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Monitoring forest phenology based on the CLMS Vegetation Phenology and Productivity Parameters

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IGiK

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NORWEGIAN INSTITUTE OF BIOECONOMY RESEARCH

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Lodz University of Technology

EVERSIS

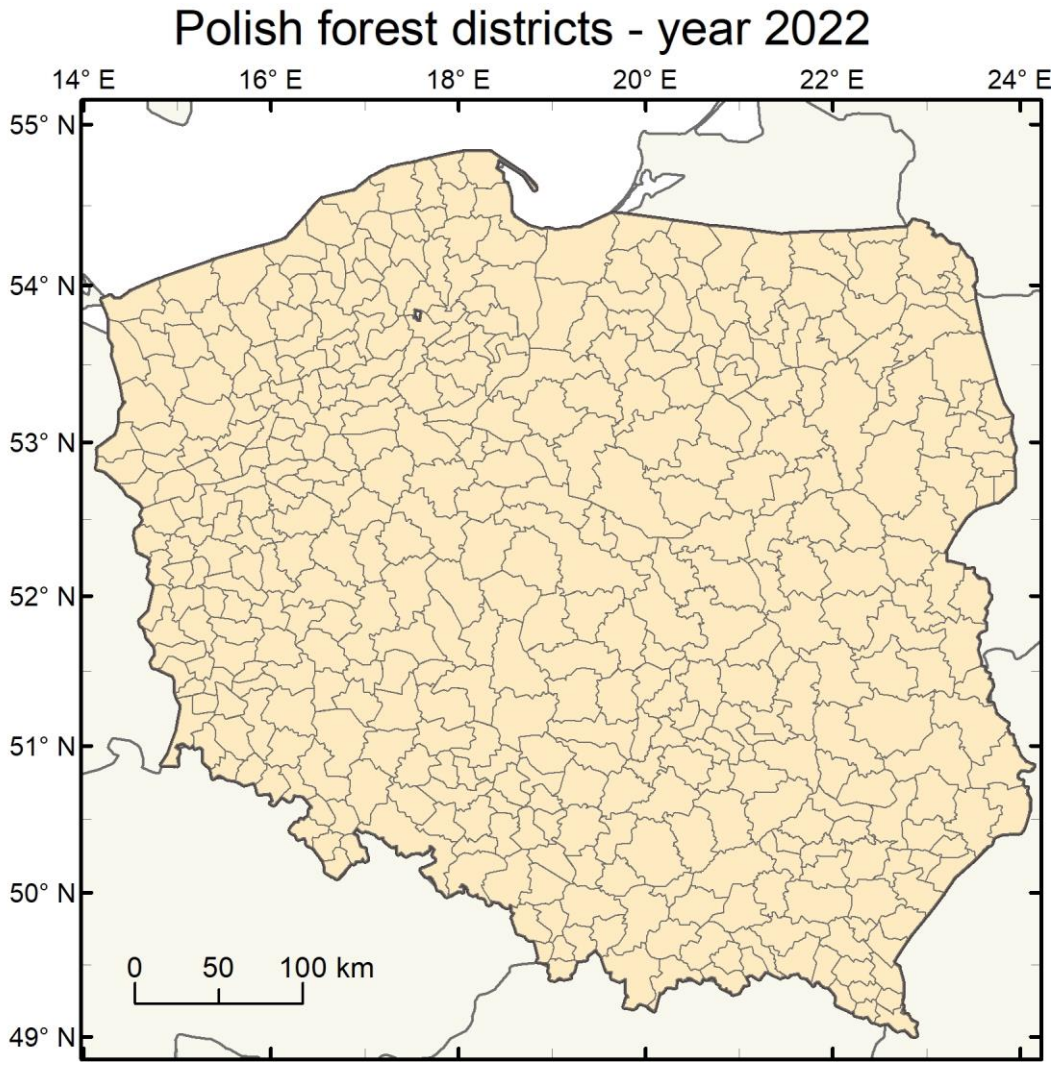
Research aim

- The determination of the start and end dates of the vegetation season for specific forest types and dominant tree species.
- Analysis of the tree species seasonality for different years across various regions of Poland.
- The assessment of the effectiveness of CLMS Phenology and Productivity products for monitoring forest phenology.

Forest Bank Data (Bank Danych o Lasach)

- Forest inventory dataset that collects and manages information about forest areas in Poland.

- Data was collected for the year 2022 for every of 429 forest districs.



Location of the study site. Poland divided into 429 forest districts. Source: own elaboration

Mask of forest type and dominant tree species based on Forest Bank Data

- The following criteria were used for filtering database to create homogenous stands:

  Part coverage: 80% or more of the same species

  Age: 20 years or older

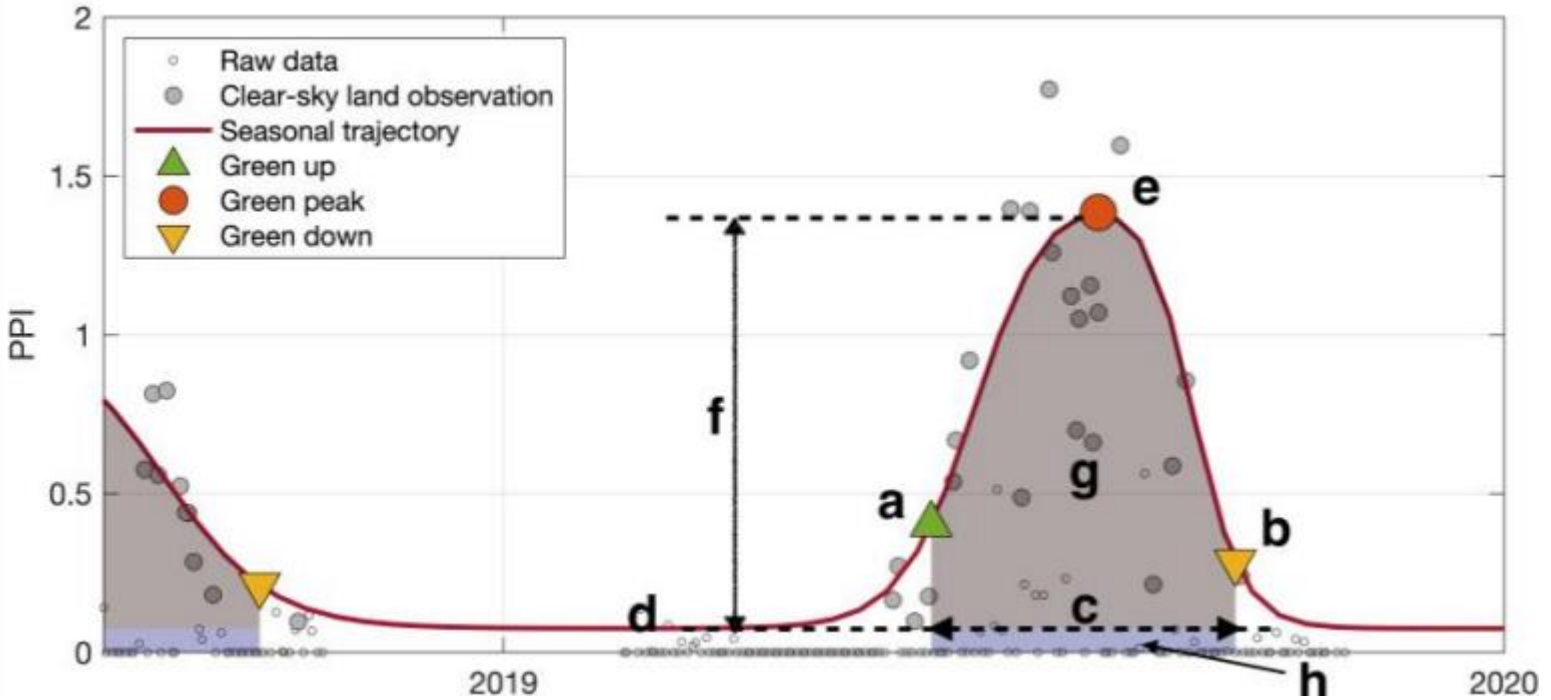
  Area type: Forest stands and first floor trees

  Shape area: 0.5 hectares or larger

Examples of polygons. Source: own elaboration

Vegetation Phenology and Productivity Parameters (VPP)

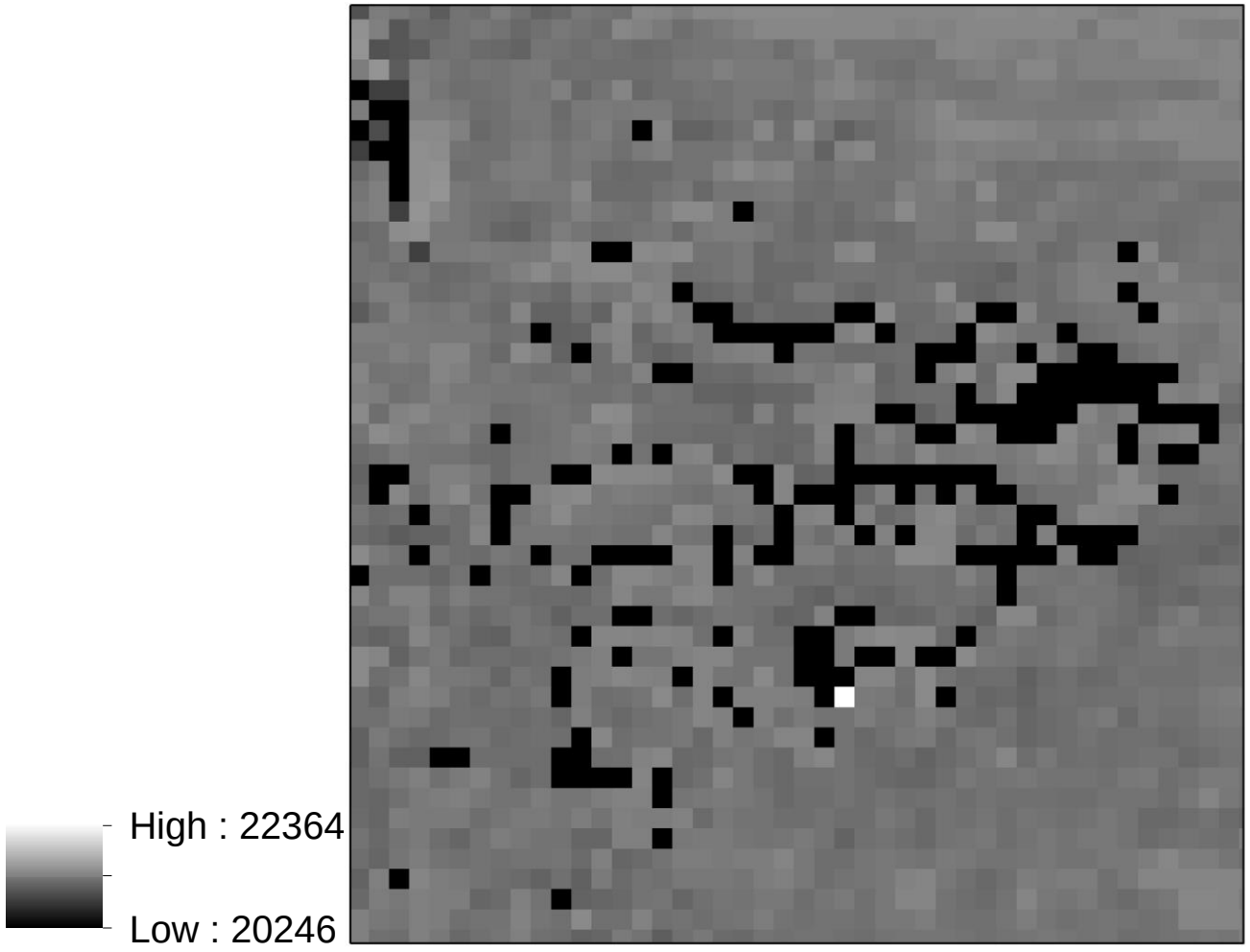
- Plant Phenology Index (PPI)
- Start-of-the-season Date (SOSD) - 25% of season amplitude during green-up period
- End-of-the-season Date (EOSD) 15% of season amplitude during green-down period



