THE HUNGARIAN AEROBIOLOGICAL NETWORK – 30 YEARS OF ACHIEVEMENTS

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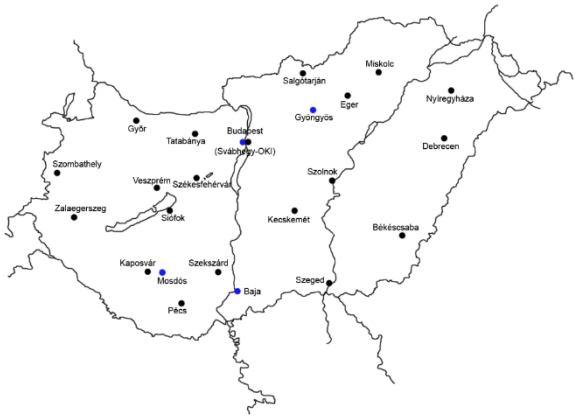
A little history

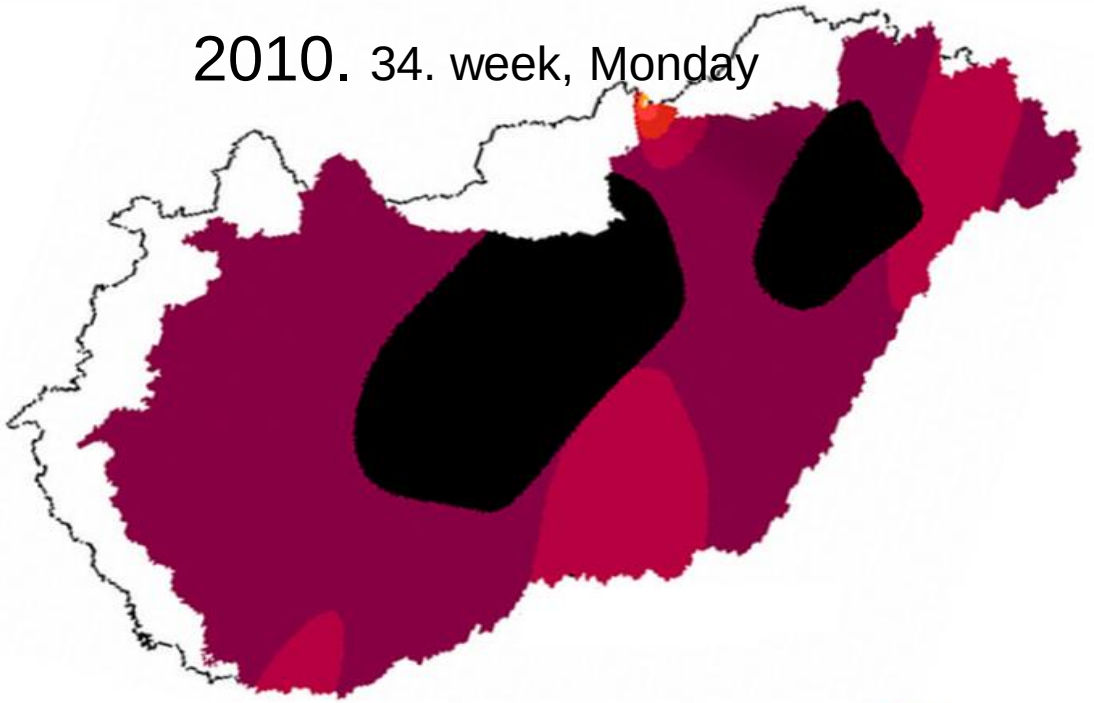
- The Hungarian Aerobiological Network (HAN) was established in 1992 by the predecessor institute of the National Public Health Center now coordinating the network.
- The HAN has been gradually built up from two stations established in the capital city to a countrywide network including 21 monitoring stations.
- The stations are operated by the local government offices according to international standards

Monitoring station	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Budapest-OKI																														
Budapest-Svábhegy																														
Pécs																														
Debrecen																														
Győr																														
Miskolc																														
Szekszárd																														
Zalaegerszeg																														
Békéscsaba																														
Kecskemét																														
Szolnok																														
Nyíregyháza																														
Veszprém																														
Salgótarján																														
Mosdós																														
Eger																														
Szeged																														
Szombathely																														
Tatabánya																														
Gyöngyös																														
Kaposvár (Mosdós)																														
Székesfehérvár																														
Baja																														
Siófok																														
Füzér																														
össz	3	7	8	8	10	10	11	12	12	12	13	14	15	19	19	19	18	18	18	19	19	20	19	19	19	20	20	21	21	21

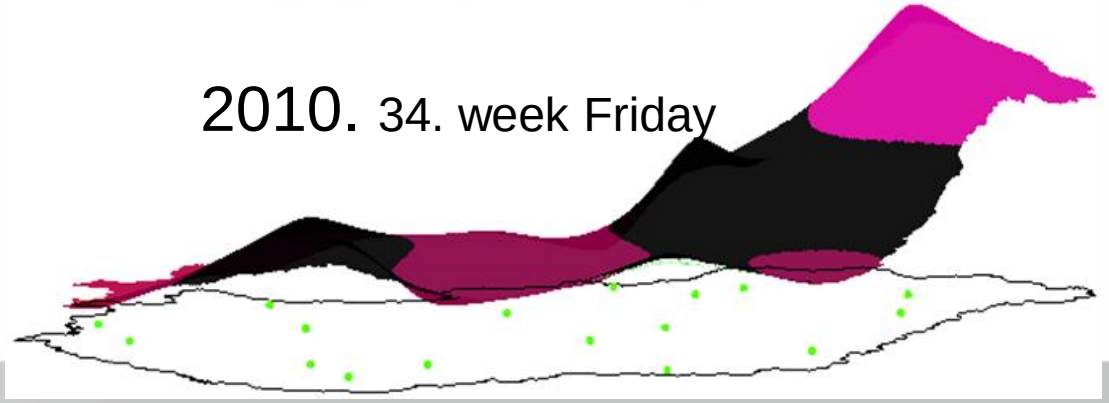


Milestones:

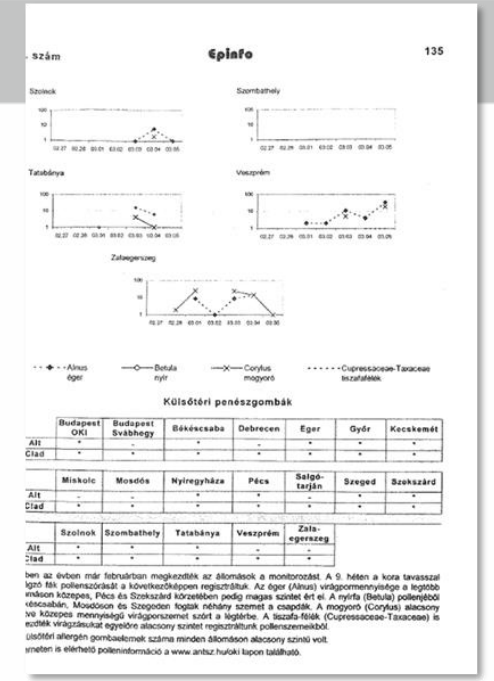
- The first pollen report was issued in 1994,
- attempts to forecast the pollen season onset started in 2010



2010. 34. week, Monday



2010. 34. week Friday

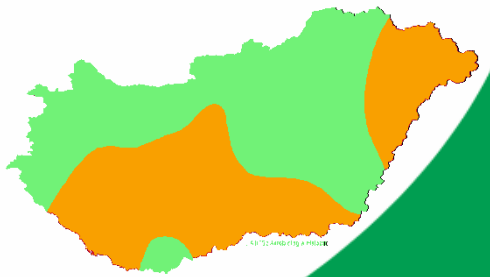


Külsőtéri penészgombák

	Budapest OKI	Budapest Svábhegy	Békéscsaba	Debrecen	Eger	Győr	Kecskemét
Alt	*	-	*	*	*	*	*
Clad	*	*	*	*	*	*	*

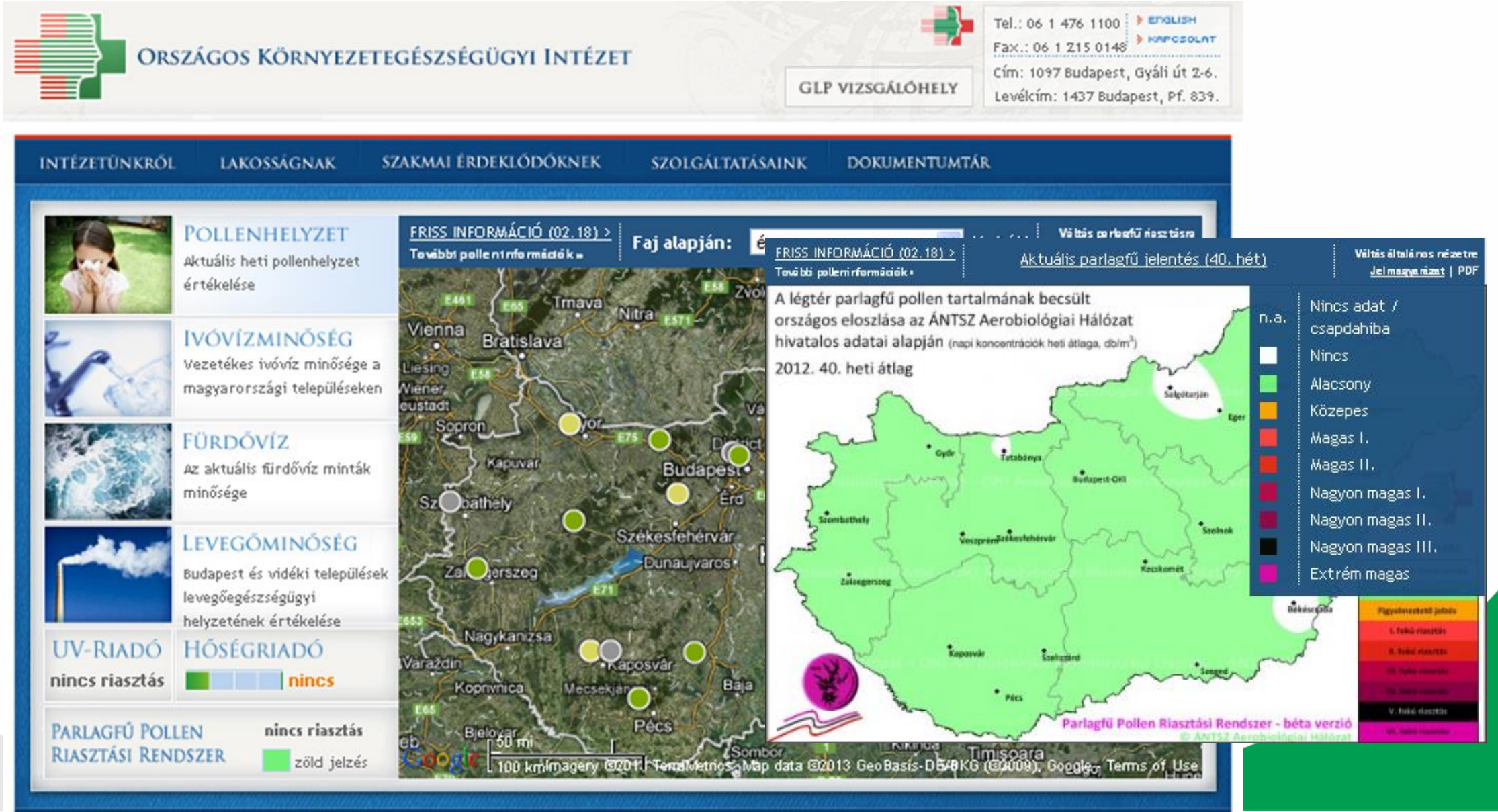
	Miskolc	Mosdós	Nyíregyháza	Pécs	Salgó-tarján	Szeged	Szekszárd
Alt	-	-	*	*	-	*	*
Clad	*	*	*	*	*	*	*

