LATVIJAS UNIVERSITĀTE

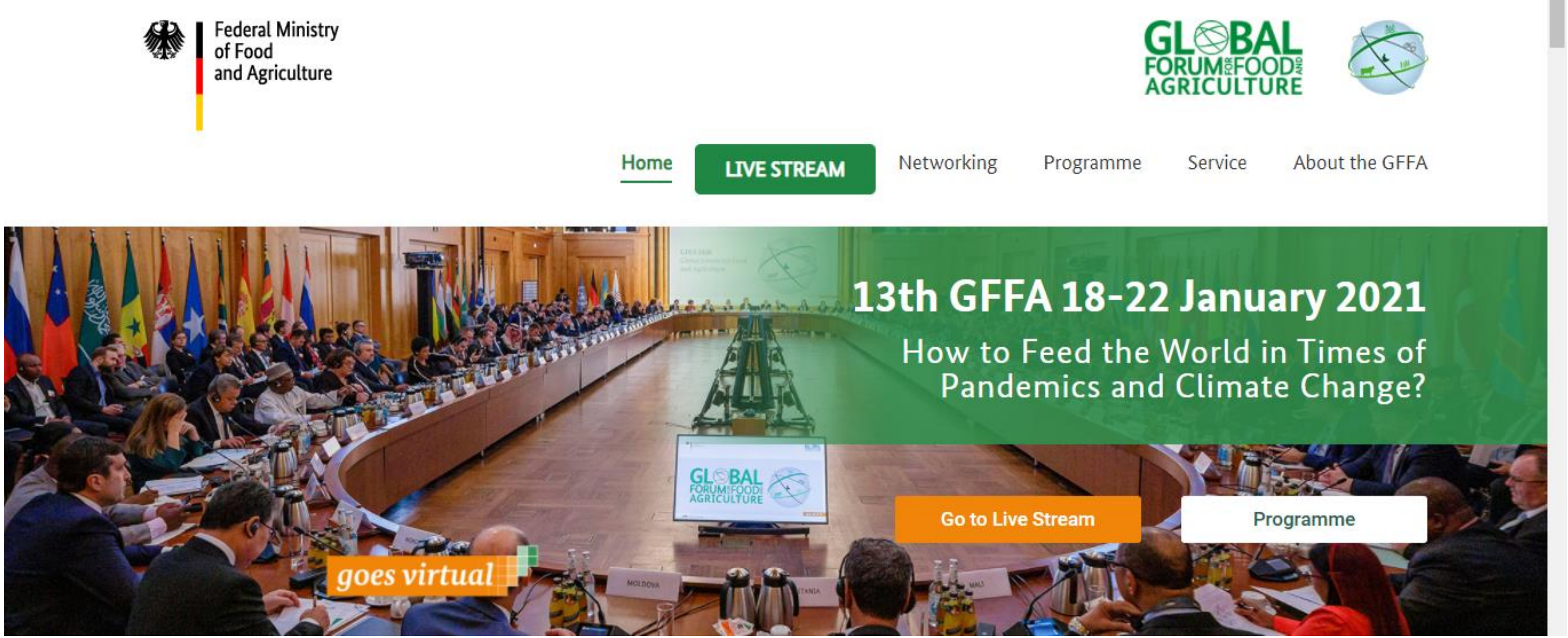
79. Latvijas Universitātes starptautiskā zinātniskā konference

Latvijas klimats un ūdeņi - mainība, tendences un ietekmes

KULTŪRAUGU FENOLOĢIJA LATVIJĀ: TRENDI UN IETEKMES

Pēcdoktorantūras pētniece **Gunta Kalvāne**

Gunta.kalvane@lu.lv



Lauksaimniecība ir viena no visvairāk klimata pārmaiņu skartajām nozarēm pasaulē.

Nepieciešami pētījumi/inovācijas un sadarbība.

Kultūraugu fenoloģija Latvijā (veikto pētījumu pārskats)

International Journal of Biometeorology
https://doi.org/10.1007/s00484-020-02068-8

ORIGINAL PAPER

Phenological trends of multi-taxonomic groups in Latvia, 1970–2018

Gunta Kalvāne[1] · Andis Kalvāns[1]

Received: 25 June 2020 / Accepted: 14 December 2020

Abstract
Phenology provides intimate insights into ongoing changes in nature and seasonality with respect to humans. In this study, the most complete volunteer observer phenological data set for the territory of Latvia from 1970 to 2018 was evaluated. The data set
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Phenology of spring barley (Hordeum vulgare) cultivars reflect adaption to climate change: case study of Priekuļi, Latvia, 1928–2019

Līga Dzedule[1], Gunta Kalvāne[2], Andis Kalvāns[2]
[1]Institute of Agricultural Resources and Economics, Priekuļi, LV-4130, Latvia;
[2]Faculty of Geography and Earth Sciences, University of Latvia, Riga, LV-1004, Latvia
Correspondence to: G.Kalvāne (gunta.kalvane@lu.lv)

Abstract. Climate change will have a major impact on the agricultural sector, affecting crop phen
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Key words

Phenological changes in Latvian horticulture: a case study of the Pūre orchard

...ne[1], Zane Gribuste[1], Andis Kalvāns[1]
...ography and Earth Sciences, University of Latvia, Jelgavas iela 1, Riga, Latvia
...e to: G.Kalvāne (gunta.kalvane@lu.lv)

