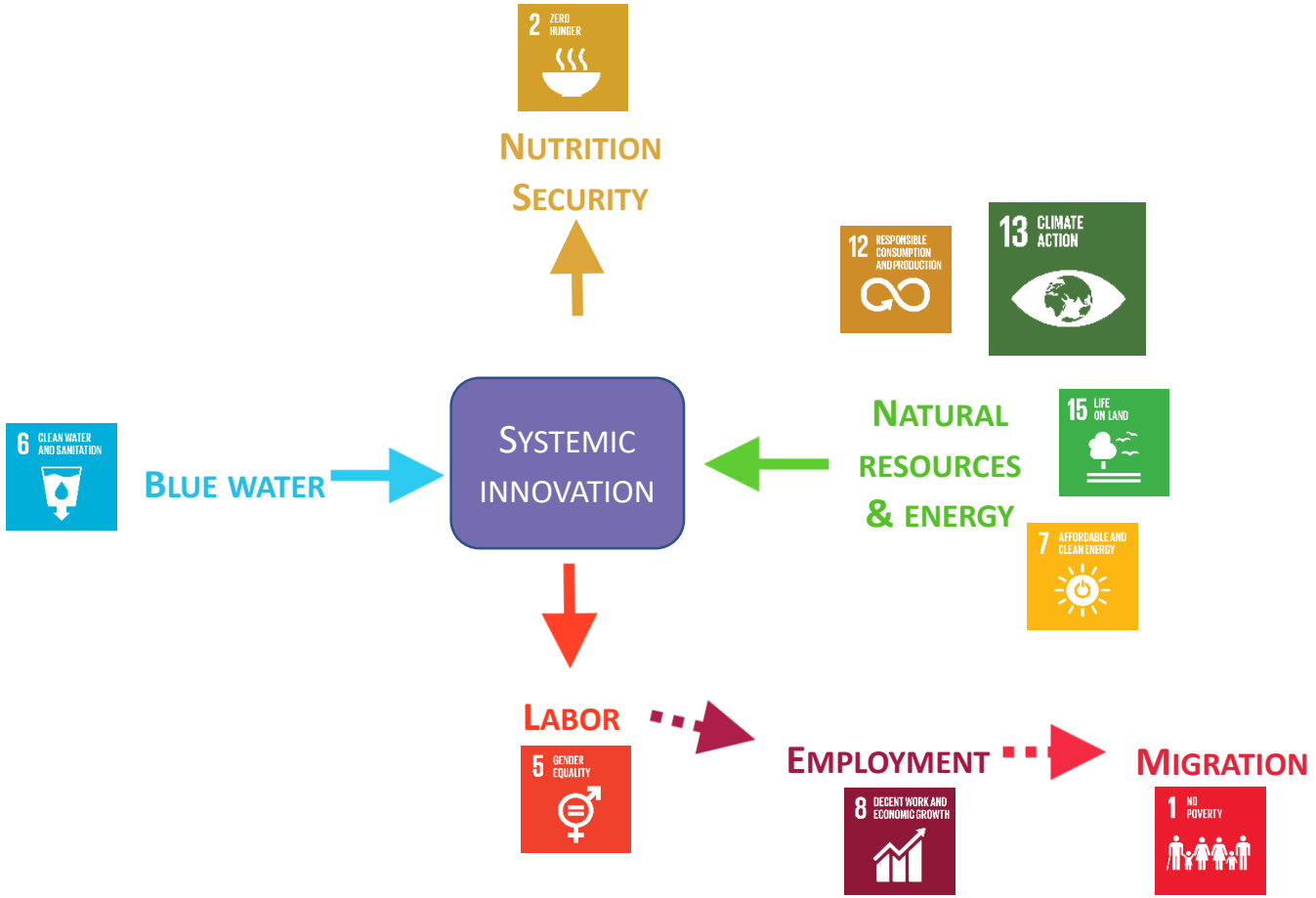
Manage salinity

All + Circularity

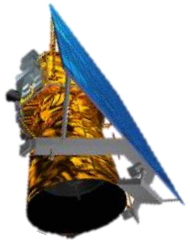


Sustainable Intensification

1. Bio-technical Innovations are on their way

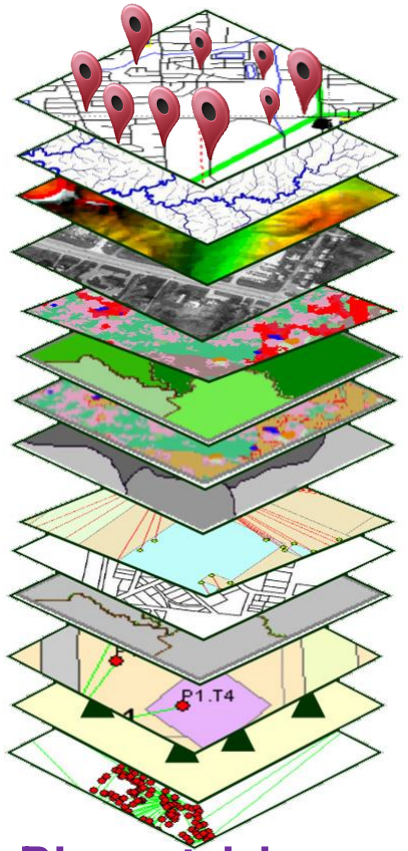


2. Big data and technologies for Smart Farming Systems



- Geo-Tagging
- Satellite data
- Agro-Tagging
- Climate data
- Soil data
- Water data
- Topography
- Demography
- Ecological data
