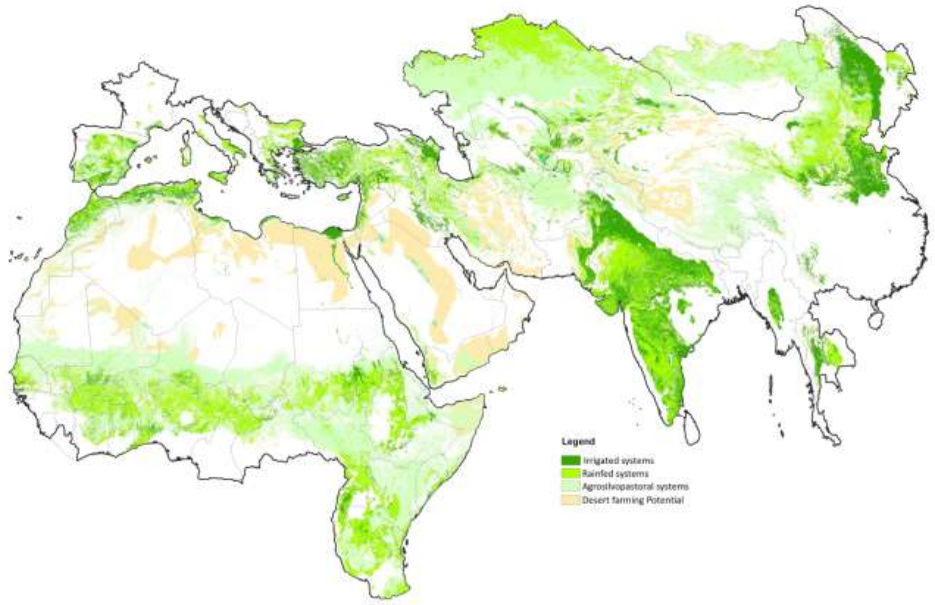
ICARDA ICRISAT IITA CIMMYT IWMI WorldFish ILRI

DryArc
Systemic Innovation for
Dryland Family Farming
CGIAR

ICARDA
Science for resilient livelihoods in dry areas

DryArc Interface



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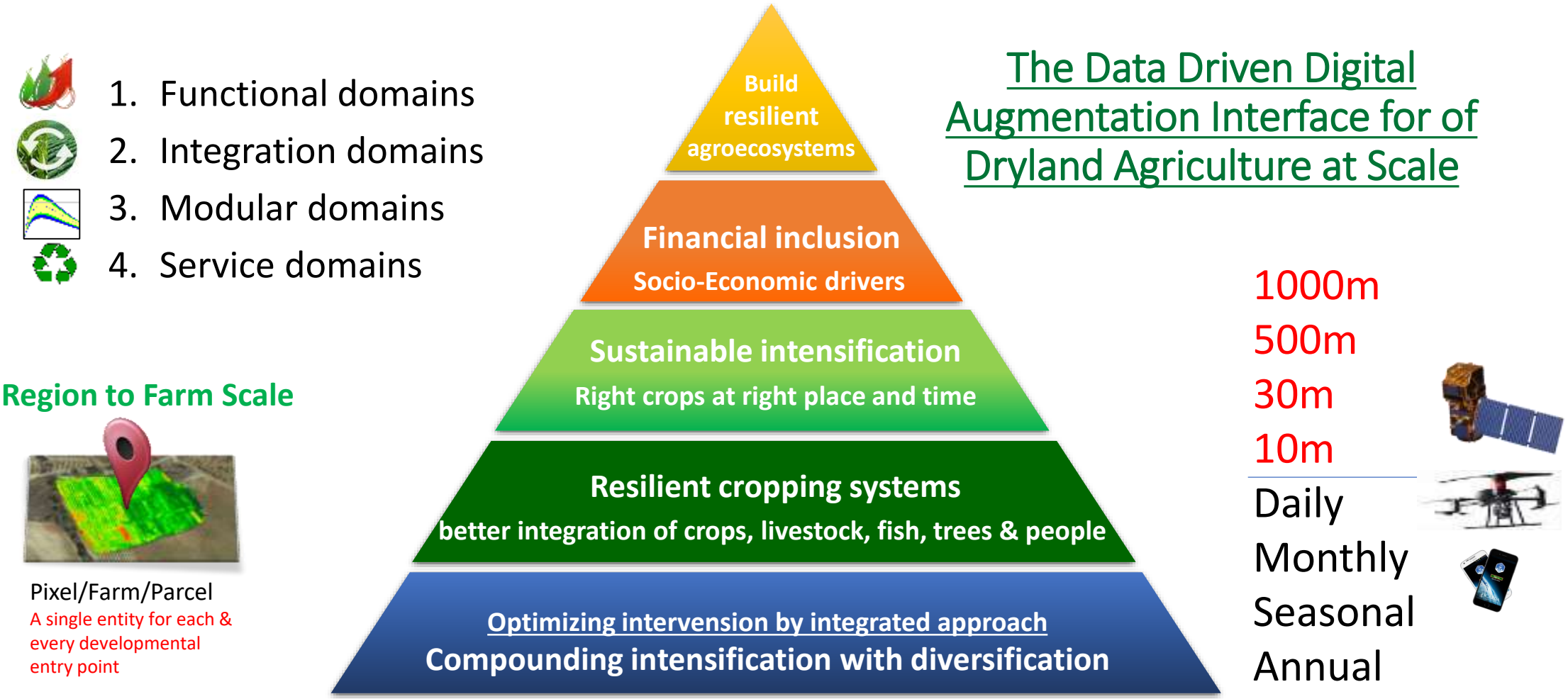
Deputy Director General –Research
Professor – Agronomy and System Research

DryArc Interface GeoAgro & FAO Regional Knowledge Platform Meeting, May 4, 2020, Cairo Egypt

Framework of DryArc Mapping Interface Tool

Digital Augmentation for Resilient Agroecosystems

1. Functional domains
2. Integration domains
3. Modular domains
4. Service domains



The Data Driven Digital Augmentation Interface for of Dryland Agriculture at Scale

Region to Farm Scale

Pixel/Farm/Parcel

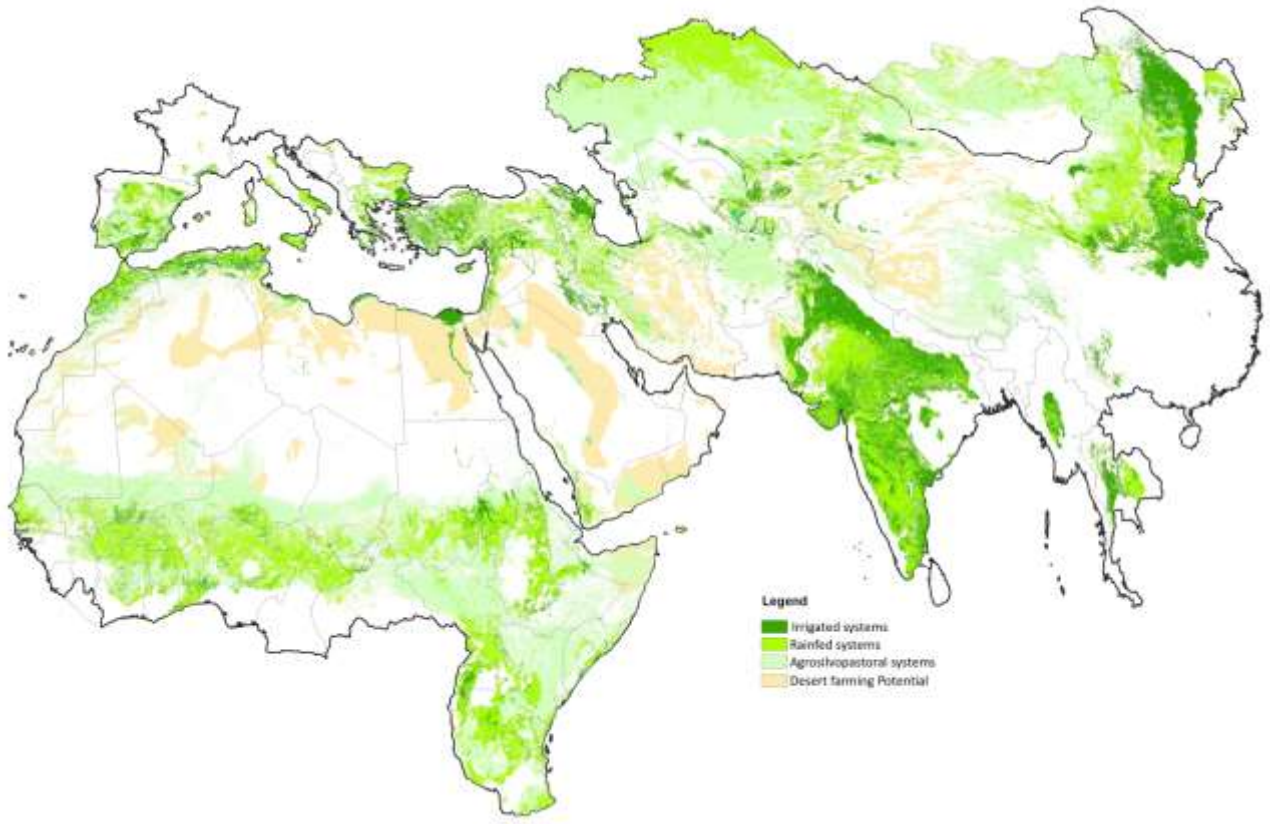
A single entity for each & every developmental entry point

1000m
500m
30m
10m

Daily
Monthly
Seasonal
Annual

Framework of DryArc Mapping Interface Tool

Digital Augmentation for Resilient Agroecosystems



SHARE Knowledge, Technologies and Data

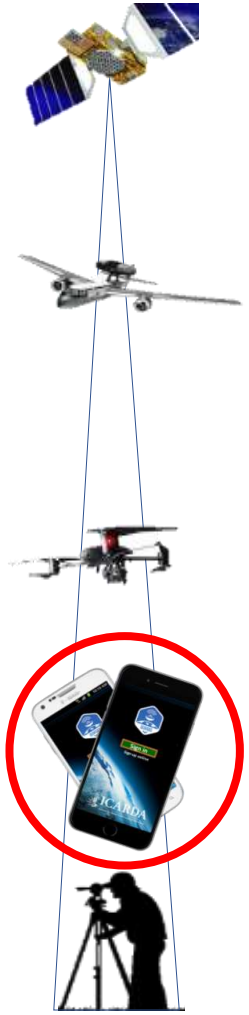
COMBINE Technologies in Systemic Innovation

ACCELERATE co-design with Farmers Communities

ENABLE- Policies and Institutions for Systemic Innovation

INTEGRATE Innovations and Methods

Scaling trade in/trade offs



Varieties/
Landraces

FIGS
HyRS
VarImpatc

Crops/
Forage

Crop Fallows
Intensification
feedstock

Farmlands/
Grasslands

MODIS
SPOT Veg.

