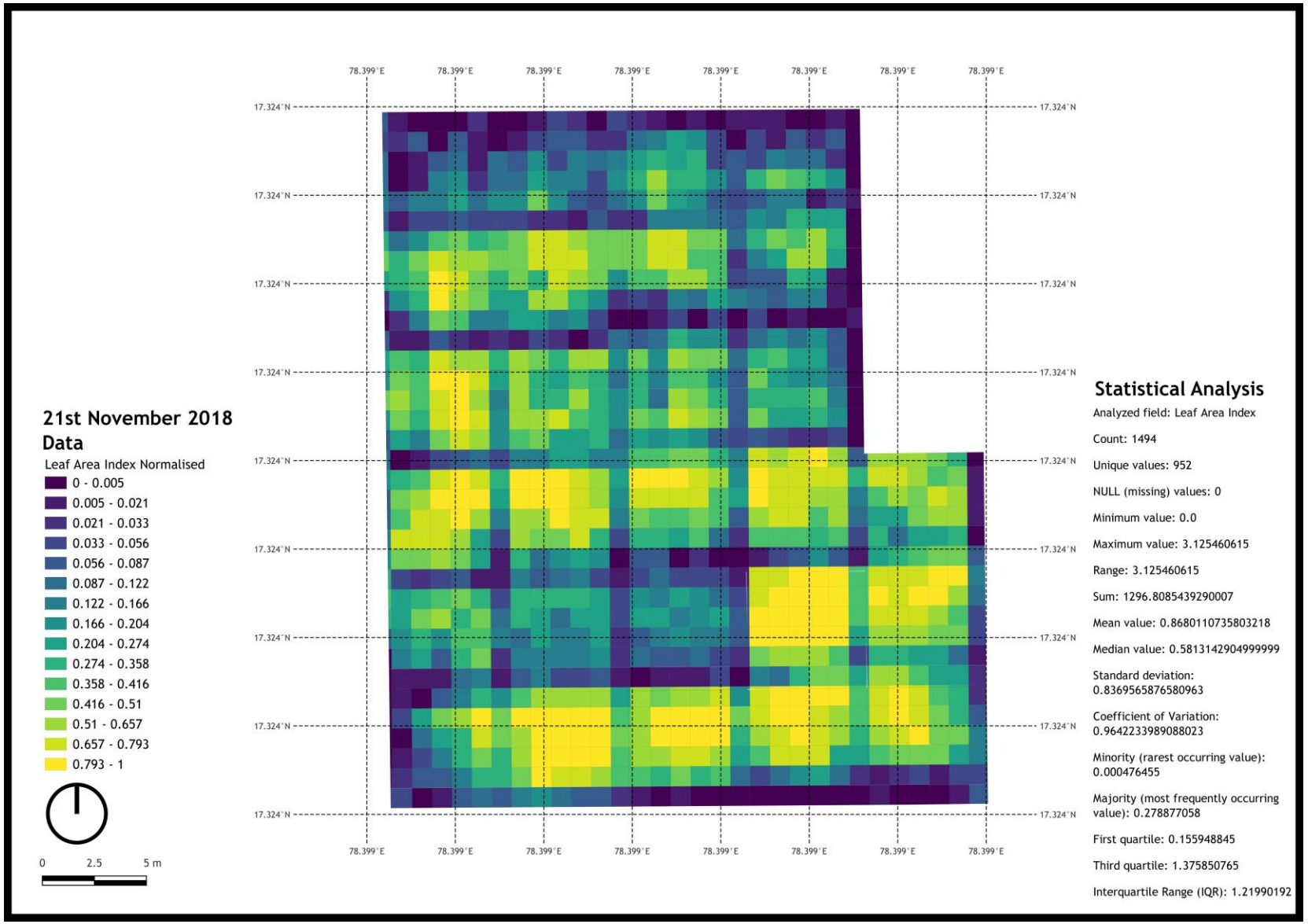
# LAI Mapping

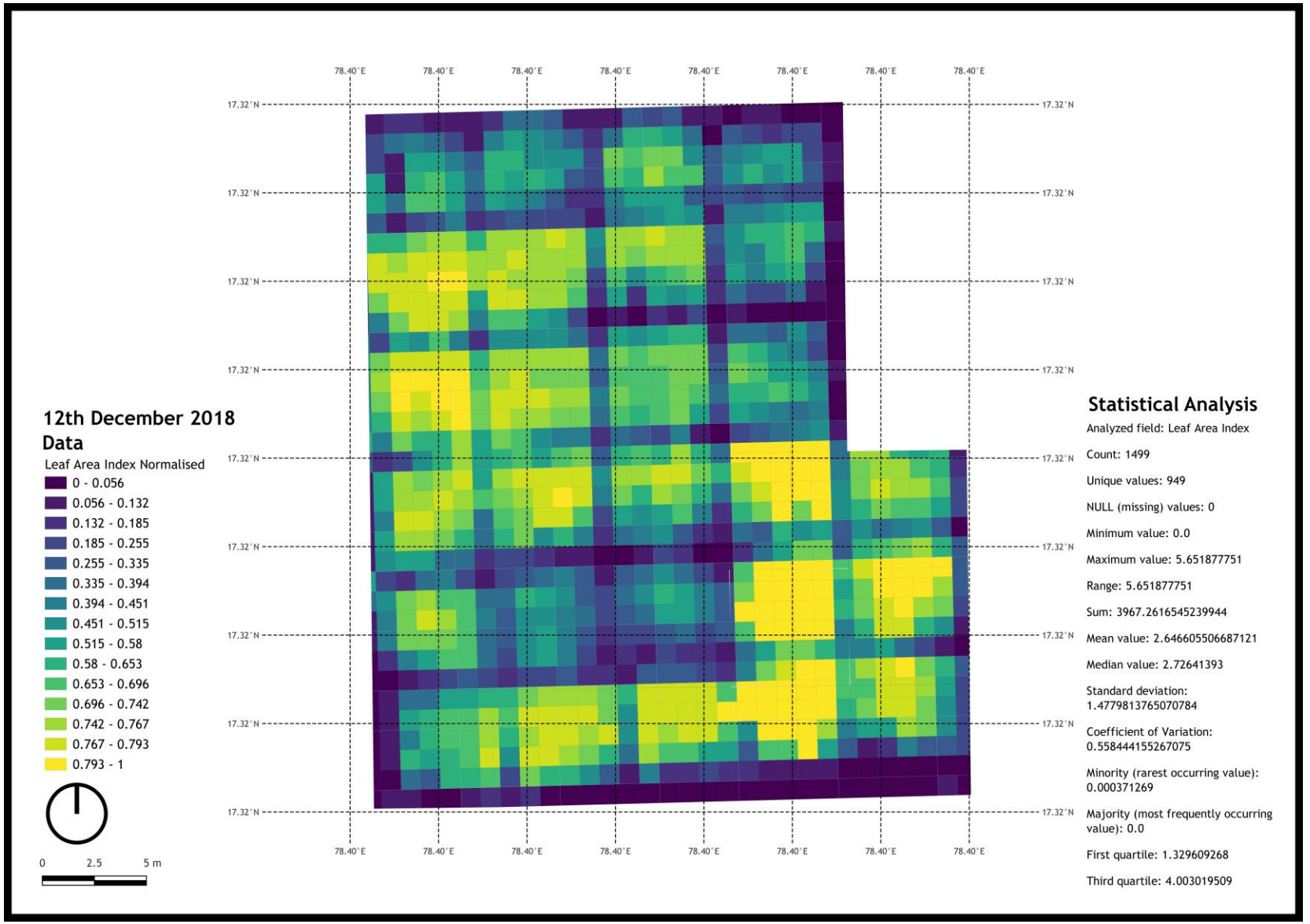
23m0312
Manish Bilore

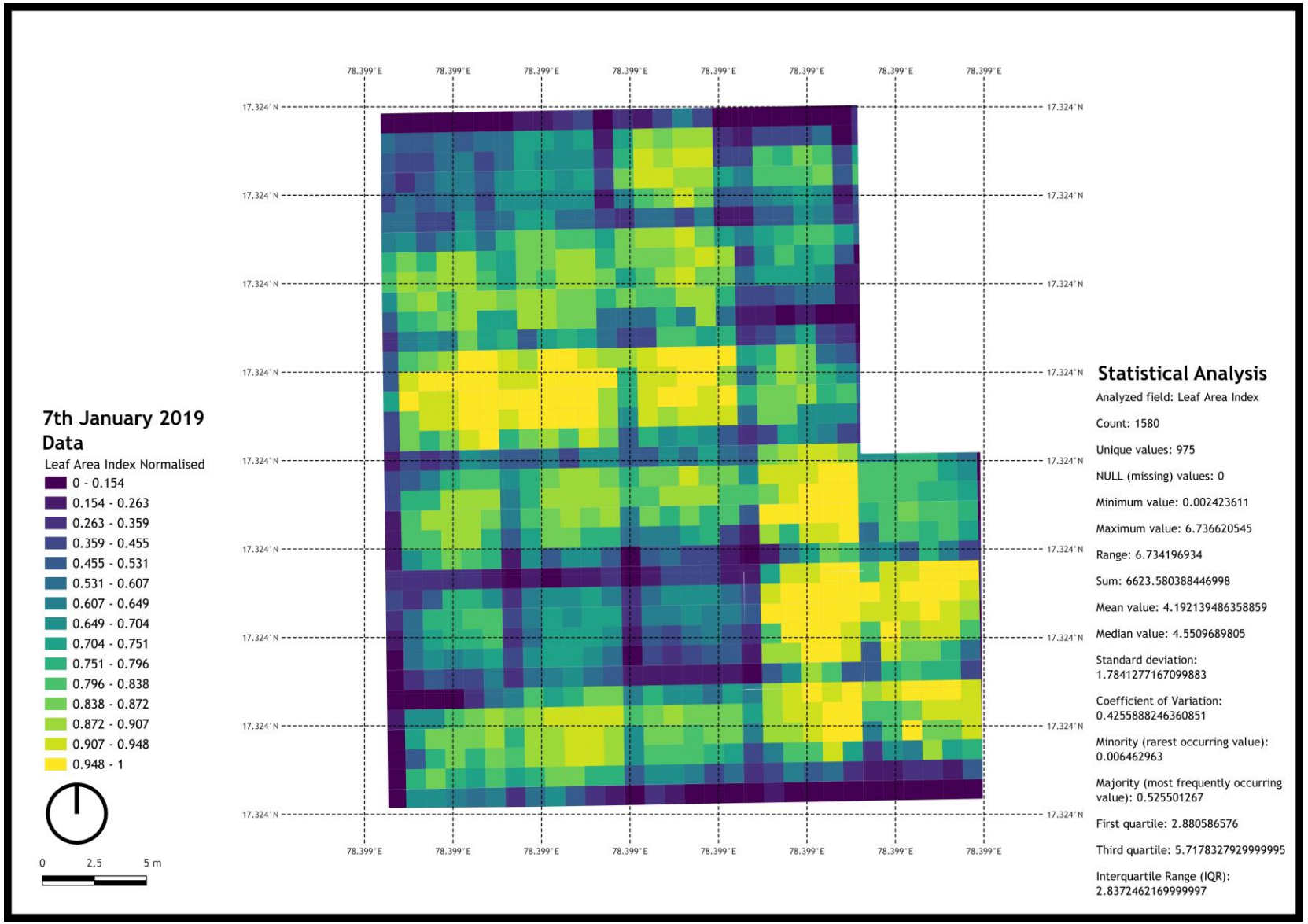
GNR 631 Mini Project

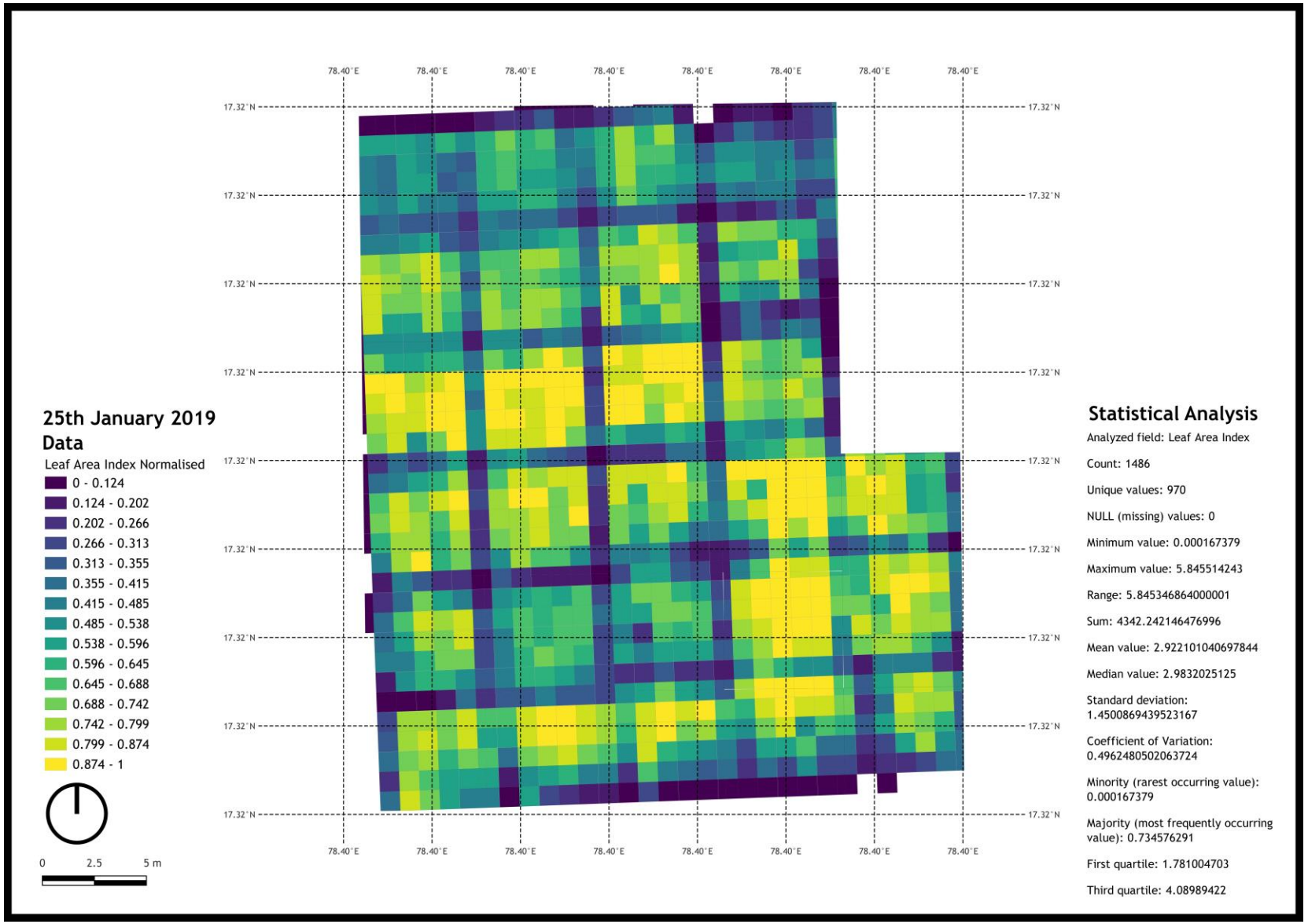
# QGIS

Based mapping


78.399°E
17.324°N
21st November 2018 Data
Leaf Area Index Normalised
0 - 0.005
0.005 - 0.021
0.021 - 0.033
0.033 - 0.056
0.056 - 0.087
0.087 - 0.122
0.122 - 0.166
0.166 - 0.204
0.204 - 0.274
0.274 - 0.358
0.358 - 0.416
0.416 - 0.51
0.51 - 0.657
0.657 - 0.793
0.793 - 1
0
2.5
5 m
Statistical Analysis
Analyzed field: Leaf Area Index
Count: 1494
Unique values: 952
NULL (missing) values: 0
Minimum value: 0.0
Maximum value: 3.125460615
Range: 3.125460615
Sum: 1296.8085439290007
Mean value: 0.8680110735803218
Median value: 0.5813142904999999
Standard deviation: 0.8369565876580963
Coefficient of Variation: 0.9642233989088023
Minority (rarest occurring value): 0.000476455
Majority (most frequently occurring value): 0.278877058
First quartile: 0.155948845
Third quartile: 1.375850765
Interquartile Range (IQR): 1.21990192

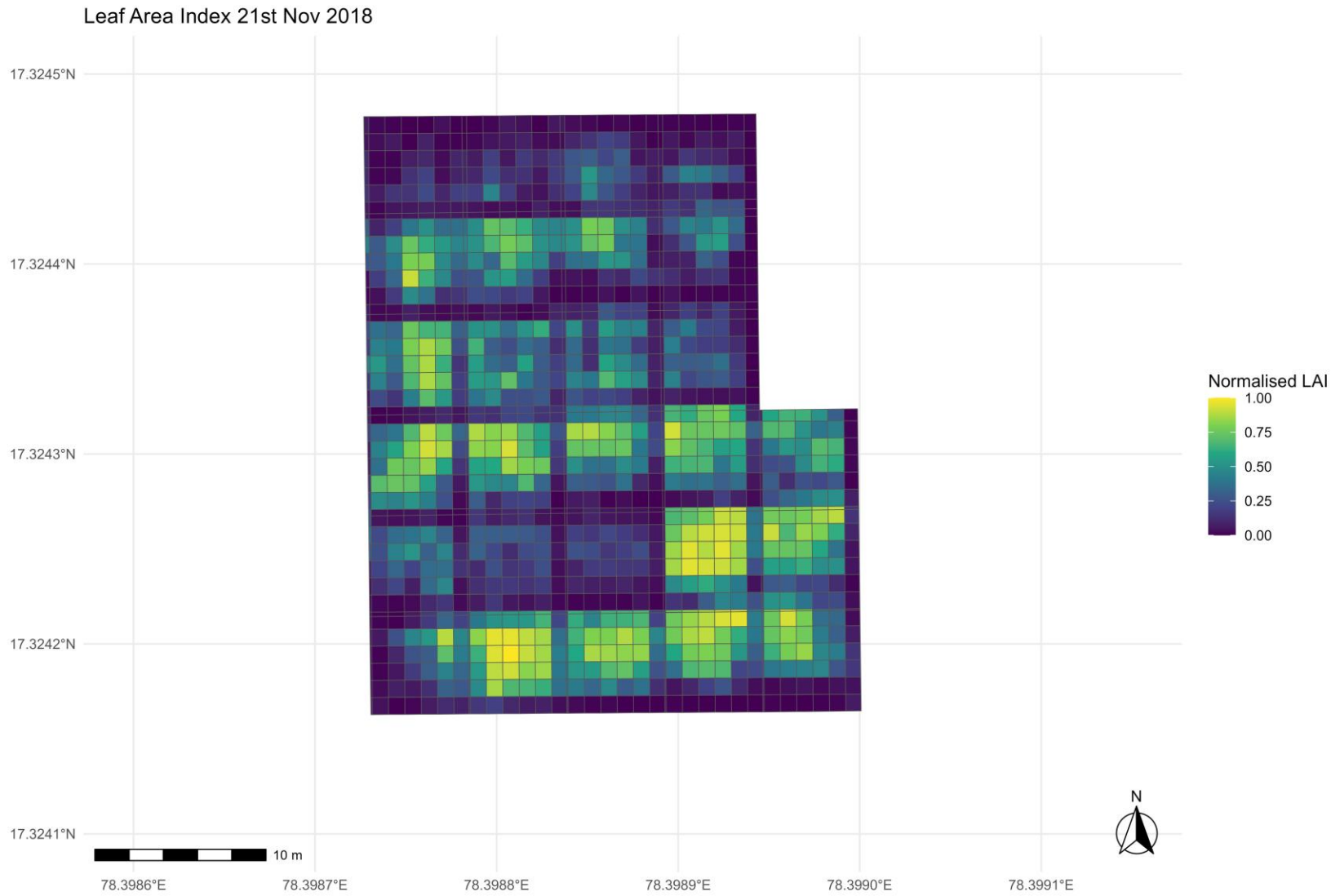

78.40°E
17.32°N
12th December 2018
Data
Leaf Area Index Normalised
0 - 0.056
0.056 - 0.132
0.132 - 0.185
0.185 - 0.255
0.255 - 0.335
0.335 - 0.394
0.394 - 0.451
0.451 - 0.515
0.515 - 0.58
0.58 - 0.653
0.653 - 0.696
0.696 - 0.742
0.742 - 0.767
0.767 - 0.793
0.793 - 1
