



Institute of Remote Sensing and Digital Earth
Chinese Academy of Sciences

Decision tree algorithm for crop type mapping using Landsat 8 optical satellite imagery

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Oral Presentation for The session: Crop Monitoring and Precision Agriculture

*6th Digital Earth Summit, Beijing
7-8 July 2016*



INTRODUCTION



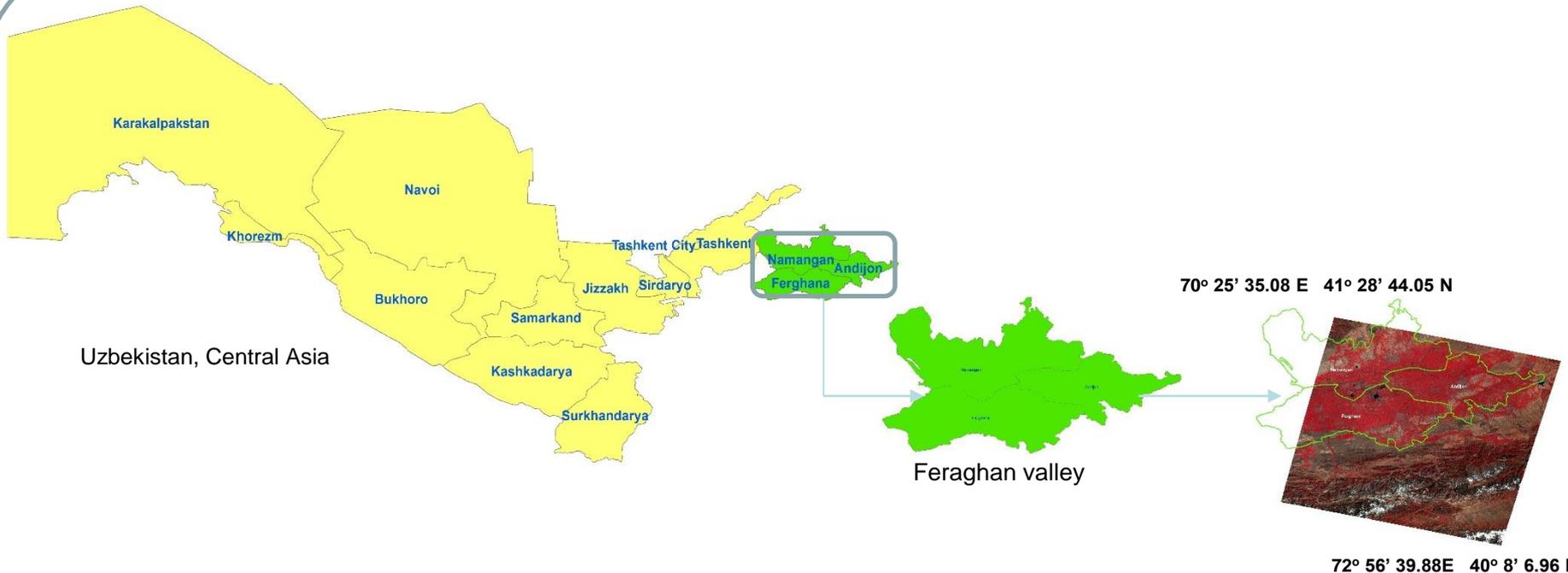
- ❖ Classification is a method by which labels or class identifiers are attached to the pixels making up a remotely sensed image on the basis of their characteristics. *(Friedman J., 1977; Pal & Mather, 2001)*
- ❖ The most commonly used classification methodologies in remote sensing are unsupervised procedures such as ISODATA and in supervised methods, the most popular of which is the maximum likelihood (ML) algorithm. *(Ghose et. Al., 2010)*
- ❖ Decision tree classifiers have, not been used as widely by the remote sensing community for land use classification despite their non-parametric nature and their attractive properties of simplicity, flexibility, and computational efficiency. *(Friedl et. al., 1997)*
- ❖ The non-parametric property means that non-normal, non-homogenous and noisy data sets can be handled, as well as non-linear relations between features and classes, missing values, and both numeric and categorical inputs. *(Quinlan, 1993)*
- ❖ Site-specific crop identification, based on satellite imagery, is important for agro-ecological studies, regional climate modeling, and agricultural policy development. *(Dubovyk et.al., 2013)*
- ❖ Also, availability of past crop maps is necessary for the understanding of land management practices and their effectiveness, as well as monitoring of environmental impacts of land uses, such as land degradation. *(Dubovyk et.al., 2013)*
- ❖ We attempted in this case study for LULC and specific crop type mapping in Feraghan valley, Uzbekistan, using decision tree classification.

DECISION TREE CLASSIFIERS



- ❖ Classification trees offer an effective implementation of hierarchical classifiers. Indeed, classification trees have become increasingly important due to their conceptual simplicity and computational efficiency. *(Friedman J., 1977; Pal & Mather, 2001)*
- ❖ A decision tree classifier has a simple form which can be compactly stored and that efficiently classifies new data. *(Friedman J., 1977; Pal & Mather, 2001)*
- ❖ Decision tree classifiers can perform automatic feature selection and complexity reduction, and their tree structure provides easily understandable and interpretable information regarding the predictive or generalisation ability of the classification. *(Ghose et. Al., 2010)*
- ❖ To construct a classification tree by an investigative approach, it is assumed that a data set consisting of feature vectors and their corresponding class labels are available. The features are identified based on problem specific knowledge. *(Ghose et. Al., 2010)*
- ❖ The decision tree is then constructed by recursively separating a data set into purer, more homogenous subsets on the basis of a set of tests applied to one or more attribute values at each branch or node in the tree. *(Ghose et. Al., 2010)*
- ❖ This procedure involves three steps: splitting nodes, determining which nodes are terminal nodes, and assigning class label to terminal nodes. *(Ghose et. Al., 2010)*
- ❖ The assignment of class labels to terminal nodes is straightforward: labels are assigned based on a majority vote or a weighted vote when it is assumed that certain classes are more likely than others. *(Ghose et. Al., 2010)*

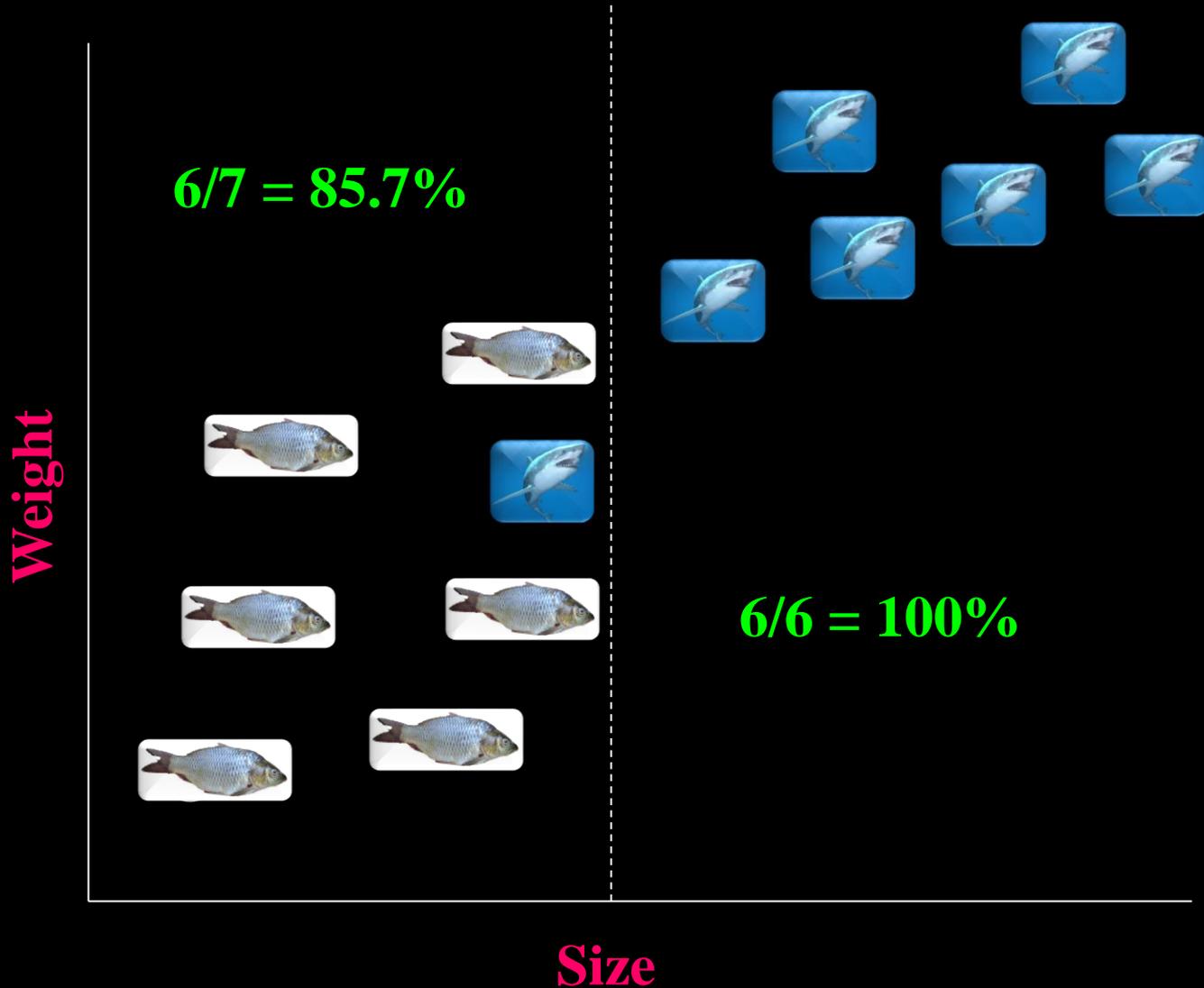
STUDY AREA



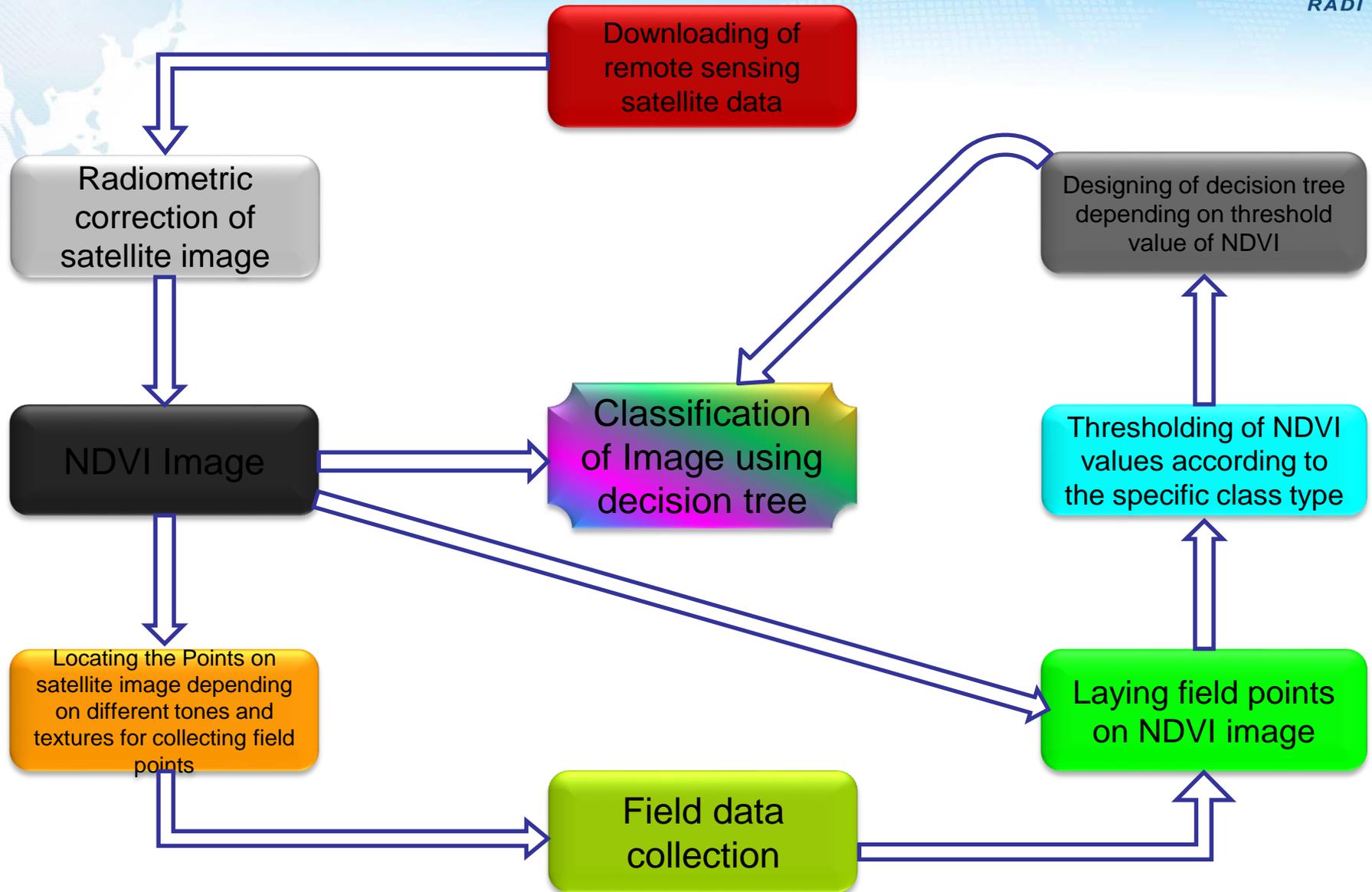
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CLASSIFICATION APPROACH

