Water balance for POCRA

Update meeting

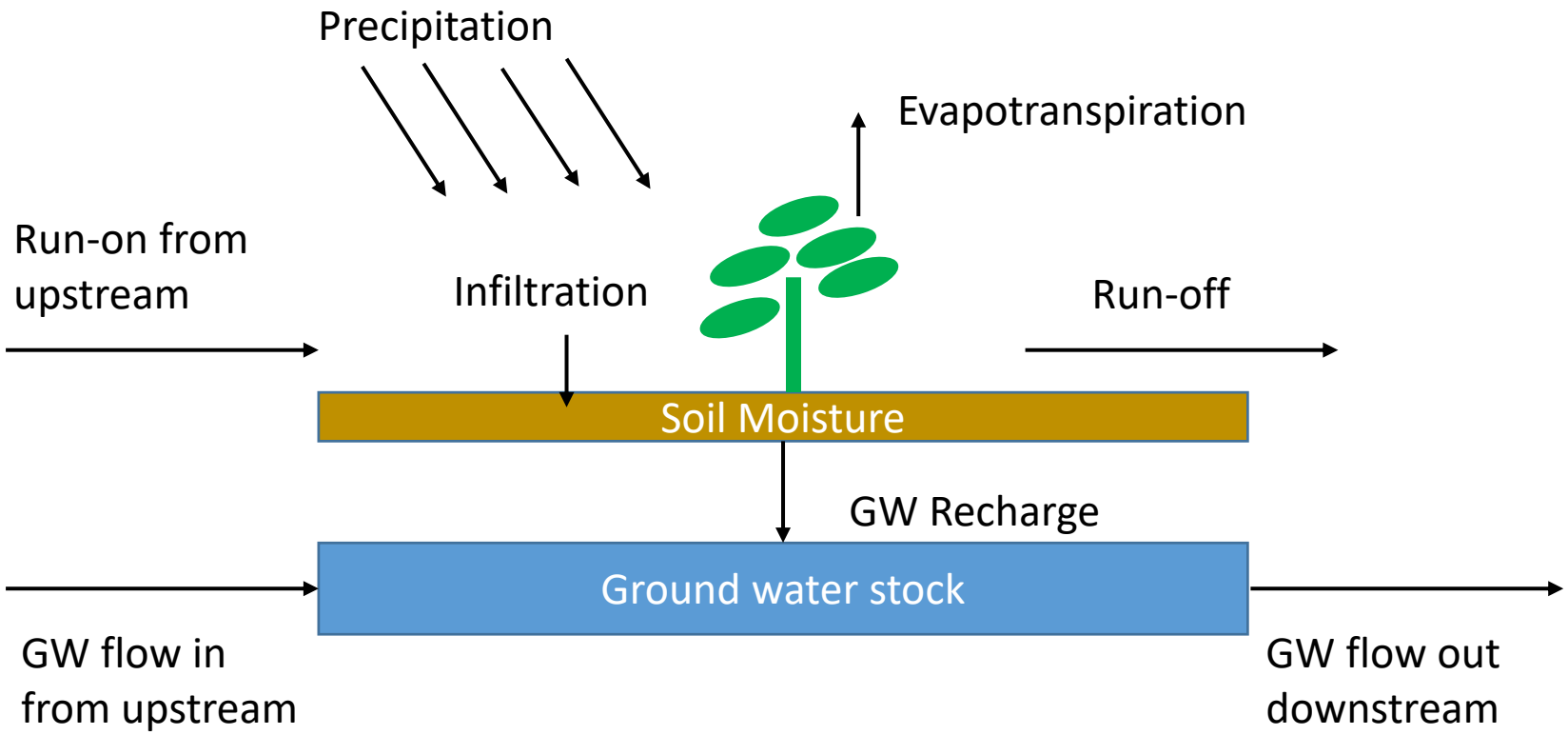
12/9/2011

CTARA, IITB

Project Objective

- Design of series of tools to help answer core questions of water availability assessment and water balance using both supply side analysis (SW, GW) as well as demand side analysis *(PoCRA MoU)*
- Output to feed into watershed development plans for the cluster
- To be validated in pilot watersheds