MODIS
AWiFS

Landsat
IRS

Cropping Systems Dy
Ag Water Productivity
Yield Gap Analysis

Algorithms
Automation
Right space-time

Big-Data Analytics
Citizen Science
Precision Decisions

Machine learning
Artificial intelligence
Neural network

Agro-ecosystems
L&W Productivity
Land Use Change

Vegetation Dynamics
Pest and Diseases Risk
Crop Modeling (Physio)
Ag hydrology

WV series
RapidEye/BB
Cartosat

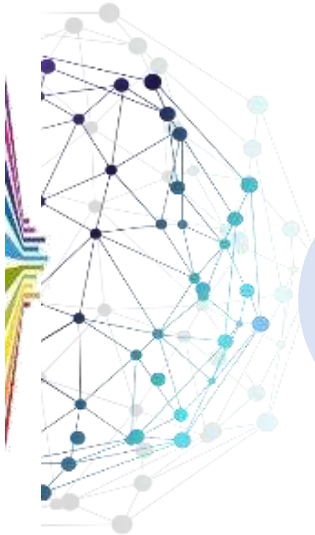
WVs/DG/UAVs

Agro-ecosystems

Landscape

Geotagging and Agrotagging
empowering field interventions

Digital augmentation for demand driven decisions for economically viable and ecologically sustainable agroecosystems