	Szolnok	Szombathely	Tatabánya	Veszprém	Zala-egerszeg
Alt	*	*	*	-	-
Clad	*	*	*	*	*



output

Ragweed Pollen Alarm System (R-PAS) – the beginning -2012

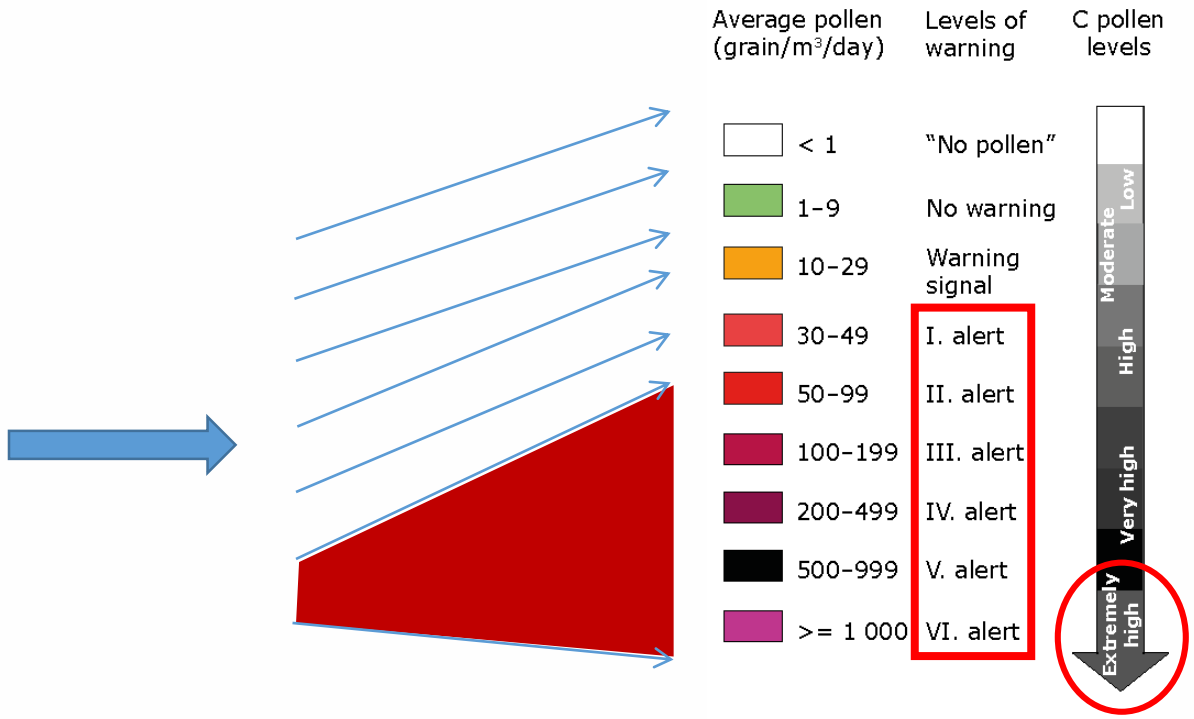


The categories and signals for ragweed pollen alert

The situation required the differentiation of the high-level category:
The R-PAS contains 9 categories (levels) with 6 alert levels:

none	0 - 2,2
Very low	2,2 - 8,9
Low	8,9 - 20,0
Moderate	20,0 - 35,6
High	35,6 - 55,6
Very high	55,6 - max

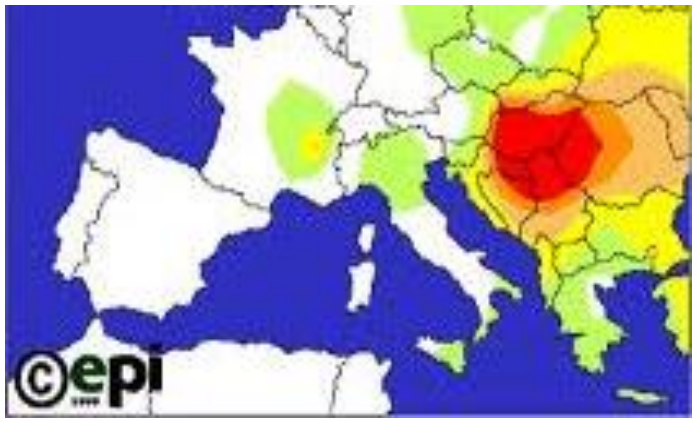
http://www.cabi.org/Uploads/File/CABI%20Switzerland/Ambrosia%20conf/5%20Clot.pdf



Note:
The pattern shows the inferential distribution of the daily mean pollen concentration by categories in respect of 22-28 of August based on the data of HAN

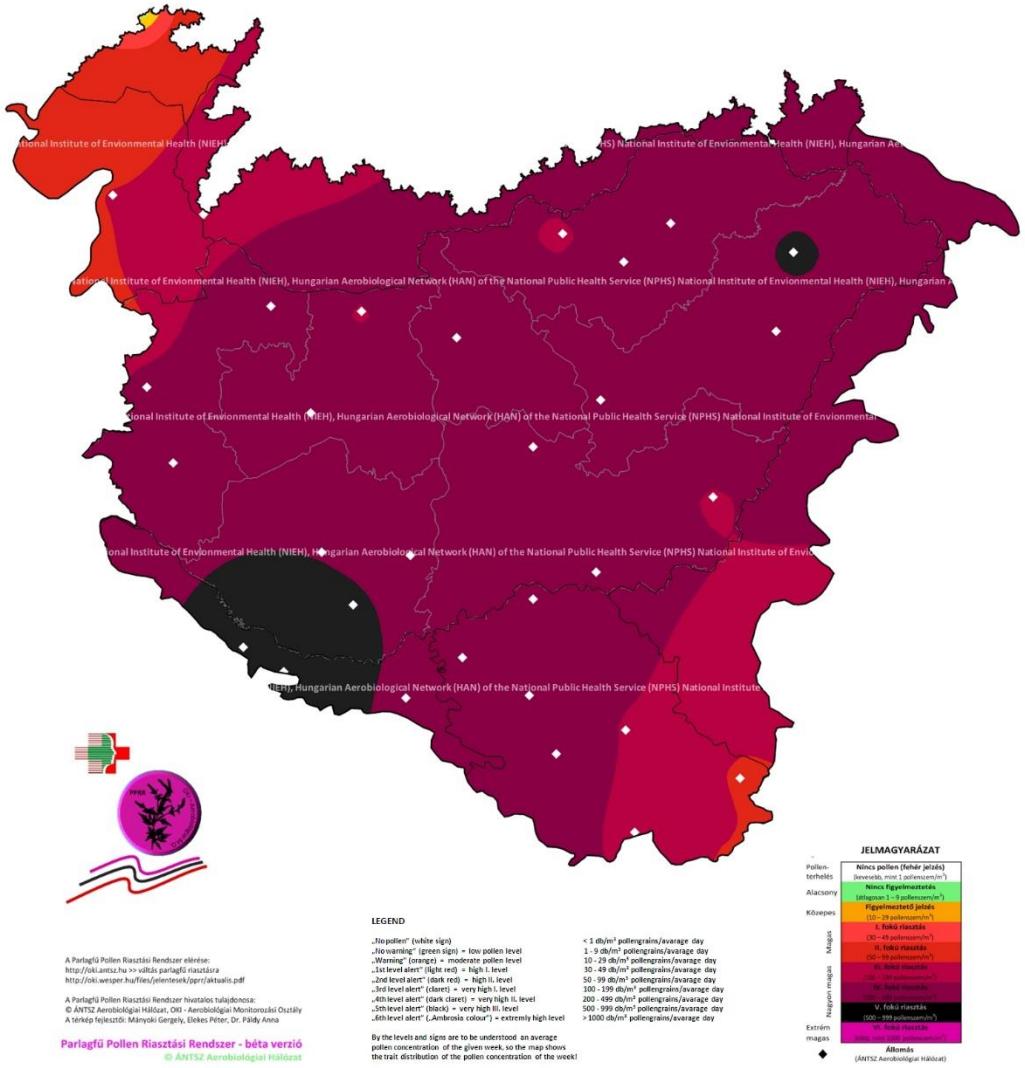
5

Next step: international extension:
Pannon Biogeographical Region



http://www.polleninfo.org/index.php?language=en&nav=&module=states&action=first_page&row=&id_parent=60&register=_r3a&typeofpollen=ambr

The estimated distribution of the daily airborne pollen concentration of ragweed in the Pannon Biogeographical Region in the season peak of 2011 (34th week) according to the Hungarian Ragweed Pollen Alarm System (RPAS)
/beta version/

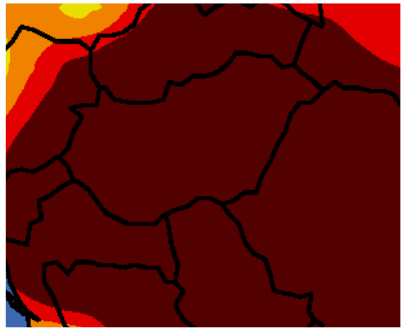


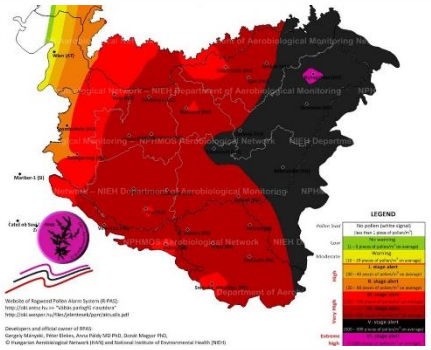
The map shows the inferential distribution of the ragweed pollen concentration categories of RPAS with six alarm levels in the Pannon Biogeographical Region (PBR).
The colours show the mean pollen concentration of the peak week of the ragweed season (in Hungary) by settlements (Aerobiological Stations in the PBR) by the archive data of EPI - EAN database.