0
2.5
5 m
Statistical Analysis
Analyzed field: Leaf Area Index
Count: 1499
Unique values: 949
NULL (missing) values: 0
Minimum value: 0.0
Maximum value: 5.651877751
Range: 5.651877751
Sum: 3967.2616545239944
Mean value: 2.646605506687121
Median value: 2.72641393
Standard deviation: 1.477981376507078
Coefficient of Variation: 0.558444155267075
Minority (rarest occurring value): 0.000371269
Majority (most frequently occurring value): 0.0
First quartile: 1.329609268
Third quartile: 4.003019509

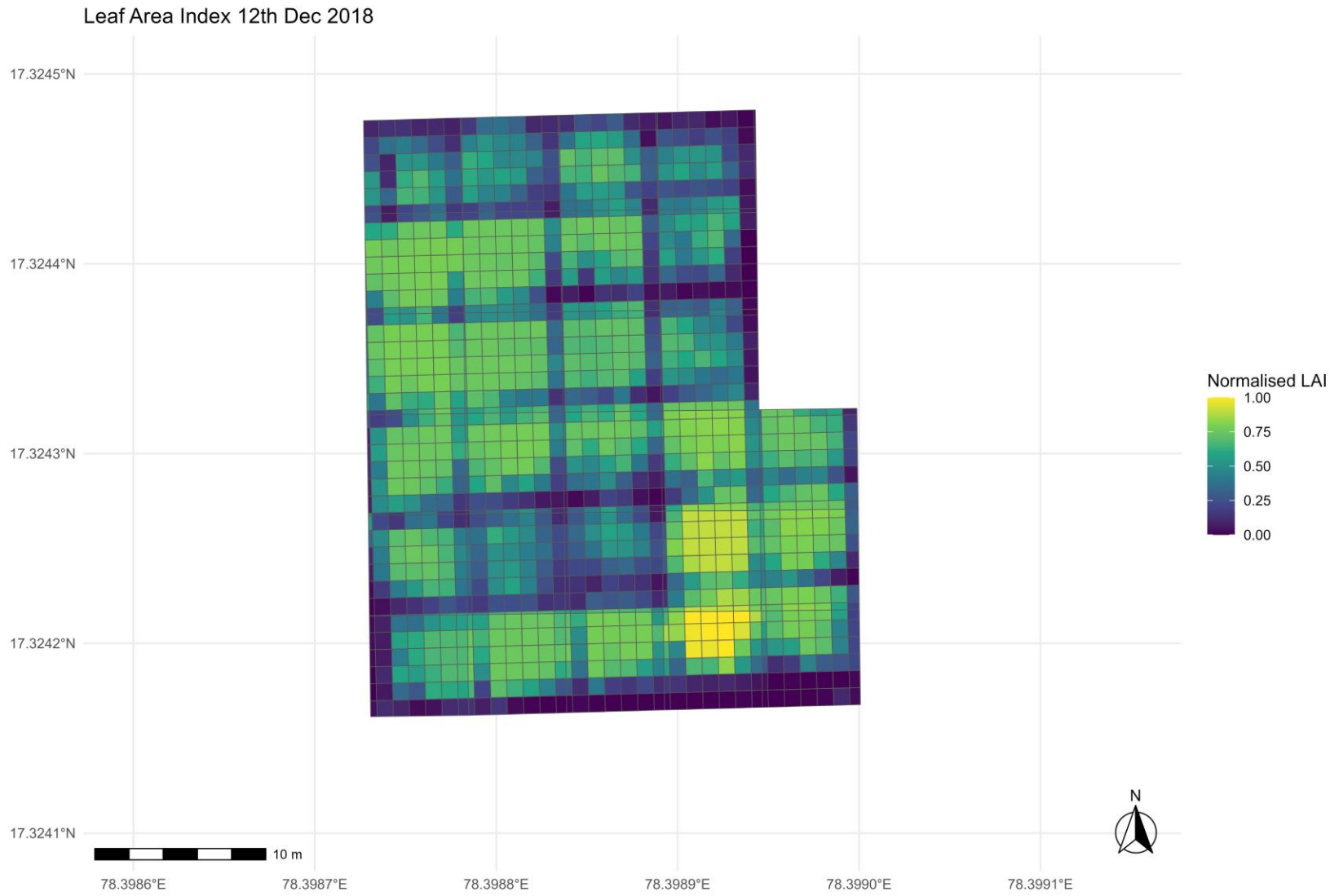

78.399°E
17.324°N
7th January 2019 Data
Leaf Area Index Normalised
0 - 0.154
0.154 - 0.263
0.263 - 0.359
0.359 - 0.455
0.455 - 0.531
0.531 - 0.607
0.607 - 0.649
0.649 - 0.704
0.704 - 0.751
0.751 - 0.796
0.796 - 0.838
0.838 - 0.872
0.872 - 0.907
0.907 - 0.948
0.948 - 1
0
2.5
5 m
Statistical Analysis
Analyzed field: Leaf Area Index
Count: 1580
Unique values: 975
NULL (missing) values: 0
Minimum value: 0.002423611
Maximum value: 6.736620545
Range: 6.734196934
Sum: 6623.580388446998
Mean value: 4.192139486358859
Median value: 4.5509689805
Standard deviation: 1.7841277167099883
Coefficient of Variation: 0.4255888246360851
Minority (rarest occurring value): 0.006462963
Majority (most frequently occurring value): 0.525501267
First quartile: 2.880586576
Third quartile: 5.7178327929999995
Interquartile Range (IQR): 2.8372462169999997