- ...

The Big Data



Biggest drivers

Computation

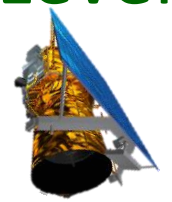
Algorithms

Applications

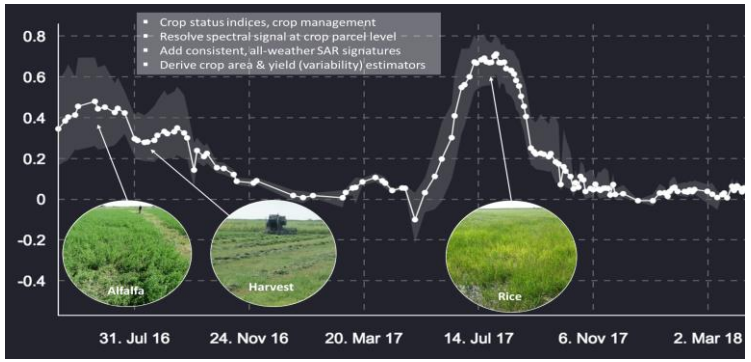
Scalability

- Mapping
- Monitoring
- Targeting
- Estimating
- Forecasting
- Warning
- Lending
- Insurance
- Value chains
- Carbon-Credits

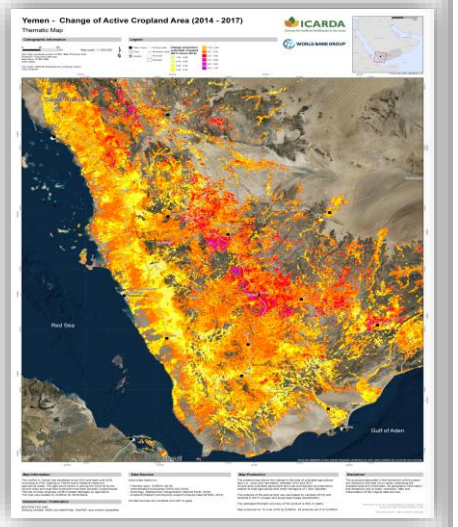
Level 1: Observation and trend analysis with low data on the ground