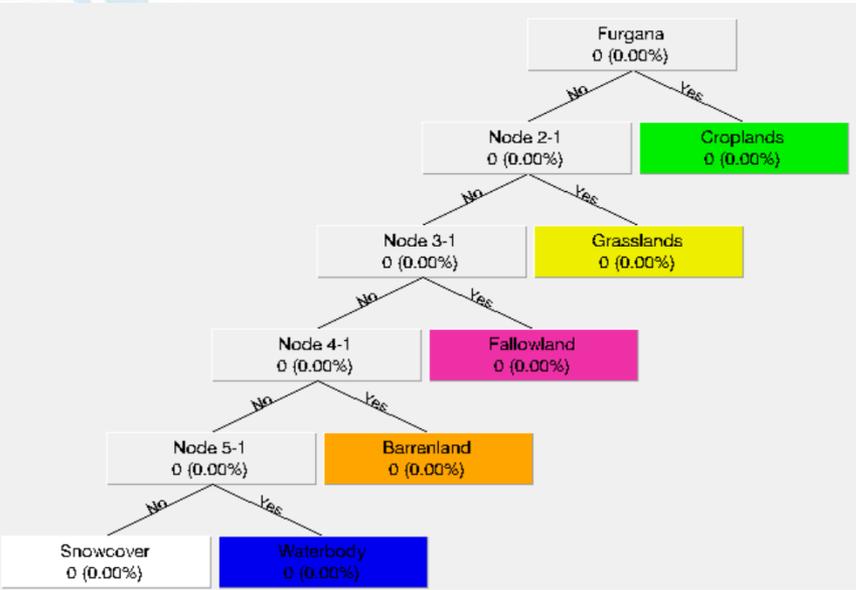
SEPARATING FISH AND SHARK (?)



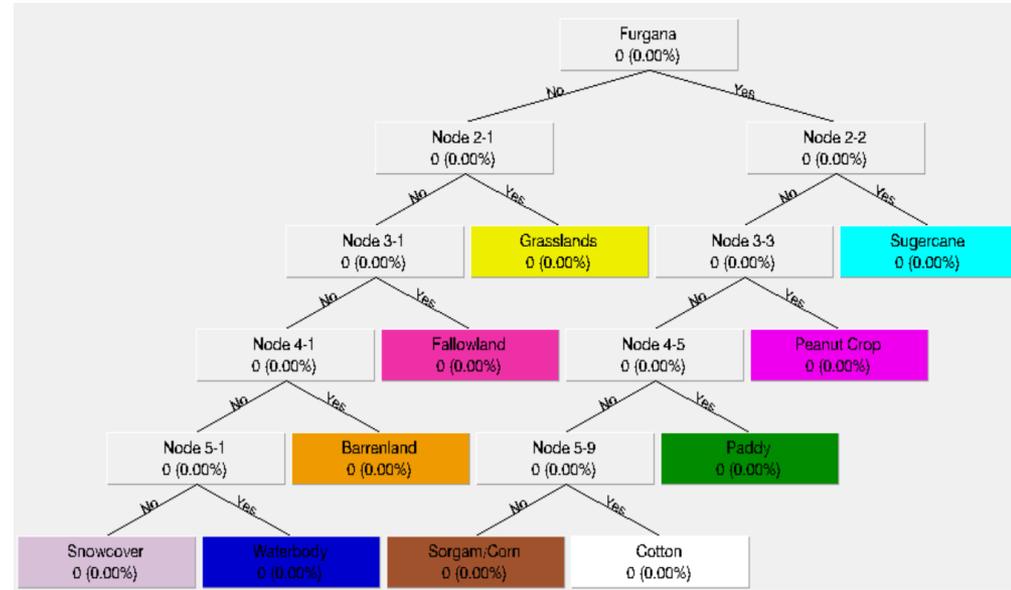
METHODOLOGY



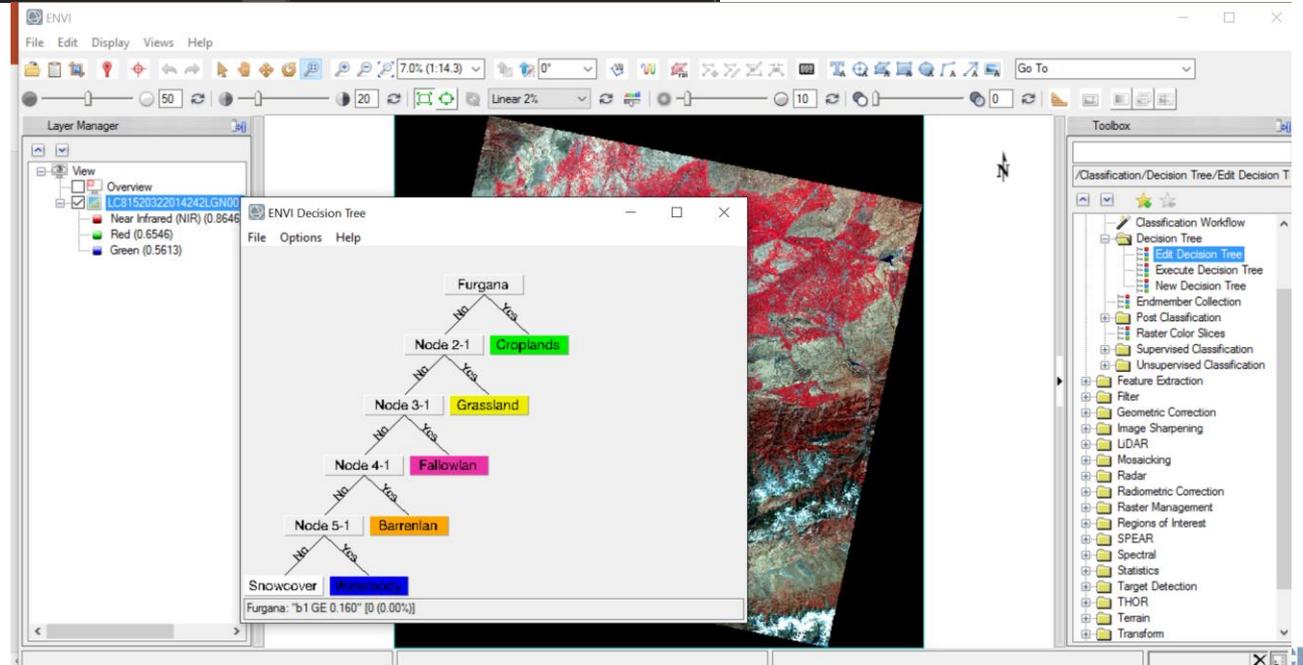
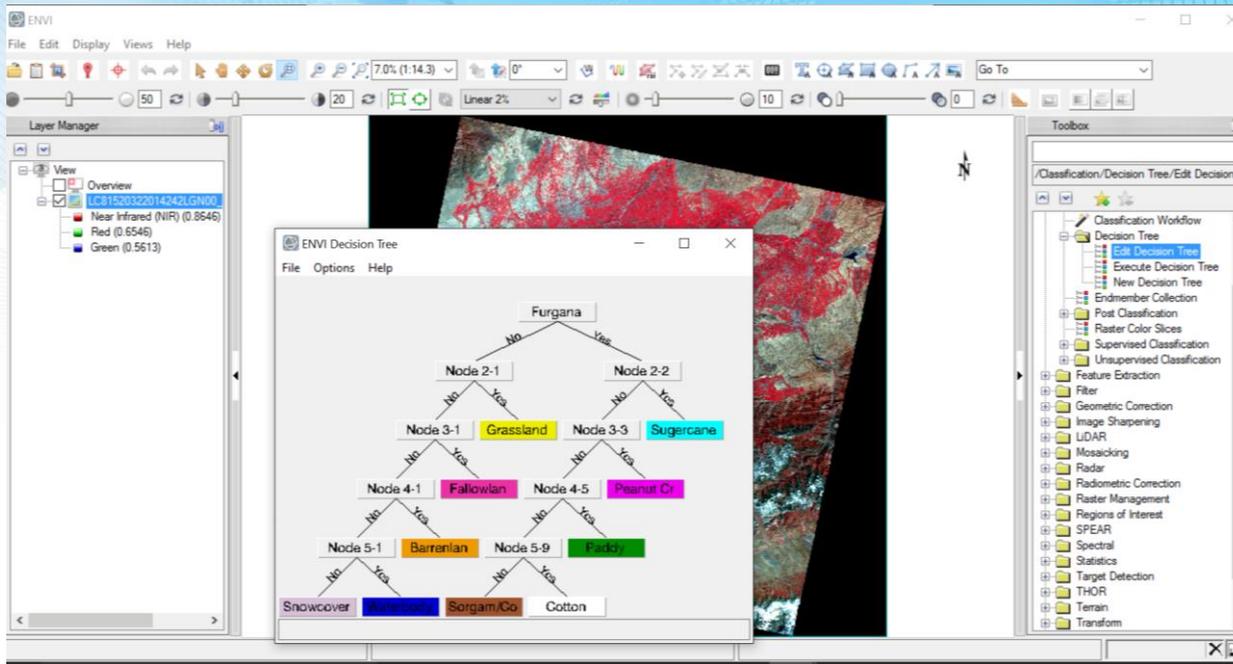
CLASSIFICATION TREES FOR LAND USE & LAND COVER CLASSES AND FOR DIFFERENT CROP TYPE CLASSES