Schematic representation of the HR-VPP product bundle.
Source: CLMS https://land.copernicus.eu/en/technical-library/hr-vpp-data-access-manual/@@download/file

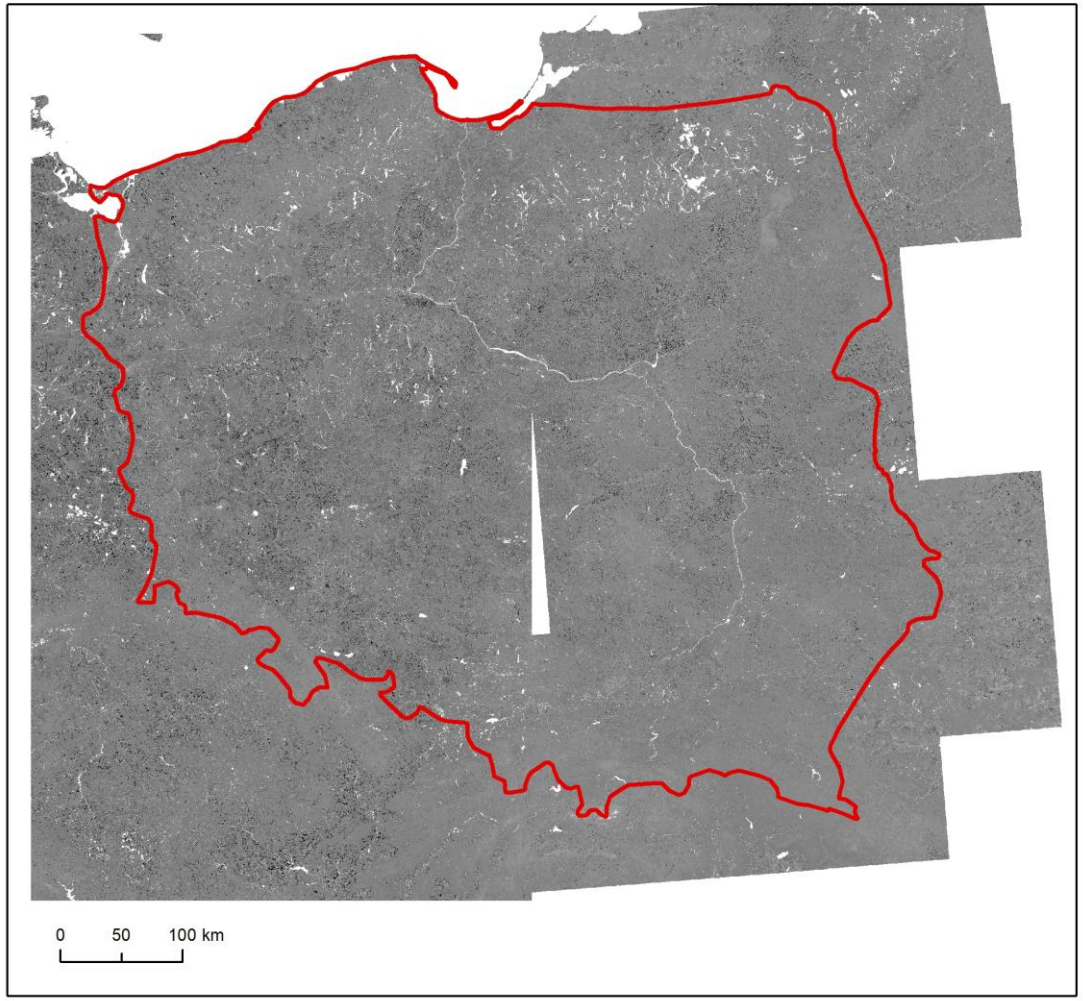
Vegetation Phenology and Productivity Parameters (VPP)

- Mosaics of SOSD and EOSD data for the period of 2019 – 2022.
- For SOSD values representing 30 days or earlier, as well as 210 days or later in the year, were replaced with No Data values.
- For EOSD values representing 170 days or earlier, as well as 350 days or later in the year, were replaced with No Data values.



