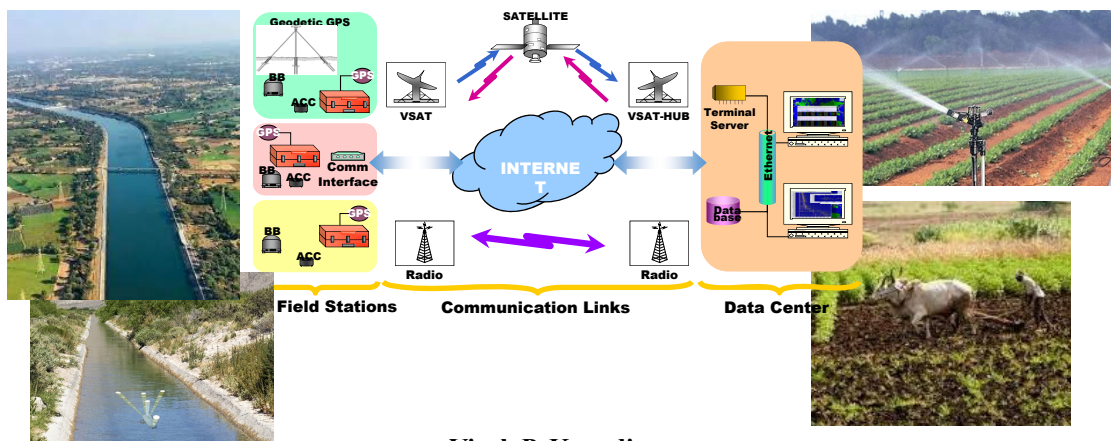


## Modernization of Irrigation Sector in Indian Context



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### Where do we stand... still

- 73 million hectares out of 141 million hectares of cultivated land is irrigated
- Cropping Intensity (% of Total cropped Area over Net Area Sown) is 155.9
- Overall irrigation efficiency (<40%) = conveyance efficiency (?) + on-farm efficiency (?)
- Heat-Tail dichotomy

No improvement since long back – why?

*Having no water accounting system is the real pain area and hence whatever numbers claimed are based on some intuitive estimation*

*Command Area Operations can never be effectively performed, nor can any policy be reliably formulated in want of reliable data*

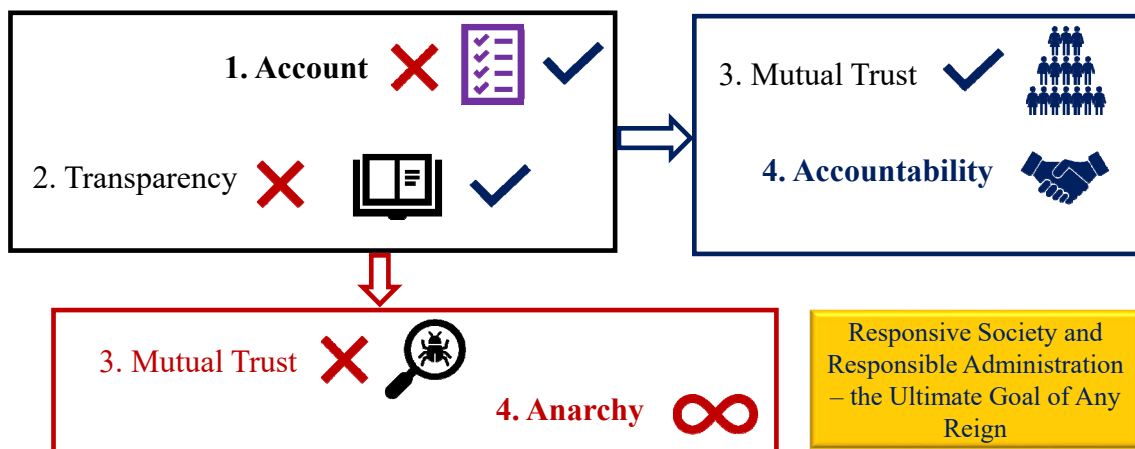
Classification of land		(thousand Hectares)
Reporting area for land utilization statistics (1 to 9)		306650
1	Forests	72021
2	Area put to non-agricultural uses	27845
3	Barren & unculturable land	16554
4	Permanent pastures & other grazing lands	10248
5	Land under Misc. tree Crops	2992
6	Culturable Wasteland	11659
7	Fallow Land Other than Current Fallows	11128
8	Current Fallow	13498
9	Net Area Sown	140705
Agricultural Land (5+6+7+8+9)		179982
Cultivated Land (8+9)		154203
Cropping Intensity (% of Total cropped Area over Net Area Sown)		155.9

