ICRISAT
INTERNATIONAL CROPS RESEARCH INSTITUTE FOR THE SEMI-ARID TROPICS

50 ICRISAT 1972-2022

International Crops Research Institute for the Semi-Arid Tropics: Five Decades of Excellence

Sreenath Dixit
Principal Scientist & Strategic Advisor

ICRISAT

A pioneering, international scientific agricultural research for development organization specializing in improving dryland farming and agri-food systems

- Deep understanding of issues and challenges of the drylands
- Focus on the most resilient, climate smart and nutritious legumes and cereal crops critical to the drylands
- Value web / value chain approach
- Strong focus on delivery and innovations at scale

Vision: A prosperous, food-secure, and resilient dryland tropics

Mission: Reduce poverty, hunger, malnutrition, and environmental degradation in the dryland tropics

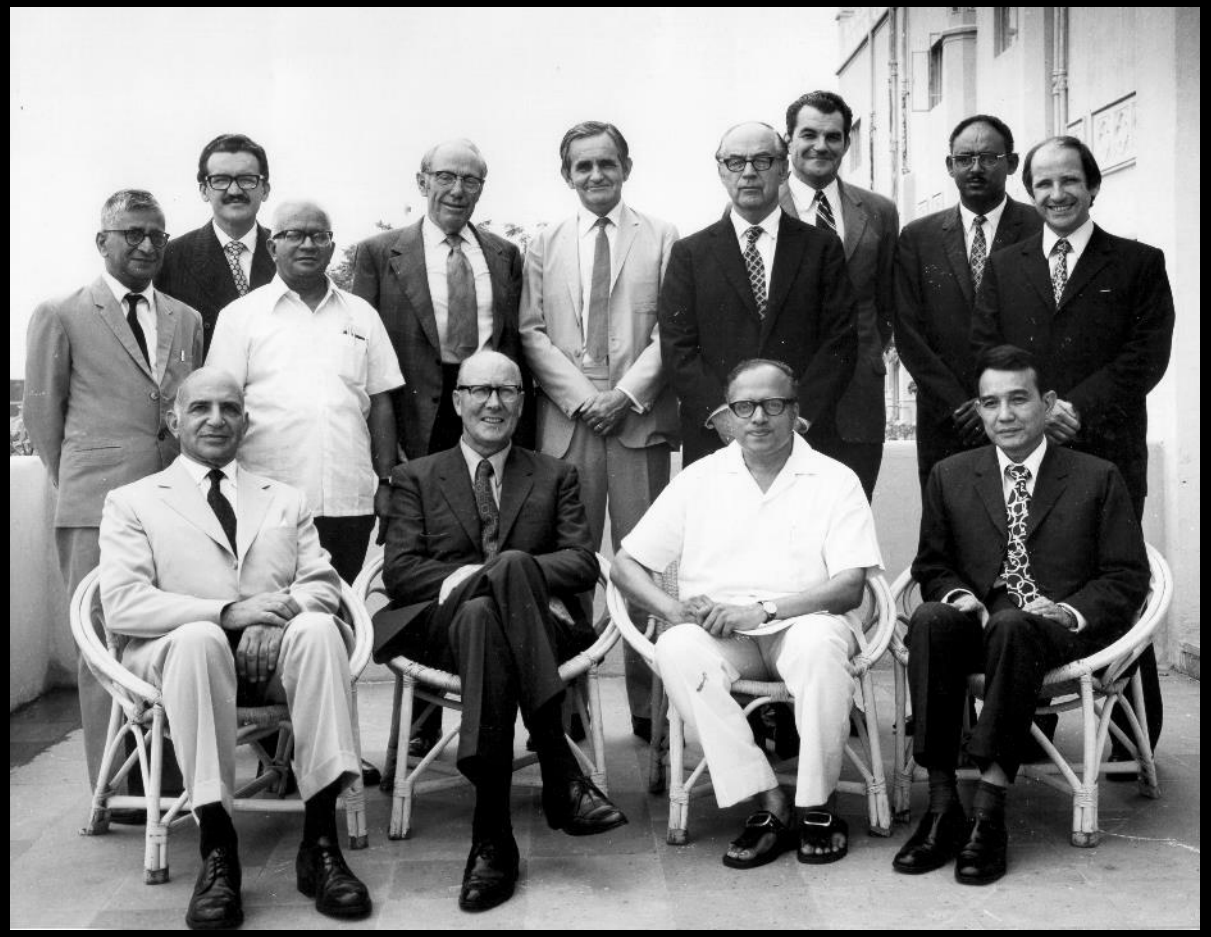
ICRISAT's global locations

1972 - ICRISAT is born

- Over five decades of partnership with the Indian Government begins.
- ICRISAT is the only International Agricultural Research Center (IARC) with headquarters in India.