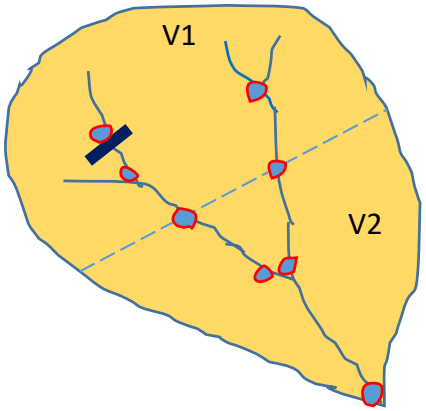
Components of water balance



- Other considerations:
  - Watershed as the unit of analysis
  - Village as the unit for planning
  - Different land-use patterns (spatial)
  - Seasonal balance (Kharif, Rabi)

Key Outputs

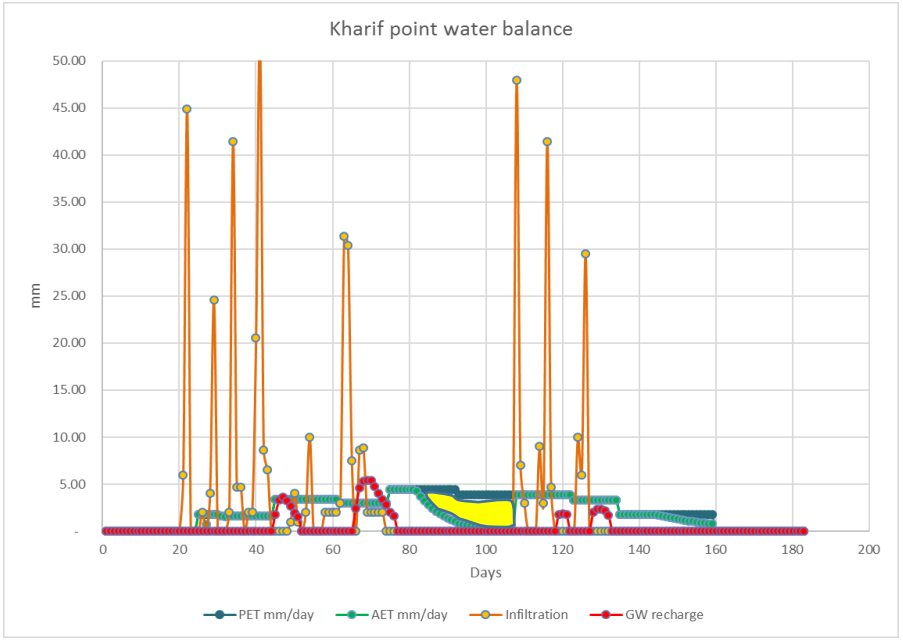
- Run-off at key locations
  - Indicates run-off available over time at key locations within a stream (e.g. at village crossings, stream joining, current structure locations etc.)
  - Inputs: Rainfall pattern, soil properties, LULC, slope



- Vulnerability maps (Kharif deficit)
  - Village level maps that indicate agricultural zones within village which are likely to be vulnerable due to poor soil type, soil thickness and slope
  - Inputs: Rainfall pattern, soil properties, LULC, slope, typical Kharif crops
- Zone level GW stock (Rabi balance)
  - Indicates groundwater stock availability in various agricultural zones based on given cropping pattern
  - Inputs: GW prospect maps…

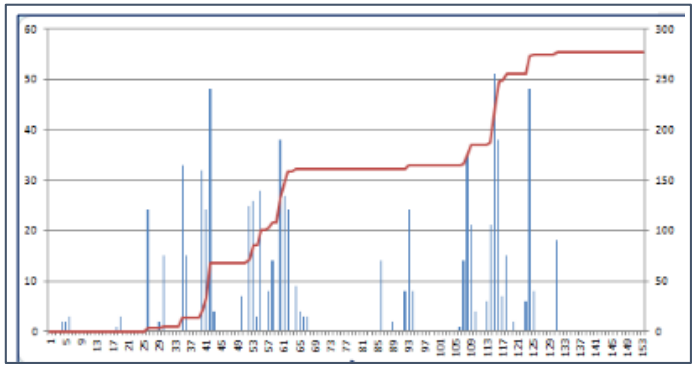
Kharif Vulnerability and Mitigation

- Objective and use: To identify and indicate agricultural zones within a village that are prone to Kharif stress especially during dry spells
- Procedure:
  - Demand side: Estimating irrigation requirement (PET-AET) at a point
  - Inputs: Rainfall pattern, soil properties, LULC, slope, typical Kharif crops