Geotag/agrotag

Multi-source data Interoperability

Algorithms Aggregate

Demand driven Analytics

Synoptic Synthesis

Precision Ag

Dissemination

Digital Extension

Resilient Agroecosystems
for sustainable future

Farming Systems Dynamics

Ecological Intensification

Crops/system Diversification

Interoperable Synergies

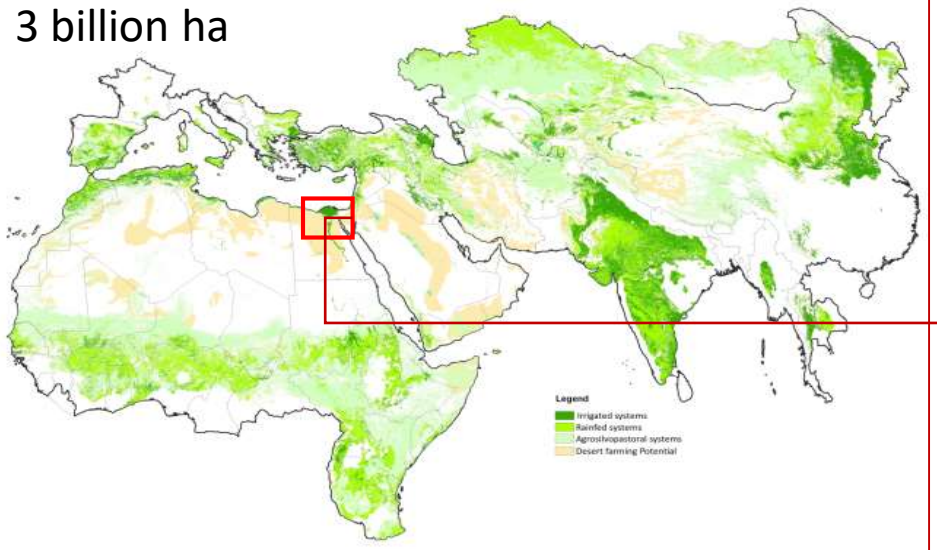
Technology Scaling and Ex-ante

Market access Rural welfare

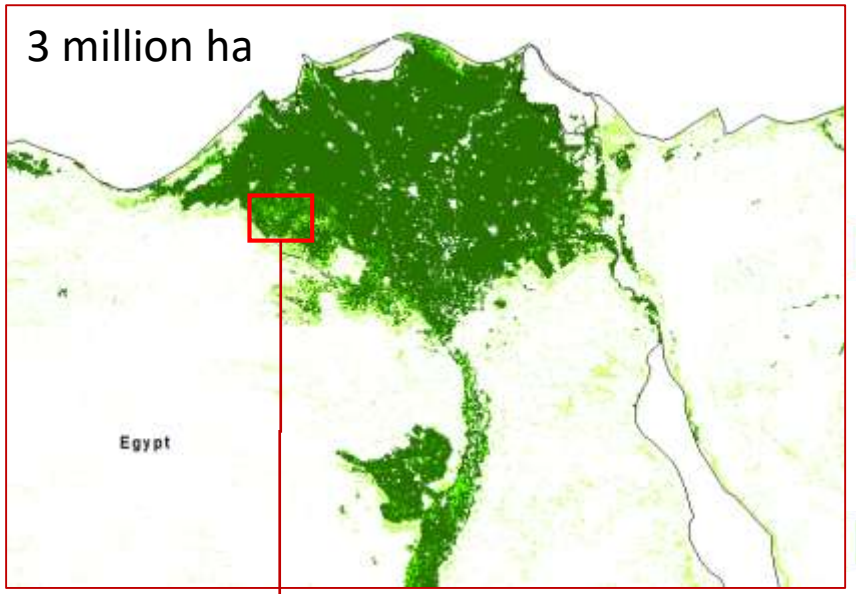
Potential Risks and shocks

A fractal approach of water-soil limited agro-ecosystems

3 billion ha



3 million ha



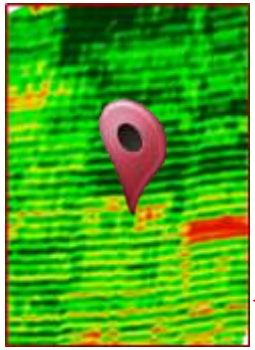
Irrigated systems

Rainfed systems

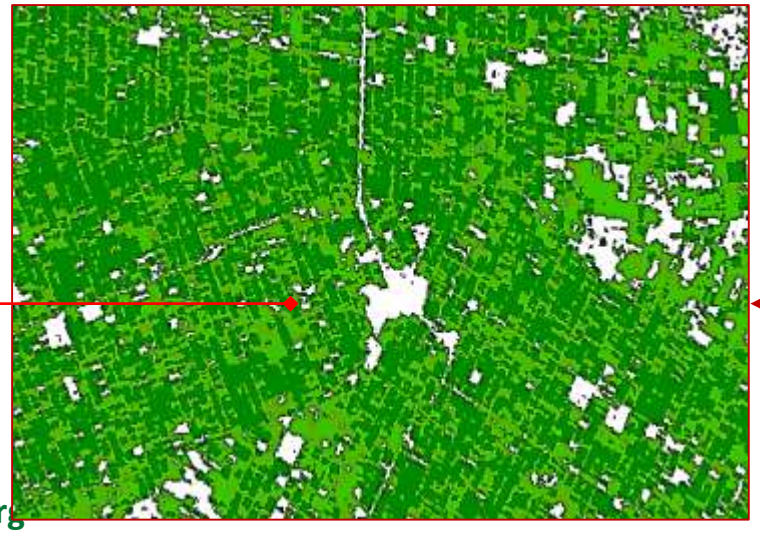
Agrosilvopastoral systems

Desert farming Potential

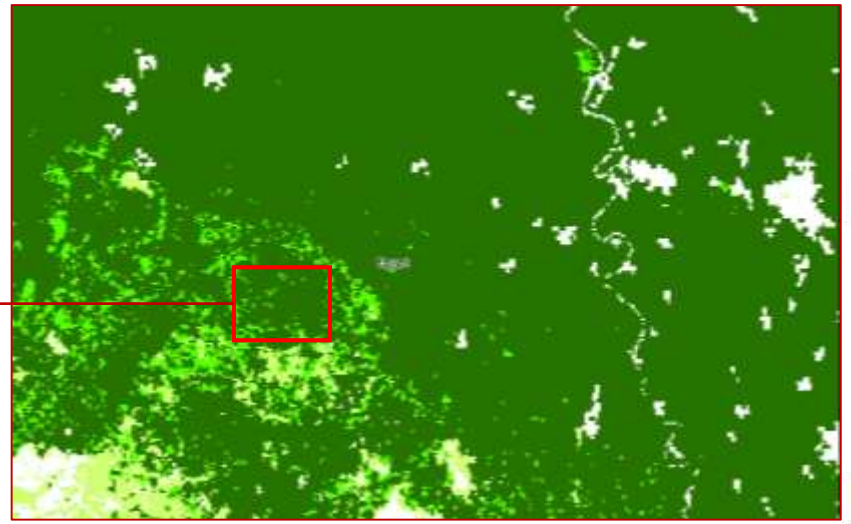
3 ha



30 k ha

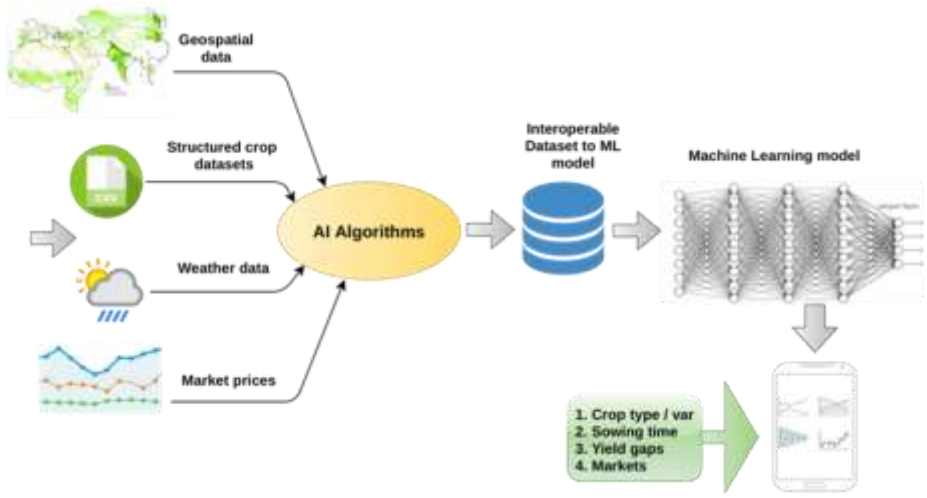


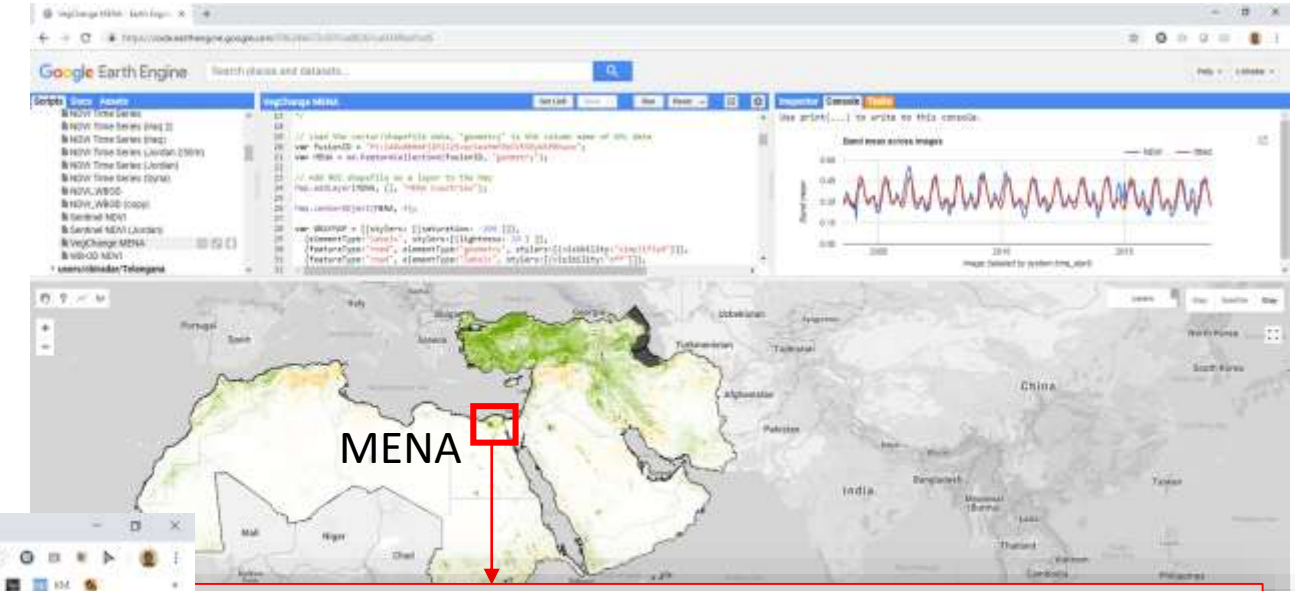
300 k ha

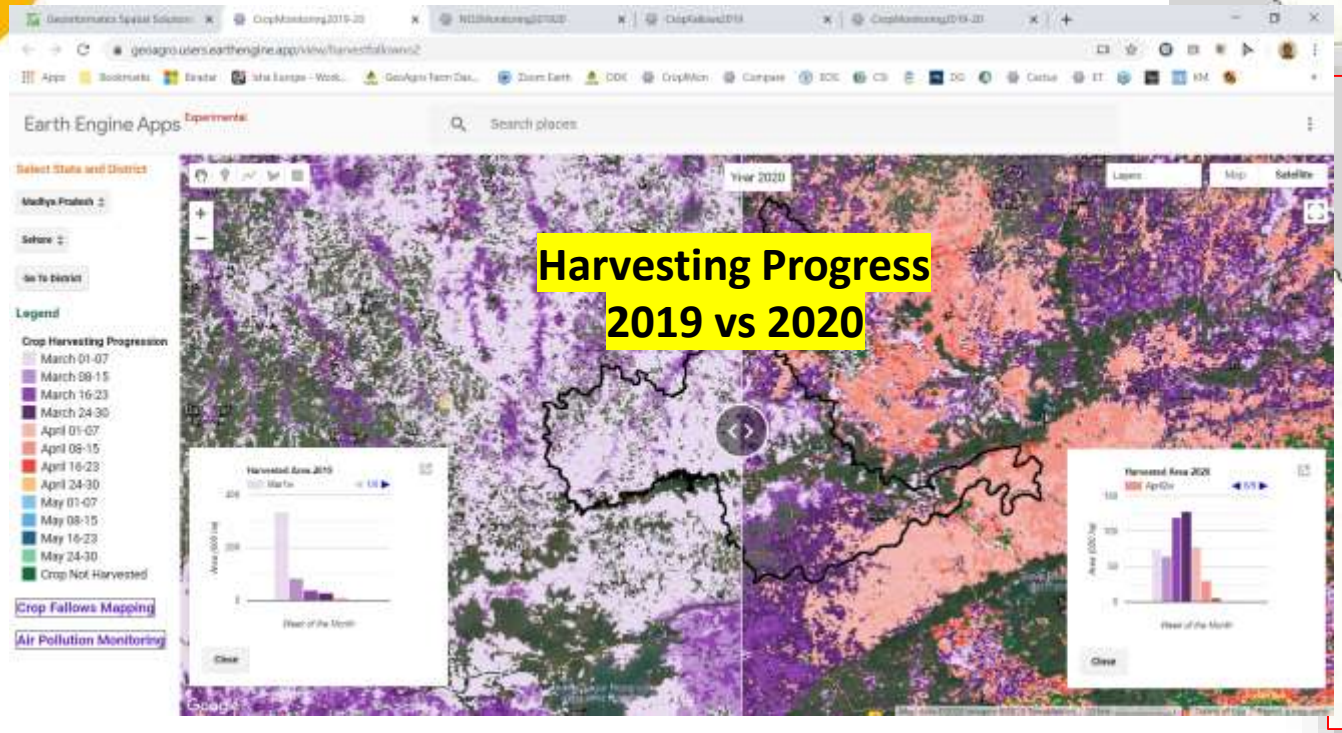


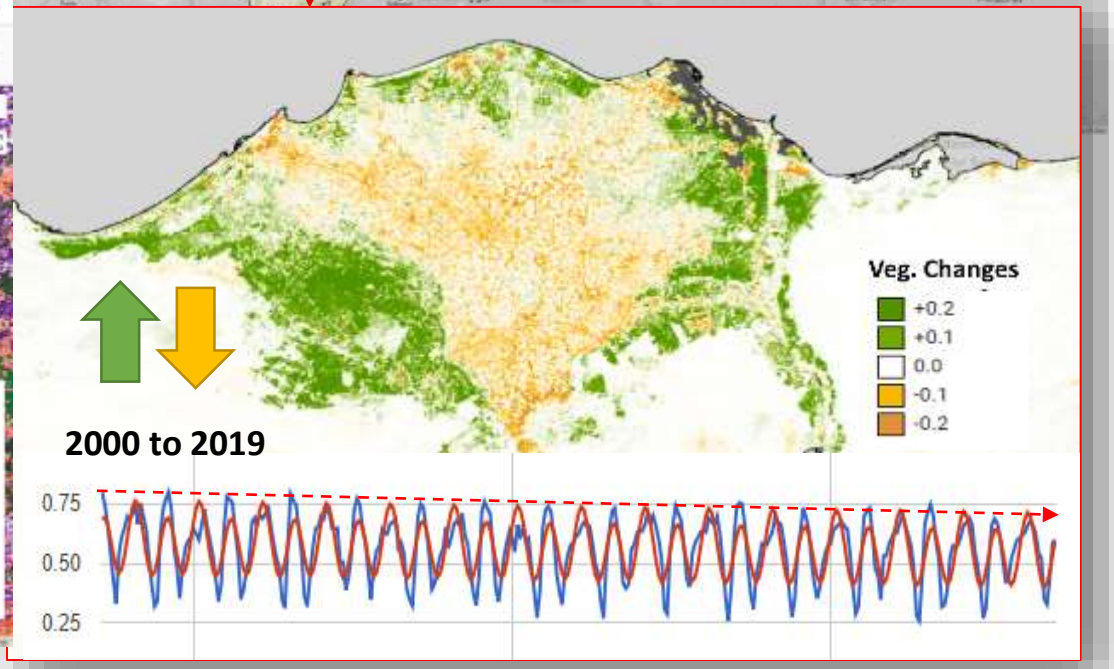
Machine Learning Intelligence & Applications (MILA)

e.g. assess cropping system dynamics









Geoinformatics Spatial Solutions | CropMonitoring2019-20 | NO2Monitoring201920 | CropFallows2019 | CropMonitoring2019-20

geoagro.users.earthengine.app/view/harvestfallowno2

Apps | Bookmarks | Biradar | GeoAgro Farm Das... | Zoom Earth | ODK | CropIMon | Compare | EOS | CSI | DG | Cactus | ET | KM | GeoAgro Mobile | RKP

Earth Engine Apps

Experimental

Search places

Select State and District

Select a State

Waiting for a State..