One of my first tasks after joining as the Director General of the Indian Council of Agricultural Research (ICAR) in January 1972 was to work with Dr Ralph Cummings in developing a Memorandum of Agreement with the Government of India concerning the establishment of ICRISAT

Dr MS Swaminathan
World Food Prize laureate, architect of India's Green Revolution and founding member of ICRISAT



1979 - The gene bank is set up

- Designing the earliest crop experiments for dryland cereals and legumes
- Initiating village-level studies
- Setting up departments on campus

Revival of neglected crops

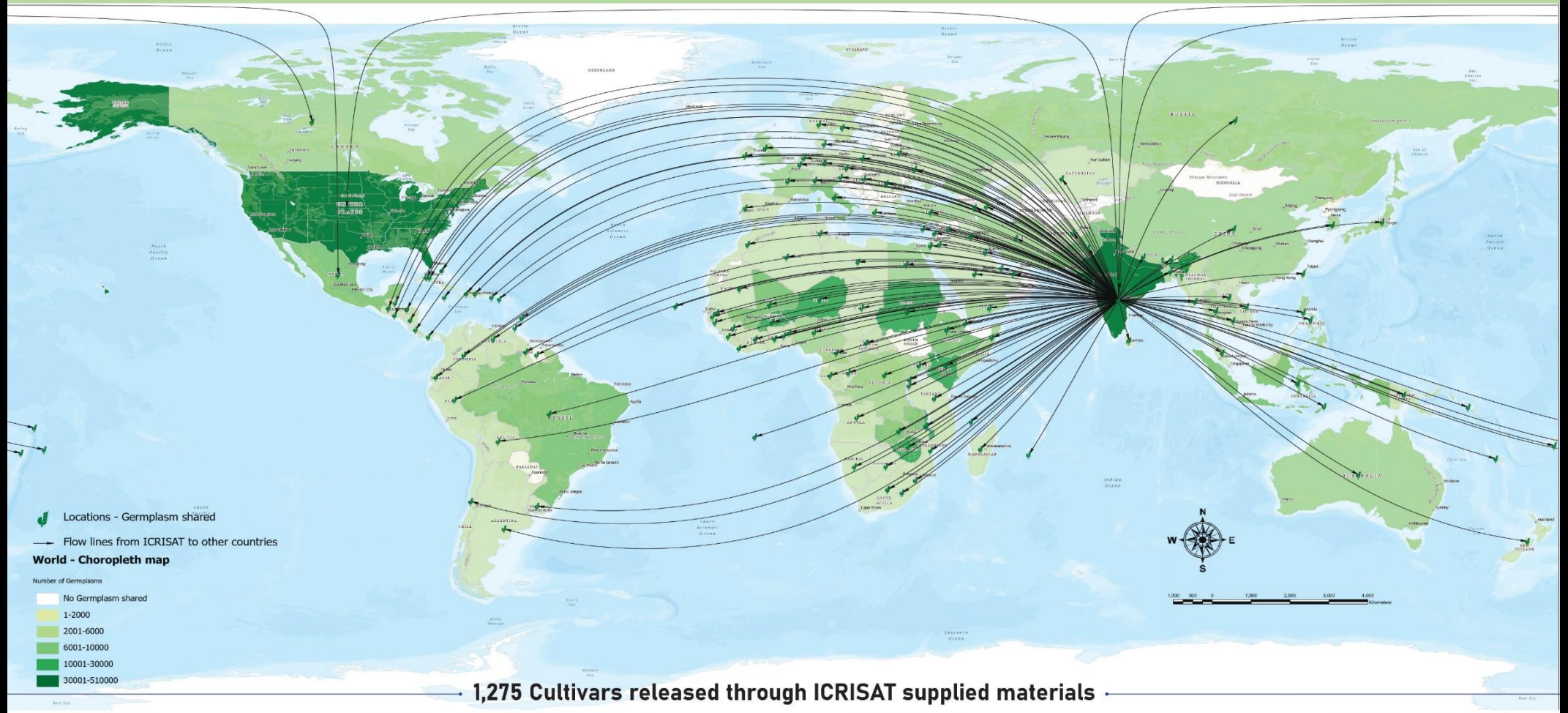
"Special attention was needed for the semi-arid tropics, where sorghum and millets, along with a range of pulses, are the major components of the cropping pattern and the major staple foods. We were indeed fortunate in finding and obtaining this site near Hyderabad, India and the whole-hearted cooperation of the Government of India and State of Andhra Pradesh."

Dr Ralph Cummings
ICRISAT's first Director General

ICRISAT Genebank Conserves **over 130,000 accessions** originating from **144 countries**

GROUNDNUT	CHICKPEA	PIGEONPEA	SORGHUM	PEARL MILLET	SMALL MILLETS
15,360 accessions	20,838 accessions	13,559 accessions	42,969 accessions	25,537 accessions	11,791 accessions
93 countries	61 countries	72 countries	93 countries	51 countries	51 countries

ICRISAT Genebank supplied about 1.72 million seed samples to 150 countries



1,275 Cultivars released through ICRISAT supplied materials

250 Cultivars in 39 countries	189 Cultivars in 28 countries	124 Cultivars in 20 countries	360 Cultivars in 46 countries	314 Cultivars in 26 countries	38 Cultivars in 7 countries

Our research approach

- Systems perspective
- Market oriented focus
- Evidence-based solutions
- Multi-disciplinary approach
- Environmental and business sustainability models
- Participatory approach
- Focus on local, regional and global partnerships across regions to maximize knowledge-sharing