Kharif Vulnerability and Mitigation

- Supply side procedure:
  - Estimating available run-off in nearby stream by aggregating the point model



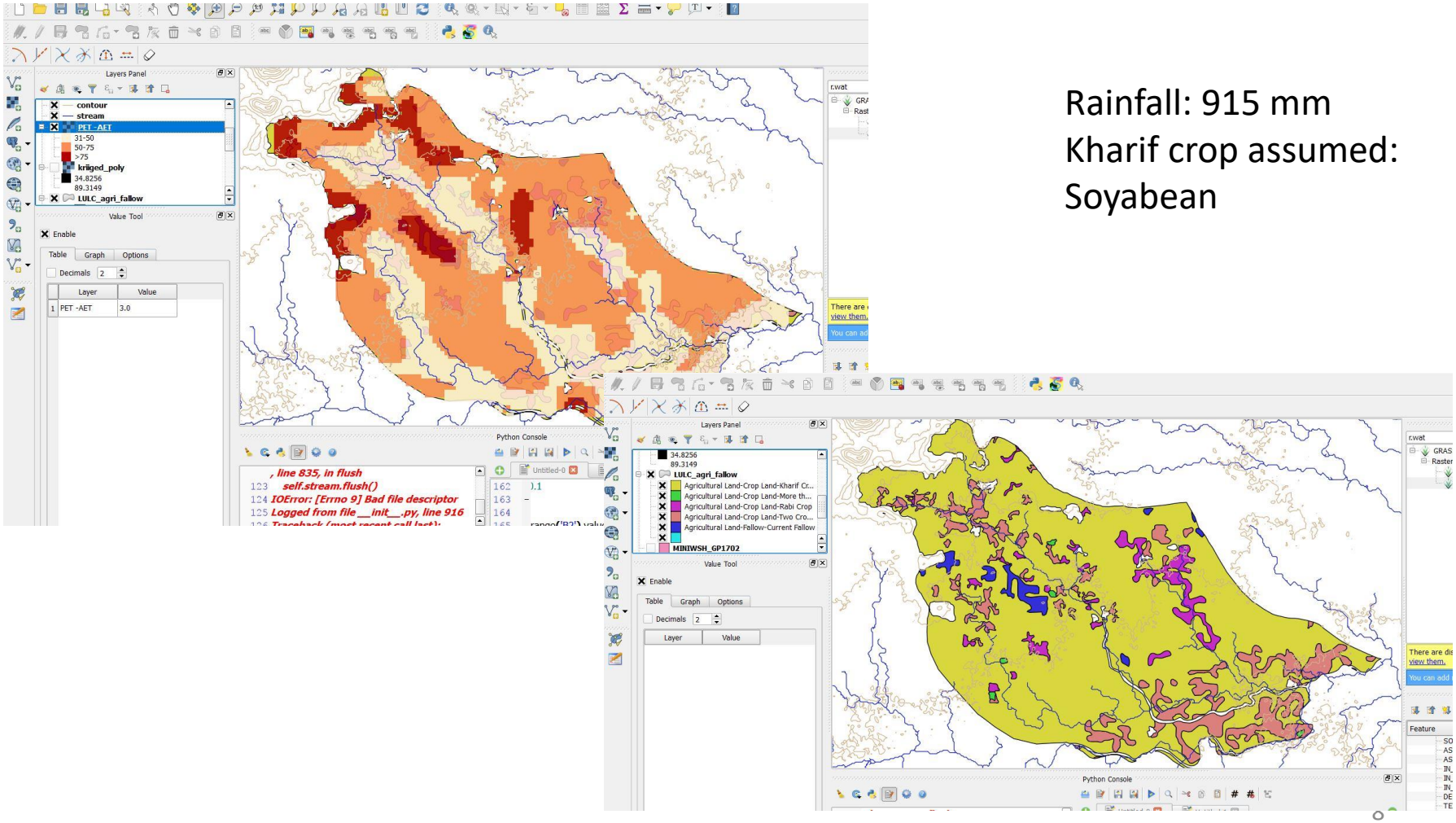
- Matching Kharif protective irrigation demand to available run-off to generate vulnerability zones
- Considerations
  - Different rainfall and dry-spell scenarios
  - Cropping pattern: typical crops vs. actual cropping pattern

