



# Slovenia Check by Monitoring Scaling up from an idea to the full production in a year

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Sinergise



# Slovenia use-case

Basic Payment Scheme and Less Favored Areas

All parcels (including the small ones) – 800.000

# Distribution

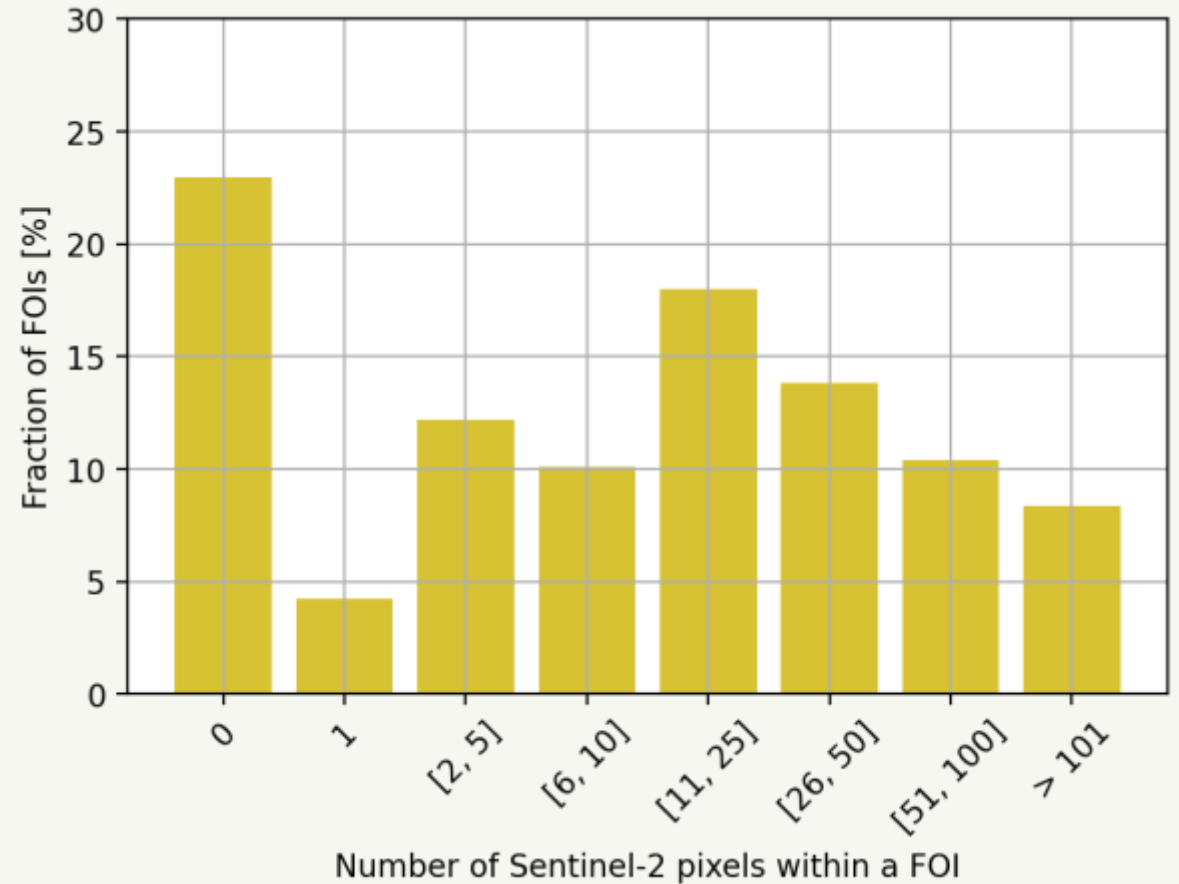
23% less than one pixel

40% less than six pixels

32% of FOIs do not survive 10m  
internal buffer rule

- Buffer + 1/5 pixels?

1% do not even have 3x3m pixel



# Pilot timeline

August 2020 – start of prototype activities

December 2020 – model soundness tested on 2019 data

March 2021 – start of operational use

May 2021 – fine-tuning of the models

August 2021 - public disclosure of intermediate results

- updated monthly

August – October 2021

- (changes of the claims)
- communication with farmers
- internal checks of the “yellow” parcels

October 2021 – “formal” review of results

# Modules

Sentinel Hub and Signal service

Markers

Visualization service

Traffic Light System

Expert Judgement App

Communication with famers

All modules written up on [Sentinel Hub Blog](#).

## Area Monitoring — High-Level Concept



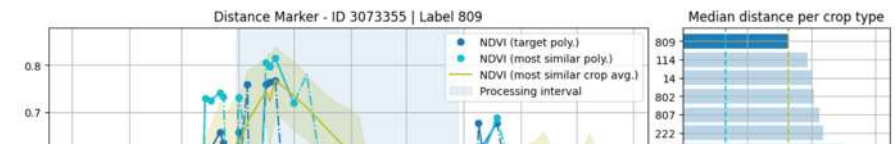
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Sep 1 · 15 min read



*We are building a generic service for a Common Agriculture Policy market, that has been from the very beginning, for decades, served by individually tailored solutions, usually by local vendors. Note to the readers — it's a very long read, combining business aspects as well as technical findings.*

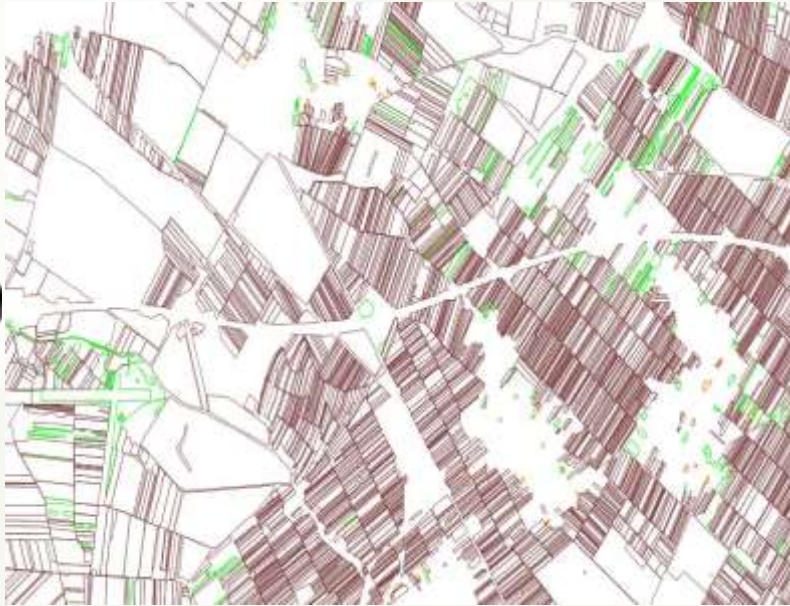


**Combination of cloud-based and on-premise**

**Designed for wider use**

# Sentinel Hub Batch Statistical API

```
evalscript = `
//VERSION=3
function setup() {
  return {
    input: [{bands: ["B04", "B08", "SCL", "dataMask"]}],
    output: [
      {id: "data", bands: 1},
      {id: "dataMask", bands: 1}
    ]
  }
}
function evaluatePixel(samples) {
  let ndvi = (samples.B08 - samples.B04)/(samples.B08 + samples.B04)
  var validNDVIMask = 1
  if (samples.B08 + samples.B04 == 0){
    validNDVIMask = 0
  }
  var noWaterMask = 1
  if (samples.SCL == 6){
    noWaterMask = 0
  }
  return {
    data: [ndvi],
    dataMask: [samples.dataMask * validNDVIMask * noWaterMask]
  }
}
`
```



```
{'data': [
  {'interval': {'from': '2020-01-01', 'to': '2020-01-31'},
    'outputs': {'data': {'bands': {'B0': {'stats': {
      'min': 0.24386687712669373,
      'max': 0.6244725584983826,
      'mean': 0.4123224201824293,
      'stdDev': 0.055874589607421066,
      'sampleCount': 3036,
      'noDataCount': 1192}}}}}},
    {'interval': {'from': '2020-01-31', 'to': '2020-03-01'},
      'outputs': {'data': {'bands': {'B0': {'stats': {
        'min': 0.2451941967010498,
        'max': 0.4233280510543823,
        'mean': 0.3160828609431641,
        'stdDev': 0.0208772593636271,
        'sampleCount': 3036,
        'noDataCount': 1192}}}}}},
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        'mean': 0.5844831434836089,
        'stdDev': 0.05766820795402124,
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        'noDataCount': 1192}}}}}},
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        'max': 0.8260128897660931,
        'mean': 0.6615912824981472,
        'stdDev': 0.05539347152437238,
        'sampleCount': 3036,
        'noDataCount': 1192}}}}}},
    'status': 'OK'
  ]
}
```