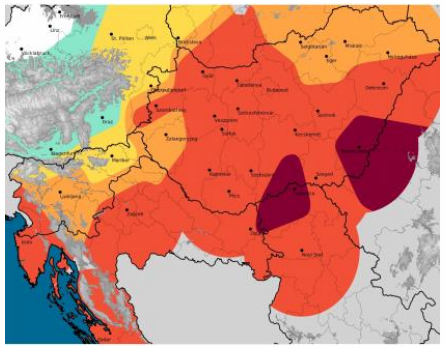
Map maker and owner: National Institute of Environmental Health (NIEH), Hungarian Aerobiological Network (HAN) of the National Public Health Service (NPHS), Budapest, Hungary

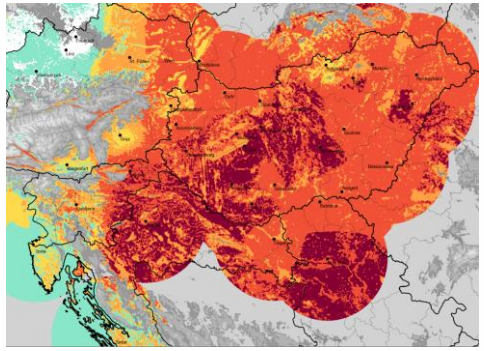
Steps of the development of Ragweed pollen alarm system

2008 2014 2019 2020







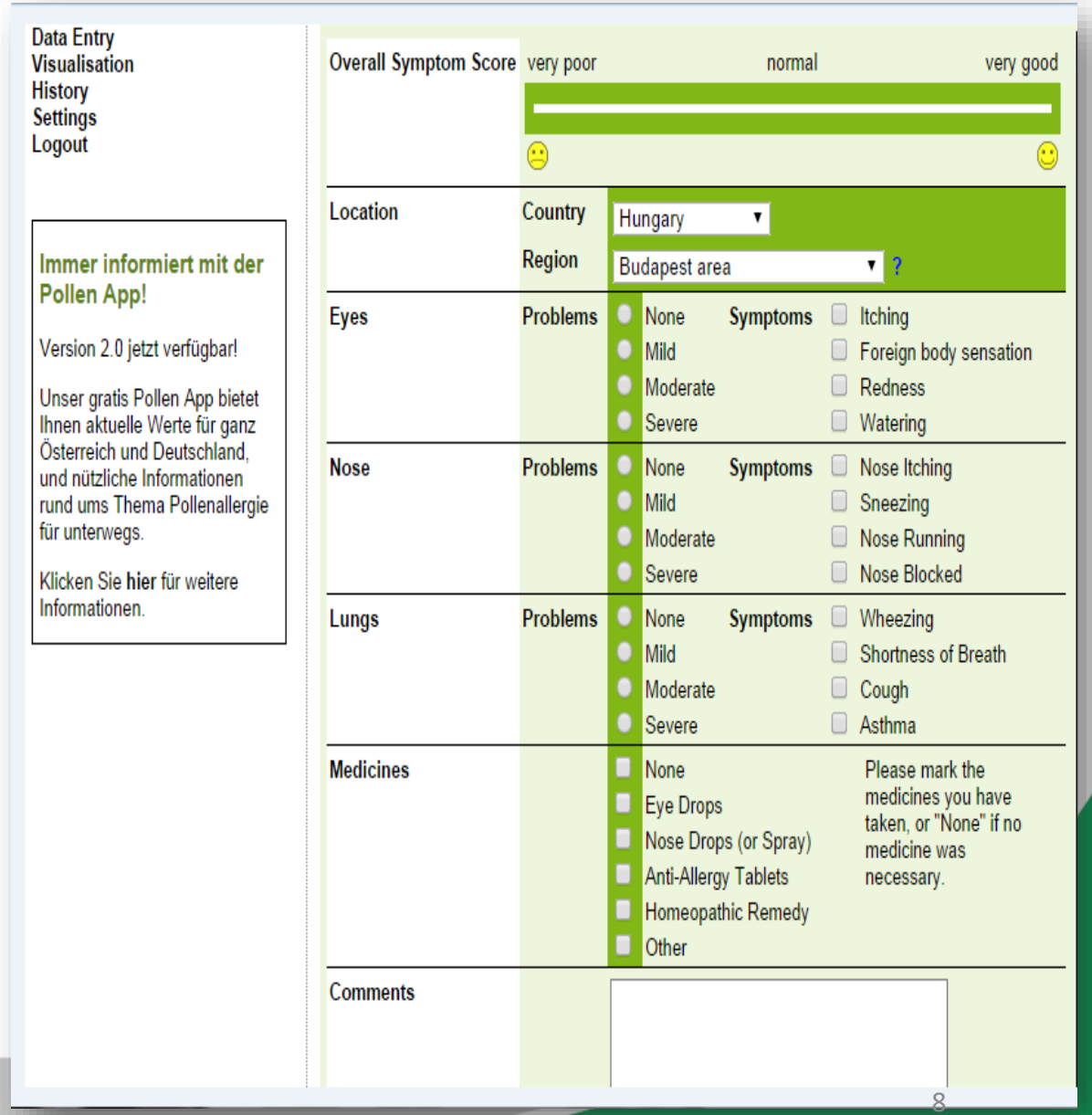


Exclusion>700m, from 1 km resolution surface modell

Skjøth et al. (2019).

Patient's Hayfever Diary (PHD) -2015

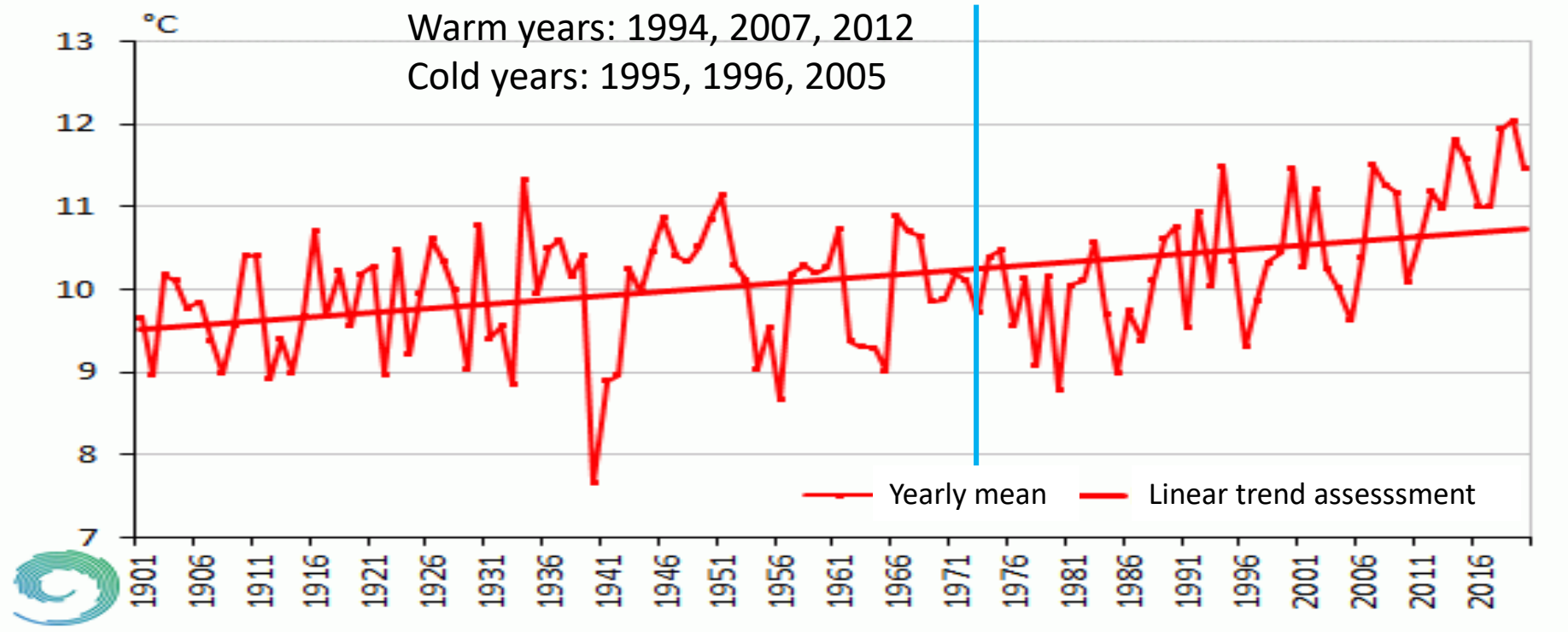
- An online webbased service run by the EAN used in 13 countries of Europe in 2015
- Users can enter the type of their symptoms („overall", conjunctival, nasal, bronchial) and it's degree from 0-3
- Overall symptom score ranged between 0-10
- What is the connection between the symptoms and the pollen exposition
- Relationship between the ragweed concentration and the level of different symptoms.



The estimated threshold levels of the eye symptoms of ragweed pollen allergy based on the Patients Hayfever Diary for Hungary

10-29 grain/m³	30-59 grain/m³	60-89 grain/m³	90-120 grain/m³
Mild eye symptoms	moderate eye symptoms	strong symptoms	extremely strong symptoms
Only one symptom at one time	One or two symptoms at one time	Two or three symptoms at one time	All symptoms at one time
Mostly eye watering, eye redness	Eye redness, eye itching, eye watering,	Eye redness, eye itching, eye watering, eye foreign body sensation	All of eye symptoms at one time
One score on the range of discomfort scale.	2 score on the range of discomfort scale	2 or three on the range of discomfort scale	3 on the range of discomfort scale

TEMPERATURE



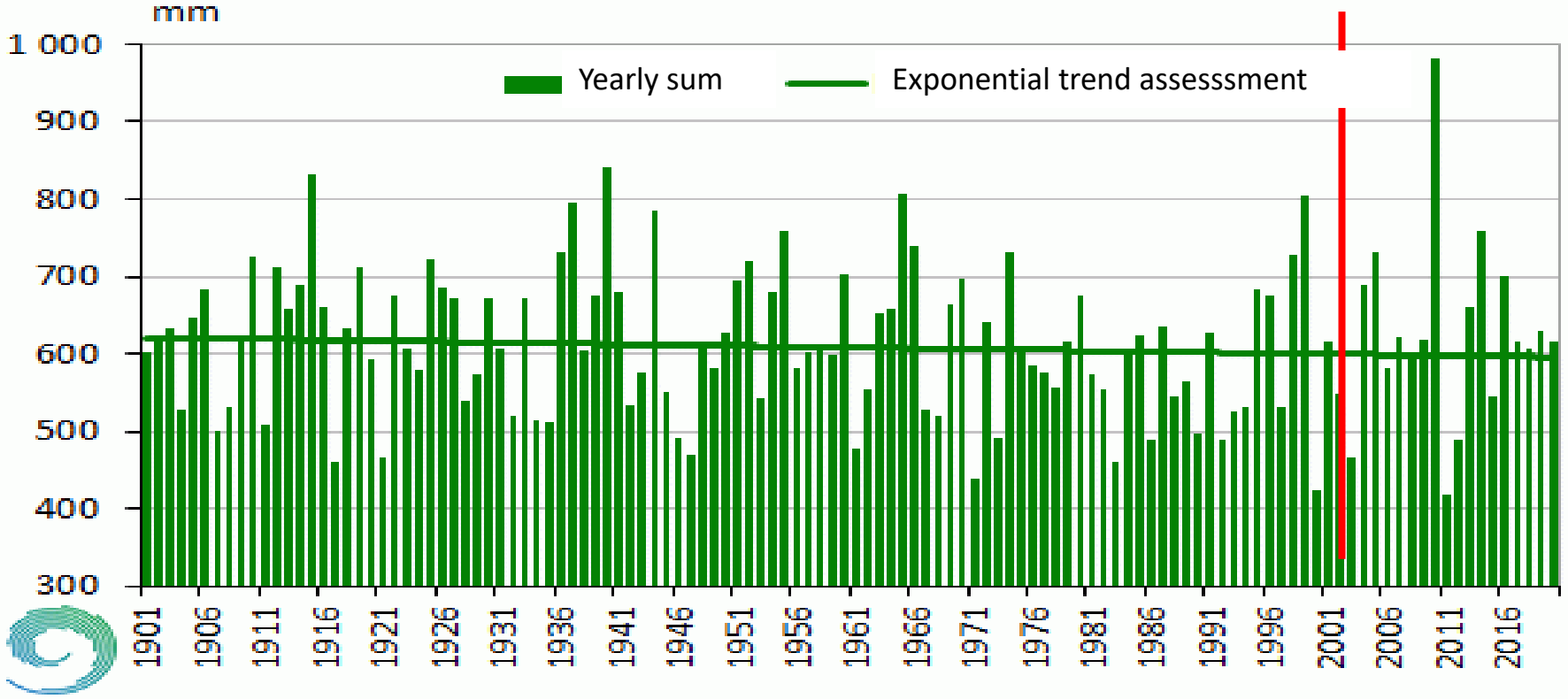
National yearly average temperature 1901 - 2020 (based on homogenised, interpolated data)

In the latest years the trend of warming is steeper, especially in the last 10 years.
Variabiity is greater, onset of flowering is disturbed by frosty periods.