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...ter-quality phenological predictions and to take account of the fragmentary nature of phenological data, in our ...sed the performance of three meteorological data sets – gridded observation data from E-OBS, ERA5-Land and direct observations from a distant meteorological station – in simple phenological degree-day models. In ...imation, the gridded E-OBS data set performs best in our phenological model.
...l flowering, *Malus domestica*, phenological modelling, climate change, Latvia

EMS Annual Meeting Abstracts
Vol. 16, EMS2019-787, 2019

Crop phenology and drought stress in changing climate

Gunta Kalvāne (1), Andis Kalvāns (1), Agrita Briede (1), Tija Sīle (2), and Līga Zaharāne (3)
(1) University of Latvia, Faculty of Geography and Earth Sciences, Rīga, Latvia (lu@lu.lv), (2) University of Latvia, Faculty of Physics, Mathematics and Optometry, Rīga, Latvia, (3) Institute of Agricultural Resources and Economics, Rīga, Latvia

Projected changes for climate extremes in 21th century show that there will be a marked increase in extremes in Europe in heat waves, droughts, and heavy precipitation events. Changes in extreme precipitation depend on the region, with a high confidence of increased extreme precipitation in Northern Europe (all seasons) and Continental Europe (except summer).
Projected increases in extreme climatic events are expected to increase crop yield variability and to lead to yield reductions in the future throughout Europe. Increasing the accuracy of crop productivity estimates is a key element in planning adaptation strategies under climate change.
Process-based crop models are effective means to project climate impact on crop yield but have large uncertainty in yield simulations. We want to see how recent climate change has affected crop phenology in Latvia. We analyze trends in precipitation, drought indexes, evapotranspiration, and soil temperature as well crop phenology for the last 30 years, considering, barley and rye.
In general, the changes in drought indexes are in line with trends of precipitation. The number of consecutive wet days in Latvia have a statistically significant increasing trend only in half of the studied time series. Overall, the long-term changes in climatological drought indices shows the significant wetter conditions during winter (December-February) and cold half (October-March) of a year. At most of the stations a general drying tendency is apparent in warm season. All the stations have shown the increase of maximum number of dry days (CDD index) also, SPI6 and SPI3 indexes have shown the decreasing tendency. However, the tendency to more drying

Ieskicējot «lielo bildi»

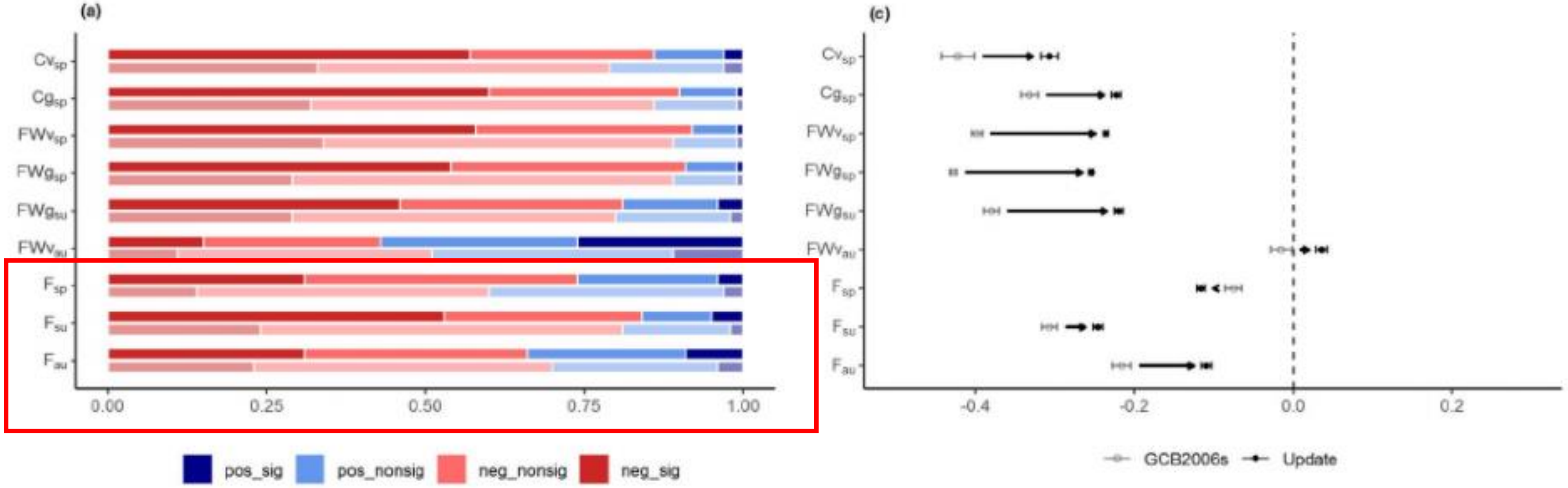

FIGURE 1 Phenological trends in Update for the nine clusters (a, c) and four periods (b, d) as defined in Table 2. CgP, Crop generative Period; Cg_{sp}, Crop generative spring; Cv_{sp}, Crop vegetative spring; F_{au}, Farmer autumn; FS, Farming season; F_{sp}, Farmer spring; F_{su}, Farmer summer; FWgP, Fruit trees & wild plant species generative Period; FWg_{sp}, Fruit trees & wild plant species generative spring; FWg_{su}, Fruit trees & wild plant species generative summer; FWv_{au}, Fruit trees & wild plant species vegetative autumn; FWv_{sp}, Fruit trees & wild plant species vegetative spring; GS, Growing Season. (a, b) Proportions of positive/negative (significant after FDR adjustment $p < .05$/ nonsignificant) trends. Paler lower bars in (a) indicate the respective proportions for GCB2006s. (c, d) mean slopes of linear trends (days/ year) with 95% confidence intervals, open circles in (c) indicate the respective mean slopes for GCB2006s [Colour figure can be viewed at wileyonlinelibrary.com]

LATVIJAS UNIVERSITĀTE

79. Latvijas Universitātes starptautiskā zinātniskā konference

Menzel, Annette & Yuan, Ye & Matiu, Michael & Sparks, Tim & Scheifinger, Helfried & Gehrig, Regula & Estrella, Nicole. (2020). Climate change fingerprints in recent European plant phenology. Global Change Biology. 26. 10.1111/gcb.15000.

