National Atmospheric Deposition Program

Aeroallergen Monitoring Science Committee Fact Sheet

The National Atmospheric Deposition Program's (NADP) Aeroallergen Monitoring Science Committee (AMSC) was formed in 2016 in response to the growing interest and concern over aeroallergens. The mission of the AMSC is to engage multi-disciplinary stakeholders in advancing the science of aeroallergen monitoring, including identifying emerging technologies, evaluating methods to ensure data quality, coordination of monitoring stations, and possibly serving as a repository of long-term aeroallergen monitoring data. More specific charges of the AMSC can be accessed through the following link: https://nadp.slh.wisc.edu/committees/amsc/

What are Aeroallergens?

An aeroallergen is any airborne substance, such as pollen or spores, which triggers an allergic reaction, commonly known as hay fever. Examples of plant pollen commonly responsible for hay fever include:

- Trees: birch (*Betula*), alder (*Alnus*), cedar (*Cedrus*), hazel (*Corylus*), hornbeam (*Carpinus*), horse chestnut (*Aesculus*), willow (*Salix*), poplar (*Populus*), plane (*Platanus*), linden/lime (*Tilia*) and olive (Olea). In northern latitudes birch is the most important allergenic tree pollen. An estimated 15–20% of those with hay fever are sensitive to birch pollen. Olive pollen is most predominant in Mediterranean regions.
- Grasses (Family Poaceae): especially ryegrass (*Lolium sp.*) and timothy (*Phleum pratense*). An estimated 90% of those with hay fever are allergic to grass pollen.
- Weeds: ragweed (*Ambrosia*), plantain (*Plantago*), nettles/parietaria (*Urticaceae*), mugwort (*Artemisia*), Fat hen (*Chenopodium*) and sorrel/dock (*Rumex*).

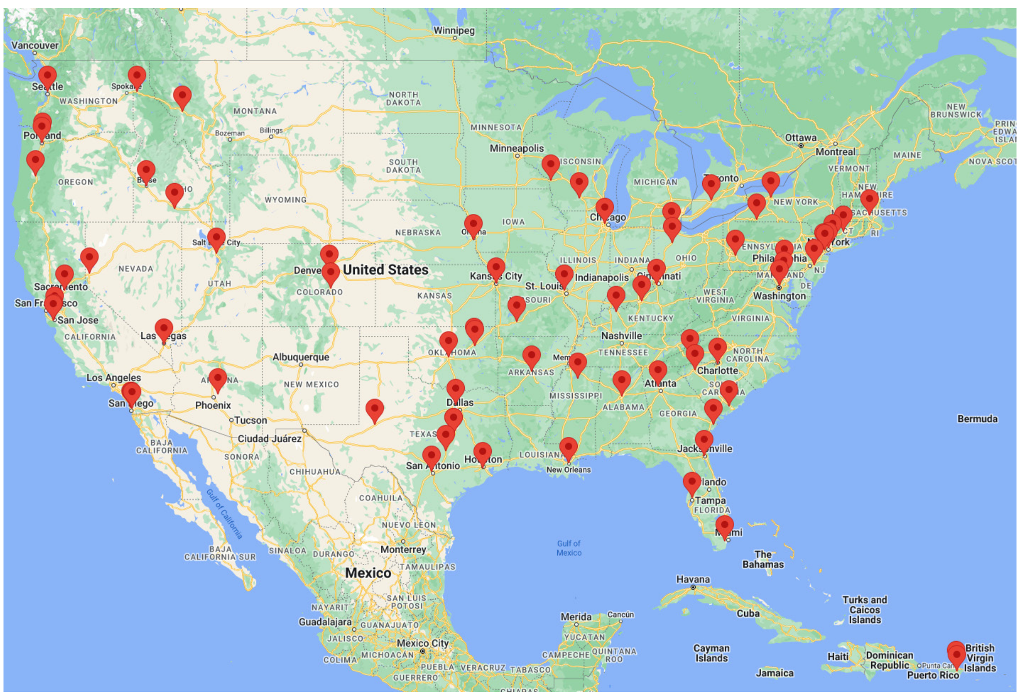
Impacts of Aeroallergens?

