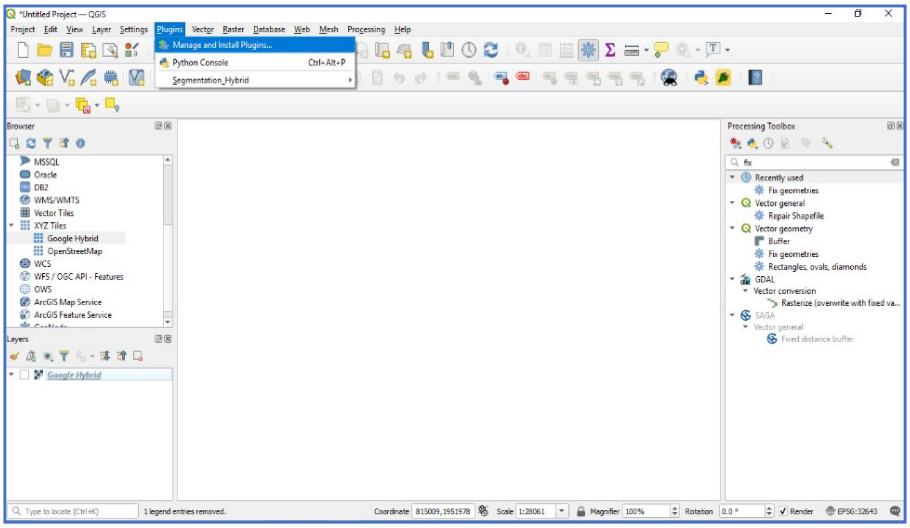
**ML-CLAS: Plug-in (Quick Guide for SVM and RF Algorithms)**

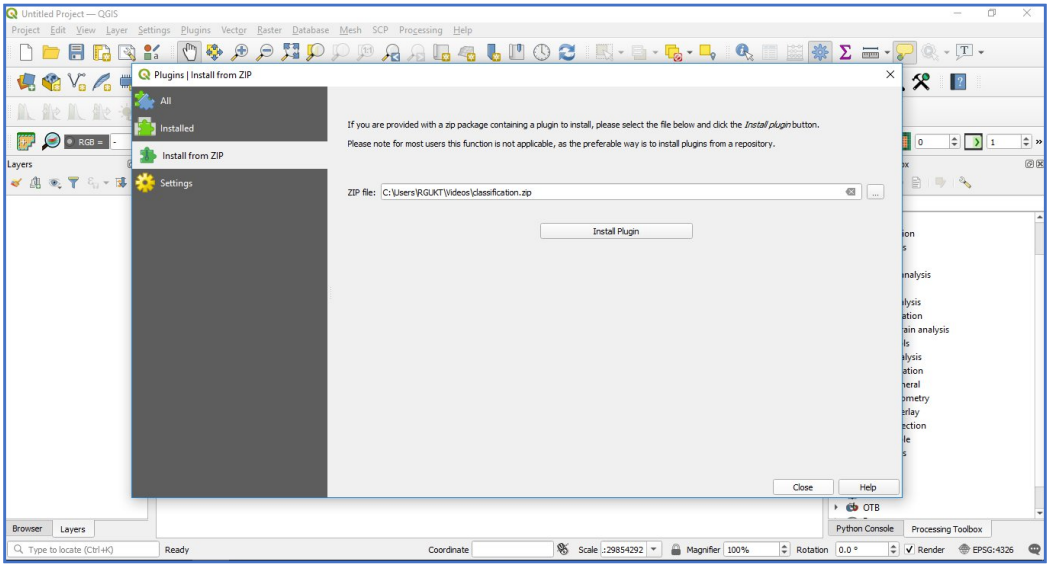
'ML-CLAS' (Machine Learning Classification for fragmented croplands) Crop Classification plug-in can perform parcel-based classification using segmented land parcels. It includes SVM_RF algorithms, where one can perform crop classification on Support Vector Machine (SVM) and Random Forest (RF) algorithms. Besides, another algorithm called TWDTW (Time Weighted Dynamic Time Warping) algorithm is also introduced in this plug-in. Prior to run SVM/RF or TWDTW we require a complex and repetitive procedure to modify the Raster & Vector data as per requirement. However, the 'ML-CLAS' plugin allows users to provide fewer inputs and produce desired outputs by achieving its default preprocess.

