

Eye in the Sky

for a Shared Development Vision on the Ground

Winston Yu

Senior Water Resources Specialist, World Bank

NASA Water Resources Team Meeting 2016



WORLD BANK GROUP

Environment & Natural Resources/Water

World Bank Group

Providing over US \$65 billion in loans, grants, equity investments and guarantees

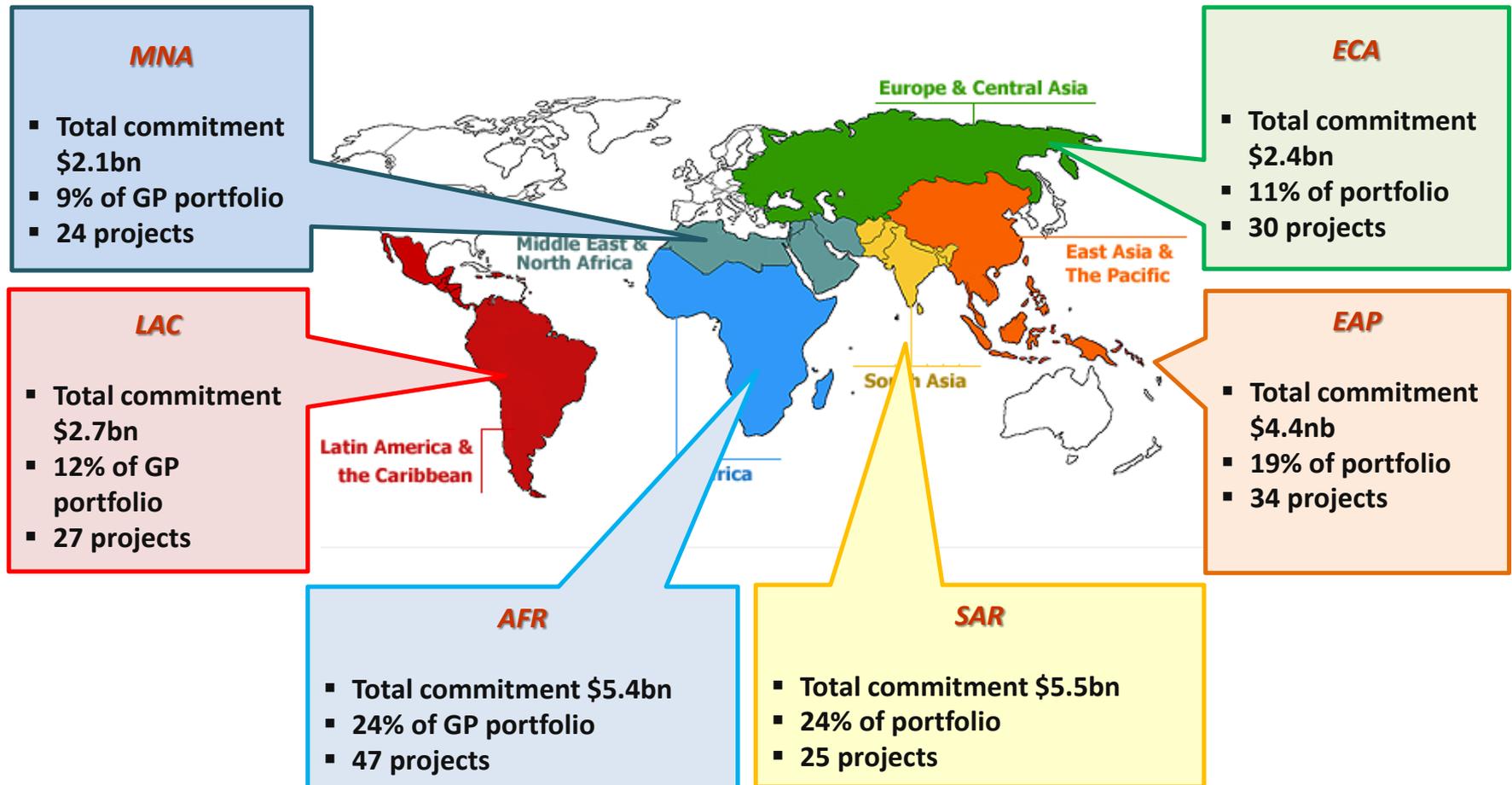
Knowledge sharing, convening, and financing



Economic growth, inclusiveness, and ensuring sustainability

Global Portfolio Summary

- **Water GP water portfolio: \$22.6bn** (10.4% of total Bank lending), **187 projects, 290 AAAs**
\$7.6bn water-related lending in other GPs



Water Development Challenges

Information

- Data coverage and quality
- Use of modern analytical tools
- Public access to data, tools, and knowledge products

Institutions

- Technical capacity
- Meaningful stakeholder involvement
- Decision making across boundaries
- Appropriate policy instruments
- Collaboration/ Partnerships

Investments

- Huge infrastructure deficit
- Sustainability of investments
- Infrastructure planning
- Inadequate monitoring and forecasting systems
- Investment coordination

Is there a role for earth observations in overcoming these challenges?