A classification tree for LULC classes



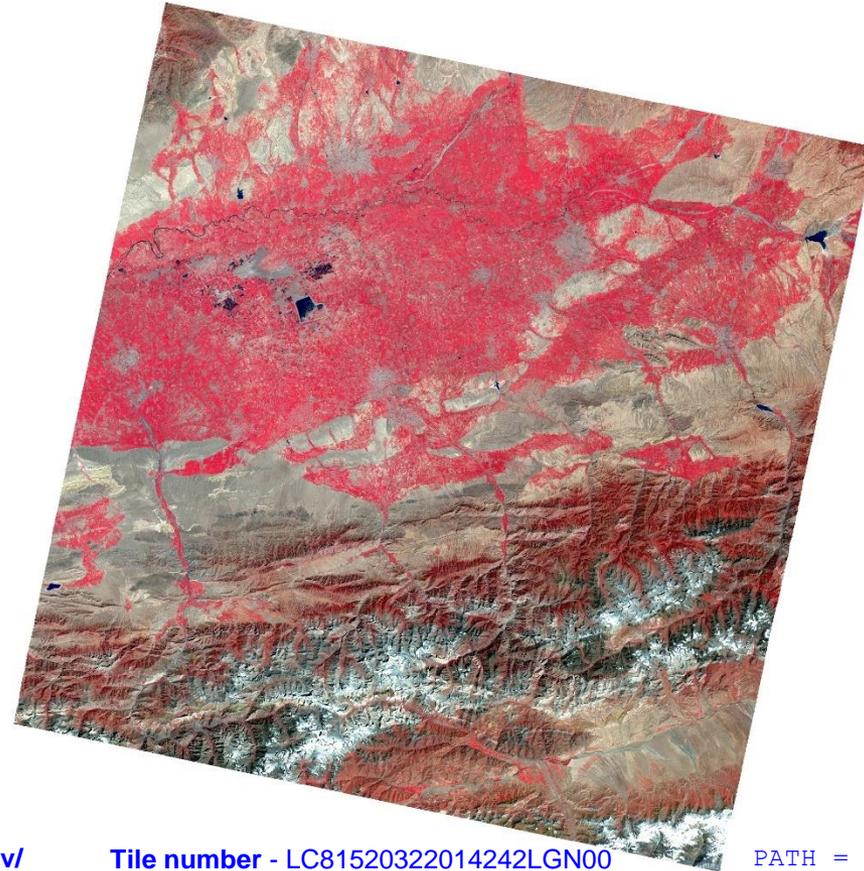
A classification tree for crop type classes



Scene Classification Results



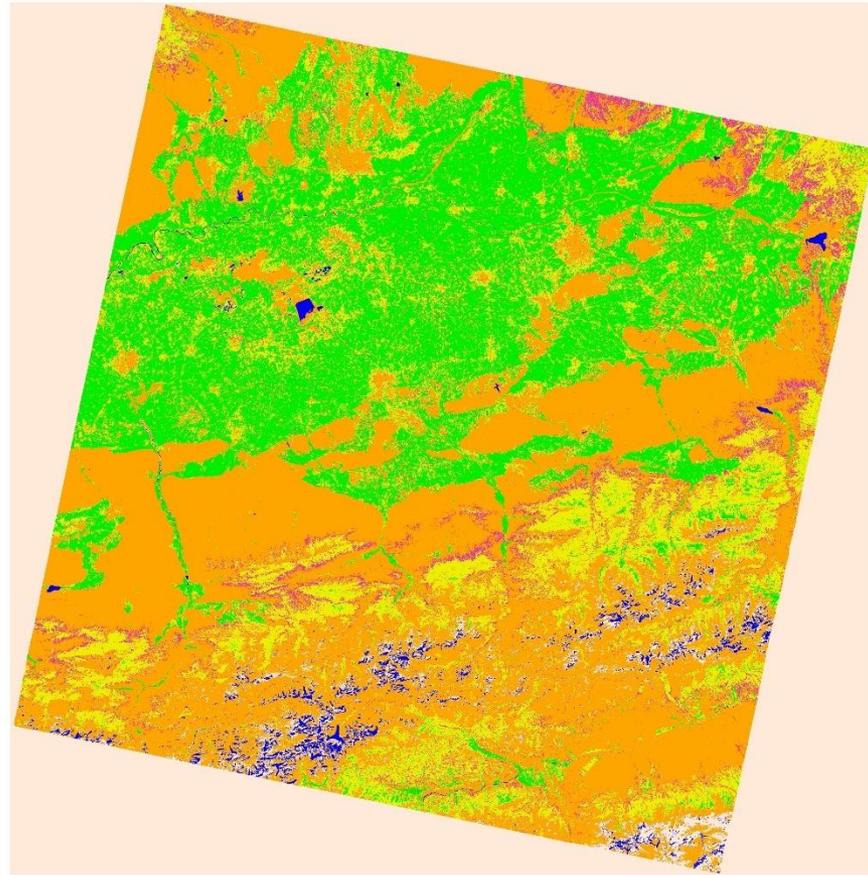
Landsat-8(FCC), Date-30-08-2014



Source: <http://glovis.usgs.gov/>

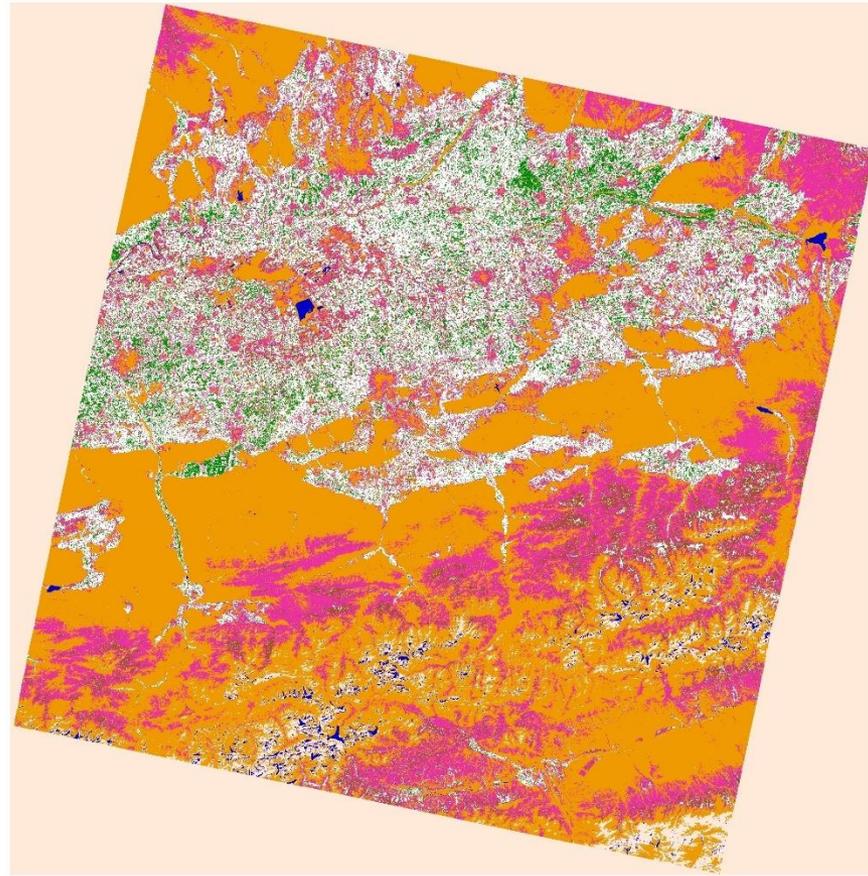
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Kappa co-efficient 93%