# Data Clean-up

## **s2cloudless**

Machine-learning (ML) approach

a lot of time invested for creating it

- training data, research, evaluation
- openly available
- quick to use
  - no labelled data needed

applicable over all land types

globally scale usage

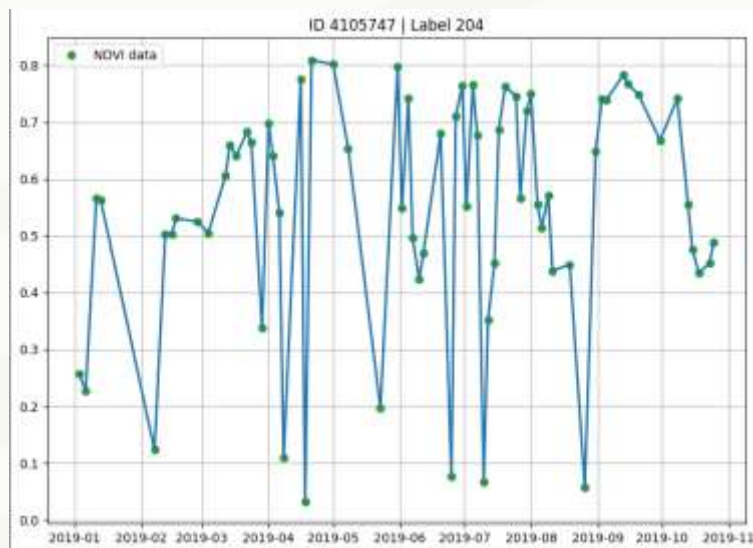
available on Sentinel Hub

## **observation outlier detector**

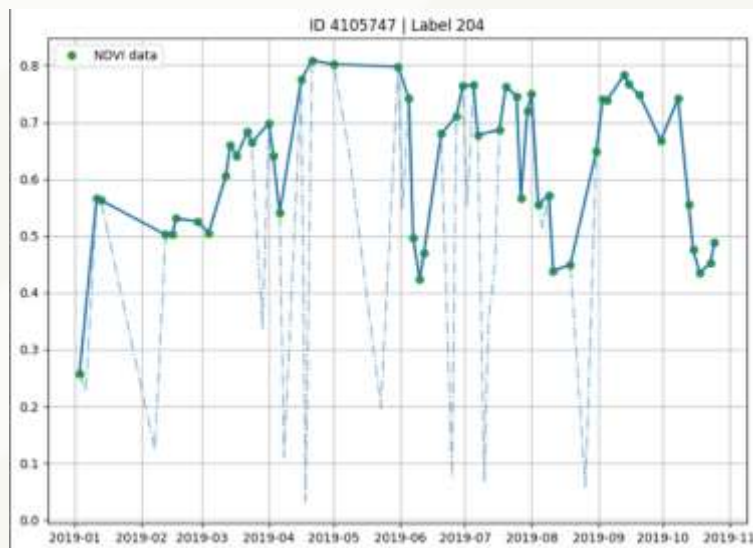
- ♦ ML approach (simplistic model)
- ♦ requires a small set of labels
  - ♦ order of 1k FOIs
- ♦ not meant for all land-types (unless supported by labelled data)
- ♦ focus on artefacts
  - ♦ missed clouds, cloud shadows, haze, ...

# Data Clean-up

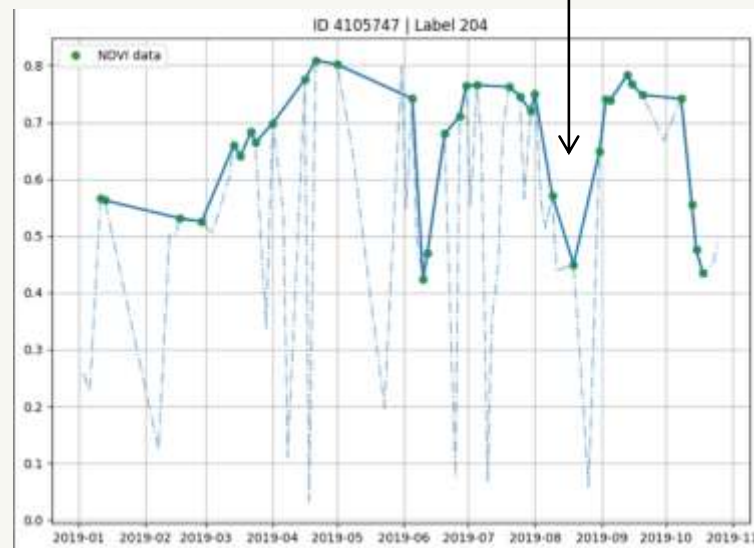
NDVI after various steps of clean-up



No clean-up



Without clouds



Without clouds and outliers



# Homogeneity marker

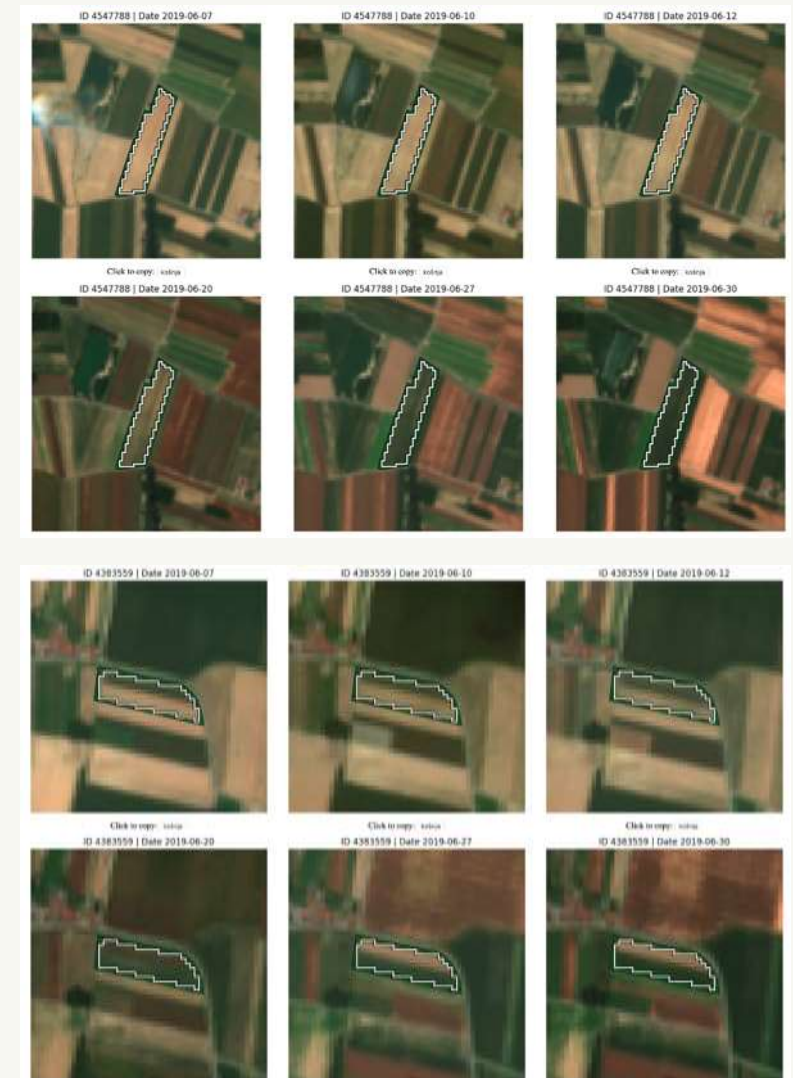
Detecting FOIs with single-crop claims growing multiple crops