Vegetation Index

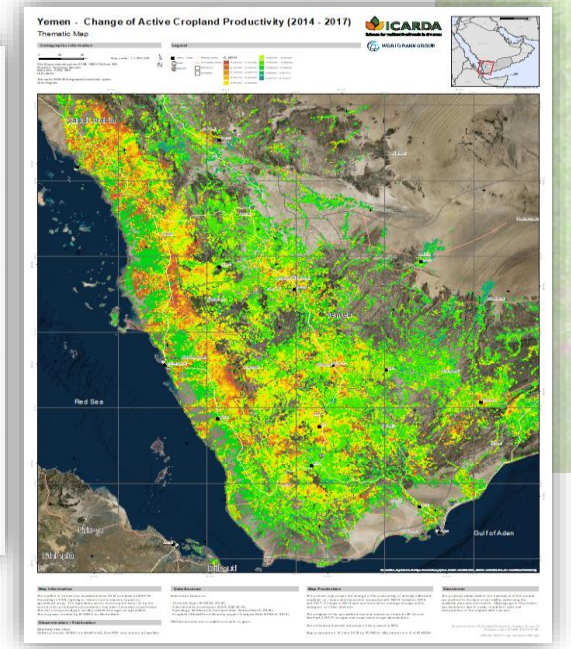


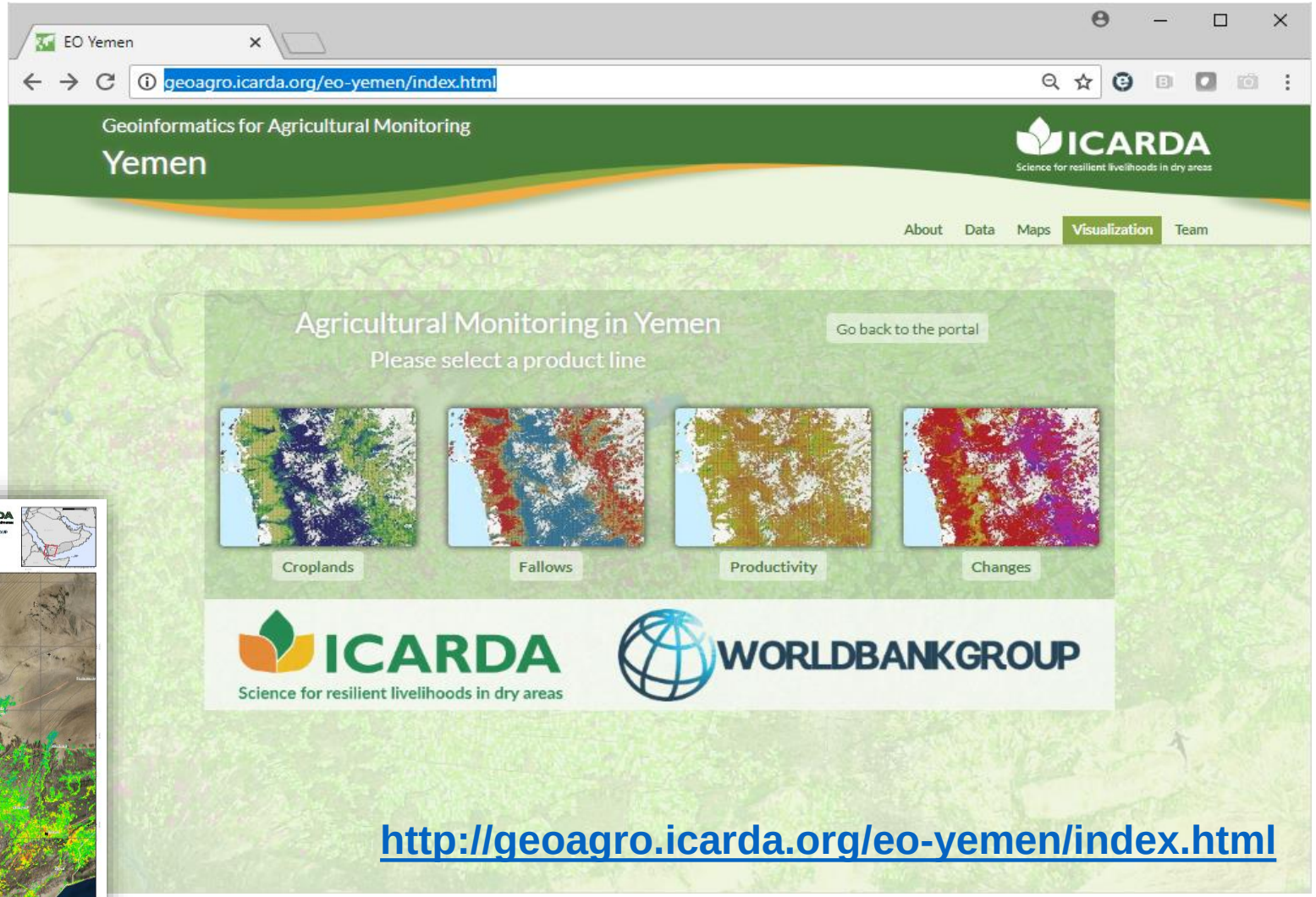
Cropland Area



2014 - 2017

Cropland Productivity



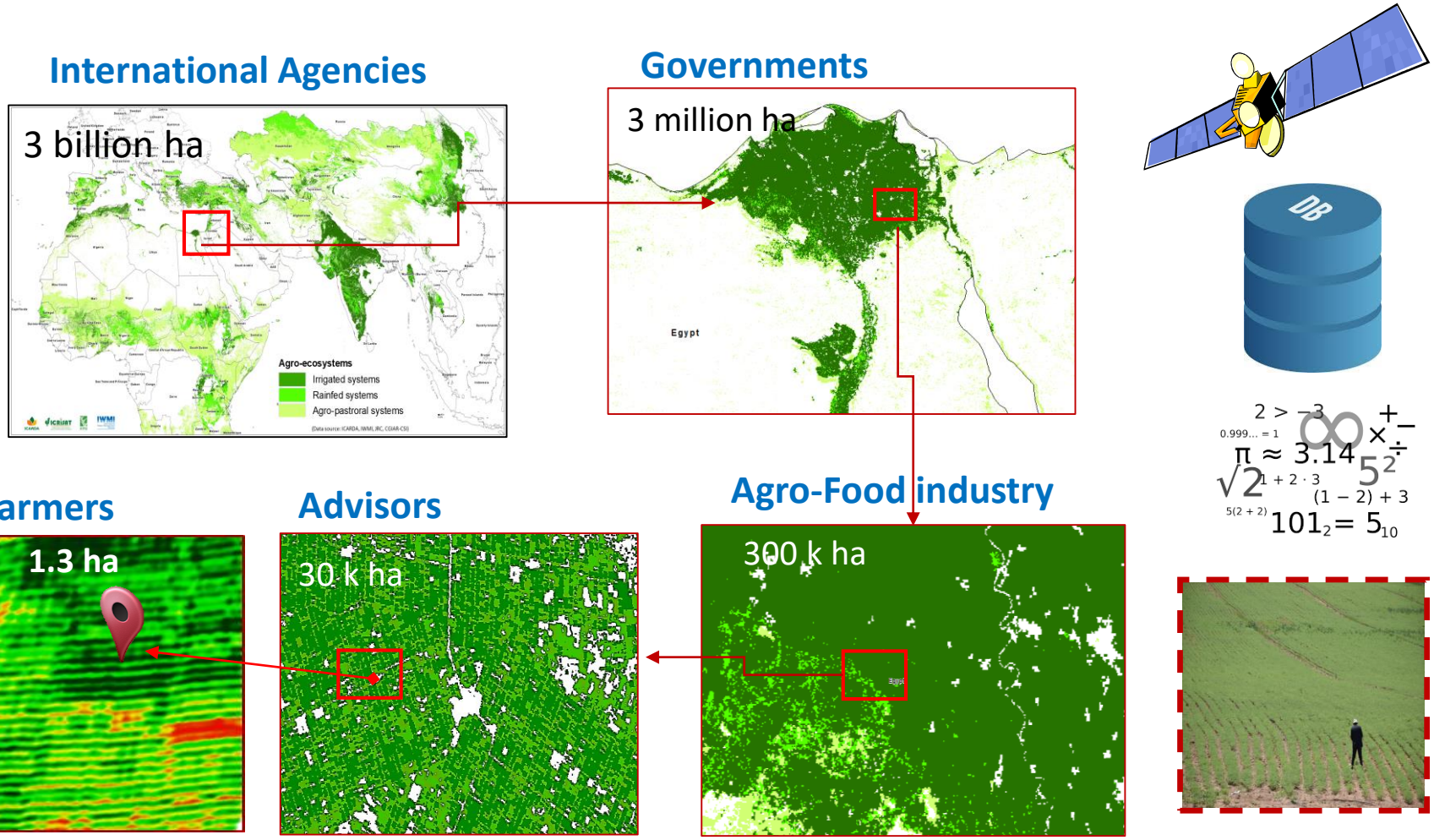


http://geoagro.icarda.org/eo-yemen/index.html

ICARDA Science for resilient livelihoods in dry areas