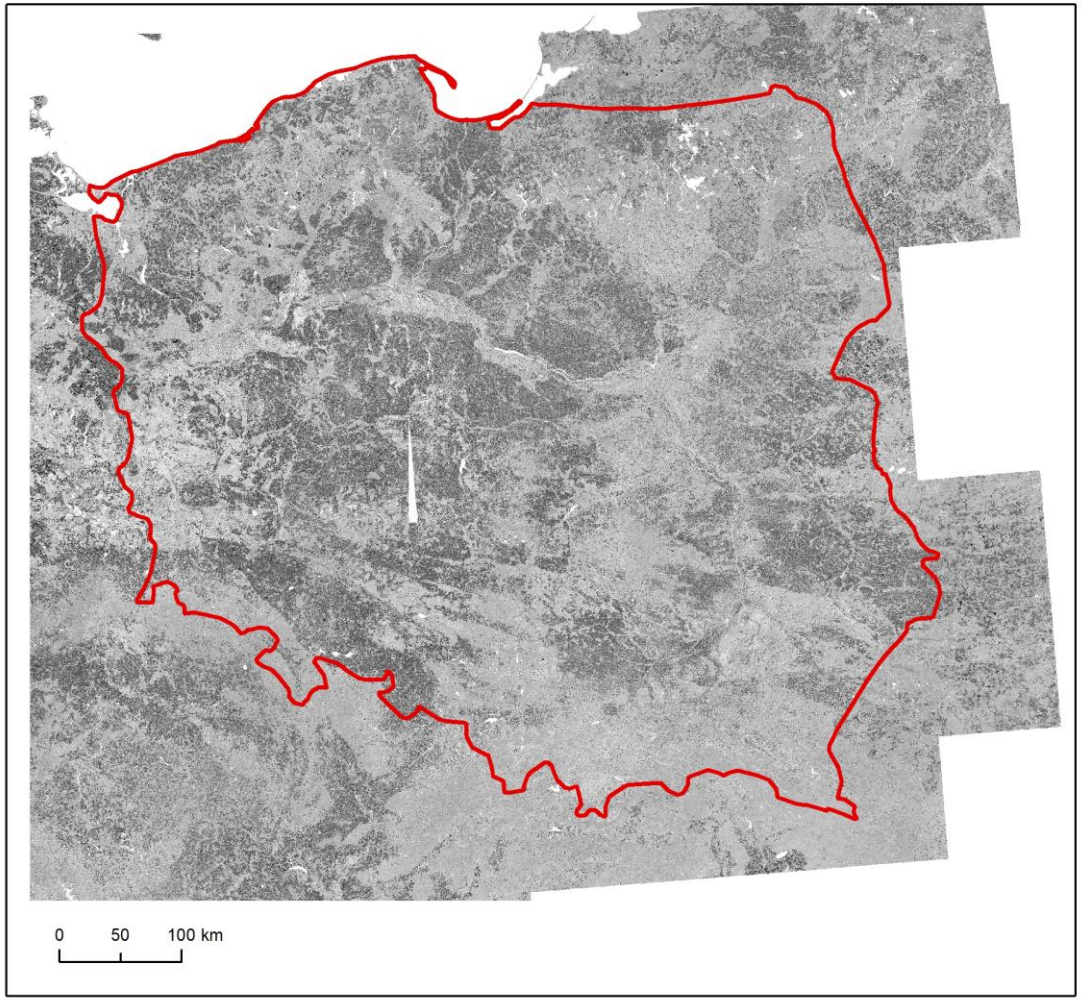
Part of SOSD 2022 mosaic. Source: own elaboration

SOSD 2019



Mosaic of SOSD data in 2019. Source: own elaboration

EOSD 2020



Mosaic of EOSD data in 2020. Source: own elaboration

Method

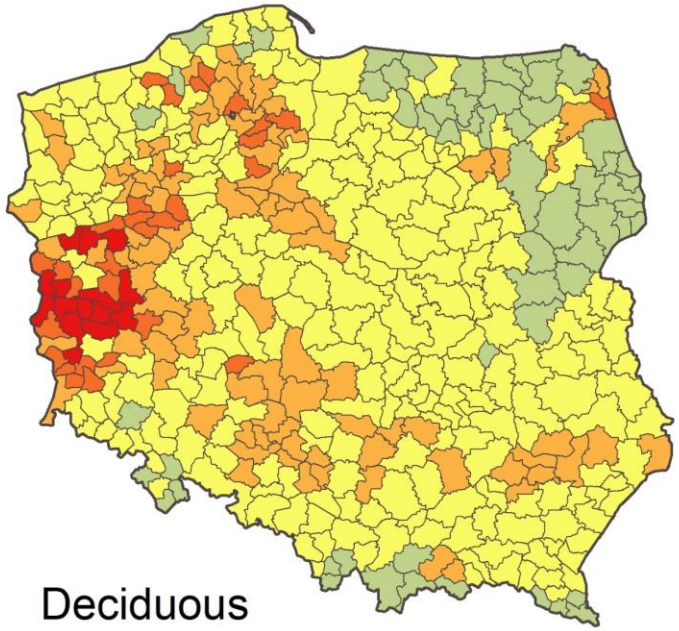
- Zonal statistics for every forest district were calculated.
- Majority as the statistic type.
- Centroid of the pixels had to be located within the polygons.

Mosaic of SOSD data in 2019. Source: own elaboration

Mosaic of EOSD data in 2020. Source: own elaboration

Start of the season date
Average for the years 2019 to 2022

Coniferous



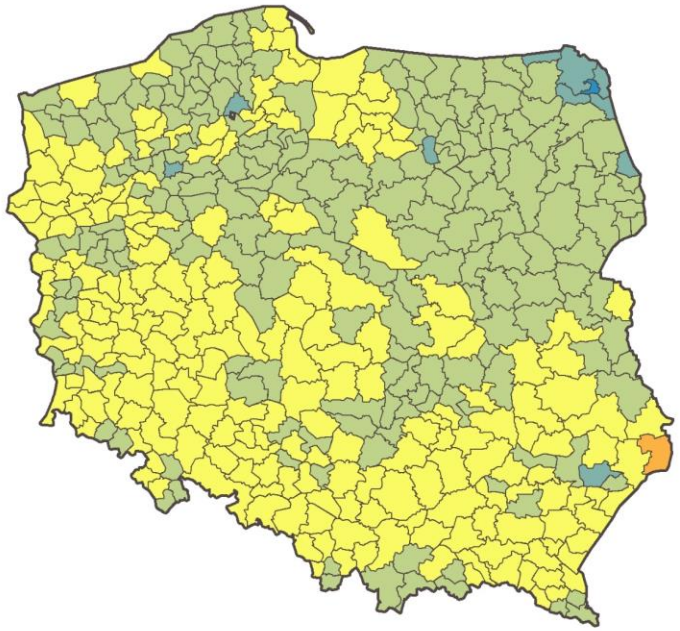
The day of the start of the growing season