- Approximately 25 million people in the U.S. suffer from asthma (1);
- Approximately 20-40% of adults and children are impacted by seasonal allergic rhinitis; (2,3)
- Total annual treatment (direct costs) and economic costs (indirect costs such as loss of work, lower productivity, home modifications, etc.) in the U.S. for allergic rhinitis were estimated to be around $20.9 billion in 2005 (4);
- Climate changes have resulted in longer pollen seasons, larger quantities of pollen, and changes in pollen distribution (5, 6);
- The time of year at which allergic symptoms manifest themselves varies greatly depending on the types of pollen. The pollen count, in general, is highest from mid-spring to early summer;
- As most pollens are produced at fixed periods in the year, a person with long-term hay fever may be able to anticipate when the symptoms are most likely to begin and end.

Pollen Forecasting and Recent Activities

- Detection of the beginnings and peaks of seasons during which plants are emitting pollen is usually conducted in selected population centers by clinicians and researchers. Most of the data for the United States has been collected by the National Allergy Bureau (NAB; 5). However, the NAB pollen stations are sparsely located (see map below), and there is a lack of coordination between the NAB and non-NAB pollen stations.
- In order to improve the pollen monitoring landscape, the AMSC is interested in facilitating a coordinated, cross-disciplinary effort to collect, catalogue, and analyze pollen as well as mold data. To this end, a Data Management Work Group has been formed within the AMSC. The establishment of a central pollen data bank would aid in:

1. Improved diagnosis and treatment of patients with allergic respiratory diseases;
2. Public health tracking;
3. Improved models for forecasting pollen levels for areas where there are no monitoring stations;
4. Research on the effects of climate on aeroallergens and health;
5. Development of evidence-based interventions; and
6. Dissemination of key findings.



Location of National Allergy Bureau Pollen Sampling Sites

https://pollen.aaaai.org/#/

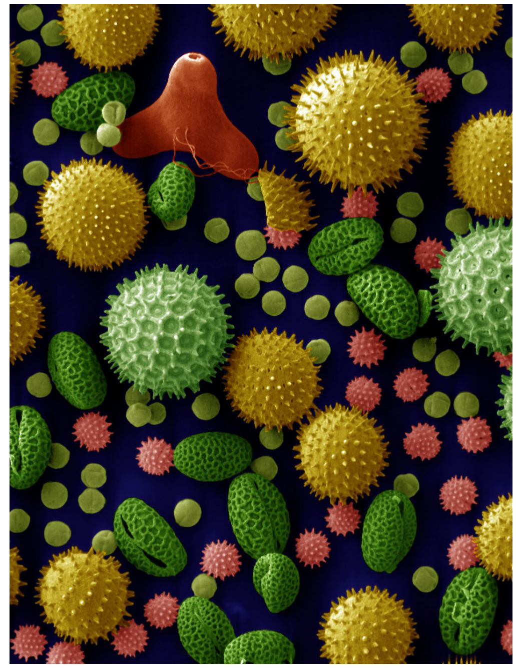
Methods Comparison Studies

- AMSC designed and implemented a pollen monitoring methods comparison study with the following goals:
  1. To develop a method for counting atmospheric pollen occurrence and concentration values using the NADP's extensive and well-distributed National Trends Network (NTN) of wet deposition measurement locations (currently 250 + sites), and
  2. Compare the results of these measurements in wet deposition to the concentrations determined with traditional and automated pollen count measurements. The results of this study have been published in *Aerobiologia* and can be accessed through this link: https://doi.org/10.1007/s10453-023-09794-7. The full reference is also provided below (7).
- Researchers at Emory University conducted a field evaluation comparing pollen concentrations measured by an automated real-time pollen sensor (APS-300, Pollen Sense LLC) with pollen collected by a Rotorod M40 with concentrations determined via a manual counting technique (8). Even though the Rotorod methodology has been considered the gold standard for decades, automated real-time pollen monitoring can greatly aid in improving pollen forecasting as the high cost of manual identification and counting substantially limits spatial coverage and timeliness of forecasts.

