Building resilient agri-food system for sustainable future

AI & IoT for Inclusive Agro-Ecosystems for Sustainable Development

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Geospatial Opportunities in Inclusive Agro-ecosystems for Sustainable Foods and Future
Sustainable Food and Future

Increased land, water and system productivity while safe guarding the environmental flows and ecosystem services

- more **crop** per **drop** - water focus
- in a **inch of land** and a **bunch of crop** - multi dimensions - integrated systems

Knowledge based prioritization (space & time) for better strategy for investment, intervention, implementation and impact

Ecological intensification
Target specific interventions
Bridging the gaps
Inputs use efficiency
Agricultural policy
Halt degradation
Technology scaling

- food and nutritional security
- resilience and risk reduction
- agro-ecosystem sustainability
- adaption and mitigation
- citizen science and collective actions
- trade, social security and stability
Earth Observation Systems for Agro-Ecosystem Research

ACTIVE SATELLITE SENSORS AND CHARACTERISTICS

Very High Resolution (Up to 1 m)

High Resolution (1 to 5 m)

Medium resolution (5 - 30 m)

Active Satellites

Satellites in Orbit

1738

2271

ICARDA
Science for better livelihoods in dry areas

* Resolution in parentheses is panchromatic
- Bands: B - Blue, G - Green, R - Red, IR - Infrared, C - Coastal blue, Y - Yellow, SW - Shortwave Infrared, M - Mid Infrared, P - Panchromatic, H - Horizontal, V - Vertical
Mutation induced variability in *Medicago*

Phenotypic/genotypic segregation in *Medicago*

HyperSpectral signature of 20 Wheat varieties

Advanced Sensors and Tools

Portable spectral devices

(Biradar et al., 2012)
Interoperability of Data for Better Decisions

AI @ genetics, chemistry, weather, agronomies, trade...

AI

IoT

Meta Analytics

deep learning
predictive analytics
translation
classification & clustering
information extraction

machine learning
natural language processing (NLP)

Demand driven
Better options

contexts
options
location
typology

Demand driven
Better options

expert systems
planning, scheduling & optimization
robotics
vision

Inclusive Agroecosystems
Big-data, Machine Learning and AI algorithms

1. Crop type/var
2. Sowing time
3. Yield gaps
4. Markets
Dynamics of Cropping Systems

- Integrated Agro-Ecosystems
- Sustainable Intensification and Diversification
- Input Use Efficiency - Conservation Agriculture
- Thematic Land-Water

Agricultural Intensification

Increase in Arable Land

Double crops
Triple crops
Population Density

Biradar and Xiao, 2009

Length of the crop fallows, start-date, end-date

Biradar et al., 2015

Biradar and Xiao, 2009
Quantification of Farming Systems @ multiple-scales

Digital Ag Platform
Digital revolution in Sustainable Intensification

On the fly demand driven query and cluster analysis

Cadastral, Object & Pixel based
Biophysical and socio-ecological
Machine Learning
Crop types, crop intensity, rotation, fallows, crop stress, AET-l8, soil moisture-SMAP
Citizen-Science
Smart Extension feedback
Direct Access and Markets/Business
Precision-Decision

Location Specific Interventions

Crowdsouce, OA, Cloud Computing at Farm Scale

Smart Extension/Citizen Science
Community of Practices

Multi-Scale EOS

Right Time Right Place

Farming Stakeholders

AI
ML
NN
GeoAgro App: Citizen Science Field Data Collection, Data Management, Precision Agriculture App for Tablets and Smart Phones

In Beta Testing

- Citizen Science
- Crop Type
- Crop Suitability
- Yield Forecasting
- Pest Risk
- Real-time Advisory
- Field Data
- Yield Gaps
- Droughts/floods
- Crop Stress
- Water use
- Real-time AET
in an inch of land and bunch of crop

Where much gain is expected?
Is that from genetic? 15-20
Is that from management? 50-60
Is that from socio-economy? 20-35

avoid the unmanageable and manage the unavoidable

Thank You

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