## In Favour of Modernization

*Gradual upgradation of existing systems rather than overnight replacing with modern ones would be more practicable in Indian context*

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## Account to Accountability: *A Smooth Transition*



4

### Why More and Accurate Data

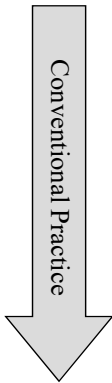
Photo with Low Pixel



Photo with High Pixel



### How Technology Can Make a Difference in Accounting



Gate opening based flow accounting system – manual hoist and no. of threads opened counted,  $C_d$  is estimated and discharge is computed

Response time of gate opening is high, control low and estimation error high

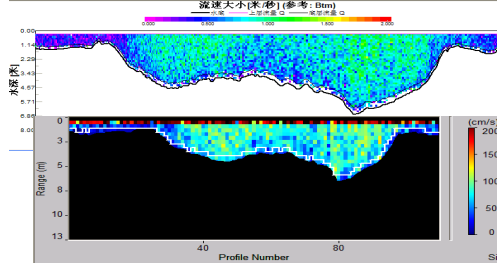
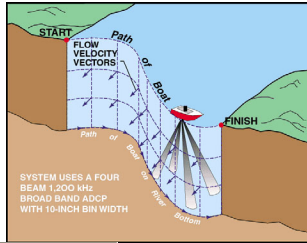
Electrical operation of gates, at least for big canals

VFD precisely records gate opening and  $C_d$  based estimation can be done, real time auto-computing and remote data communication can be coupled



## How Technology Can Make a Difference in Accounting

Towards further improvement...

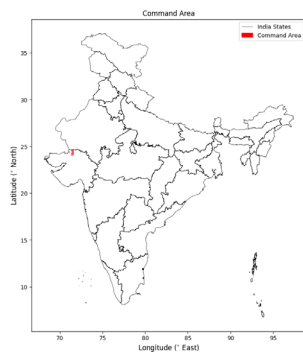


At strategic locations in the canal systems, flow profiling using sonic and radar systems helps better operate the canals and also calibrate the  $C_d$

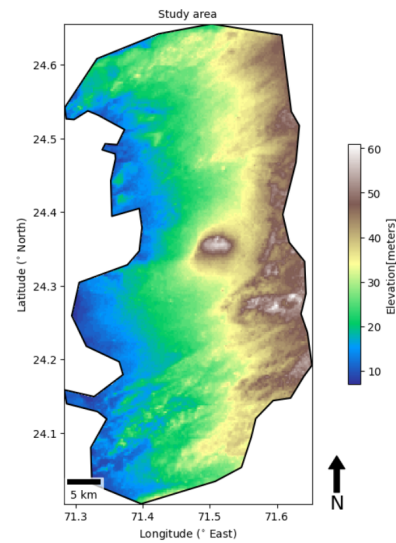
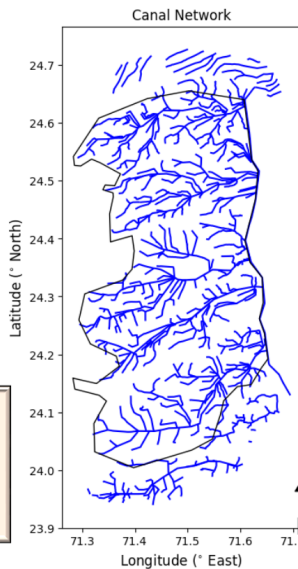
Radar system fitted on deck beam soffit of a bridge is safe against vandalism

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## Technology Can Take Us Much Beyond Accounting



Evapotranspiration reflects the combined water loss from soil evaporation and plant transpiration, serving as an indicator of water consumption and availability for crops