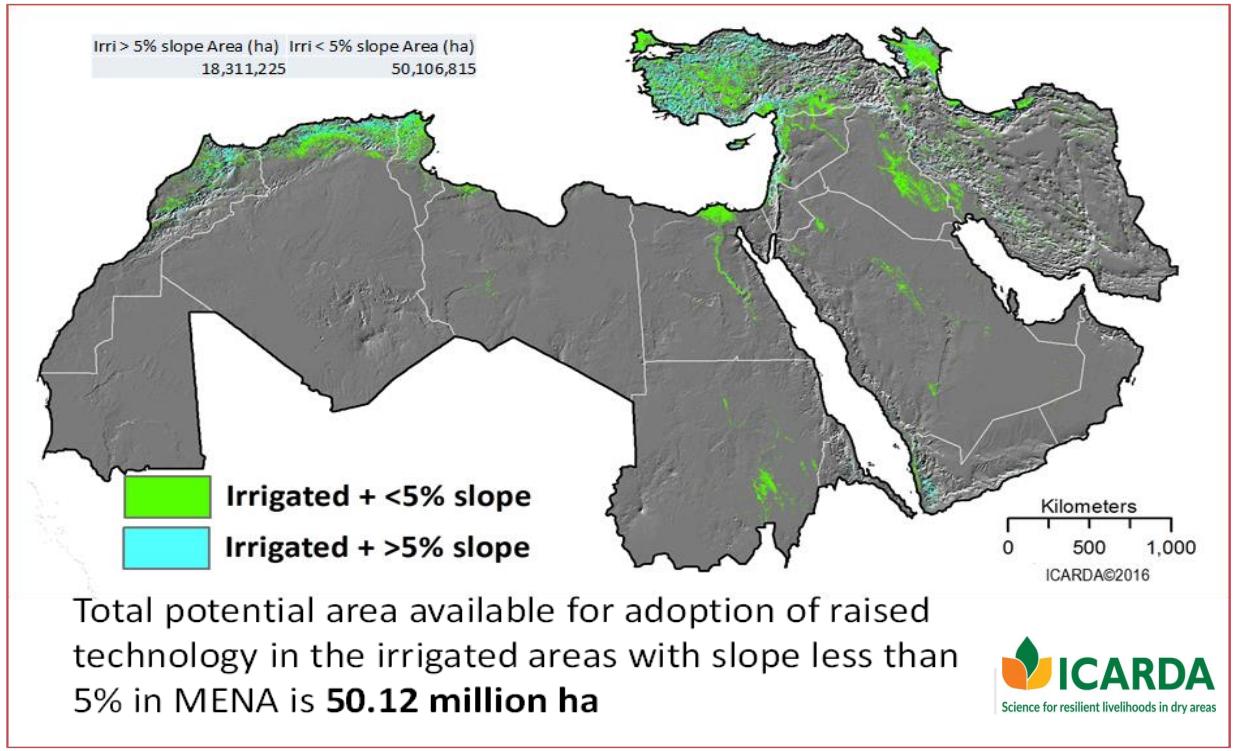
WORLD BANK GROUP

Level 2: Quantification of key indicators for decision making



Multi-scale knowledge on **climate variability** (spatial and temporal), **soil fertility**, **water availability** and **quality** and **crop