

Meeting Minutes, Joint Sessions 1 and 2, Spring 2023 NADP Meeting

Draft Joint Agenda (Session I)

Time (CDT)	Wednesday May 3, 2023: 08:30-12:00 CDT [3.5 hr]	Minutes
8:30 AM	Welcome, Logistics, Introductions, and Approval of 2022 Fall Joint Minutes (Tim Sharac)	10
8:40 AM	Welcome Address by Dr. James Schauer, WSLH Director, NADP Principal Investigator	10
8:50 AM	State of the NADP (David Gay, NADP Coordinator)	30
9:20 AM	Executive Committee on the status of our 2023 priorities (Linda Geiser)	10
9:30 AM	Rebranding NADP labs (Richard Tanabe)	10
9:40 AM	CASTNET Update (Melissa Puchalski)	15
9:55 AM	NPS Update (Kristi Morris)	15
10:10 AM	Break	15
10:25 AM	CAPMoN Update (Jason O'Brien)	15
10:40 AM	USGS NGWOS Update (Mike McHale)	15
10:55 AM	Daily precipitation volume data availability (Doug Burns)	10
11:05 AM	QAAG Update (Nichole Miller)	15
11:20 AM	AMoN ALPHA samplers (David Gay)	5
11:25 AM	Black Carbon (Ross Edwards/David Gay)	10
11:35 AM	Spatially varying nitrogen critical loads and the influence from mediating factors (Justin Coughlin)	15
	Subtotal Minutes	200

Draft Joint Agenda (Session II)

Time (CDT)	Thursday May 4, 2023: 01:30-05:00 CDT [3.5 hr]	Minutes
1:30 PM	Great Smokies Brook Trout and Acid Deposition (Jim Renfro)	10
1:40 PM	Subcommittee Highlights-Motions Only	50
	MELD (Rick Haeuber/Colleen Flanagan-Pritz/Katherine Ko)	
	TDEP/CityDep (Amanda Cole/Colleen Baublitz/Ryan Fulgham)	
	CLAD (Kris Novak, Jeremy Ash, and Nifer Wilkening)	
	Ozone Working Group (Jeffrey Herrick/Kris Novak)	
	AMSC (Andy Johnson/Selma Isil)	
	NOS (Tim Sharac)	
	EOS (Catherine Collins/Rebecca Dalton)	
	DMAG / NADP Website Update (Mark Kuether/Zac Najacht)	
2:30 PM	Network stability/financial pressures/cost saving proposals, sites in jeopardy (David Gay)	20
2:50 PM	Break	15
3:05 PM	Program Office Review Response (Richard Tanabe)	15
3:20 PM	PFAS Update (Martin Shafer)	20

3:40 PM	PFAS in Archived Cloud Waters at Whiteface Mtn (John Offenberg)	10
3:50 PM	PFAS Deposition Modeling Implications (Krish Vijayaraghavan)	15
4:05 PM	Conditions and trends of critical load exceedances on federal lands (Mike Bell)	20
4:35 PM	Fall Meeting 2023 and Science Symposium (Mike Bell)	5
4:30 PM	Daily precipitation volume data availability (Doug Burns)	10
4:40 PM	Spring Meeting 2024 (Michael McHale)	5
4:50 PM	Final Discussion/Questions/Wrap-up (Tim Sharac)	10
	Subtotal Minutes	195

Four motions were passed in Joint.

- Approval of the Fall 2022 Joint Minutes
- Motion to name the HAL and CAL labs the NADP Analytical Laboratory (NAL).
- The Executive Committee (EC) requests that the Program Office (PO) ensure that raw 15-minute, hourly, and daily precipitation depth data be made available graphically and in tabular form for viewing on the new version of the NADP web site.
- The Executive Committee (EC) requests that the Program Office (PO) ensure that quality assured 15-minute, hourly, and daily precipitation depth data be made available for download on the new version of the NADP web site. The EC additionally requests that the PO make these data available in as timely a manner as possible after completion of all quality assurance steps.

Welcome, Logistics, Introductions, and Approval of 2022 Fall Joint Minutes (Tim Sharac)

Motion: Approval of the Fall 2022 Joint Minutes.

Welcome Address (Dr. James Schauer)


Dr. Jaime Schauer gave an excellent round of highlights of the program.

- UW-Madison has both a clinical and non-clinical laboratory
 - Introduced Steve Strebel– interim director of non-clinical laboratory; NADP falls under this lab.
- Participated with David Gay and others to attend the 2020 Acid Rain Meeting a few weeks ago.
 - Really nice to connect to EANet community and to consider how NADP fits into global monitoring
 - Also helpful to connect on topics like PFAS, black carbon, aeroallergens, and newer viewpoints on N loading to ecosystems

State of the NADP (David Gay)

- Current Network Situations
 - David G showed that NTN continues to grow, 252 sites currently

National Trends Network



- Currently: 252 active sites
- Newest:
 - WI92, Chequamegon Bay (Brule River Move). 11/8/2022
 - WA04, Confederated Tribes of the Umatilla Indian Reservation, 12/27/2022
 - AB35, Elk Island (Province of Alberta) 1/3/2023
 - OK01, McGee Creek (OK17 Move) 3/14/2023
 - SC03 Savannah River restart coming soon

Five Alberta, Canada sites coming into NADP over the next 2 years; also Lakeland Industry and Community Association (LICA) – not-for-profit association would like to start three NTN sites in the Cold Lake Region of Alberta (south of Fort McMurray)

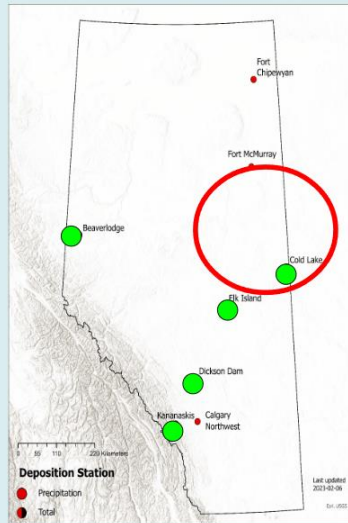
It is Raining Canadian Sites

Five sites for Province of Alberta

- Elk Island (AB35) Jan 2023
- Cold Lake April 2024
- Kananaskis April 2024
- Dickson Dam April 2025
- Beaverlodge April 2025
- possible new site, working toward for April 2023

Lakeland Industry and Community Association (LICA)

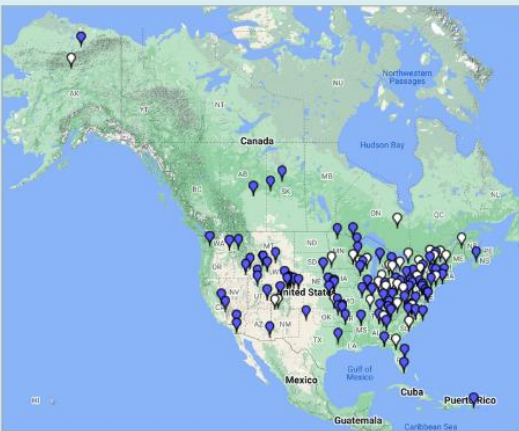
- not-for-profit association
- Would like to start 3 NTN sites in **Cold Lake Region**



- AMoN has 94 sites

David has received many calls, particularly from Tribes, about starting new AMoN sites
 Neilson Watkins has been reaching out to David to discuss AMoN monitoring at NCORE (urban) sites

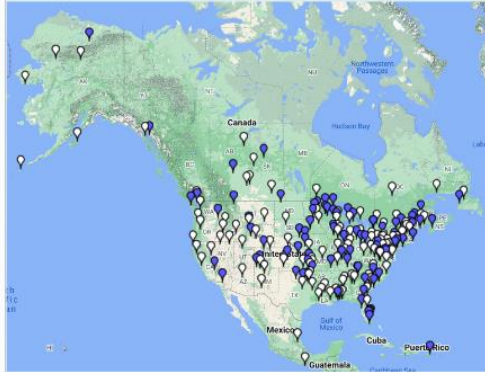
AMON



- Currently: 94 active sites
- Newest:
- CA93La Posta Band of Mission Indians, San Diego CA, 10/25/2022
- NE98Santee Sioux Nation, 10/1/2022
- Have had a lot of interest in these sites

- MDN has 85 active sites.

Mercury Deposition Network



- Currently: 85 active sites
- Newest: WA04, Confederated Tribes of the Umatilla Indian Res. 1/3/2023
- Brule River (WI08) was saved, now operating at WI92, operated by Nathan Kilger (Bad River Band of Lake Superior Chippewa, but will need long term funding (EPA R5 is involved, Michelle Becker). Also making PFAS measurements.
- NE98 Santee Sioux, Oct 2022, Jerome Proctor
- AK02 Juneau, restart



- AMNet has 10 active sites

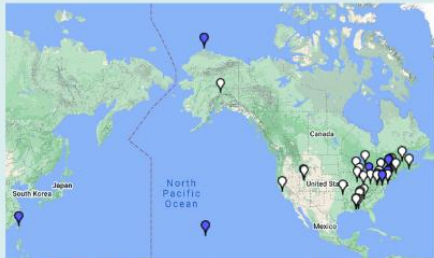
A Tekran elemental system was delivered to Dr. R. Sosa/UNAM last week

Request for equipment, Vietnam (professor that was one of Guey-Rong Sheu's student)

Would need to come up with AMNet site fee cost

Are we interested in this?

Atmospheric Mercury Network (AMNet)

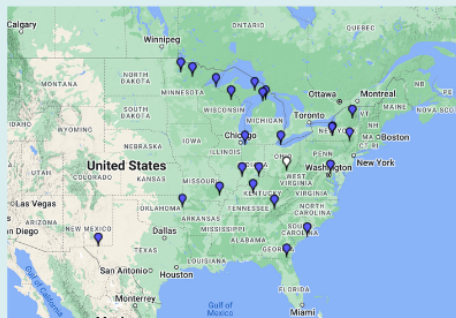


AK95	Utqiagvik		AK	2021-10-08
HI00	Mauna Loa	Hawaii	HI	2010-12-30
MD08	Pinney Reservoir	Garrett	MD	2008-01-01
MD28	Beltsville	Prince Georges	MD	2007-01-26
NJ30	New Brunswick	Middlesex	NJ	2015-10-01
NJ4	Elizabeth Lab	Union	NJ	2015-10-01
NY20	Huntington Wildlife	Essex	NY	2007-11-21
NY98	Whiteface Mountain	Essex	NY	2020-09-30
OH52	South Bass Island	Ottawa	OH	2011-12-31
TW01	Mt. Lulin		TW	2010-01-01

- Currently: 10 active sites
- Newest: a Tekran Elemental system was delivered to Dr. R. Sosa/UNAM last week
- Request for equipment, Vietnam (Nguyễn Lý Sỹ Phú, Guey-Rong Sheu's student)
are we interested in this?

- MLN has 24 sites. No closures.

Mercury Litterfall Network (MLN)



- Currently: 24 active sites
- Newest:
 - KY10, Mammoth Cave National Park, 2021-09-08
 - TX22, Guadalupe Mountains NP, TX, 2021-09-01
 - TN97, Great Smokey NP (Jim Renfro) second site, for 1 year
- Sampling for this year will begin in August

- Financial Notes
 - Budgets are pretty balanced
 - Shipping bill is about \$185k to date, essentially \$18k/month. Up significantly. \$30k/month in lab supplies
 - Cost savings ideas:
 - Consider lab automation
 - Consider new AMoN sampler
 - Alternate shipping may have \$ (UPS is easier, but more expensive; FedEx may be an option to save \$)
 - Consider Bag Sampling for MDN – go to NOS to hear more
- Passive Hg Effort
 - Things are moving towards MerPAS-based passive Hg capability
 - Winston Luke put out first NADP passive Hg sampler on April 1

Executive Committee on the status of our 2023 priorities (Linda Geiser)

- NADP Strategic Plan
 - WSLH and NADP executed a strategic planning initiative in 2020 to identify and address ongoing and new directions for the NADP stakeholders, supporters, and data users.
 - Strategic Plan was drafted in 2021 and will be shared through the NADP listserv. The Executive Committee will finalize and post.
 - The Executive Team will help support the implementation of the strategic plan by focusing on four action priorities. The four priorities for the Executive Committee include:
 - 1) Expand urban monitoring
 - 2) Prepare guidance for addressing site level operational and funding issues
 - 3) Offer total N and total P analysis
 - 4) Offer PFAS analysis
- Potential Options for Addressing Operational/Funding Issues
 - Coordinating team: Melissa Puchalski, Kristi Morris, Winston Luke, and Greg Wetherbee.
 - Goals: Develop recommendations for NADP site sponsors to common issues related to operating

- and funding network sites
- Recommendations for:
 - Common land lease/landowner issues
 - Identifying a new site operator
 - Addressing annual resource constraints and temporary funding lapses
 - Short-term funding lapses or disruptions
 - Appendix: Example agreement for installation and maintenance of an NADP monitoring site
- Draft guidance is ready for NADP Joint review. Melissa to share by email after this meeting.

Rebranding NADP labs (Richard Tanabe)

Richard moved for a motion for rebranding of the HAL and CAL labs to be called the NADP Analytical Laboratory (NAL).

Motion: The NADP Program Office proposes that the Central Analytical Laboratory (CAL) and the Mercury Analytical Laboratory (HAL) are rebranded as the NADP Analytical Laboratory (NAL). References to the CAL and HAL on the website will be changed and only new documents that are produced/updated (i.e., QAP/QAR, field SOPs, Governance Handbook, etc.) will have the updated name.