Useful also for cleaning up crop-related training data

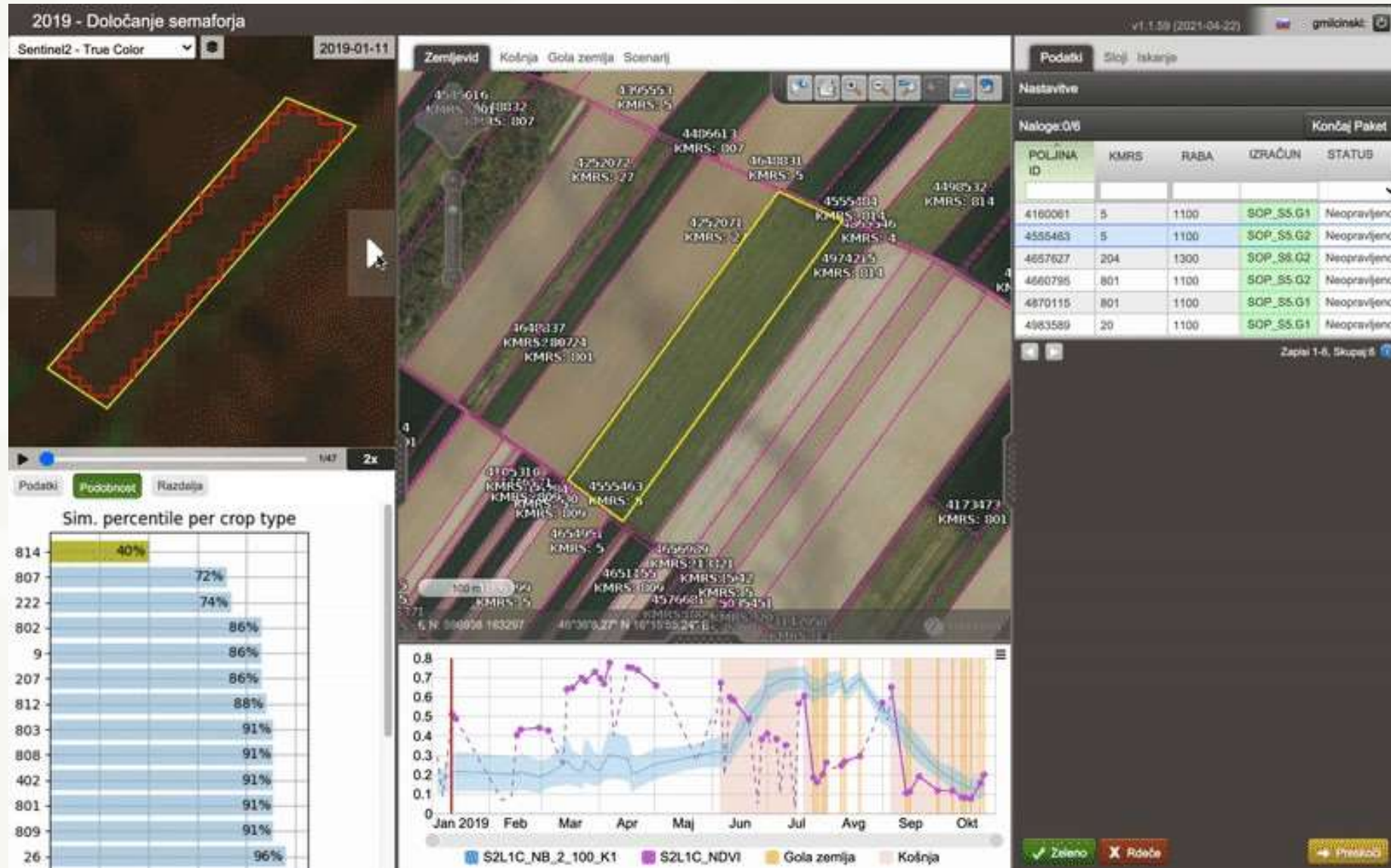
Trained a ML model on a set of fields where multiple crops are expected

Training sample with multiple crops

- different crops share relatively equally large parts
- crops have to be distinguishable (use pre-defined groups)