 Barrenland  Cropland  Fallowland  Grassland  Snowcover  Waterbody

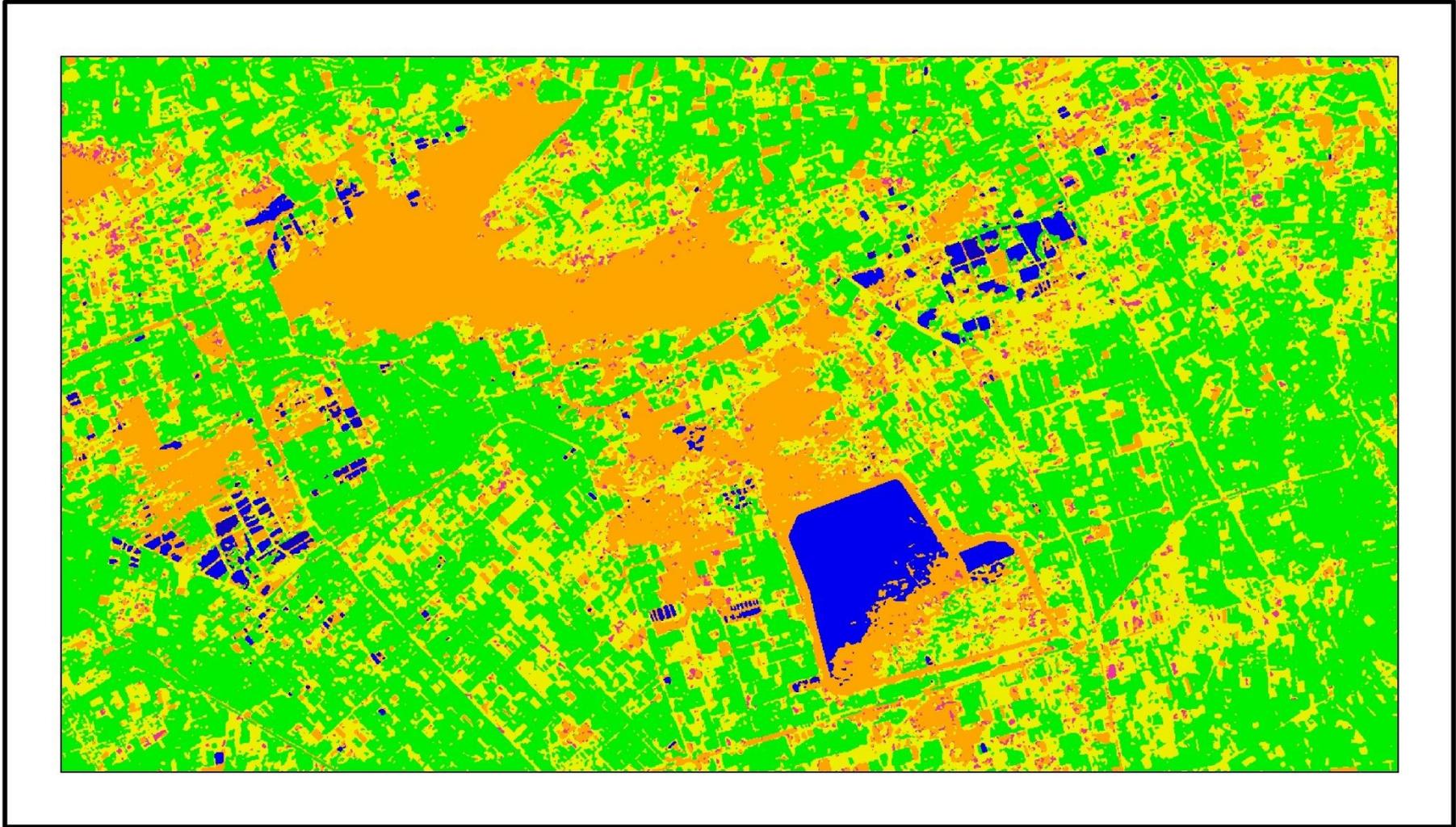


Kappa co-efficient 81%

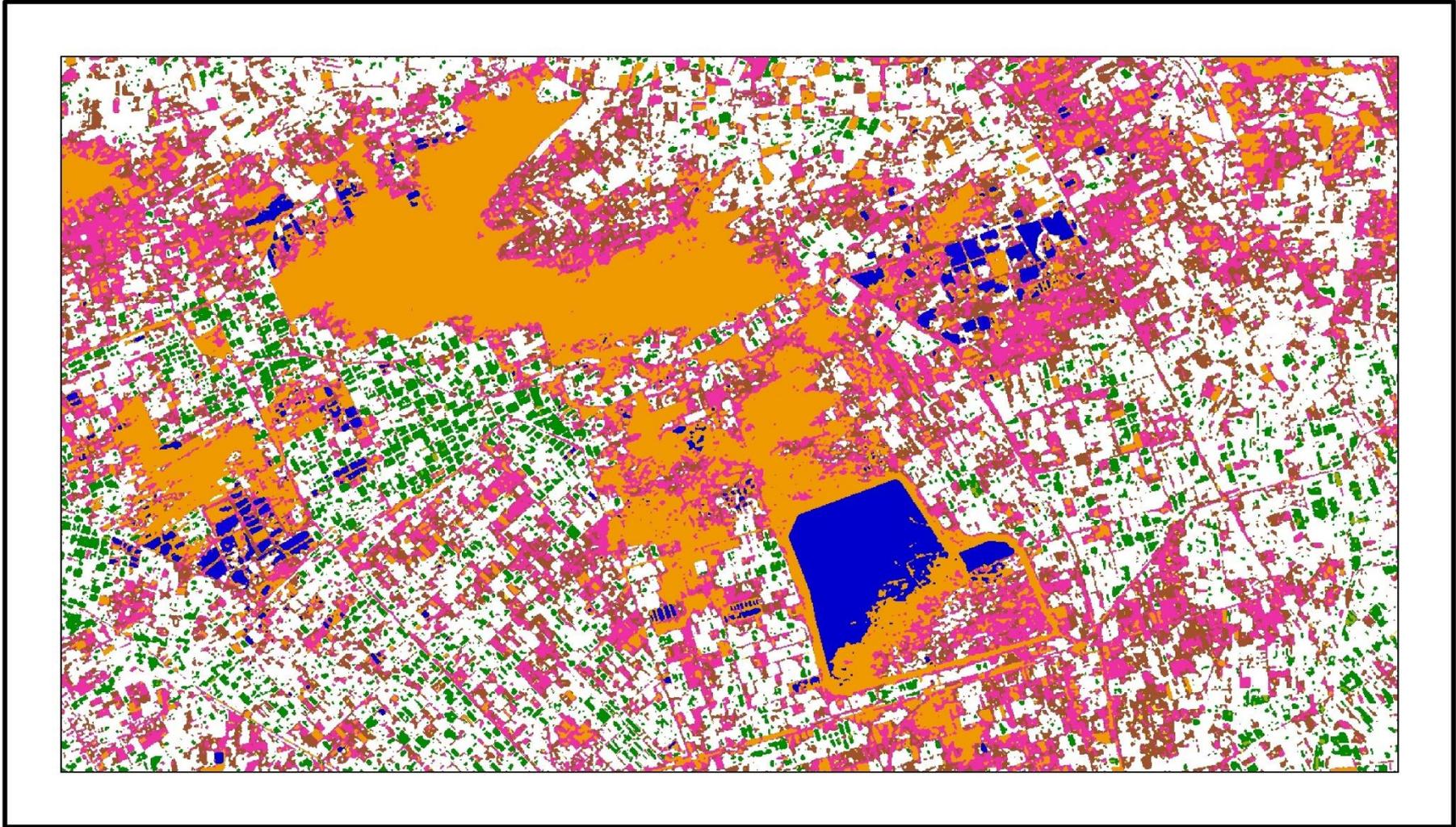


EXAMPLES OF CLASSIFICATION RESULTS

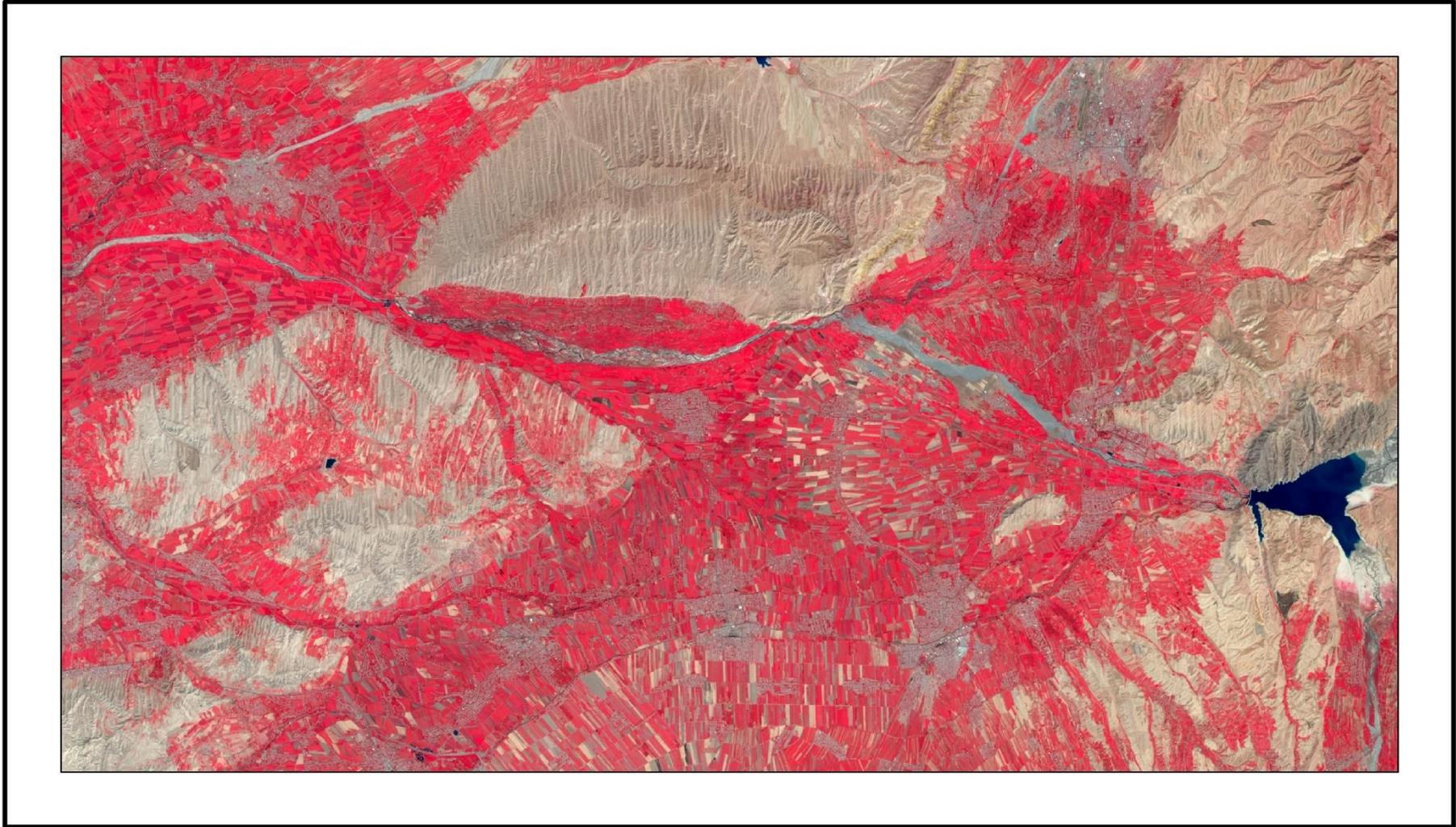


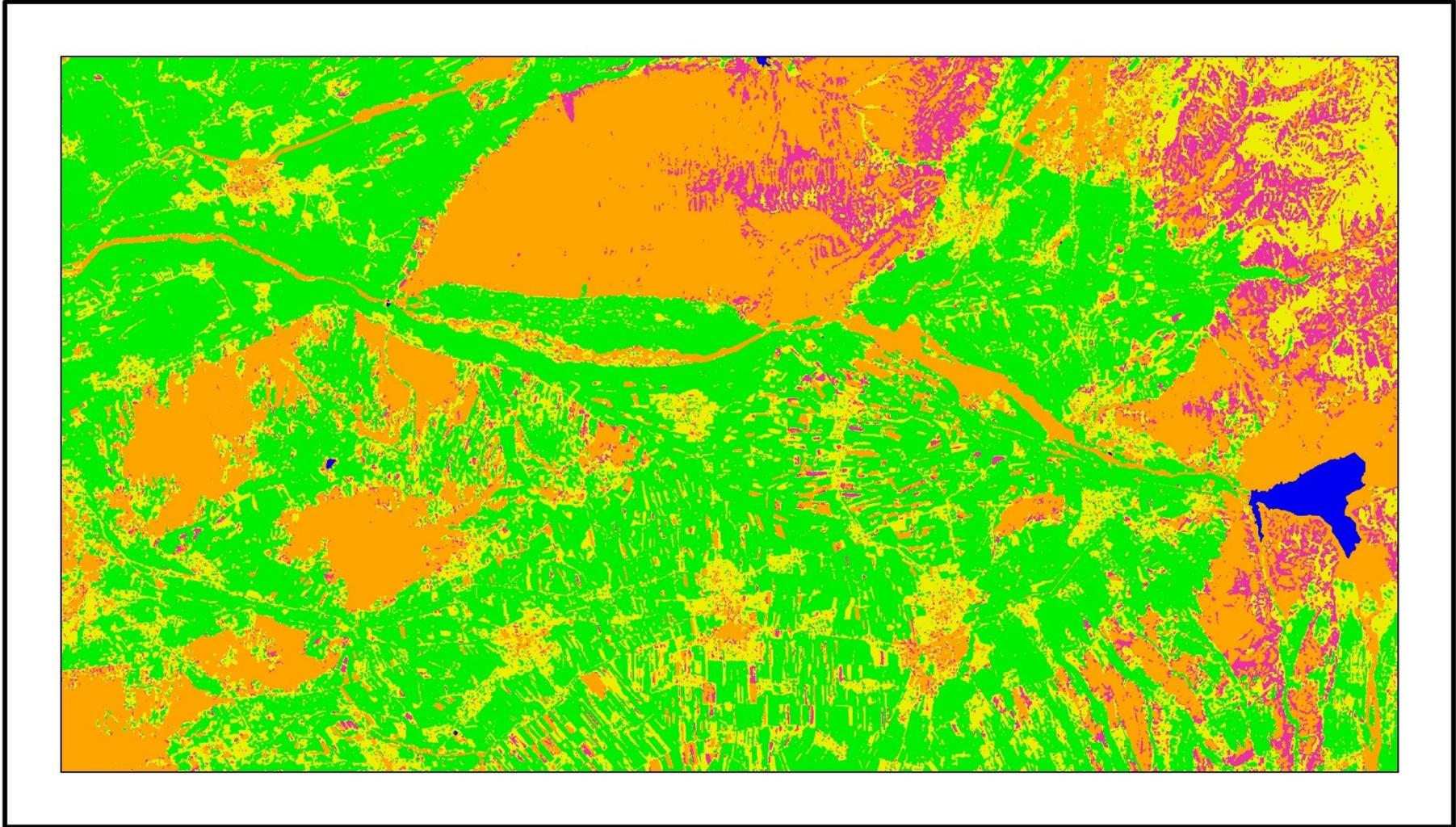