**Installation of plugin :**

1. Open QGIS. Go to **Plugins** in the Menu bar ⟶ click on **Manage and Install Plugins**.

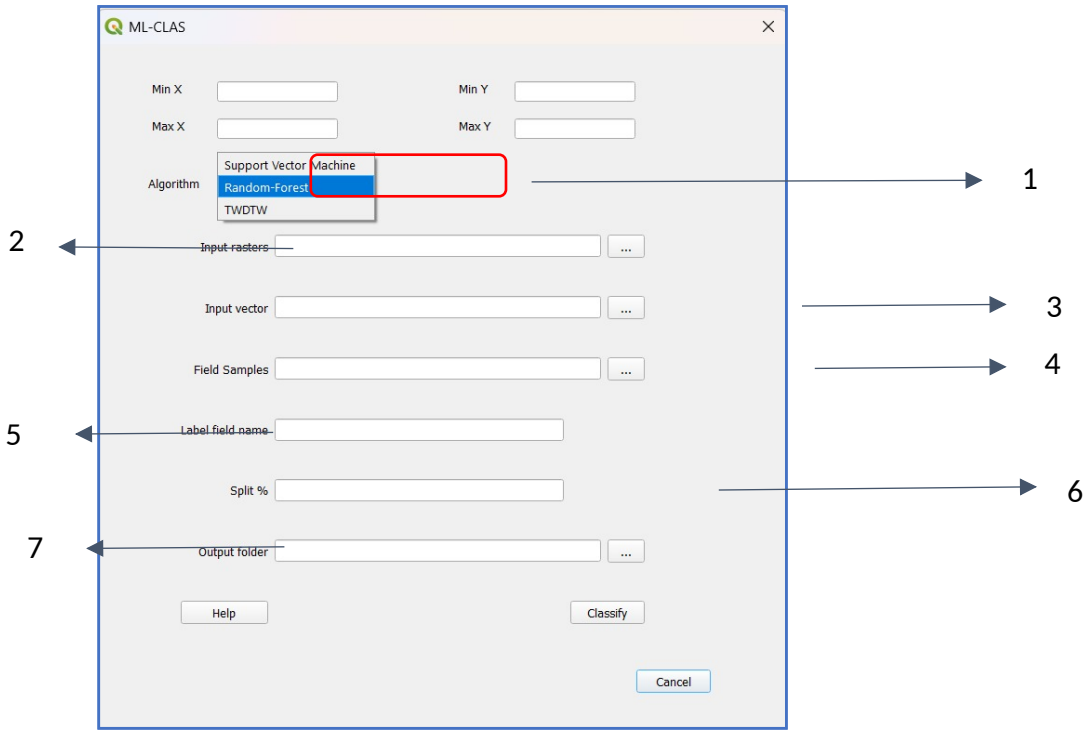



2. Click on **Install from ZIP** in the right panel ⟶ Load the **ML-CLAS.ZIP** (file provided) ⟶ Now click on **Install Plugin**.

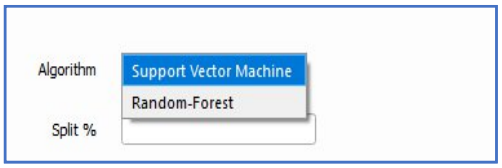


3. Finally, the plugin has installed and plugin icon appears on the top panel bar.
4. Click on that plugin icon and new dialog box named **ML-CLAS** will open (as shown below).