responses** (yield, water productivity, soil carbon, pests-diseases…)

Outscaling proven technologies

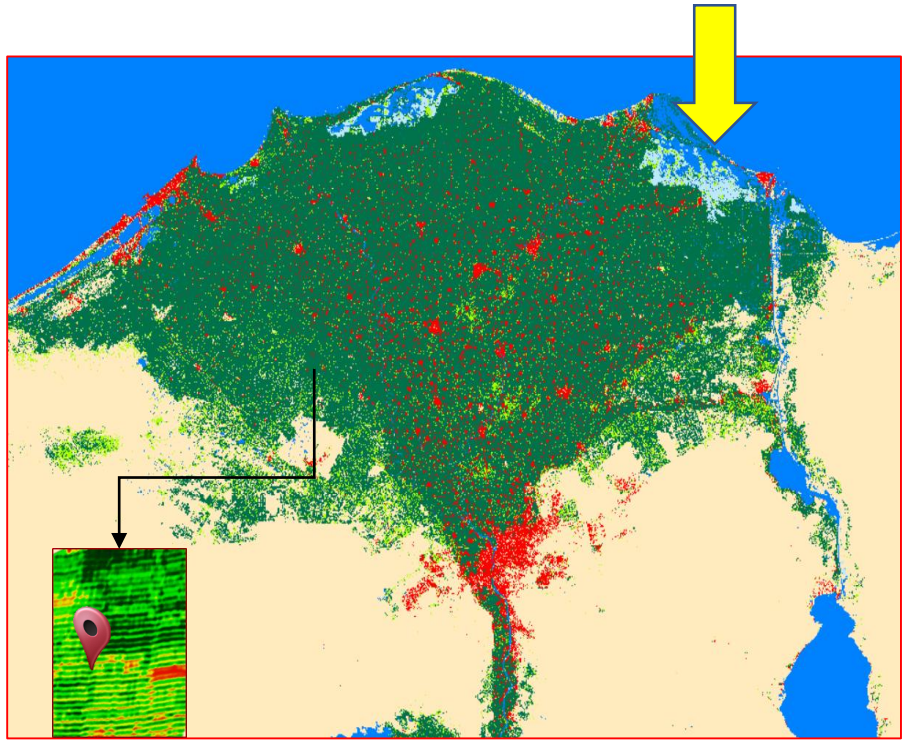


Total potential area available for adoption of raised technology in the irrigated areas with slope less than 5% in MENA is **50.12 million ha**