Addressing the SDGs

Overcoming poverty

Overcoming hunger

Championing gender equality

Addressing climate change

Partnerships

ICRISAT
1972-2022

Research specialties

- Crop genetics, pre-breeding, breeding and seed systems
- Genomics, systems biology and crop informatics
- Genomes and gene-editing
- Crop physiology, crop protection and modelling
- Socioeconomics
- Systems-based natural resource management
- Digital innovations and technologies
- Interdisciplinary research
- Crop diversification
- Crop-livestock integration
- Biofuels

Facilities and Services

The Centre of Excellence on Climate Change Research for Plant Protection

Centre of Excellence in Genomics and Systems Biology Facility

Remote Sensing and Geographic Information Systems

Phenotyping Facility

Plant Quarantine Laboratory

Platform for Translation Research on Genome Edited Crops

Rapid-Gen Advancement Facility

Soil Laboratory: FAO accredited

Genebank

Business Incubation Services

Skills Transfer

Sorghum

333 varieties released in 46 countries

Seed production of these varieties : 21,239 t

Striga, midge resistance, drought tolerance, biofortified, hybrids 3-4 t/ha *etc.*

Pearl millet

289 varieties released in 26 countries

Seed shared with farmers, NARES, NGOs
6,612 t

High iron and zinc, dual purpose lines, drought and Striga tolerance

Groundnut

230 varieties released in 39 countries

129,730 t seeds shared

Disease-resistant, drought tolerant, early maturing, high oleic acid varieties, confectionary types

Chickpea

185 varieties released in 27 countries

>276,900 t seed shared

Extra early varieties 80-85 days *cf* 160 days

Pan-genome assembled (3,366 genomes sequenced)

Pigeonpea

121 varieties released in 19 countries

23,445 t seed shared

Super early <100 days to maturity, Fusarium wilt and sterility mosaic disease resistance