Fenoloģiskie novērojumi Latvijā (datu bāze)

1973. gada pavasara

Vietas nosaukums	Atlidoja strazdi	Sākās bērzu sulu cirkulācija	Sāka ziedēt lazdas	Izlidoja pirmās bites	Atlidoja dzērves	Atlidoja bezdelīgas	Sāka plaukt ērkšķogu lapas	Sāka plaukt upeņu lapas	Sāka plaukt ievu lapas
1. Vērgale	8.III	10.III	20.III	10.III	28.III	6.V	10.IV	15.IV	26.IV
2. Aizpute	12.III	13.III	23.III	10.III	27.III	8.V	24.IV	17.IV	1.V
3. Pope	24.III	30.III	22.III	—	—	8.V	16.IV	21.IV	24.IV
4. Penkule	16.III	22.III	—	16.III	13.IV	2.V	2.V	4.V	28.IV
5. Dobele	14.III	24.III	24.III	—	—	4.V	—	30.IV	22.IV
6. Lielplatone	13.III	—	23.III	28.III	—	—	—	21.IV	19.IV
7. Jelgava	10.III	2.IV	10.IV	14.III	20.IV	6.V	4.V	6.V	6.V
8. Code	8.III	30.III	11.III	14.III	—	1.V	20.IV	13.IV	18.IV
9. Katlakalns	16.III	23 III	26.III	24.III	26.IV	5.V	27.IV	26.IV	24.IV
10. Saurieši	15.III	25.III	—	—	14.IV	5.V	1.V	28.IV	28.IV
11. Bulduri	19.III	28.III	15.III	25.III	24.IV	15.V	22.IV	24.IV	30.IV
12. Vecpiebalga	28.III	10.IV	18.III	15.III	—	31.V	2.V	—	26.IV
13. Madliena	15.III	25.III	19.III	15.III	—	—	5.V	25.IV	25.IV
14. Nereta	15.III	28.III	26.III	14.III	18.III	29.IV	16.IV	30.IV	23.IV
15. Stučka	16.III	27.III	26.III	13.III	16.III	3.V	17.IV	28.IV	18.IV
16. Alūksne	22.III	28.III	31.III	27.III	25.IV	1.V	4.V	6.V	4.V
17. Jumurda	11.III	1.IV	27.III	14.III	—	1.V	29.IV	2.V	28.IV
18. Cesvaine	24.III	26.III	26.III	25.III	—	6.V	28.IV	27.IV	23.IV
19. Dzelzava	16.III	26.III	30.III	1.III	20.IV	7.V	29.IV	9.V	6.V
20. Lubāna	20.III	30.III	28.III	14.III	18.IV	30.IV	3.V	21.IV	18.IV
21. Zvidziena	24.III	28.III	31.III	15.III	31.III	3.V	1.V	4.IV	2.V
22. Mēdzūla	23.III	31.III	27.III	25.III	30.III	5.V	24.IV	24.IV	19.IV
23. Aduliena	16.III	1.IV	29.III	14.III	26.III	4.V	2.V	2.V	29.IV
24. Atašiene	15.III	10.IV	29.III	23.III	11.IV	—	—	—	6.IV
25. Subate	15.III	25.III	24.III	21.III	27.III	2.V	7.IV	24.IV	18.IV
26. Višķi	26.III	23.III	—	25.III	—	9.V	3.IV	2.IV	16.IV
27. Šķaune	20.III	3.IV	29.III	25.III	27.III	1.V	22.IV	25.IV	29.IV