Go To District

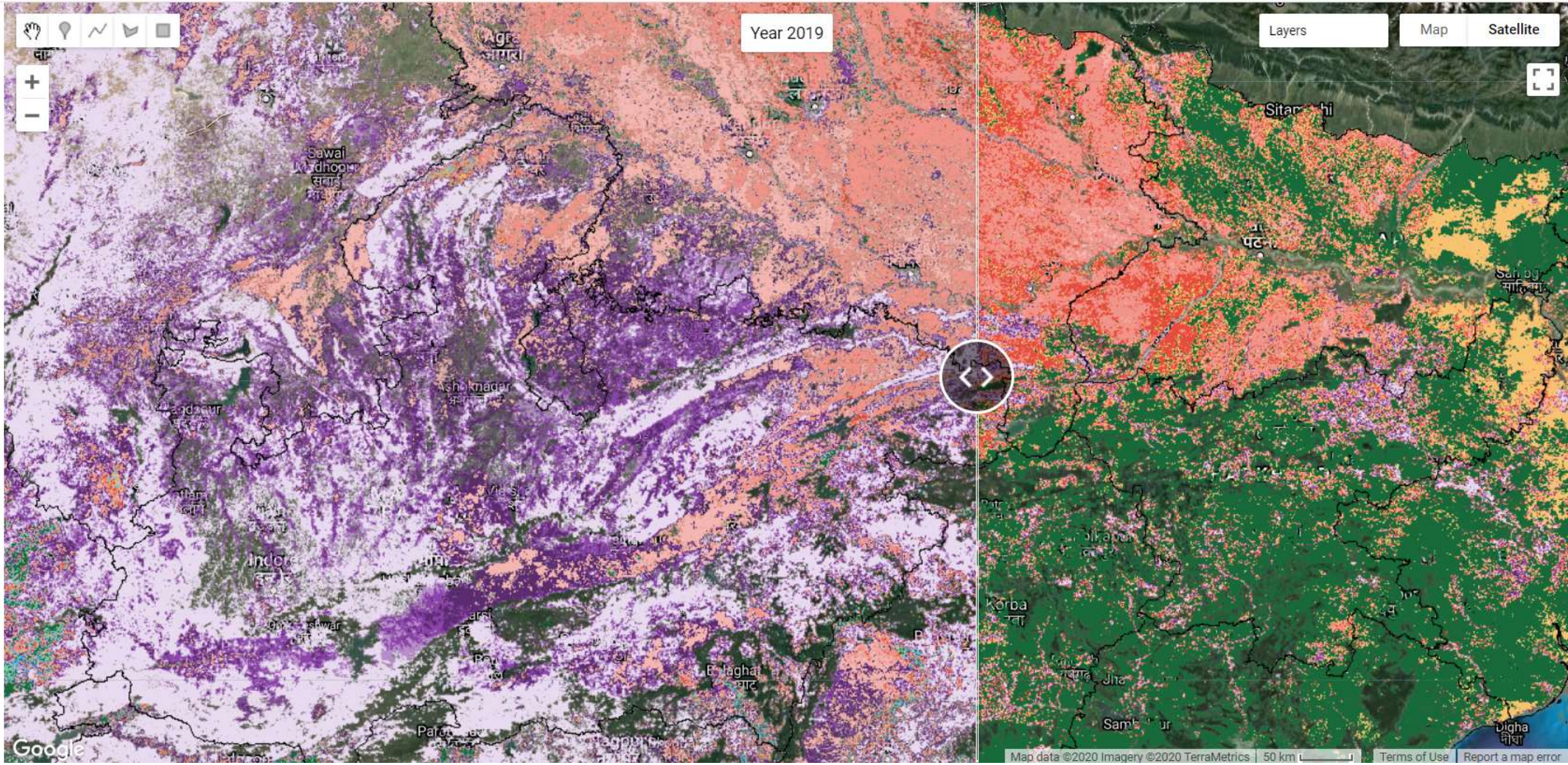
Legend

Crop Harvesting Progression

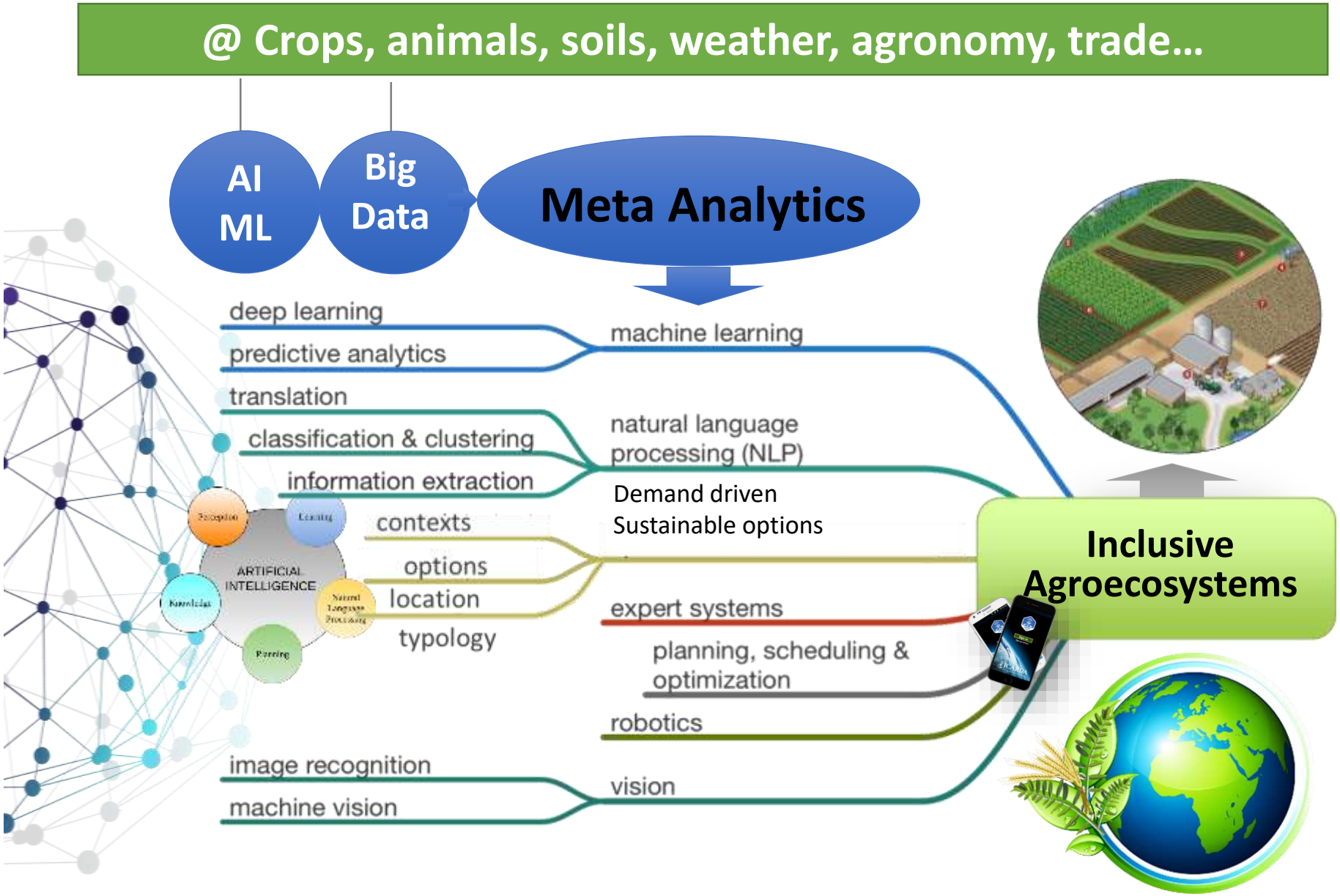
- March 01-07
- March 08-15
- March 16-23
- March 24-30
- April 01-07
- April 08-15
- April 16-23
- April 24-30
- May 01-07
- May 08-15
- May 16-23
- May 24-30
- Crop Not Harvested

Crop Fallows Mapping

Air Pollution Monitoring

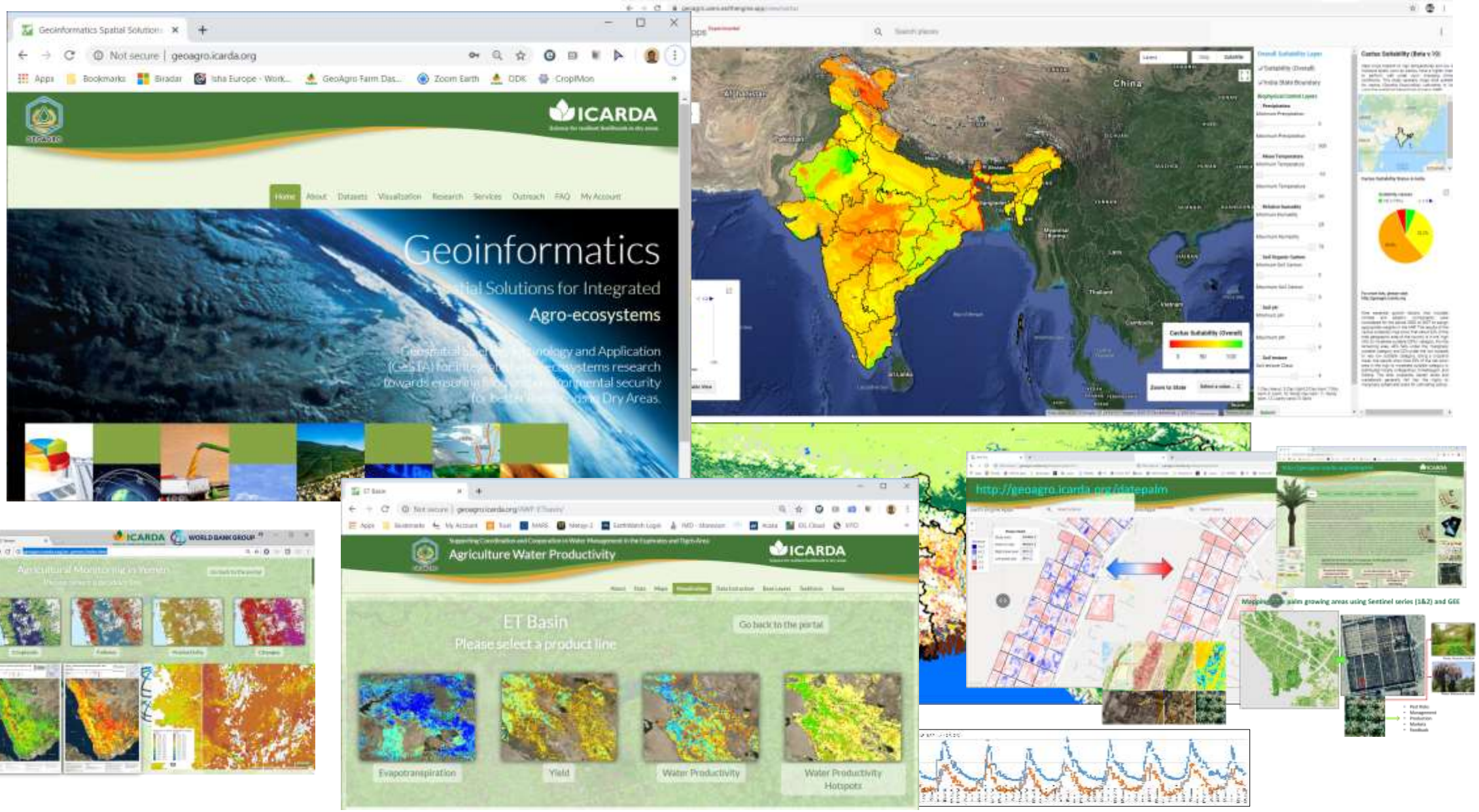


Data and Info Integration and Interoperability

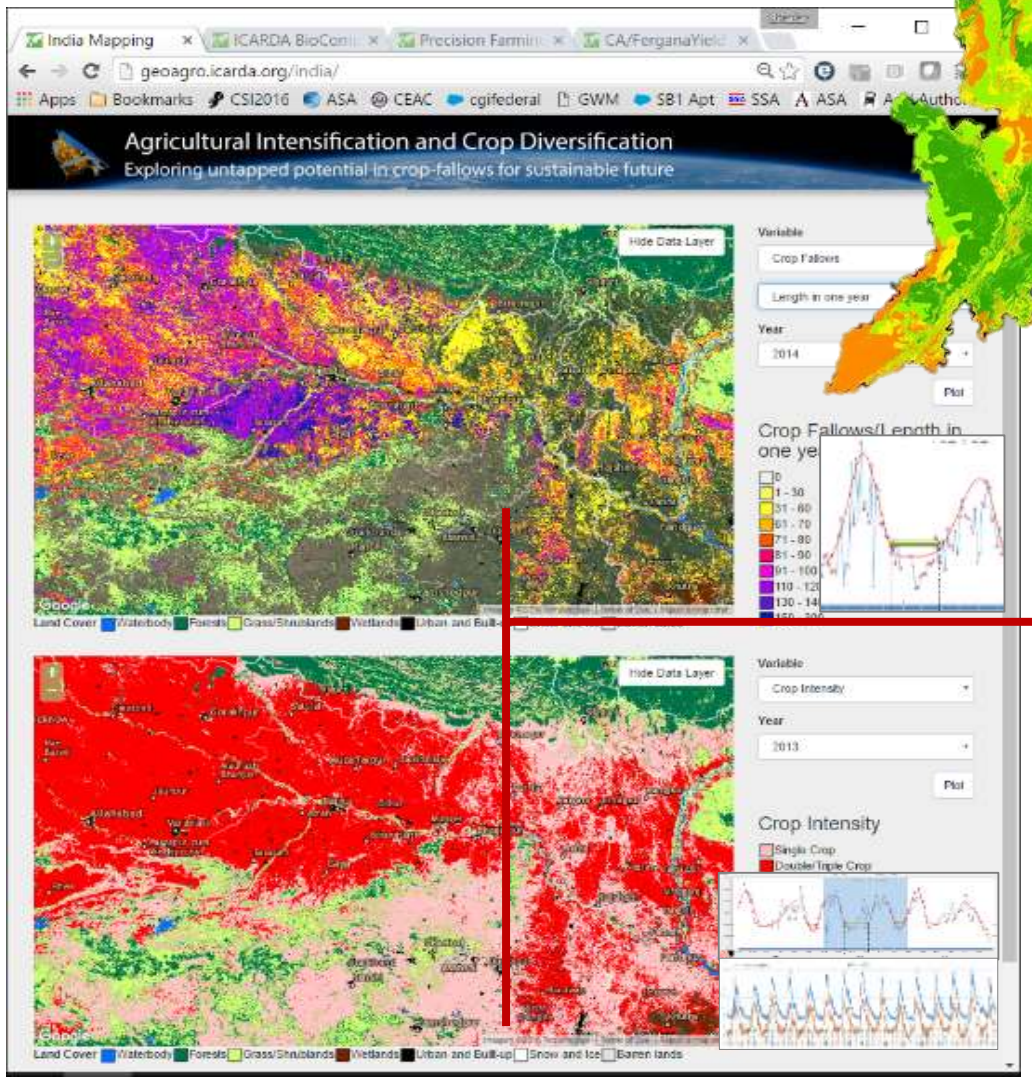


Multi-domain integrations

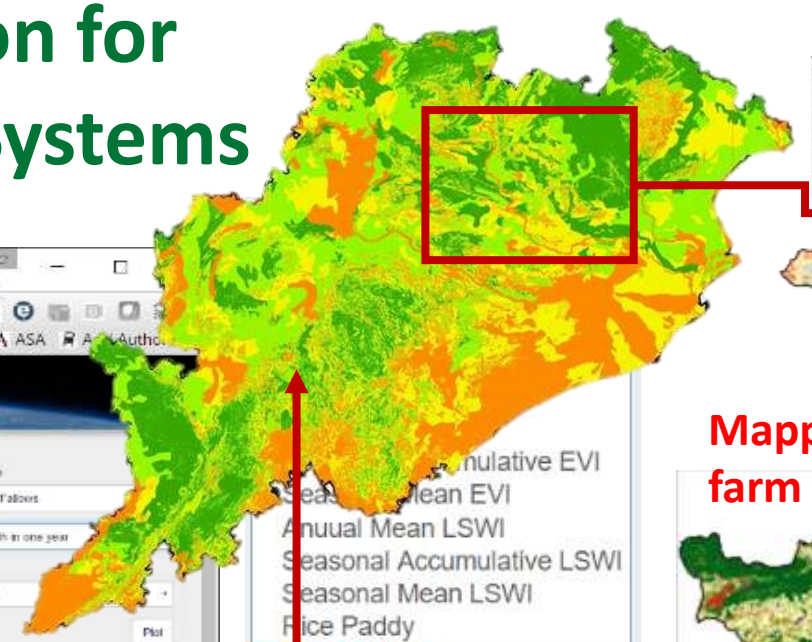
Project specific outputs and integration into interface