Finger millet

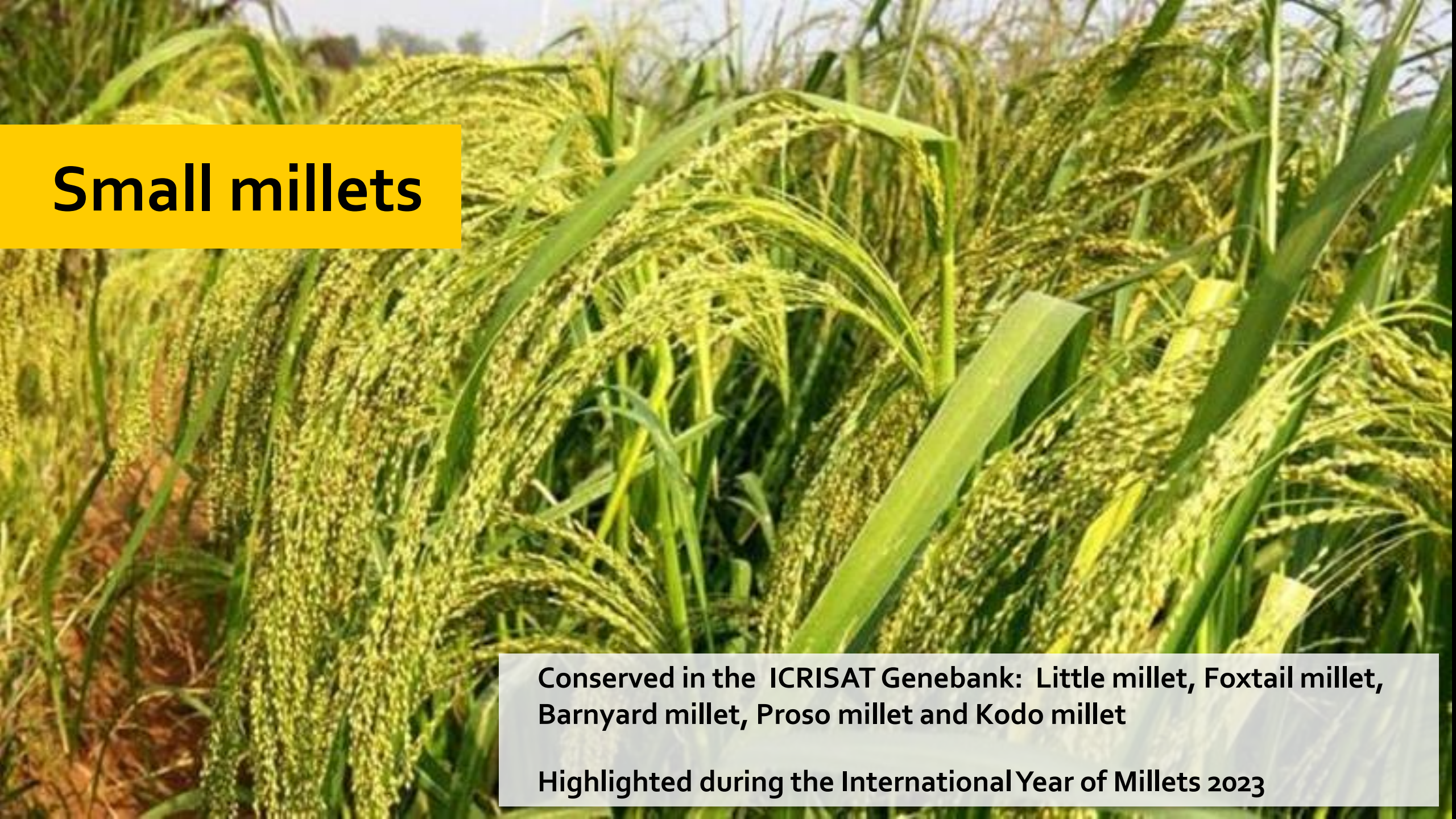
29 varieties released in 7 countries

453 tons seed shared

Avg. yield <2 t/ha *cf* yield potential of

Easy Harvest; pipeline lodging resista
high protein and good malting

Small millets



Conserved in the ICRISAT Genebank: Little millet, Foxtail millet, Barnyard millet, Proso millet and Kodo millet

Highlighted during the International Year of Millets 2023

Oil seeds

Request from our partners to focus also on sunflower, sesame and rapeseed

As part of the drylands cropping system and contributing to edible oils for cooking and food processing

Photo credit - Satish Awate

Reviving traditional rainwater harvesting systems: *Haveli* cultivation

***Haveli* system**

- Traditional RWH system of central India
- Originated from Malwa region during *Chandela* dynasty
- Earthen embankment harvesting surface runoff