Barrenland Cropland Fallowland Grassland Snowcover Waterbody

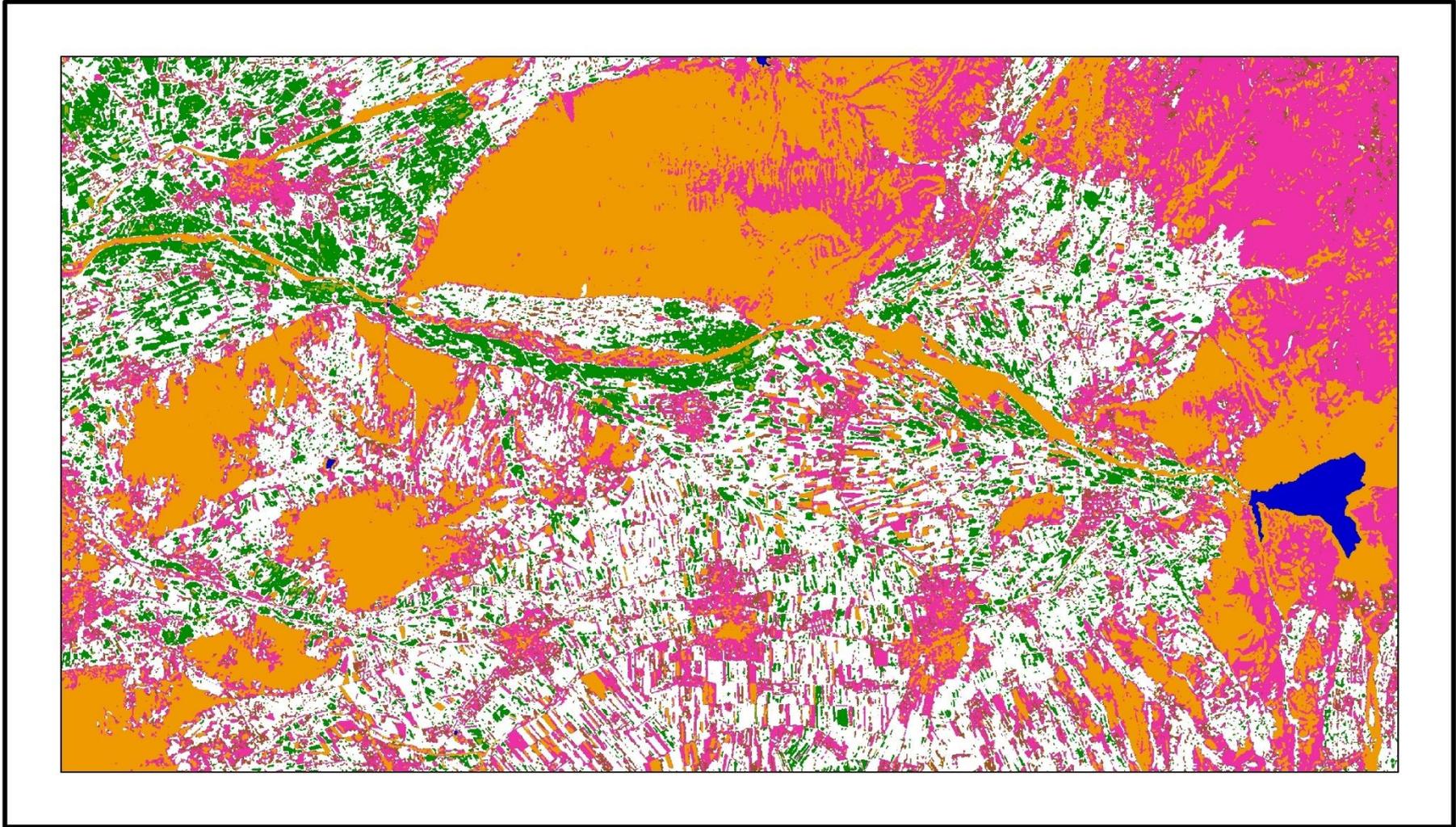


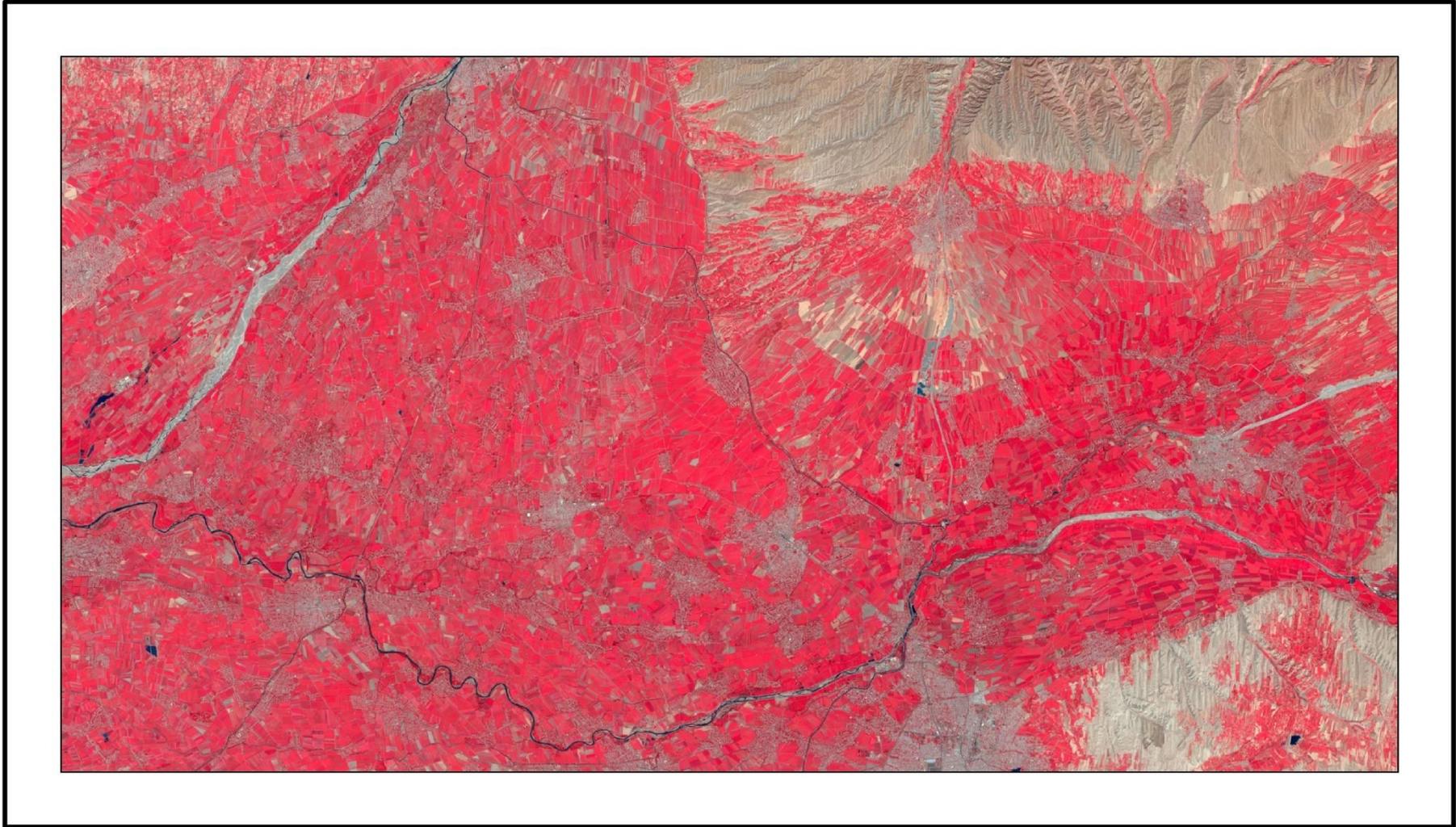
- Barrenland
- Cotton
- Fallowland
- Grassland
- Paddy/Rice
- Peanut
- Snowcover
- Sorgam
- Sorgam2/Maiz
- Waterbody