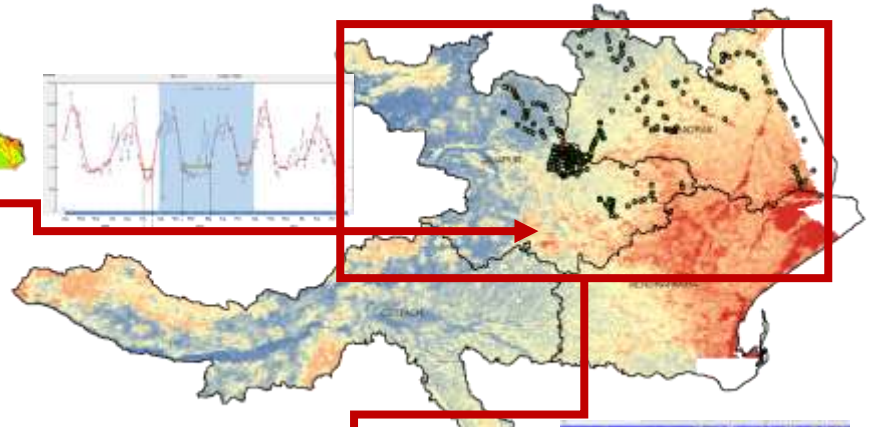


Systemic Innovation for Diversified farming Systems

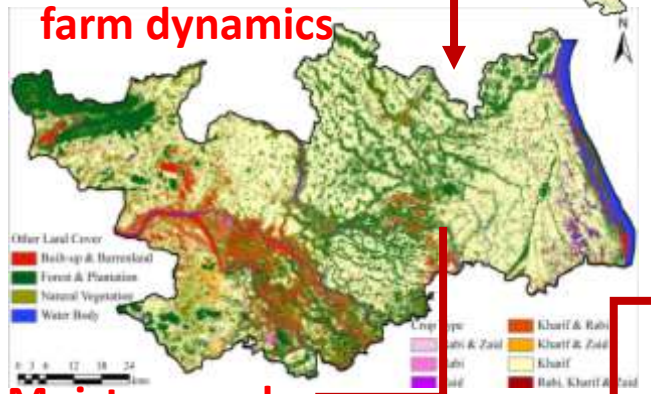


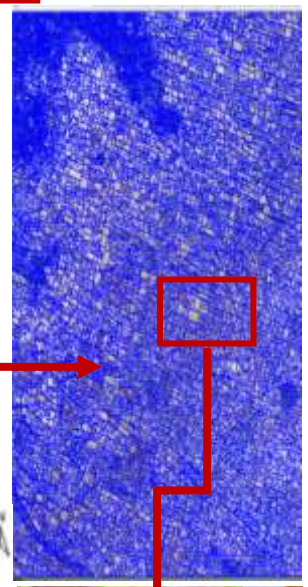
From 2000 to current (real-time mapping)