# Similarity marker

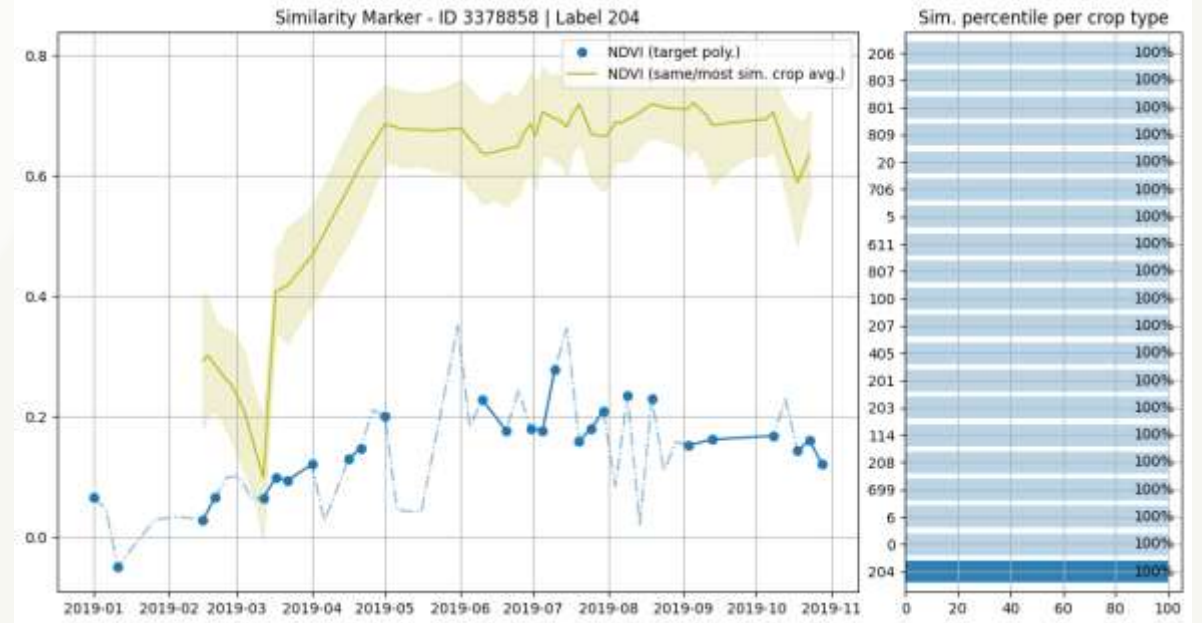




# Similarity marker

- Non-eligible cases

ID	mean_dist	CROP_ID	T_GROUP_ID	P_GROUP_ID	link
5991345.0	0.6831213635582621	201.0	1.0	7.0	<a href="http://am.sinergise.com/vis/ids/5991345">http://am.sinergise.com/vis/ids/5991345</a>
582185.0	0.5723437290687289	204.0	1.0	7.0	<a href="http://am.sinergise.com/vis/ids/582185">http://am.sinergise.com/vis/ids/582185</a>
1888247.0	0.5699694595950041	204.0	1.0	7.0	<a href="http://am.sinergise.com/vis/ids/1888247">http://am.sinergise.com/vis/ids/1888247</a>
4548500.0	0.5637413484656801	204.0	1.0	1.0	<a href="http://am.sinergise.com/vis/ids/4548500">http://am.sinergise.com/vis/ids/4548500</a>
2447656.0	0.5633514244921917	204.0	1.0	1.0	<a href="http://am.sinergise.com/vis/ids/2447656">http://am.sinergise.com/vis/ids/2447656</a>
4549015.0	0.5270976959569412	204.0	1.0	1.0	<a href="http://am.sinergise.com/vis/ids/4549015">http://am.sinergise.com/vis/ids/4549015</a>
3083390.0	0.5257867145499165	204.0	1.0	12.0	<a href="http://am.sinergise.com/vis/ids/3083390">http://am.sinergise.com/vis/ids/3083390</a>
3048111.0	0.5077859514916038	201.0	1.0	7.0	<a href="http://am.sinergise.com/vis/ids/3048111">http://am.sinergise.com/vis/ids/3048111</a>
4343171.0	0.5010939237867578	204.0	1.0	7.0	<a href="http://am.sinergise.com/vis/ids/4343171">http://am.sinergise.com/vis/ids/4343171</a>
3514210.0	0.4988804768012182	204.0	1.0	12.0	<a href="http://am.sinergise.com/vis/ids/3514210">http://am.sinergise.com/vis/ids/3514210</a>
1414266.0	0.4987856542200701	204.0	1.0	1.0	<a href="http://am.sinergise.com/vis/ids/1414266">http://am.sinergise.com/vis/ids/1414266</a>
4583152.0	0.4947615959805328	204.0	1.0	1.0	<a href="http://am.sinergise.com/vis/ids/4583152">http://am.sinergise.com/vis/ids/4583152</a>
3378658.0	0.4929409388604416	204.0	1.0	1.0	<a href="http://am.sinergise.com/vis/ids/3378658">http://am.sinergise.com/vis/ids/3378658</a>
5807927.0	0.4920617432900761	204.0	1.0	1.0	<a href="http://am.sinergise.com/vis/ids/5807927">http://am.sinergise.com/vis/ids/5807927</a>
5972908.0	0.4902738032373686	204.0	1.0	7.0	<a href="http://am.sinergise.com/vis/ids/5972908">http://am.sinergise.com/vis/ids/5972908</a>
4071352.0	0.487100278604139	204.0	1.0	12.0	<a href="http://am.sinergise.com/vis/ids/4071352">http://am.sinergise.com/vis/ids/4071352</a>
1997635.0	0.484447870866169	204.0	1.0	1.0	<a href="http://am.sinergise.com/vis/ids/1997635">http://am.sinergise.com/vis/ids/1997635</a>
53103.0	0.4835899493697056	204.0	1.0	12.0	<a href="http://am.sinergise.com/vis/ids/53103">http://am.sinergise.com/vis/ids/53103</a>
95357.0	0.4773782304696631	201.0	1.0	7.0	<a href="http://am.sinergise.com/vis/ids/95357">http://am.sinergise.com/vis/ids/95357</a>
5380328.0	0.4749310654193185	204.0	1.0	2.0	<a href="http://am.sinergise.com/vis/ids/5380328">http://am.sinergise.com/vis/ids/5380328</a>
5454482.0	0.4734436986047713	204.0	1.0	7.0	<a href="http://am.sinergise.com/vis/ids/5454482">http://am.sinergise.com/vis/ids/5454482</a>
767022.0	0.4718063743868055	801.0	3.0	2.0	<a href="http://am.sinergise.com/vis/ids/767022">http://am.sinergise.com/vis/ids/767022</a>
1585129.0	0.4692818277714189	807.0	3.0	2.0	<a href="http://am.sinergise.com/vis/ids/1585129">http://am.sinergise.com/vis/ids/1585129</a>
5270637.0	0.4689792256628454	204.0	1.0	7.0	<a href="http://am.sinergise.com/vis/ids/5270637">http://am.sinergise.com/vis/ids/5270637</a>
1045213.0	0.4662988333602425	204.0	1.0	7.0	<a href="http://am.sinergise.com/vis/ids/1045213">http://am.sinergise.com/vis/ids/1045213</a>
823084.0	0.4659210437419388	801.0	3.0	2.0	<a href="http://am.sinergise.com/vis/ids/823084">http://am.sinergise.com/vis/ids/823084</a>
342370.0	0.4639518484600092	801.0	3.0	2.0	<a href="http://am.sinergise.com/vis/ids/342370">http://am.sinergise.com/vis/ids/342370</a>
730946.0	0.4617381445974492	204.0	1.0	7.0	<a href="http://am.sinergise.com/vis/ids/730946">http://am.sinergise.com/vis/ids/730946</a>
3333986.0	0.4611417626330138	204.0	1.0	7.0	<a href="http://am.sinergise.com/vis/ids/3333986">http://am.sinergise.com/vis/ids/3333986</a>
6073527.0	0.4609502932431744	109.0	14.0	16.0	<a href="http://am.sinergise.com/vis/ids/6073527">http://am.sinergise.com/vis/ids/6073527</a>
2452811.0	0.4592143966907167	809.0	4.0	2.0	<a href="http://am.sinergise.com/vis/ids/2452811">http://am.sinergise.com/vis/ids/2452811</a>
6049067.0	0.4580728900873447	203.0	1.0	1.0	<a href="http://am.sinergise.com/vis/ids/6049067">http://am.sinergise.com/vis/ids/6049067</a>