Source Hungarian Met. Office

PRECIPITATION

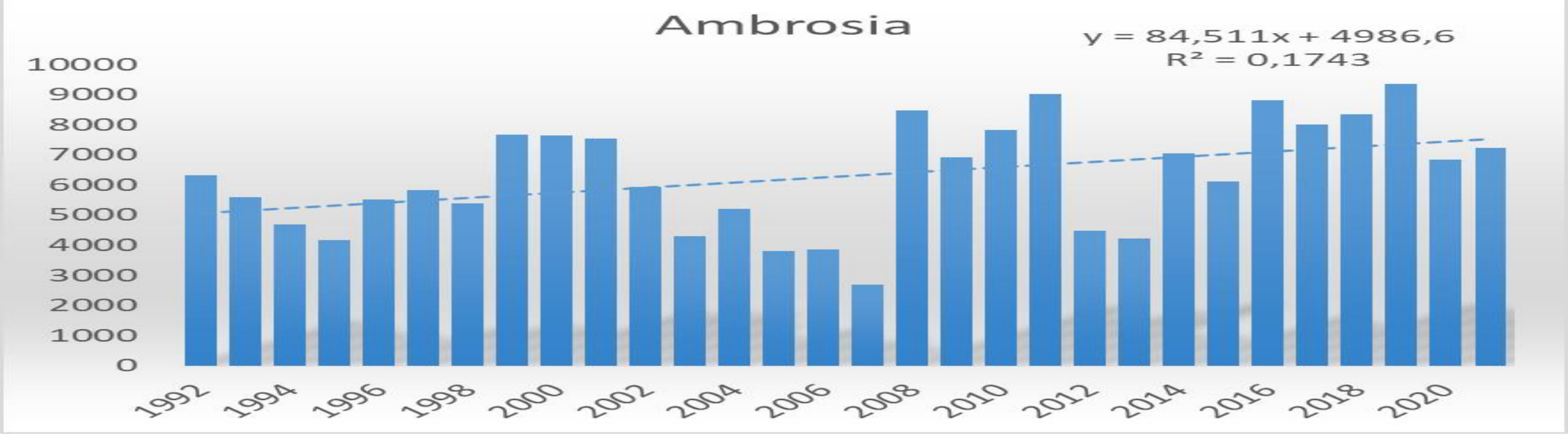
Rainy years: 1998, 1999, 2010
Dry years: 2000, 2003, 2011

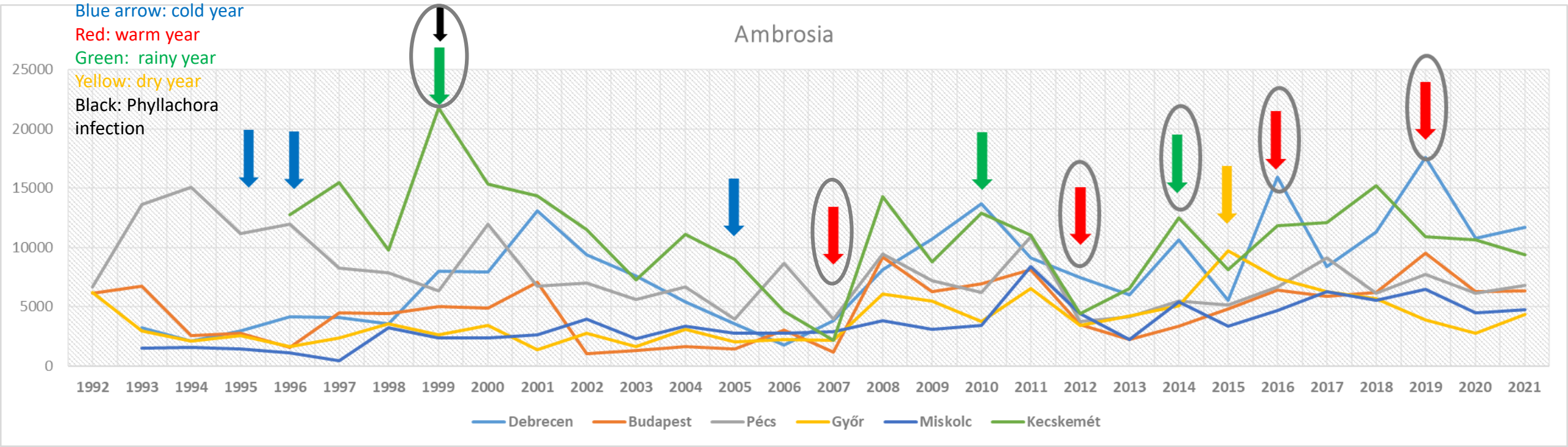


National sum of precipitation 1901 - 2020 (based on homogenised, interpolated data)

Precipitation shows a slight, non significant decreasing tendency

Source Hungarian Met. Office


Ambrosia
y = 84,511x + 4986,6
R² = 0,1743
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020


Blue arrow: cold year
Red: warm year
Green: rainy year
Yellow: dry year
Black: Phyllachora infection
Ambrosia
25000
20000
15000
10000
5000
0
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
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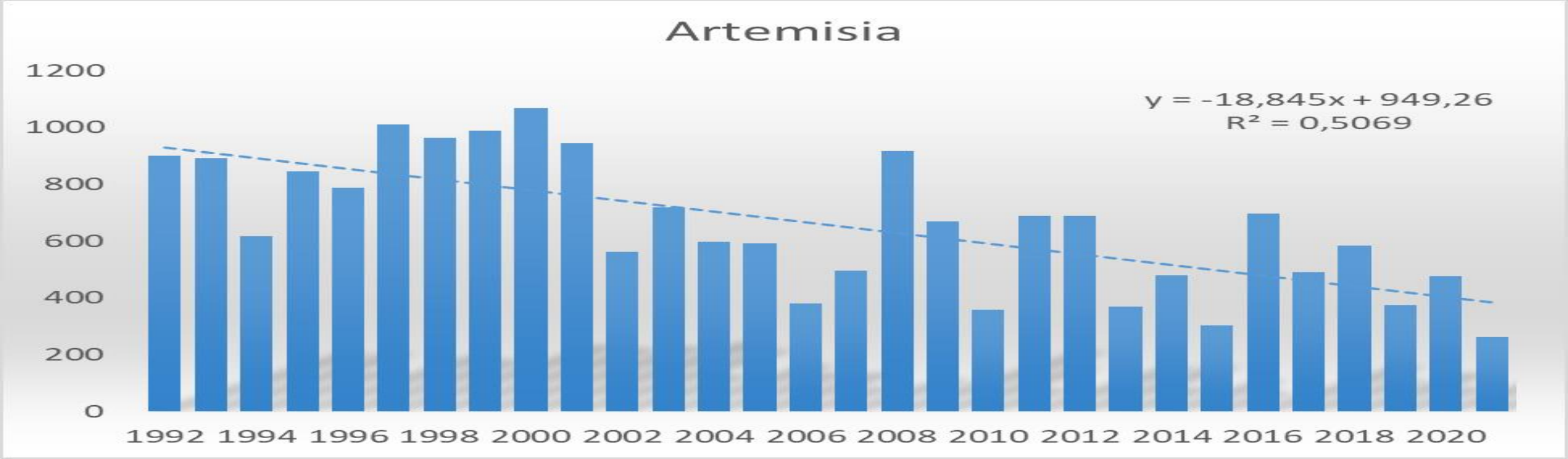
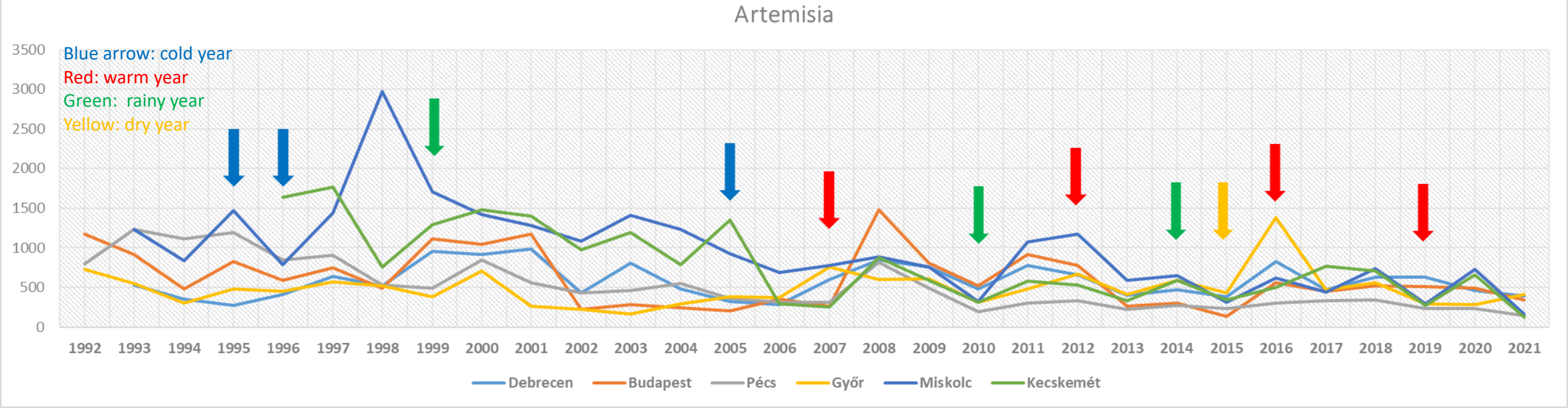
Debrecen
Budapest
Pécs
Győr
Miskolc
Kecskemét


Artemisia
y = -18,845x + 949,26
R² = 0,5069
1200
1000
800
600
400
200
0
1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020


Artemisia
Blue arrow: cold year
Red: warm year
Green: rainy year
Yellow: dry year
3500
3000
2500
2000
1500
1000
500
0
1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Debrecen
Budapest
Pécs
Győr
Miskolc
Kecskemét

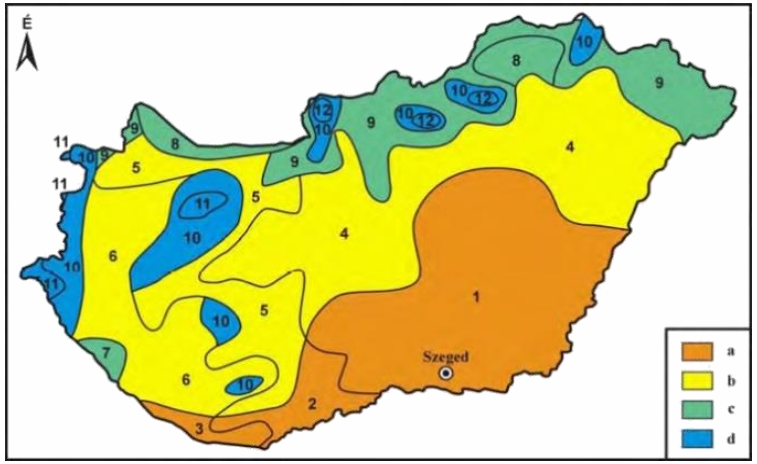
Climate-specific indicators developed under the CEHAPIS project