- Reservoir during *kharif* and agricultural land during *rabi*

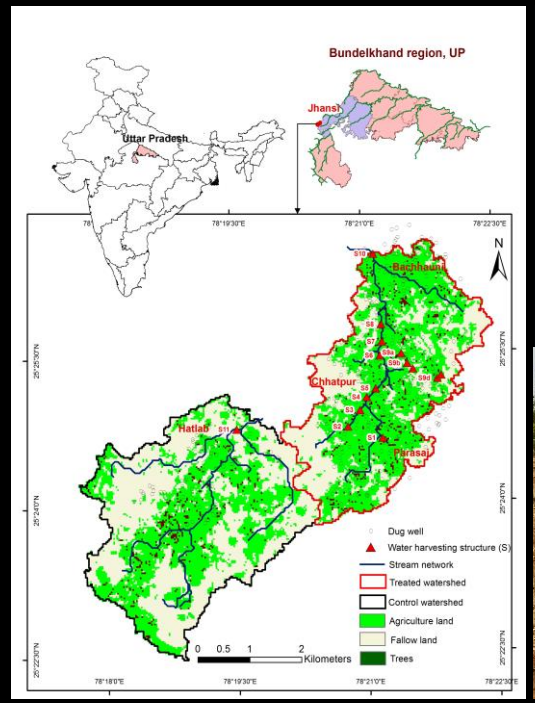
Innovations made

- Introduced core wall to protect breeching and cut the seepage line
- Check dam cum rectangular weir as outlet at appropriate location to optimize the cost
- Introduced stone masonry with reinforcement (lean structure with high strength)
- State-of-the-art instrumentation for analysing water balance

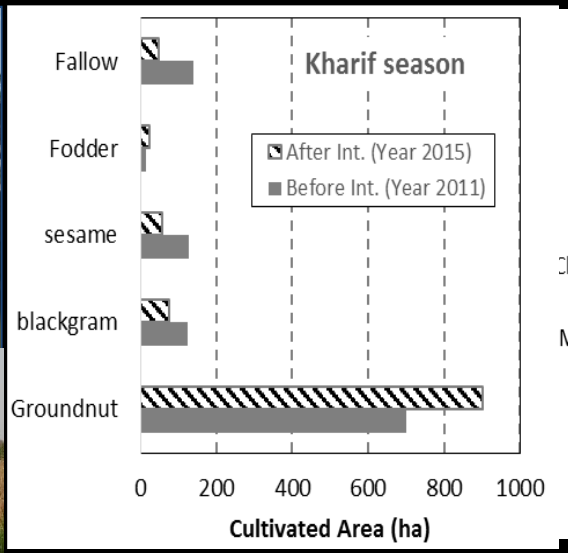
Opportunities for transforming agriculture

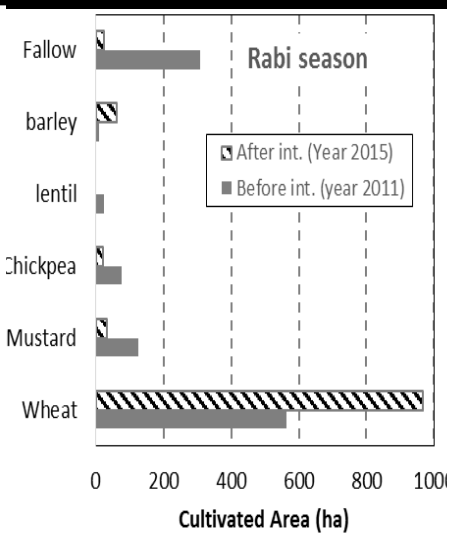
- Permanent fallows converted into productive cultivation
- Improved surface and groundwater availability
- Sustainable crop intensification and diversification

Addressing water scarcity in rainfed ecosystems through NRM interventions: *Parasai-Sindh* watershed, *Jhansi*, Central India