Kharif vulnerability and mitigation: Methodology

- Kharif protective irrigation requirement
  - Point-level daily water balance model taking daily rainfall, soil parameters and daily crop PET as input and point run-off, soil moisture, AET and point GW recharge as output
  - Run-off calculation using curve number, a simplified model that assumes soil as a single layer/ 2 layers
  - Generating PET-AET zone maps

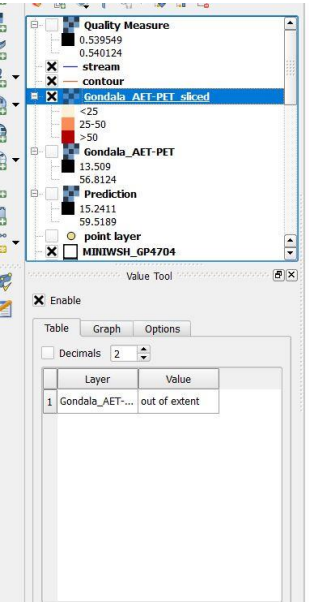
- Scientific validity:
  - Validation of output against SWAT
  - Field level validation of model input and output in pilot clusters

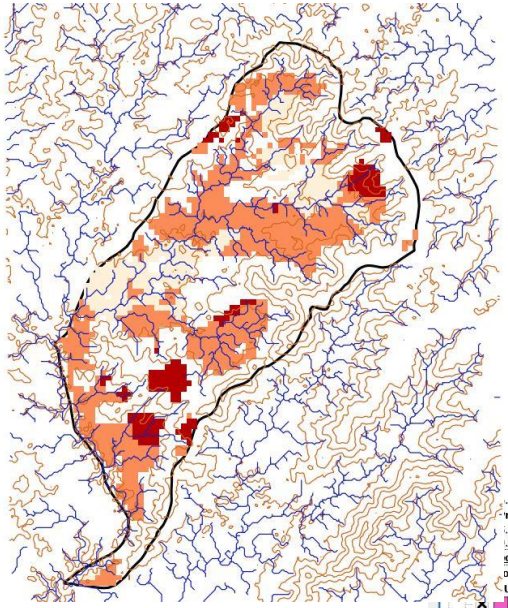
Sample PET-AET maps: Bajar Wahegaon

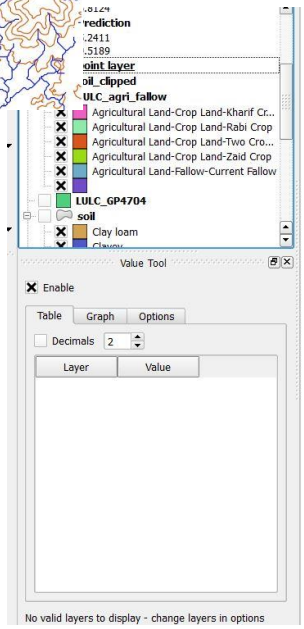


Rainfall: 915 mm
Kharif crop assumed: Soyabean

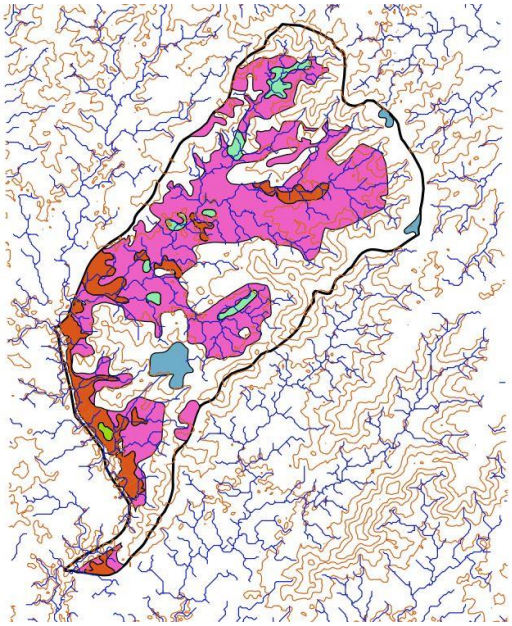
Sample PET-AET maps: Gondala







Rainfall: 837 mm
Kharif crop assumed: Soyabean



Run-off map

- Method:
  - Point level run-off calculation using SCS Curve number methodology
    - Inputs: Rainfall, LU type, soil type, slope
  - Run-off aggregation by demarking the catchment area for point of interest
    - Inputs: location of current interventions
- Model validation:
  - Validation of output against SWAT
  - Field level validation of key outputs in pilot clusters