78.40°E
17.32°N
25th January 2019
Data
Leaf Area Index Normalised
0 - 0.124
0.124 - 0.202
0.202 - 0.266
0.266 - 0.313
0.313 - 0.355
0.355 - 0.415
0.415 - 0.485
0.485 - 0.538
0.538 - 0.596
0.596 - 0.645
0.645 - 0.688
0.688 - 0.742
0.742 - 0.799
0.799 - 0.874
0.874 - 1
0
2.5
5 m
Statistical Analysis
Analyzed field: Leaf Area Index
Count: 1486
Unique values: 970
NULL (missing) values: 0
Minimum value: 0.000167379
Maximum value: 5.845514243
Range: 5.845346864000001
Sum: 4342.242146476996
Mean value: 2.922101040697844
Median value: 2.9832025125
Standard deviation: 1.4500869439523167
Coefficient of Variation: 0.4962480502063724
Minority (rarest occurring value): 0.000167379
Majority (most frequently occurring value): 0.734576291
First quartile: 1.781004703
Third quartile: 4.08989422

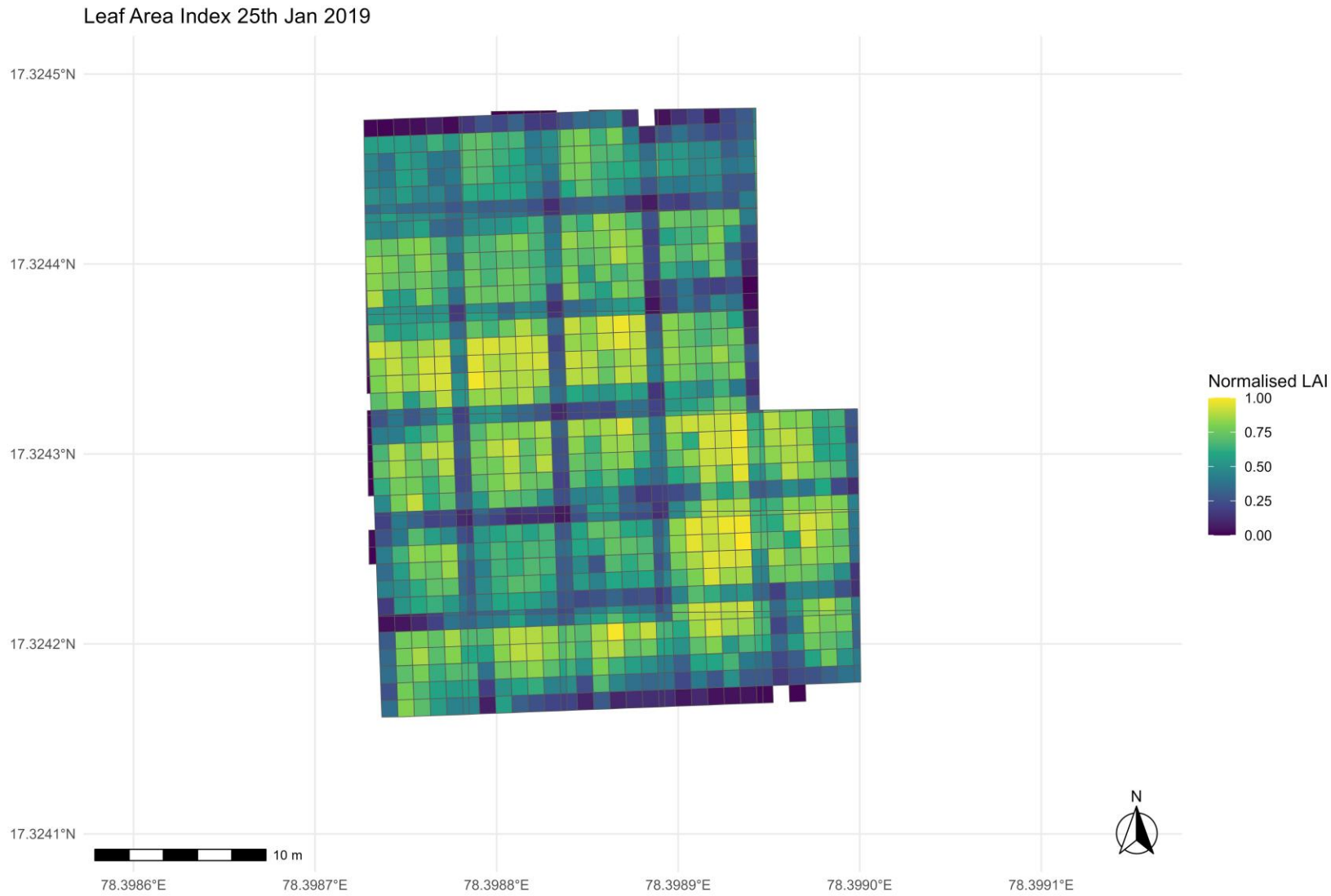
# R Programming

Based mapping

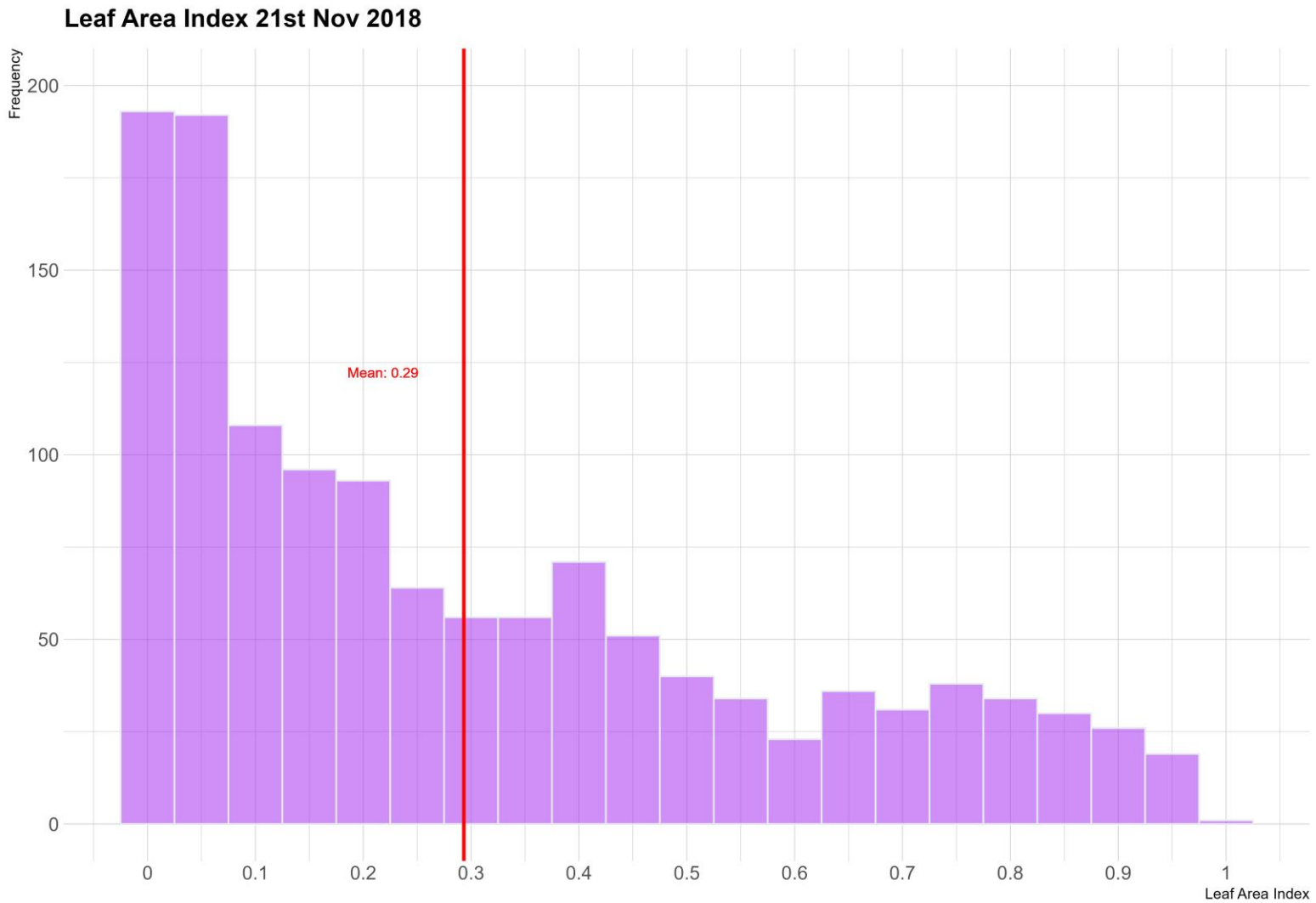

Leaf Area Index 21st Nov 2018
17.3245°N
17.3244°N
17.3243°N
17.3242°N
17.3241°N
78.3986°E
78.3987°E
78.3988°E
78.3989°E
78.3990°E
78.3991°E
10 m
N
Normalised LAI
1.00
0.75
0.50
0.25
0.00

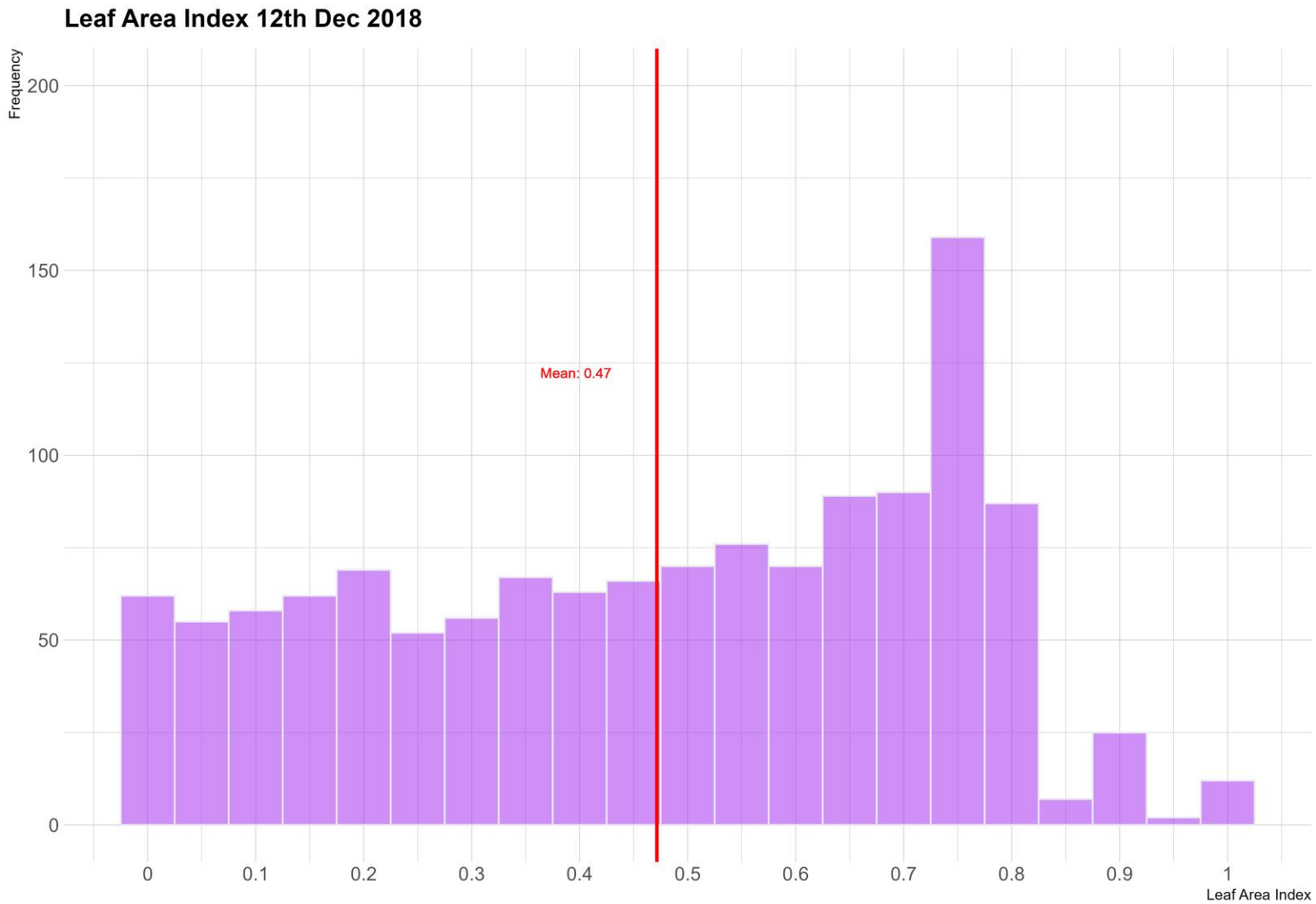

Leaf Area Index 12th Dec 2018
17.3245°N
17.3244°N
17.3243°N
17.3242°N
17.3241°N
10 m
78.3986°E
78.3987°E
78.3988°E
78.3989°E
78.3990°E
78.3991°E
N
Normalised LAI
1.00
0.75
0.50
0.25
0.00