DOF

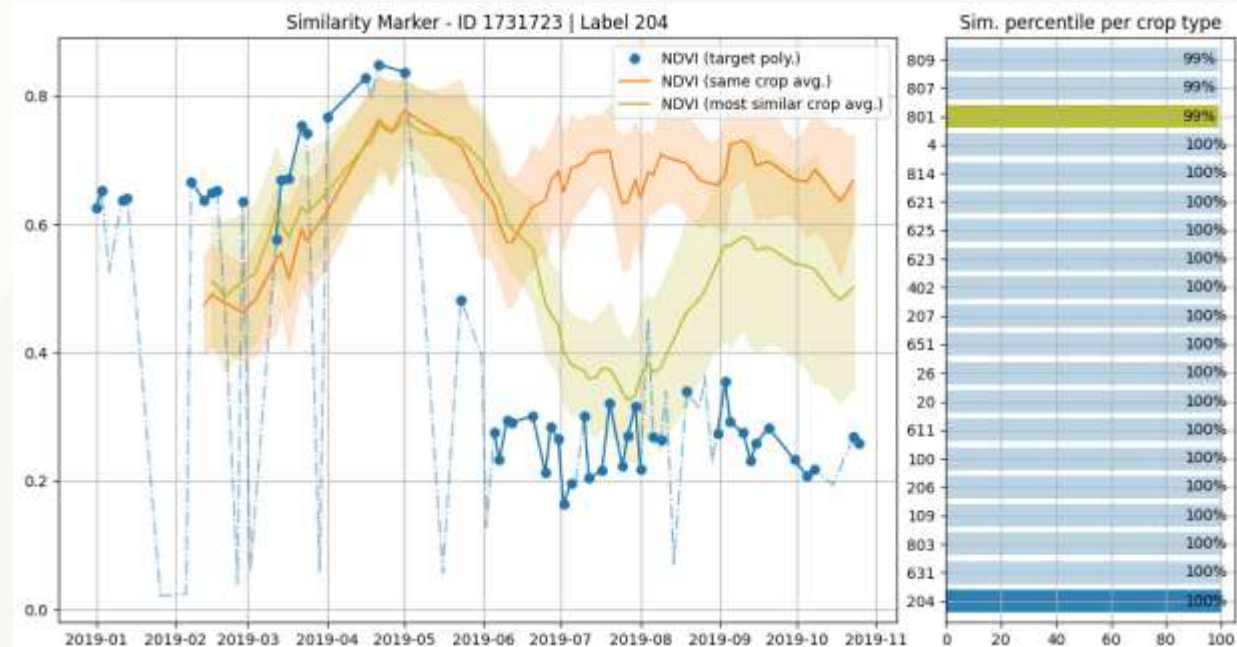


Google

# Similarity marker

- Non-eligible cases

2086230.0	0.3863232609427841	809.0	4.0	2.0	<a href="http://am.sinergise.com/vis/ds/2086230">http://am.sinergise.com/vis/ds/2086230</a>
2106653.0	0.3862843745470356	402.0	7.0	4.0	<a href="http://am.sinergise.com/vis/ds/2106653">http://am.sinergise.com/vis/ds/2106653</a>
4279008.0	0.38588876491987584	204.0	1.0	4.0	<a href="http://am.sinergise.com/vis/ds/4279008">http://am.sinergise.com/vis/ds/4279008</a>
5259573.0	0.385895586209946	809.0	4.0	2.0	<a href="http://am.sinergise.com/vis/ds/5259573">http://am.sinergise.com/vis/ds/5259573</a>
402526.0	0.3856028074807867	807.0	3.0	2.0	<a href="http://am.sinergise.com/vis/ds/402526">http://am.sinergise.com/vis/ds/402526</a>
587100.0	0.385550430736864	204.0	1.0	12.0	<a href="http://am.sinergise.com/vis/ds/587100">http://am.sinergise.com/vis/ds/587100</a>
3091299.0	0.38479400206229003	204.0	1.0	1.0	<a href="http://am.sinergise.com/vis/ds/3091299">http://am.sinergise.com/vis/ds/3091299</a>
5327905.0	0.3844072999078748	809.0	4.0	2.0	<a href="http://am.sinergise.com/vis/ds/5327905">http://am.sinergise.com/vis/ds/5327905</a>
3481824.0	0.3843102505212952	204.0	1.0	1.0	<a href="http://am.sinergise.com/vis/ds/3481824">http://am.sinergise.com/vis/ds/3481824</a>
5699518.0	0.3842578056127271	222.0	13.0	15.0	<a href="http://am.sinergise.com/vis/ds/5699518">http://am.sinergise.com/vis/ds/5699518</a>
3072466.0	0.3841533360320854	402.0	7.0	1.0	<a href="http://am.sinergise.com/vis/ds/3072466">http://am.sinergise.com/vis/ds/3072466</a>
863034.0	0.3841090615964073	6.0	2.0	9.0	<a href="http://am.sinergise.com/vis/ds/863034">http://am.sinergise.com/vis/ds/863034</a>
1138984.0	0.3840828813847818	5.0	2.0	3.0	<a href="http://am.sinergise.com/vis/ds/1138984">http://am.sinergise.com/vis/ds/1138984</a>
4988003.0	0.3840146238029323	402.0	7.0	7.0	<a href="http://am.sinergise.com/vis/ds/4988003">http://am.sinergise.com/vis/ds/4988003</a>
1878911.0	0.3832533918455927	801.0	3.0	2.0	<a href="http://am.sinergise.com/vis/ds/1878911">http://am.sinergise.com/vis/ds/1878911</a>
836328.0	0.3821454880260885	807.0	3.0	10.0	<a href="http://am.sinergise.com/vis/ds/836328">http://am.sinergise.com/vis/ds/836328</a>
844725.0	0.3819671036348273	809.0	4.0	2.0	<a href="http://am.sinergise.com/vis/ds/844725">http://am.sinergise.com/vis/ds/844725</a>
850922.0	0.3818595344688461	402.0	7.0	3.0	<a href="http://am.sinergise.com/vis/ds/850922">http://am.sinergise.com/vis/ds/850922</a>
1731723.0	0.3814039785979408	204.0	1.0	7.0	<a href="http://am.sinergise.com/vis/ds/1731723">http://am.sinergise.com/vis/ds/1731723</a>
3328858.0	0.3813418894051898	809.0	4.0	2.0	<a href="http://am.sinergise.com/vis/ds/3328858">http://am.sinergise.com/vis/ds/3328858</a>
612507.0	0.381102268662532	801.0	3.0	2.0	<a href="http://am.sinergise.com/vis/ds/612507">http://am.sinergise.com/vis/ds/612507</a>
153125.0	0.3810619918193873	203.0	1.0	7.0	<a href="http://am.sinergise.com/vis/ds/153125">http://am.sinergise.com/vis/ds/153125</a>
1033564.0	0.3808960858079324	809.0	4.0	2.0	<a href="http://am.sinergise.com/vis/ds/1033564">http://am.sinergise.com/vis/ds/1033564</a>
5779281.0	0.38077292792956174	203.0	1.0	1.0	<a href="http://am.sinergise.com/vis/ds/5779281">http://am.sinergise.com/vis/ds/5779281</a>
325216.0	0.3805916211893207	801.0	3.0	2.0	<a href="http://am.sinergise.com/vis/ds/325216">http://am.sinergise.com/vis/ds/325216</a>
6094103.0	0.3804387642502044	6.0	2.0	7.0	<a href="http://am.sinergise.com/vis/ds/6094103">http://am.sinergise.com/vis/ds/6094103</a>
95737.0	0.38037185097547216	809.0	4.0	2.0	<a href="http://am.sinergise.com/vis/ds/95737">http://am.sinergise.com/vis/ds/95737</a>
4056651.0	0.3802471495827249	204.0	1.0	1.0	<a href="http://am.sinergise.com/vis/ds/4056651">http://am.sinergise.com/vis/ds/4056651</a>
4057419.0	0.3802179672638573	204.0	1.0	7.0	<a href="http://am.sinergise.com/vis/ds/4057419">http://am.sinergise.com/vis/ds/4057419</a>
3020927.0	0.3801973319506991	801.0	3.0	2.0	<a href="http://am.sinergise.com/vis/ds/3020927">http://am.sinergise.com/vis/ds/3020927</a>
1552230.0	0.3801037923336461	6.0	2.0	4.0	<a href="http://am.sinergise.com/vis/ds/1552230">http://am.sinergise.com/vis/ds/1552230</a>
983343.0	0.3795667022543021	809.0	4.0	2.0	<a href="http://am.sinergise.com/vis/ds/983343">http://am.sinergise.com/vis/ds/983343</a>
457407.0	0.3794739776251077	402.0	7.0	6.0	<a href="http://am.sinergise.com/vis/ds/457407">http://am.sinergise.com/vis/ds/457407</a>
5975432.0	0.379207047773258	204.0	1.0	1.0	<a href="http://am.sinergise.com/vis/ds/5975432">http://am.sinergise.com/vis/ds/5975432</a>
3053802.0	0.378559488881695	204.0	1.0	7.0	<a href="http://am.sinergise.com/vis/ds/3053802">http://am.sinergise.com/vis/ds/3053802</a>