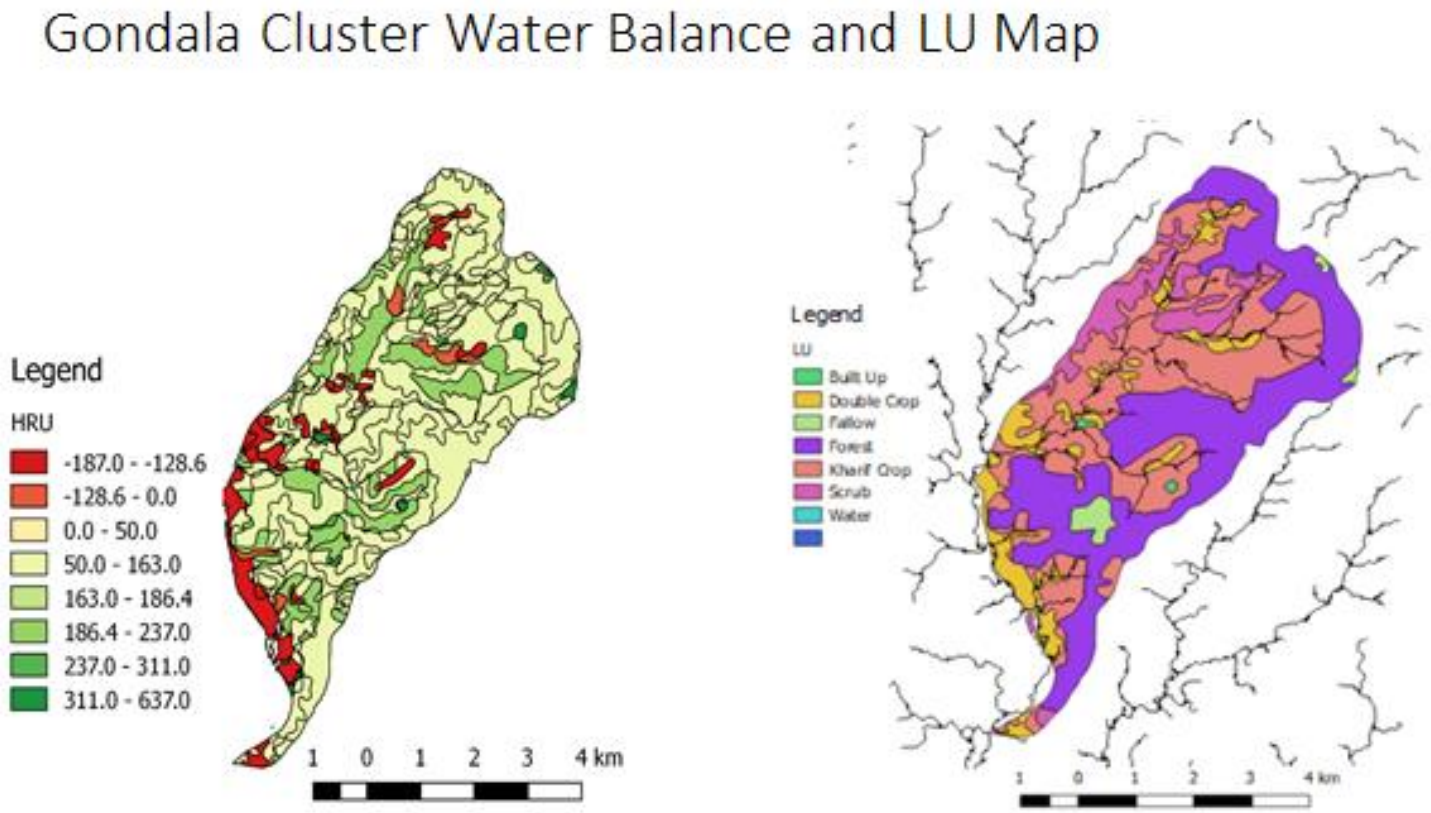
GW Stocks and Rabi balance

- Objective and use: A simplified model to indicate the groundwater availability at the end of Kharif and during Rabi season for different agricultural zones in a village. This is useful to determine zone wise water balance for Rabi based on given cropping pattern
- Needs to consider ground water in-flow and out-flow
- Inputs: In addition to inputs for Kharif balance, needs groundwater prospect maps, aquifer properties like specific yield.