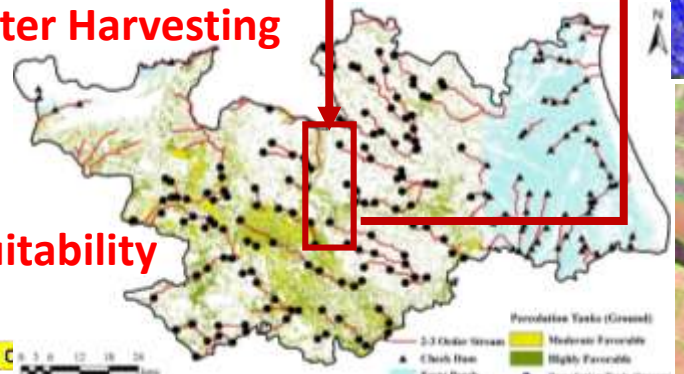


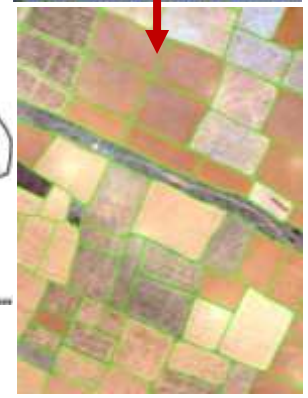
Mapping Realtime farm dynamics



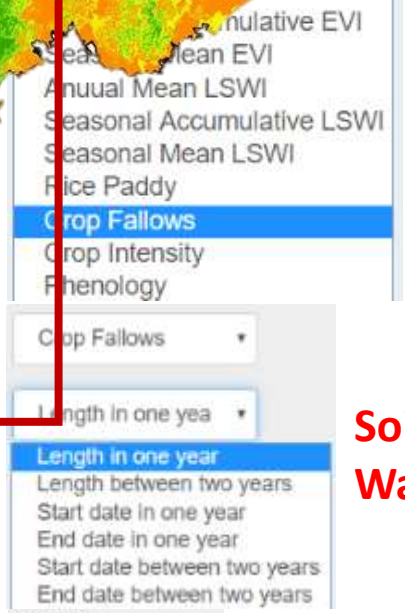


Soil Moisture and Water Harvesting

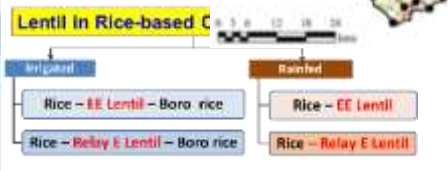




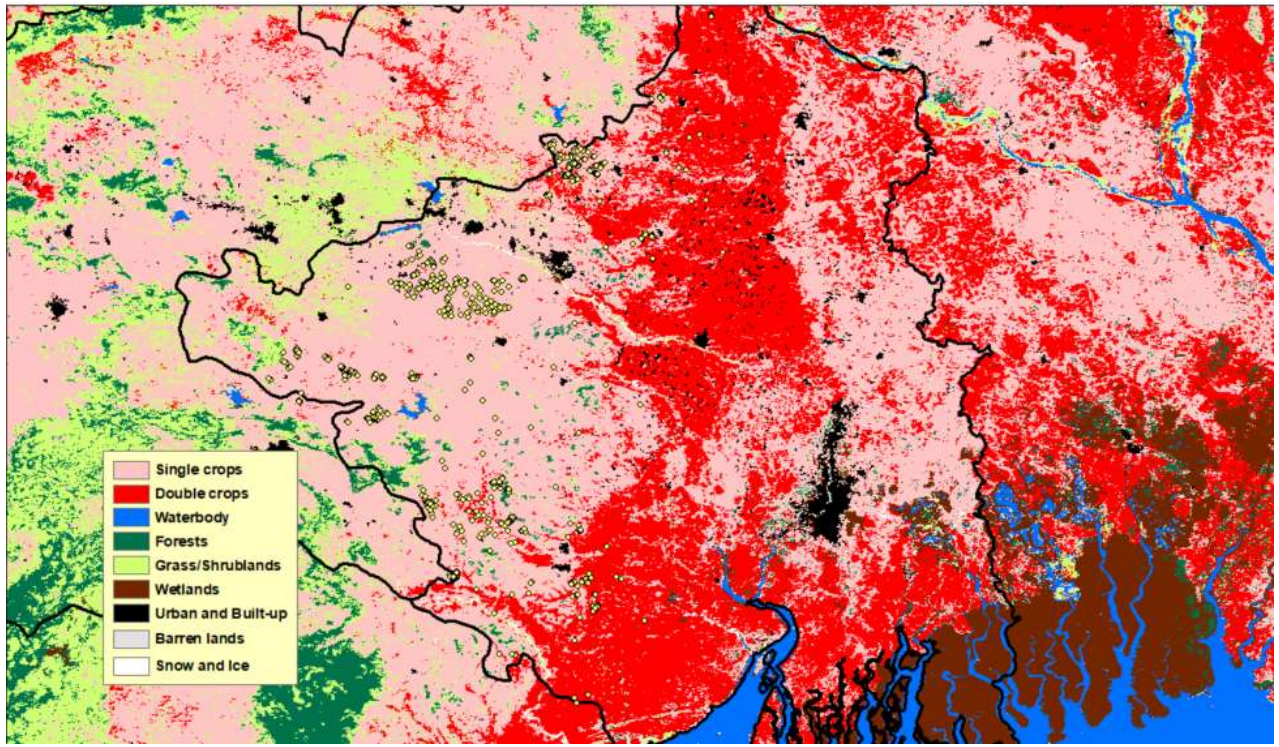
Agro-Tagging

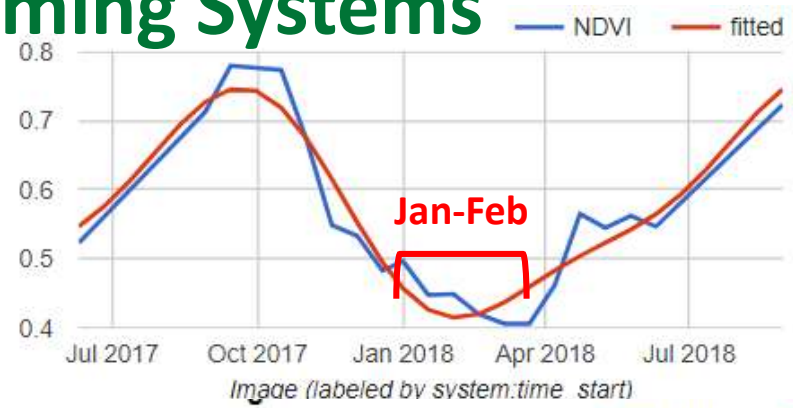


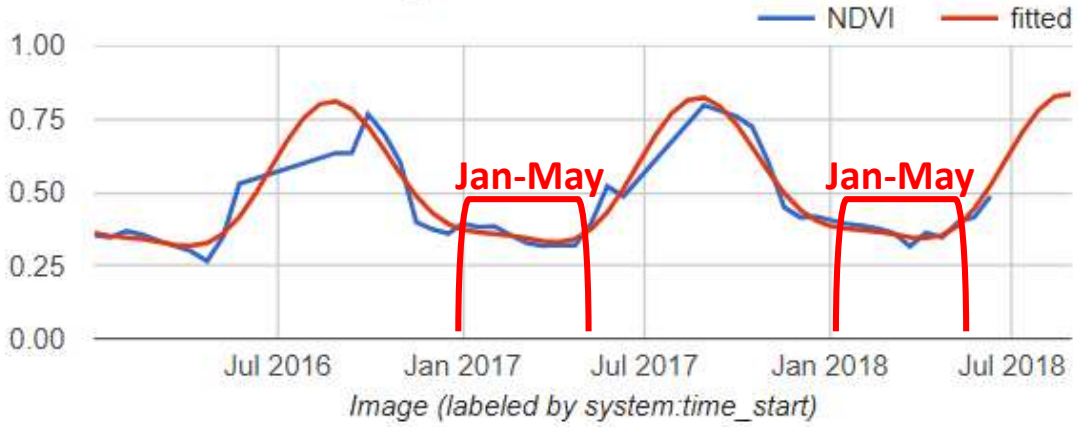
Variety Suitability

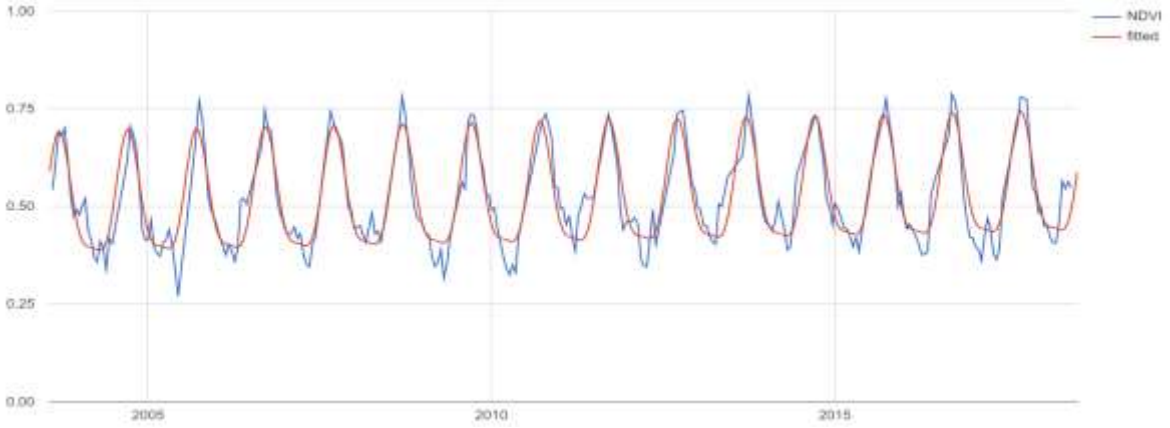


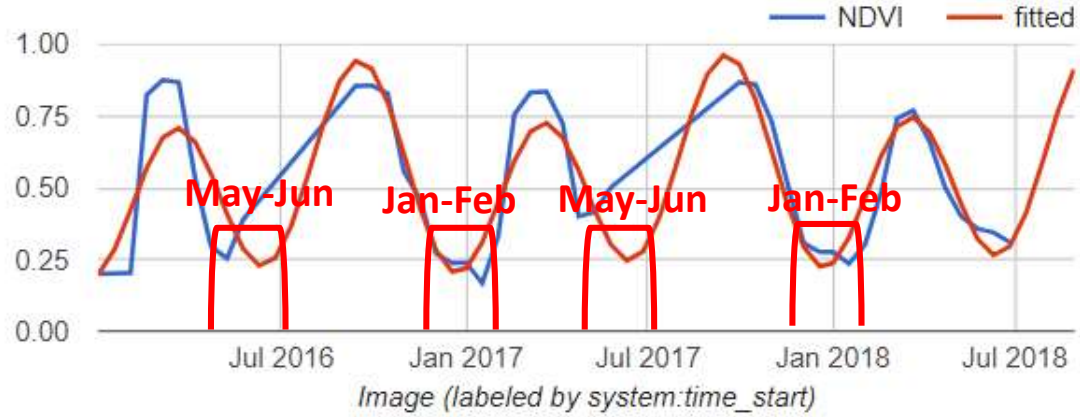
Systemic Innovation for Diversified farming Systems





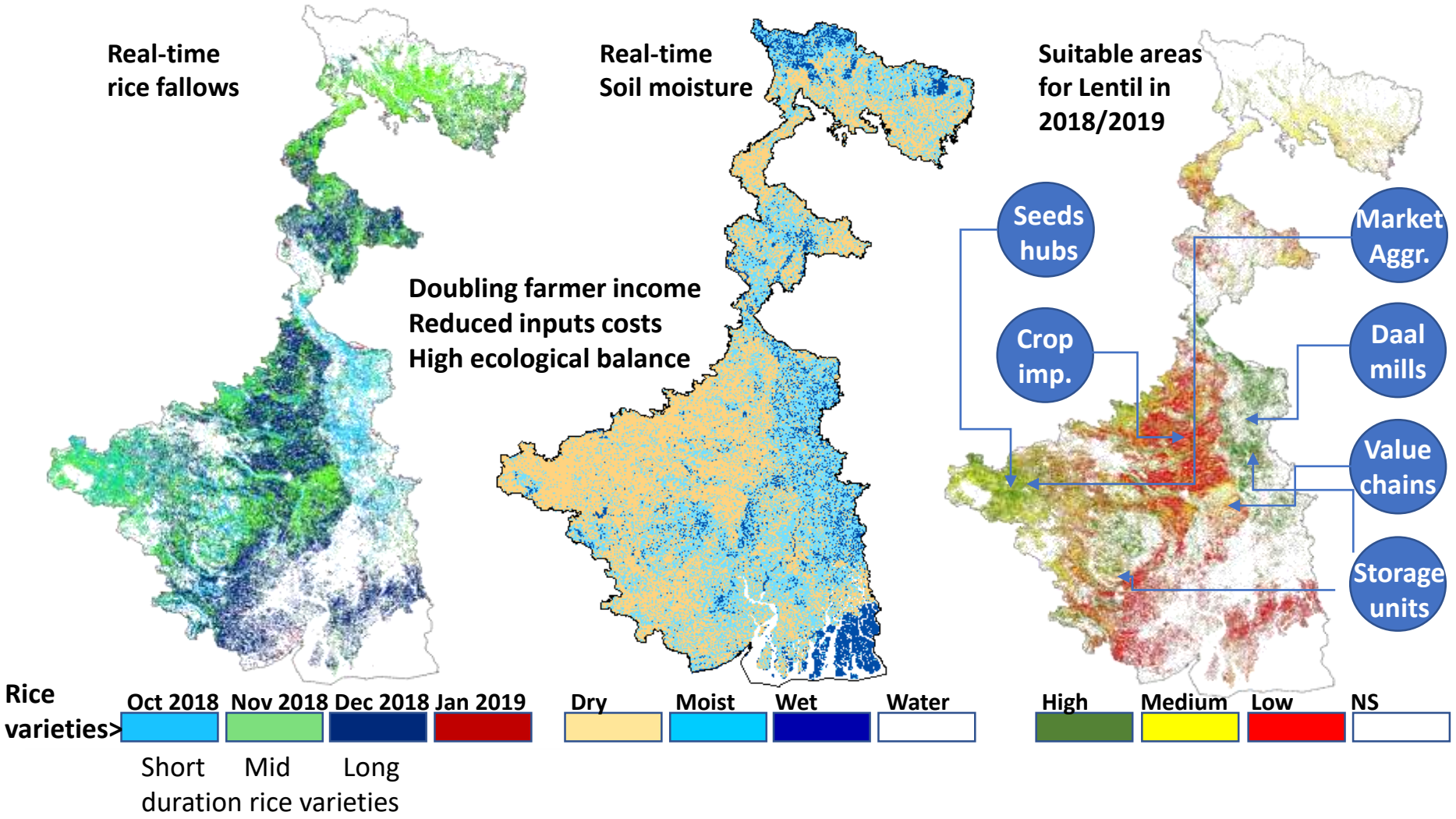






Sustainable intensification of the cereal-based systems with legumes

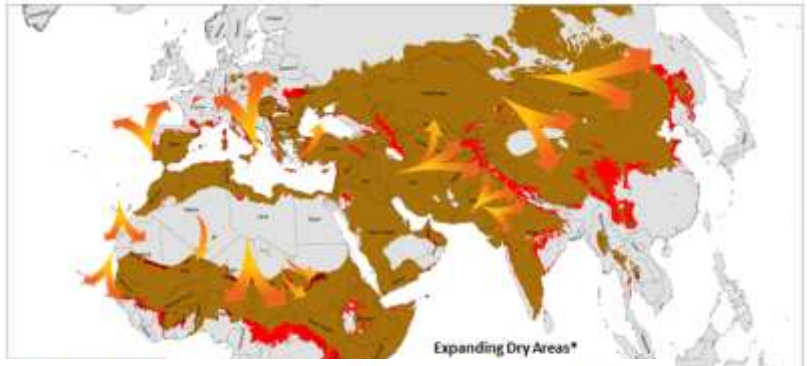
Near Real-time monitoring to target site specific interventions (package of practices)

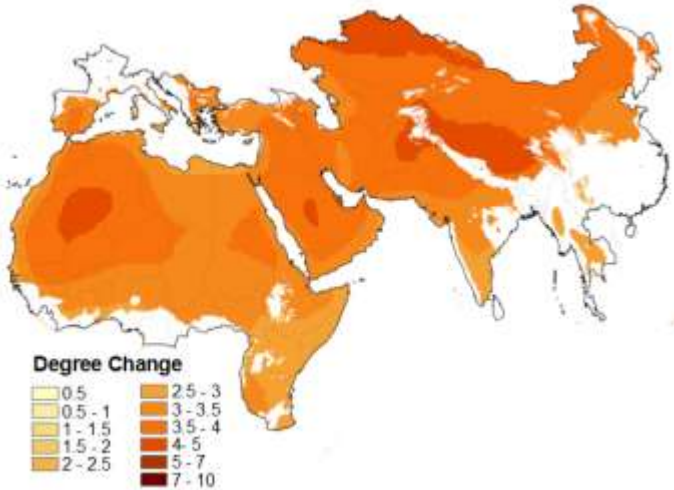


Small farms field the world: food grown in small farms are more healthy, tasty, nutritious and it helps rebuilding living soils and resilient agroecosystems

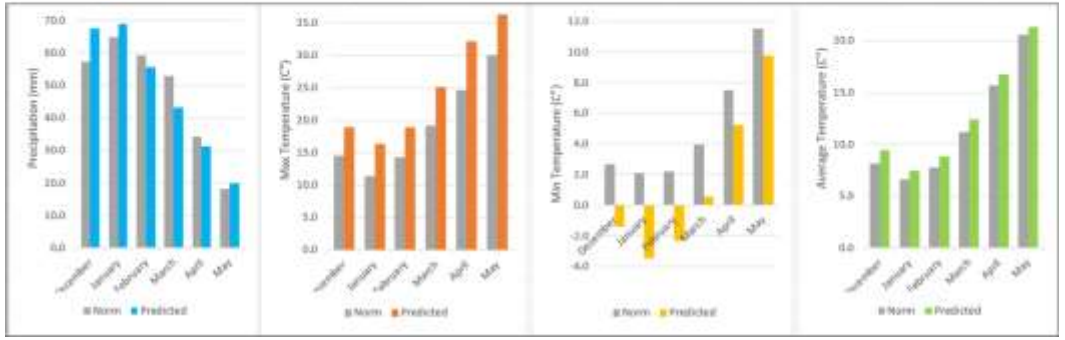
Biradar et al., 2019

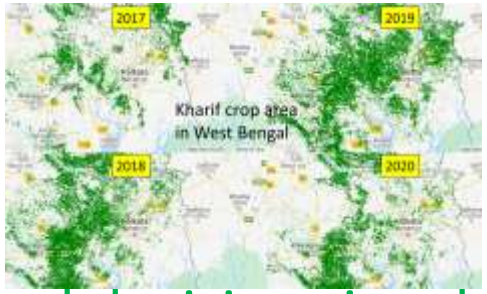
Potential risks and adaptations for current & future scenarios





Month	Sum Precipitation			Max Temperature			Min Temperature			Average Temperature		
	Norm	Pr. (>norm)	Predicted	Norm	Pr. (>norm)	Predicted	Norm	Pr. (>norm)	Predicted	Norm	Pr. (>norm)	Predicted
December	57.3	58%	67.5	14.6	100%	18.9	2.7	4%	-1.4	8.1	80%	9.5
January	64.8	50%	68.8	11.4	100%	16.3	2.1	3%	-3.5	6.6	68%	7.5
February	59.3	39%	55.7	14.2	97%	18.9	2.2	5%	-2.3	7.7	72%	8.9
March	52.8	29%	43.3	19.2	96%	25.1	4.0	16%	0.6	11.2	74%	12.4
April	34.3	36%	31.2	24.6	100%	32.2	7.5	16%	5.2	15.7	73%	16.8
May	18.1	44%	19.8	30.0	100%	36.3	11.6	14%	9.8	20.6	67%	21.3