ID 1731723 | Date 2019-03-01



ID 1731723 | Date 2019-03-23



ID 1731723 | Date 2019-06-05



ID 1731723 | Date 2019-09-30

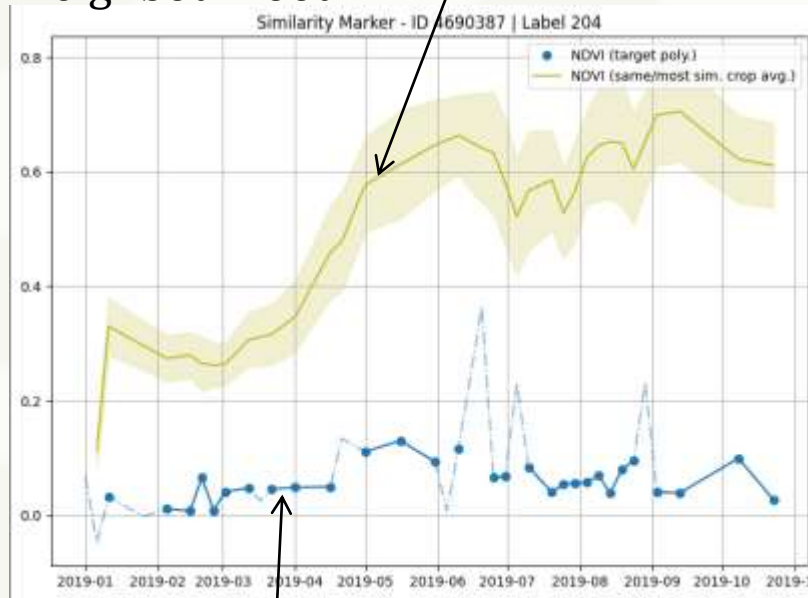




# Mean-NDVI marker

Examples claimed to be permanent meadows