Earth Observation and Water

Water Resources
Management

Water Supply and
Sanitation

Agricultural Water
Management

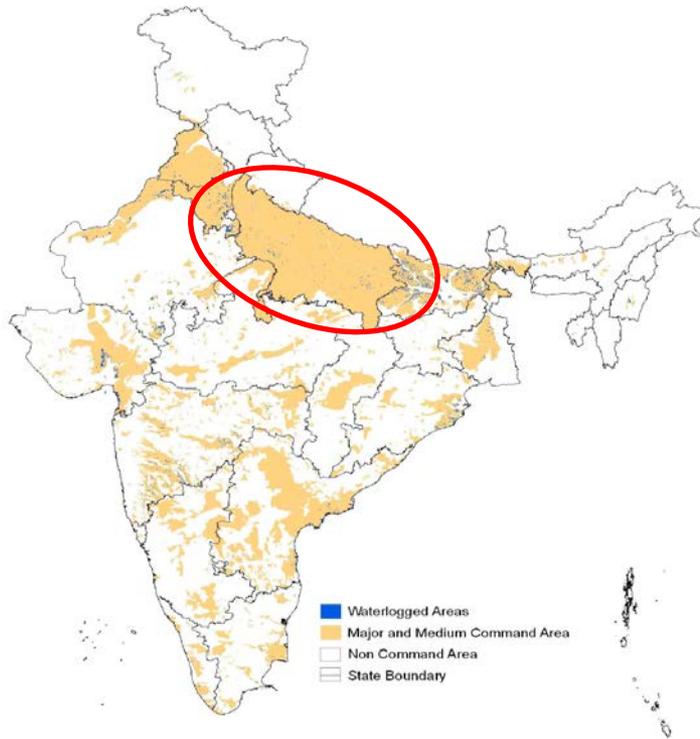
Hydropower

Potential applications

- Assessing water use “efficiency” in irrigated crops
- Mapping irrigated areas (over time)
- Flood extent, prediction, mapping
- Drought monitoring
- Crop production and ET
- Water balance accounting
- River morphology changes
- Coastal erosion patterns
- Snow and glacial cover
- Water quality
- River flow estimates
- And more....

Using Remote Sensing for Monitoring of Irrigated Agriculture Investments

UTTAR PRADESH: LARGE STATE, LARGE PROBLEMS



Major and Medium Command areas

Population:	200 million (2012)
Area:	24 M Ha
Net Sown Area :	17 M Ha
Net Irrigated Area:	13 M Ha (out of 80 M)
Canal Command Area:	9.4 M Ha

Canal Irrigation Efficiency: **30%**

Surface water	162 BCM
Ground water	76 BCM

Agriculture Sector:	30% of GDP
Major Crop:	Food Grains
- Area	20 M Ha
- Production	42 M t
- Yield	2.1 t/Ha