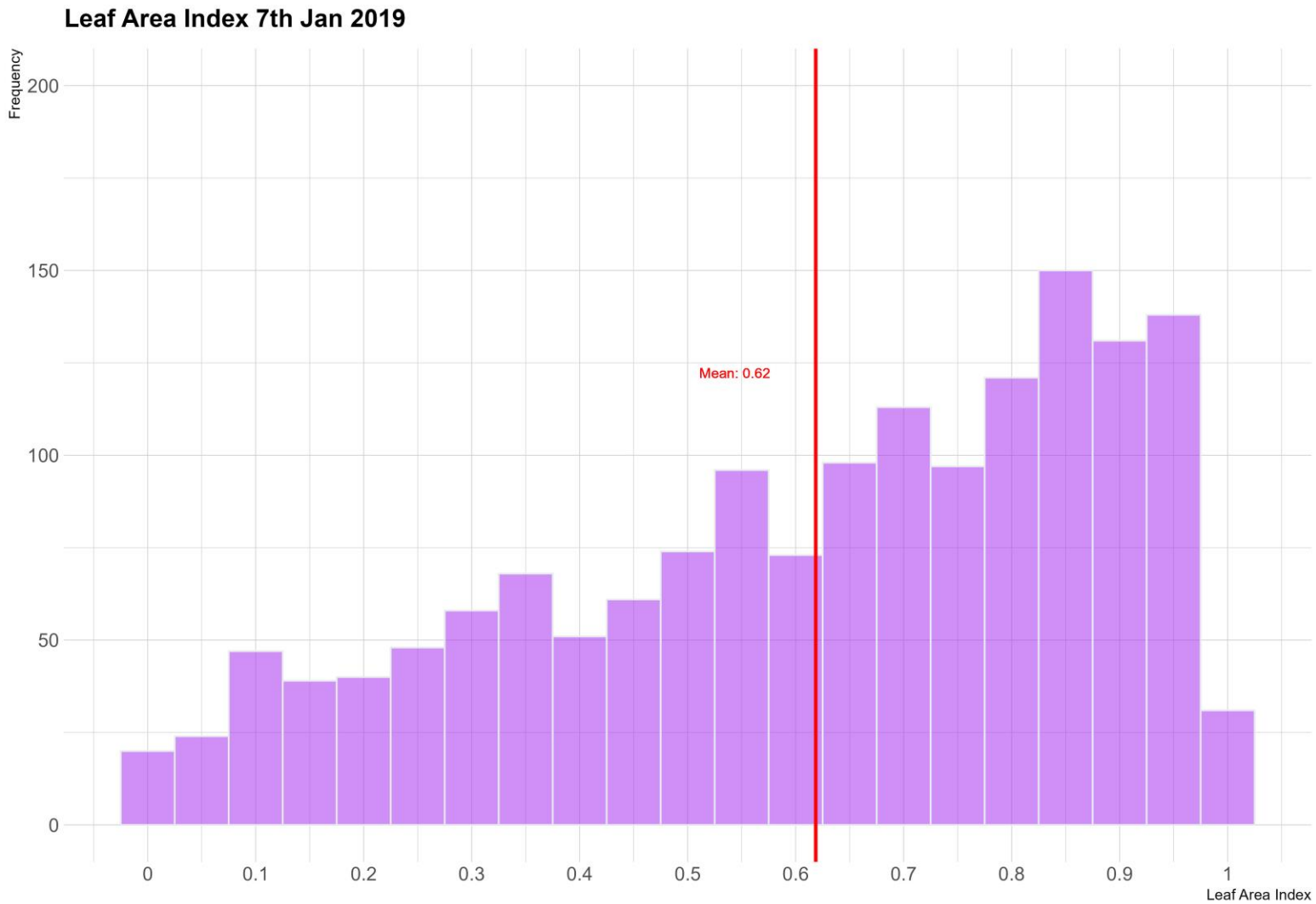

Leaf Area Index 7th Jan 2019
17.3245°N
17.3244°N
17.3243°N
17.3242°N
17.3241°N
10 m
78.3986°E
78.3987°E
78.3988°E
78.3989°E
78.3990°E
78.3991°E
N
Normalised LAI
1.00
0.75
0.50
0.25
0.00

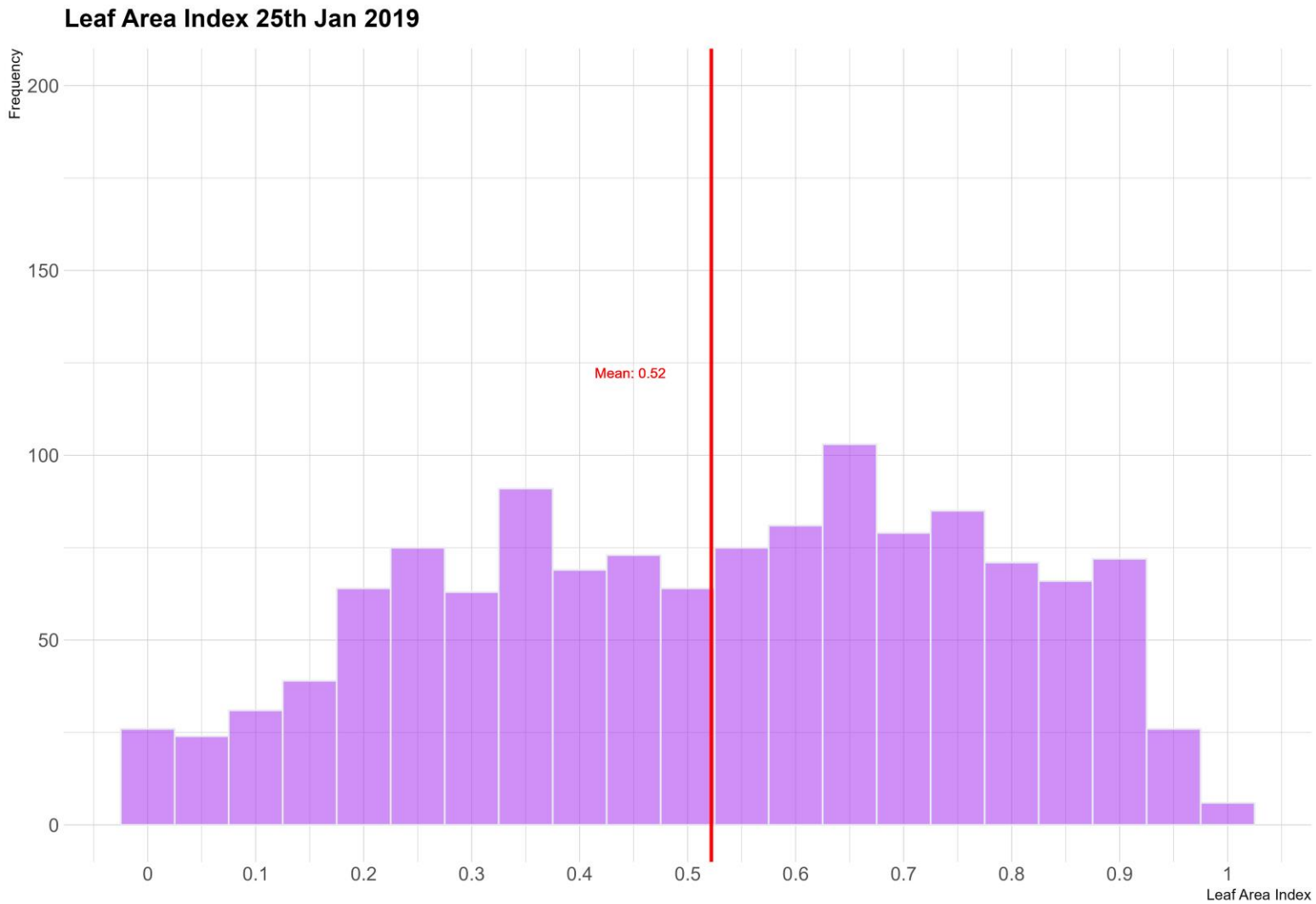

Leaf Area Index 25th Jan 2019
17.3245°N
17.3244°N
17.3243°N
17.3242°N
17.3241°N
10 m
78.3986°E
78.3987°E
78.3988°E
78.3989°E
78.3990°E
78.3991°E
N
Normalised LAI
1.00
0.75
0.50
0.25
0.00

# Histogram analysis

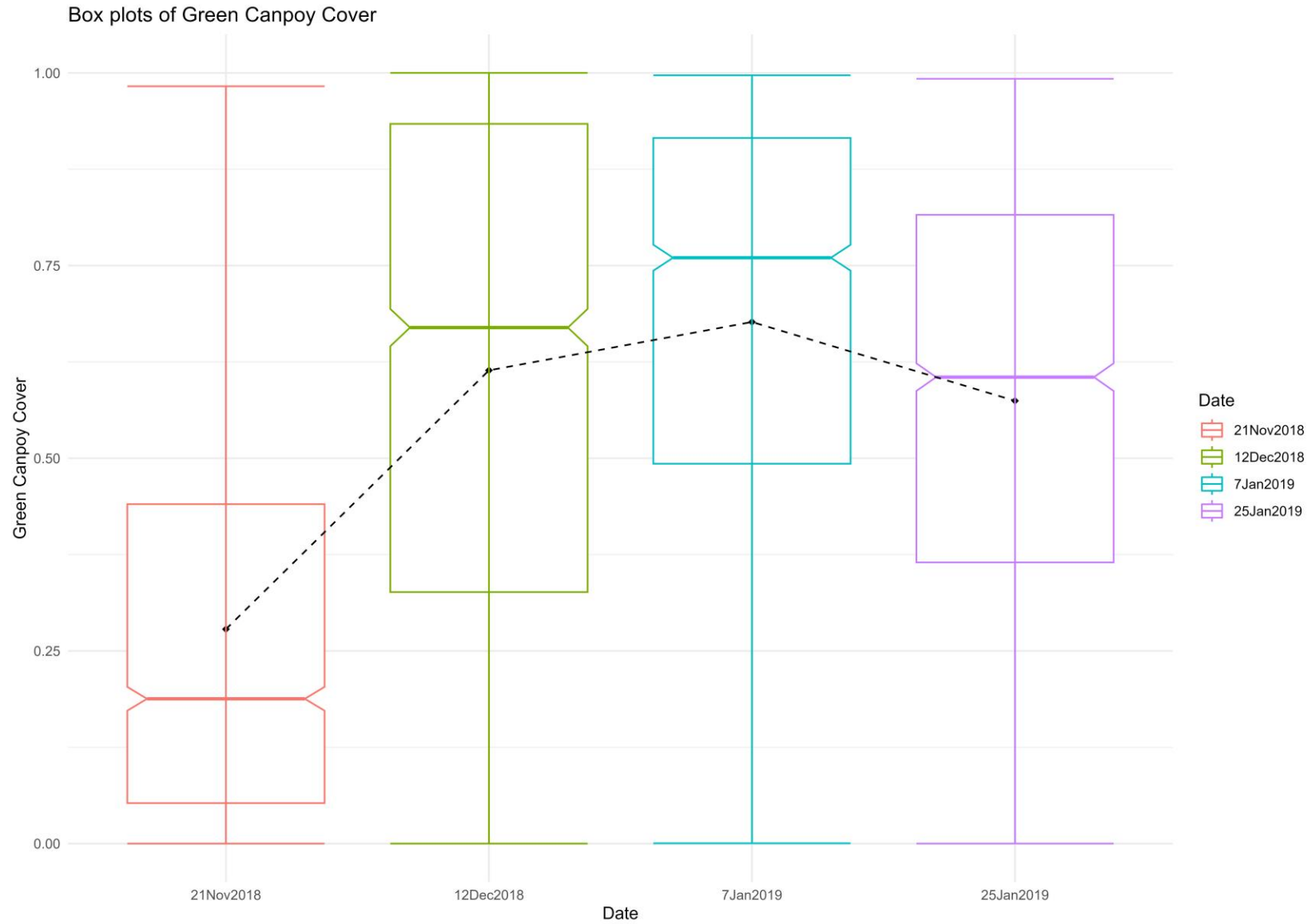

Leaf Area Index 21st Nov 2018
Frequency
200
150
100
50
0
Mean: 0.29
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Leaf Area Index