Pilot-tested indicators are highlighted by yellow colour

Topic Area	INDICATORS			
	State	Exposure	Effect on health	Action
Extreme weather events				
Heat waves		Population exposure to heat waves	Excess mortality due to heat waves	Policy to prevent heat-related health effects
Floods and draughts		Population exposure to actual floods		Actions to secure water supplies
		Population vulnerability to floods		
Air quality				
Ambient air pollution		Urban population exposure to ozone	Cardio-respiratory mortality	
Airborne pollen allergens	Flowering of allergenic plants	Exposures to birch, alder and grass pollen	Anti-allergy medication sales	
		Exposure to ragweed pollen		
Infectious diseases				
Food-borne diseases			Salmonellosis incidence and seasonality	Actions to prevent infectious diseases (cross-cutting)
Water-borne diseases			Cryptosporidiosis incidence and seasonality	
Vector-borne diseases		Lyme borreliosis occurrence of vector	Lyme borreliosis incidence	

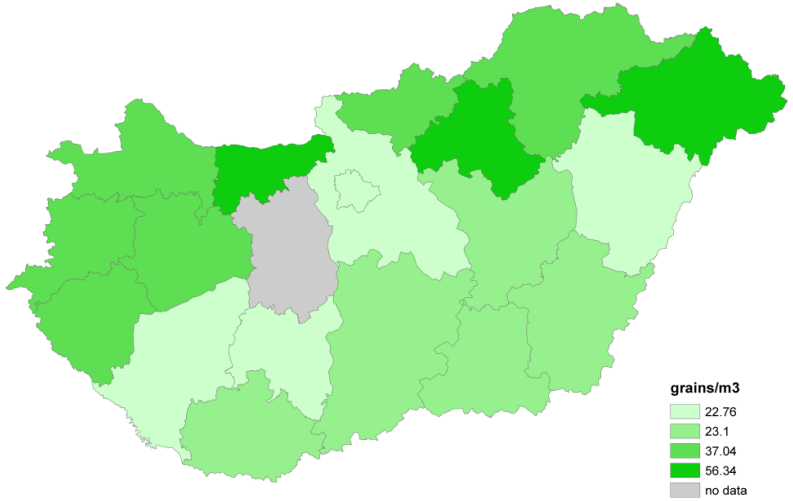
WHO, 2011: Tools for the monitoring of Parma Conference commitments. Report of the meeting 25-26 November 2010. Available at: http://www.euro.who.int/data/assets/pdf_file/0019/134380/e94788.pdf

Ragweed: Population-weighted average ragweed pollen concentration (grains/m^3) by climatic regions in Hungary, 2007 and 2010

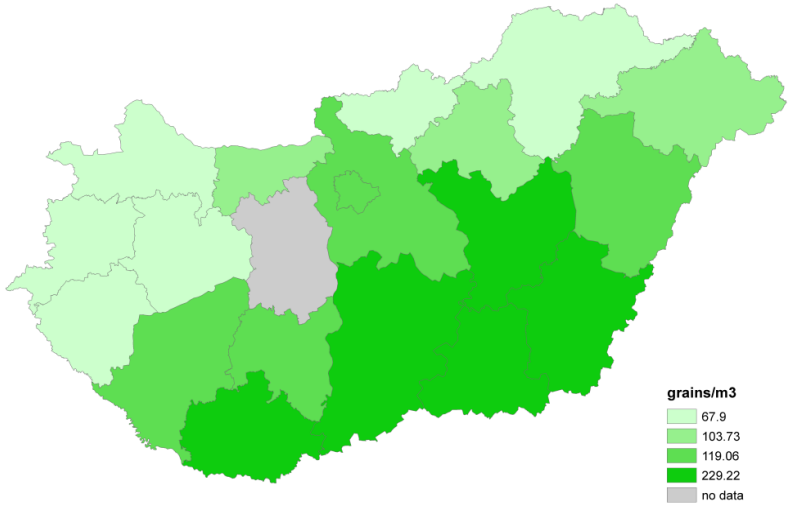


brown: warm, dry
yellow: moderate warm
green: moderate cold
blue: cold and wet

2007: extreme dry summer

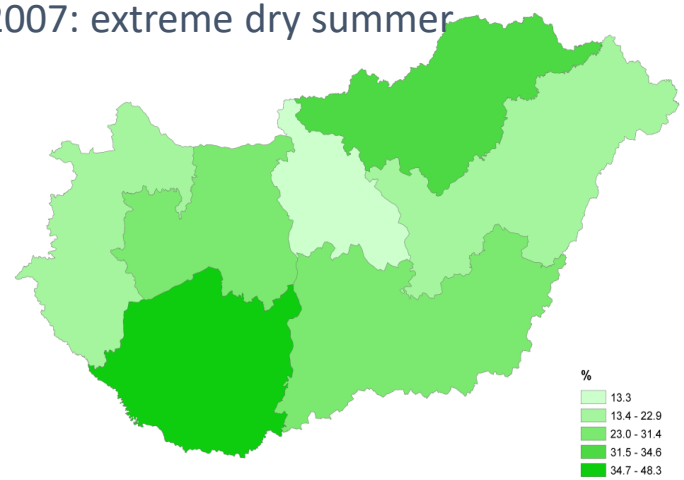


2010: extreme wet summer

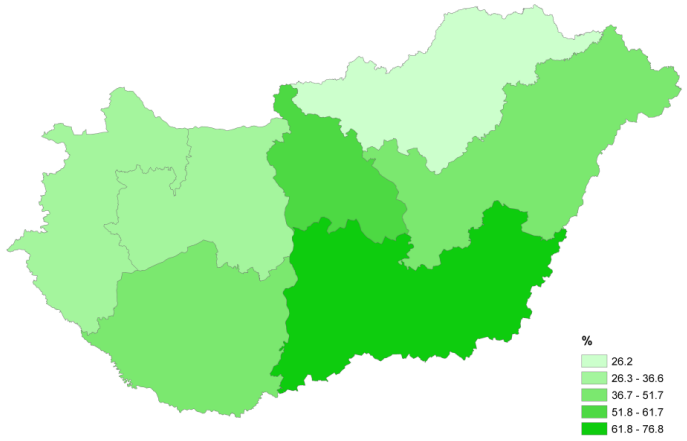


Population-weighted proportion of days above ragweed threshold concentration (%) by **statistical regions (NUTS2)**, 2007,

2007: extreme dry summer

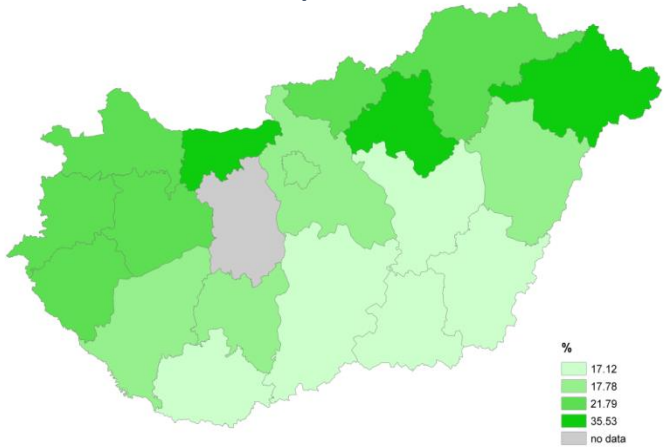


2010: extreme wet summer

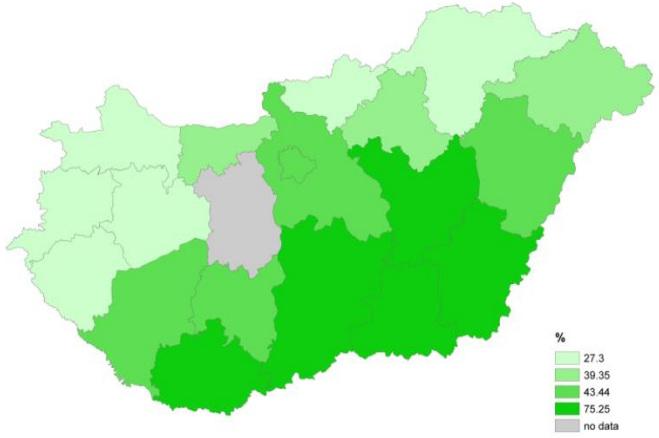


Population-weighted proportion of days above ragweed threshold concentration (%) by **climatic regions**. 2007. 2010

2007: extreme dry summer

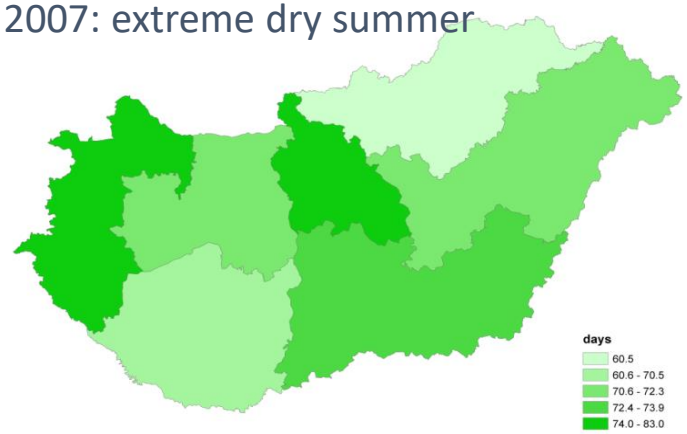


2010: extreme wet summer

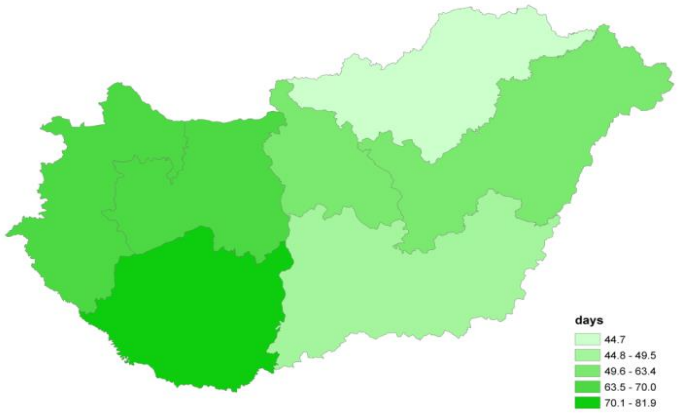


Population-weighted duration of ragweed pollen season (Days) by **statistical regions (NUTS2**) in Hungary, 2007, 2010