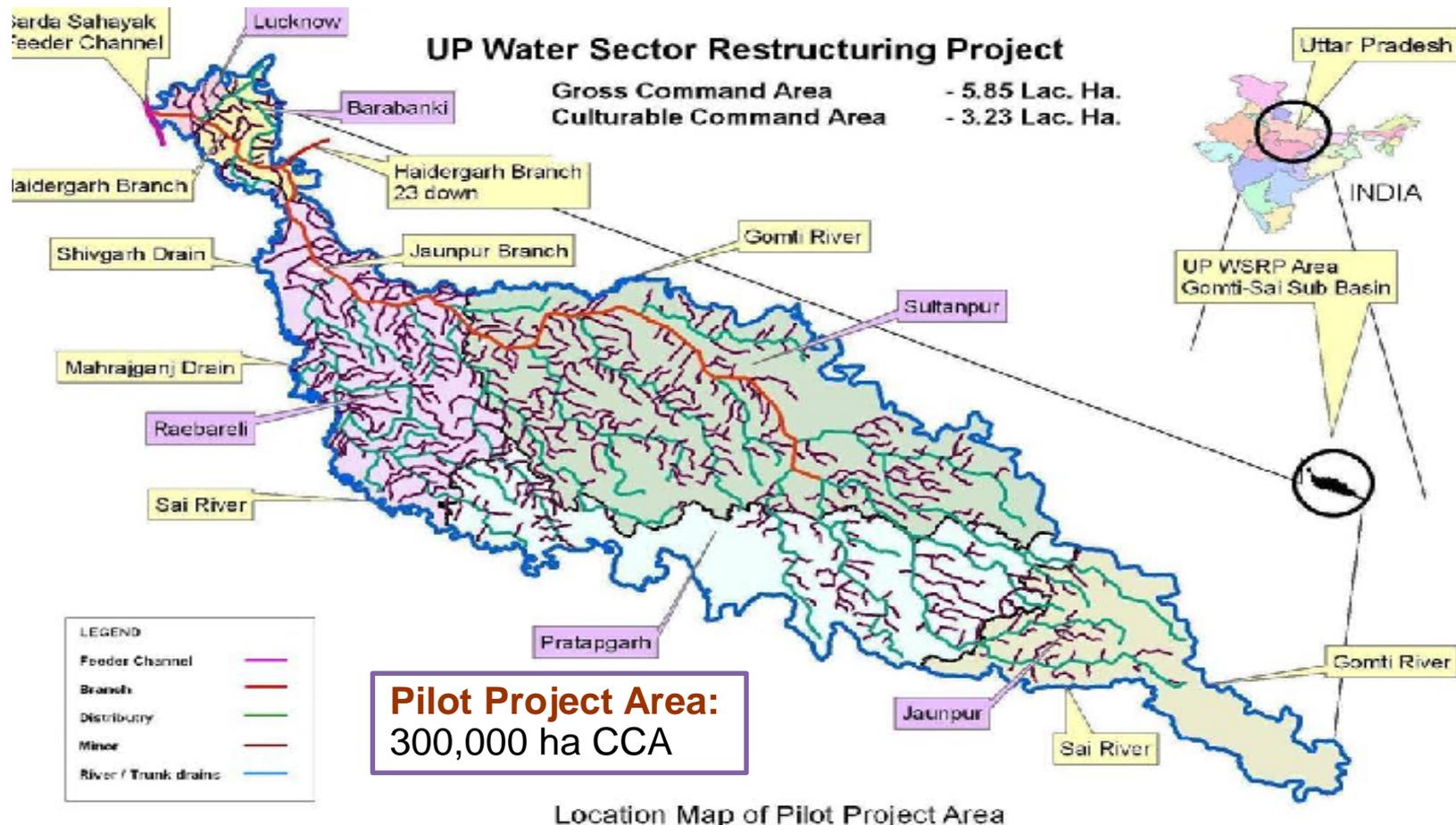
Poverty:	50 M BPL
Flood Prone Area:	7.3 M Ha

Project at a Glance

Project cost: \$150 Million **Closed:** October 2011 (new follow-on operation)

Development Objectives:

- Enabling institutional and policy framework for water sector reform
- Initiate I&D sector reform to increase water and agriculture productivity



IMPACT OF IRRIGATION & AGRICULTURAL INTERVENTIONS