Chat dialogue:

01:46:00	Tom Butler:	I like National Atmospheric Deposition Analytical lab
01:46:36	wetherbee:	Program Analytical Laboratory (PAL) Everyone needs a Pal.
01:46:58	Maria Jones:	I agree with Tom Butler
01:47:39	Kristi Morris:	Reacted to "Program Analytical L..." with 🤔
01:47:44	Cari Furiness:	Noting that on the NADP website Laboratory staff are Identified at NADP Analytical Laboratory
01:48:12	Cari Furiness:	https://NADP.slh.wisc.edu/contacts/
01:48:19	Tom Butler:	NADP Analytical Lab sounds good
01:49:08	Kristopher Novak:	Please use mics in the audience for the benefit of folks tuning in virtually.
01:49:36	Alexander Nyhus:	National Atmospheric Deposition Laboratory (NADL)
01:49:36	Cari Furiness:	Another vote for NADP Analytical Laboratory
01:50:21	Greg Beachley:	Reacted to "National Atmospheric..." with 🇺🇸
01:52:18	colin kelly:	red mark green mark
01:52:30	Greg Beachley:	I oppose the nested acronyms!
01:52:44	colin kelly:	green check is yes, red x is no
01:52:48	Greg Beachley:	OK, I accept defeat!

Seconded by Mike McHale. The motion passed.

CASTNET Update (Melissa Puchalski)

- The Clean Air Markets Division is supporting power sector regulations and assessments. Focused on clean energy transition and tracking implementation of IRA-related activities as it relates to the power sector. Assessments include:
 - How is transition to clean energy impact AQ and the environment? Where?
 - How are climate stressors impacting AQ and the environment? Which communities are most vulnerable?
 - Are we meeting the current NAAQS (ozone, PM2.5) overall and within EJ communities?
- Tribal and EJ-related Monitoring
 - La Posta CASTNET and AMoN site installed Jan 2023, two adjacent tribes were trained and

participated in air monitoring site.

- Used the White House's Climate and EJ Screening Tool (CEJST) to identify CASTNET sites in EJ areas.

- Additional Site Updates

- Alberta CASTNET site at Elk Island sponsored by Alberta Environment.

- Two new FL sites sponsored by Indian River Lagoon Council/St John's River Management District/Florida Atlantic University

- Exploring a new tribal site with Region 9

- Wind Cave National Park, SD is no longer operating a filter pack

- CASTNET website update

- New data download tool to quickly retrieve data

- Measurements of speciated nitrogen in PM at CASTNET sites

- Revised TDEP Map projects are available online, shared by Greg Beachley at the TDEP meeting yesterday

- Greg is also working on different network configurations to understand measurement uncertainty

- Current network status:

- Suspended 26 monitoring locations on May 10, 2022 including CASTNET and NADP sites

- Some sites were re-started with external support

- Working with the EPA's Scientific Advisory Board (SAB) to review CASTNET and will chart a path forward within a reduced budget

- OAP plans to use IRA Multipollutant Monitoring funding to transform CASTNET (\$5M one-time

funding)

- SAB Review

- EPA's SAB office accepted proposal for a scientific review of EPA's Long-Term Rural Ambient Air Monitoring Program (CASTNET)

- The panel convened with SAB DFO on 4/13/2023; public meeting to be held on May 24-26, 2023 in Bethesda, MD.

- <https://sab.epa.gov/ords/sab/f?p=114:19:12947946185523:::RP,19:P19 ID:1002>

- Moving Forward

- Propose a network configuration that fits within annual budget based on:

- SAB panel recommendations + public comments

- Partner engagement

- IRA funding levels

- FY24 budget uncertain

- Continuing to repair, refurbish, and replace aging equipment and infrastructure

NPS Update (Kristi Morris)

- NPS Current Budget & Operating Status
 - NPS' Air Resources Division has been undergoing some budget planning exercises including for NADP, CASTNET and our webcams, and our nephelometers, and the gaseous pollutant monitoring network.
Our budget has remained flat or slightly increased over the past many years, and as a result our division spending power to manage our monitoring programs has decreased on the order of 35% over the last 15 years.
 - NPS Shortfalls for Operations
 - We assumed:
 - No increases in the ARD budget
 - Reduction in funding of the Monitoring Program due to positions being filled
 - Increases in network costs ~ 2-3%/year
 - Have been asked to cut 10% and 20% to each of these networks
 - Have undergone a budget exercise to evaluate parks
 - Starting in 2024, budget shortfalls are expected to be \$370k, but 202 the deficit is projected to be over \$500k
 - Have been partnering with external groups to cover some site costs to continue operations
 - Also had an opportunity to apply for IRA funds for two different projects

Canadian Air and Precipitation Monitoring Network (CAPMoN) Update (Jason O'Brien)

- Map of CAPMoN
 - Not much change in the network since 2022
 - Precip chem: 24 sites
 - Aerosols & related gases: 16
 - Ground level ozone: 16
 - PM2. + PM10 mass: 1
 - Continuous PM2.5: 1
 - Mercury in precip: 5
 - Total gaseous Hg: 3
 - Continuous N and S: 2
 - Co-located with NADP measurements:
 - AMoN: 3
 - MDN: 5
 - NTN: 1
 - Additional partner networks for GHGs and remote sensing
- Laboratory Updates
 - Current backlog for precip samples: Jan 2021 – June 2021; estimate completion Dec 2023
 - Current backlog for air samples (particles/gasses) (Jan 2021 – Dec 2022); estimate completion Mar 2025
 - QA study ongoing to assess stability of long term storage of precip samples; initial results are positive with good stability except for pH
 - Testing of new FIA instrumentation (NH4 and TN) is complete and a new ICP-OES (metals) is in progress
 - Precip sample bag testing (chemistry) for new supplier
 - Field testing of Nylon filters in June/July 2023

- Expect some special studies to resume late 2023/early 2024 as sample backlog declines
- Field Updates
 - Sites remained >95% operational in 2022
 - Full schedule of field audits anticipated for 2023
 - Precip sample bag testing (physical – strength testing and testing seals) from new supplier
 - Continued upgrades to the D400 precip collector (new actuators) and testing
 - Infrastructure work continues for a new site Searchmont, Ontario (could replace Algoma site)
 - Bratt's Lake, SK new site installed – measurements to start in Summer 2023
 - Testing and evaluation of continuous PM2.5 instrumentation
 - Weekly air sampling method development and testing (Summer 2023) – to try to save costs from daily air sampling methods
- Data Updates – primarily from Amanda Cole's group
 - CAPMoN data sets available on the Open Government Portal: (Search "CAPMoN")
<https://open.canada.ca/en/using-open-data>
 - Published up to 2019 precip data
 - Published filter pack data 1982-2018 (2019 coming soon)
 - Published up to 2018 TGM (2019-2020 coming soon)
 - Published up to 2021 NH3 passive sampler data
 Blank- and temperature-corrected, replicates averaged.
 - Continued progress on in-house QA-QC capacity (RMDQ2) for cost-savings.
 - Progress on electronic capture of site metadata and merging with lab and other data; to replace paper copies throughout the network
- Publications
 - Cheng et al., 2022. Long-term declines in atmospheric N and S deposition ..
 - Feng et al., (in prep). Inter-comparison of measurements of inorganic chemical components in precipitation from NADP and CAPMoN at collocated sites in the US and Canada..
 - You et al., (in prep). Contribution of emissions from the oil sands activities to atmospheric concentration and deposition of N and S species at a downwind site.

Daily precipitation volume data availability (Doug Burns)

When we did the program office audit last fall. One of the things that came out of that was the group which was myself, Kristi Morris, Catherine Collins, and Chris Rogers. This is a priority for USGS. You can get weekly precipitation volume from the website, with a 6-7 month lag time. Doug is proposing make this data more available in a timely manner – perhaps up to a few months lag to allow for QA.

Discussion

Greg W: We need to standardize language. Precipitation is measured in depth, not volume. Sample volume is in the bucket or bottle.

Doug B: Precipitation as measured by the rain gauge is measured as depth. Precipitation is sometimes measured by volume for instances of snow or ice. Depth is fine.

Greg W: Isn't this already available on the website, I download those data all the time; and they're current, provided that data are uploaded on a weekly basis (and some sites don't).

Richard T: The website that hosts the data that Greg W downloads from is still active, but this will disappear when the WI State lab makes this site no longer available. The current NADP website does not make these data available, so this motion is to make this functionality available on the current NADP website.

Doug B: The data that Greg W downloads, are those QA'd? [Unclear what the response to the question was]. What we need to specify is whether the posted data are QA approved or not.

David G: What time resolution, hourly?

Zac N: About the precipitation management program that Casey is working with a team from OIS. Basically the precipitation data is linked to the all of the other program data, so that's why there's a lag with the precipitation data. So Dana and her team are working on a new program to get these precipitation data onto the web sooner.

Eric H: So this won't effect the raw [precipitation] data, that Greg W uses, that will still be available, right?

Greg W: Yes, I hope that's the case, because we need access to those raw data to troubleshoot.

Richard T: The way the motion is written, it wouldn't be the same as what's available now.

Greg W: Are we going to get rid of what's available now?

Richard T: We don't have the option of keeping the old way based on OIS, that's on a server that's being [removed?].

Greg W: I wouldn't vote for this motion because we'll get the QA'd precipitation data eventually, but we need to know whether the rain gauges are actually working, are the data coming in, is the telemetry goofed up, and are bad data being generated because something is wrong.

Doug B: I don't think it needs to be either-or, we can flag the data as QA'd or not. USGS does this routinely, this should solve the problem with a simple column to state whether the data are QA'd or not.

Richard T: Referring to "timely as available" is not referring to the data availability, it's referring to the program office to make this data available on the web as timely as possible. Also, we can provide both 15-min and hourly data.

Mike M: We're talking about two different things now, the raw data – just being made available as soon as it's downloaded and making the QA'd data being available as soon as it's QA'd.

Richard T: We understood it as – how fast can the program office get this up and running.

John O: Are you thinking this will be a bulk QA process or a rolling QA process?

Dana G: I review data on a weekly basis and it's pretty much QA'd on a weekly basis. That data is automatically updated on the web to the QA'd data.

Chris R: I would agree with Richard's interpretation on timeliness. We wanted this to be a priority. I agree with Greg W, it's two different things: one is providing the data to the public in the best temporal resolution (15-min, hourly, daily) as possible; and the other idea is a different motion to essentially recreate the precipitation dashboard to allow Greg W, Eric H, and any site operators access to their real-time data.

Doug B: Should we request two separate motions, to address two issues as Chris R as suggested? One to transition immediate data availability onto the new website and separate from the QA'd and approved data.

Richard T: What's our direction from Exec? The [currently displayed motion on the screen] motion is the one for the public for QA'd data. I think Chris R is right, what's the separate motion we need to ask the Program Office?

Mike M: We need to ask Zac and Dana to clarify the process now. It's a rolling process now? We would need to make these into two motions.

Zac N: Definitely needs to be two separate motions to clarify what's happening now and where it needs to go.

Richard T: Part of the challenge is, we need to go through the "Do-it" program on campus. We can work towards this and get this started in the background.

Greg W: I need to clarify before I voted, will I lose the ability to get any and all of the last-week's data?

Doug B: No. And we're not voting now, we're going to re-word the motions to present at the next Joint meeting tomorrow.

QAAG Update (Nichole Miller)

- Site Support and Site Operations
 - Eric Hebert gave an update on site audits and they are on track
 - Currently communicating with Dana and the PO with any recurring field issues
 - Richard Tanabe informed the group of the new site support hub they have been using (see his demonstration in NOS this afternoon) – this has been working better than the current trouble ticket they have been using
 - There is interest in Alberta for adding a few more sites
- Siting Criteria
 - Tim Sharac provided an update on siting criteria
 - Will be posting the site survey compilation spreadsheet on the website for easier use by sites; easier than the long EEMS annual reports
 - Discussion about providing a waiver to sites who fail criteria due to wind direction to change the orientation of their collector
 - Using wind rose plots to determine obvious wind direction
 - Vote on a site by site basis
 - Will need further discussion on this
 - Wind rose and tabular spreadsheets of data are available for anyone interested
- External QA Update
 - Noel gave a presentation on the results for the inter laboratory comparison study, system blanks (MDN), and field audit (NTN) samples
 - See her presentation in NOS tomorrow morning
- System Blank and Field Audit
 - Amy Mager gave an update on this process.
 - Last year the lab took over preparing and shipping the system blank and field audit samples for 2022
 - The system blank process worked out really well – started in June 2022 and had a 52% completion rate
 - The field audit process (NTN version) had a few setbacks – started in September 2022 and had a

45% completion rate – note that a site must have had to have a dry week to complete this.

Preparing – took a little time, 100 L of solution

Shipping – didn't work as well as MDN because don't ship on a weekly basis

- Discussing the option of having USGS take back the field audit portion until we can work out these issues – yet to be finalized between Amy Mager and USGS

- Bag Testing (NTN and PFAS)

- New batch of NTN bags have been thoroughly tested and out in the field (see presentation in NOS this afternoon)

- Martin gave an update on the testing of bag sampling for PFAS use

- All results were promising and no methanol rinse is needed

- See his PFAS presentation in Joint tomorrow afternoon

- MDN Bottle Contamination

- We had a bottle lot for MDN that passed initial QA testing and was put out in the field and then was discovered to have high sporadic contamination

- Shipment of that bottle lot was immediately stopped

- We are able to track which bottle lot each sample is in.