Average of meadows in the neighbourhood

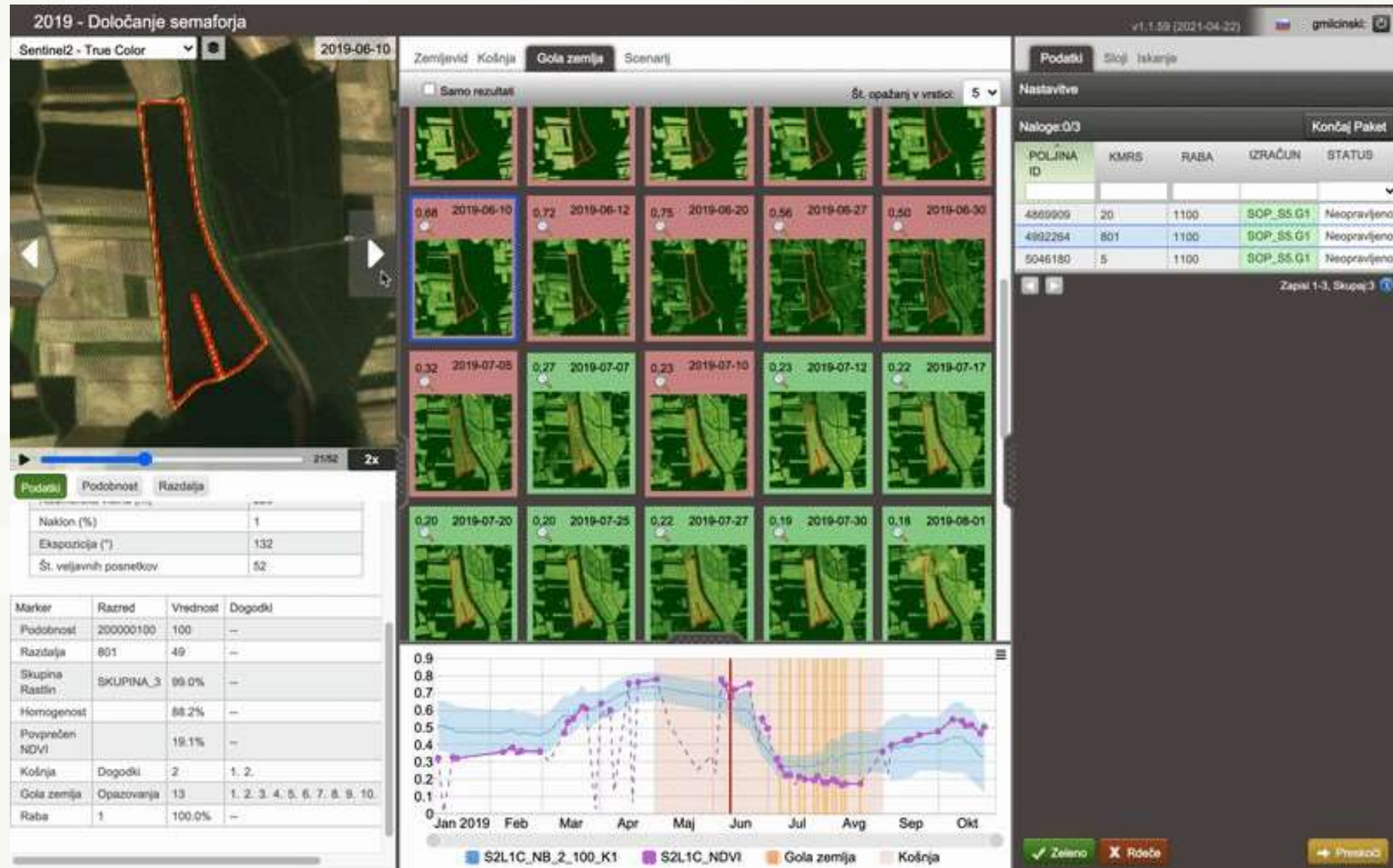


NDVI profile of this FOI

Digital Orthophoto

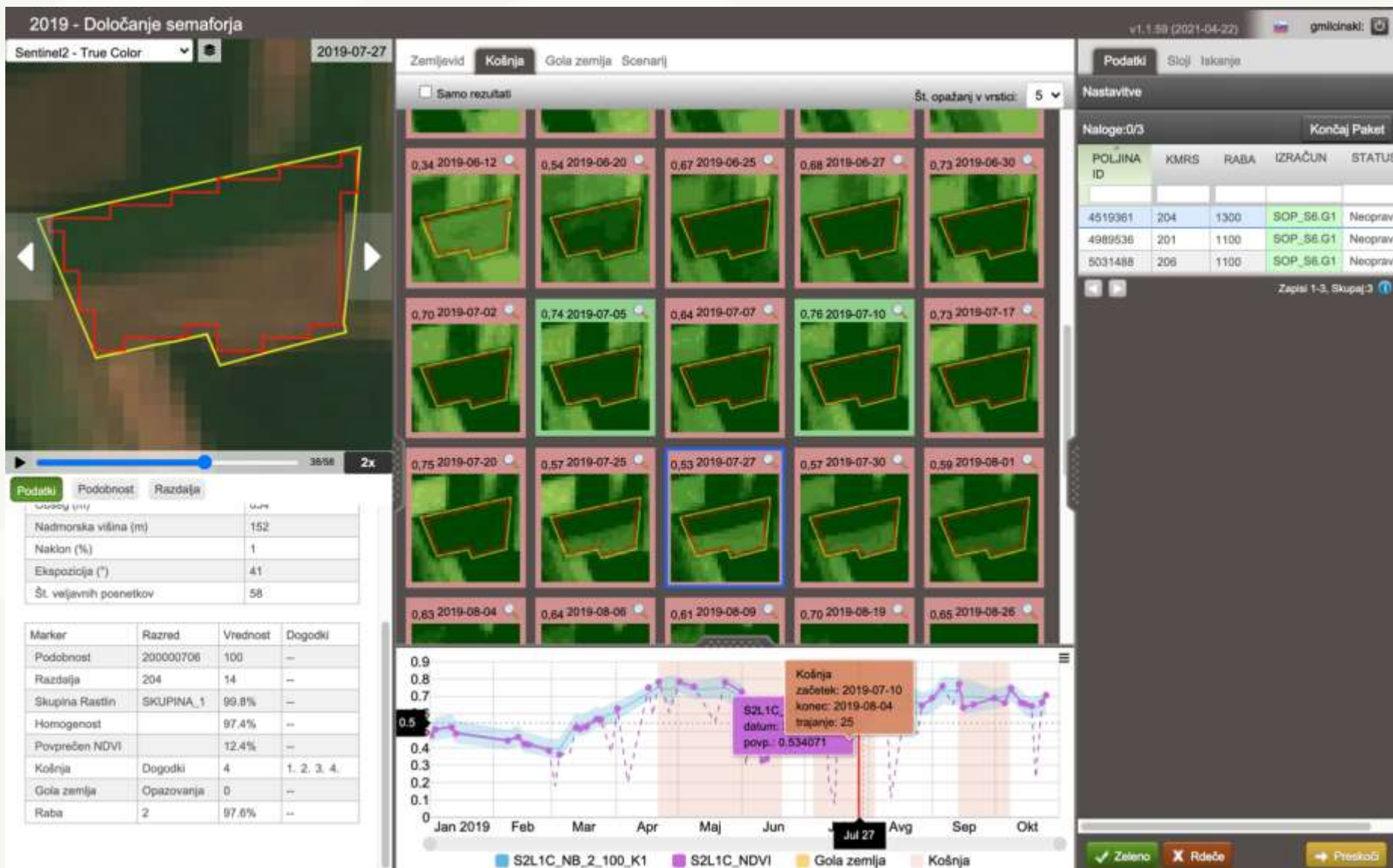


# Bare soil

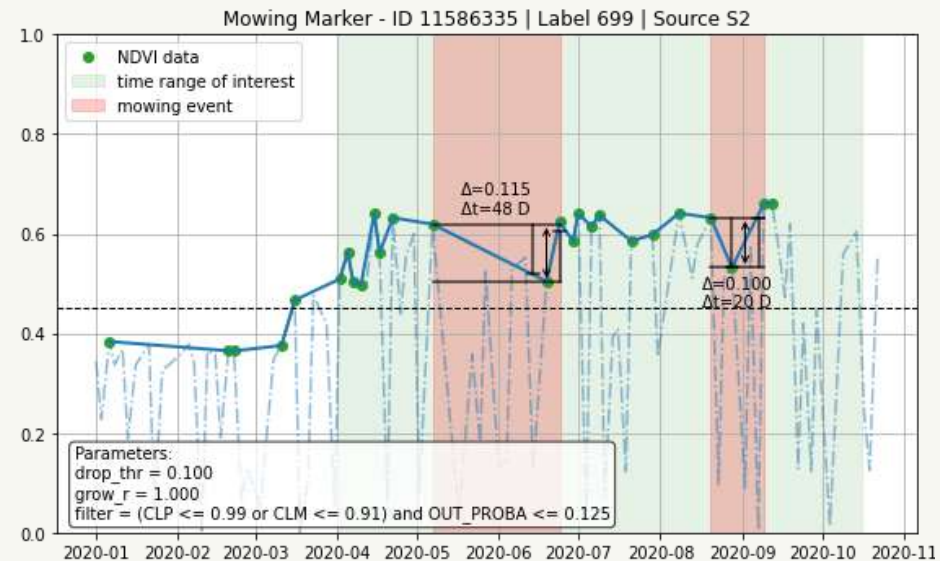
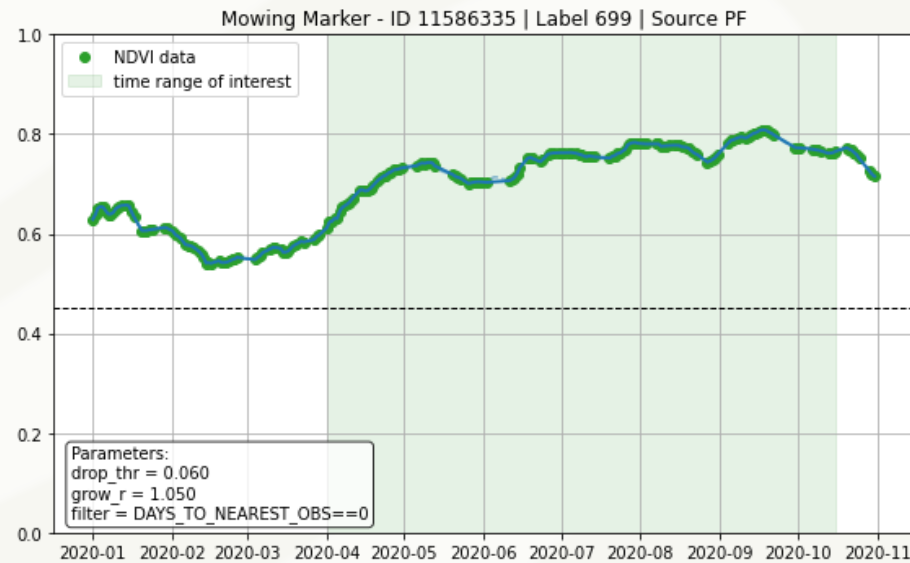