102

```
> d %>%
+   select(Station, Year, Species, Phenophase, Date)
# A tibble: 46,933 x 5
   Station     Year Species    Phenophase       Date
   <chr>      <dbl> <chr>      <chr>            <date>
 1 Bukaisi_1   2018 snowmelt   last occurrence  2018-03-19
 2 Ranka       2018 snowmelt   last occurrence  2018-03-10
 3 Garkalne    2018 snowmelt   last occurrence  2018-01-25
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Long-term phenological data set of multi-taxonomic groups, agrarian activities and abiotic parameters from Latvia, northern Europe

Gunta Kalvāne[1], Andis Kalvāns[1], Andris Ģērmanis[2]

[1]University of Latvia, Faculty of Geography and Earth Sciences, Riga, Jelgavas street 1, LV-1002, Latvia
[2]Rīga State Gymnasuim No.2., Rīga, Krišjāņa Valdemāra street 1, LV-1010, Latvia.

Correspondence to: Gunta Kalvāne (gunta.kalvane@lu.lv)

Abstract. A phenological data set collected by citizen-scientists from 1970 to 2018 in Latvia is presented, comprising almost 47,000 individual observations of eight taxonomical groups, in addition to agrarian activities and abiotic parameters, covering in total 159 different phenological phases. These original data published offline in annual issues of the Nature and History Calendar (in Latvian, *Dabas un vēstures kalendārs*) have been digitized, harmonized and geo-referenced. Overall, the possible use of such data is extensive, as phenological data are excellent bioindicators for characterising climate change and can be used for the elaboration of adaptation strategies in agriculture, forestry, and environmental monitoring. The data also can be used in cultural–historical research; for example, the database includes data on sugar beet and maize, the cultivation of which was imposed on collective farms during the Soviet period. Thus, such data are not only important in the

Kalvane, G., Kalvans, A., Ģērmanis, A. (2020) Long-term phenological data set of multi-taxonomic groups, agrarian activities and abiotic parameters from Latvia, northern Europe. Earth System Science Data (ESSD). Open data journal, submitted

November 13, 2020

Dataset Open Access

Phenology data set of plants and birds and other taxonomic groups, as well as agrarian activities and abiotic phenomena from Latvia, 1970-2018

Gunta Kalvāne; Andis Kalvans; Andris Ģērmanis