 - Contamination was sporadic but very noticeable when it happened.

 - Looked at site by site precipitation basis and by volume

 - Looked at samples month by month

 - Accepted data that fell within 2 standard deviations

- Samples from that lot started coming back in October, peaked in November and December, and have started declining quite a bit

- All samples are on hold from that lot and being put through a deeper validation process

- About 30% of samples have been qualified/invalidated. Should be ok with mapping.

- Data will be on the website, with a disclaimer and possibly a list of affected samples – will discuss in Exec.

- Network QAPP has been updated and will be made available on the website.

Discussion

Question: Did NADP go back to Degage bags? Yes. Found out that the earlier problem wasn't the bags, it was the solution.

AMoN ALPHA samplers (David Gay)

- Saving Funds

- Using the Alpha Sampler for AMON

 - 6-8 months ago came up with the idea of saving money to consider using Alpha samplers instead of Radiello

- Alpha Sampler

- Centre for Ecology & Hydrology, Edinburgh Research Station, UK

- They are not a for-profit business so, we purchase at a fixed cost

 - Price, £12, or about (~ \$15)

- Weekly monitoring = 0.05 - 400 ug NH₃ m⁻³

- Journal Article

- Recent paper comparing Alpha and Radiello. Some are even claiming that the Alpha may be better.

Martin et al., 2018. Validation of ammonia diffusive and pumped samplers in a controlled atmosphere test facility using traceable Primary Standard Gas Mixtures. Atmospheric Environment. Volume 199, 15 February 2019, Pages 453-462

<https://www.sciencedirect.com/science/article/pii/S1352231018308185>

- Where are we?
 - Delay due to personnel changes in the network, and moving of the laboratory equipment (Ag Dr 200)
 - Abby Carr is going to do the testing here
 - Not where we hoped to be, but Katie has begun testing/estimating
- Katie's Initial Estimates
 - Every two weeks, should save 8-9 hours/week. Will not have to spend as much time cleaning compared to the Radiello.
- Estimated Savings
 - Should save the network approximately \$20k per year
 - Cost for network per week: \$659.35 (Alpha) vs \$1,428.50 (Radiello)
 - Save \$219.76 per site per network year

Discussion

Eric P: From the mercury passive sampler, the Radiello has a much higher sampler rate than a disk sampler – that will play a role with the detection limit.

Melissa P: Did they compare with a denuder?

David G: No, they compared against an analyzer in a controlled environment with controlled temperature.

Update on Black Carbon Project (David Gay and Ross Edwards)

So what are we doing again?

- At the spring meeting, 2022 we proposed a 1 year test of black carbon measurements in NADP samples studies
 - We chose thirteen sites
 - Determine weekly black carbon concentration and deposition in NADP samples
 - Wet weeks only
- Support Dr. Ross Edwards (10% of this salary) and the work of Piyaporn Sricharoenvech (PhD student, who did graduate)
 - To see how much it'd cost to operate in a network fashion
- Black Carbon Project
 - Using excess water (water after NTN samples)
 - Started in August 2022
 - Currently have 9 months of samples collected
 - Ross is going to give us some of the specifics....
- Refractory black carbon aerosols (rBC)
 - They can be heated up to 4000 Kelvin which is a very unique property.
- Analysis of rBC by single-particle intracavity laser incandescence (SP2)
 - rBC (1) heated to incandescence (~ 3800 – 4200 K) inside CW intracavity laser (1064 nm).
 - Red detector (2.) : amplitude of incand light = the volume (and mass) of rBC (Moteki, 2023).
 - rBC incand temp approximated using two-color pyrometry (detectors 2 and 3).
 - rBC identified by incand temp.

- Detects rBC masses 0.3 to 80 fg C.
 Moteki, Nobuhiro. "Climate-relevant properties of black carbon aerosols revealed by in situ measurements: a review." *Progress in Earth and Planetary Science* 10.1 (2023): 1-16.
- Analysis of refractory BC in wet – deposition
 - rBC liberated from water by nebulization and desolvation.
 - SP2 rBC masses summed over 5 seconds and averaged over 5 min.
 - Conc standards = partially oxidized fullerene soot dispersed in high purity water / trace NH₄.
 - Detection limit ~ 0.03 µg rBC / L .
 - Method detection limit ~ 0.1 rBC µg / L .
 - Single rBC mass ranges from ~ 0.3 to 80 femtograms.
- rBC concentration Oct 26th - Dec 1st 2020
 - Site mean (weighted) rBC Conc
 - Median = 3.6 µg / L
 - Max = 35.0 µg / L
 - Min = 0.1 µg / L
 - Precip weighted site means interpolated (inverse distance) to PRISM precip grid. Method of Latysh NE, Wetherbee GA. Improved mapping of National Atmospheric Deposition Program wet-deposition in complex terrain using PRISM-gridded data sets. *Environ Monit Assess.* 2012 Jan;184(2):913-28. doi: 10.1007/s10661-011-2009-7.
- rBC wet deposition Oct 26th - Dec 1st 2020
 - Site rBC wet deposition
 - Median = 2.3 g/ha
 - Max = 20.3 g/ha
 - Min = 0.02 g/ha
 - rBC wet dep from interpolated rBC concentration and PRISM precipitation.
 - Highest deposition associated with fires Nov 13th - Nov 20th
- Current Research
 - Multi-year rBC time series from 12 sites (start date = July 26th 2022).
 - Includes 1 site in Canada and Bermuda (Tudor Hill marine atmospheric observatory).
 - Weekly rbc wet-deposition concentrations and fluxes.
 - Comparison of weekly deposition rates with chemical transport models (NASA Merra 2).
 - Sub-event scale variations in rBC wet dep.
- BC Weekly Concentrations
 - Aug 2022 to Feb 2023 rBC data :
 - max rBC comparable to November 2020.
 - Broader rBC conc distribution than Nov 2020.
 - Most wet-dep rBC concentration < 10 µg / L .
 - November 2020
 - Median = 3.6 µg / L
 - Max = 35.0 µg / L
 - Min = 0.1 µg / L
 - Aug 2022 – Feb 2023
 - Median = 4.5 µg / L
 - Max = 36.0 µg / L
 - Min = 0.03 µg / L * (detection limit)
- Status
 - 278 BC samples analyzed since August 2022.
 - Estimate ~ 400 BC samples analyzed by August 2023.

- Concentration and deposition ranges comparable to 2020 study.
- Still need to compare buckets to bags, but new data does not show any significant difference.
- Long-term data sets are needed to investigate variability and trends.
- Studies at the sub-event level are needed to investigate wet deposition processes.
- Comparison with chemical transport model BC wet deposition estimates and back trajectories are needed.

Discussion

John O: Can one think of units in terms of surface area instead of mass units for black carbon?

Ross E: The relationship between the incandescence and mass is volume, which is associated with mass. But with this measurement, you cannot measure surface area. Black carbon has extremely high surface area to mass.

Spatially varying nitrogen critical loads and the influence from mediating factors (Justin Coughlin)

- This work started with a paper that was published:
 - Pavlovic et al., 2023. Empirical nitrogen and sulfur critical loads of U.S. tree species and their uncertainties with machine learning. *Science of The Total Environment*. Volume 857, Part 1, 20 January 2023, 159252.
- We used machine learning techniques to evaluate growth and survival of different tree species as a response to N and S.
- Motivation
 - Horn et al., 2018 and Pavlovic et al., 2023 use the same environmental conditions in their modeling approaches.
 - Mediating factors, such as soil conditions (buffering capacity), can also influence a tree's N sensitivity.
 - We included predictors that could act as mediating factors to understand how N critical loads may spatially vary as a result.
 - We also updated the dataset to include more recent data (through FIA 2021).
- Data Set
 - Observations of 1.2 – 1.5 million trees, 108 tree species for survival, and 90 species for growth, based on the January 2021 US Forest Service Forest Inventory and Analysis National Program (FIA) database.
 - Data set includes ozone concentrations, soil characteristics, drought, and previously-used parameters {temperature, precipitation, tree height, basal area, above-ground biomass, years elapsed}.
- Methods
 - We apply machine learning techniques to understand the relationship of N deposition to tree growth and survival geospatially.
 - Why ML?
 - Does not rely on parametric assumptions
 - Inherently models variable interactions
 - Model interpretation techniques can be used to model variable relationships
 - Uncertainty methods provide an objective approach to determine the level at which adverse effects occur
- Methods
 - Develop dose-response curves for tree growth and survival for N deposition
 - Train ML models (XGBoost) to predict tree growth and survival using N deposition and supporting variables
 - Calculate relationship between deposition and tree health of 108 tree species

Develop CL base on tree health (growth or survival)

Estimate uncertainty for CL values using bootstrap methods

- N Deposition Sensitivity Mediated by Other Factors
 - N deposition + Mediating Factors -> Variable N Deposition Sensitivity -> Machine Learning -> Critical Loads
 - Mediating Factors
 - Geology
 - Climate
 - Competition
 - Ozone Exposure
 - Soil Characteristics
- Model Performance
 - Saw improvements in the Pavlovic et al., 2023 method using this model
 - Model performance improves with addition of new data and predictors (y-axis model performance) relative to the predictive models we developed in prior work (x-axis model performance).
- Assessing Variable Responses
 - Partial dependence plots (PDP) show the change in average predicted value as a stressor is perturbed
 - Individual conditional expectation (ICE) plots can disaggregate PDPs by plotting individualistic responses as a stressor is varied.
 - Overall, we use a 1% decrease from the maximum growth rate or survival probability to set the CL.
- Evaluating Critical Load Error for Individual Trees
 - With bootstrapping, we can use trained models to determine the error around an individual tree's critical load.
 - We use the 95% confidence interval (CL) width to assess the error.
 - Some species have more constrained widths (e.g., ponderosa pine), while others have higher error (e.g., yellow-poplar).
 - This allows us to evaluate a range of critical load exceedances (i.e., lower, median, and upper critical load).
- Spatially Varying Critical Loads
 - Using the bootstrapping approach, we look at spatial patterns with median critical loads.
 - Black cherry tends to be more sensitive in the north for growth, but more sensitive in the south for survival.
 - Ponderosa pine is more sensitive in the pacific northwest (PNW) than in the SW.
 - We can also use the spatially varying N CL to evaluate where CL exceedances are taking place across a species' range.
- Spatially Varying Exceedances
 - Using the lower, median, and upper critical loads, we can evaluate exceedances of N deposition.
 - For black cherry, we see many plots exceeding critical loads at the lower critical load, with more plots not exceeding at the higher critical load levels (i.e., upper).
 - This not only provides potential error assessments but also the ability for federal land managers to target their efforts.
- Differences with Static Critical Load Exceedances
 - With spatially varying N critical loads, we are able to observe more exceedances than with static critical loads.
- Determining the Most Influential Predictors
 - Some stressors are highly correlated at FIA plots.
 - This complicates our ability to assess single environmental stressors.
 - Tools, such as Shapley Additive Explanations (SHAP), can quantify which stressors have the largest

impact on model outputs.

- Some of the most important predictors for modeling sugar maple responses including competition, sulfur deposition, and precipitation.

- **Conclusions**

- Using machine learning techniques, we can quantify spatially varying critical loads or levels, and errors, that are due to differences in mediating factors.

- With spatially varying critical loads, we can evaluate exceedances that may be missed with static critical loads.

- Our results can provide benefits to federal land managers and NEPA analyses that would be specific to an administrative unit (e.g., National Forest).

- Machine learning methods (e.g., SHAP) can be used to evaluate the influences of mediating factors on ecosystem component' N sensitivity.

Discussion

Doug B: I wonder if you thought of using this approach in a different way for policy implications. What would happen to Critical Loads if NOx emissions were reduced by 10%?

Justin C: No, we haven't. It could be used in this fashion using emission scenarios working within the confines of the data that are available.

