Validation of Plugin Output

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Objective:

This document provides the procedure followed to validate/check the input dataset, plugin functionality, and its water balance outputs namely -

- 1. Input dataset
 - a. 15 District folders with its clusters folders for that district
 - b. Presence of Soil, LULC, Cadastral, Slope, Drainage shapefiles and Rainfall and ET0 '.csv' files in cluster folder
 - c. Rainfall files default average rainfall and last 5 year rainfall for all circles in the cluster
 - d. Appropriate ET0 file for that cluster
- 2. Functionality
 - a. Outputs generation village wise excel water balance files, crop wise vulnerability maps in QGIS window, cluster water balance excel output for all villages
 - b. Runs for all crops shown in plugin
 - c. Gives agricultural as well as non-agricultural water balance for each zone irrespective of agricultural or non-agricultural area being present in zone.
 - d. Runs for average rainfall year for revenue circle of each village
 - e. Runs on first circle in default rainfall file for matching rainfall circle with revenue circle, not available on maharani website
- 3. Excel water balance output for cluster villages Technical validation

Outcomes:

The outcome is a functionally and technically validated plugin with its input dataset – which generates results as per SWAT based excel point model.

Procedure:

One time functionality check

- 1. Checked the input dataset folders for presence of 15 district folders with its cluster folders in the districts
- 2. Checked for presence of soil, LULC, slope, drainage shapefiles and rainfall, ET0 '.csv' files in cluster folders
- 3. Checked if separate village output files appear in cluster folder after running the plugin
- 4. Checked if the plugin runs for all 27 kharif, long kharif, annual and 13 rabi crops available in selection list and those outputs appear in village output file
- 5. Checked if 6 LU types (Non ag, current fallow, permanent fallow, scrub, forest, wasteland) appear in each zone irrespective of that zone having/not having non-agricultural area in LU map– permanent fallow, current fallow, wasteland, scrub and forest.

- 6. Checked if balance for all selected agricultural crops appears in each zone irrespective of that zone having/not having agricultural area in LU map.
- 7. Checked the English, Marathi, Crop season mapping and LU mapping
- 8. Checked with Nano stuff if Marathi crop names in PoCRA microplanning app match with Marathi crop names in plugin excel output. As these crop names are picked by PoCRA microplanning app from plugin excel output.
- 9. Checked if PET of crops is as per WALMI CWR range
- 10. Checked if vulnerability map for all selected agricultural crops is generated in QGIS window after running the plugin.

Technical Validation of Excel output:

Following table lists the attributes generated in excel output file of plugin and the method followed for validation of each. Most of these attributes are interrelated and so checked together using simple arithmetic. The method to check is based on the fact that the components of rainwater after rainfall - runoff, soil moisture (SM), Ground Water (GW), Actual Crop Evapotranspiration (AET) get added to be equal to rainfall. Other attributes are checked using available input files.

The validation is done by taking a random sample crop from a random sampled zone, from a random sample of village output file. The is done for 3 - 4 samples.

			Check method on
			random samples in
Sr. no.	Village Name	Validation check	output file
			check with zone shapefile
1	Census Code	Yes	- attribute table
			checked together by
2	Zone	Yes	matching zone name with
			zone area in excel output
			with zone shape file
			attribute table for random
3	Zone Area (ha)	Yes	2-3 zones in a village
4	Crops in English	-	verify if it is displayed
5	Crops in Marathi	-	correctly - marathi crop
			matches with its english
			version, crop season and
6	Crop Season and Landuse	-	LU type
			check with rainfall file -
			upto monsoon end date
			and the rainfall for village
7	Rainfall (mm)	Yes	revenue circle
			Sum of Monsoon end and
			post monsoon PET
			checked with crop end
			PET - for Long kharif,
8	PET Monsoon End	Yes	annual crops

Table 1 Technical validation Method

			Check method on
			random samples in
Sr. no.	Village Name	Validation check	output file
			AET+GW+SM monsoon
			end checked with
9	AET Monsoon End	Yes	Infiltration monsoon end
			difference check PET –
10	Monsoon Deficit(PET-AET)	Yes	AET
			AET+GW+SM monsoon
			end checked with
11	GW Recharge in Monsoon	Yes	Infiltration monsoon end
			Runoff + Infiltration in
			monsoon checked with
12	Runoff in Monsoon (mm)	Yes	rainfall in monsoon
			AET+GW+SM monsoon
			end checked with
			Infiltration monsoon end,
			also checked the SM
			values for small crops -
13	Soil Moisture Monsoon end	Yes	lies in similar range
			Sum of Monsoon end and
			post monsoon PET
			checked with crop end
14	Post Monsoon PET	Yes	PET
			1.Runoff + Infiltration in
			monsoon checked with
			rainfall in monsoon.
			2.AET+GW+SM
			monsoon end checked
			with Infiltration monsoon
15	Infiltration in Monsoon (mm)	Yes	end
			compared with monsoon
16	Soil Moisture Crop end	Yes	end and post monsoon pet
			compared relatively with
			monsoon end AET for
			Long Kharif and annual
17	AET Crop End	Yes	crops
			Checked if it lies in
			WALMI CWR range (one
18	PET Crop End	Yes	time)
			checked with crop end
19	Crop duration Deficit(PET-AET)	Yes	difference PET-AET
			corelated to post monsoon
20	Post Monsoon Ground Water	Yes	rainfall
			corelated to post monsoon
21	Post Monsoon Runoff	Yes	rainfall events
			Check with rainfall file
22	Rainfall Year	Yes	year and 5 year rainfall