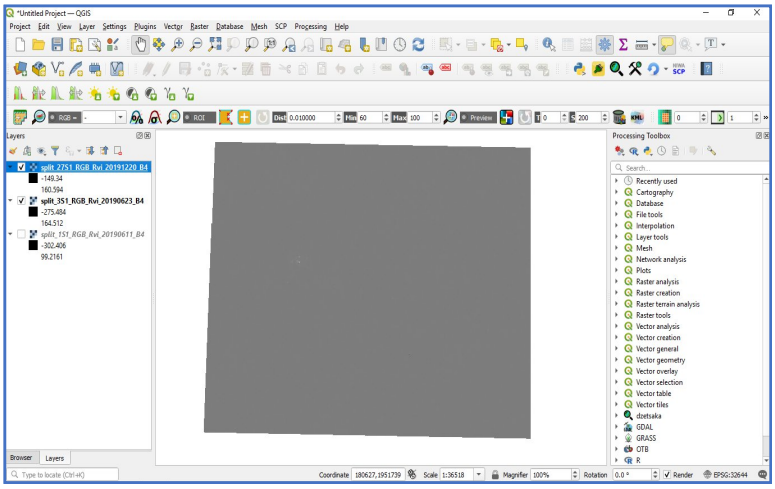
**ML-CLAS ; SVM_RF Inputs :**



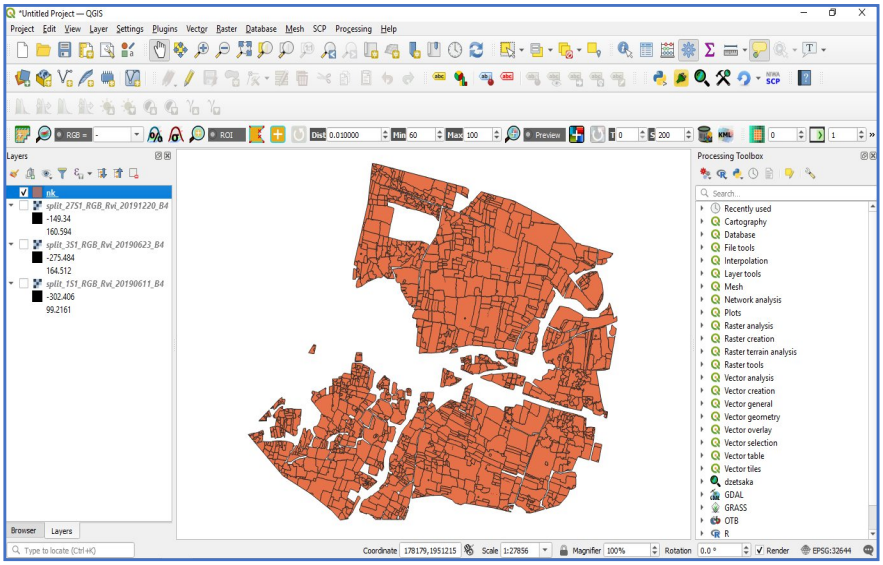

1. **Algorithm :**
   - The given plugin contains two well-known Classification algorithms :
     1) Random Forest
     2) Support Vector Machine
   - User has flexibility to select any of the algorithms.




2. **Input rasters :**
   - It takes one or more preprocessed satellite bands as input (i.e., TIF/raster image).
   - User can select multiple satellite bands in single click.

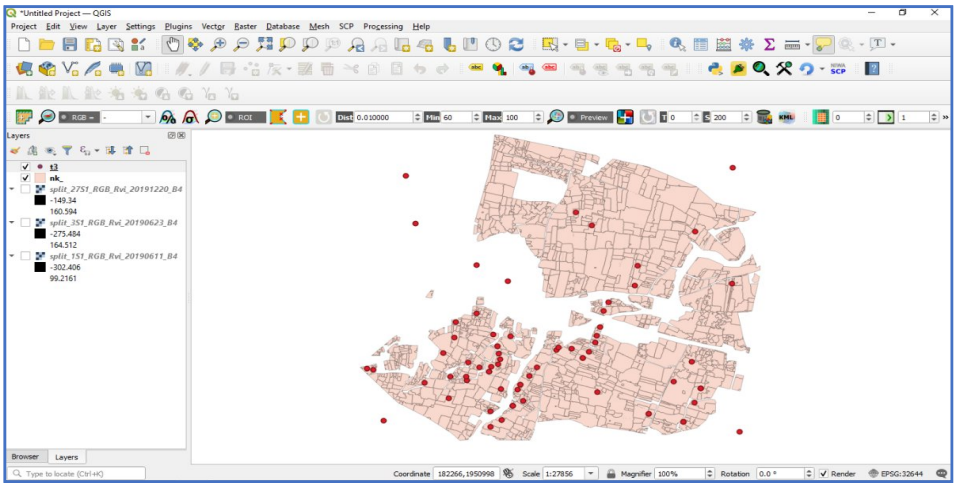


3. **Input vector :**
    - Segmentation should be done before the classification. So the output segmented land parcels (i.e.,agricultural field boundaries) of our region of interest obtained from segmentation is considered as an input vector. It takes **.shp** file only.



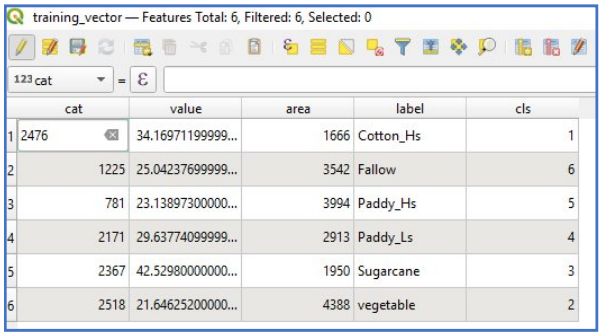
4. **Field samples :**
    - These are nothing but sample ground truth dataset obtains from field observations, which are provided to learn how to categorize new observations into other classes.
    - User should provide field observations as a vector data (i.e., points shown in below image)/**.csv** file.

- The input file must contain location details like latitude & longitude, data of sowing & harvesting and type of crop in that location.