End of Session 1

Joint Session 1 Participants

Name (Original Name)

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Chris Lepley

colin kelly

Kenny Yan

Tom Butler

Greg Beachley

Maria Jones

WSLH NADP Zoom Laptop

Jamie Gauthier

Hazel Cathcart

Kristopher Novak

Ralph Perron

Jayde Alderman

Chris Rogers (Christopher Rogers)

Cari Furiness

Anne Marie Macdonald

Mary Lynam

Marcus Stewart

Naomi Tam

Amanda Cole

Jason O'Brien

Kulbir Banwait

Emmi Felker-Quinn

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Joint Session 2, 2023 Spring NADP Meeting, Madison, WI, Wednesday, May 4, 2023

Agenda

1:30 PM	Great Smokies Brook Trout and Acid Deposition (Jim Renfro)
1:40 PM	Subcommittee Highlights – Motions Only
	MELD (Rick Haeuber/Colleen Flanagan-Pritz/Katherine Ko)
	TDEP/CityDep (Amanda Cole/Colleen Baublitz/Ryan Fulgham)
	CLAD (Kris Novak, Jeremy Ash, and Nifer Wilkening)
	Ozone Working Group (Jeffrey Herrick/Kris Novak)
	AMSC (Andy Johnson/Selma Isil)
	NOS (Tim Sharac)
	EOS (Catherine Collins/Rebecca Dalton)
	DMAG / NADP Website Update (Mark Kuether/Zac Najacht)
2:30 PM	Network stability/financial pressures/cost saving proposals, sites in jeopardy (David Gay)
2:50 PM	Break
3:05 PM	Program Office Review Response (Richard Tanabe)
3:20 PM	PFAS Update (Martin Shafer)
3:40 PM	PFAS in Archived Cloud Waters at Whiteface Mtn (John Offenberg)
3:50 PM	PFAS Deposition Modeling Implications (Krish Vijayaraghavan)
4:05 PM	Conditions and trends of critical load exceedances on federal lands (Mike Bell)
4:25 PM	Fall Meeting 2023 and Science Symposium (Mike Bell)
4:30 PM	Spring Meeting 2024 (Michael McHale)
4:35 PM	Final Discussion/Questions/Wrap-up (Tim Sharac)

Great Smokies Brook Trout and Acid Deposition (Jim Renfro)

- A video of a news segment reported on CBS affiliate WVLT focused on the decline of Brook Trout in the Great Smoky Mountains National Park
 - Seven populations have been lost/eradicated since the early 1990s due to declining stream pH
 - 1/3 of the streams in the park are under threat
 - Smaller, older streams farther upstream show worse water quality
 - Violating the Clean Water Act for pH
 - Matt Kulp (NPS) and Jim Renfro (NPS) were interviewed on camera
 - The entire park was in non-attainment in the early 2000s
 - Dramatic improvement from decades ago
 - TVA reduced NO_x and SO₂ in the region by 97% and 98%, respectively, since 1977
 - NADP deposition maps were used to show reductions of sulfate deposition from 1980s to now
 - Dry deposition of nitrates from vehicles still an issue
 - Soils are still acidic from prior deposition
 - 30 miles of stream have been restored by transplanting fish from healthy streams
 - Tennessee Aquarium in Chattanooga has raised trout and released them in other streams in Cherokee National Forest
 - Talk of using aircraft to spray basic chemicals onto acidified soils, still tentative

Subcommittee Highlights – Motions Only

- TDEP passed two motions regarding workgroups

- Motion to incorporate the CityDep workgroup into the Measurements and Monitoring Workgroup
- Motion to incorporate the Deposition Uncertainty WG into the Measurement-Model Fusion WG
- CLAD voted unanimously to dissolve Working Group 4 (Deposition Uncertainty) – as above
- Ozone Working Group passed no motions
- ASMC passed no motions
 - Still lots of activity going on with many ambitious plans ahead. The AMSC meeting had over 30 attendees.
- NOS adopted the minutes from the Fall 2022 meeting, and passed a single motion
 - Motion: “The program office will make a Tekran mercury speciation system available to Vietnam National University, with the understanding that the university must join AMNet and pay the associated network fees. Shipping costs will be borne by the Vietnam National University, and the equipment will not be shipped until the network fee is paid.”
- EOS two motions
 - Approval of the minutes from the Fall 2022 Meeting
 - Update the governance handbook to reflect the rebranding of the CAL and HAL as the National Atmospheric Deposition Program Analytical Lab (NAL)
- No motions from MELD
- No motions from DMAG

Discussion

Mike Bell: I know that we initially moved to motions only within joint because some of the presentations were getting long, but I think it does the all the work that we do at the beginning of the week a disservice by not highlighting some of the things we do. Especially for ASMC, it usually like runs counter to CLAD and I'm curious what's going on. I want to know if there's things that matter that we can contribute to. So I think we should reconsider how we do this in the future. Perhaps limit each presentation to time duration of 5 minutes?

Tim Sharac: I agree, that was a great point

Richard Tanabe: I would propose that each committee put together one slide with meeting highlights and get it to Joint in advance so that we can combine the slides into one presentation.

TS: Any more discussion?

Jeff Herrick: I'm Jeff Herrick at EPA. We have the fledgling ozone working group and I just want to highlight that we have a few publications on ozone effects and seedlings and on herbaceous species, but I really want to highlight some of that work is being already used in the reconsideration of the ozone standard. So if you're not aware, The EPA is reconsidering the last administration's NAAQS ozone standard. So we're in the middle of that. The Clean Air Advisory Science Committee met in March. We'll see where it goes, but from their comments they seem like they want lower ozone standards. So even if it's not directly related to everything you all measure, that's going to put pressure on reducing emissions even more so both for the health and the ecological standard. There were pretty strong opinions on that panel, so they're going to be working on a letter in May. I think it's May 23rd and 24th is a public meeting. So if you can find the Clean Air Science Advisory Committee, if you just like Google “CASAC” and “NAAQS ozone” you'll find the meeting information, and you can watch on YouTube. Thank you.

TS: Any more highlights?

RT: So a few years ago we started trying to come up with a block agenda that was kind of set in terms of times, not necessarily committees and where they slot in, but it was more for the program office to be able to plan ahead,

make sure we know the number of rooms we're going to need for the week and not have to make last minute changes. Coming up with this block agenda would also help people with travel plans, you know, kind of knowing where it's at. But then the other thing was kind of coming up with some sort of rotation. So that Monday morning isn't always CLAD or TDep, and spread around the pain. But in the fall we were limited to the two days, so we kind of have to do two (meetings) in the morning and two in the afternoon,. And I just want to know is does that work? Do people have comments on how that's been going? I think it's been about two years of meetings we've been trying to work that.

MB: I think the one piece of feedback we got this meeting is that it's kind of weird having a cold open like CLAD without there being any introduction to NADP. It's like we are already set in the weeds. Even if just maybe scheduling a 15 minute general introduction of this is what things are. Or maybe sending something out the week before, I don't know. Finding a way to connect people to start the meeting. Again, I don't have an answer to it, but just it seemed like it was all of a sudden it was just like, oh, we're deep in it. But otherwise I think it's relative. It's worked for us. I mean, I'm usually in most of the rooms, so I'm here Sunday night one way or the other.

TS: Other comments or?

RT: I think, Mike, I think you know for the fall meeting, you know your plan of trying to engage first timers and as students. And so I think working together for that will kind of develop. We can come up with a package that goes out to people ahead of time and then we can make that a regular thing and kind of, you know, and that's the other thing that would help is if committees could get their agendas to us sooner so we can get them on the website and that way, people know ahead of time what, you know, if there's something they want to see, then they know when they're making their travel plans so that that would just be for all the committees.

TS: All right.

Network stability/financial pressures/cost saving proposals, sites in jeopardy (David Gay)

David Gay: I was sitting in the back and one thing I really appreciate about NADP is how friendly everyone is. I was watching people just talking and laughing, and you don't see that at a lot of meetings. They're not nearly as many meetings. So I really like that.

- There is quite a bit of worry over money...
 - Budget discussions are getting frequent
 - Lots of worry over keeping budgets that we have, wanting more \$, etc.
- Opinion #1
 - We have a pretty good track record of keeping NADP operating
 - We have lots of degrees in this group (1000 degrees or so)?
 - We are smart, and can find a solution
- Opinion #2
 - Inflation is real, so we have to face it
 - But this is not the first time this problem has occurred....
 - So we can figure it out
 - And I know I have a bias...
- Opinion #3
 - We at the PO have lots of opinions...
 - However, it is improper for us to say "start a site here", or "shut down that site", etc.

Our job is to give you considered and honest opinions

Make suggestions

Carry out the orders/directives of Executive

- Opinion #4

- One thing that IS our job

- Is to use your money effectively and efficiently to the best of our ability

- So that means using a \$2 sample bottle rather than the \$15 premium model

- No BMWs when a Honda will do

- And....Bring to your attention changes that we can make to save money, time, and effort

- There is always a better way to do things

- Opinion #5

- In Our Most Recently Approved Budget

Personnel (Salary, benefits, etc.)	61.2%	1.7 million dollars
Laboratory Supplies	13.2%	389 thousand dollars
Services (incl. shipping/freight)	5.9%	200 thousand dollars
Meetings	2.0%	68 thousand dollars
Travel	1.1%	31 thousand dollars

- All of these are increasing

- But we can be smart about this stuff, and improve things to save money

- Salary & benefits, laboratory supplies are the largest expense

- Focus on these areas

- Opinion #6

- Being more efficient is NOT going to solve all of our problems

- But it will help....

- Opinion #7

- Things we can do for keeping the salary costs in line

- Robotics, allows same people to do more and other things

- Opinion #8

- Things we can do for keeping the supply costs in line

- We can't control the cost of what we need, but...

- We can control what we need

- Alphas for AMON

- Bag samples in the NTN

- Bag sampling for MDN, Etc

- Opinion #9

- We can't control the cost of what shipping, but...

- We can control what we ship:

- Bag samples in the NTN

- Bag sampling for MDN, much reduced shipping

- Etc.

- Opinion #10

- Summary of the things that can add value/reduce costs:

- Passive NH3 with Alphas vs. Radiellos (saves costs and time)

- Passive Hg sampling (saves costs, time, adds shipping costs, adds scientific value)

- Black Carbon in precip (more cost, more time, but adds new scientific information)

- MDN Bag sampling (saves costs, time, shipping)

- Robotic NTN sample prep/pH/conductivity/filtering (saves costs and time)

- Two-week MDN sampling (saves costs, time, shipping, reduces scientific information)

- Pollen network (adds new scientific information)
- TNTP (adds new scientific information, adds scientific value)
- Already done:
 - NTN Bags vs buckets (saves cost, time, shipping)
 - Digital vs. Belfort gauges (adds new scientific information and scientific value)
 - NTN and MDN bulk shipping (saves shipping)
- Sites in Jeopardy
 - AMNet
 - Fairly stable
 - Adding site in Mexico City, plans on a second site
 - AMoN
 - 3 potential sites coming (Eastern Shore, MD; Southern California; EPA/OAQPS)
 - Losing 3 sites (Toolik (AK96); Reserve (KS03); WA24 will not move forward)
 - MDN
 - Adding MI52, MN05
 - Losing Coffeerville (KS05)
 - NTN
 - Adding NY52, 99NY, 99VT, AB35, OK01, TX03, Choctaw Nation
 - Losing CA28, AZ97 (Petrified Forest), NY59, WI92 (NTN and MDN) needs funding
 - IL46 Mothballed/site move
 - Ponca Tribe may come in?
 - Adding SC03 (NTN/MDN), WA04 (NTN/MDN)

Discussion

Tim Sharac: One idea was kind of discussing with EEMS a little bit is travel costs for audits. Nothing to do with our contract, just fuel prices in general. Hotel prices in general and everything else. Are there ways for us to maybe have like a local auditor? You know, much closer within a few 100 miles of the actual site. Instead of asking our one single auditor to travel 50,000 miles per year, which is a lot. I mean it's worked so far. You know it's great, but when travel, when the price of diesel goes up, say 40% or so, those costs are borne by us because we have the contract, so is there any room for exploring the idea of someone more local? I'm thinking Alaska. Just to pick a place, where the travel costs are prohibitively expensive and the audit costs are very minimal, maybe someone more local to the site would be able to perform an audit for NADP. A comment or push back on that idea. I'm just throwing that out there. It's not the salary cost, it's just that the plane ticket and the shipping of all the equipment: it's nothing we can really have control over, and when those costs rise dramatically with tighter budgets it just, you know....

Winston Luke: I don't know that there's any remedy here, but the shipping costs are ridiculous. I don't know if there's any way to effect this change, but if we can somehow spin shipping through a federal contract, that would help, it would help dramatically. The Department of Commerce has a small package contract with UPS and we get phenomenal discounts on the shipping. I mean 75-80% discounts. Unfortunately, I don't know programmatically or budgetarily how we could accomplish that. But you know it's pretty outrageous that shipping costs are approaching \$200,000 a year.

TS: Greg, were you going to say anything?

Greg Wetherbee: Yeah. So first of all, I wanted to acknowledge EEMS and Eric and his crew for all the work that they're doing for us, which is just invaluable. I mean I don't know what we would do without those guys right now. We have and the program obviously has been really great to work with and helping us to access their

services and make that all that happen and so I would say that Eric mentioned that they're re-competing the contract and that they're in the game here, at least until mid August or something like that. And so we have, we have two sites that we need to move. MT00 is probably going to be moved. It's not for sure yet, but it's looking that way. And then IL78, we have to move that site. There are other things that we need fixed in the field, small things that aren't as expensive, but I think we have some resources left whereby the program office can use it for a variety of things, really. If you want to be able to use EEMS to move sites or do some repairs or something like that. You know it's really for USGS sites, but at the end of the year, if we have something left in the tank, we have to do something with it. I'm just throwing this out there and Doug would have to be the final decision maker on this. But, in the interest of keeping the network going and trying to orchestrate different changes in the network and site moves and things like that, I think that we can have a discussion about how that can happen. I don't really have any availability myself to get in the field too much, but I might have to make a trip here and there too, so we'll see how that goes. But I think that we're talking about moving some sites around and closing some, unfortunately. I just want to make sure that people know that they should pick up the phone and call us and call each other, you know, to try to make these things happen in the field. And then the other thing is, I've been preaching this all meeting long and I think it's good that every agency has to look at their sites that they're funding and look at their resources and then do some prioritization, but when you when you come right down to a list of sites that could be vulnerable, I think that's what we need to come together, in interagency way and say, alright, what's going to be the best thing for the national map here? Should we take out an expensive site and fund three that would normally go down. Because like I said, our site operation costs at some sites are astronomical, and if we can remove a site like that and not affect the national map but then fund some sites like in the West for example, where that would really affect the national map, then I think that we need to talk about moving those resources from one site to three or four. There are two sites in particular that are very expensive for us. And if we eliminated those we could fund anywhere from six or seven sites I think. But that means that the agency has to do the operation. We're talking about funding the NADP fee. And that works at a place like a National Park or perhaps Forest Service, where personnel are in the field on site that can do the operation as part of the already overflowing plate that they have. If people can operate a site as part of their network and they just needed funding at the NADP, that does that. That does a lot of things. We can take the equipment from a site that we're closing and that can be redistributed and that that lightens up things, especially if we have an Aerochem at a site that helps out the NED. And then if you know, obviously we can kill two sites and save six or seven, that's great. It also alleviates us from having to do these contracts with site operators. For the sites that I'm talking about, I think we have contracts that are pretty solid and in place for a while yet. And there's not an immediate need to renew those. But when we do have to renew those, it's not trivial anymore. It's taking us a long time to get contracts done. And also when we have a site operator retire, disappear, or otherwise quit, if it's in a remote area, it's really difficult to find a site operator and so if we're going to move resources to a site that where that's not an issue, that's a more sustainable model, then that works. And finally, I think the other thing that we need to really look at is co-locating NTN with MDN wherever we can and if that means ending a long term record somewhere, which is very unfortunate, I don't like it either, but if we have to pull a site and move it so it can be co-located with MDN or vice versa, moving an MDN site to an NTN site so we can consolidate the operations at that site and save costs, saves shipping, I think we need to do that wherever we can. Plus it does give you a consolidated data set with both mercury and major ions, which can be helpful. I think there's a lot of shuffling of the deck that can be done, but we have to do it together. We can't do this in a vacuum, one agency at a time. It has to be done as a group. I think that that we need to come together on this and we're not there yet, but I would rather do this now rather than wait for FY24. I think that we should have a plan in place with some scenarios for cutting a few or many sites – how will we handle that? We always put all our effort into saving costs, which is great, we need to do that and also determine where are we going to make the least amount of damage to our networks by cutting sites. I don't think we spend enough time trying to be creative about bringing in new money to the network so that we can do what we really need to do. I know that we can't lobby (Congress) and I get that, but there has to be some creative ways that we can at least knock on doors and say, hey there are

important networks that have been around for almost 45 years and we don't want them to go away. What can you do for us? So I think we need to find other ways to be creative about getting resources.