☐ Increase in land utilization (% of cultivable area)

Particulars	2001-02 (Pre-project*)	2005-06 (Baseline)	2008-09 (Present Study)
Net Sown Area (NSA)	77.72	87.8	91.1
Kharif	56.70	84.5	87.3
Rabi	57.42	74.6	81.2
Zaid	0.01	0.01	10
Orchards	3.76	3.79	5

☐ Increase in cropping intensity

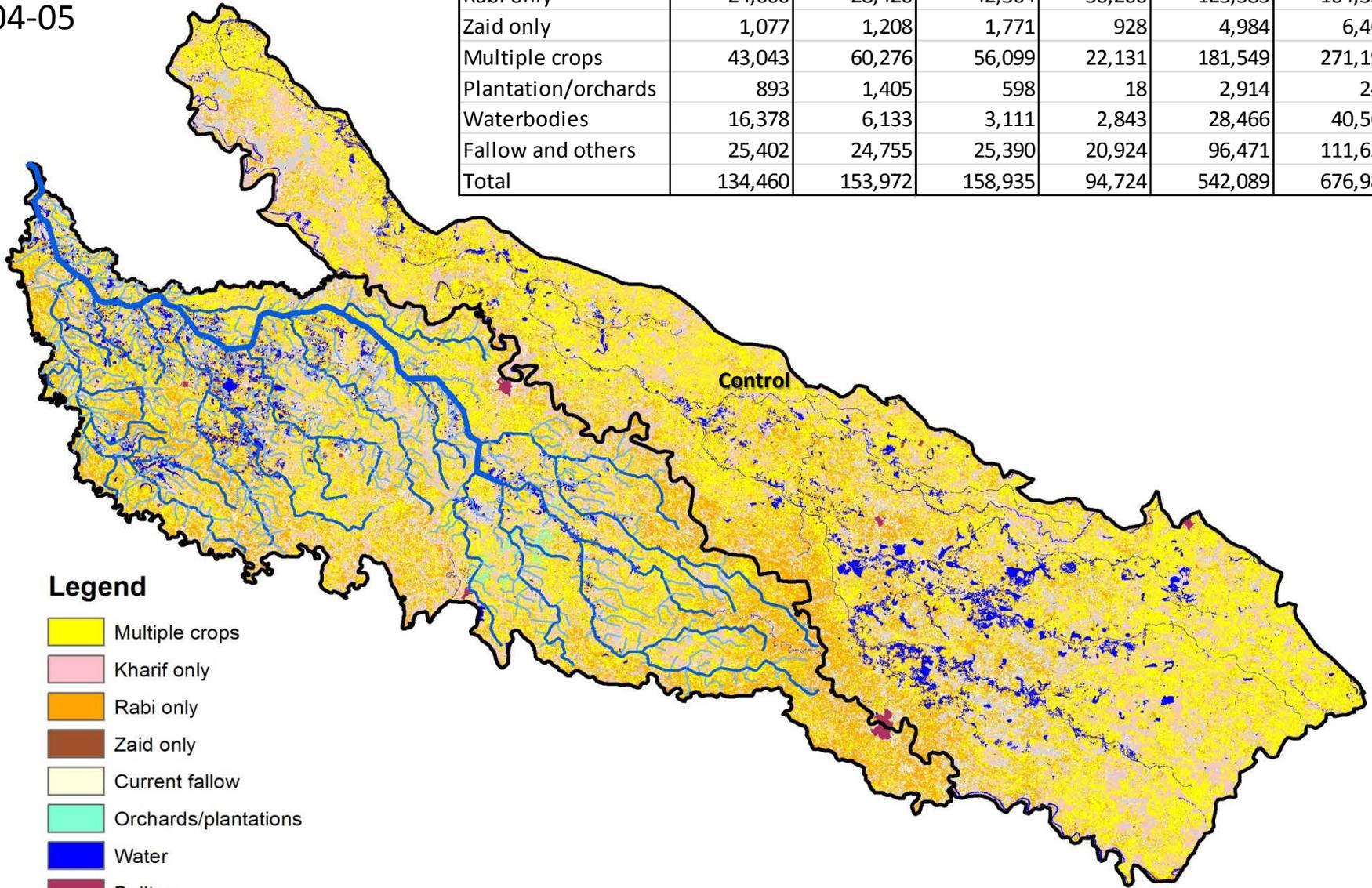
Year	Cropping Intensity (%)
2001-02	152.3
2005-06	181.6
2006-07	189.5
2008-09	194.5
Control Area (2008-09)	185.3