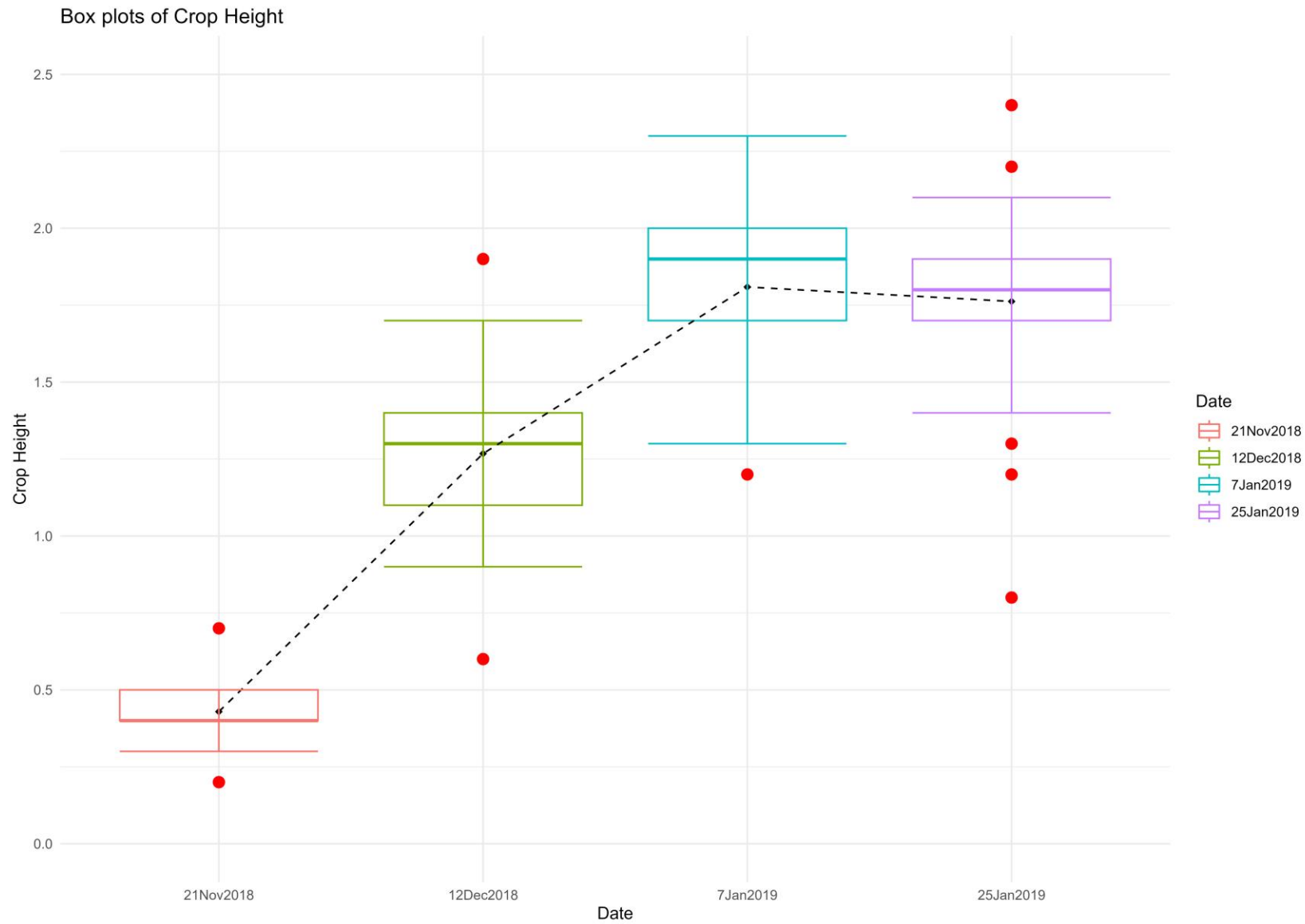

Leaf Area Index 12th Dec 2018
Frequency
200
150
100
50
0
Mean: 0.47
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Leaf Area Index

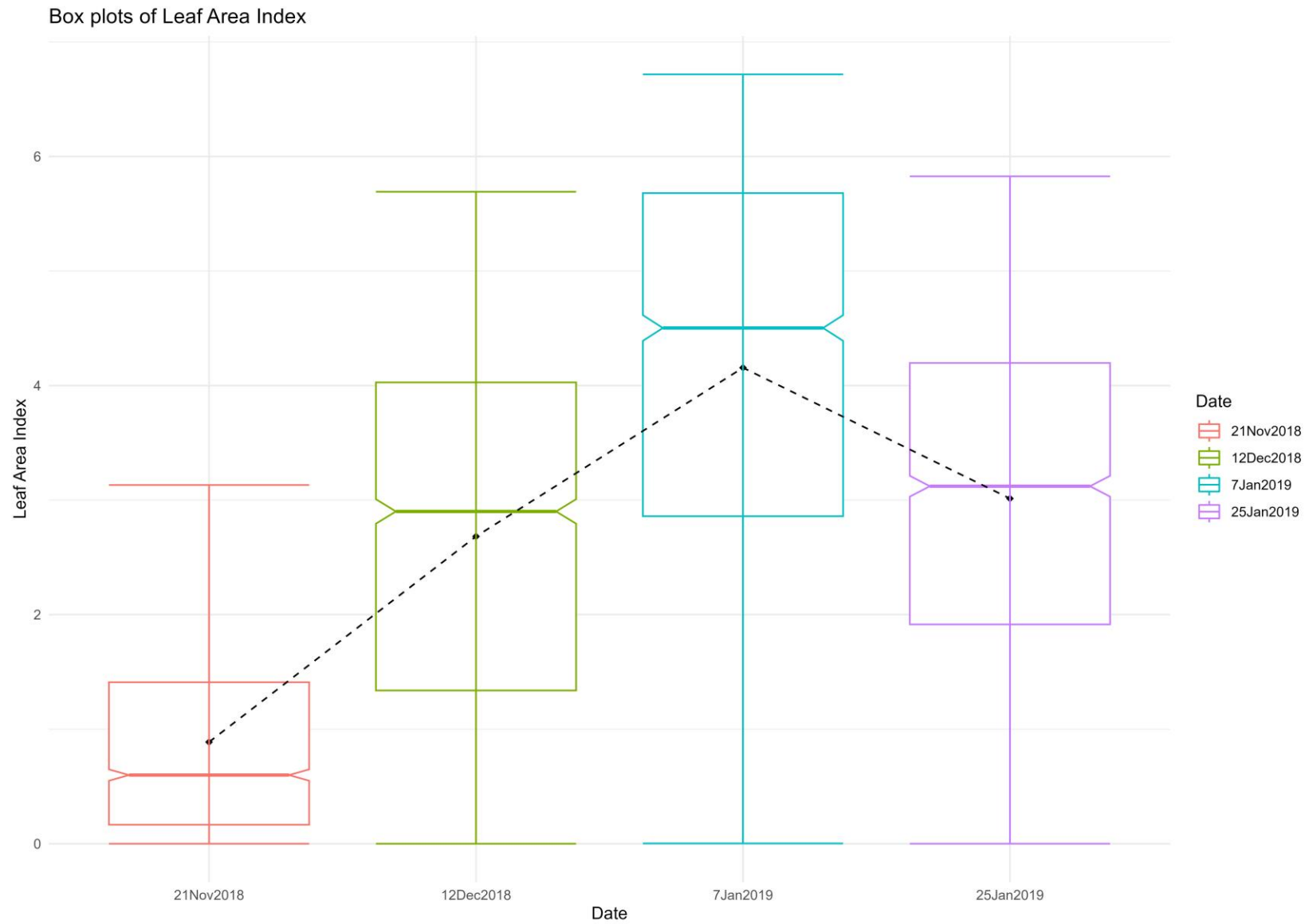

Leaf Area Index 7th Jan 2019
Frequency
200
150
100
50
0
Mean: 0.62
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Leaf Area Index

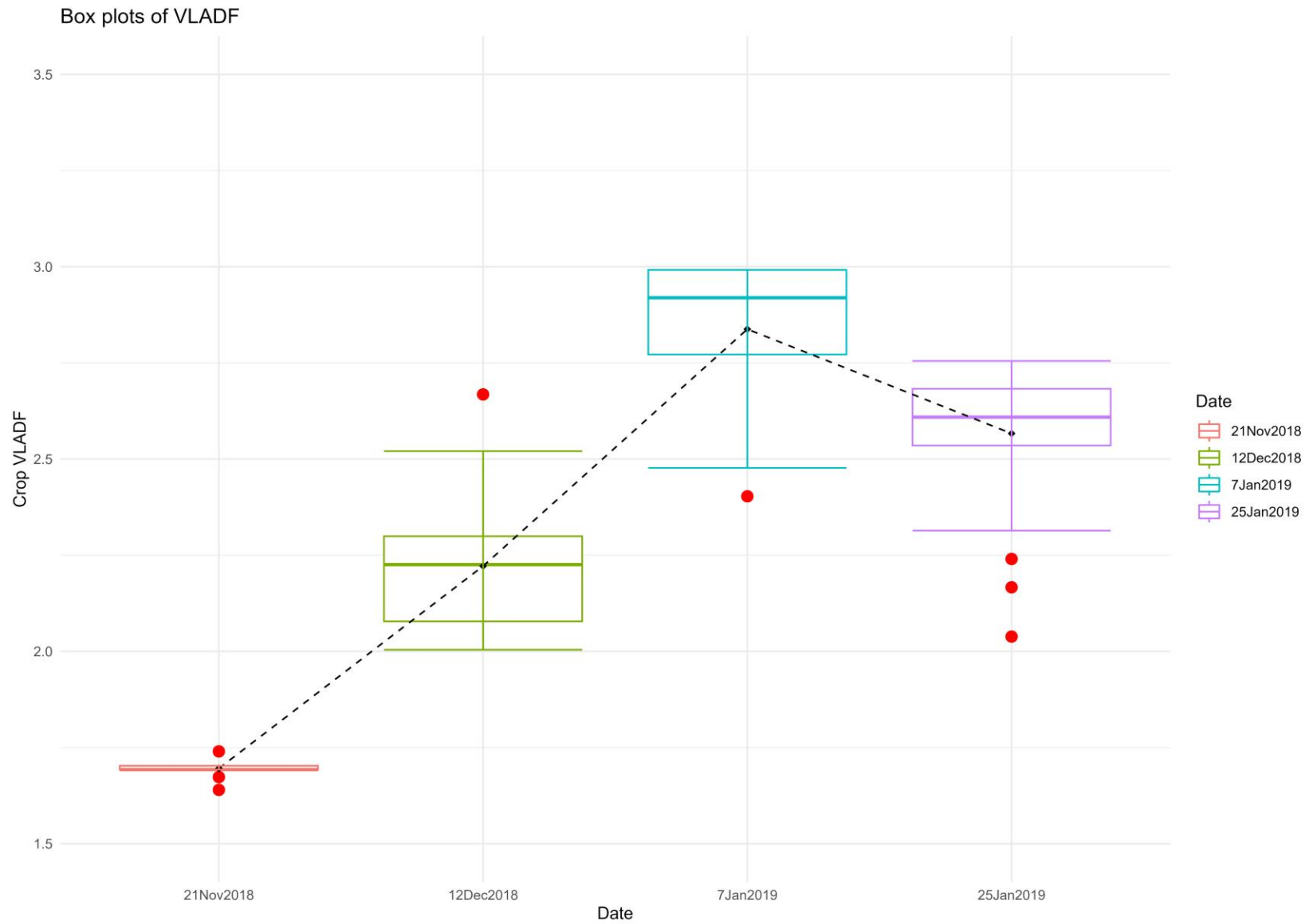

Leaf Area Index 25th Jan 2019
Frequency
200
150
100
50
0
Mean: 0.52
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Leaf Area Index

# Box Plot

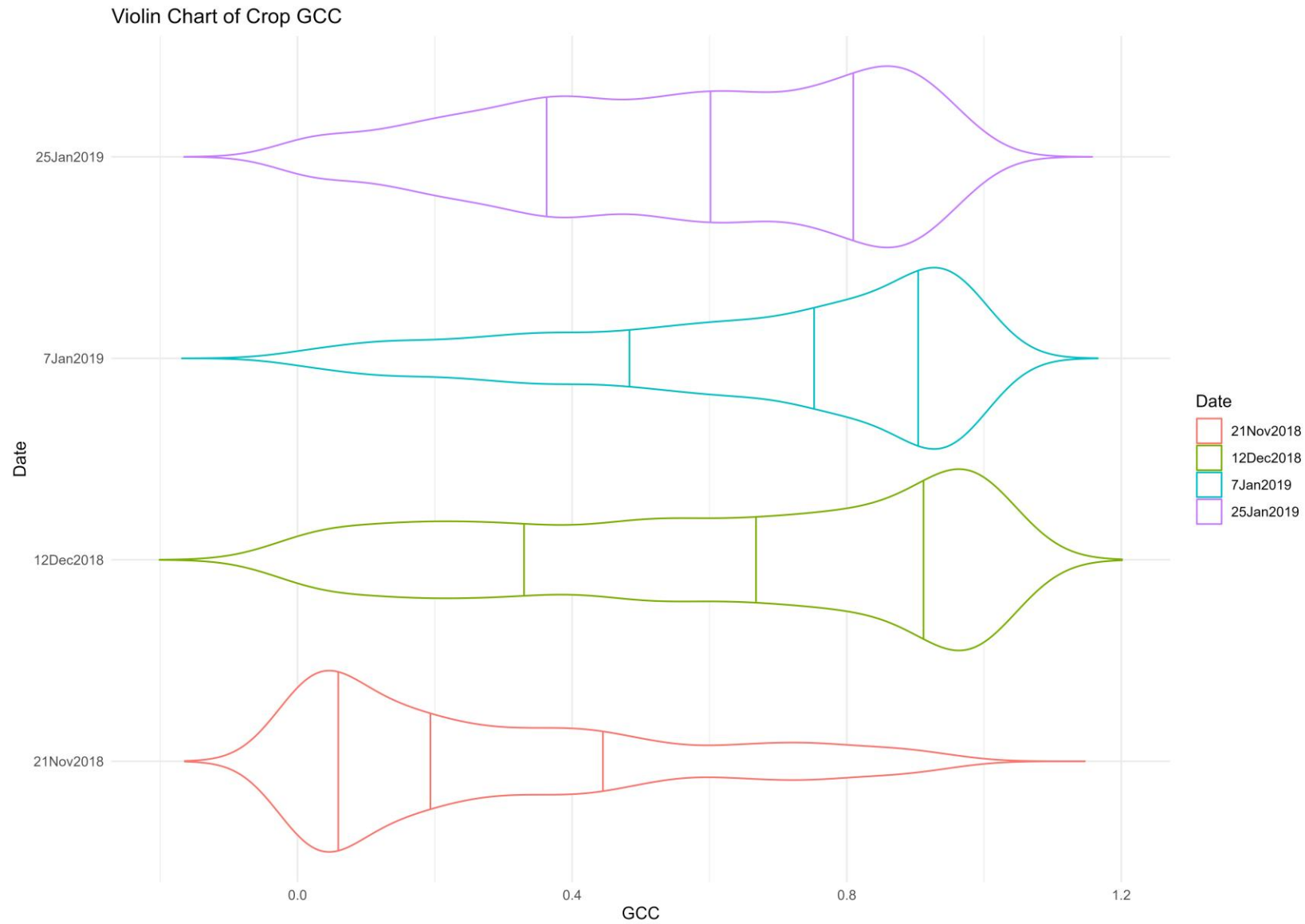

Box plots of Green Canpoy Cover
1.00
0.75
0.50
0.25
0.00
Green Canpoy Cover
21Nov2018
12Dec2018
7Jan2019
25Jan2019
Date
Date
21Nov2018
12Dec2018
7Jan2019
25Jan2019