TS: Thank you, Greg. That was great. You're saying the hard words that we're kind of thinking, but not really voicing. Kind of illustrating on one idea that you were kind of expanding on, working together as multiple, federal agencies just from a federal perspective. I'm thinking like an Excel spreadsheet or something color-coded with stoplight colors, showing which sites incur above average expense, which are expensive, and then maybe below average expense, if you know push comes to shove. But that's a budget exercise and that's not my domain, but just as a simple cartoon that I can visualize. Again, we're open to ideas here.

WL: Greg, I go back to the time when my lab director wanted to cut a number of NTN sites. And to your credit, we got you on a zoom call and you made the pitch and you convinced him that, OK, maybe we drop operator costs, right? But we're still paying for analysis at Tennessee, paying for analysis at Oklahoma. And those were sites we were going to close. So here's a thought. Is it practical? Is it possible for the reps from the federal agencies to make a concerted effort to bring to our meetings some of the decision makers, the money managers, heads of the relevant agency divisions that make these budgetary decisions? Because it's really easy to cut a budget when you're looking at a number on a page. But your ability to convince Ariel not to carry out the cuts that he wanted to do. I never thought that would happen. It may be worth a shot so, but we saved the worst. We staved off the worst of the cuts. Now. I realize we're only sponsoring a handful of sites, but still.

GW: Yeah. Well, I mean, I can't speak for every agency. My recent experience with my agency would send chills down my spine to invite them to something like this because of what? You know, decisions were made previously. I think that maybe in some agencies like yours, for example. You know, great. It worked for now, you know. I don't know. I can't read the tea leaves with my agency. But you know our experience of late has not been positive.

TS: One thing Eric and I were talking about yesterday was that EEMS has little beacons on their vans. And I know that seems kind of silly. But Greg, you want to know where the vans are going? Traveling cross country. They're within 50 miles of a site that needs a new sensor, and EEMS is close by. We've been trying to explore the idea of sharing the site audit schedule and we can preemptively share roughly here where the vans will be roving around the country. Instead of like, let's start back from zero, send you from Fort Collins or wherever to head out. But you know it just makes sense and we don't need congressional approval, we just e-mail or call and say, hey, look, he's going to be right there. And there's some cost sharing, right? This is how we've been doing it, and it just kind of works. Amongst our really small group here but, but you know this is kind of how we apply the things that we can do, to work together because it's not just an EPA contract that pays three vans to rove around mindlessly and just whatever we want to do, but partner with you guys and just help you know in real time.

WL: The audit schedules, coordinating in advance: they don't go out in an e-mail blast to the listserv, do they? I don't get them, maybe we should just disseminate that more widely?

Dana Grabowski (?): We've already kind of been doing that. I kind of coordinate because I know the EEMS schedule and we've been doing monthly meetings, which Greg has been invited to and he attended the last one. And I kind of tend to take a look at sites nearby that I know are also having issues that they might be able to stop by. And I think there was a site in Missouri: I think EEMS replaced the event recorder cable when he was driving by so. But it makes sense, yeah.

Eric Hebert: And we try to do our best for cost sharing and to be efficient and not only would we also reach out to our other clients that are in the same areas and say if we're going to do some work for say an SO2 monitor that needs to be audited, we will put some CASTNET or NADP sites that are nearby on that same schedule to cut down the travel costs for you. And I know Greg at one time put together or shared a map of a combination of networks across the United States. So it wasn't just NADP, CASTNET, and our private clients, but there are other networks that might be able to benefit from service in the area if they know that there's somebody driving by. So that would also help to share the cost of travel if we could somehow implement that process.

TS: Anybody else?

Cari Furiness (from chat): Maybe sponsorship for site surveys from Google Earth. They can capture street views along the way.

TS: Oh yes, you get all the national parks. The other question is posted earlier in the chat (Mary Lynam), is whether USPS is competitive and efficient compared to UPS and FedEx, which we've heard referring to the shipping costs? Yes, that's the question for David, if there are others – is USPS more cost efficient than the UPS or FedEx?

Amy Mager: It can be less monetarily, but it often takes quite a bit of time for things to get there, so we have a few sites that we need to use Postal Service for: a couple Canadian sites typically. But USPS is not one of our choices because of the long shipping period.

GW: Yeah. Our experience with shipping has been that, you know, we get such an incredible discount with FedEx, just like Winston was talking about. It doesn't make sense for us to use anybody else unless a laboratory like Rodolfo's for example, is paying for the shipping and then we shipped DHL. I don't know what's going on with FedEx, but two months ago we shipped a package to Japan. I think it cost us 21 dollars or something like that. And the next month, the same size package was about \$272. And then we had a package going to Norway to NILU that was about 41 dollars, and that increased to \$296 or something the following month. Come on. And so I protested it and at first they said, you know, no, the higher prices are right. And I thought can't be. And so I pursued a little bit more and I think they backed off and have gotten the charges reduced substantially, but shipping is going through the roof and you have to watch it like a hawk, too. Because I think that they're making mistakes in their favor, but I would be very hesitant to shoot to to ship Postal Service. I think that FedEx for us is very competitive, extremely competitive. Yeah, if people can take advantage of the NED's rates, that's great, but that that does put a burden on them so. And that's one way to control costs.

CF (chat): Related, are there federal contracts with UPS or only FedEx?

WL: With both, and I thought it was government wide, but...

TS: FedEx is cheaper.

WL: I think I've asked this question before but I'll ask it again. I realized that only a portion of the NADP budget spins through NIFA, spins through USDA, but I wonder if there's any budgetary mechanism by which we can maybe use a USDA discount, through the NIFA agreement that would apply to NADP?

GW: It's worth asking. We're having an executive committee meeting tomorrow, and they're going to be in it, right? So...

TS: OK, I think that's if there's nothing else. Look, I know this is painful, but who among us doesn't look at Amazon.com and start sorting by low to high? You know, just saving money is just, well, something. maybe just I do. This is, I know this is painful and gloom and doom. I hear you. But you know. Where we can tackle this, we're pretty smart people, so.

GW: I mean, I'm usually gloom and doom, but I'm encouraged by the sites that are joining the network. I think that this is good news about, the potential for AMoN. There was good news in the AMSC meeting with the potential once again for starting a national automated pollen monitoring that could happen. We've got some new NTN sites: look what's happening in Alberta. I mean, it's not all bad news, it's just bad news on the federal side right now. I think there are some reasons to be optimistic. I know that that sounds really weird coming out of my mouth. But you know, I think that, yeah, I'm encouraged by what David's presented and I think that we can do some smart things to do some consolidation and collaboration. Yeah, close a few sites, but we'll keep the wheels on the cart and we might just be a lot better off for it.

Program Office Review Response (Richard Tanabe)

- Background: October 4-6, 2022
 - Purpose: determine how well Program Office functions and processes are serving the NADP stakeholder community and to suggest improvements if warranted
 - Scope: communications, data management, data publishing and display, network support, and financial management
 - Last review that will focus solely on the PO – future reviews will be integrated PO/Lab
 - Review Team: Doug Burns (USGS), Kristi Morris (NPS), Chris Rogers (WSP), Catherine Collins (US FWS)
 - Several recommendations (suggestions for consideration) and findings (request a formal written response)
- Highlights
 - Communication among staff members are sound – meetings, spirit of cooperation, open door policy, team approach to management
 - Transition of Bob Larson's duties is well underway – Richard assumed web site, Mark is handling data, Dana precipitation review, Wyatt data logger programs, key transitions that needed to occur before Bob retired
 - Financial system appears outstanding – invoices, accounting, financial projections, Nate LePak is a real asset to the program (Nate left WSLH on 3/24/2023)
 - NED – well organized, good working space, efficient operation, SOPs for equipment Installations
- Recommendations
 - Position Responsibilities and Management (3)
 - Quality Assurance (3)
 - Data Management and Presentation (7)
 - Network Communication (1)
 - Financial Management (2)
- Findings: Quality Assurance
 - 1. Develop a plan and timeline to evaluate data uncertainty for the NADP networks
 - Response: In recognition of the enormity of the overall DQO task, and very limited resources, The PO prioritized the DQO effort to focus on Assessment of Overall Network Uncertainties (d), and Parsed/Component Network Uncertainties (e) – i.e. NADP data product uncertainties.

- The PO will draft a more detailed plan for assessment of the uncertainties outlined in work areas (d) and (e). These plans will be presented to the QAAG for review and approval prior to the Fall 2023 meeting.

2. Update the April 2016 Network Quality Assurance Plan

- Response: The network QAP was reviewed and finalized internally, it was sent to QAAG for Review and approval on 4/6/2023. Awaiting final approval from QAAG before posting on the website.

- Findings: Data Management and Presentation

3. Prioritizing transition of front-end LIMS functions to Horizon

- Response: The WSLH would also like for NADP LIMS to substantially move to Horizon and away from our minimally supported, University of Illinois-developed, LIMS.

- During November, we had an initial meeting with Mike Anderson (OIS Director of Web and Application Development).

- Due to other major development projects ahead of us, it will be at least next year (2024) before OIS can move us over to the Horizon LIMS.

- Findings: Data Downloading from website

Given the importance of data delivery to users from the web site, the updates to the web site to fix these issues should be the highest priority for the PO/OIS management, including a new agreement with DoIT, if necessary.

4. AMoN data are not downloaded from a final, static database table

- Response: Bob had constructed the database tables and performed an initial data transfer into the review tables (Oct/Nov 2022).

- SQL procedures were created to move lab data into a transfer table for review, then into the web tables for publication.

- Functionality of scripts reviewed with Mark, and what checks are done before publishing to the web.

- The tasks to complete with AMoN are:

Review and correct data per Bob's recommendations

Move data to web table

Update web page to use web table in lieu of the current script

5. There are issues with the DoIT widgets developed. Some widgets are using the wrong API calls.

- Response: The OIS programmer is in the process of documenting all the API calls and creating a list of what needs to be fixed for DoIT

- We are currently testing all APIs

- OIS programmer to work with DoIT to updates website, dependent on their schedule.

- Findings: Datalogger Programming

6. The informal notes on the data logger programming needs to be documented in a formal SOP

- Response: The SOP was completed by Wyatt Sherlock and submitted for internal review on 3/15/2023.

- Findings: Precipitation Review

7. PO needs to develop a formal SOP documenting the precipitation review process.

- Response: Substantial sections of this review process are detailed in the Draft Data Management SOP. The precipitation data review application is currently under development, it will have similar functionality but also improvements. Dana Grabowski will finalize this section when the new system is in place.

- Completion: Fall Meeting 2023

8. Precipitation is the most valuable type of climate data provided by the combined networks, and the deployment of nearly 350 electronic rain gages operated throughout North America with

excellent, consistent quality assurance is a valuable (and marketable) asset. Availability of the precipitation data (daily) on the public website should be a focus whenever possible based on staffing resources.

- Response: We concur with the review team's finding. The NADP PO will explore the development after formally charged to do so by the NADP Executive Committee. If so charged, in Spring 2023, such capacity may be built in about a year's time, dependent on staffing resources and DoIT coordination for front end.
- Findings: Network Communication
 - 9. Develop a process that effectively gathers network problems from all sources of information and provide data available in a centralized location for all to address the issue.
 - Response: Resolution of this finding was started shortly after the program review, and the solution was implemented on 10/18/2022.
 - "Site Support Hub" is a Google Sheets (Google App Script) based spreadsheet that tracks all of the communications with sites
 - Common equipment issues are identified through precipitation review.
 - It is continually being improved based on needs and requirements.
- Summary
 - Final Review Team report received 11/22/2022
 - Written response submitted to Review Team on 2/13/2023
 - Review final report and response submitted to QAAG for review/comments on 4/6/2023
 - PO presentation of Findings response 5/4/2023

Discussion

Tim Sharac: Well done. Thank you.