Study area with distribution of elevation

## Technology Can Take Us Much Beyond Accounting

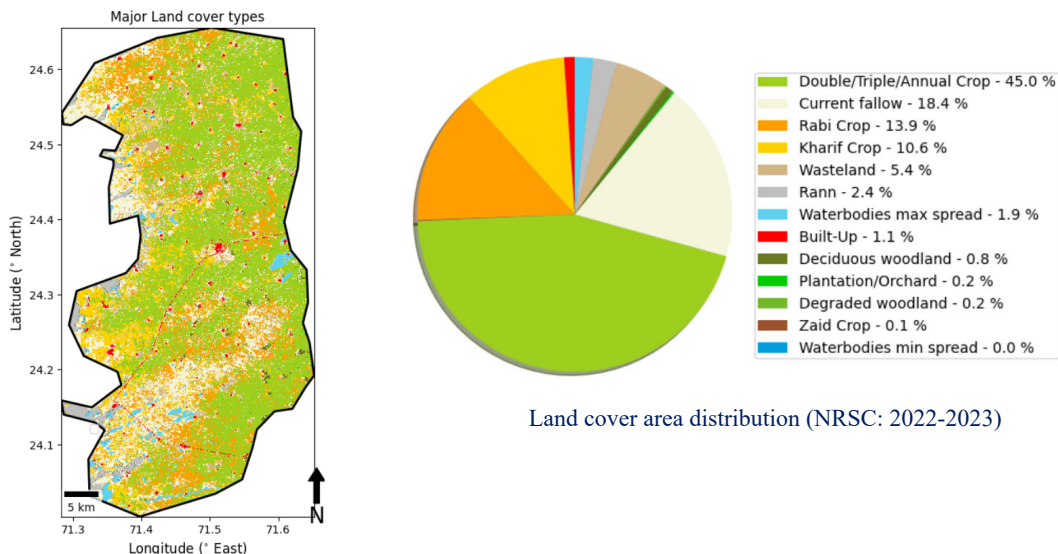
Handy, instant and economical tools form a smart approach substituting a hard work on field

Open access data sources used in analysis

Variable	Product	Spatial Resolution (m)	Temporal Resolution	Source	Availability
Elevation	AW3D30	30	--	<a href="https://www.eorc.jaxa.jp/ALOS/en/aw3d30/index.htm">https:// www.eorc.jaxa.jp/ALOS/en/aw3d30/index.htm</a>	--
Land cover	NRSC 250k	56	Annual	<a href="https://www.nrsc.gov.in/EO_LULC_Objective">https:// www.nrsc.gov.in/EO_LULC_Objective</a>	2005-
Net Primary Production	WaPOR v3	300	Monthly	<a href="https://wapor.apps.fao.org/">https:// wapor.apps.fao.org/</a>	2018 -
Actual Evapotranspiration	WaPOR v3	300	Monthly	<a href="https://wapor.apps.fao.org/">https:// wapor.apps.fao.org/</a>	2018 -
Precipitation	IMD	27750	Daily	<a href="https://mausam.imd.gov.in/">https:// mausam.imd.gov.in/</a>	1981 -

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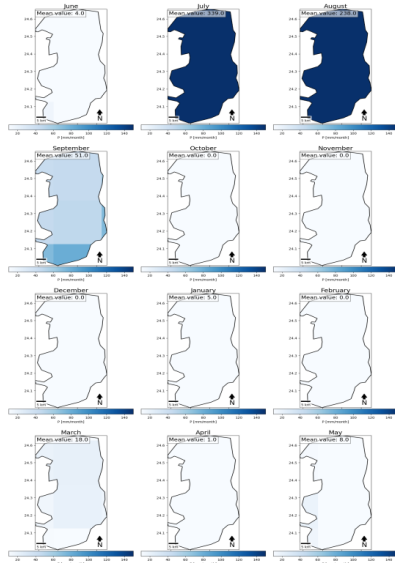
## Technology Can Take Us Much Beyond Accounting



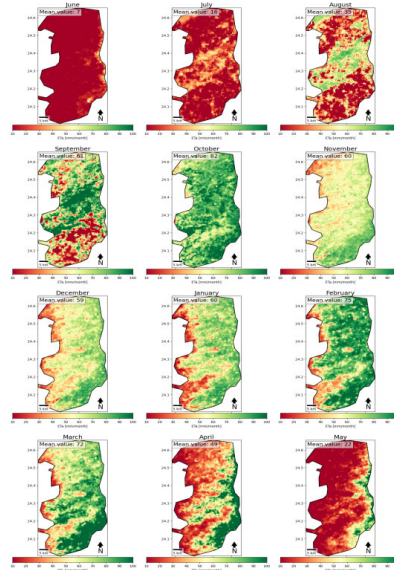
Land cover map (NRSC: 2022-2023) of study area

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## Technology Can Take Us Much Beyond Accounting



Monthly precipitation from June to May (2022-2023)