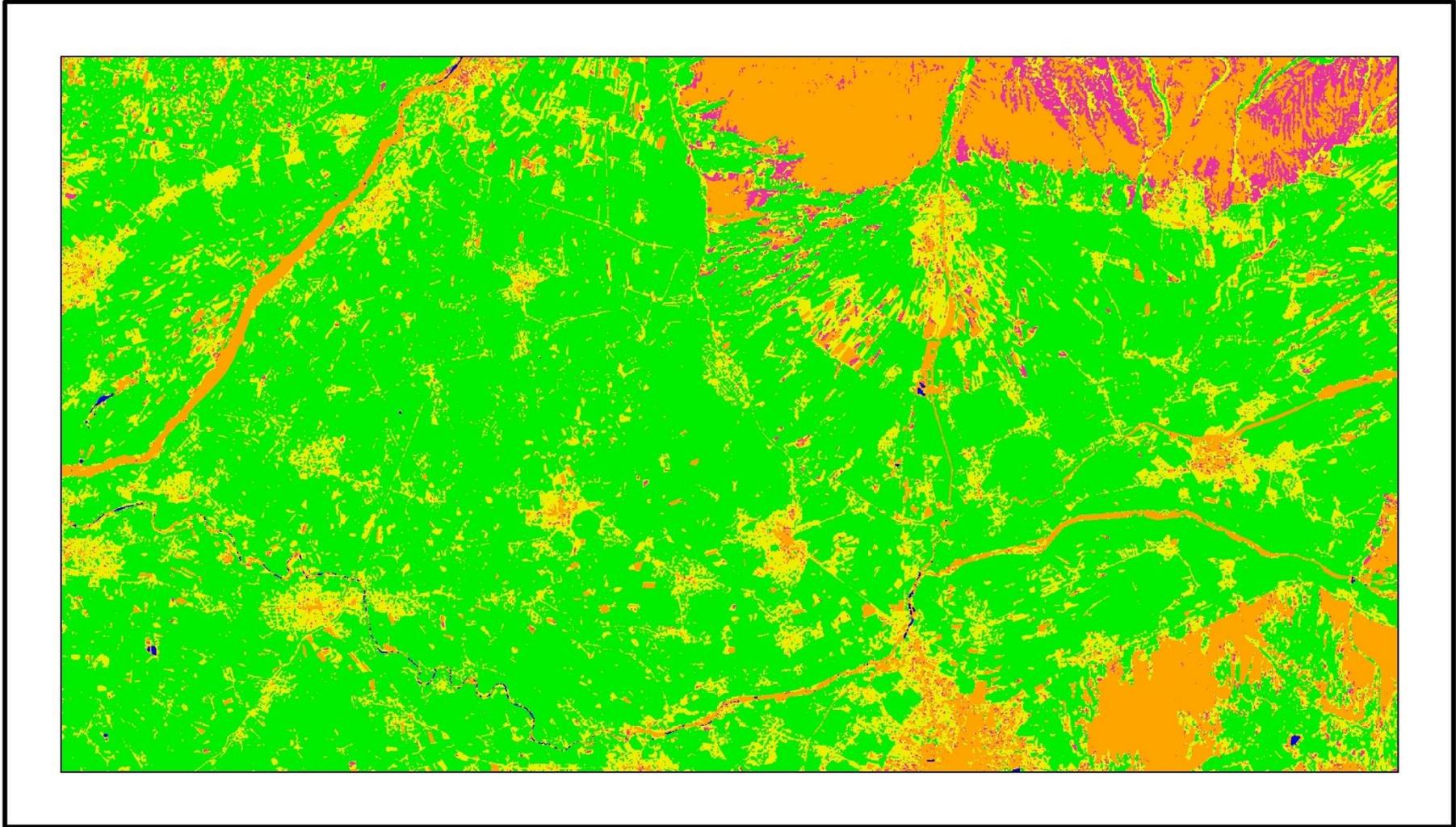




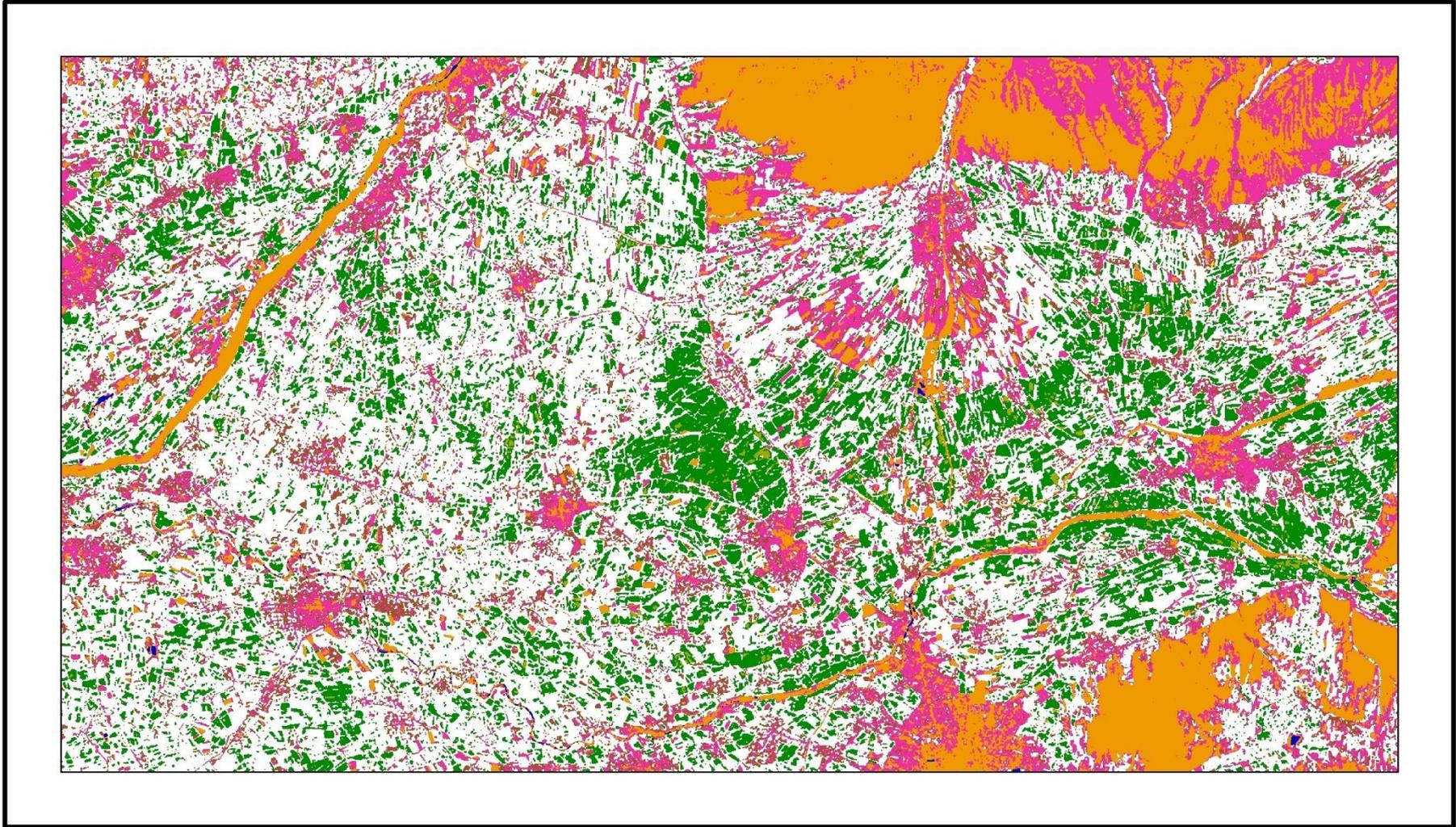
Barrenland Cropland Fallowland Grassland Snowcover Waterbody



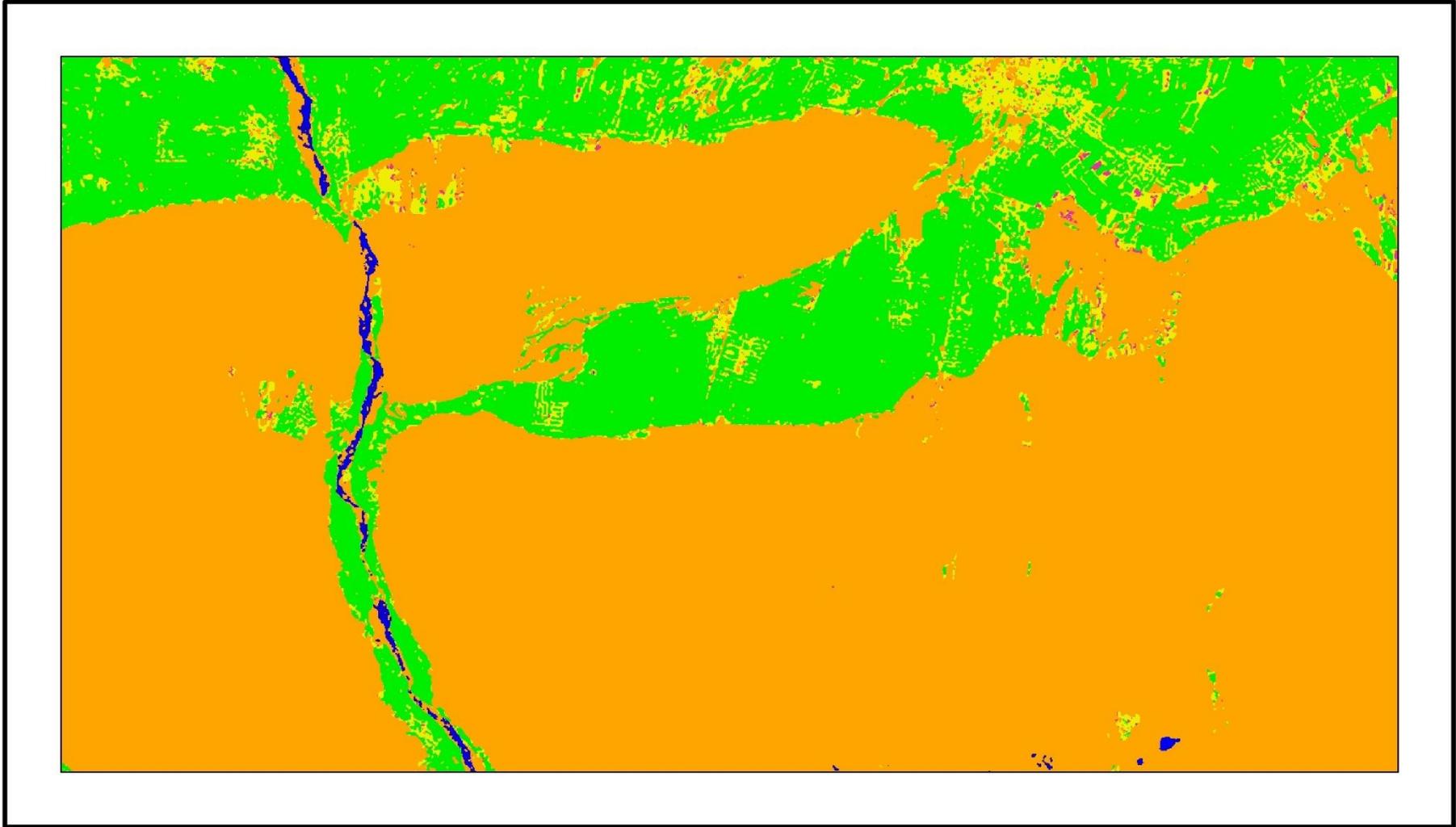




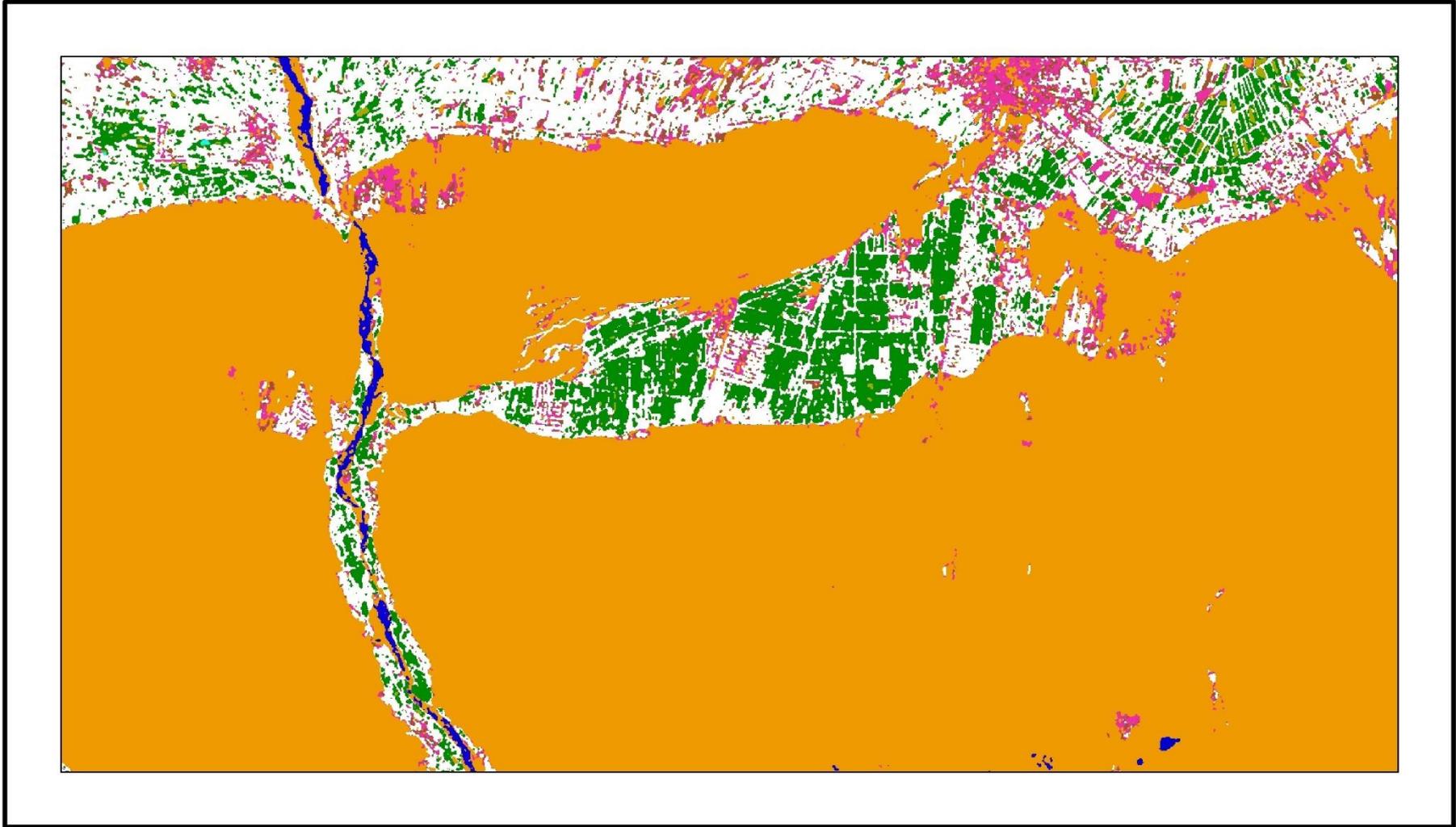
 Barrenland  Cropland  Fallowland  Grassland  Snowcover  Waterbody