A data set of phenological observations of plants, birds, as well as agrarian activities and abiotic phenomena from Latvia, 1970-2018 is presented. The data include limited number of observations of insects, amphibians, mammals, mushrooms, mollusks and fishes as well. The data was collected by voluntary observers (citizen scientists) and published as paper based yearly bulletins. It includes almost 48 000 individual observations of 159 different phenological phases from 103 locations in Latvia. Each entry is comprised of following fields:

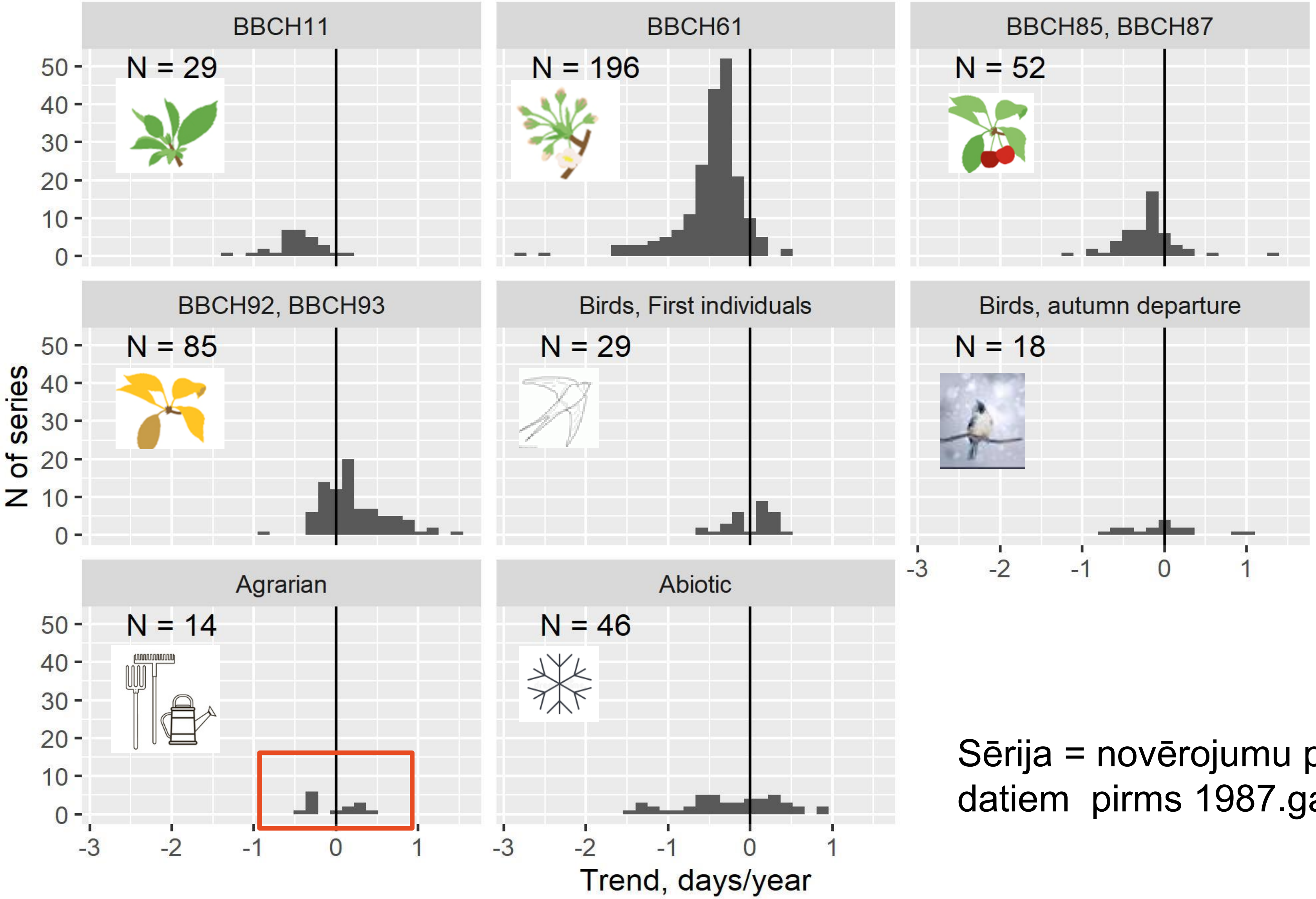
1. Station: name of the observation station
2. Year: year of observation
3. Season: season of observation as indicated in the primary publication
4. Species: English name of the species observed or description of phenomena observed in case of abiotic occurrences
5. Species Latin: Latine name of the species observed
6. Taxonomic_group: taxonomic group of the species observed or grouping of non-biological phases ("Abiotic" for meteorological phenomena and "Agrarian" for agrarian activities)
7. Phenophase: description of phenological phase observed
8. BBCH: attributed BBCH code for phenological phase observed, where applicable

Publication date:
November 13, 2020
DOI:
DOI 10.5281/zenodo.3982086
Keyword(s):
phenology

Dati brīvi pieejami ikvienam lietotājam

Kalvane, G., Kalvans, A., Ģērmanis, A. (2020) Long-term phenological data set of multi-taxonomic groups, agrarian activities and abiotic parameters from Latvia, northern Europe. Earth System Science Data (ESSD). Open data journal, submitted

Fenoloģiskās izmaiņas Latvijā (1970.-2018.)



Sērija = novērojumu punkti/fāzes ar vismaz 4 gadu datiem pirms 1987.gada un pēc 1992.gada

Ābeles *Malus domestica* fenoloģija Pūrē

Phenological changes in Latvian horticulture: a case study of the Pūre orchard

Gunta Kalvāne[1], Zane Gribuste[1], Andis Kalvāns[1]

[1]Faculty of Geography and Earth Sciences, University of Latvia, Jelgavas iela 1, Riga, Latvia

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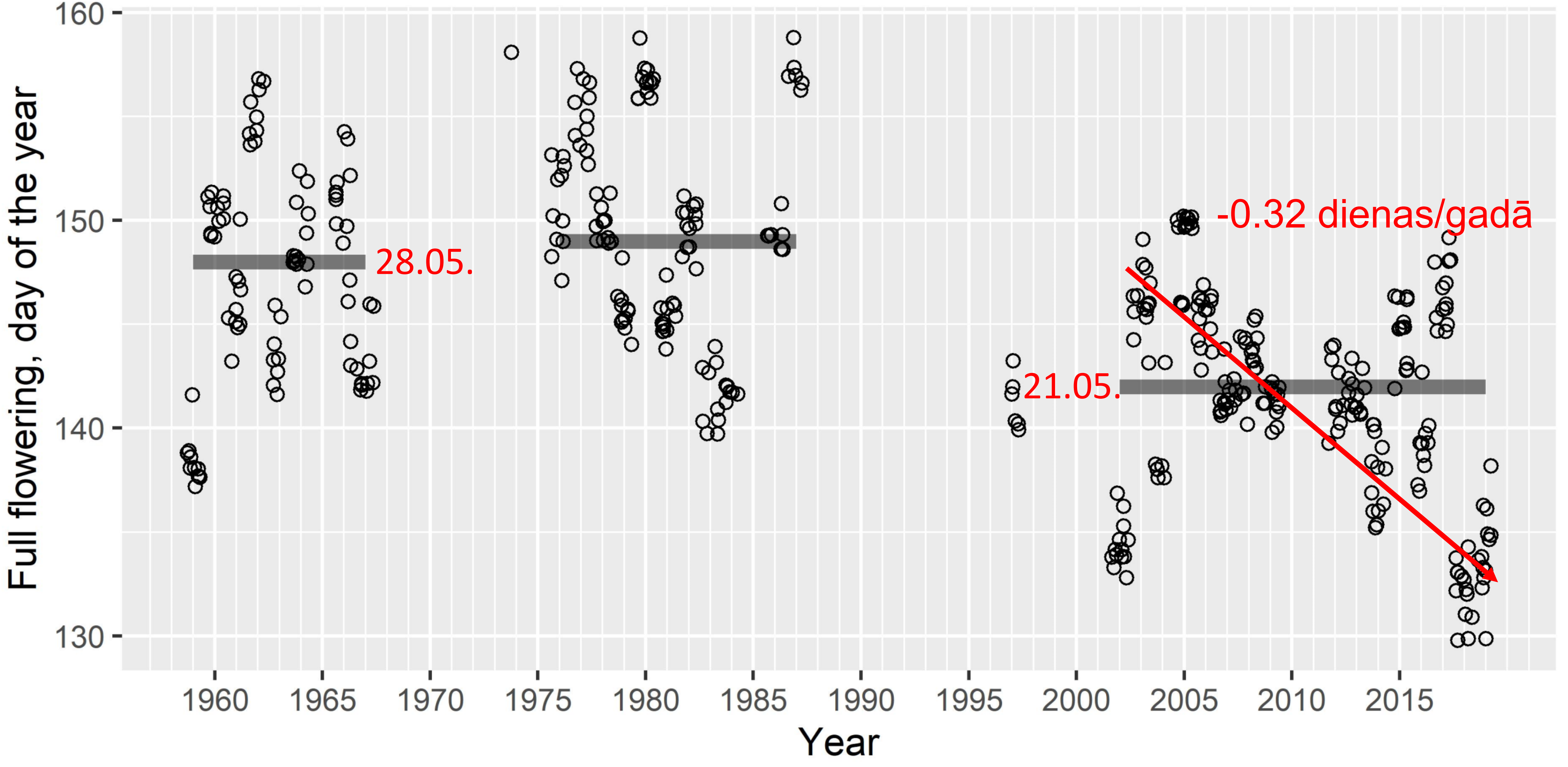