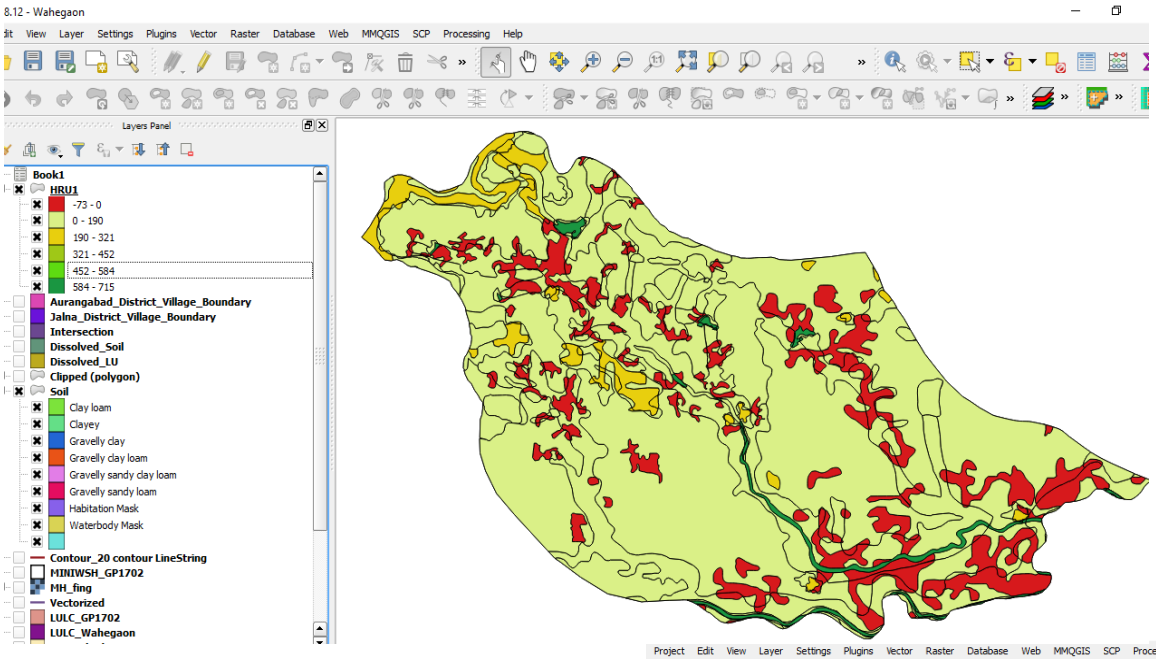
GW Stocks and Rabi balance

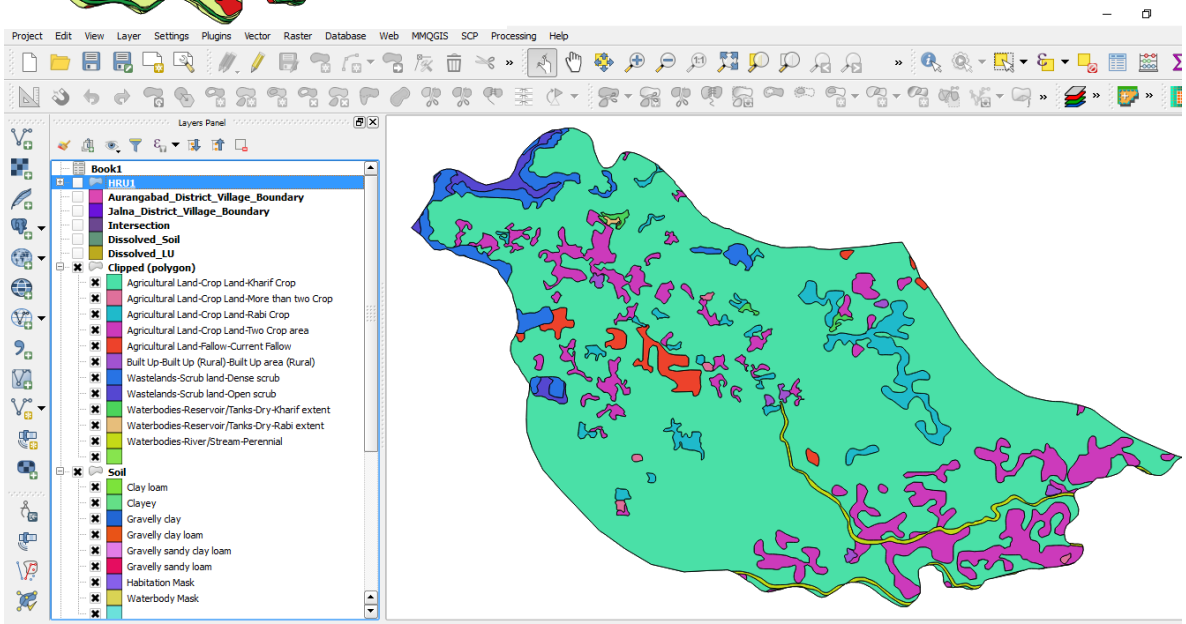
- Methodology:
  - Point wise model (same as Kharif model) used to estimate point level GW recharge during monsoon months
  - Aggregation at zone level by creating zones of roughly similar GW behavior
  - Estimation of fraction of GW inflow and outflow and time-delay/ conductivity
- Model validation:
  - Validation of output against Modflow
  - Field level validation of key inputs and outputs in pilot clusters