Can we do better in unraveling the impacts of the investment in irrigation and drainage?

Land Use Map of the Jaunpur Canal Command area and Sultanpur Control Area

Land Use Class	Head	Middled	Tail	Non-CA	JBS Total	Control
Kharif only	23,065	31,775	29,601	17,680	102,121	142,534
Rabi only	24,600	28,420	42,364	30,200	125,585	104,352
Zaid only	1,077	1,208	1,771	928	4,984	6,462
Multiple crops	43,043	60,276	56,099	22,131	181,549	271,197
Plantation/orchards	893	1,405	598	18	2,914	240
Waterbodies	16,378	6,133	3,111	2,843	28,466	40,568
Fallow and others	25,402	24,755	25,390	20,924	96,471	111,637
Total	134,460	153,972	158,935	94,724	542,089	676,989

2004-05



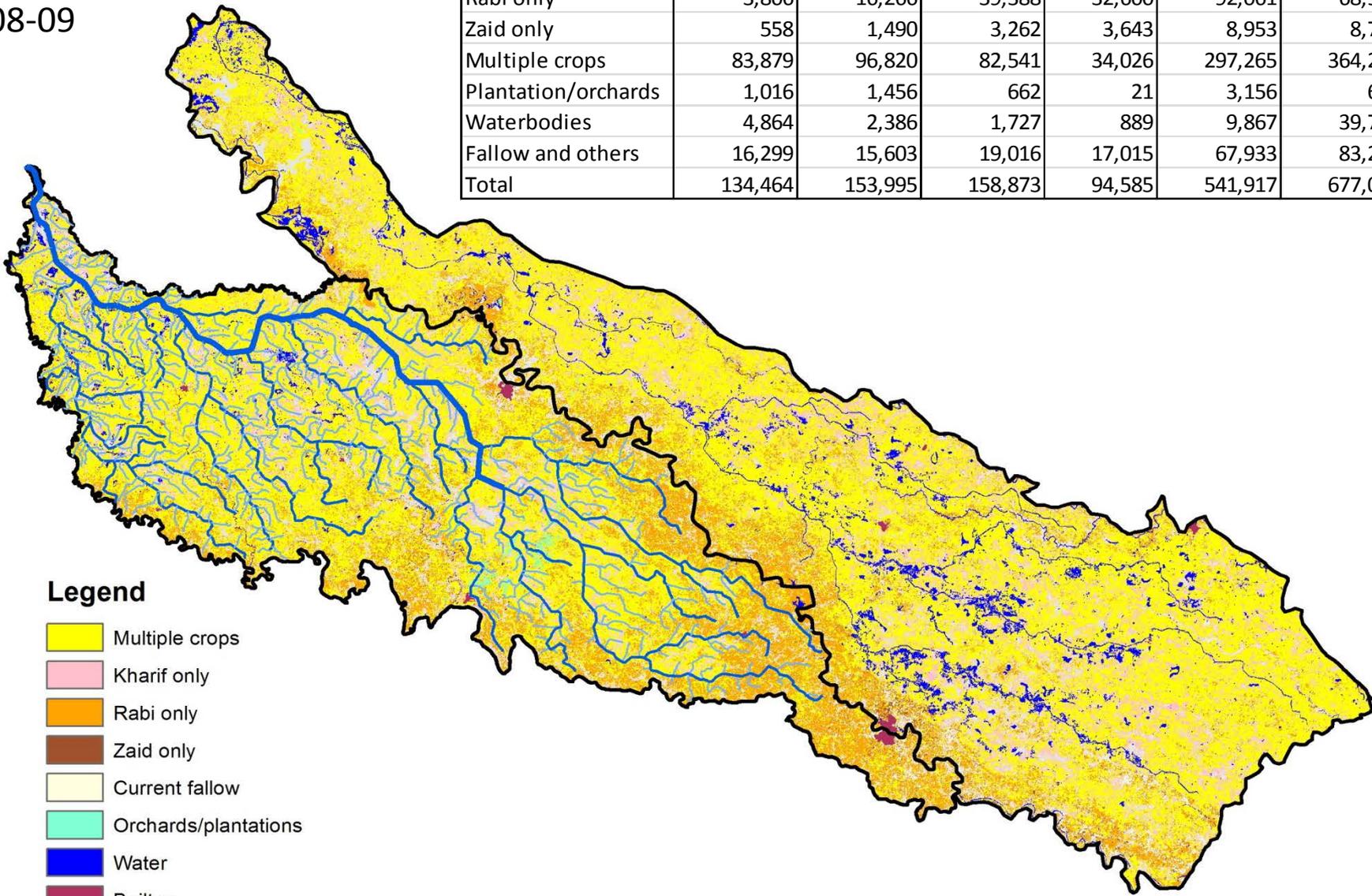
Legend

- Multiple crops
- Kharif only
- Rabi only
- Zaid only
- Current fallow
- Orchards/plantations
- Water
- Builtup
- Others

Land Use Map of the Jaunpur Canal Command area and Sultanpur Control Area

Land Use Class	Head	Middled	Tail	Non-CA	JBS Total	Control
Kharif only	24,041	19,974	12,276	6,391	62,683	111,627
Rabi only	3,806	16,266	39,388	32,600	92,061	68,929
Zaid only	558	1,490	3,262	3,643	8,953	8,738
Multiple crops	83,879	96,820	82,541	34,026	297,265	364,229
Plantation/orchards	1,016	1,456	662	21	3,156	606
Waterbodies	4,864	2,386	1,727	889	9,867	39,733
Fallow and others	16,299	15,603	19,016	17,015	67,933	83,201
Total	134,464	153,995	158,873	94,585	541,917	677,063