Sr. no.	Village Name	Validation check	Check method on random samples in output file
			file for average rainfall year

Sample Validation check:

Example 1 : Wadhavi Village – Zone 2 (Agricultural Zone) – Washim Cluster

Following is the sample check on Wadhavi village zone 2 – complete agriculture zone. Few crop samples shown in Table 2 are checked here. The 5 Non-agricultural LU types have also got generated for this agricultural zone from plugin – as per functional requirement.



Figure 1 Wadhavi – Zones Landuse map (Zone 2)

Table 2 Wadhavi Zone 2 Validation Table

Village Name	Wadhavi	Wadhavi	Wadhavi	Wadhavi	Wadhavi	Wadhavi	Wadhavi	Wadhavi
Census Code	530966	530966	530966	530966	530966	530966	530966	530966
	zone-	zone-	zone-	zone-		zone-	zone-	zone-
Zone	Wadhavi-2	Wadhavi-2	Wadhavi-2	Wadhavi-2	zone-Wadhavi-2	Wadhavi-2	Wadhavi-2	Wadhavi-2
Zone Area (ha)	60	60	60	60	60	60	60	60
Crops in					permanant fallow			
English	Cotton	fodder_crop	soyabean	Gram	crop	wasteland	Scrub	forest
0		खरीप चारा			कायम पड			
Marathi	कापूस	पिके	सोयाबीन	रबी हरभरा	(गावठाणसह)	पोटखराबा	गायरान	वनक्षेत्र
Crop Season								
and Landuse	Long_kharif	Kharif_Main	Kharif_Main	Rabi	Landuse	Landuse	Landuse	Landuse
Rainfall (mm)	473	473	473	473	473	473	473	473
PET Monsoon								
End	551	335	411	0	165	349	385	531
AEI Monsoon	216	241	070	0	145	070	200	220
Monsoon	310	241	213	0	145	212	300	320
Deficit(PET-								
AET)	235	94	138	0	20	77	77	211
GW Recharge		_						_
in Monsoon	3	5	3	0	9	4	6	(
Runoff In Moncoon								
(mm)	113	155	137	0	253	139	101	90
Soil Moisture	110	100	107	Ŭ	200	100	101	
Monsoon end	41	72	60	0	65	57	58	55
Post Monsoon								
PET	312	0	0	250	0	204	296	326
Infiltration in								
Monsoon								
(mm)	360	318	336	0	220	334	372	383
Soil Moisture				•				
Crop end	1	38	14	0	39	1	1	1

Village Name	Wadhavi	Wadhavi	Wadhavi	Wadhavi	Wadhavi	Wadhavi	Wadhavi	Wadhavi
Census Code	530966	530966	530966	530966	530966	530966	530966	530966
	zone-	zone-	zone-	zone-		zone-	zone-	zone-
Zone	Wadhavi-2	Wadhavi-2	Wadhavi-2	Wadhavi-2	zone-Wadhavi-2	Wadhavi-2	Wadhavi-2	Wadhavi-2
Zone Area (ha)	60	60	60	60	60	60	60	60
Crops in				-	permanant fallow			
English	Cotton	fodder_crop	soyabean	Gram	crop	wasteland	Scrub	forest
AET Crop End	356	241	273	0	145	328	364	374
PET Crop End	863	335	411	0	165	553	681	857
Crop duration								
Deficit(PET-	507	0.1	400		00	005	047	40.4
AEI) Best Menseen	507	94	138	0	20	220	317	484
Ground Water	0	18	5	0	11	1	1	0
Post Monsoon								
Runoff	0	0	0	0	0	0	0	0
Validation								
Check								
Monsoon end								
(AET+SM+GW		0.4.0		2		004	070	
) = Inflitration	360	318	336	0	220	334	372	383
Monsoon (Infiltration								
(IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII								
Rainfall	473	473	473	0	473	473	473	473
Monsoon								
Deficit =								
Monsoon end								
(PET-AET)	235	94	138	0	20	77	77	211
Post Monsoon								
PET+PET								
PET Crop								
End	863	335	411	250	165	553	681	857
Crop duration	000	000		200	100	000	501	001
Deficit = Crop								
end (PET-AET)	507	94	138	0	20	225	317	484

*All values are in mm **The validation part and matched output part are highlighted in same colour

The technical validation check has been done on 8 random sample crops from Wadhvi zone 2 spanning across all seasons. Cotton - Long Kharif crop, Fodder, Soybean – Kharif Crops, Gram/Harbara – Rabi Crop, 5 LU types – Permanent fallow, Current fallow, Wasteland, Forest and Scrub. The technical validation shows that plugin is giving appropriate results. This has also been validated that the plugin gives output for 5 Non ag LU types for complete Agricultural zones also.