Sample image: Gondala

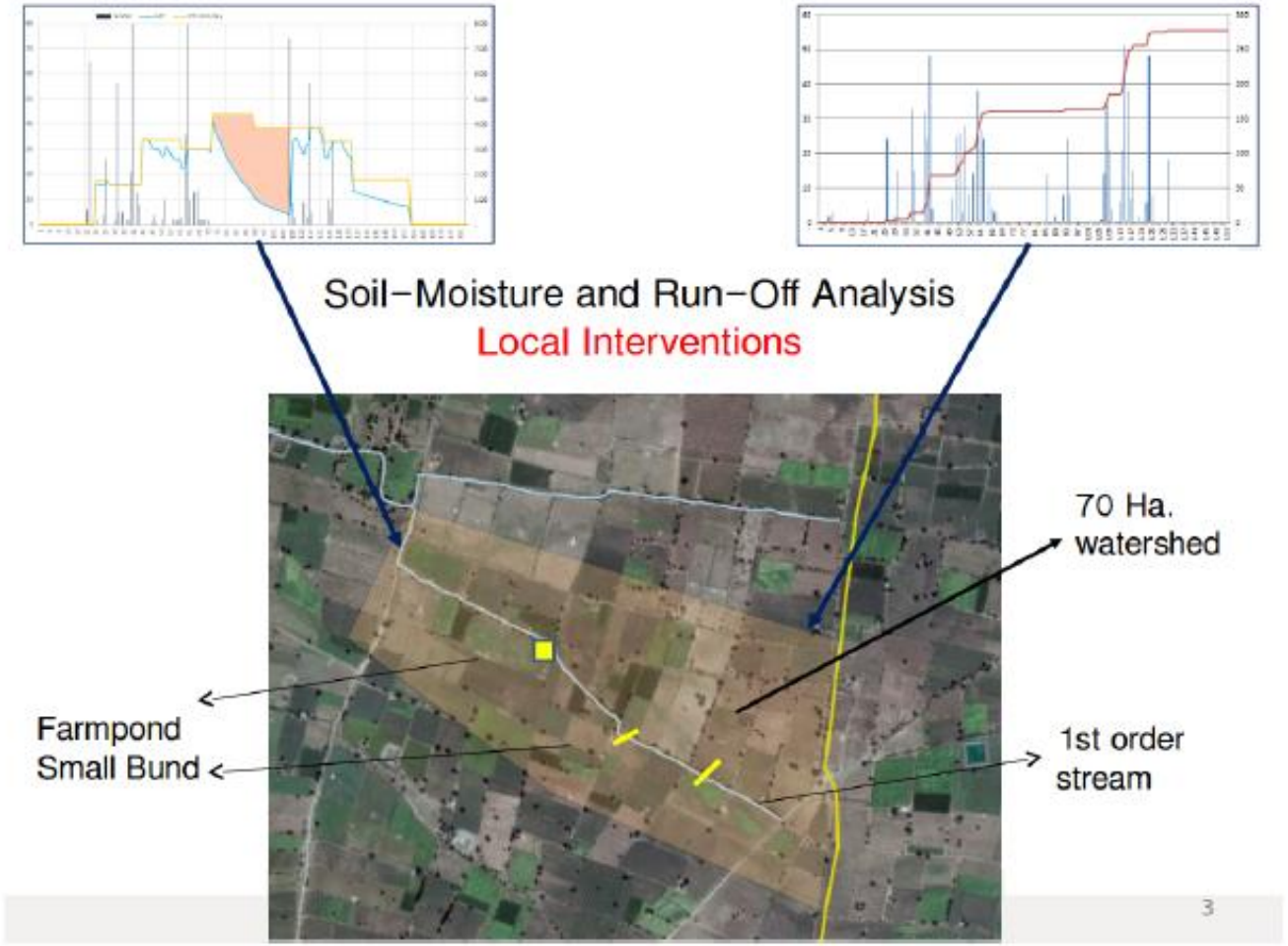


Sample maps: Bajar Wahegaon



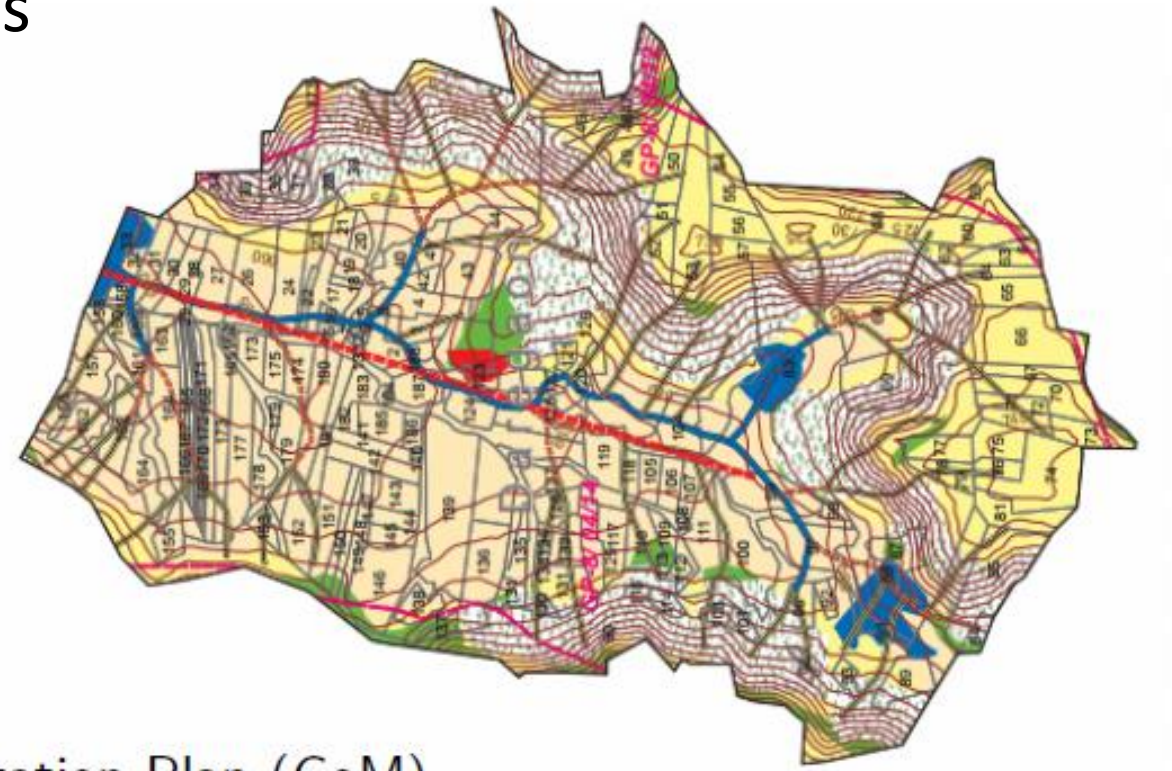


Putting it together



GoM JYS “action” plan

- Mapping zones to recommended watershed activities



Implementation Plan (GoM)

Next steps

- Technical development
  - Point-level water balance validation against SWAT (ongoing)
  - Aggregated run-off analysis (ongoing)
  - QGIS coding and representation (ongoing)
  - GW model development (under design)
- Template/format process development (to be designed)
  - Process : POCRA PMU/IT, CTARA, microplanning team
  - Data collection and validation formats
- Reporting and validation:
  - Preliminary report on model selection: 16th Sep
  - Field visit and model validation in Hingoli and Jalna pilot clusters : Sep 22-24
- Data needed
  - Year wise LULC
  - GW potential
  - Better DEM, contour
  - Stream map

Thank you!