# Mowing



# Support of Planet data for cloudy areas



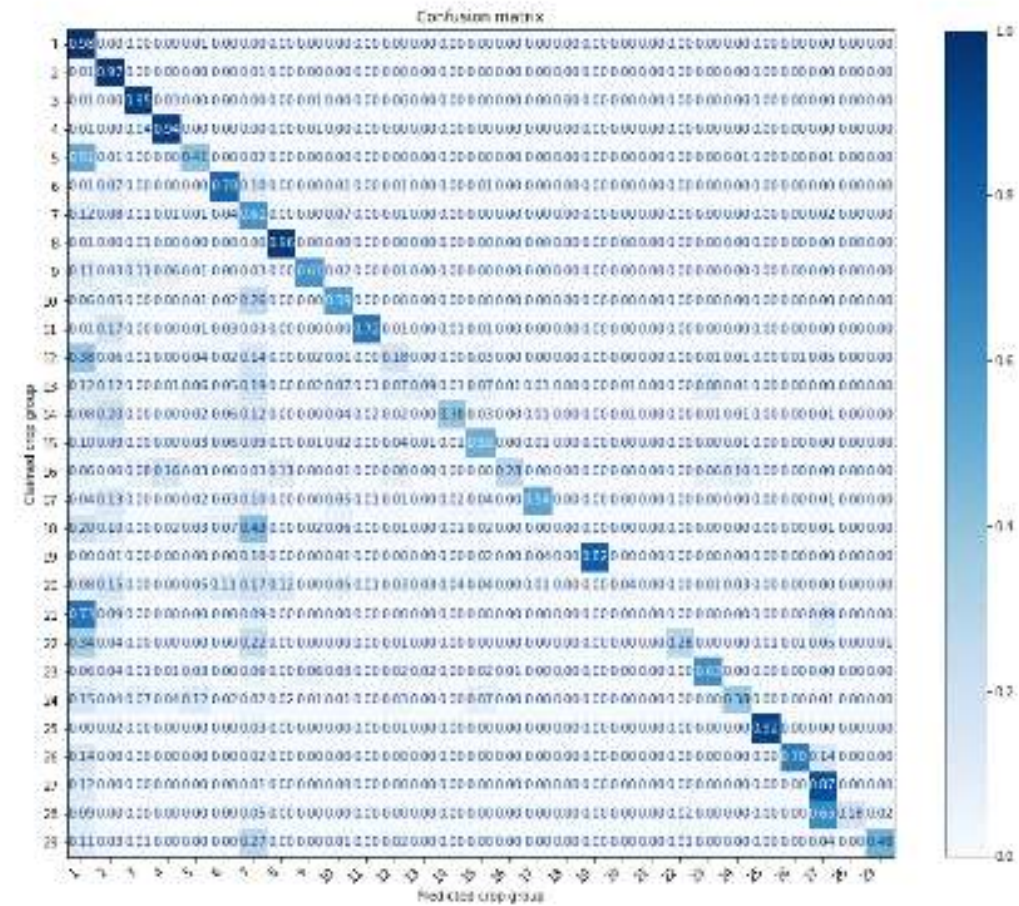


# Crop group classification

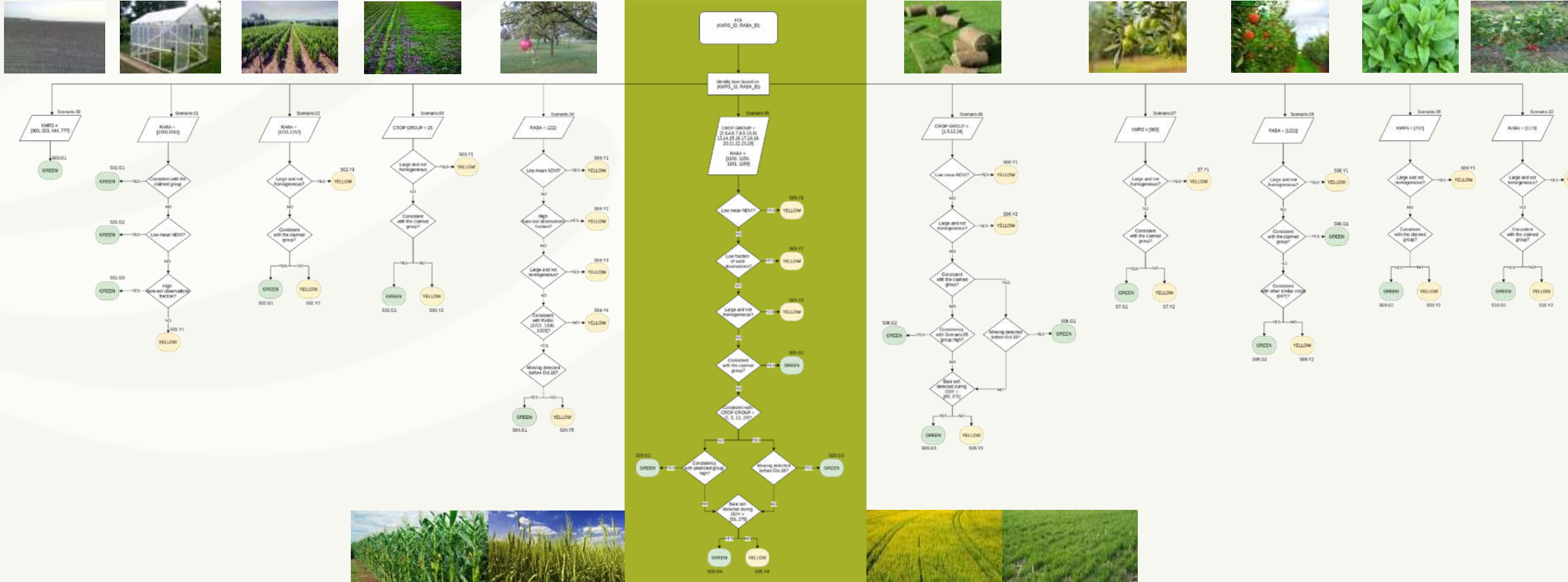
Accuracy: 93.9

Weighted average

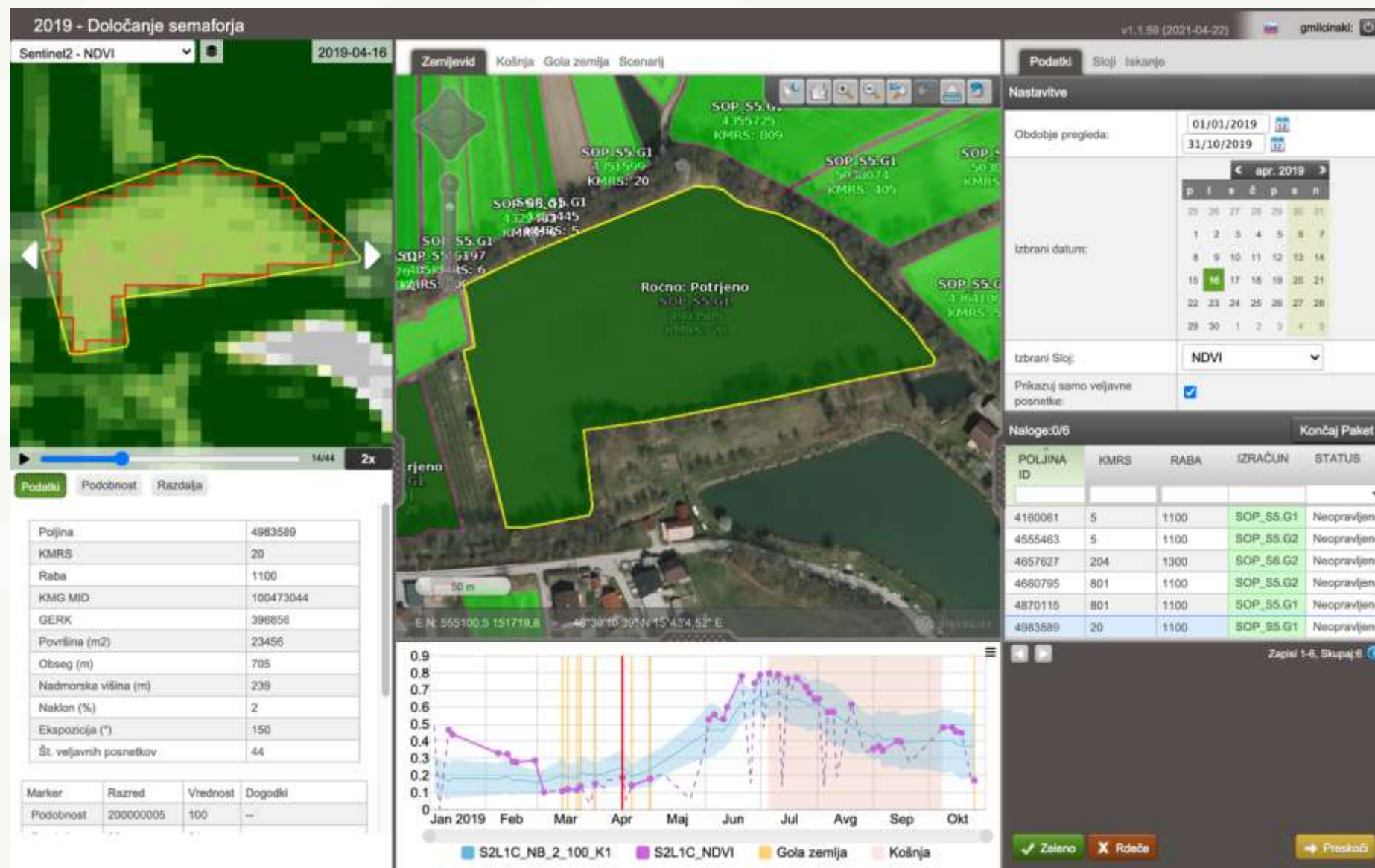
- Precision: 93.4
- Recall: 93.9
- F1-score: 93.6



# Traffic Light System




# Expert app







# Communication with famers



REPUBLIKA  
SLOVENIJA

 APLIKACIJA SOPOTNIK

VLOGA\_ID: 511497



Grega Milcinski

Odjava

Stanje semaforja po poljinah (63/63)

Filtriraj po stanju semaforja:

! (0)

? (7)

✓ (56)

✕ (0)

GERK 1070113 - ZA GABROVSKOM 2

1 ?

6724627 - travnodeteljne mešanice - 39 ar

GERK 656825 - PRI OGRAJI

1 ?

6724632 - trajno travinje - 19 ar

GERK 4076912 - DRŽAVNI

1 ?

6724572 - lucerna - 12 ha 5 ar

GERK 3237404 - MOŠE

1 ✓

6724574 - koruza za silažo - 7 ha 52 ar


GERK 3651508 - KOMPLEKS

1 ✓

6724576 - koruza za silažo - 3 ha 75 ar

GERK 4582412 - RAKOVA JELŠA\_1

2 ✓



20 m

Podrobnosti poljine

Opažanja

Površina poljine je homogena.

Površina poljine je bila preorana.

Površina poljine je bila pokošena ali požeta.

Površina poljine je bila vse leto v kmetijski rabi.

Raba tal je skladna s prijavo na geoprostorskem obrazcu.

Kmetijska rastlina je skladna s prijavo na geoprostorskem obrazcu.

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NE

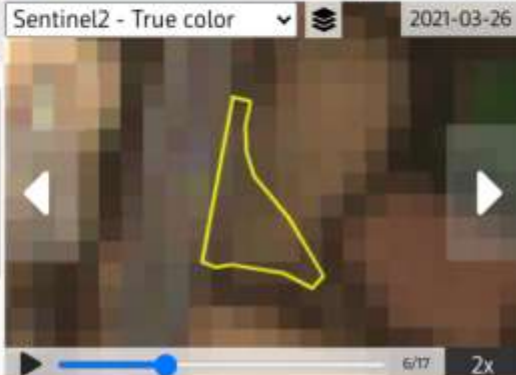
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Sentinel2 - True color

2021-03-26



6/17 2x

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## **Planet Fusion for the Common Agricultural Policy (CAP) Webinar**

<https://register.gotowebinar.com/register/4079918634918355213>

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