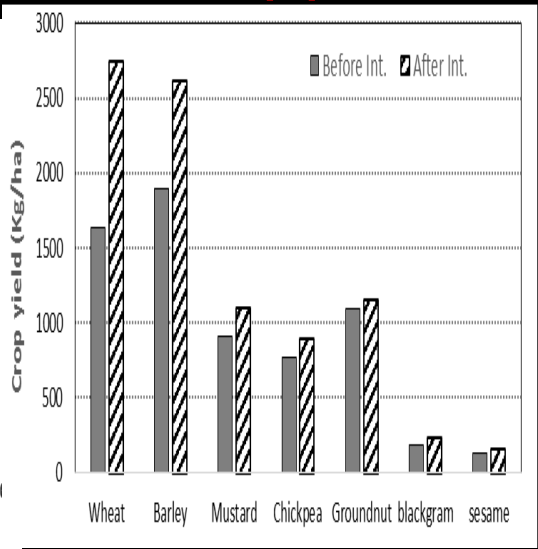


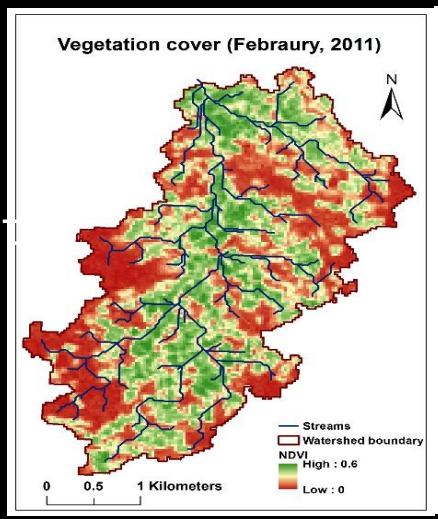
Crop intensification

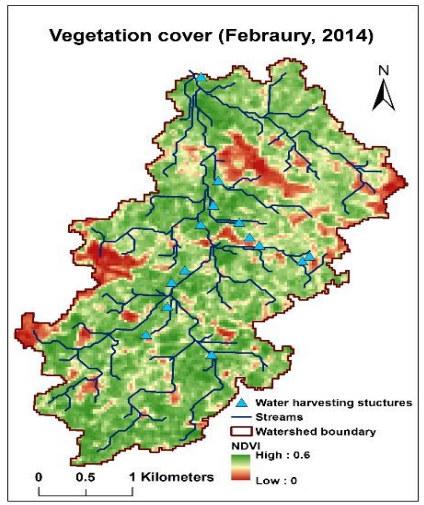


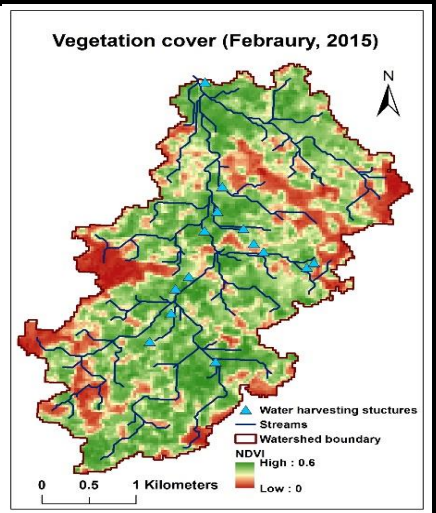


Crop yield







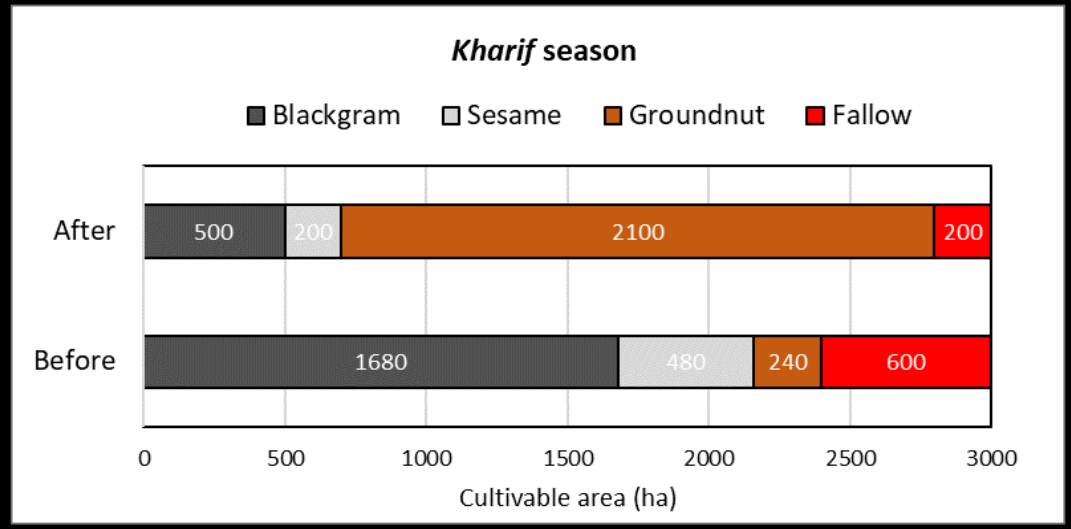


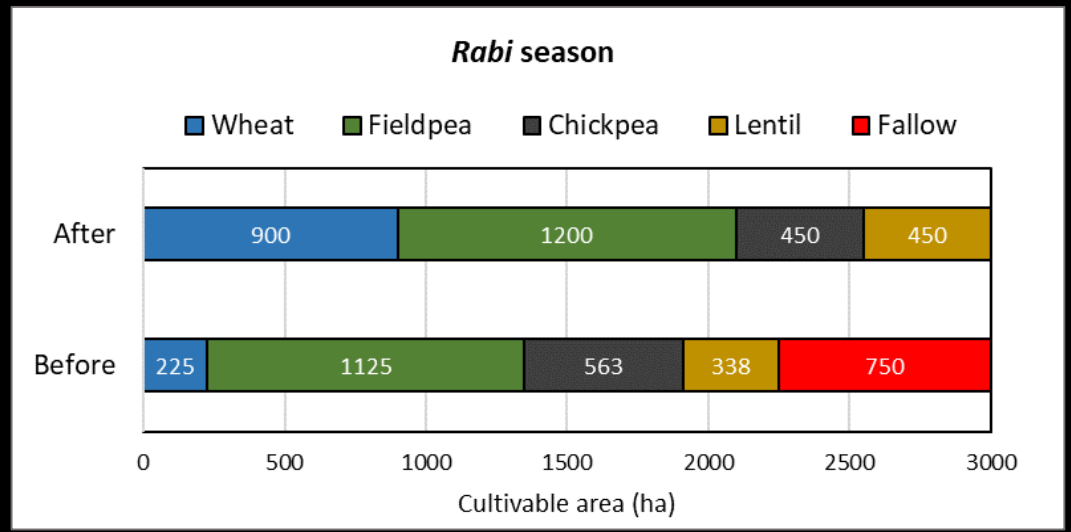
- Significant fallow lands in upstream locations brought back into productive cultivation
- Cropping intensity increased from 120% to 180%
- Crop yield increased by 50-150%
- Household income increased nearly 3x

Promoting diversified cropping: Building climate resilient communities

Resource availability, production, C footprints and net income	2019 (before)	2021 (after)
Groundwater levels (bgl: m)	20-25	5-8
Functioning dug/bore wells (no.)	20	220
Diesel consumption (L/ha/irrigation)	69	32
CO_2 emission for irrigating one ha land (tons/ha/irrigation)	0.179	0.084
Number of irrigation applied in watershed (ha-irrigation)	4300	9300
Total production from landscape (Field pea equivalent in tons/year)	5698	12350
Net income from agriculture (US $/ha/year)	550	1390
Carbon footprint (tons CO_2/ton food production)	0.14	0.06
Net income: kharif (Million US$)	0.64	1.73
Net income: rabi (Million US$)	1.00	2.42
Net income/year (Million US$)	1.64	4.15
Returning migrant families (no.)	-	350