ICARDA
Science for resilient livelihoods in dry areas

ICARDA
Science for resilient livelihoods in dry areas

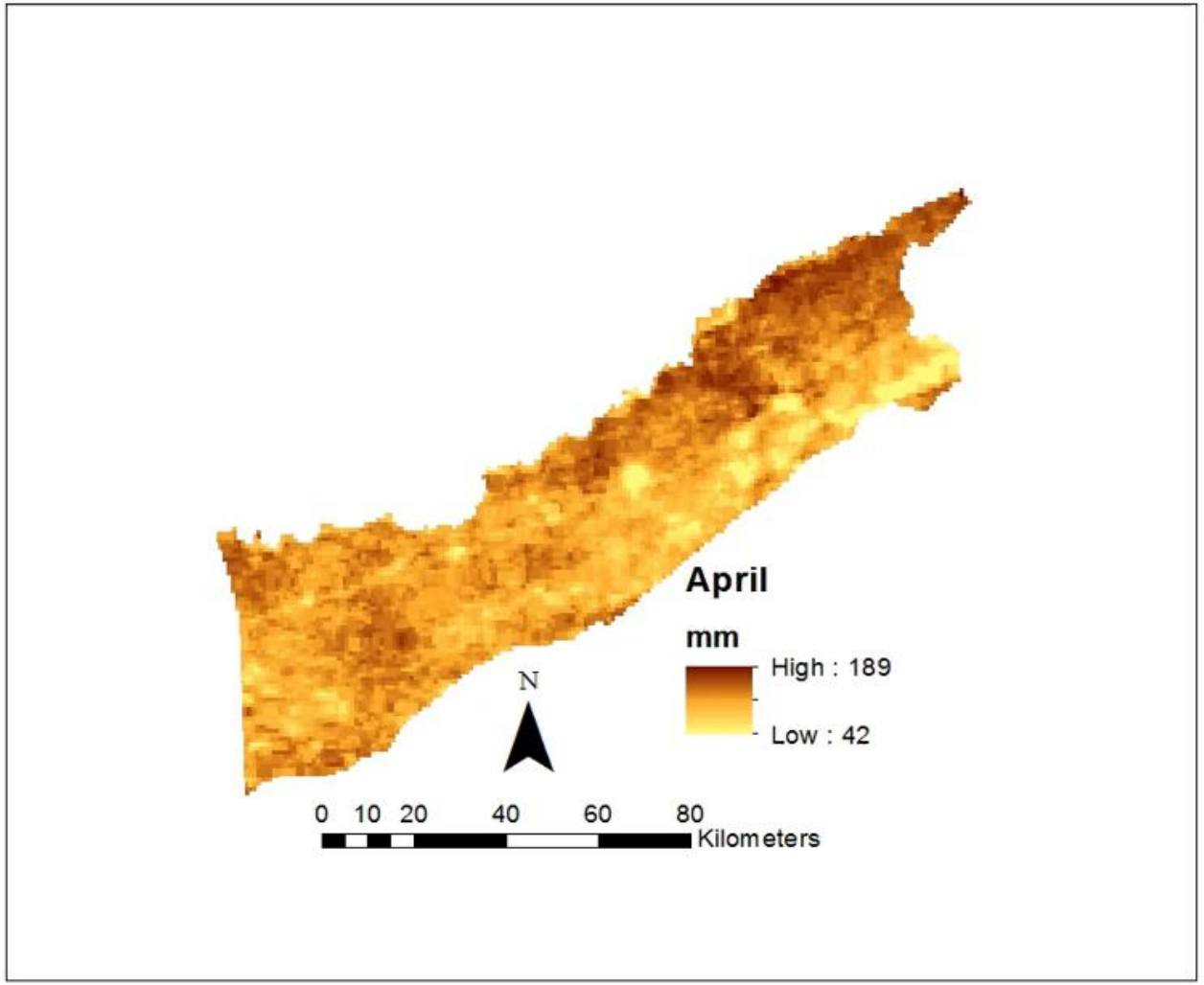
وزارة الزراعة واستصلاح الأراضي
Ministry of Agriculture and Land Reclamation
ARC
مركز البحوث الزراعية
Agricultural Research Center