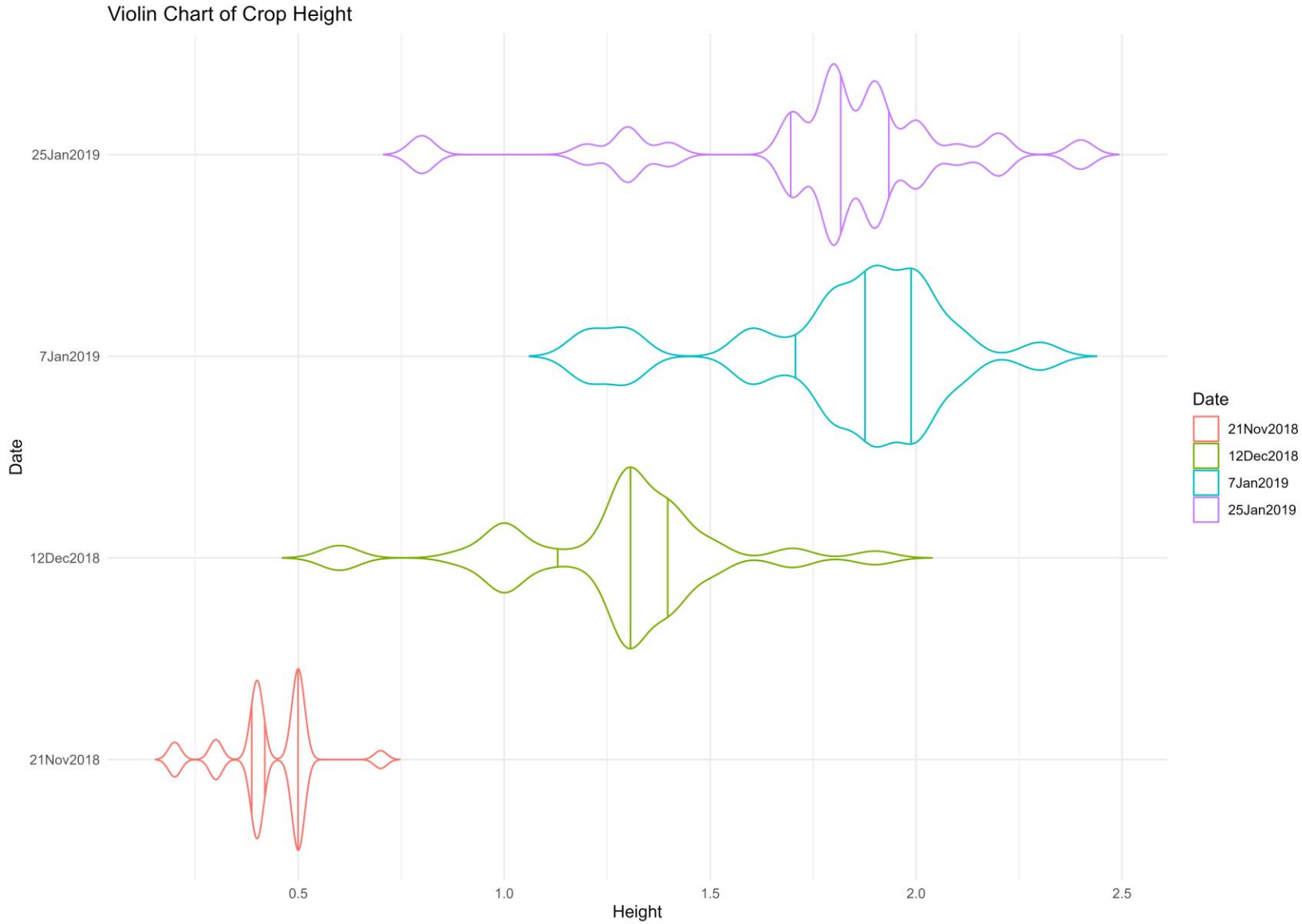

Box plots of Crop Height
2.5
2.0
1.5
1.0
0.5
0.0
Crop Height
21Nov2018
12Dec2018
7Jan2019
25Jan2019
Date
Date
21Nov2018
12Dec2018
7Jan2019
25Jan2019

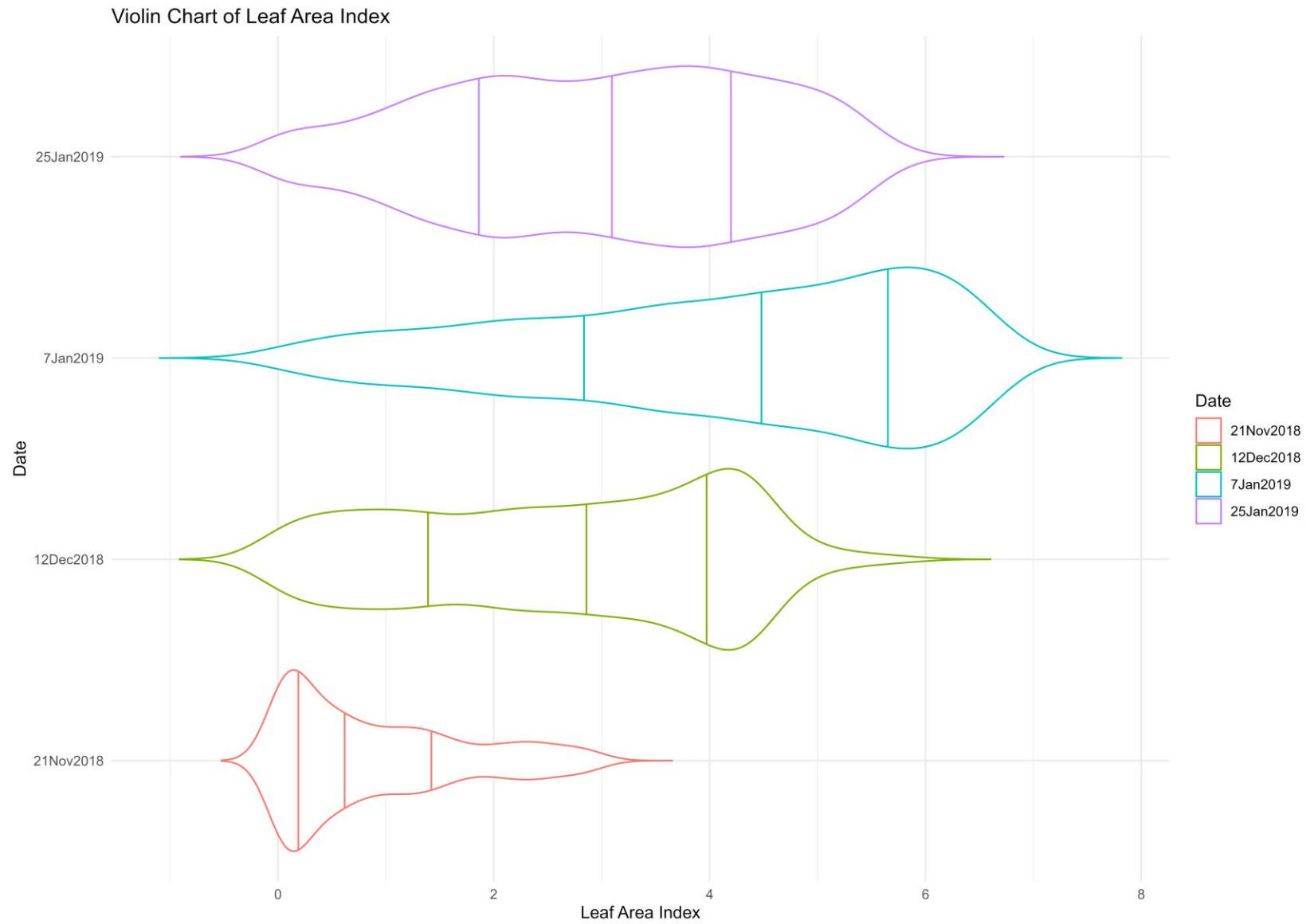

Box plots of Leaf Area Index
Leaf Area Index
0
2
4
6
21Nov2018
12Dec2018
7Jan2019
25Jan2019
Date
Date
21Nov2018
12Dec2018
7Jan2019
25Jan2019

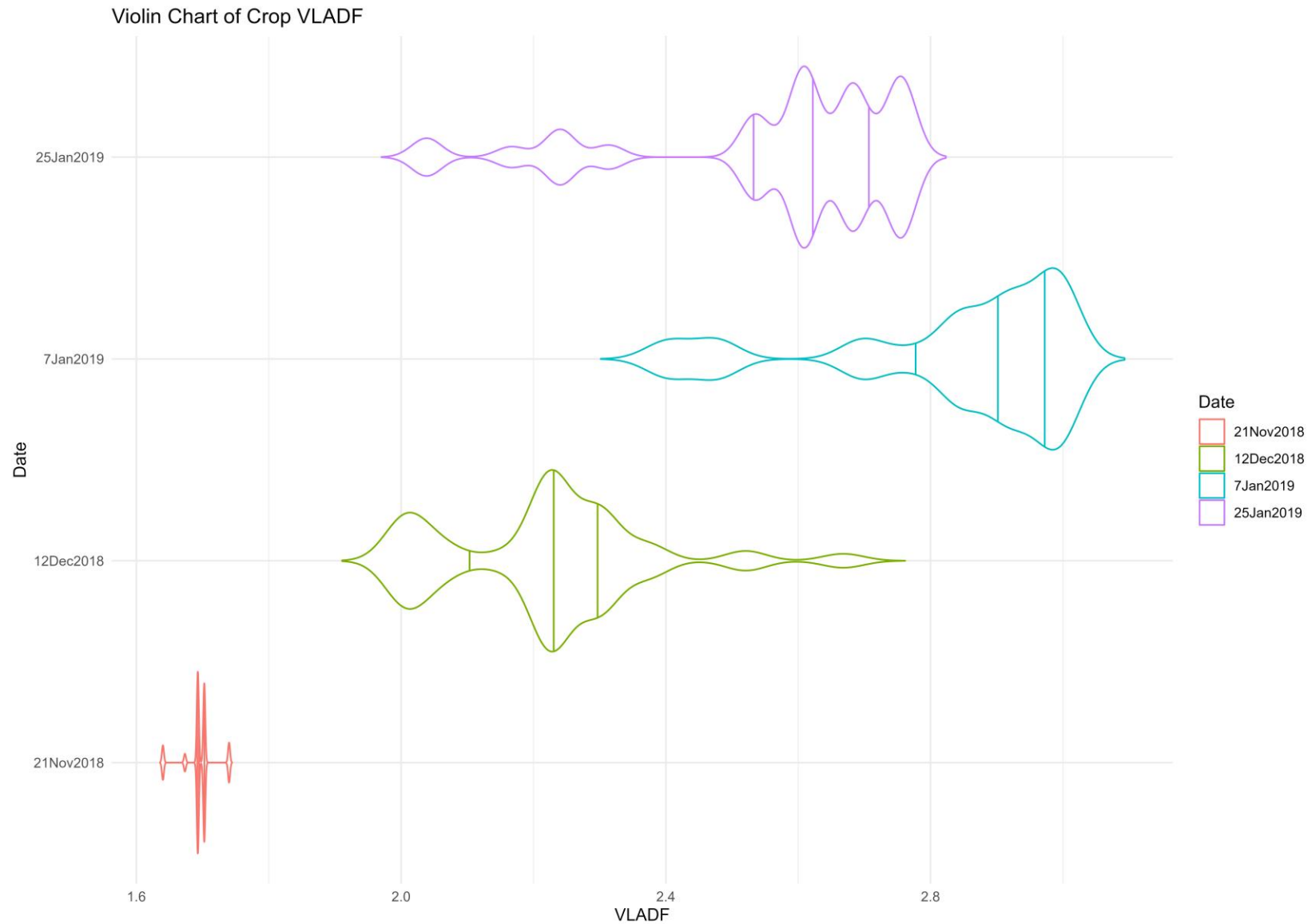

Box plots of VLADF
3.5
3.0
2.5
2.0
1.5
Crop VLADF
21Nov2018
12Dec2018
7Jan2019
25Jan2019
Date
Date
21Nov2018
12Dec2018
7Jan2019
25Jan2019