Change in cropping pattern

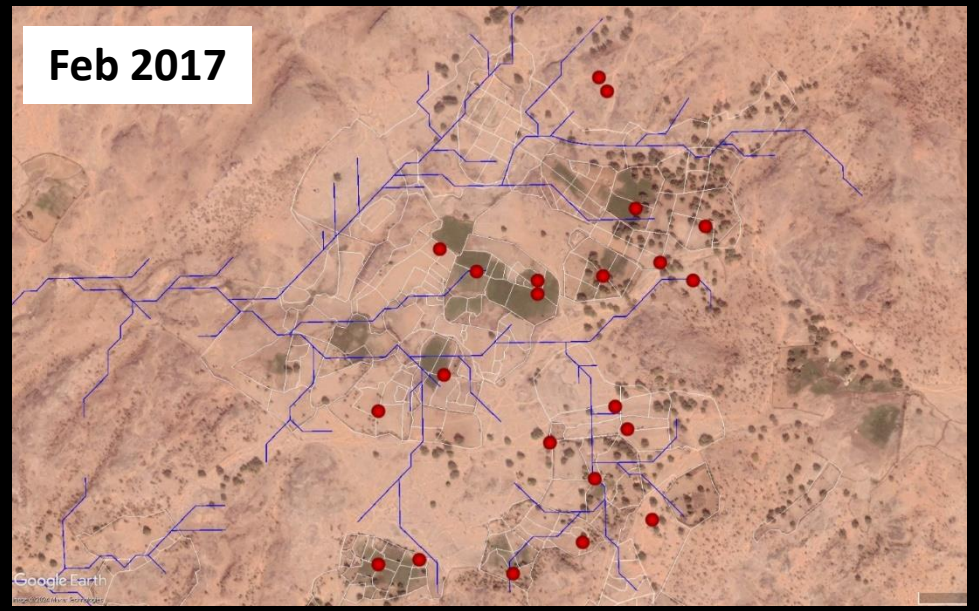


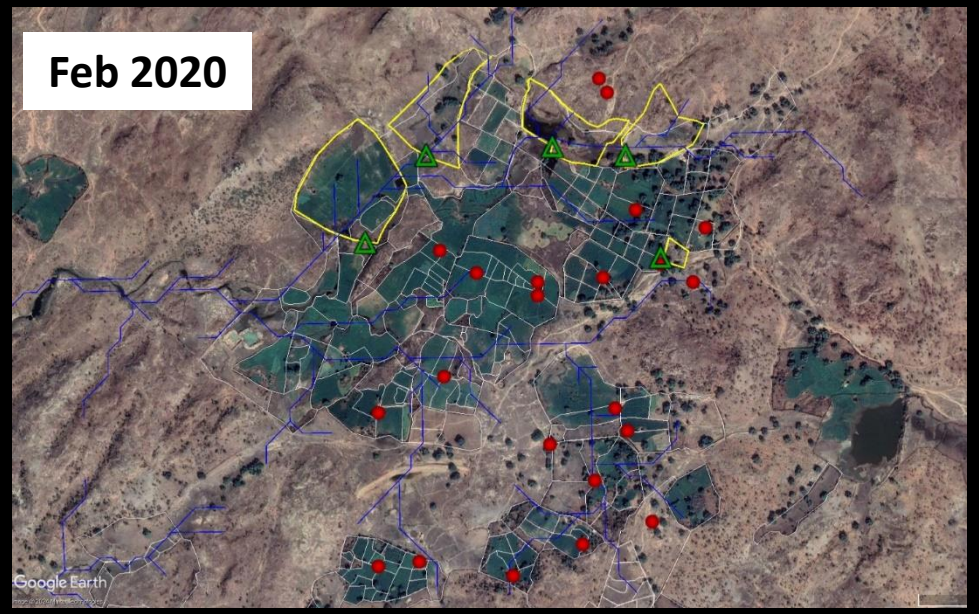


Impact of landscape treatment: Turning degraded landscapes into productive ones:

Birdha village, *Lalitpur*, *Bundelkhand*, Central India

Indicators	2019	2020	2021	2023
Groundwater level (bgl:m)	10	4	2	2
Well recovery period (hours)	120	20	10	10
In-migration (no. of families)	-	15	45	45
Area cultivated (ha)	4	35	100	110
Net income: kharif (USD)	850	9000	27000	36850
Net income: rabi (USD)	1700	30000	85000	95000
Net income: agroforestry (USD)				1400
Net income: Pisciculture (USD)			6000	8500
Net income: Livestock (USD)		3000	14000	14000





Large-scale rainwater harvesting based on scientific landscape management principles

Jhansi

Lalitpur

Mahoba

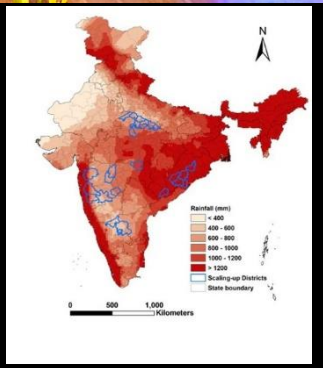
Regenerative landscapes for transforming smallholder agrifood systems

- Farmer income: 3X
- Water table: Up from 2.6 m to 4.5 m
- Enhanced base flow by 150%
- Emission intensity: Down from 0.14 to 0.06
- Livelihoods (In-migration)
- Cropping intensity up from 110 to 180%
- Arresting land degradation
- Sustainable intensification of 100,000 ha degraded fallow land
- Temperature regulation towards (1.5 °C targets)

ICRISAT awarded 'UNDP-Mahatma Award 2023 for Biodiversity Conservation' for using regenerative landscape approach