PFAS Update (Martin Shafer)

- Sources, Transport, Transformations, and Sinks of PFAS
 - Large uncertainties
 - Point sources and fugitive emissions, aerosol injection, diffuse sources (POTW fields, landfills, sea spray injection)
 - Cloud processing and oxidative transformation, Long range transport
 - Wet and Dry deposition
 - Gas-phase PFAS very effectively partition to CCN and ice crystals. Rain (and snow) "amplification" of PFAS.
 - Within-cloud processing
 - Gas ⇌ Particle Phase Reactions @ CCN Surfaces
 - Transformation of Surface-Sorbed Precursor
 - Multi-phase Chemistry
 - Aerosol Microphysics
 - Nucleation of Cloud Droplets
 - Below-cloud processing
 - Rain-out of Dissolved & Particulate PFAS
 - Wet-Deposition Scavenging of Aerosol-PFAS
 - Precipitation is an efficient scavenger of certain forms of PFAS and a major pathway for transfer of PFAS from the atmosphere to the hydrosphere. Speciation and transformations are key to understanding wet-deposition of PFAS).

- PFAS Studies – Field Methods – NADP Integration: Summary
 - Loss of PFAS is minimal for compounds of carbon number <10 under current NTN protocols
 - Losses are observed for longer-chain (>10 carbon) PFAS compounds: but recoverable with a MeOH rinse of the bucket
 - The current NTN protocols are “CLEAN” for a broad range of PFAS compounds.
 - Standard NADP collection protocols can be readily modified to address losses of longer-chain compounds (MeOH rinsing).
 - Most NADP-NTN sites are now configured for “bag-in-bucket” collections and we are evaluating the PFAS blank and sorption characteristics of the NTN bags, and preliminary data indicate no detectable contamination and minimal sorption of PFAS.
 - Currently we have long-term studies at six NTN sites evaluating the efficacy of bag collections, and for those sites, MeOH rinsing, if it is required, will be performed back in the lab (not the field).
 - Precipitation (and Air) are effective monitoring matrices for detection of trends (likely better than other environmental receptors).
- WSLH-NADP PFAS Tool-Box
 - Developed a standardized robust protocol (SOP) for PFAS wet-deposition measurements using the NADP-NTN infrastructure
 - Incorporates optimized analytical methods
 - Will support site-specific, state, regional, and national PFAS wet-deposition efforts
 - Model (process) for other emerging contaminants
- Wisconsin 2020 PFAS in Precipitation Study: NADP/NTN Monitoring Site Map
 - PFAS in precipitation monitoring at 8 NADP/NTN sampling sites in WI
 - 33 PFAS compound method
 - Two studies: 91 Wet-Deposition samples
 - Spring/Summer 2020: Background study at 7 sites (14 weeks)
 - Fall 2020: Source study at 2 sites
 - Marinette: temporary installation (point-source impacted)
 - Trout Lake: permanent site
 - Pfothenauer D., Sellers E., Olson M., Praedel K., Shafer M. 2022. Atmospheric Environment 119368.
- WI 2020 Study Results – Frequency of PFAS Detection
 - 22 PFAS compounds were detected in at least 2 samples (6 others in just 1 sample)
 - Carboxylates (PFCAs) were by far the most frequently detected PFAS compound class
 - The C4 – C9 PFCAs were each quantified in over 90% of the samples
 - With the exception of PFOS, the sulfonates (PFSAs) are much less abundant in precip
 - Fluorotelomers (FTSAs) and Sulfonamides (FASAs) are less frequently detected, but important at certain sites
 - Abundance of the PFCAs generally is inversely proportional to carbon number
 - The high relative abundance of PFCAs, reflects:
 - Emission sources
 - Transformations in the atmosphere
 - Precipitation washout factor
 - (PFAS compound analytical menu)
 - High concentrations of 6:2 FTSA at WI19 points to clear influence of PFAS point sources on precip
- Study Results – PFOA, PFOS, Sulfonamide Concentration
 - Evidence of seasonal pattern in concentrations – highest in Spring
 - Elevated concentrations at Brule River, Devil’s Lake, Perkinstown, Spooner and Marinette

- Range from < 0.2 ng/L to > 2 ng/L (at Devil's Lake) – above the Danish MCL & proposed WI groundwater limit, 2 ng/L
- WI 2020 Intensive Study Results – “Washout effect”
 - Several other published studies have noted an increased PFAS concentration for shorter rain-events – or less precipitation over the sampling period.
 - Suggests a potential “diluting” effect, where most of the PFAS is rained out within the first few millimeters of rainfall. Any additional rainfall may thus cause a dilution of the final PFAS concentration. Indicative of below-cloud processes.
 - Some relationship between PFAS species and this washout effect noticed (especially lower carbon number compounds & 6:2 FTSA).
- PFAS In Precipitation EPA-ORD Pilot Program
 - “Long-term” Monitoring for PFAS at NADP-NTN sites
 - John Offenber, John Walker, Melissa Puchalski, Doug Burns, Andy Johnson, Martin Shafer
 - Expand “synoptic” sampling using NADP infrastructure
- PFAS in Wet Deposition: 1st Phase Sampling Initiated Fall 2020. Continuing until July 2023
 - Casco Bay-Wolf's Neck Farm, Freeport, ME (ME96)
 - Site Sponsor: ME DEP
 - 2-years
 - Start 10/13/2020
 - Whiteface Mountain, NY (NY98).
 - Site Sponsor: USGS. Partner: SUNY Albany
 - 2-years
 - Start 09/01/2020
 - Washington's Crossing, NJ (NJ99)
 - Site Sponsor: EPA/OAP/CAMD. Partner: NJ DEP
 - 2-years
 - Start 09/01/2020
 - Duke Forest, NC (NC30)
 - 3 years of wet deposition: single sampler: for targeted PFAS
 - Start 09/08/2020
 - Including co-located triplicate samplers for PFAS wet deposition (several years)
 - NC96, NC97 Start 11/10/2020
- PFAS in Wet Deposition: 2nd Phase Sampling
 - Started Oct. 2021 and March 2022. Continuing until July 2023
 - Kickapoo Tribe, Powhattan, KS (KS97)
 - Site Sponsor: Kickapoo Tribe
 - 1-2 years
 - Start Oct. 2021.
 - Bronx, NY (NY06)
 - Site Sponsor: NYSERDA
 - 1-2-years
 - Start Oct. 2021.
 - UW Arboretum, WI (WI06)
 - Site Sponsor: UW-Madison/WSLH/NADP
 - 2-years
 - Start March 2022.
 - Devil's Lake, WI (WI31)
 - Site Sponsor: WDNR

2-years

Start March 2022

- Phases 1 and 2 sites:
 - Isolated: NY98
 - Rural: KS97, ME96, WI31
 - Suburban: NC30 (NC96,97)
 - Urban: NJ99, NY06, WI06
- 3rd Phase, Fall 2022
 - WY94 Grand Tetons NP
 - AK03 Denali NP
 - WA04 Umatilla Tribes
- Status of EPA-ORD/NADP PFAS in Precipitation Initiative: Sample Collection/Processing
 - 735 precipitation samples have been collected & processed as of March 2023. Average field sample yield = 69%
 - Reasons for <100% PFAS Sample Yield
 - Dry weeks
 - Insufficient volume/pooled weeks
 - Debris contamination
 - Most extensive study of its type in scale and scope ever conducted
- PFAS Compound Detection Percentage
 - All Sites Pooled: September 2020 to September 2021, 192 Samples
 - To date, over 735 precipitation samples (90+ from a given site) have been collected, with now full two-year+ weekly records for many sites.
 - Highest percent detected for PF Carboxylates
- PFAS Annual Wet-Deposition Fluxes: Sum of all Detected Compounds (33)
 - Study period = Sept. 2020 – Sept. 2021 for EPA Pilot Sites, 192 Samples
 - Study period = April-August (Nov.) 2020 for Wisconsin Sites, 91 Samples
 - Deposition range: ~900-3600 ng m⁻²
 - For Wisconsin sites, similar deposition at isolated, suburban, and urban sites ~1700-3600 ng m⁻²
 - For EPA PFAS pilot sites, larger deposition at urban sites (~2500 ng m⁻²) than at isolated, rural, and suburban sites (~900-1450 ng m⁻²)
 - These fluxes are very significant for many environments, e.g., large lakes with long residence times and terrestrial environments with few point sources.
- Co-Located Sampler Precision: NC Duke Forest
 - 2 Collection Periods
 - May 11 – June 01
 - August 24 – August 31
 - 7 common PFAS compounds
 - With a few exceptions, very good/excellent precision across co-located samplers for all species, even at low concentrations
- Throughfall Collections at Duke Forest (NC)
 - Collectors moved from NC30 field to under canopy on March 15, 2022
 - Substantially higher PFBA concentrations under canopy (throughfall) than in direct precipitation
 - Stresses importance of dry deposition of PFAS compounds
- Key Points/Lessons Learned
 - Concentrations of individual PFAS compounds in precipitation are typically <1 ng/L, though levels can be significantly higher at specific sites/dates. However, the summed PFAS levels can exceed proposed water quality criteria.

- Regional/background PFAS atmospheric deposition, even in the absence of a local source, may represent a/the dominant PFAS flux to both terrestrial and aquatic landscapes.
- The carboxylates (PFCAs) dominate the PFAS composition of precipitation – primarily as a result of atmospheric processing.
- Legacy PFAS compounds (PFOS, PFOA) are STILL major contributors to PFAS atmospheric pools
- Will remain problematic due to high persistence, widespread contamination and atmospheric cycling.
- With the appropriate datasets and modeling tools, one should be able to resolve point/local sources from regional/background levels and sources.
- A comprehensive field and laboratory quality assurance (QA) program is absolutely essential to the production & documentation of high quality, defensible atmospheric PFAS data.
- Network Updates
 - EPA-ORD Pilot Program
 - Complete 2020-2021 dataset submitted to EPA last year. External data quality audit completed. Next step, manuscripts.
 - Complete 2022 dataset to be submitted to EPA (and external auditor) by mid-May 2023
 - Expansions
 - Two NTN sites in New Mexico. Collaboration with USGS. Start early summer 2023. Multiple years.
 - Major New Jersey DEP effort.
 - Three existing NTN and one new NTN site. Two year precipitation program.
 - Two additional sites TBD. 1 year.
 - Air (aerosol, vapor) monitoring at two sites for 1 year.
 - Passive air samplers at several sites.
 - Start early summer 2023.
- PFAS – New Method Development
 - Optimization of PFAS Extraction from PUF/XAD Substrates
 - Solvent type & mixture (methanol, ethyl acetate)
 - Extraction platform/energy (Soxhlet, shaker table)
 - Extraction time (30, 60, 120 min., 24 hours)
 - Isotopically-labeled surrogates & target compound recoveries
 - Spiked substrates & field samples
 - Blanks, LC/MS/MS interferences/chromatography
 - OPTIMAL: 70:30 MeOH:EtAc, 120 minute, shaker table.
 - Further Enhancement of LC/MS/MS LODs:
 - Double LC injection volume (1 → 2 μL)
 - Shift cal curve to lower concentrations (0.05 – 10ppb)
 - LOD studies with 250 mL SPE volumes
 - IMPROVED LODS: 0.03 – 0.10 ng/L (33 PFAS compounds)
- Gas and Aerosol–phase PFAS Measurements at Selected NADP Sites in Parallel with Precipitation Collection
 - Funded by EPA
 - At Eagle Heights and Devil’s Lake
 - Triplicate Co-located Hi-Vols: Vapor and Aerosol Phase PFAS
 - Duplicate Co-located N-CONS: Wet-Deposition (PFAS Dedicated)
 - E-Raingage
 - One-Year Intensive
 - Targeted Analysis (33 compounds)
 - EOF & NTA (selected samples)
- High-Volume Air Sampling for PFAS: Evaluation

- Precision
 - At least duplicate co-located samples from each collection
- Accuracy/Recovery
 - Isotopically labeled surrogates (24) spiked onto substrates
 - Target compound (33) spikes – “special” sampler
- Contamination
 - Field blanks
- Sampling Variables
 - Air Flow Rate [120, 230 L/min]
 - Collection Period [24, 48, 72 hours]
 - XAD Mass [15, 20, 25 grams]
- PFAS in Air
 - At both Eagle Heights & Devils Lake
 - 36 co-located (duplicate) sample sets
 - Primary and co-located Hi-Vols
 - 20 “special” samples (3rd Hi-Vol)
 - 8 field blanks
 - 4 field target compound spikes
 - 184 Total Sample Sets
 - 24 Total QC Samples
 - Aerosol and Vapor
- “Supersite” PFAS Source/Deposition (Devils Lake & Eagle Heights) Primary Study
 - Air (Vapor & Aerosol), Precipitation collection (Wet Dep), e-gage, Meteorological pack (T, RH, WS, WD)
 - Air PFAS concentrations: 0.1-10 (background), 10-1000 (point source impacted) pg/m³
 - Triplicate Hi-Vols at Devils Lake (DL), Duplicate Hi-Vols at Eagle Heights (EH)
 - Spring 2022 to Winter 2023
 - Atmospheric Deposition Receptors
 - Devil’s Lake Water Column and sediment core measurements
 - Soil cores at Devil’s Lake and Madison area
- Devil’s Lake Sediment Coring
 - February 2023
 - Seepage lake in rural WI
 - Cores sectioned at 1cm intervals.
 - 25 sections Devil’s Lake, 40 sections Hope Lake. Approx. 1920 at base.
 - Will date cores using ²¹⁰Pb, ¹³⁷Cs and ⁴⁰K.
 - Organic carbon, elements
 - Very few published dated PFAS lake sediment cores.
- Hope Lake Sediment Coring
 - February 2023
 - Seepage lake in Southern WI near Dane County
 - Receptor of emissions from Madison metro area
- PFAS in Cloud water: Sourcing & Processing
 - At Whiteface Mountain, NY
 - Collaboration between:
 - SUNY Albany: Sara Lance, Chris Lawrence
 - EPA-ORD: John Offenbergl, Melissa Puchalski
 - WSLH: Martin Shafer