Example 2: Vayale Village – Zone 3 (Non agricultural Zone) – Jalgaon Cluster



Figure 2 Vayale Zones – Landuse Map (Zone 3)

Table 3 Vayale Zone 3 Validation Table

Village Name	Vayale	Vayale	Vayale	Vayale	Vayale	Vayale	Vayale	Vayale	Vayale
Census Code	526990	526990	526990	526990	526990	526990	526990	526990	526990
	zone-	zone-Vayale-	zone-	zone-			zone-	zone-	zone-
Zone	Vayale-3	3	Vayale-3	Vayale-3	zone-Vayale-3	zone-Vayale-3	Vayale-3	Vayale-3	Vayale-3
Zone Area (ha)	292.3	292.3	292.3	292.3	292.3	292.3	292.3	292.3	292.3
Crops in					current fallow	permanant fallow			
English	maize	Pomegranate	sorghum	rabi_wheat	crop	crop	wasteland	scrub	forest
Crone in						कायम पड			
Crops in Marathi	खरीप मका	डालिंब	खरीप ज्वारी	रबी गह	ਹਾਕ ਧਤ	(गावठाणसह)	पोटखराबा	गायरान	वनक्षेत्र
Crop Season	Gitterin	01100-1							-1-1-41-1
and Landuse	Kharif_Main	Annual	Kharif_Main	Rabi	Landuse	Landuse	Landuse	Landuse	Landuse
Rainfall (mm)	469	469	469	469	469	469	469	469	469
PET Monsoon									
End	442	134	333	0	144	144	306	336	462
AET Monsoon									
End	275	134	259	0	113	113	219	281	340
Monsoon									
Deficit(PEI-	167	0	75	0	24	21	07	FF	100
GW Bochargo	107	0	75	0	31	31	0/	00	122
in Monsoon	a	21	11	0	21	21	16	12	10
Runoff in	3	21		0	21	21	10	12	10
Monsoon									
(mm)	120	233	160	0	246	246	165	117	78
Soil Moisture									
Monsoon end	64	80	40	0	89	89	69	59	41
Post Monsoon									
PET	0	916	66	500	0	0	200	298	308
Infiltration in									
Monsoon	0.40	000	000	0	000	000	004	050	004
(mm) Soil Moioture	349	236	309	0	223	223	304	352	391
Crop and	15	1	л	0	66	66	1	1	1
	10	1	4	0	00	00	1	207	200
AET Grop End	275	210	295	0	113	113	283		380

PET Crop End	442	1050	399	0	144	144	506	633	769
Crop duration									
AET)	167	840	105	0	31	31	222	297	389
Post Monsoon									
Ground Water	15	3	0	0	40	40	4	2	0
Post Monsoon Runoff	0	0	0	0	0	0	0	0	0
Validation									
Check									
Monsoon end (AET+SM+GW)									
= Infiltration	349	236	309	0	223	223	304	352	391
Monsoon (Infiltration + Runoff) =									
Rainfall	469	469	469	0	469	469	469	469	469
Monsoon Deficit = Monsoon end (PET-AET)	167	0	75	0	31	31	87	55	122
Post Monsoon PET+PET Monsoon end = PET Crop									
End	442	1050	399	500	144	144	506	633	769
Crop duration Deficit = Crop end (PET-AET)	167	840	105	0	31	31	222	297	389

Vayale Village Zone 2 is a complete Non Agricultural Zone: It has been validated that Agricultural Crops water balance is being generated for complete non agricultural zones also and technical validation on random crop samples in this zone also shows that plugin is giving an appropriate water balance output.

Conclusion

The functionalities mentioned below -

- 1. Village wise output files for all villages in cluster
- 2. Plugin running for all set of displayed crops
- 3. 6 Non-Agricultural LU types (Permanent Fallow, Current Fallow, Scrub, Forest, wasteland, Non Agricultural) are being generated as output for each zone irrespective of it having/not having Non-agricultural land in LU map.
- 4. Agricultural crop output is being generated for each zone irrespective of it having or not having agricultural land in its LU map.
- 5. English-Marathi-Crop season and LU Mapping
- 6. Matching of Marathi crop names with Nanostuff Marathi crop names for PoCRA Microplanning App.
- 7. PET of crops as per WALMI CWR range
- 8. Vulnerability maps for all selected crops being generated in QGIS window
- 9. Average rainfall year is chosen for each circle in default rainfall file and village budget is generated for its own revenue circle average rainfall year

Input datasets -

- 1. Presence of Soil, LULC, Cadastral, Slope, Drainage shapefiles and Rainfall, ET0 '.csv' files in cluster folder
- 2. Presence of Rainfall files default average rainfall and last 5 year rainfall for all circles in the cluster
- 3. Presence of appropriate ET0 file for that cluster

Have been verified on random samples. The Plugin is working functionally and technically as per its objectives.