icarda.org

In-season decision making

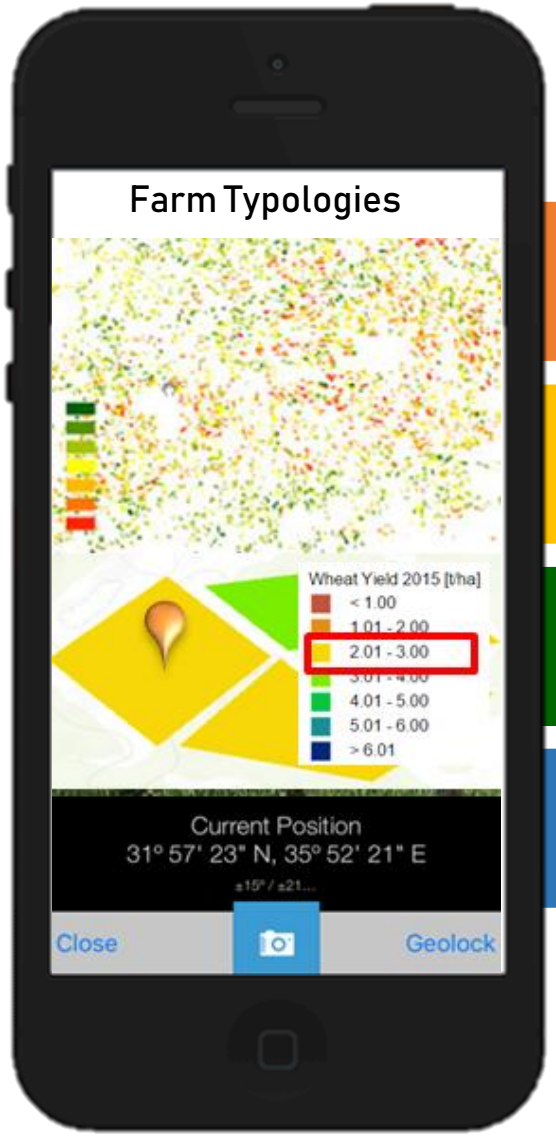
Monthly Actual Evapotranspiration in an irrigation scheme of Punjab province of Pakistan



SEBAL algorithm applied on satellite remote sensing products of MODIS

Provided by Dr Usman Awan
Groundwater Hydrologist
ICARDA

Technologies are mature but need data



Thousands of research and outreach data points in each season across the agro-ecosystems

Open source near real-time earth observation data at field, farm and landscape scales

Enormous power of cloud computing, open access, algorithms and analytics to process data on time

Smart phone enabled apps and cloud web-GIS for decision making at point, farm and administrative units

AWS Google Earth Engine

Level 3: Farming Systems Assessment and Design

What do we integrate?

A:
Crop types, rotation and health mapping

B:
Crop Yield estimation and forecasting

C:
Systems analytics and resource use tradeoffs

At which temporal and spatial scales?

Temporal

Mode 1:
Archives and end-of-year

Mode 2:
Within-season monitoring

- Land use intensity
- Yield gaps
- Land degradation
- Early crop acreage estimation
- Crop stress
- Early water demand estimation
- Early estimation of food production