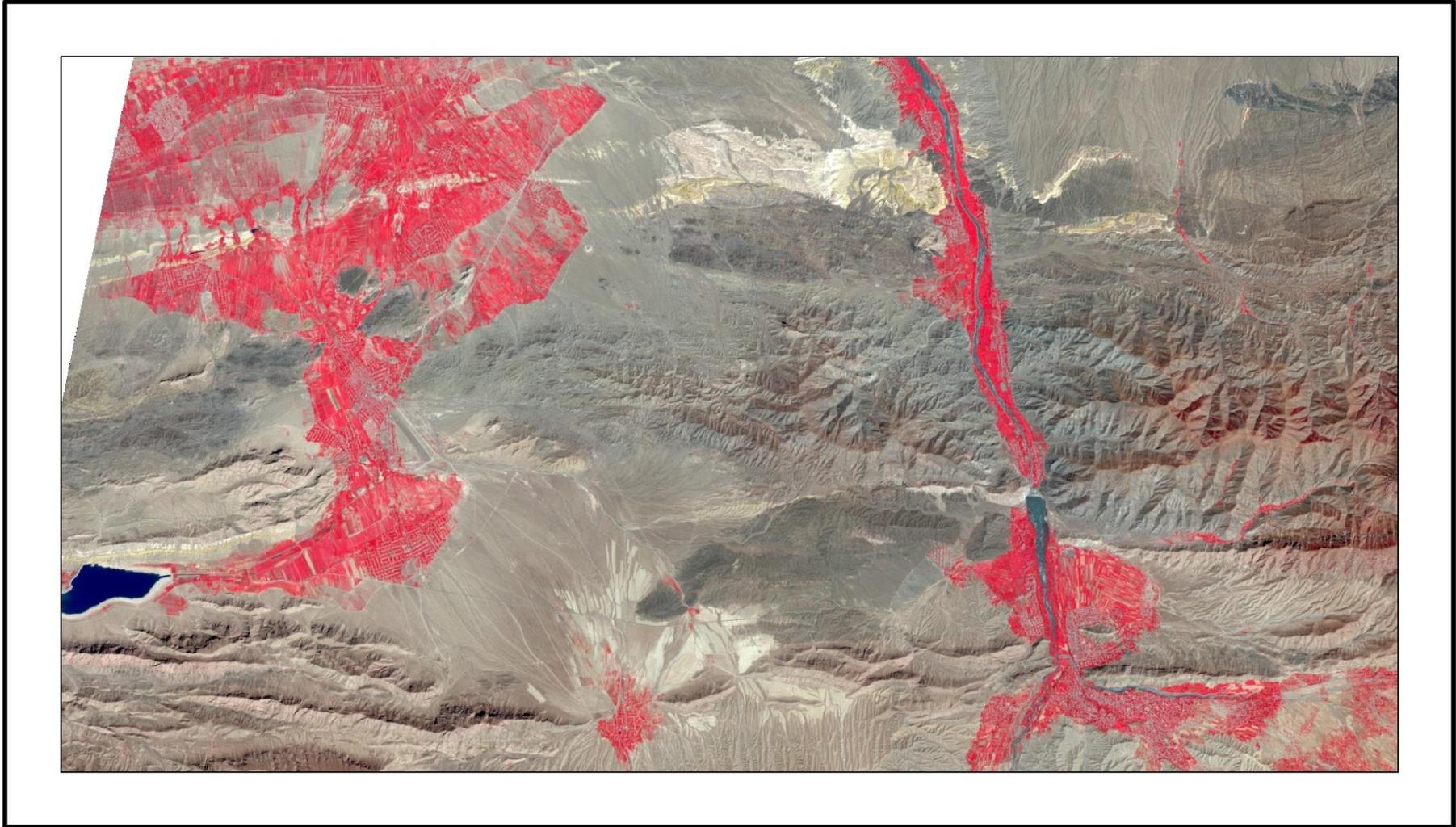


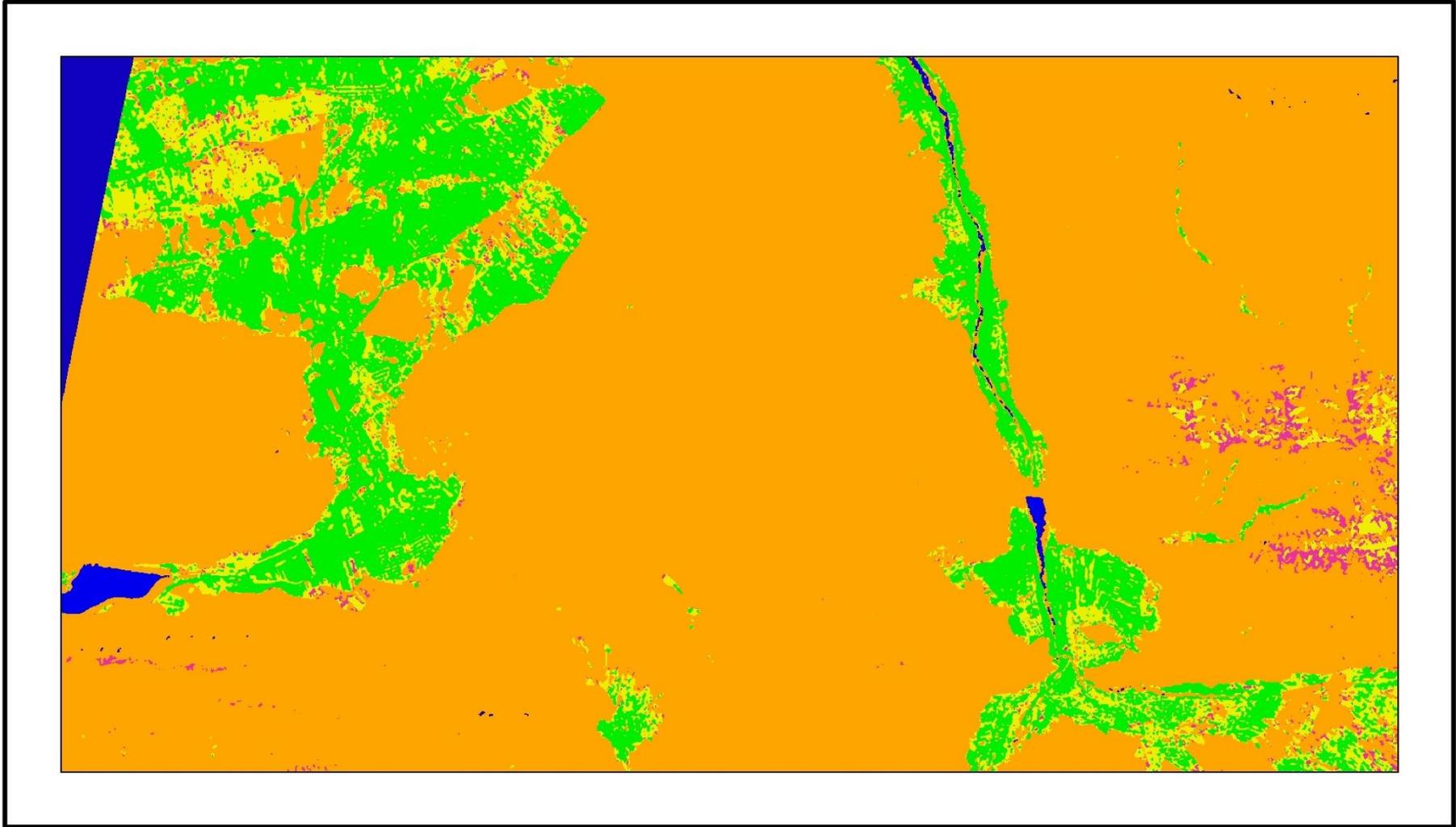


Barrenland Cropland Fallowland Grassland Snowcover Waterbody

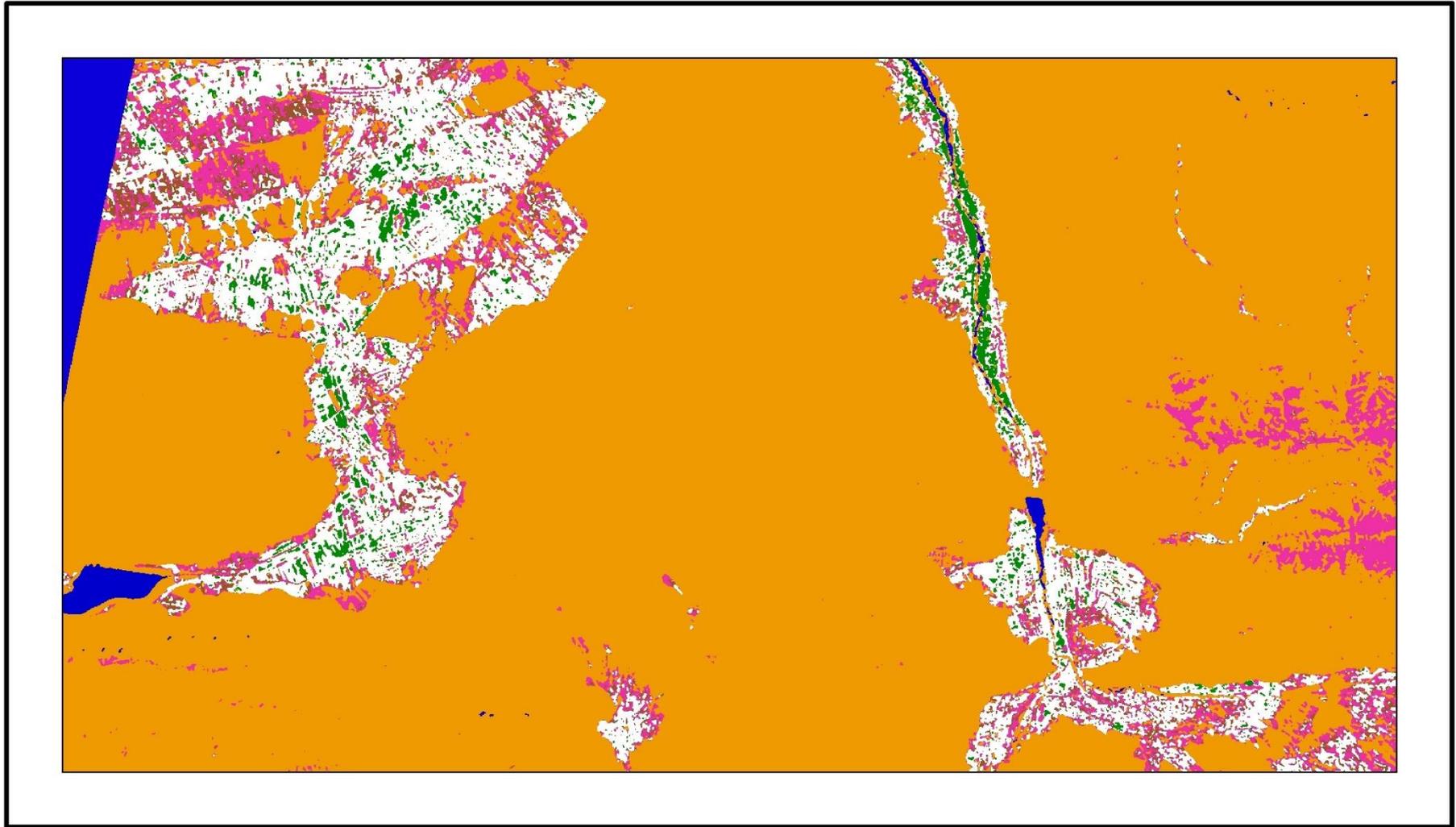


Barrenland Cotton Fallowland Grassland Paddy/Rice Peanut Snowcover Sorgam Sorgam2/Maiz Waterbody