The field evaluation showed statistically significant and strong correlations between the Rotorod method and automated real-time method for measurements of total and speciated tree pollen. Areas in need of future improvement, such as the counting and speciation of grass and weed pollen, were also identified.

The Future of Aeroallergen Monitoring

The AMSC will continue its efforts to form a central pollen data repository by collaborating with pollen scientists and stakeholders as well as supporting ongoing efforts by individual states to form pollen monitoring networks. Currently, the State of Maine is in the process of evaluating the APS-400 and considering potential deployment sites as well as collaborating with native tribes interested in monitoring on tribal lands. The states of Connecticut, Iowa, Minnesota, and Wisconsin have also expressed interest in launching pollen monitoring networks. The State of Washington owns nine Pollen Sense sensors, is purchasing three more, and is in the process of rolling out a pollen monitoring network. Some states, like Tennessee, are looking for grant monies from the Environmental Protection Agency (EPA). The Cherokee Nation in Oklahoma has approval to purchase three Pollen Sense sensors with grant money from the Inflation Reduction Act of 2022 (IRA).



References

1. Akinbami, L J., Moorman, J.E., Liu, X., and National Center for Health Statistics. 2011. Asthma prevalence, health care use, and mortality: United States.
2. Meng, et.al. 2016. Asthma, oculonasal symptoms, and skin test sensitivity across National Health and Nutrition Examination Surveys. Annals of Allergy, Asthma & Immunology, 116(2):118-25.
3. Grammer, L.C., and Greenberg, P.A. eds. Patterson's Allergic Diseases. Seventh Edition, Baltimore:Wolters Kluwer Health, 2009.
4. Muhamad, et. al. 2022. Allergic Rhinitis: A Clinical and Pathophysiological Overview. Volume 9. (https://doi.org/10.3389%2Ffmed.2022.874114)
5. Levetin, E., and Van de Water, P. 2008. Changing pollen types/concentrations/distribution in the United States: Fact or Fiction? Current Allergy and Asthma reports, 8(5), 418-424.
6. Ziska, L.H., Knowlton, K., Rogers, C., Dalan, D., Tierney, N., Elder, M.A., Frenz, D.2011. Recent warming by latitude associated with increased length of ragweed pollen season in central North America. National Academy of Sciences. 108(10), 2448-2451.
7. Wetherbee, G.A., Gay, D.A., Uram, E.R., Willaims, T.L., and A. Johnson. 2023. Initial comparison of pollen counting methods using precipitation and ambient air samples and automated artificial intelligence to support national monitoring objectives. Aerobiologia. https://doi.org/10.1007/s10453-023-09794-7
8. Jiang, C., Wang, W., Du, L., Huang, G., MnConaghy, C., Fineman, S., and Y. Liu. 2022. Field Evaluation of an Automated Pollen Sensor. International Journal of Environmental Research and Public Health. 19, 6444. https://doi.org/10.3390/ijerph19116444

National Atmospheric Deposition Program

http://nadp.slh.wisc.edu
Wisconsin State Laboratory of Hygiene
465 Henry Mall, Madison, WI 53706
(608) 263-9162

Disclaimer: The NADP is the National Research Support Project-3: A Long-Term Monitoring Program in Support of Research on the Effects of Atmospheric Chemical Deposition. More than 250 sponsors support the NADP, including private companies and other non-governmental organizations, universities, local and state government agencies, State Agricultural Experiment Stations, national laboratories, Native American organizations, Canadian government agencies, the U.S. Geological Survey, the U.S. Environmental Protection Agency, the National Park Service, National Oceanic and Atmospheric Administration, the U.S. Fish & Wildlife Service, the Bureau of Land Management, the U.S. Department of Agriculture - Forest Service, and the U.S. Department of Agriculture - National Institute of Food and Agriculture under agreement no. 2022-39133-38451. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the program sponsors or the University of Wisconsin-Madison.