- 81 - 90
- 91 - 100
- 101 - 110
- 111 - 120
- 121 - 130
- 131 - 140
- 141

Day number	Month
1 - 31	January
32 - 59	February
60 - 90	March
91 - 120	April
121 - 151	May
152 - 181	June
182 - 212	July
213 - 243	August
244 - 273	September
274 - 304	October
305 - 334	November
335 - 365	December

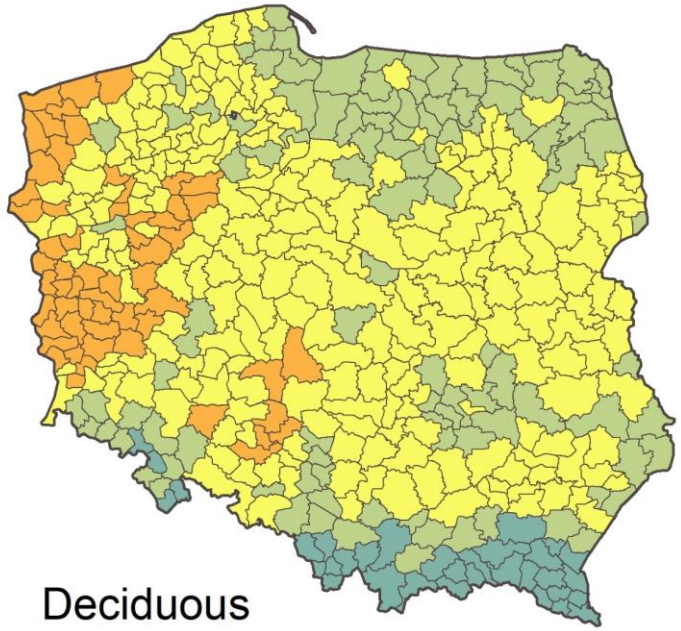
0 50 100 km

Deciduous



End of the season date
Average for the years 2019 to 2022

Coniferous



The day of the end of the growing season

- 273 - 280
- 281 - 290
- 291 - 300
- 301 - 309

Day number	Month
1 - 31	January
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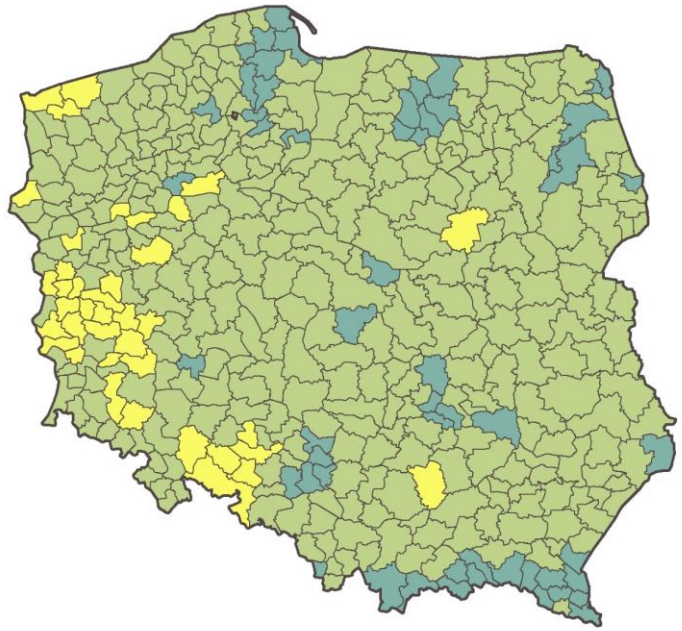
335 - 365	December