# Violin Plot


Violin Chart of Crop GCC
25Jan2019
7Jan2019
12Dec2018
21Nov2018
Date
0.0
0.4
0.8
1.2
GCC
Date
21Nov2018
12Dec2018
7Jan2019
25Jan2019

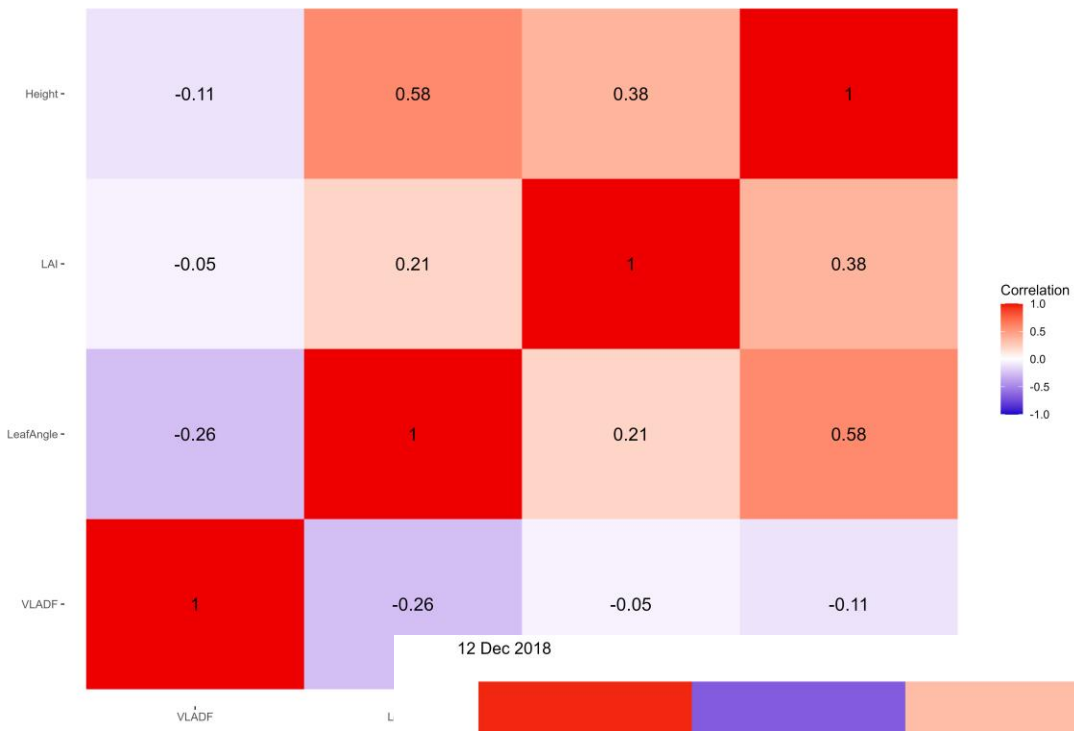

Violin Chart of Crop Height
25Jan2019
7Jan2019
12Dec2018
21Nov2018
Date
0.5
1.0
1.5
2.0
2.5
Height
Date
21Nov2018
12Dec2018
7Jan2019
25Jan2019


Violin Chart of Leaf Area Index
25Jan2019
7Jan2019
12Dec2018
21Nov2018
Date
0
2
4
6
8
Leaf Area Index
Date
21Nov2018
12Dec2018
7Jan2019
25Jan2019

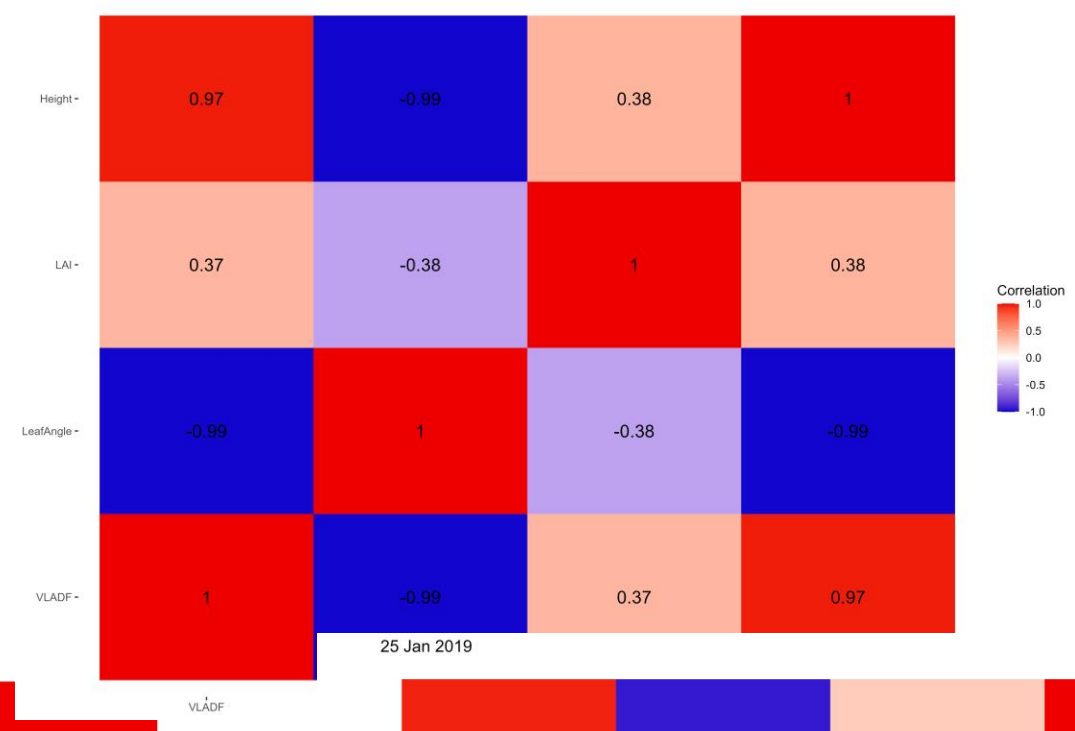

Violin Chart of Crop VLADF
25Jan2019
7Jan2019
12Dec2018
21Nov2018
Date
1.6
2.0
2.4
2.8
VLADF
Date
21Nov2018
12Dec2018
7Jan2019
25Jan2019