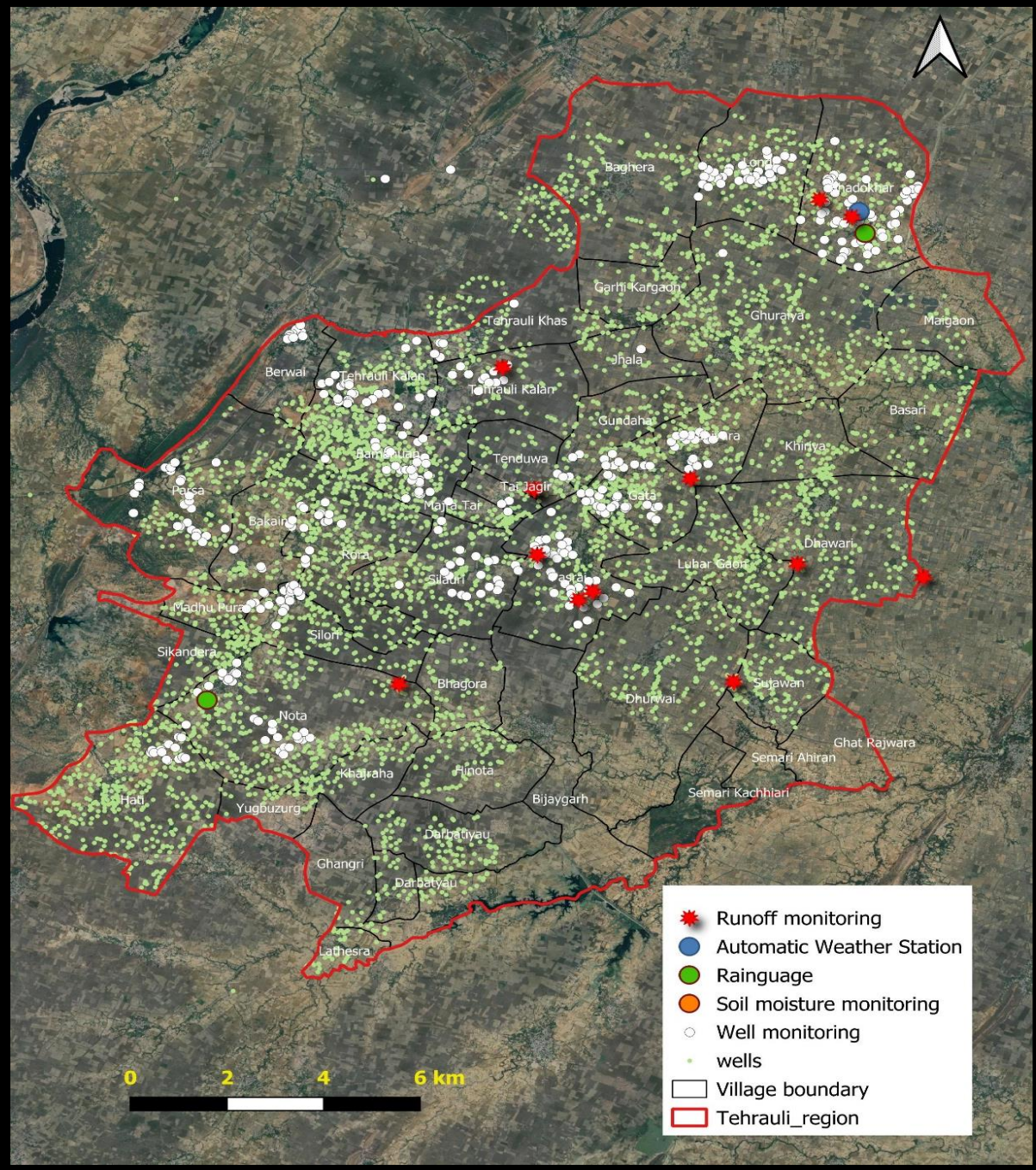
Science evidence led impact on landscape management

- Seven agroecologies: rainfall 400-1500 mm
- 150K households
- 100K ha area



Rejuvenation of aquifer system in *Tahrauli* cluster, *Jhansi,* Central India

- 28000 ha; cluster of 40 villages (Tahrauli, Jhansi, UP); 2022 to 2025;
- Seasonal/permanent fallow : 11147 ha (40%)
- RWH capacity created: 5 million cu.m; groundwater table up by 2-10 m
- 4000 wells rejuvenated (of 5400 dried wells): well recovery period brought down from 120 h to 10 h
- 7000 ha seasonal/permanent fallow brought under cultivation; enhanced total production by 5000 M t
- Crop productivity increased by 20-60%



Technologies and Innovation

Digital Technologies

- Plantix [with PEAT Germany & ANGRAU]
- Sowing [Iwith Microsoft & AP govt]
- STARS-One [with MANOBI SA and STARS partners]
- ISAT, [with Microsoft, IMD, ANGRAU]

Aflatoxin Management

- Mobile, low-cost aflatoxin detection kits - lateral flow immunoassay test for the whole value chain
- Simple test kits using cELISA – no extensive laboratory facilities needed

Watershed Management

- Global leader - evidence-based community-driven model.
- Holistic approach: water & soil management, improved varieties and production practices
- Global CSR Excellence & Leadership Award

Pest and Disease Management

- Integrated Striga management
- Biological control of millet head miner
- Root pathogen detection using LAMP (Loop-mediated isothermal amplification

Climate-Smart Agricultural Technologies

- Bioreclamation of degraded lands
- Decentralized wastewater treatment system for safe re-use in agriculture
- Microdosing

Opportunities to join hands with ICRISAT

- ICRISAT continues to maintain our lean and responsive structure.
- We have strengthened our ability to listen and respond to our partners and stakeholders.
- Exploring joint funding opportunities and partnerships
- With our new communications platform we have significantly expanded our global reach.
- We are ready and flexible to explore new areas of research.
- We develop close partnerships with stakeholders, resulting in joint impact.

International Year of Millets 2023

- International Steering Committee
  - Chair: Dr. Neena Malhotra, Ambassador of India to the Republic of Italy, San Marino & UN Organizations in Rome
  - Vice Chair: Dr Jacqueline Hughes, Director General, ICRISAT
- The focus crops of the International Year of Millets 2023 are the **dryland small grains that contribute to food and nutrition security**
- Planning of the International Year of Millets; main advocacy tools prepared (agreed, embargoed), tag lines (being finalized); pre-launch events discussed; launch at FAO and in India

smart food

- ICRISAT, with the support of CORAF, FANRPAN, FARA and APAARI.
- Smart Food - including but not limited to ICRISAT's specialty crops
  - good for you (nutritious and healthy);
  - good for the planet (environmentally sustainable); and
  - good for the farmer (climate smart, potential to increase yields, multiple uses).

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Thank YOU

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