0 50 100 km

Deciduous



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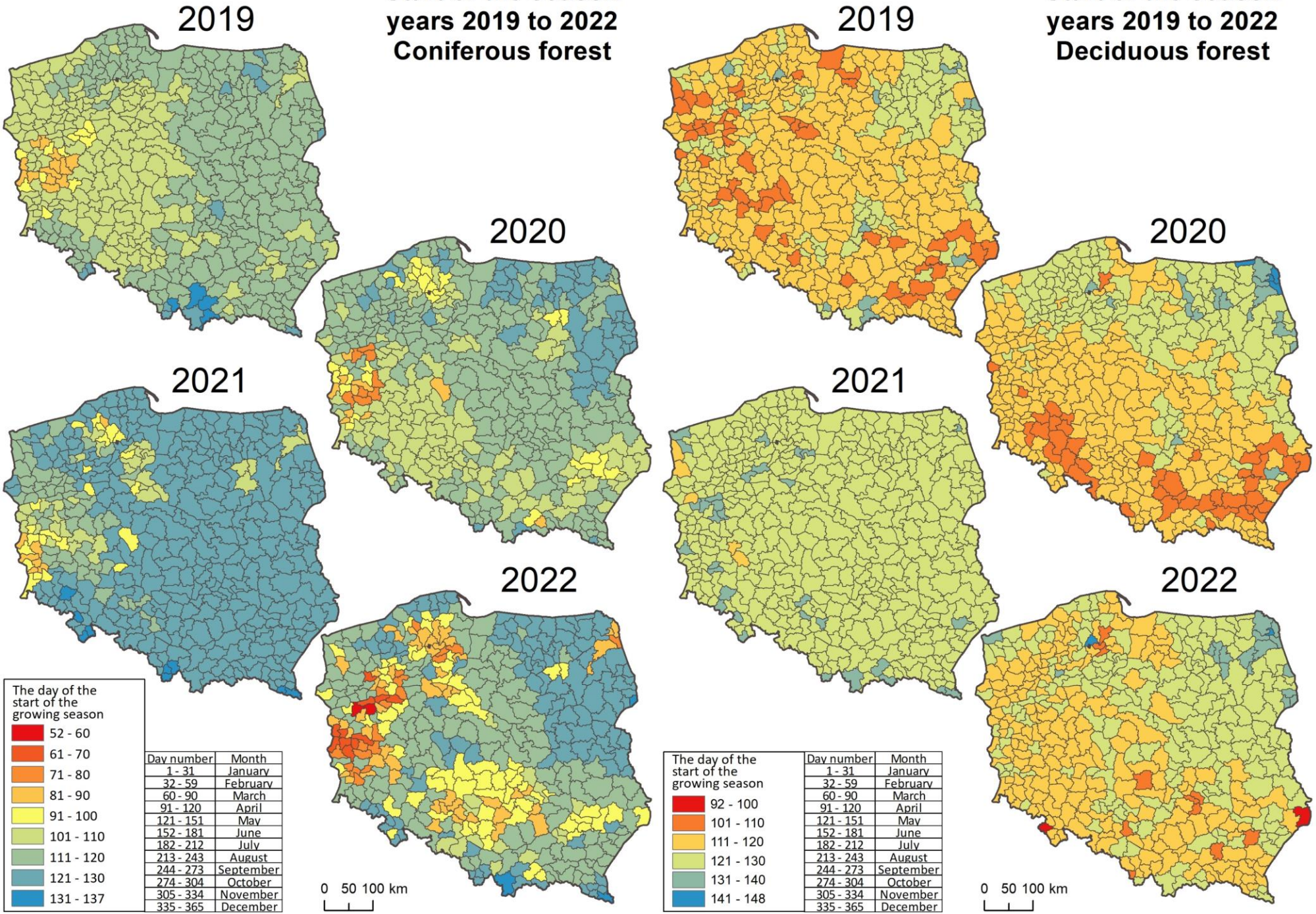
Start of the season years 2019 to 2022 Coniferous forest



Start of the season years 2019 to 2022 Deciduous forest

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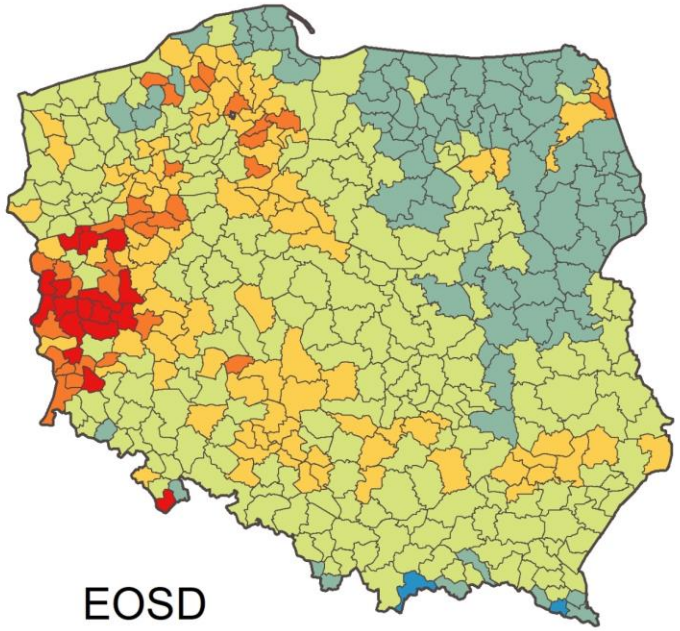
Coniferous										
	SOSD				EOSD				SOSD	EOSD
	2019	2020	2021	2022	2019	2020	2021	2022	2019 - 2022	2019 - 2022
average	110	111	120	108	292	292	294	292	113	293
mininum	82	74	87	52	263	273	258	257	81	273
maximum	137	128	137	133	312	322	312	315	130	309
standard deviation	7.15	9.21	9.37	17.18	10.11	9.24	8.21	9.80	9.08	7.10
median	111	112	124	117	293	292	295	295	115	294

Deciduous										
	SOSD				EOSD				SOSD	EOSD
	2019	2020	2021	2022	2019	2020	2021	2022	2019 - 2022	2019 - 2022
average	117	119	127	121	283	286	285	286	121	285
mininum	105	101	115	92	257	261	268	254	109	274
maximum	140	148	138	142	305	303	301	304	141	300
standard deviation	6.19	6.84	2.77	5.68	6.59	5.87	4.36	7.83	4.38	4.20
median	116	119	126	121	283	286	285	287	121	285

Start and end of the season date
Average for the years 2019 to 2022
Pine

SOSD



The day of the start of the growing season

- 81 - 90
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- 111 - 119
- 120 - 130
- 131 - 132