- Archived samples: (June-Sept.)
 - 7 from 2018
 - 7 from 2019
 - 7 from 2020
 - 8 from 2021
- 5 Collector Rinses
- 3 Field Blanks
- 5 Trip Blanks (bottle blanks)
- Cloud water concentrations 10X-40X those in precipitation
- PFAS Collection Protocol & NTN Bag Testing
 - Can we move the NTN PFAS “network” to bag collections?
 - Most sites are currently using buckets without bags
 - If we move to bags, is the methanol rinse necessary?
 - With the current bucket collection, the methanol rinse of the bucket is required for quantitative recovery of certain PFAS compounds
 - If the methanol rinse is still required with bag collections, can the rinse of the bag be performed at the NADP/WSLH laboratory?
 - The methanol rinse is currently performed in the field by the site operator
 - Blanks: MQ matrix. 7-day trials. Aqueous and MeOH rinse collections. Bagged-buckets.
 - Spikes – MQ matrix. 33 PFAS compounds – 1 and 5 ng/L levels. 7-day trials. Aqueous and MeOH rinse collections. Bagged-buckets.
 - Spikes – Ambient precipitation matrix. 33 PFAS compounds – 2 ng/L levels. 7- and 3-day trials. Aqueous and MeOH rinse collections. Bagged-buckets and Buckets.
 - Field collections from bagged-buckets. Aqueous and MeOH rinse of the bag.
 - Long-term stability studies in 1L NTN PP bottles. 0.5, 1, 2, 3, 6 months. 33 PFAS compounds. 1.5 ng/L. Frozen and refrigerated. Aqueous and MeOH rinse collections.
- Bag Study Outcomes
 - Blanks
 - No PFAS were detected at levels above their respective LODs in any of the blank trials
 - Target PFAS Compound Recoveries
 - With the exception of two neutral sulfonamides all target compound recoveries were Acceptable
 - Target PFAS in Methanol Rinses
 - The methanol rinse contains less than one percent of the spiked PFAS mass for all Compounds
 - Manuscript Drafted
 - “Development & Validation of Protocols for Measurement of PFAS in Precipitation using NADP-NTN Infrastructure”
- PFAS Measurement Approaches at the WSLH
 - Total
 - PIGE, XRF, NMR, GFAA-MAS, TOF/CIC, EOF/CIC, AOF/CIC
 - Non-targeted
 - QToF/MS, Orbitrap, Discovery, Suspect-Screening (Semi-Quantitative)
 - Total Oxidizable Precursor (TOP)
 - Assessment oxidizable precursors
 - Not all PFAS are “forever”
 - Oxidative conversion of targeted & unknown precursors
 - Protocols are in-place

- Coupled with targeted
 - Targeted
 - LC/MS/MS
 - 12-50 species
 - Quantitative
 - Tox relevant
 - Small fraction of total
 - Volatile
 - GC/MS/MS
 - Quantitative
 - Neutrals
 - e.g. FTOHs
 - Air relevant
 - Combustion Ion Chromatography (CIC)
 - Total PFAS (AOF, EOF)
 - What fraction of total PFAS are we measuring with targeted methods?
 - Instrument system installed & validation complete
 - Assessment of EOF/TOF in various matrices underway
 - Metrohm-Profilor:
 - Most recent generation of CIC (2021). Enhanced for fluorine. Designed for PFAS application.
 - All components fully interfaced & automated
 - Determination of TOTAL Fluorine
 - Total Organic Fluorine
 - Extractable Organic Fluorine (EOF)
 - Adsorbable Organic Fluorine (AOF)
 - APHL Environmental Health Fellow at UW-Madison/WSLH focused on CIC method/applications for precipitation and other environmental matrices
- Quantifying multi-media loadings of PFAS in the Great Lakes basin using targeted and non-targeted Analyses
 - Research Project Funded by USGS NWRI
 - Investigators: Remucal, Shafer, Corsi
 - 3-years, January 2022- December 2024
 - Use multiple techniques to quantify PFAS in tributaries, precipitation, open water, and sediments to:
 - Estimate partitioning within the water column
 - Provide point-in-time loading estimates
 - Perform source fingerprinting.
 - 30 Tributaries, Lake Superior
 - 5 Dated Sediment Cores, Water column
 - 8 NADP/NTN Sites, 2+ Years
- Tracing Atmospherically Deposited PFAS from Source to Sediment in the Great Lakes Region
 - Research Project Funded by USGS NWRI
 - Investigators: Frie, Ulrich, Shafer
 - 3-years, January 2023- December 2025
- Characterization of Disperse PFAS sources to groundwater using targeted and non-targeted analyses
 - Focus in fingerprints in various sources of PFAS to Groundwater
 - Use multiple techniques to:
 - Characterize PFAS in disperse sources likely to impact groundwater

Quantify leachability, and
Perform source fingerprinting.

- Components

Biosolids (n = 10-15)

Landfills (n = 5)

Septage (n = 25 OSSF)

Atmospheric Deposition (n = 20)

Wastewater Effluent (n= 6)

- Analyses

Extractable Organic Fluorine (EOF)

Non-target High-Resolution Mass Spectrometry

Total Oxidizable Precursor (TOP)

Targeted PFAS by LC/MS/MS

Discussion

Unknown Speaker: Two things, Martin. Because of the Tycho(sp?) plant in Marinette and the industry in Wisconsin, is our area of the country considered more prone to PFAS contamination?

Martin Shafer: From those annual estimates I showed, I don't think we're any worse. There may be certain areas that we haven't captured yet, but I think in general, a good portion of the population are probably seeing similar atmospheric precipitation. But localized impacts from emissions to the air will impact the surface waters, too. There are many other sites in North Carolina and West Virginia, and other places that probably have much greater regional impacts from their industry. PFAS concentrations in the air are 1-50 pg/m³ so they're low, but that's what supports the concentrations in the rain.

John Offenberg: Said another way 10 or 50 pg/m³ with an extremely water favorable Henry's law constant means the connection. I'll briefly jump in and say I would not expect Wisconsin to be the lowest nor the highest – it is probably an average state. Some of the higher expected concentrations in air are probably around the chemical synthesis facilities and to my knowledge that's not centered here in the United States.

PFAS in Archived Cloud Waters at Whiteface Mountain (John Offenberg)

John opened with a reading from the EPA's Safe Water Drinking Act website:

“On March 14, 2023, EPA announced the proposed National Primary Drinking Water Regulation (NPDWR) for six PFAS including perfluorooctanoic acid (PFOA), perfluorooctane sulfonic acid (PFOS), perfluorononanoic acid (PFNA), hexafluoropropylene oxide dimer acid (HFPO-DA, commonly known as GenX Chemicals), perfluorohexane sulfonic acid (PFHxS), and perfluorobutane sulfonic acid (PFBS). The proposed PFAS NPDWR does not require any actions until it is finalized. EPA anticipates finalizing the regulation by the end of 2023. EPA expects that if fully implemented, the rule will prevent thousands of deaths and reduce tens of thousands of serious PFAS-attributable illnesses.

EPA is requesting public comment on the proposed regulation. The public comment period is now open following the proposed rule publishing in the Federal Register on March 29, 2023. Public comments can be provided at www.regulations.gov under Docket ID EPA-HQ-QW-2022-0114. Comments must be submitted during the public comment period that ends on May 30, 2023.

EPA held an informational general overview webinar of the proposed PFAS NPDWR on March 16, 2023, and another informational webinar about the proposed PFAS NPDWR specifically for water utilities and the drinking water professional community on March 29, 2023.”

Post-hoc update as of March 18, 2024 – The public comment period ended on May 30, 2023. EPA's proposed rule received over 120,000 public comments. The public docket can be accessed at www.regulations.gov under Docket ID: EPA-HQ-OW-2022-0114. On May 4, 2023, EPA held a public hearing on the proposed PFAS NPDWR (supporting documents below).

EPA submitted the final Per- and polyfluoroalkyl substances (PFAS) National Primary Drinking Water Regulation (NPDWR) for interagency review in winter of 2023. This final rule considers public comments and EPA looks forward to issuing the final rule after interagency review concludes.

Regulation proposes Maximum Contaminations (MCLs) – similar to NAAQS for atmospheric pollutants. They are human-health based.

- PFAS in Ambient Atmosphere – ORD Plans & Ongoing
 - Cloud Waters – exploratory analysis of archived water samples
Whiteface Mountain. Collected near NTN: NY98 by SUNY-Albany
Modified ISO 21675 non-potable water Method by WSLH
- Cloud Water Archive Exploration
 - Whiteface Mountain, NY
 - ASRC SUNY-Albany
 - First 14 archived cloud water samples analyzed
 - Collection, transfer, and archiving techniques not evaluated
 - For the entire cloud water record, the cloud water collector is automatically deployed when all of the following conditions are met:
 - Liquid water content is 0.05 g m⁻³ or greater
 - Wind speed is 2 m s⁻¹ or greater
 - Temperature is 2 °C or greater
 - Heated grid rain sensor indicates no rain
- PFAS Wet Deposition – Overview of plans/coordination
 - Selection of Archived Samples
 - SUNY-Albany
 - Extension of existing Cloud Water analysis protocols
 - Coordination with SUNY-Albany and WSLH (supplies, QA)
 - Only samples of convenience (i.e. existing w/ sufficient water ~>250mL)
 - PFAS Analysis by Wisconsin State Lab (WSLH) after
 - Modified ISO 21675 non-potable water Method by WSLH
 - 33 PFAS compounds by isotope dilution, SPE-LC/MS/MS
 - No non-ionic PFAS compounds (e.g. FTOHs by GC)
 - No mono-chloro-polyfluoro-polyether carboxylates (Washington et al. 2020, Science) – a facility in Central NJ is the only place in North America that make these compounds
 - Potential to Develop: adding Non-Targeted Analysis (NTA)
 - Dependent on analyst & instrument availability
 - Cloud water samples, those that we have done and these are the only ones so far in the world, at Whiteface Mountain, are above 4 ng L⁻¹ (the proposed MCL)

What that means for human drinking water consumption is a huge question. What it means for ecosystem impacts, ecosystem services, all of that, that people in this room understand far better, is an additional set of questions.

Do we understand the role of in cloud processing versus transformations, degradation, Oxidation, before these compounds make it into the cloud? I would argue no, we don't. Those are some of the questions that we need to understand.

- Most of what is being observed so far in cloud waters, but mostly dominated by perfluorocarboxylic acids.

Is this an artifact of how these samples were collected?

Or this a true representation of what's in a cloud?

Unclear

That is the terminal or likely terminal oxidation product of whatever was released in whatever form it was released.

These are unfiltered, bulk samples

- PFBA, PFHXA, PFOA and PFOS, some of which are in 50% of the samples were some of those same compounds that are in the drinking water proposed regulatory process.

- The atmospheric processing of these compounds is very scientifically interesting and may have implications.

Discussion

Ryan McCammon: So what I'm curious about is OK, you have the ground based measurements. What about taking an airplane and flying through clouds and with fast analyzers for some of these compounds to see if there's any difference between what you're observing on the land as opposed to, you know, at various altitudes, those kinds of things.

John Offenberg: That's a great idea. Our agency works on the ground. NOAA works in the air. I am working in a parallel world with a postdoc doing fast online gas-only time of flight mass spectrometry. The folks at NOAA are also aware of it. I don't know what they're going to do. There's a fairly large field experiment this summer in New York City, AEROMMA, and I believe they're going to run their Aerodyne CIMS in the same sort of way.

Unknown Speaker: I want to thank both you and Martin for this, for maybe ruining my afternoon, because this is great science data from a public health standpoint. It's not good news to hear. I'll hear about how much we're seeing just out of the clouds when Martin starts talking about a little bit of the through fall and where that might go. It's just, it's great. I sure hope you know. It just shows us how much more funding is going to be needed to really get on control of this as a country, if we really want to. So hopefully this data will get some people thinking that way. But I appreciate the work we started with.

JO: I agree with you. I would say that the Office of Water might be 15 years ahead of OAR in terms of thinking and progress and what that timeline going forward is clear as clear as mud to me.