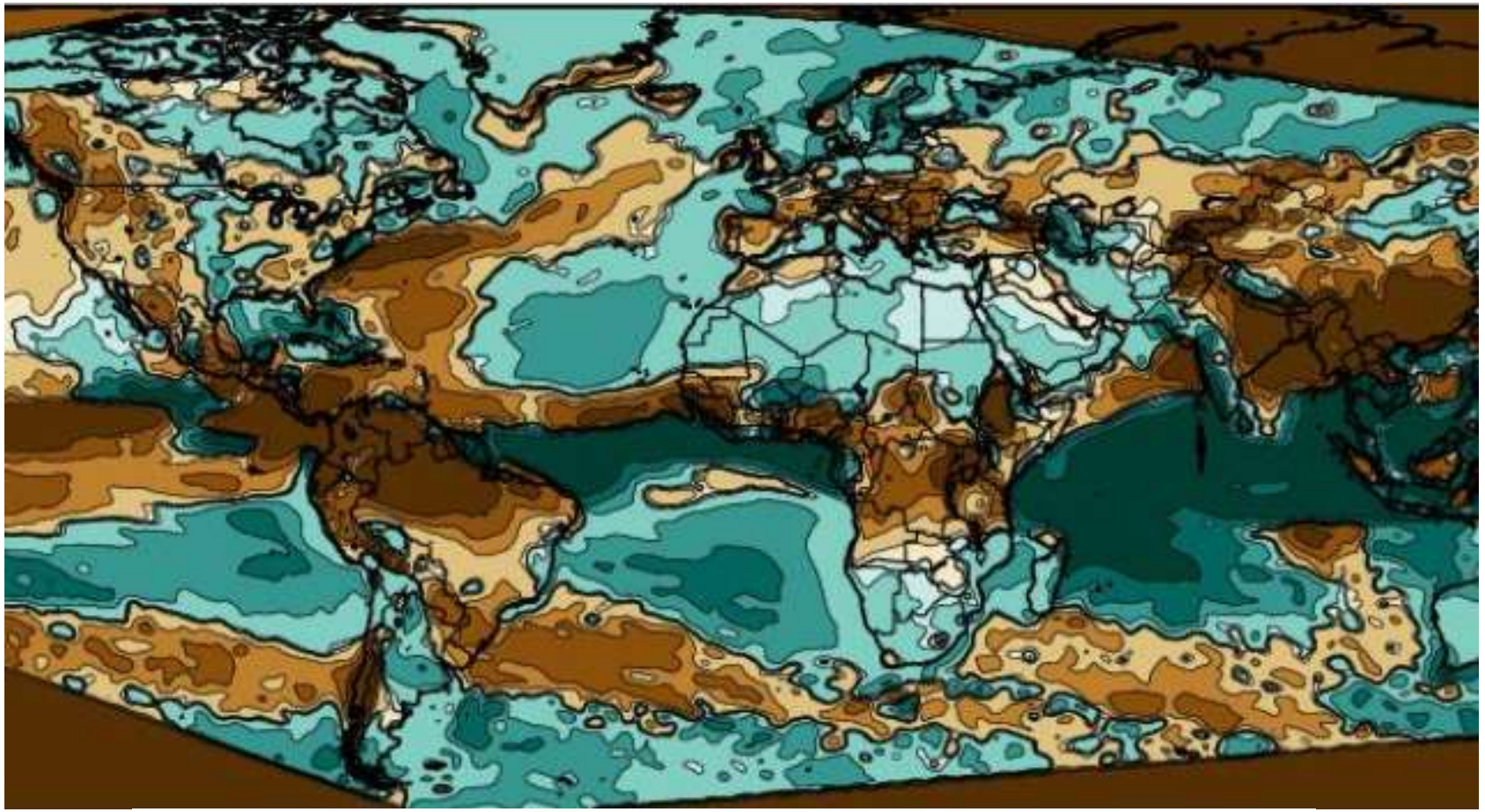
Impact on

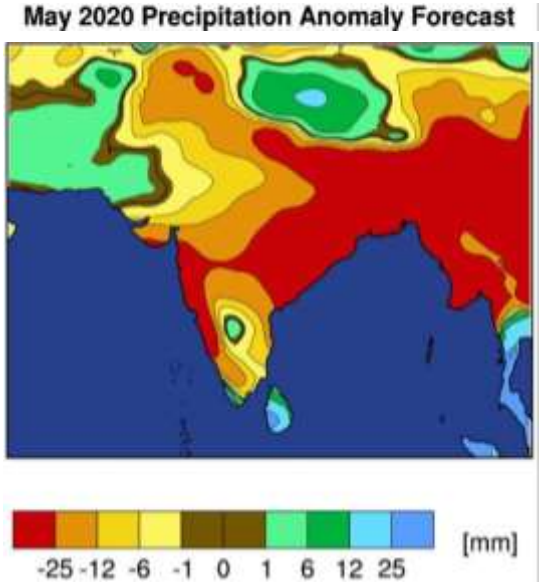
Productivity
Production
Quality
Trade

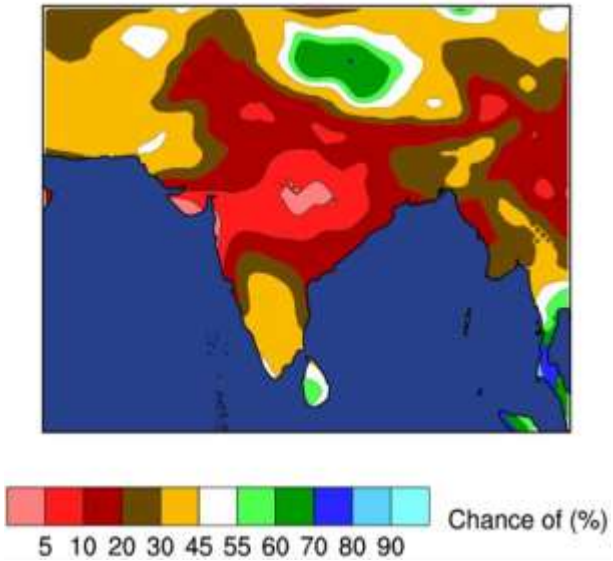
Climate change impacts and scenarios

Informed decisions in advance
Predicted risks
Early warning
Mitigation measures

Potential climate risk for current and future

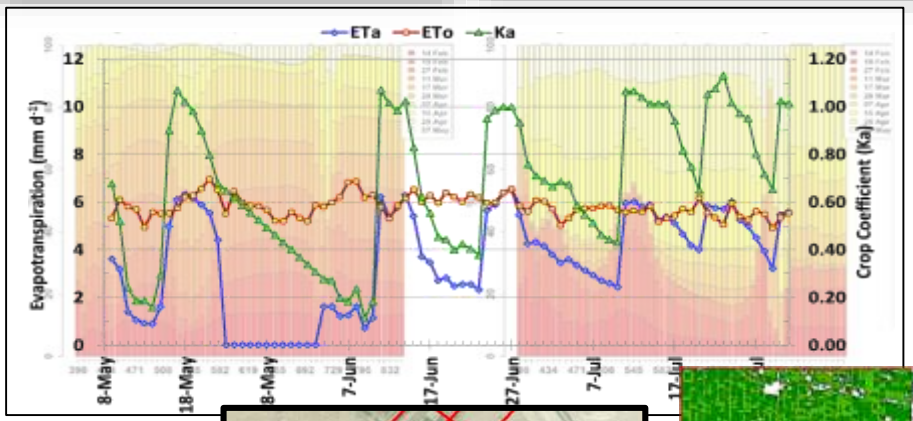


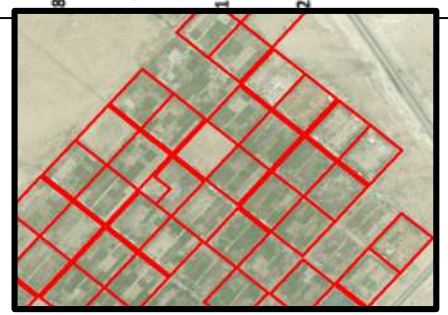


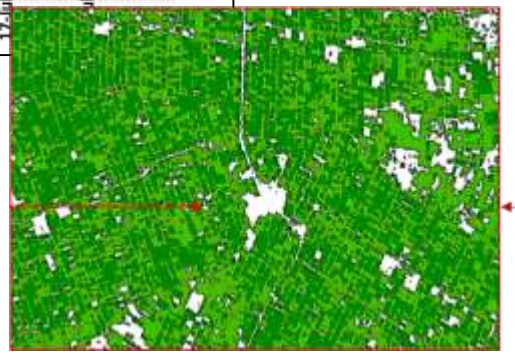


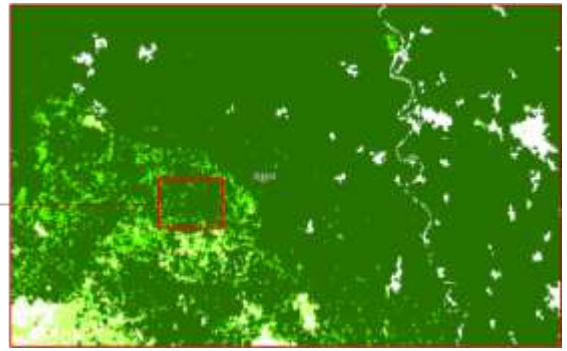
Based on IBM Forecasts under CGIAR BDP

GeoAgro based decisions and dissemination









We need Systemic Innovation for a Sustainable Transformation of Agri-food Systems

Resilience with Farm Diversity

Sustainability with Landscape management

Livelihoods with Market Linkages

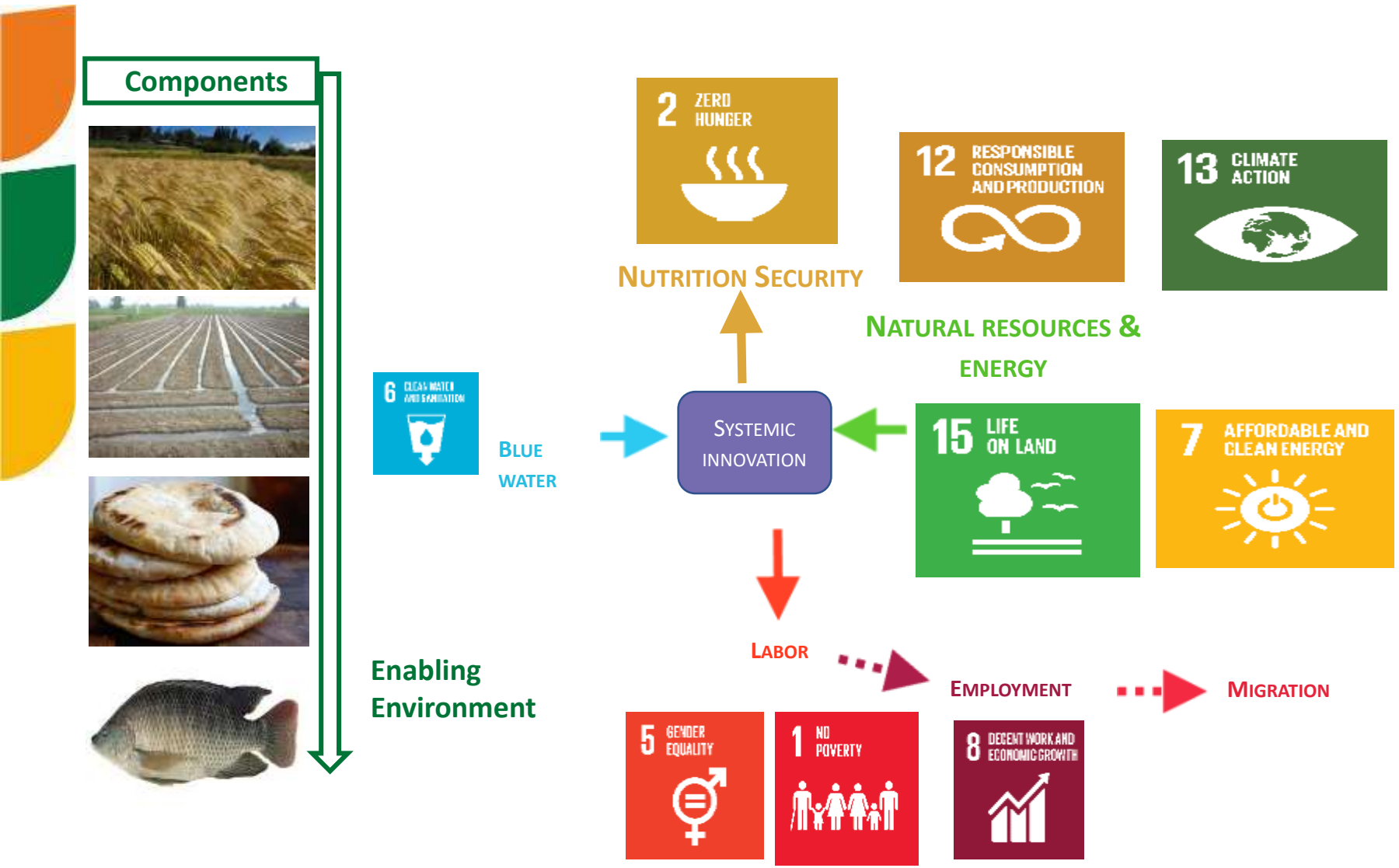
Rainfed

Irrigated

Agro-Sylvo- Pastoral

Desert Farming

Systemic Innovation for synergies among SDGs in Drylands



The DryArc's application of systemic innovation is underpinned by **five core principles**:

1. Harnessing key **interactions** rather than focusing on individual components
2. Promoting **synergies** and minimizing trade-offs for resource use efficiency
3. Effectively **scaling** innovations by considering multiple spatial and temporal scales and sectors
4. Designing plausible and comprehensive **trajectories**
5. The enabling potential for uptake of innovations and impact lies in the **socio-economic** domain

MODULES for potential collaboration

SHARE

- Acts as a **global and open access repository** using the FAIR principles to describe and enable searching into **ready-to-scale technologies** (crops, livestock, fish, soil, water, energy, food processing, ICT etc.) adapted to irrigated, rainfed, agro-pastoral or desert farming systems which have been developed over the past 40 years by the **public and private sector.**
- It also supports **benchmarking** analysis and ex-ante impact assessment of technologies that are under development for the drylands by public and private sectors.

COMBINE

- Builds on the knowledge base of the SHARE module to **design systemic innovations** adapted to a specific scale (from farm to country) and in specific enabling environments (community, policy, market).
- By integrated modelling, trade-off analyses and ex-ante impact assessments, these technologies - normally initially developed for application one by one - are integrated, co-designed and transformed into a set of systemic innovation options adapted to specific contexts targeting a set of SDGs.
- Involves on-farm experiments and prototyping approaches with stakeholders for the most complex combinations when there is a lack of data and models on key interactions.

ACCELERATE

- Supports **community-based projects** to accelerate scaling of the systemic innovation options in regions and farming systems were the socio-economic (including gender) and policy contexts are conducive and can rapidly transform the agri-food systems to achieve a targeted set of SDGs.

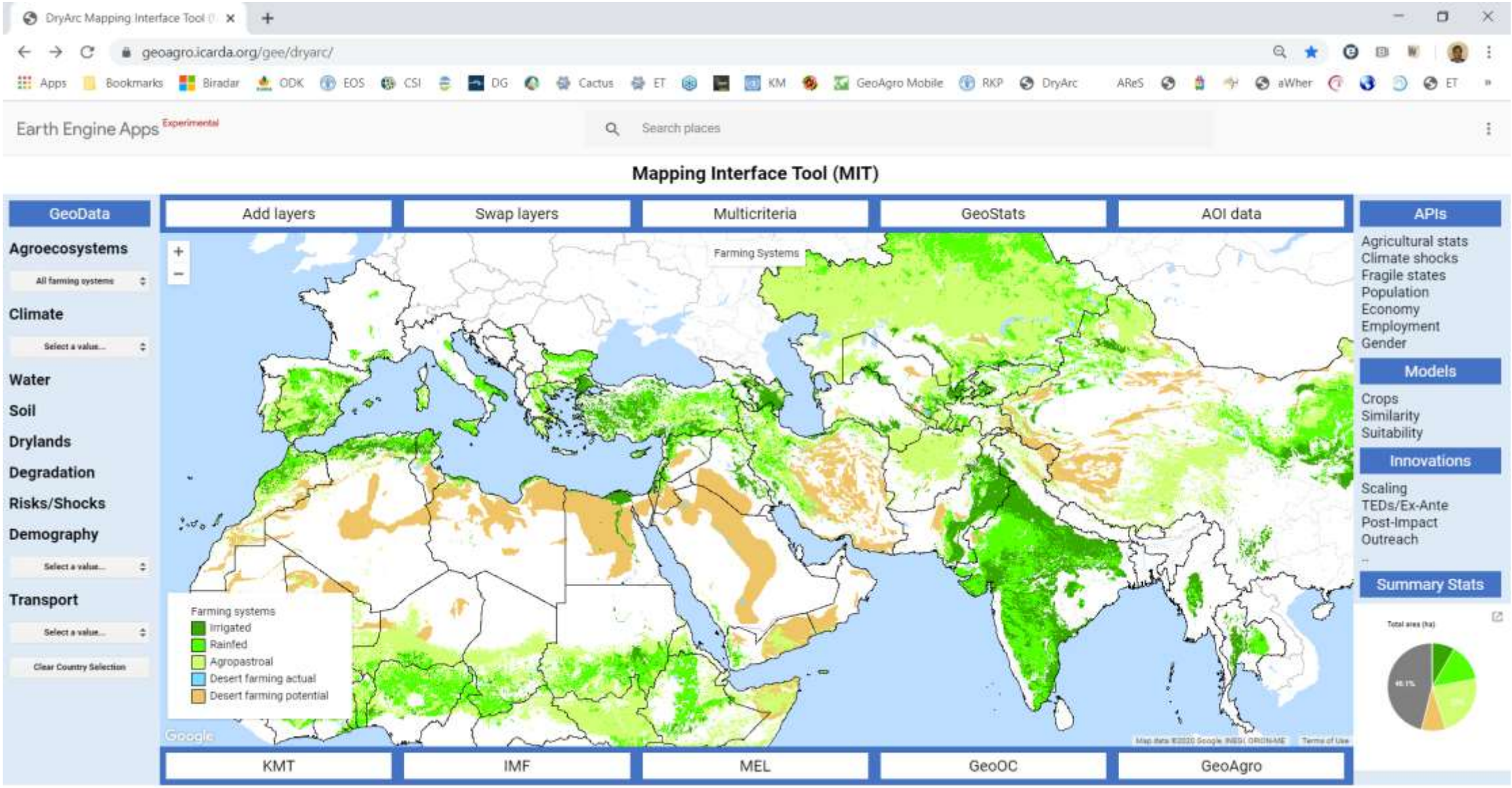
INTEGRATE

- Allows **component-based research** (e.g. plant breeding, development of innovative soil, water and energy technologies) to be integrated at an early stage (from product profile definition) in the missing components of the SHARE module for systemic innovation in the drylands.

ENABLE

- Support **capacity development, policy design and cost-benefit analysis** in order to create the enabling environment for agri-food systems transformation by the ACCELERATE module.
- Foster **knowledge exchange** across scales, sectors and stakeholder groups to develop capacities to put in place the policies, institutions and services to bring systemic innovation to scale for impact and sustainable intensification of the key agri-food systems across the DryArc region.
- Encourages increased and improved **(evidence-based) investments** by the public and private sectors including governments, development and financial institutions, companies (local, national and international) and farming communities.
- Supports foresight analysis of the **DryArc Hotspots** where conditions of the “Perfect Storm” are met as well as ex ante impact assessments in these regions.
- Supports a **DryArc Academy** to develop capacities on systems analysis and innovation process in research, extension, public and private services.

The DryArc Interface for Digital Augmentation of Dryland Agriculture: provide services to stakeholders, countries and researchers to implement projects with the DryArc modules



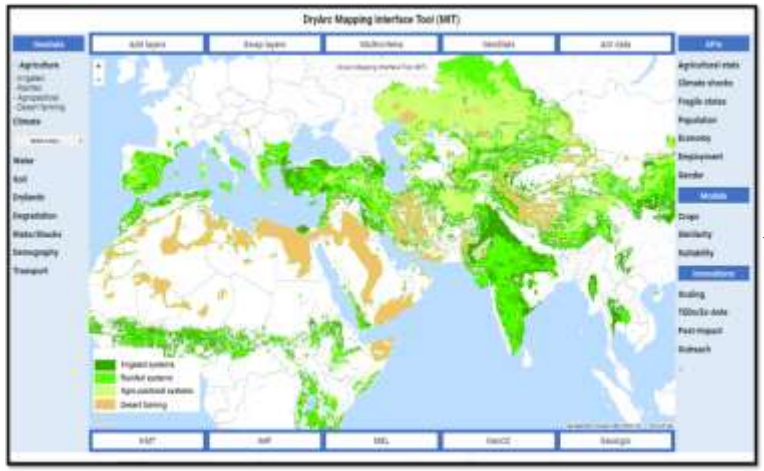
AOI-Area of Interest; APIs- Application Program interface; KMT-Knowledge Management Tools; IMF- Integrated Modelling Framework; MEL- Monitoring and Evaluation Platforms; GeoOC-Geoinformatics Option and Context; GeoAgro- Geoinformatics for Sustainable Agroecosystems; TEDs- Technology Extrapolation Domains;

Examples of Potential collaboration between DryArc and FAO on Dryland Agri-food systems

1. Functional domains
2. Integration domains
3. Modular domains
4. Service domains

(1) Tools, Databases, Services

DryArc Interface



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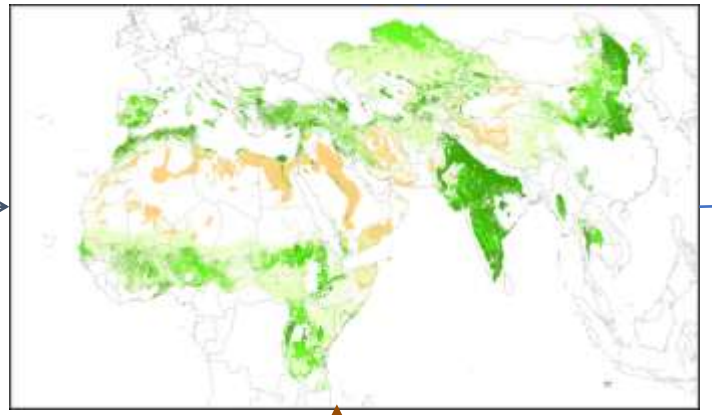
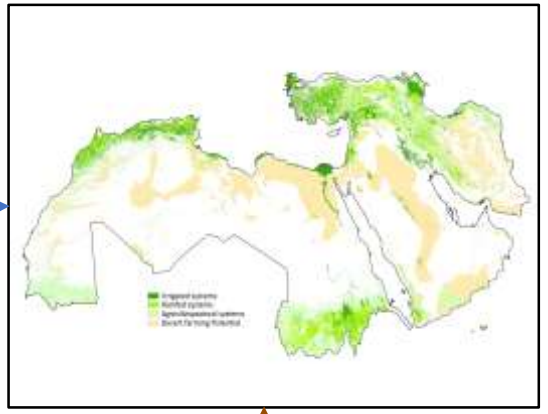
(2) R4D and D Projects

Global Drylands



Hand-in-Hand Initiative

NENA Region



Water Scarcity Initiative

MENA ET-Network

Thank You

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