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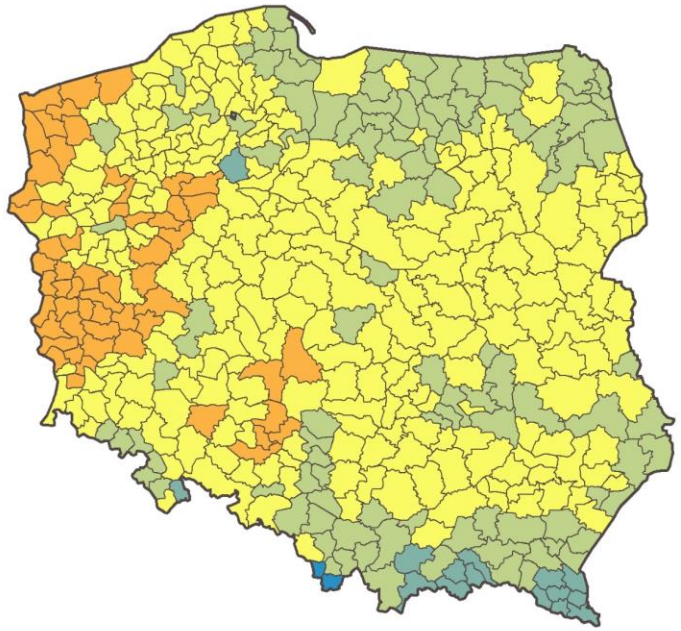
274 - 304	October
305 - 334	November
335 - 365	December

0 50 100 km

EOSD



The day of the end of the growing season

- 266 - 270
- 271 - 280
- 281 - 290
- 291 - 300
- 301 - 309

Day number	Month
1 - 31	January
32 - 59	February
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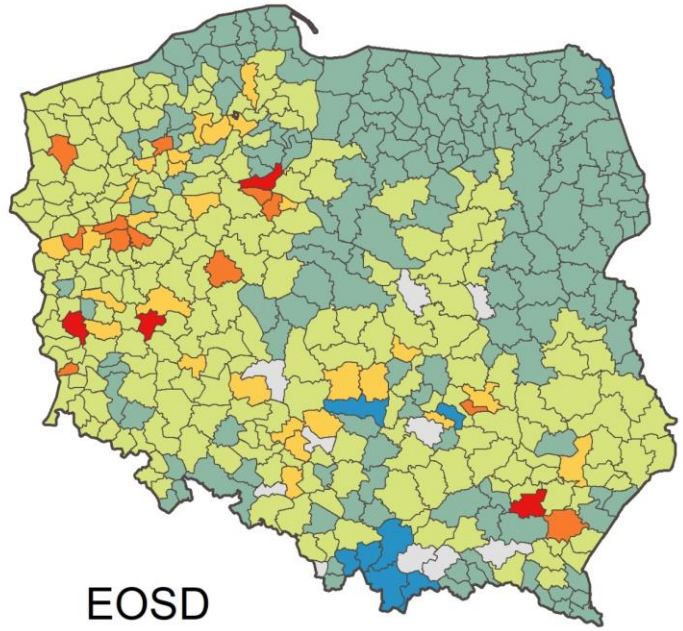
Start and end of the season date
Average for the years 2019 to 2022
Spruce

SOSD



The day of the start of the growing season

- 82 - 90
- 91 - 100
- 101 - 110
- 111 - 120
- 121 - 130
- 131 - 139
- No Data

Day number	Month
1 - 31	January
32 - 59	February
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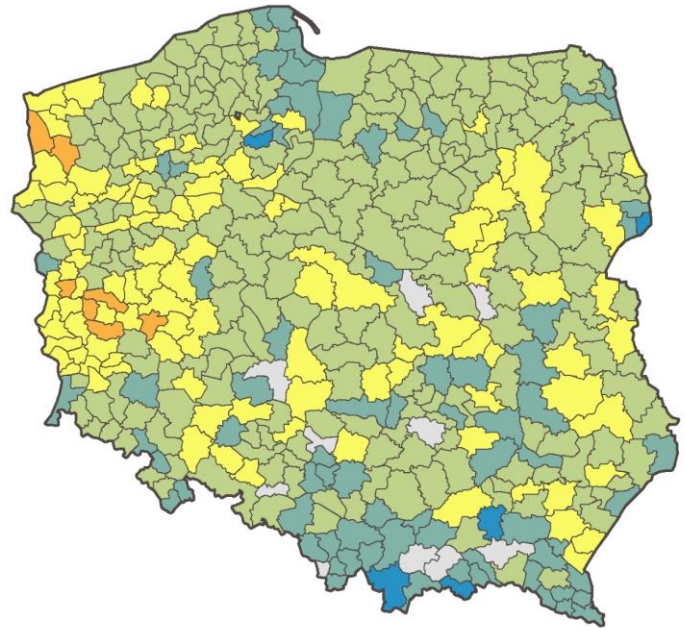
305 - 334	November
335 - 365	December

0 50 100 km

EOSD



The day of the end of the growing season

- 267 - 270
- 271 - 280
- 281 - 290
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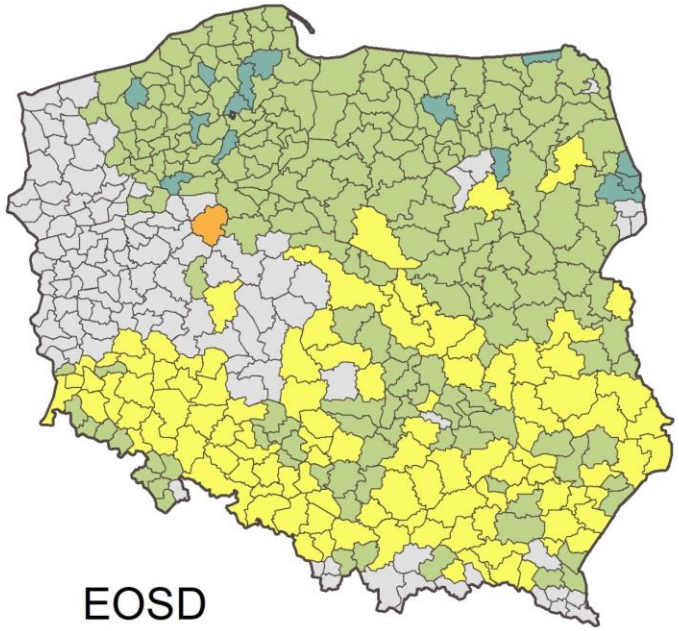
Start and end of the season date
Average for the years 2019 to 2022
Oak