5. **Label field name :**

- The given field observations involve various Classes and all those classes indicated with field name called “Label” (user has to enter “label” as it’s default input).



training_vector — Features Total: 6, Filtered: 6, Selected: 0

123 cat = ε

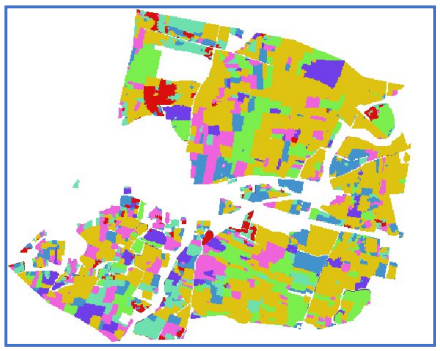
| | cat | value | area | label | cls |
|---|---|---|---|---|---|
| 1 | 2476 | 34.16971199999... | 1666 | Cotton_Hs | 1 |
| 2 | 1225 | 25.04237699999... | 3542 | Fallow | 6 |
| 3 | 781 | 23.13897300000... | 3994 | Paddy_Hs | 5 |
| 4 | 2171 | 29.63774099999... | 2913 | Paddy_Ls | 4 |
| 5 | 2367 | 42.52980000000... | 1950 | Sugarcane | 3 |
| 6 | 2518 | 21.64625200000... | 4388 | vegetable | 2 |

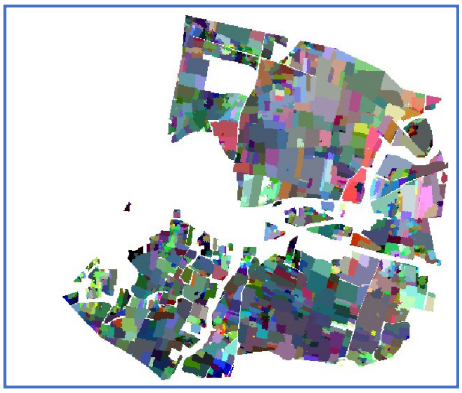
6. **Split %:**

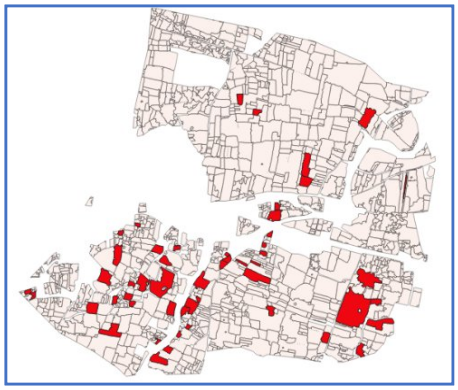
- The given data is divided into training data and validation data. Training data is a part of original data i.e., used to train the machine learning model whereas the validation data is used to check the accuracy of model.
- So in ML-CLAS crop classification plugin user should enter the percentage (%) of data for validation. Let’s assume 30% is your testing data then enter 30.

7. **Output Folder:**

- Select the output folder location where you want to save your Classification files.
- Click on **classify** to initiate the classification, once the operation has done following output files will appear in your output folder
- **NOTE:** All the required inputs are provided in the folder **“SourceFiles”.**







Confusion Matrix Report
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| | Fallow | cotton_HS | cotton_LS | paddy_HS | paddy_LS | sugarcane | vegetable | Total |
|---|---|---|---|---|---|---|---|---|
| Fallow | 9 | 1 | 2 | 0 | 1 | 0 | 0 | 13 |
| cotton_HS | 0 | 11 | 1 | 1 | 1 | 2 | 2 | 18 |
| cotton_LS | 0 | 1 | 19 | 0 | 0 | 1 | 1 | 22 |
| paddy_HS | 2 | 0 | 1 | 8 | 0 | 1 | 0 | 12 |
| paddy_LS | 1 | 1 | 0 | 0 | 10 | 1 | 2 | 15 |
| sugarcane | 1 | 1 | 2 | 0 | 2 | 14 | 2 | 22 |
| vegetable | 0 | 0 | 3 | 0 | 3 | 1 | 11 | 18 |
| Total | 13 | 15 | 28 | 9 | 17 | 20 | 18 | 120 |

Accuracy Metrics Report
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| | Fallow | cotton_HS | cotton_LS | paddy_HS | paddy_LS | sugarcane | vegetable |
|---|---|---|---|---|---|---|---|
| precision | 0.69 | 0.73 | 0.68 | 0.89 | 0.59 | 0.70 | 0.61 |
| recall | 0.69 | 0.61 | 0.86 | 0.67 | 0.67 | 0.64 | 0.61 |
| f1-score | 0.69 | 0.67 | 0.76 | 0.76 | 0.62 | 0.67 | 0.61 |

| | |
|---|---|
| Overall Accuracy | 68.33 |
| Kappa | 0.63 |