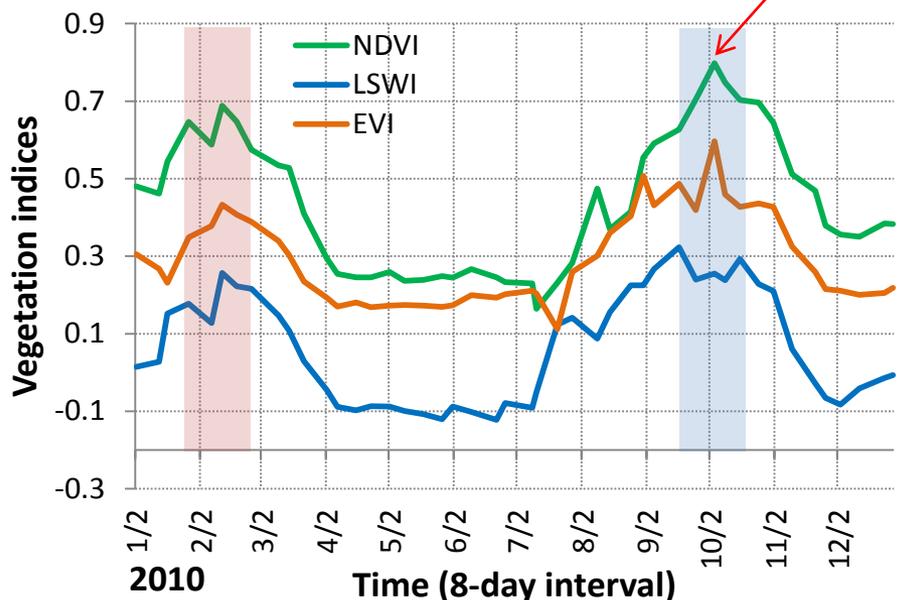
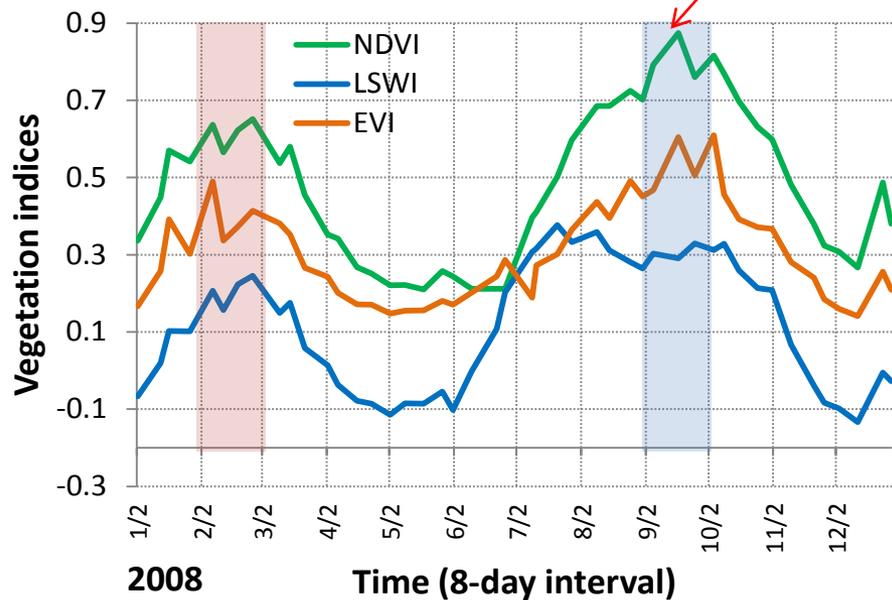
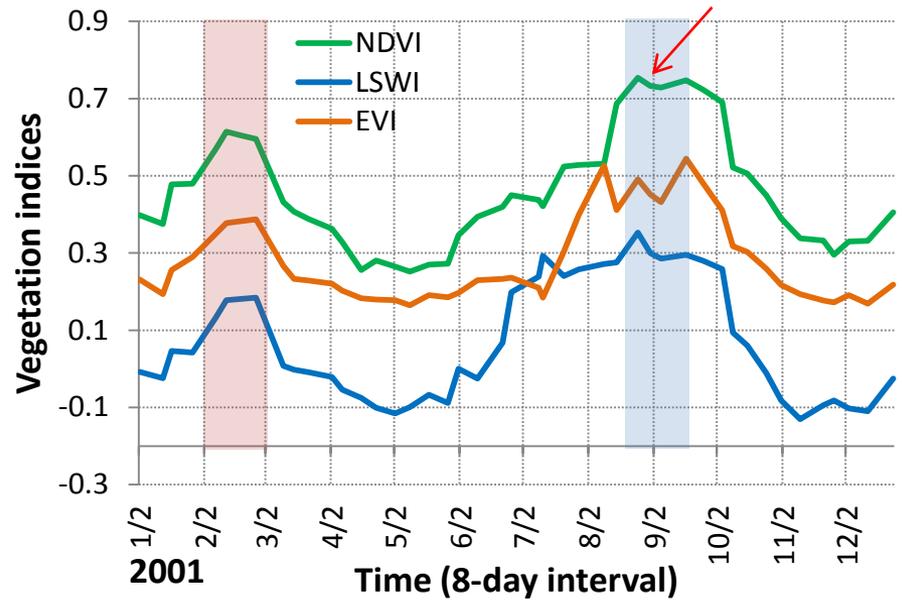
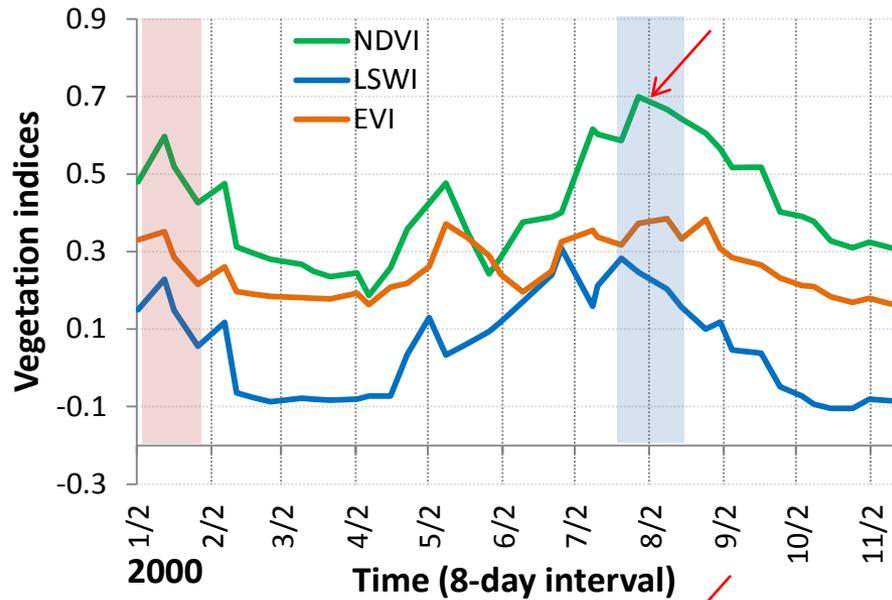
2008-09