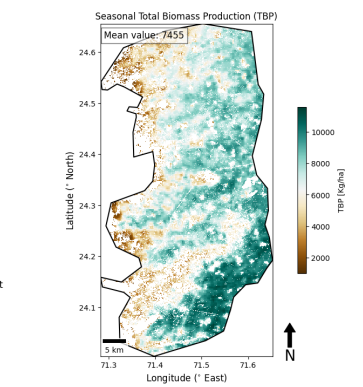
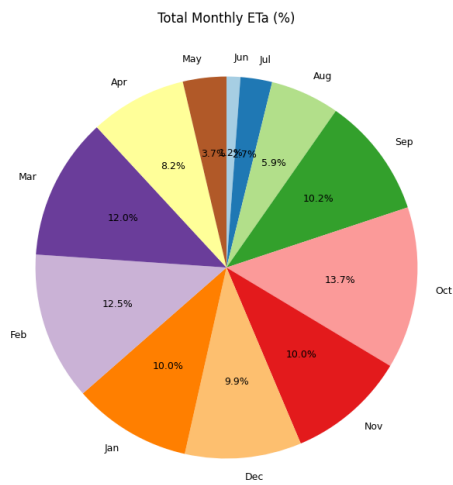


Monthly actual evapotranspiration (ETa) from June to May (2022-2023)

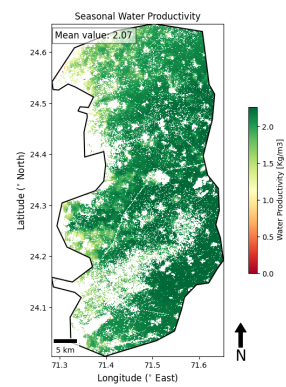
11

## Technology Can Take Us Much Beyond Accounting

### Water and land Productivity



Seasonal TBP (Kg/ha) over cropland



Seasonal Water Productivity (Kg/m³) map over cropland

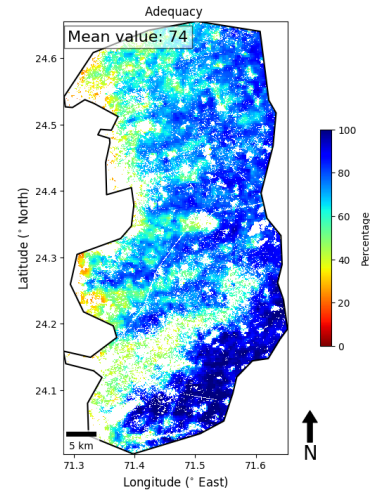
12

## Technology Can Take Us Much Beyond Accounting

### Adequacy

Mapping adequacy of water over cropland provide insights about lack of water availability spatially and support investment decisions that aim at improving equity in service delivery across the cropped area

Head-tail discrepancies could be easily identified in multiple ways

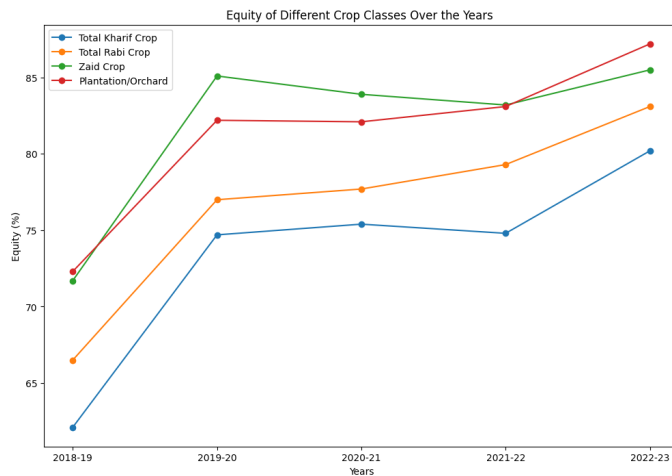


Adequacy during the assessment season (November – March)

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## Technology Can Take Us Much Beyond Accounting

### Equity



- Equity is assessed by evaluating the uniformity of water distribution across agricultural lands.
- It is  $1-C_V$  of actual evapotranspiration (ETa) for each agricultural land use class, where  $C_V$  is the coefficient of variation.
- A higher value of  $1-CV$  indicates more equitable water distribution, as it reflects lower variability in ETa

Results of calibration and retrofitting of canal network in 2021 onwards are encouraging

Head-tail discrepancies could be easily identified in multiple ways

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**THANKS**