SOSD



The day of the start of the growing season

- 107 - 110
- 111 - 120
- 121 - 130
- 131 - 140
- No Data

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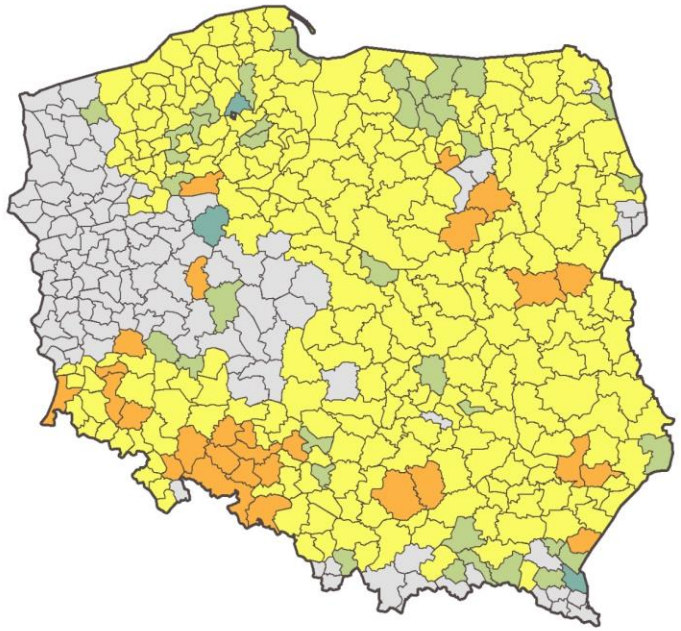
0 50 100 km

EOSD



The day of the end of the growing season

- 261 - 270
- 271 - 280
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- 291 - 297
- No Data

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Start and end of the season date
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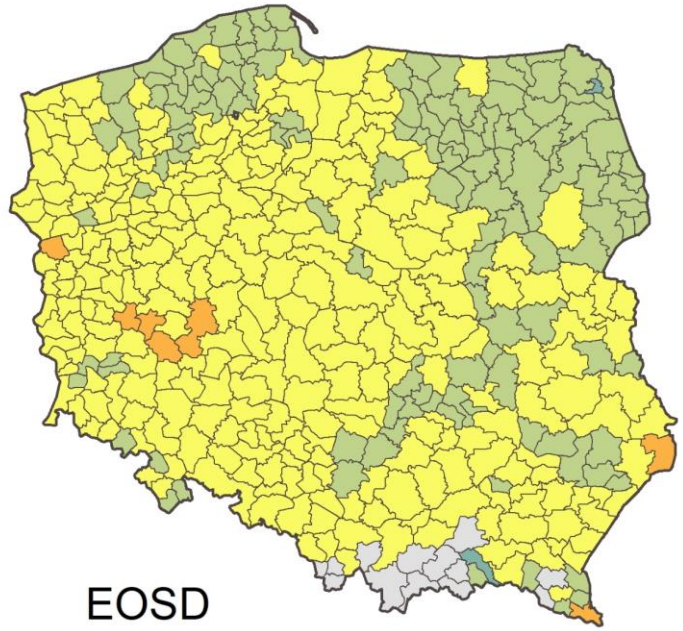
Birch

SOSD



The day of the start of the growing season

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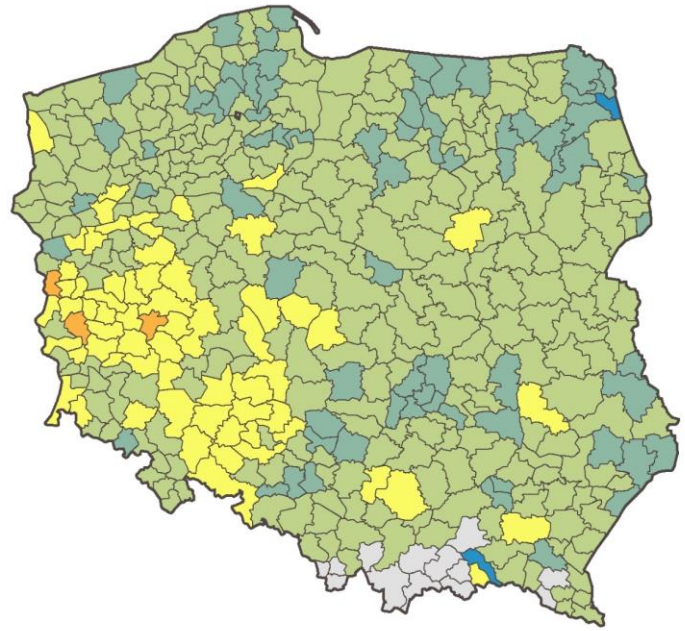
EOSD



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Conclusions

- The alignment of SOSD and EOSD values with temperature-based models underscores the reliability of the data and its utility in capturing regional variations in vegetation season dynamics.

- The assessment of Copernicus HR-VPP data underscores its potential for improving vegetation season monitoring, though careful examination and validation are necessary.

- The noted differences, especially the prevalence of No Data pixels in the SOSD 2022 dataset, raise questions about data accuracy and interpretation.

Thank You for listening

Publication in progress

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