# Covariance Matrix

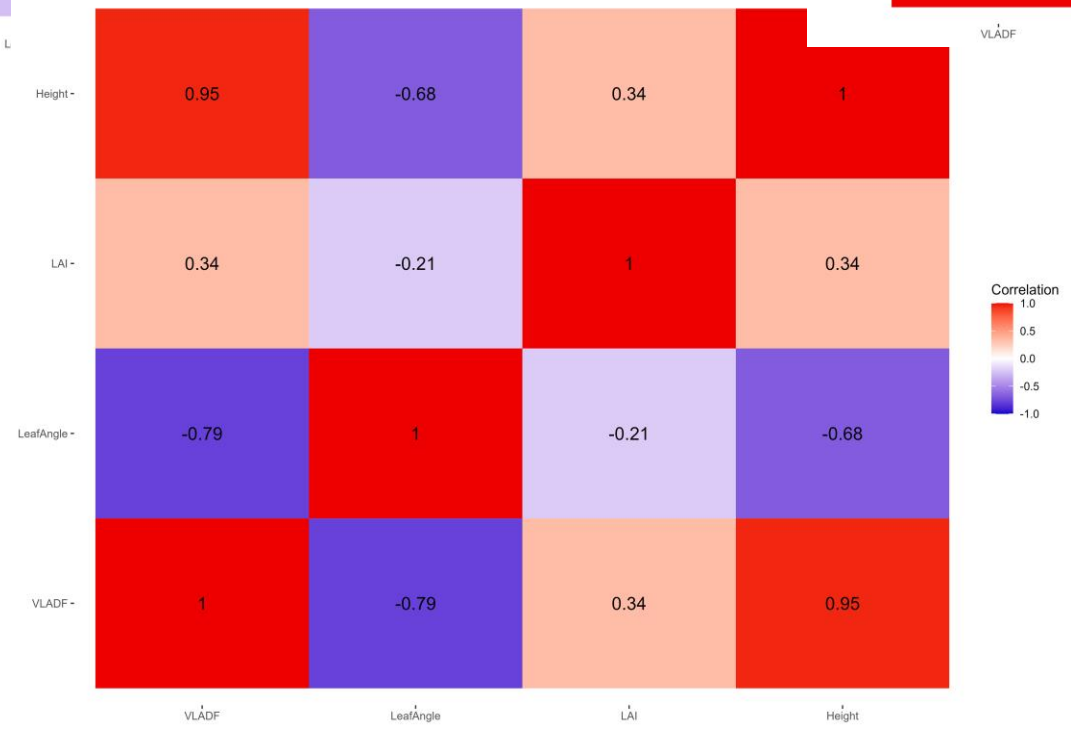
21 Nov 2018



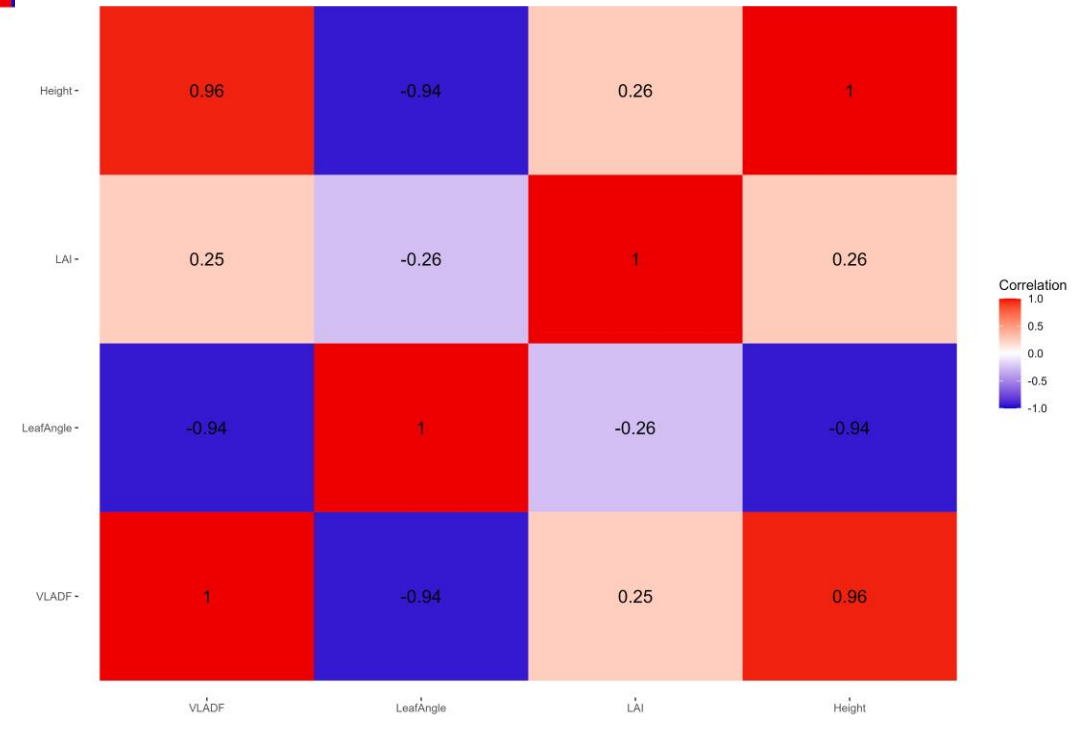

7 Jan 2019




12 Dec 2018

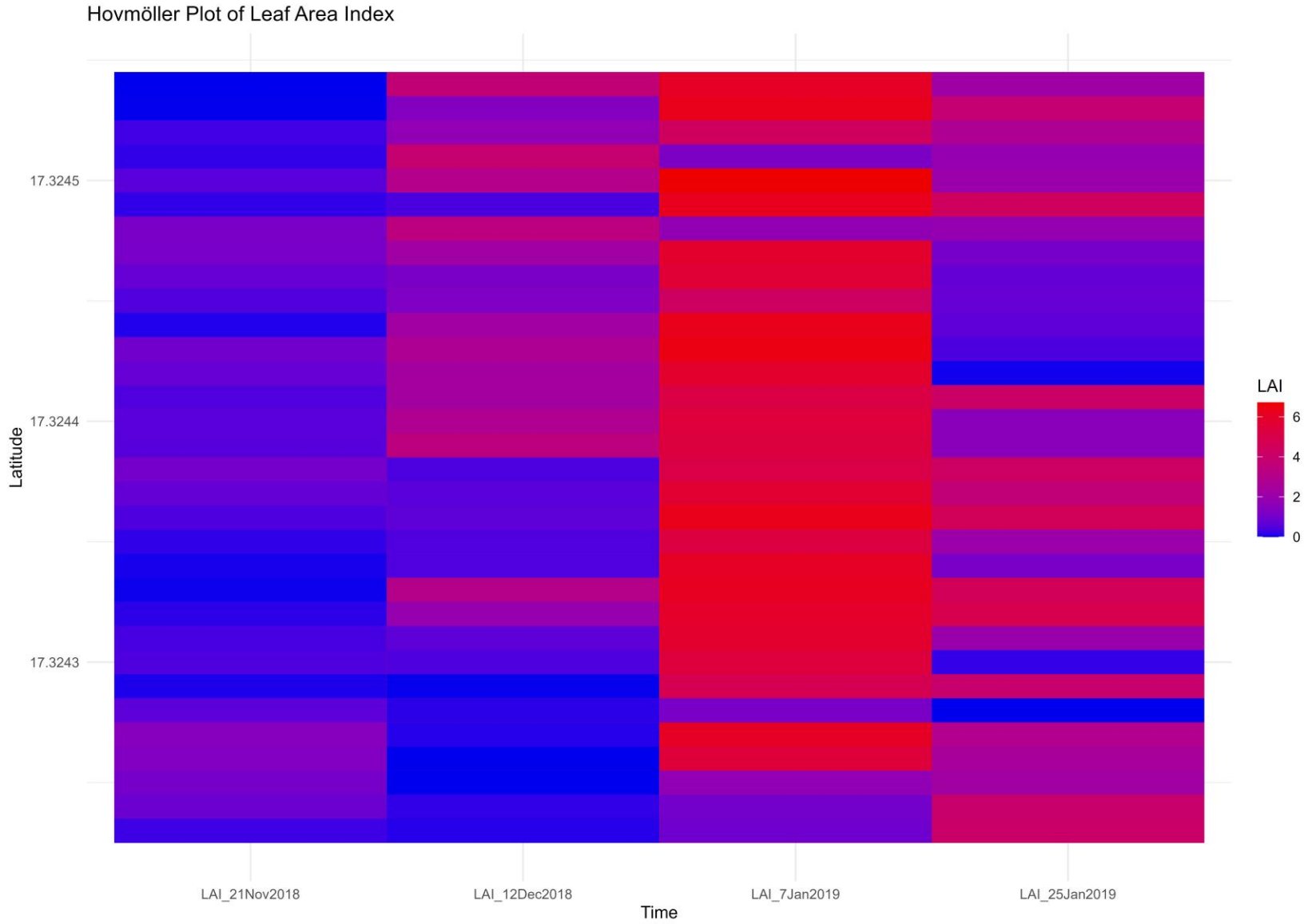


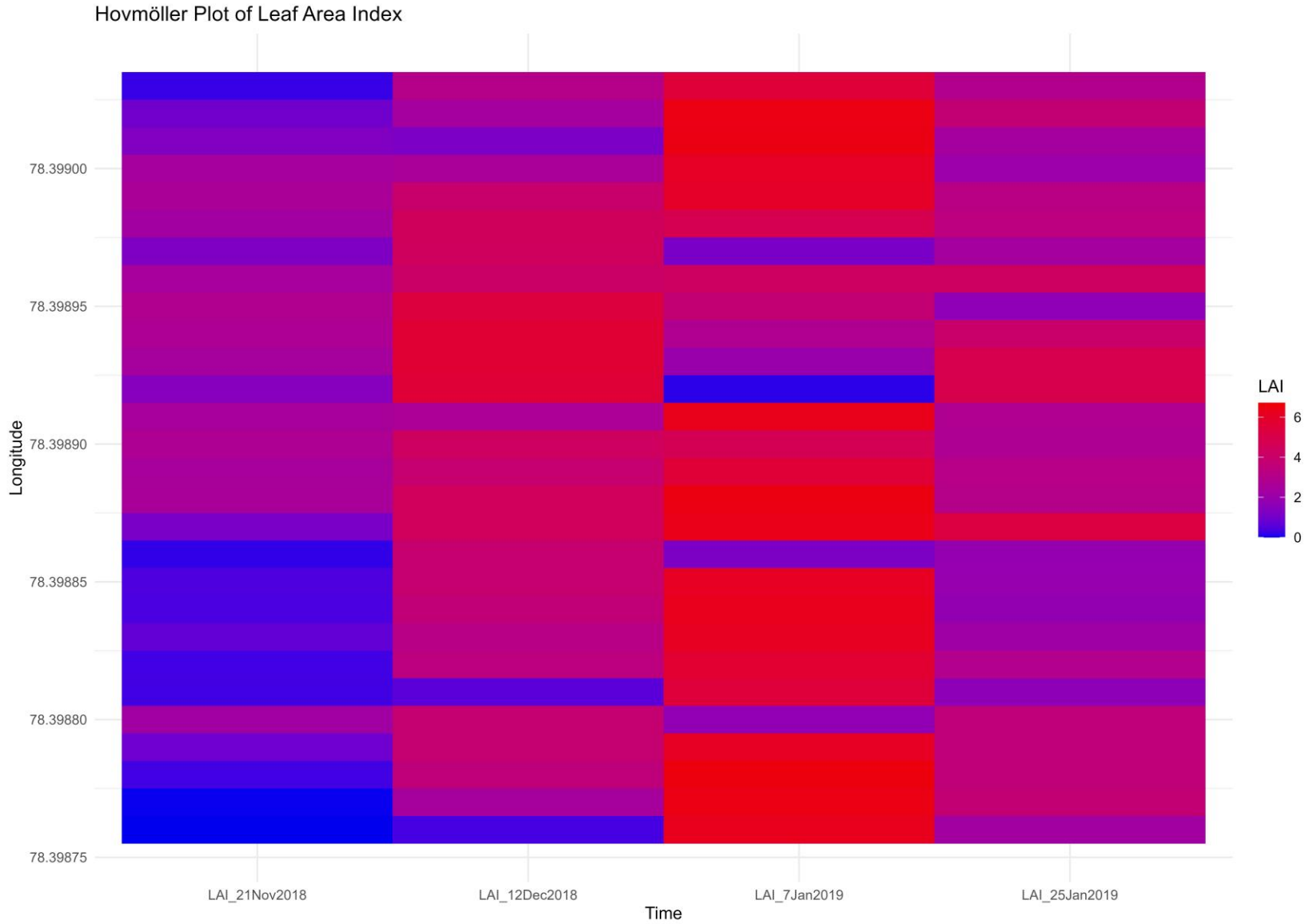

25 Jan 2019



# Hovmoller Plot

generated to visualize the spatial and temporal patterns of LAI


Hovmöller Plot of Leaf Area Index
17.3245
17.3244
17.3243
Latitude
LAI_21Nov2018
LAI_12Dec2018
LAI_7Jan2019
LAI_25Jan2019
Time
LAI
6
4
2
0


Hovmöller Plot of Leaf Area Index
78.39900
78.39895
78.39890
78.39885
78.39880
78.39875
Longitude
LAI_21Nov2018
LAI_12Dec2018
LAI_7Jan2019
LAI_25Jan2019
Time
LAI
6
4
2
0

# LiDAR model

01.psx — Agisoft Metashape Standard (30 days left)

File Edit View Workflow Model Photo Tools Help

Workspace

Workspace (1 chunks, 88 images)
Chunk 1 (88 images, 53,737 tie
Images (88/88 aligned)
Components (1)
Tie Points (53,737 points)
Depth Maps (88, High quality
Point Cloud (21,979,549 poin

Model

Perspective 30°

points: 21,979,549

Console

2024-04-13 02:17:40 channels: 3 uint8
2024-04-13 02:17:40 loaded camera partition in 0.001 sec
2024-04-13 02:19:19 Finished processing in 98.615 sec (exit code 0)
2024-04-13 02:19:19 Error: Can't write file: There is not enough space on the disk (112) D:/GNR401 Mini Project/PointClouds/01 files/001/colorize_data.tmp/color0.dat

Search

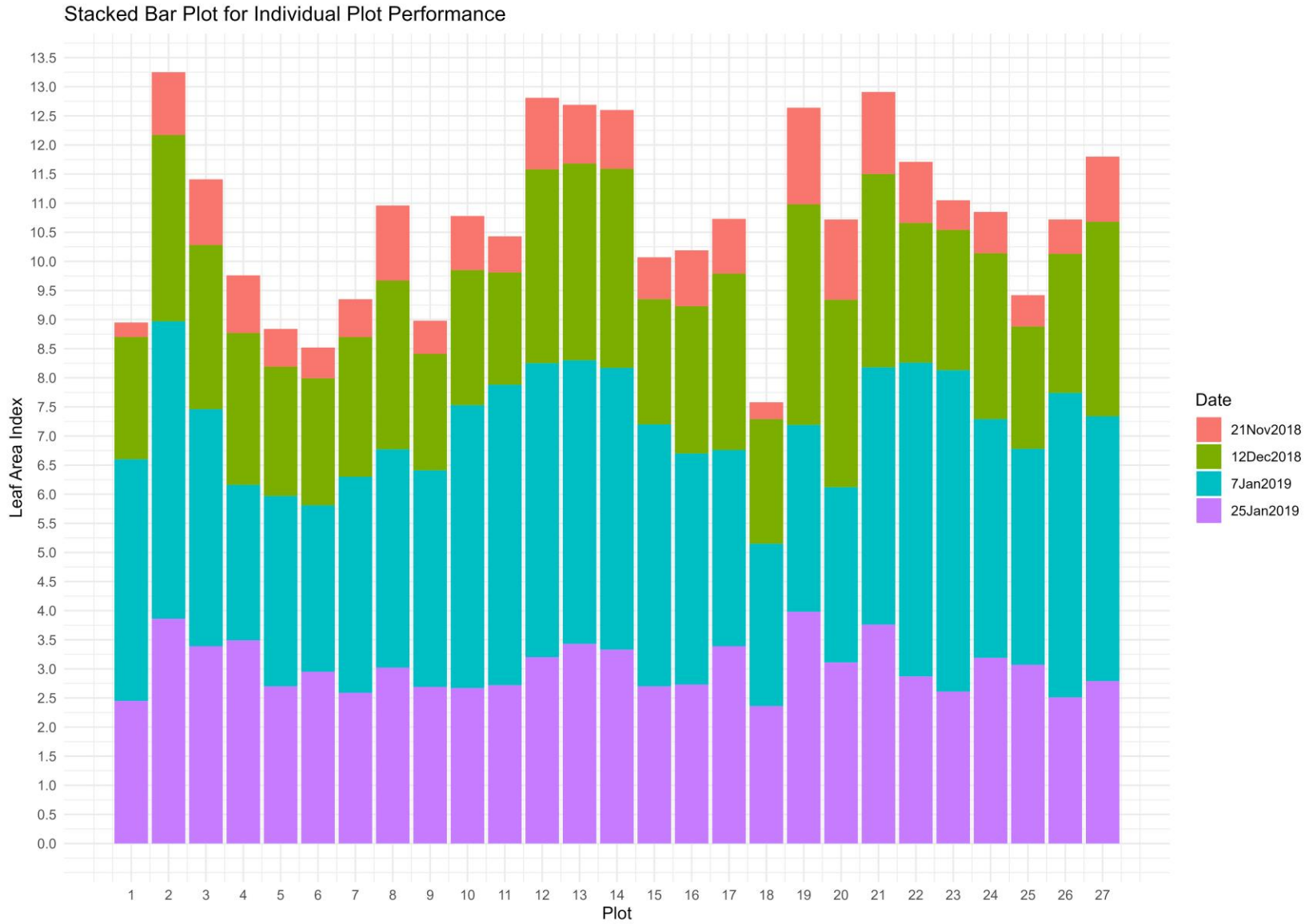
ENG IN

02:27 13-04-2024

# Analysis of Individual plots

Identifying best and worst performing plots


LAI of 7th Jan 2019 with Plot Ids
17.3245°N
17.3244°N
17.3243°N
17.3242°N
17.3241°N
y
18
17
16
19
13
14
15
20
12
11
10
21
7
8
9
22
27
6
5
4
23
26
1
2
3
24
25
10 m
78.3986°E
78.3987°E
78.3988°E
78.3989°E
78.3990°E
78.3991°E
x
N
Normalised LAI
1.00
0.75
0.50
0.25
0.00


Stacked Bar Plot for Individual Plot Performance
Leaf Area Index
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Plot
Date
21Nov2018
12Dec2018
7Jan2019
25Jan2019

# Conclusion

The implementation of LAI mapping methods involved the utilization of R for data preprocessing, statistical analysis, and model training. QGIS was employed for spatial analysis and visualization of the derived LAI maps. The RGB images collected via drones were processed to extract relevant parameters such as canopy height, green-canopy cover, and VLADF. These parameters were then utilized in the development and validation of the empirical and conceptual models for LAI estimation.

- The overall trend is -
  - 7 Jan 2019 is the most vigorous day for the crops.
  - 21 Nov 2018 is the least vigorous day for the crops
  - The activity increases till 7 Jan 2019 later falling
- For individual plots -
  - Overall plots 2, 12, 13, 19, and 21 are the most productive as their cumulative LAI for the is over 12.
  - Overall plot 18 is the least productive.