To develop better-quality phenological predictions and to take account of the fragmentary nature of phenological data, in our study we assessed the performance of three meteorological data sets – gridded observation data from E-OBS, ERA5-Land reanalysis data and direct observations from a distant meteorological station – in simple phenological degree-day models. In the first approximation, the gridded E-OBS data set performs best in our phenological model.

Key words: full flowering, *Malus domestica*, phenological modelling, climate change, Latvia

Kalvane, G., Gribuste, Z., Kalvans, A. Phenological changes in Latvia` horticulture: case study for Pūre orchard. *Advances in Science and Research (ASR). Contributions in applied meteorology and climatology*, submitted

Ābeles pilnziedēšanas fenoloģija Pūrē (1959.-2019.)



Korelācijas matrica: pilnziedēšana un mēneša vidējā gaisa temperatūra un nokrišņi (Stende)

Šķirne	Februāris		Marts		Aprīlis		Maijs	
	Nokr.	Temp.	Nokr.	Temp.	Nokr.	Temp.	Nokr.	Temp.
'Antonovka'	0,24	0,25	0,10	0,47	0,03	0,52	0,36	0,67
'Antonovka Novoje'	0,36	0,03	0,03	0,38	0,08	0,57	0,42	0,55
'Auksis'	0,05	0,36	0,04	0,31	0,42	0,50	0,36	0,52
'Baltais Dzidrais'	0,15	0,25	0,15	0,39	0,37	0,57	0,24	0,60
'Celmiņu Dzeltenais'	0,13	0,08	0,18	0,52	0,48	0,31	0,42	0,72
'Jelgavas Vasara'	0,31	0,42	0,07	0,50	0,24	0,69	0,45	0,64
'Koričnoje Novoje'	0,35	0,20	0,30	0,47	0,00	0,76	0,40	0,32
'Kortland'	0,39	0,23	0,12	0,38	0,25	0,60	0,39	0,61
'Kovalenovskoje'	0,06	0,27	0,09	0,24	0,23	0,43	0,31	0,52
'Krapes Cukuriņš'	0,33	0,41	0,03	0,46	0,30	0,73	0,52	0,70
'Laizānu Ziemas'	0,00	0,17	0,04	0,60	0,47	0,49	0,49	0,76
'Melba'	0,27	0,44	0,00	0,56	0,18	0,56	0,50	0,69
'Paides Ziemas'	0,42	0,04	0,43	0,65	0,25	0,43	0,36	0,67
'Parastais Cukuriņš'	0,42	0,46	0,00	0,50	0,24	0,60	0,56	0,69

Gribuste, Z. (2020)

Labības fenoloģija

EMS Annual Meeting Abstracts
Vol. 16, EMS2019-787, 2019

Crop phenology and drought stress in changing climate

Gunta Kalvāne (1), Andis Kalvāns (1), Agrita Briede (1), Tija Sīle (2), and Līga Zaharāne (3)
(1) University of Latvia, Faculty of Geography and Earth Sciences, Rīga, Latvia (lu@lu.lv), (2) University of Latvia, Faculty of Physics, Mathematics and Optometry, Rīga, Latvia, (3) Institute of Agricultural Resources and Economics, Rīga, Latvia

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Projected increases in extreme climatic events are expected to increase crop yield variability and to lead to yield reductions in the future throughout Europe. Increasing the accuracy of crop productivity estimates is a key element in planning adaptation strategies under climate change.