Spatial

Mode 1:
Pixel-level

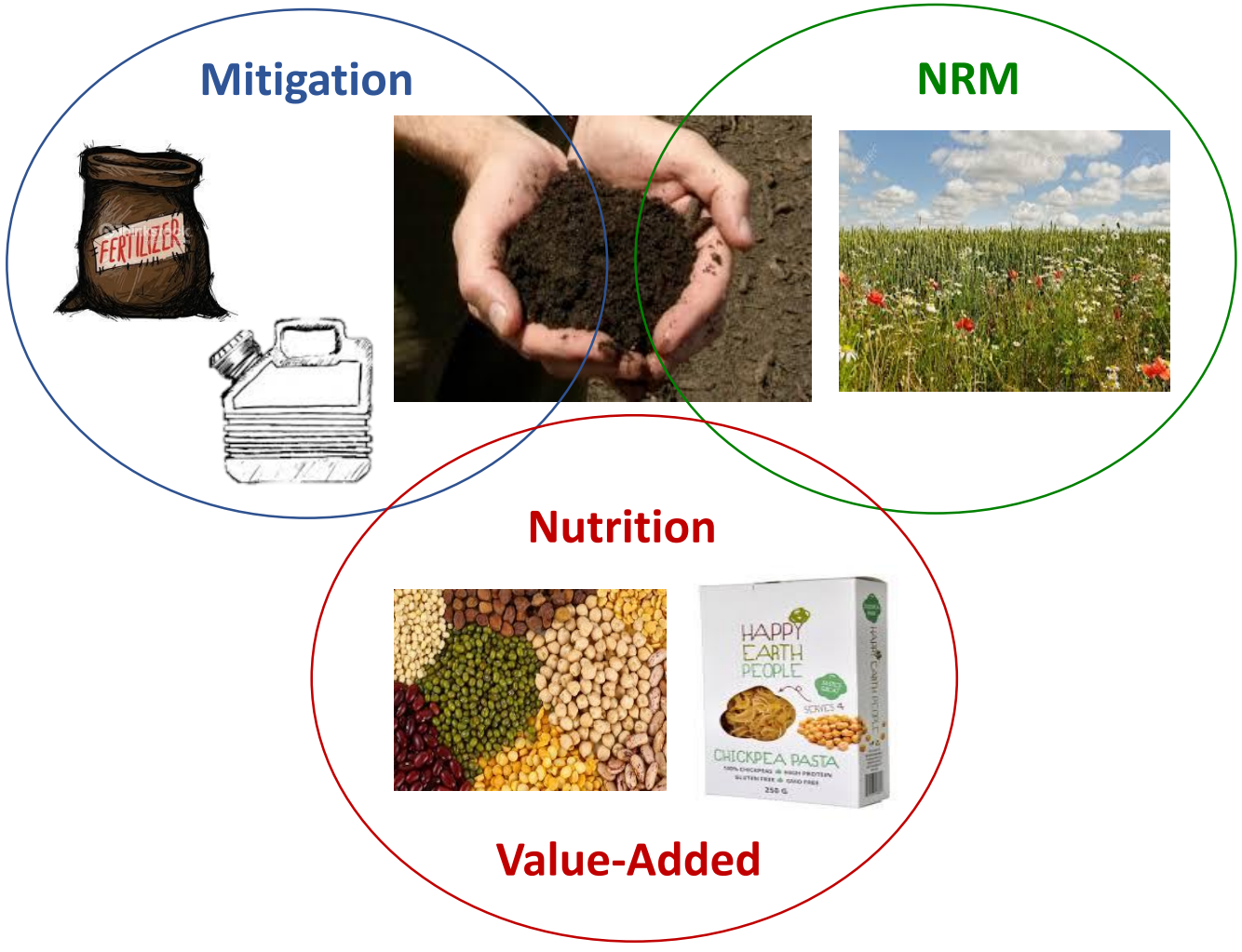
Mode 2:
Object-level

GBDX amazon web services esri Google Earth Engine

From research-to-service provision

http://geoagro.icarda.org

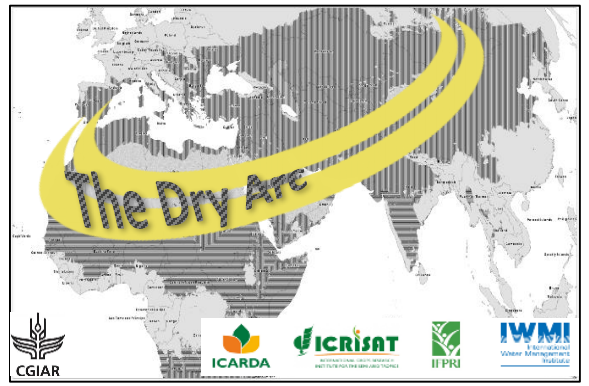
Technologies cannot deliver without a sound agro-ecology



3. Smart Farming requires a strong paradigm shift

1. Diversity for resilience (rotations/intercropping; mix farming…)
2. Nature-based solutions, technology and circularity for ecosystems services (including water productivity and trade-off management)
3. Multi-criteria assessment and policy analysis to support systemic innovation in agri-food systems
4. Smart knowledge (data, models, ICT) for adaptation to
    - variability (rainfall, soils, farms…)
    - changes (climate, markets, demography…)

Multi-scale and Multicriteria Scenario Analysis to support Research and Development Investments in the Drylands



CRPs | CGIAR Centers | Public Sector NARS, ARIS, Univ. | Private sector

Interface for the Drylands

Knowledge management

Data, RS, GIS layers, CC Scenarios

Framework and models for integrated modelling and assessment of agrifood systems in the drylands

Multi-criteria assessment

Participatory approach

4. The Way Forward

- Basic resilience and performance provided by integrated farming systems → Smart combination of Bio-technical Innovations and enabling environment (policies, supply chains)
- Efficiency and De-risking provided by ICT Based services, planning and foresight → Sustainable agri-food systems
- Smart Farming Systems have a high potential in Egypt
- Collective intelligence and coordinated R4D is required