Legend

- Multiple crops
- Kharif only
- Rabi only
- Zaid only
- Current fallow
- Orchards/plantations
- Water
- Builtup
- Others

Cropping Calendar for the Uttar Pradesh Water Sector Restructuring Project



Land Use Change: Daulatpur Dy Minor Canal Command

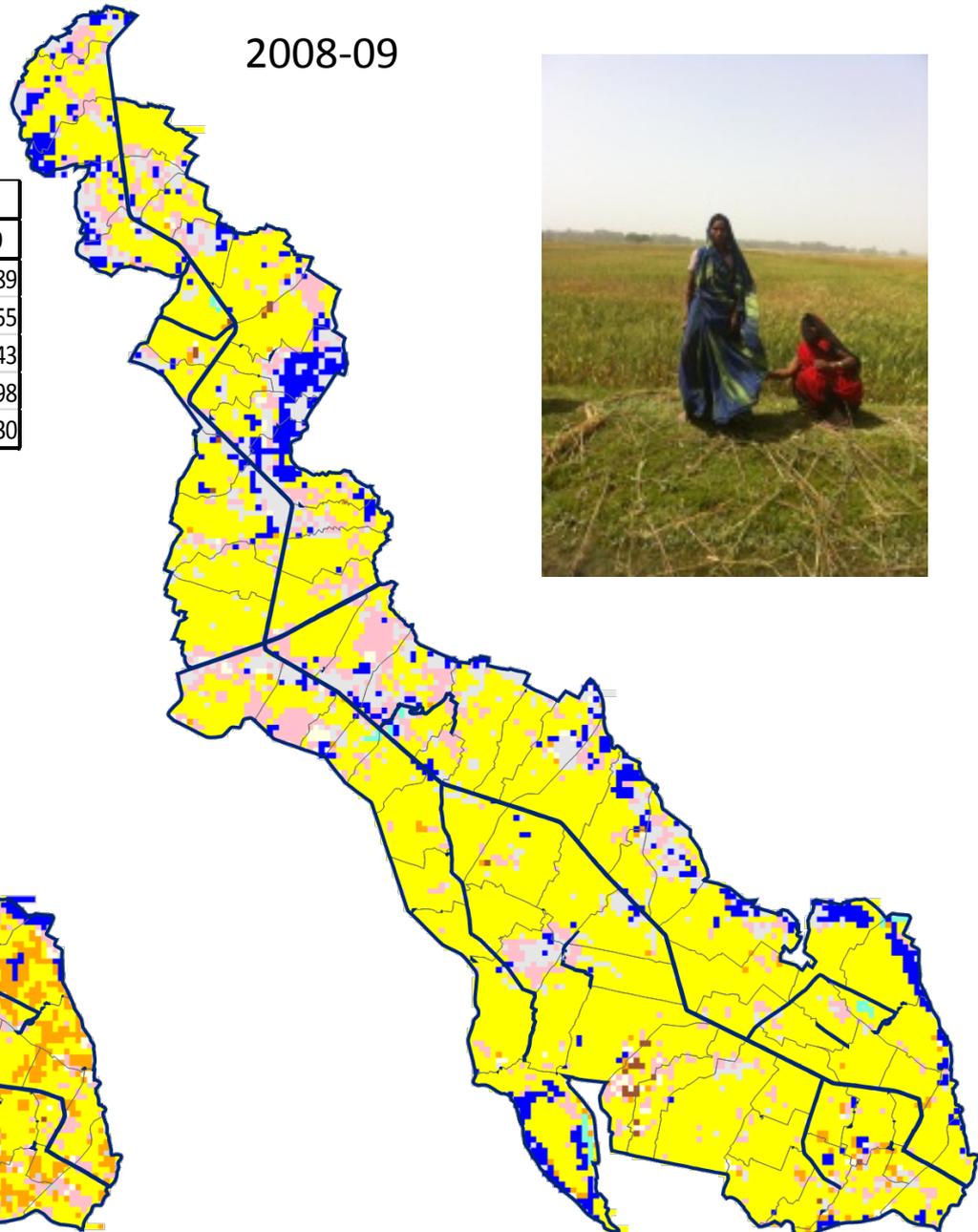
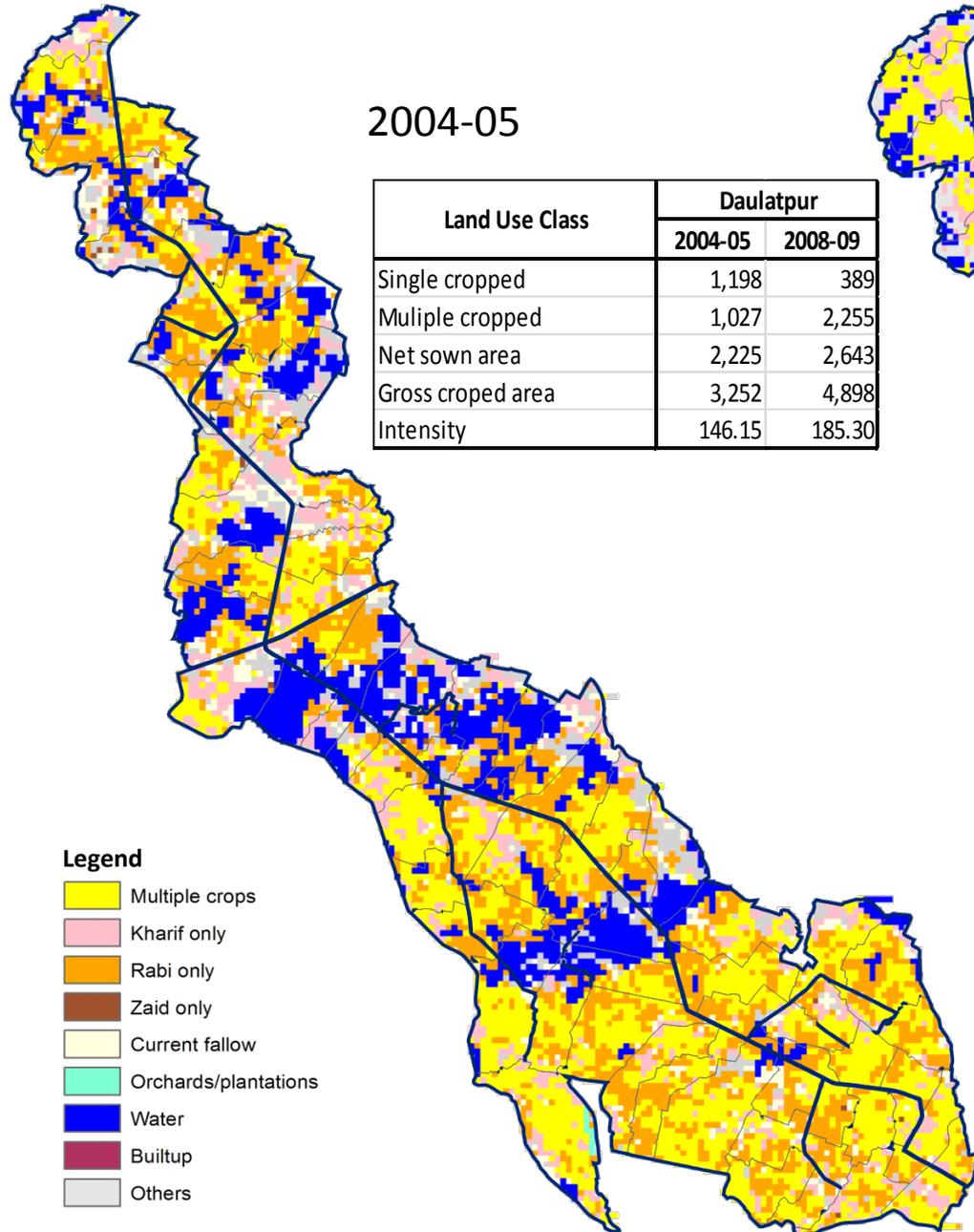
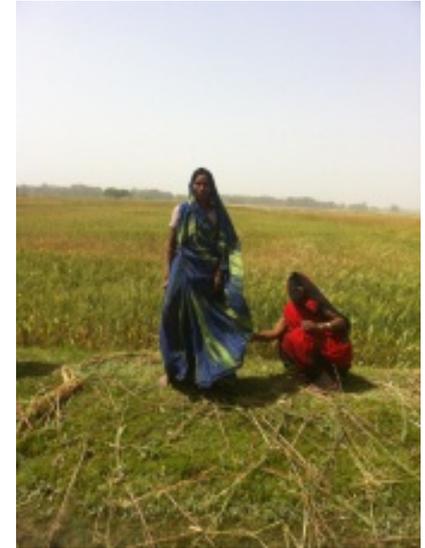
2004-05

2008-09

Land Use Class	Daulatpur	
	2004-05	2008-09
Single cropped	1,198	389
Muliple cropped	1,027	2,255
Net sown area	2,225	2,643
Gross cropped area	3,252	4,898
Intensity	146.15	185.30

Legend

- Multiple crops
- Kharif only
- Rabi only
- Zaid only
- Current fallow
- Orchards/plantations
- Water
- Builtup
- Others



Earth Observations & Partnerships in Water

- EOWorld: Collaboration with the European Space Agency
- Water MoU with US Government Agencies: NASA, USGS, and other US agencies
- Water Partnership Program supports Water From Space Initiative

Thank You!

Contacts:

- Winston Yu, wyu@worldbank.org
- Nagaraja Harshadeep, harsh@worldbank.org
- Noosha Tayebi, ntayebi@worldbank.org
- Rita Cestti, rcestti@worldbank.org



WORLD BANK GROUP

Environment & Natural Resources/Water