2007: extreme dry summer

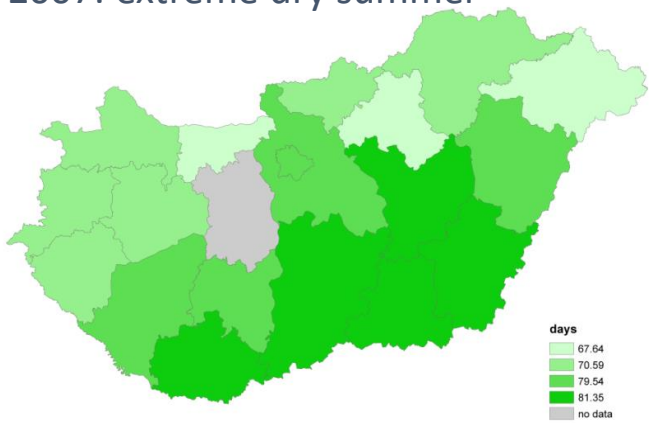


2010: extreme wet summer

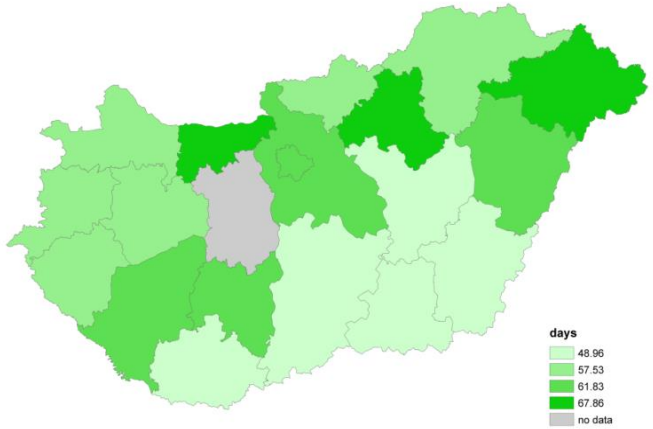


Population-weighted duration of ragweed pollen season (Days) by **climatic regions** in Hungary, 2007, 2010

2007: extreme dry summer

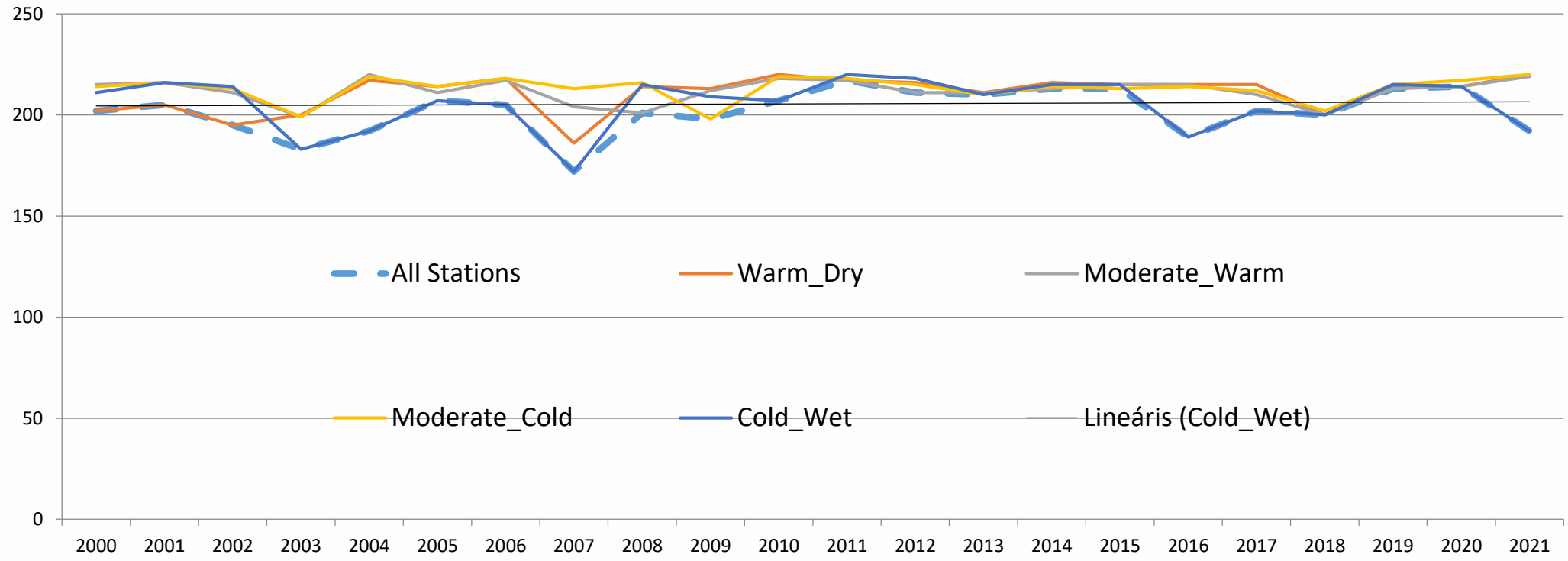


2010: extreme wet summer

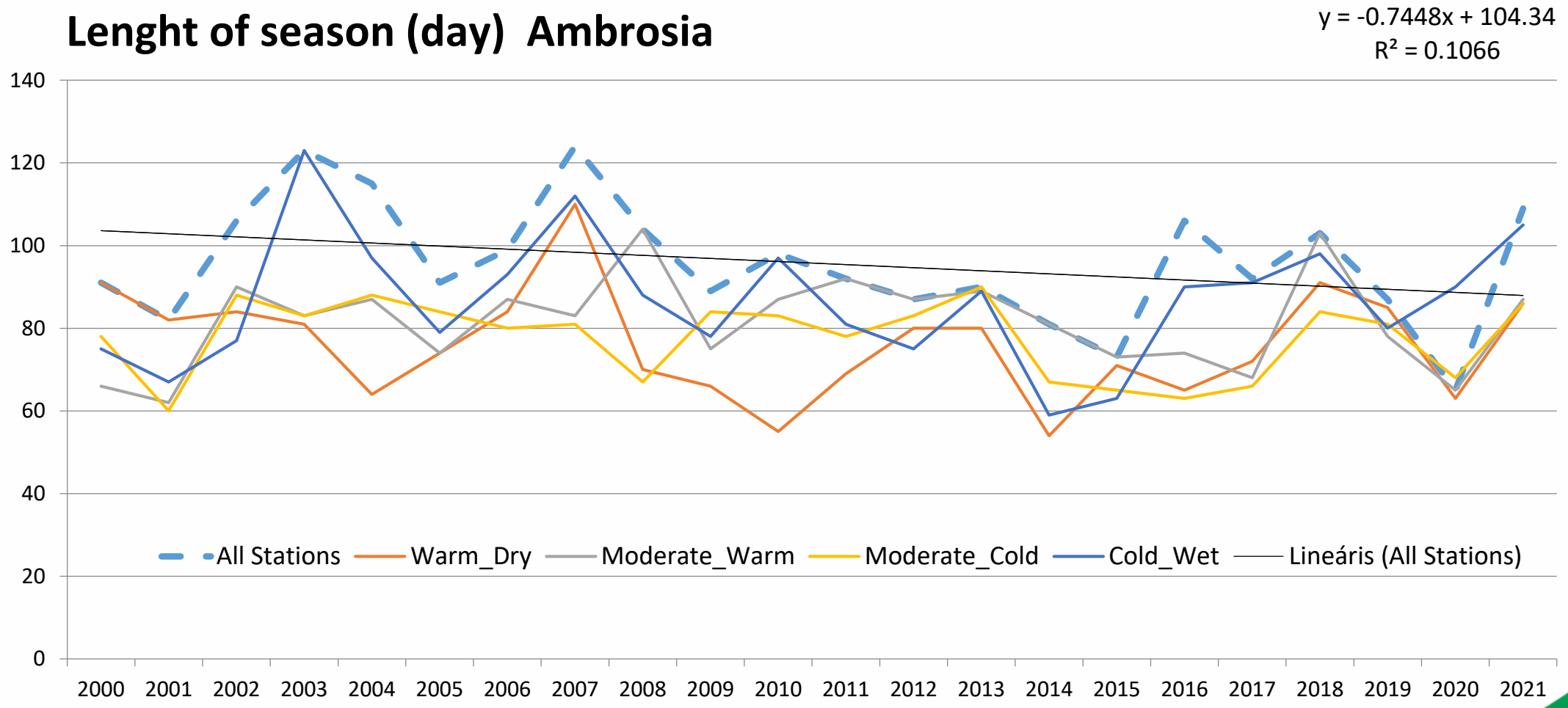


Start of ragweed pollen season (DOY)

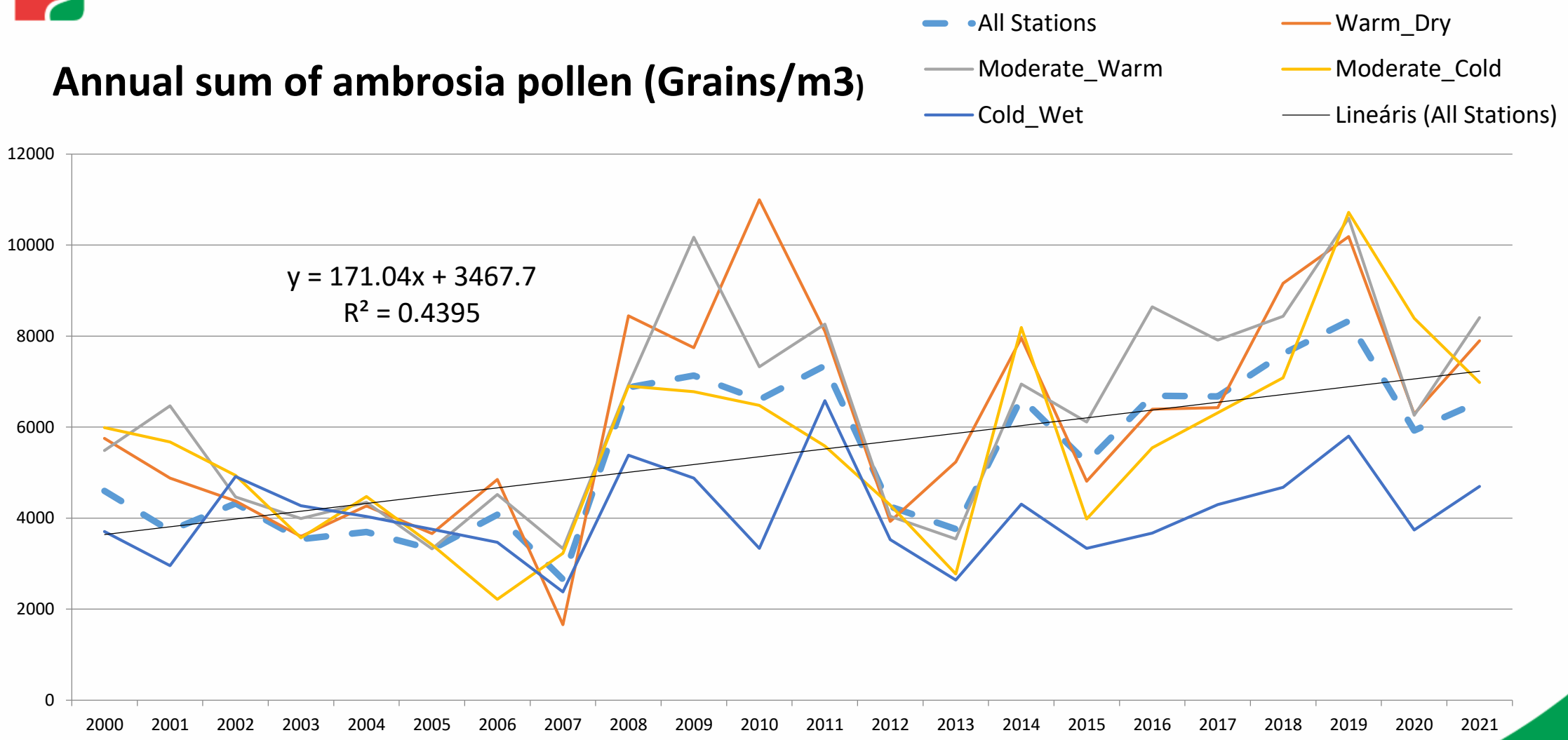
y = 0.0977x + 204.38
R^2 = 0.0025



Lenght of season (day) Ambrosia



Annual sum of ambrosia pollen (Grains/m3)