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In general, the changes in drought indexes are in line with trends of precipitation. The number of consecutive wet days in Latvia have a statistically significant increasing trend only in half of the studied time series. Overall, the long-term changes in climatological drought indices shows the significant wetter conditions during winter (December-February) and cold half (October-March) of a year. At most of the stations a general drying tendency is apparent in warm season. All the stations have shown the increase of maximum number of dry days (CDD index) also, SPI6 and SPI3 indexes have shown the decreasing tendency. However, the tendency to more drying

Phenology of spring barley (Hordeum vulgare) cultivars reflect adaption to climate change: case study of Priekuļi, Latvia, 1928–2019

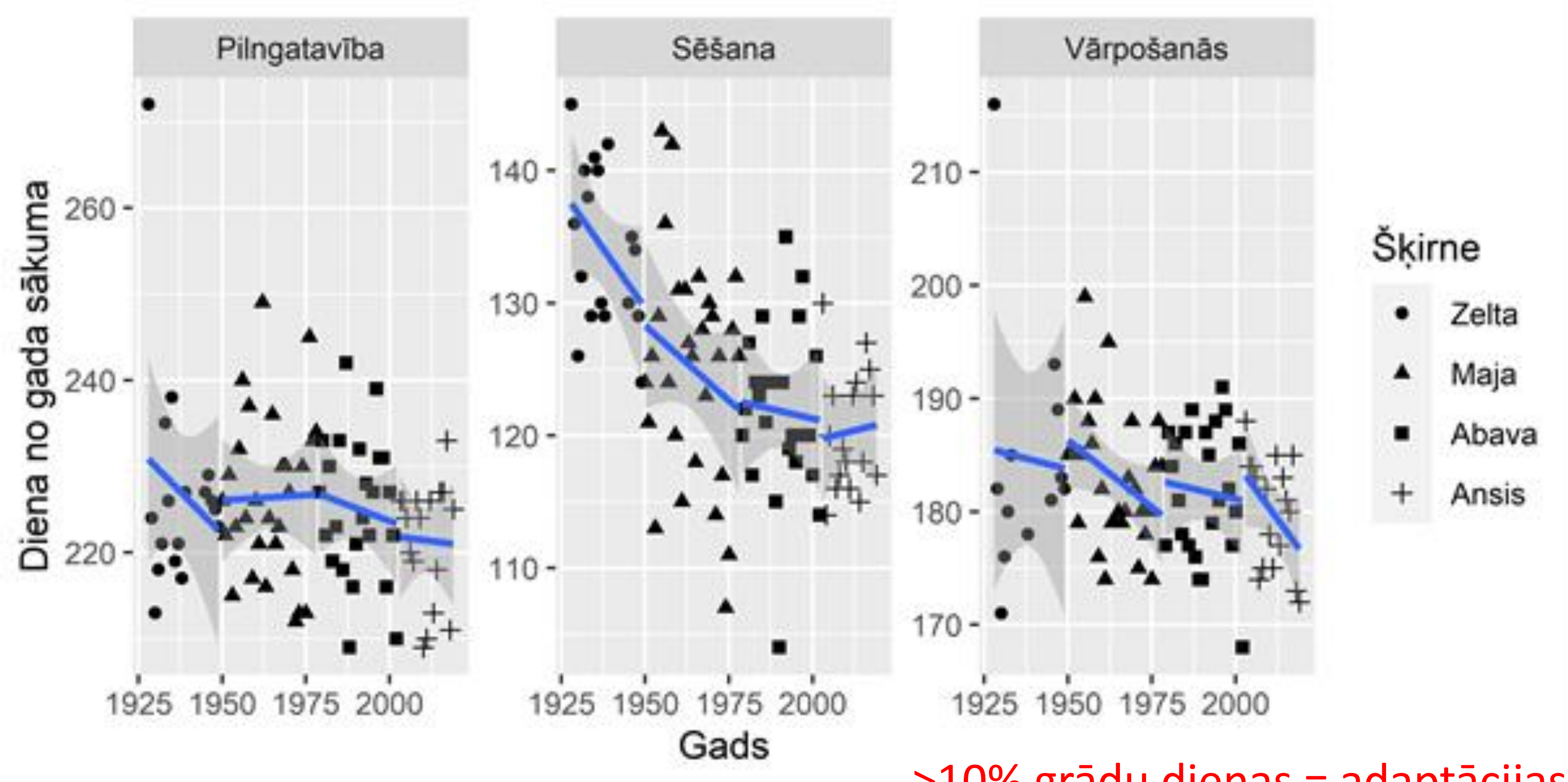
Līga Dzedule[1], Gunta Kalvāne[2], Andis Kalvāns[2]
[1]Institute of Agricultural Resources and Economics, Priekuļi, LV-4130, Latvia;
[2]Faculty of Geography and Earth Sciences, University of Latvia, Riga, LV-1004, Latvia
Correspondence to: G.Kalvāne (gunta.kalvane@lu.lv)

Abstract. Climate change will have a major impact on the agricultural sector, affecting crop phenology and yields. The study has analysed the phenological phases of spring barley (Hordeum vulgare), evaluating the onset of three phases, sowing, heading and fully ripe, and the duration between phases over a near century (1928–2019) in Priekuļi, Latvia. We have evaluated application of a phenological model for different varieties of spring barley. Air temperature increased significantly during the analysis period, which has had an impact on the phenology of cereals: the phases analysed tend to start earlier and yields have also increased. We found that accumulated active temperature needed to reach heading and full ripening phenological phases for modern spring barley varieties is 800°C-days and 1555°C-days respectively, that is increase up to 10% compared to varieties cultivated in the first part of 20th century.
Key words: spring barley (Hordeum vulgare) phenology, climate changes, phenological model, Baltics.

1 Introduction