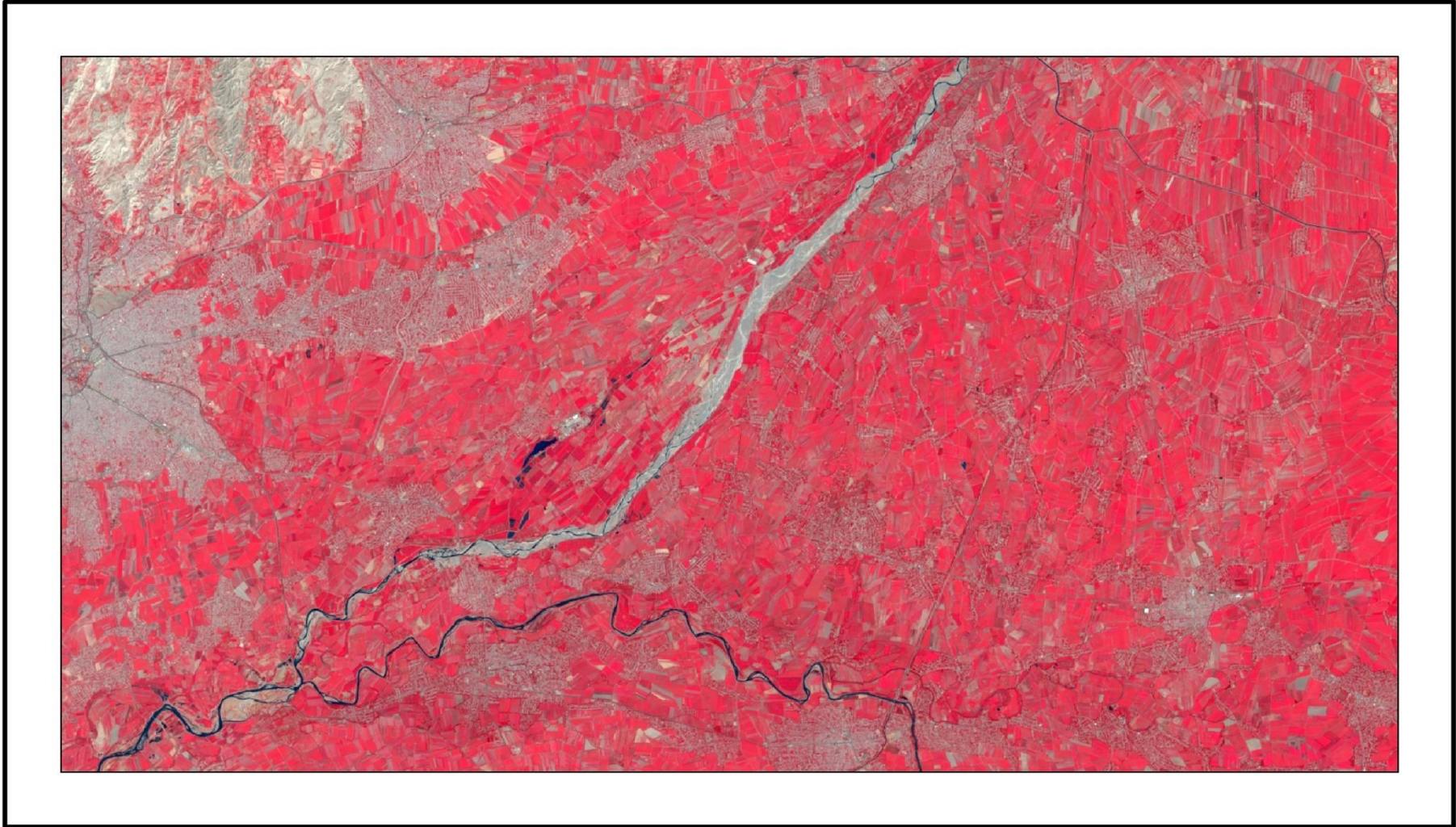


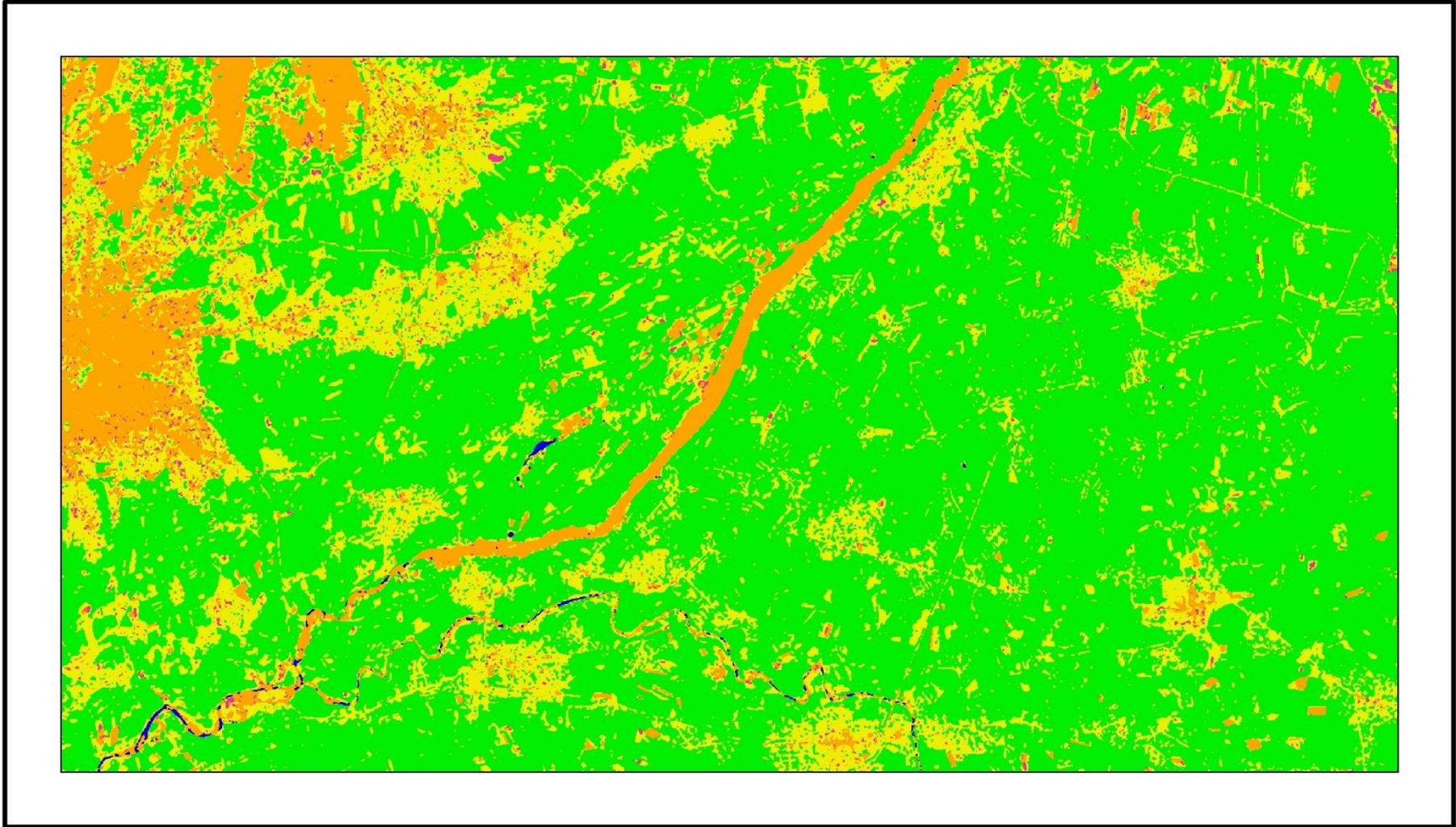


Barrenland Cropland Fallowland Grassland Snowcover Waterbody

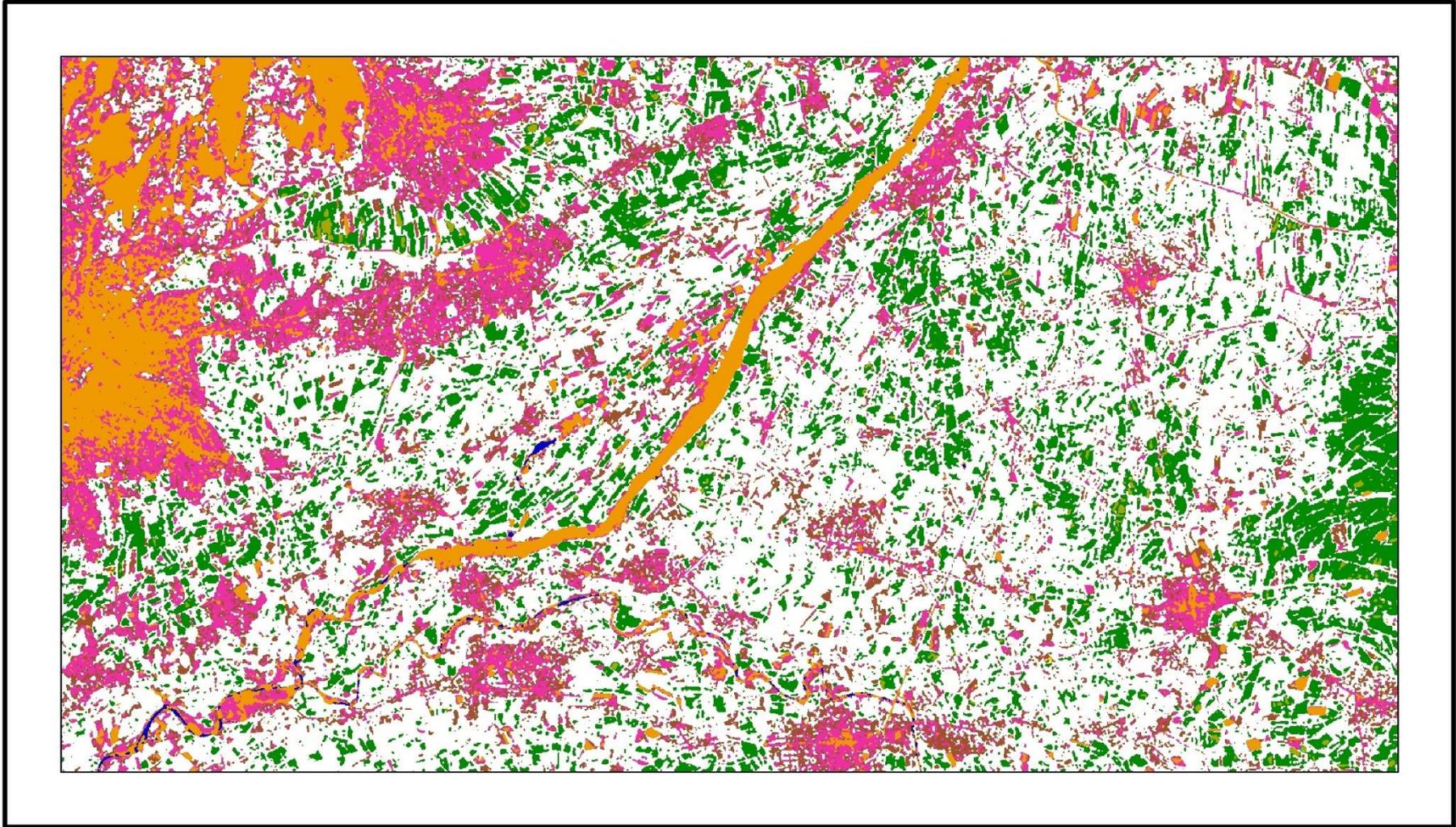


Barrenland Cotton Fallowland Grassland Paddy/Rice Peanut Snowcover Sorgam Sorgam2/Maiz Waterbody





 Barrenland  Cropland  Fallowland  Grassland  Snowcover  Waterbody



CONCLUSION



- ✓ Total 187 field points were used for thresholding of NDVI for different classes and 30 field points were used for accuracy assessment
- ✓ In classification of major LULC classes, the kappa co-efficient was 93% and for the sub classes i.e. crop types with LULC classes, kappa co-efficient was 81%.
- ✓ The decision-tree classification showed promising results.
- ✓ Decision tree classification process is **rapid** and large areas can be classified in short period of time and LULC classes and crop types can be classified using NDVI thresholding.
- ✓ **Repeatable** classification can be done.
- ✓ Decision tree classification **utilize categorical data**.
- ✓ Classification is **Less sensitive to errors** in training data.
- ✓ Decision tree algorithm will have an edge over its statistical counterpart because of its **simplicity, flexibility** and **computational efficiency**.
- ✓ Rare ecological systems and systems that consist of a **wide range of cover types** (i.e. shrub steppe types) tend to lower accuracies.
- ✓ To get high accuracy classified map **lots of training** sites are required.
- ✓ In classified map the **accuracy % weights** toward the **relative %** of training data

Thanks!



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