DRAFT FOR DISCUSSION

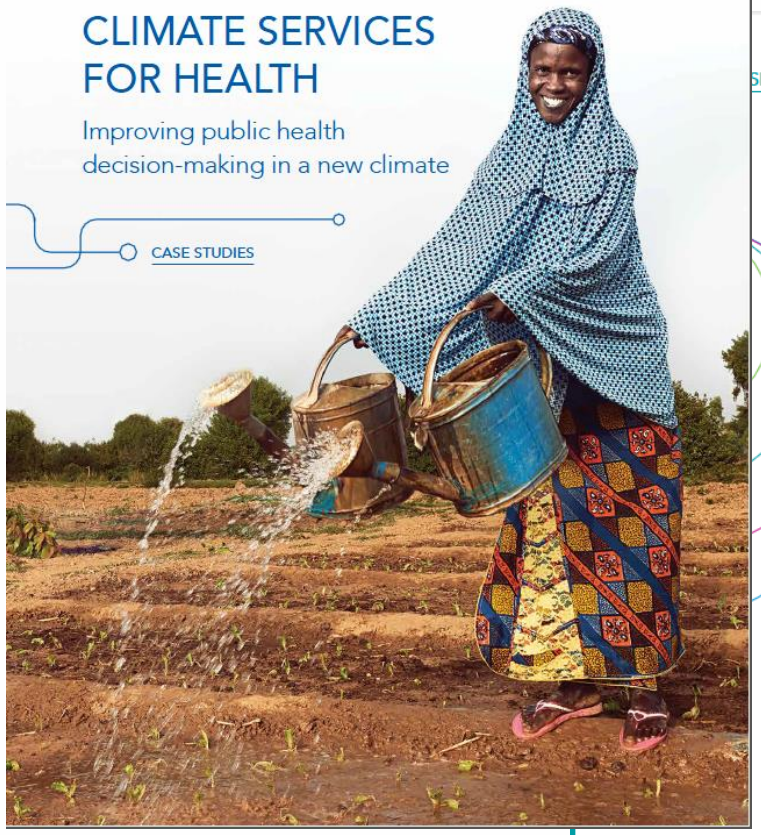
WORLD METEOROLOGICAL ORGANIZATION | World Health Organization

JOINT OFFICE FOR CLIMATE AND HEALTH

CLIMATE SERVICES FOR HEALTH

Improving public health decision-making in a new climate

CASE STUDIES



Development of climate-related indicators

INDICATORS

CLIMATE-SPECIFIC POLLEN INDICATORS AND POPULATION EXPOSURE MONITORING TOOLS TO BETTER MANAGE THE ALLERGY SEASON IN HUNGARY

Authors: J. Bobvos, A. Páldy, B. Fazekas, G. Mányoki, D. Magyar (National Institute of Environmental Health, Budapest, Hungary), A. Egorov, D. Dalbokova, C. Gapp (WHO European Centre for Environment and Health, Bonn Office).

CONTEXT

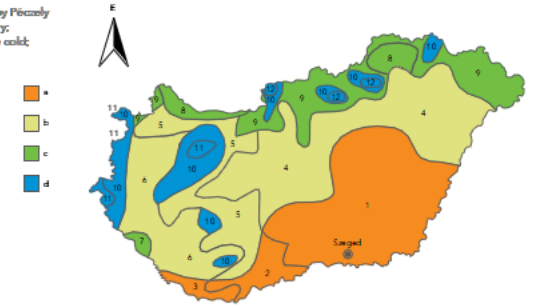
The 4th Assessment Report of IPCC (30) states that climate change has caused an earlier onset of the spring pollen season in the northern hemisphere. It is reasonable to conclude that allergenic diseases caused by pollen, such as allergic rhinitis, have experienced some concomitant change in seasonality. There is limited evidence that the length of the pollen season has also increased for some species. Furthermore the EU Strategy on adaptation to climate change *(31)* highlights that climate change might potentially increase the seasonality and duration of allergic disorders such as hay fever or asthma with implications for direct costs in terms of care and medicines, as well as lost working hours. The 5th Assessment Report of IPCC *(32)* stated that warmer conditions generally favour the production and release of airborne allergens. Progressively increasing temperatures may modify the global pollen load *(33)*. Adaptation measures identified to date include aeroallergen monitoring and forecasting. Therefore it is of high importance to evaluate the pollen exposure of populations living in different geographical and climatic regions in order to adjust information and adaptive measures.

NEW APPROACHES

The WHO European Centre for Environment and Health (WHO/ECEH), with the contribution of Member States, has developed climate-related indicators as part of the CEHAPIS project.* Four allergen plants were selected as indicators: alder (Alnus sp.); birch (Betula sp.); grasses (Poaceae sp.); ragweed (Ambrosia sp.). These provoke high sensitization rates, have fairly broad geographical and temporal coverage in the European flowering season (i.e. spring to autumn). The indicator set is based on daily airborne pollen emmission measurements in continuous volumetric samplers (e.g. Hirst type, Burkard) with standard methods. Use of data from existing monitoring stations, located in different climatic regions of a given country is recommended. Each climatic zone needs to be characterized with a sufficient number of stations placed in populated areas. The number of inhabitants living in a radius of 10–30 km of the monitoring stations should be noted for weighting purposes.

* Climate Change, Environment and Health Action Plan and Information System (CEHAPIS) is co-funded by EC DG Sanco SPC 2007WHO03.

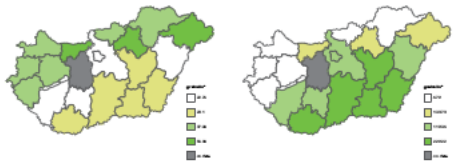
Figure 5.11 Climatic regions by Péczely (26) in Hungary: (a: warm and dry; b: moderate warm; c: moderate cold; d: cold and wet).



A software tool has been elaborated with the contribution of the National Institute of Environmental Health (NIEH) Hungary *(34)*. The software enables calculation of the start and end, duration (days), severity of the pollen period (annual sum and daily maximum of pollen grains (grains/m³) of the current and previous pollen seasons. To characterize the exposure further, population-weighted indicators can be computed: (i) proportion of days (%) with allergenic concentration of pollen (≥30 grains/m³); (ii) average exposure to the pollen (gr/m³); (iii) duration of the pollen season (days).

The software was tested using ragweed pollen data for the period of 2000–2013 of the Hungarian Aerobiological Network run by the National Institute of Environmental Health. The meteorological data were provided by the Hungarian Meteorological Service. Figure 5.11 shows the climatic regions within Hungary *(35)*; Figure 5.12 displays the effect of weather variability on the population-weighted pollen exposure.

Figure 5.12 Ragweed: Population-weighted average pollen concentration (grains/m3). Left: extreme dry summer 2007. Right: extreme wet summer 2010.



ACKNOWLEDGEMENTS

World Health Organization
REGIONAL OFFICE FOR Europe

BENEFITS AND LESSONS

The software is used by the National Public Health Center (NPHC, formely NIEH). The results are communicated for the health care system, especially to the allergologists and general practitioners, to help adjust health care for allergenic patients in the short and long term. The results can be used by the agricultural sector to optimize summer weed (especially ragweed) eradication programmes to reduce exposure. The NPHC plans to disseminate the software at the international level, and to make it freely downloadable from its website.

Assessment of the predicted impact of climate change on the ragweed pollen season for the periods of 2021-2050 and 2071-2100

Aims: assessment of the changes of pollination season of ragweed for Hungary, the increase of pollen production in relation of the increased CO_2 emission, for two periods of 2021-2050 and 2071-2100 using A1B emission scenario based on the RegCM regional climate model.

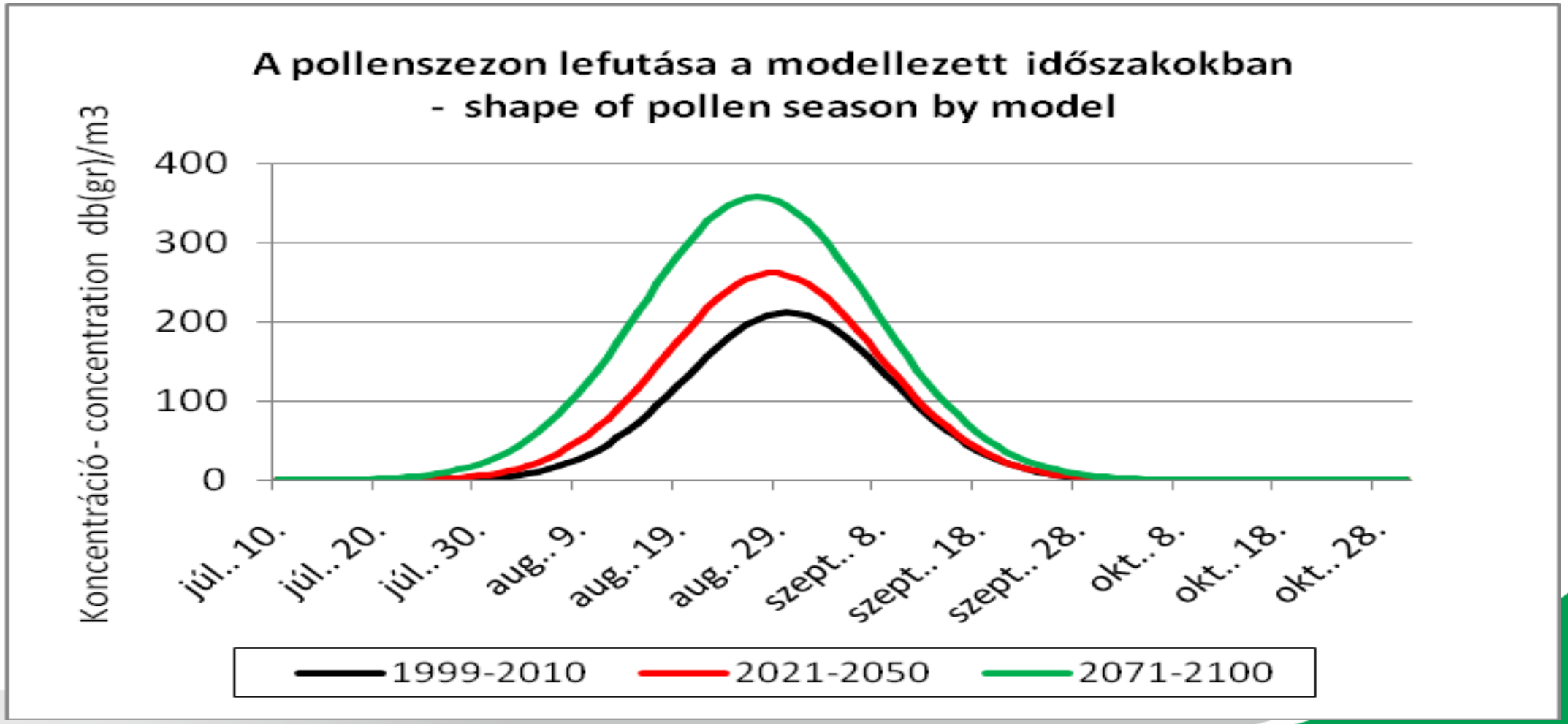
Results: Acc. to the A1B emission scenario, the atmospheric CO_2 concentration will increase from the present 380 ppmv to 700 ppmv by 2100,

the related increase of surface temperature will be 2.8ºC by the end of the 21st century.