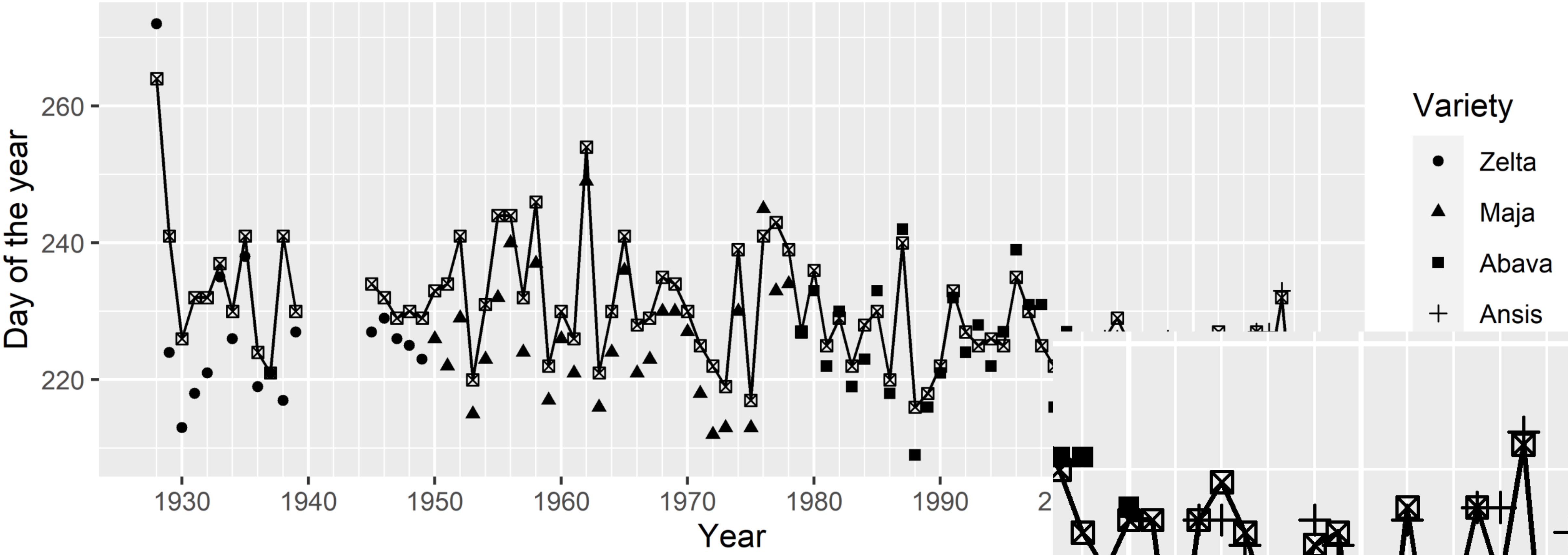
The phenology of cereals has long been one of the most important areas of phenology, and its role has become more important again in recent years as agriculture is highly sensitive climate change (European Environment Agency 2019; Ceccarelli et al. 2010). Climate changes have an effect on not only phenology, but also impact agricultural production, management and agricultural decision-making. Significant changes have occurred in the phenology of cereals, particularly the lengthening of the growing season (Eyshi Rezaei et al. 2017; Sujetoviene et al. 2018; Středová et al. 2017). Long-term trends in crop phenology are crop-specific (Eyshi Rezaei et al. 2017); for some species, the changes are more pronounced. Středová, et al. (2017) noted that the prolonging of the growing season significant influences the yield and its quality. The projected warmer climate significantly affected the potential scheduling of agricultural practices, accelerating the occurrence of sowing and harvest dates. In Latvia there has not yet been a detailed assessment of data on the phenology of cereals, but studies in Lithuania have shown that trends in harvest dates of spring barley show a slight delay, and the total vegetative period of spring barley advanced by >12 days over 1961–2015 (Sujetovienė et al. 2018). This study has analysed observations made by experts from

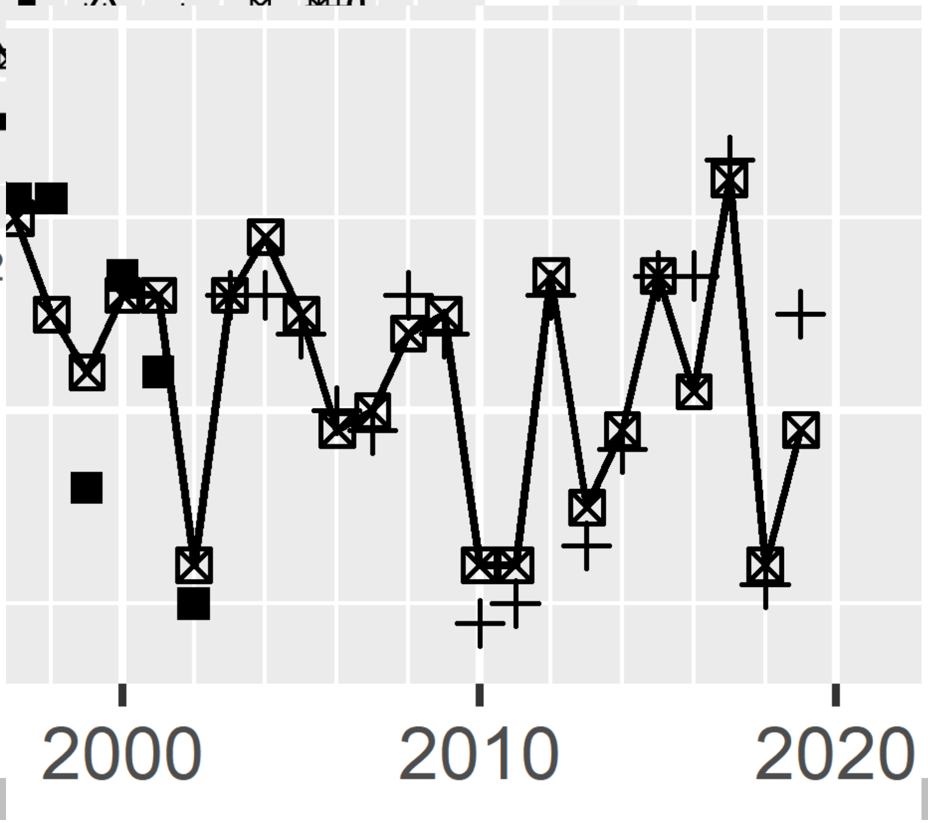
Vasaras miežu fenoloģija Priekuļos (1928.-2019.)



>10% grādu dienas = adaptācijas mehānisms

Dzedule,L., Kalvāne, G., Kalvāns A. Phenology of spring barley (Hordeum vulgare) cultivars reflect adaption to climate change: case study of Priekuļi, Latvia, 1928–2019. *Advances in Science and Research (ASR). Contributions in applied meteorology and climatology*, submitted





Nogatavošanās fāze: Fenoloģiskais modelis (grādu dienas) / novērojumiem

Modeļa RME 2-7 dienas (lielāka kļūda ‘Zelta’ un ‘Māja’); agrajos gados modelis vēlāk nekā novērojumi; vēlajos – agrāks. T.i, modelis «piesardzīgāks» savās prognozēs

PostDoc Latvia

Pētījums veikts ERAF projekta Nr. 1.1.1.2/VIAA/2/18/265 ietvaros

Valsts izglītības attīstības aģentūra
NACIONĀLAIS ATTĪSTĪBAS PLĀNS 2020
EIROPAS SAVIENĪBA
Eiropas Reģionālās attīstības fonds
IEGULDĪJUMS TAVĀ NĀKOTNĒ

Paldies par uzmanību!