Egészségtudomány - Volume LVI. No 3. 2012.- http://egeszsegtudomany.higienikus.hu

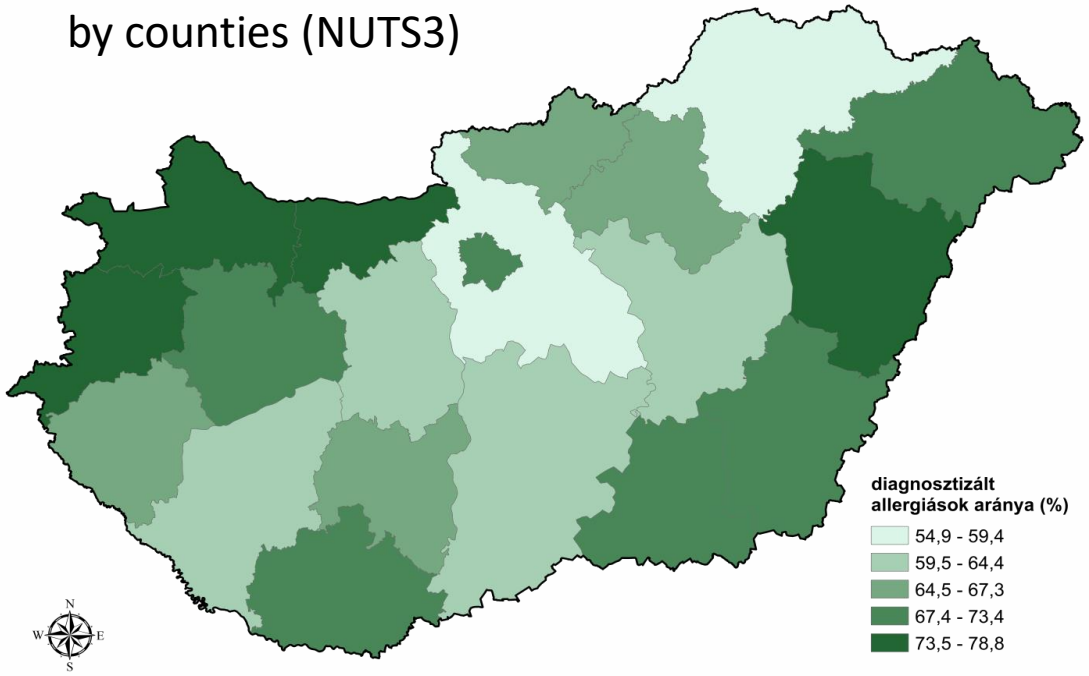
- The yearly mean pollen load will reach 6950 grains/m^3 meaning an increase of 28% in the period of 2021-2050.
- In the period of 2070-2100, the yearly mean pollen load will be 10470 grains/m^3 meaning a 92% increase.
- Besides the increase of daily maximum concentration, the increase of the number of days with pollen concentration>10 grains/m^3 is also predicted

Shape of pollen season modified by the increase of temperature and CO_2 emission for the reference and future periods

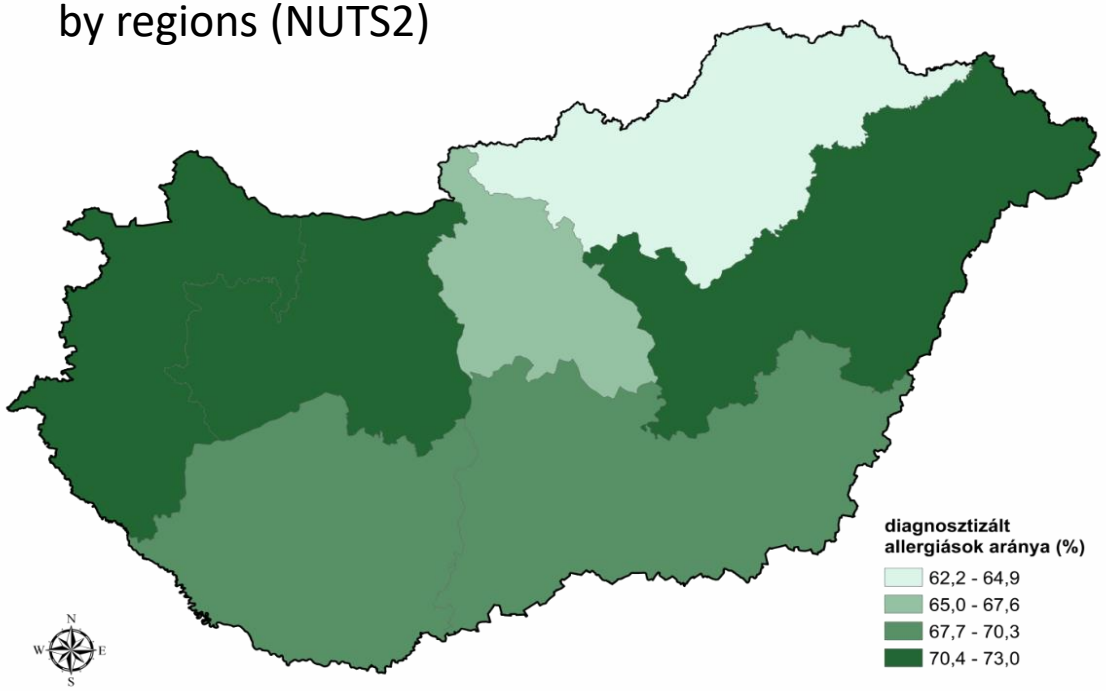


SPATIAL DISTIBUTION OF PREVALENCE OF DIAGNOSTED ALLERGY 2021

Rate of diagnosed allergy
by counties (NUTS3)



Rate of diagnosed allergy
by regions (NUTS2)

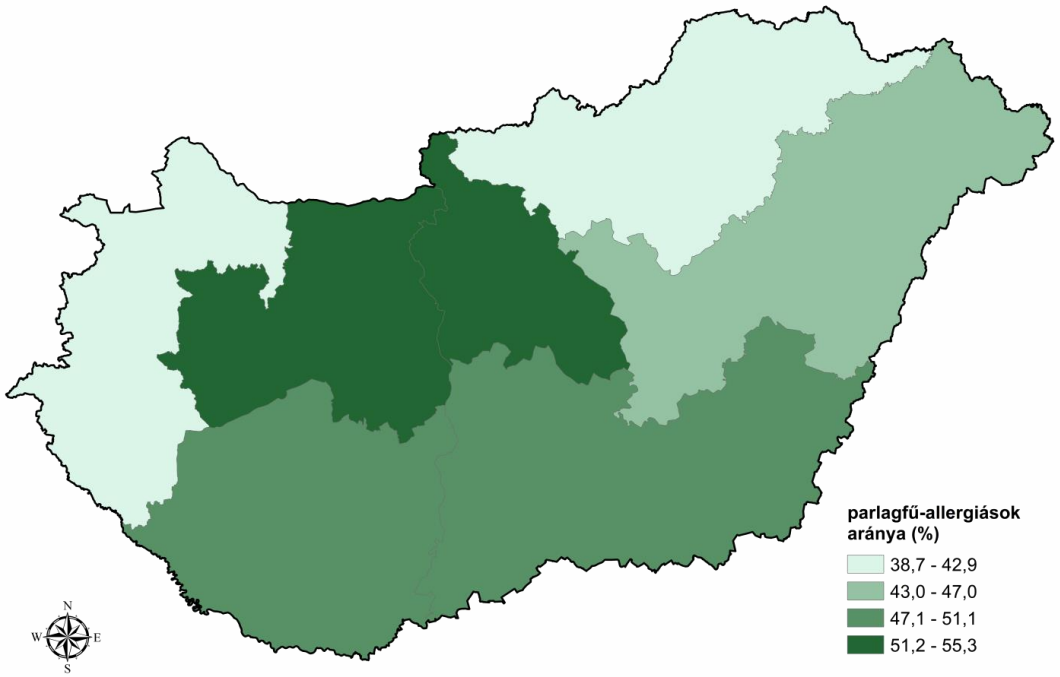


Source: Questionnaire survey, NPHC, 2021

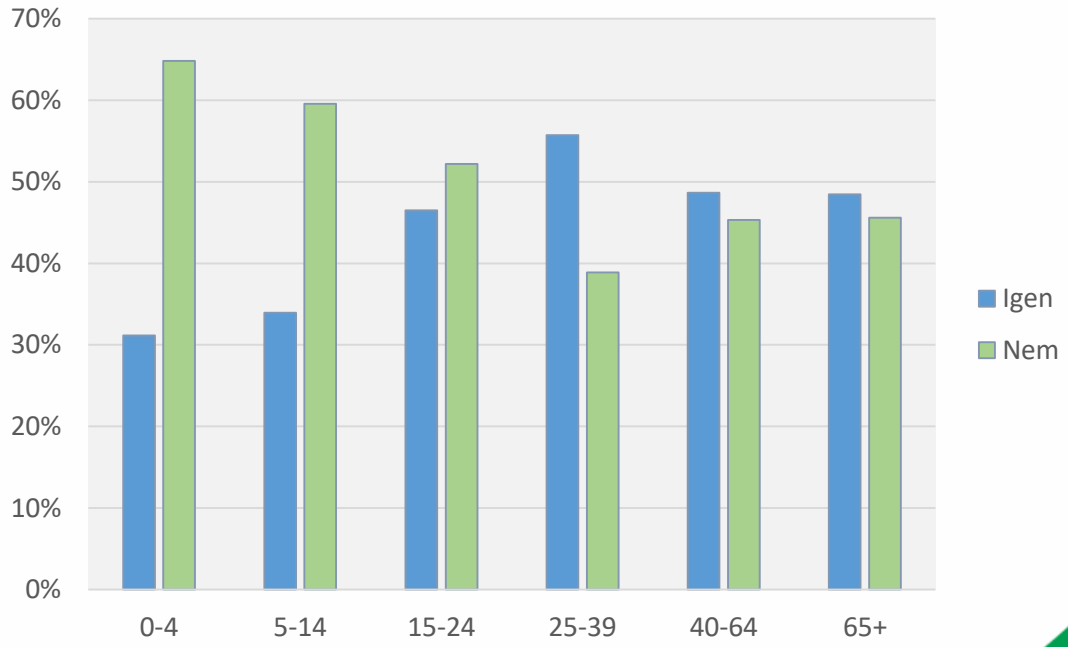
RATE OF DIAGNOSED RAGWEED ALLERGY WITHIN THE ALLERGENIC PATIENTS

2021

Rate of diagnosed ragweed allergy by regions (NUTS2)



Rate of diagnosed ragweed allergy by age groups (blue=yes, green=no)



Prevalence of ragweed pollen allergy in the total population: 17%

Thank you very much for your attention!

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