PFAS Deposition Modeling Implications (Krish Vijayaraghavan)

- Outline
 - PFAS Overview
 - Conceptual model
 - Sources and emissions
 - PFAS deposition properties

- Near-field vs. regional photochemical modeling
- Relevance of NADP measurements to modeling
- Long-range transport and deposition
- Background PFAS
- Summary
- PFAS Nomenclature
 - Polymeric (Fluoropolymers, e.g. PTFE)
 - In existence for 50+ years
 - Tend to be heavier, deposit very close to the source
 - Non-polymeric
 - Of great concern today
 - Perfluoroalkyl
 - Perfluoroalkyl acids (PFAA)
 - Perfluorocarboxylic acids (e.g., PFOA)
 - Perfluorosulfonic acids (e.g., PFOS)
 - Other
 - Polyfluoroalkyl (e.g., FTOH (Precursor))
- Firefighting foam itself has got PFOS and other compounds, which is a concern because it for obvious reasons. But also there are concerns about the turn out gear worn by firefighters. There was a recent report by NIST on the levels of PFAS in the gear, which could of course be an inhalation concern
- Conceptual Model for PFAS Dispersion and Deposition
 - Air emissions
 - Wet and dry deposition
 - Groundwater infiltration (a slow process)
 - Long range transport
 - Air dispersion and transformations
 - Runoff
 - Uptake to vegetation
 - Deposition to surface waters
 - Subsequent groundwater infiltration is faster
 - Re-emission from water
- PFAS Sources and Emissions
 - Large uncertainties in sources and emissions
 - Direct:
 - Production
 - Primary manufacturing (PFOA)
 - Limited scope in the US – moved to Asia and E. Europe
 - Secondary manufacturing (PFOA for PTFE)
 - Applications and use – more common source in US
 - PFOA for fabric coating
 - PFOS in AFFF for fire fighting
 - Disposal
 - Landfills, waste water treatment plants, incinerators
 - Indirect
 - Formation in the Atmosphere
 - Re-emission from water
- More than 30,000 facilities in the US use PFAS

- EPA 2021 Toxics Release Inventory: 44 facilities report air emissions of 1400 lbs exceeding threshold
- Number of industrial sectors and facilities reporting will increase with increase in the number of reportable PFAS (189 for 2023 reporting year)
- PFCA emissions from fluoropolymer production have “moved” from USA to Asia & Eastern Europe
Come back to USA through long range atmospheric transport and deposition?
- Some PFAS Properties Affecting Deposition
 - Terminal PFAAs very stable because of C-F bond and resist atmospheric degradation
 - Precursors such as FTOH degrade in the atmosphere to form PFAAs
 - PFCA and PFSA in anionic form in water and are highly water soluble with negligible vapor pressure.
So washed out easily in wet deposition
 - Henry’s Law is sometimes not completely valid for PFAAs because of surfactant properties
 - Ionic compounds in air typically in aerosols: PFOA present in very small particles (<0.15 μm)
 - Smaller particles (< 2.5 μm) travel further and are typically deposited at small levels afar
 - FTOH and similar compounds are more volatile than PFOA/PFOS and are present as vapor
 - Dry deposition can be higher than wet deposition for non-ionic PFAS
 - Dry deposition flux dependent on particle size
- Near-Field vs. Regional Photochemical Modeling
 - Both:
 - Provide estimates of the impact of air emissions on PFAS air concentrations and deposition
 - Require emission rates, source parameters, particle size distribution, deposition characteristics of emitted PFAS, meteorology, and land use
 - Model outputs typically include hourly concentrations and wet and dry deposition fluxes which
Are collated for locations and time periods of interest
 - Near-field dispersion models (e.g., AERMOD) provide higher resolution near source
 - Regional photochemical modeling (CAMx , CMAQ) useful for
 - Chemical transformation of precursors to terminal PFAS products
 - Long-range transport
 - Background PFAS deposition contributions
 - Source attribution and PFAS forensics
- Relevance of NADP PFAS Wet Deposition Measurements to Modeling
 - Useful for evaluating regional model predictions
 - Provide measure of background deposition
 - Identify focus regions
 - Highlight species of concern (e.g., long-chain vs. short-chain, Per vs. Poly)
- Long Range Transport and Deposition
 - Terminal products such as PFAAs have very low volatility and so are dispersed only when adsorbed on particles or dissolved in water droplets
 - Fluorotelomers like FTOH are very volatile and can be transported long distances
 - FTOH, PFBA and PFOA found in the air in remote areas such as Arctic
 - Potential for background deposition in the US from non-local sources including sources as far away as Asia
 - FTOHs → Aldehydes → PFCAs
 - Polymeric PFAS such as PTFE are likely to be transported only short distances due to high molecular weight and low volatility
 - Modeling studies indicate only a small fraction (typically <5%) typically deposits near the source. So, understanding background deposition is often important.

- Importance of Modeling and Measuring Background Air Deposition
 - Determine non-local emission source contributions to observed soil and water contamination
 - Contributions from long-range atmospheric transport
 - Estimate benefit, if any, of proposed emission controls on improving soil and water quality
 - Choose optimal locations for background soil sampling based on spatial patterns of deposition
 - Identify if a source did not contribute to observed water contamination because its emissions and deposition are not significant enough to affect runoff and water quality
 - No threshold for PFAS deposition. Should there be one like Critical Loads?
- Summary
 - Limitations in emissions inventories of PFAS for modeling
 - Uncertainty in the atmospheric deposition properties of several PFAS
 - Long-range transport and chemical transformations of PFAS can introduce background contributions to a site
 - While long-chain PFAS are being phased out, deposition due to historical emissions of long-chain and current emissions of short-chains can continue to be relevant
 - The combination of measurements and modeling of deposition can be a powerful tool to understand the contribution, or lack thereof, of air emissions to observed contamination

Discussion

Mike Bell: Krish, I just wanted to comment but yeah, I really think now that we're measuring this stuff, we have an idea of how much is coming down. It's worth starting to look into is it getting into the ecosystems, identifying some of those thresholds which we're seeing harm perpetuate through ecosystems. And now especially: I know we have a couple of sites in National parks. Maybe we need to start doing some litterfall collections and see where it's going.

Krish Vijayaraghavan: Yeah, absolutely. If anybody has any questions or wants to collaborate, I'm happy to talk. Thanks.

Conditions and Trends of N and S Deposition using TDep and Critical Loads (Mike Bell)

Mike Bell: This is going to be a follow up on my meet my presentation at the fall meeting last year where I was talking about how we're standardizing the application of critical loads to different federal Land Management areas. So what we did with all of that data is that we're putting it into this conditions and trends website that the National Park has managed for a while.

- National Park Service has been developing Condition & Trends reports since 2009
 - Online format
 - Visual, map-based approach
 - Colored site-specific indicators for conditions of each pollutant
 - green = good, yellow = fair, red = poor
 - Arrows denote trend of indicator
 - Up arrow = improving
 - Down arrow = deteriorating
 - Left and Right arrows = unchanging
 - Up and Down arrows = varied
 - Confidence in trend denoted by thickness of circle around indicator
 - Bold/thick line = high confidence
 - Medium thick line = medium confidence
 - Faint/thin line = low confidence
 - In last few years we collaborate with US Forest Service and FWS to use same type of

- analysis and provide data in a similar way
- Charts for visibility, human and vegetation health effects for ozone, PM, and mercury in biota (invertebrates, fish, birds)
- Graphical charts display numerical values for each pollutant with relevant thresholds for condition
- National map summaries showing conditions for each pollutant across the U.S.
- Graphical presentations of trends over time for pollutants, measured wet deposition and modeled dry deposition (PRISM)
- For Nitrogen deposition, also an analysis of component contributions to wet/dry (CASTNET) deposition
- Will be integrating the TDEP model to show how deposition is trending over time, and applying that to the ecosystem components that are there
 - The TDEP map uses three-year averages to minimize stochastic variation in precipitation or extreme weather events
 - Display the maximum, median, and minimum deposition that occurs within the boundaries of each of these land units
- User can then select a single site and it'll show you depending on what you select either a 10- or 20-year trend for each of the statistics there
 - For example, can black out the maximum and minimum trends, and display only the median trend
 - Data are also available in tabular form. User can see all the data points, the trends that are calculated from each of those, and a description data sources
- System will also show the component (species) contribution to median deposition based on the different TDEP maps
 - Seven different species for nitrogen, 3 for sulfur
 - Gives a general sense of what deposition type looks like in each of these land areas
- Using Ecosystem Responses to define condition
 - 8 ecosystem components with a response to N
 - 5 ecosystem components with a response to S
 - Condition is based on a three category system
 - Good, Fair, Poor
 - Use the Good/Fair benchmark as the initial CL of an ecosystem component are exceeded
 - Use the Fair/Poor benchmark if there is a significant amount of harm happening
 - Informs the level of concern a stakeholder may have, and invites a closer look at the data accordingly
 - Category Benchmarks
 - Identified critical loads and ecosystem response levels for each component and calculated exceedances based on resource locations
- Condition of Ecosystem Response
 - Pie chart showing the average condition of each component
 - Aquatic eutrophication, herbaceous communities, herb occurrence, lichen communities, Mycorrhizal communities, tree growth, tree survival, alpine communities
 - Color coded green, yellow, red (gray when no data are available)
 - Confidence based on number of components
 - Trend based on maximum deposition
 - Explanation of conditions, benchmarks for exceedances
- Overview
 - The report and associated tools are intended to be a piece of the critical load story for a park
 - Will link to the Critical Load Assessment by site mapping tool for locations of exceedances and

- the Critical Load Summary Reports for lists of species and their expected range of response.
- With budget cuts, etc., it is important to communicate the importance of the NADP sites by Producing clear, useful outputs to demonstrate the usefulness of the sites and how our ability to assess ecosystem health will disappear as these sites are lost
- Final touches
 - Currently wrapping up the methods documentation and QA/QC of data.
 - Should be available online at the end of June.

Discussion

Unknown Speaker: That was awesome. I was just wondering, what's your metric for Alpine communities and herbaceous communities? Is it growth and survival or?

Mike Bell: For Alpine, we have one that's an increase in sedge vegetation like the level of 3. We're trying to get more research done from more species and how they respond in Alpine, but right now it's based off a single species indicator. While for the higher level, it's based on nitrate leaching out of soil and Alpine communities. So when the soils are saturated, which is around 10. Herbaceous communities are based off of a decline in species richness. So at what level the increases that may occur with. Fertilization and more species come in start actually pulling species out of the ecosystem.

Unknown: Thanks. This is really awesome. So could I ask on what time scale you anticipate this being updated?

MB: Yeah, the cool thing about this is that basically put, every time there's a new TDep release, we will recalculate the exceedances and within a couple of months get a data release. (Garbled) ...are developed add lines and graphs to that and/or change the methodology to use the most recent critical loads in place of what we've done.

Unknown: OK, thanks. That's great. This seems super effective in terms of having it be a public communication and engagement tool that people can easily access and get a sense from red to green and red if it's good or bad. I was wondering if you've had any thoughts: certainly in the climate community and IPCC there's been so much thought put into communication of uncertainty. And I was wondering if, on a longer time scale, you have any thoughts for how some representation of the uncertainty in these processes might be represented in a way that the public could engage with or understand.

MB: Yeah, the CLAD Working Group 2 is focused on critical load uncertainty. We are close to getting a publication drafted around our understanding of uncertainty of each of the critical loads that are up here. We're hoping that the summary reports are going to have a detailed description of the certainty which of the species that exist, which of the areas that we're applying this to, or where it should be applied to, and once we have that data published, we're going to limit the application when that's the case to these parks. So we're not displaying information that we're not confident in. We don't want to tell someone something's bad or good if we don't believe the data says that that's the case. The other aspect of this is that the methods we're using here we want to be consistent across all the different products that CLAD is putting out. We want to make sure that we're saying species and ecosystems respond in the same way in the class tool and the reports and in any use they have, like flag for PSE (Garbled) or NEPA evaluations, so that we have a consistency. It's not going to make something an adverse determination. But the methods that are there could be the same methods we're going to use when we're responding to those kind of things.

Doug Burns: So we should think about these as steady state critical loads, right? Is that how we should be thinking about these in a way?

MB: Each of them are kind of uniquely calculated like the tree. Herb ones are empirically evaluated based on local conditions, and so the herbs, especially the critical loads, do change with local soil pH, temperature, precipitation, etc. If

you remember Justin Coughlin's presentation yesterday in Joint he was showing with machine learning and how critical loads varied based on local conditions and those are the type of variation that will occur and will be taken into account here. So we're not always just using a single value, although some of them like when Linda Geiser was presenting showed the in CLAD on Tuesday that across different climate regimes that lichens all responded in the same. And the aquatic ones, like the acidification that I didn't show, were all based on more steady state or mass balance type of equations. And all of that detail is in the methods document for and will be hopefully described consistently across all of our products to make sure people know where the data is coming from. Yeah, and I'll send out a link to all of them at NADP when this is live and when you can start playing around with it.

Fall Meeting 2023 and Science Symposium (Mike Bell)

- Will be in Madison, WI October 23-27, 2023
 - Part of the decision around this is budgetary – will save travel costs for NADP staff
 - This is part of our climate story. There's a large carbon cost of flying everyone across the country to different places so.
 - With most of the federal agencies leaning into climate mitigation and climate response, I thought it would be a good opportunity to try to focus people's efforts on how each of our projects and our research is affected by climate. How is it affecting climate? How is it mitigating for climate?
 - We have a bunch of climate-adjacent critical load studies, so I'm excited for us to lean into this a little more.
 - There will be a lot of differences in atmospheric chemistry, etcetera, that responds to the climate. So I think it will impact our TDEP maps and other things.
 - And so I really wanted to focus on being explicit about these connections and, thinking towards the future, of what we can do to better capture those climate changes.
 - Business Meetings in the Pyle Center
 - Science Symposium in the Fluno Center
 - Field trip to Devils Lake State Park. Devils Lake was in some of the early PFAS studies, and was in a lot of these other long term metrics we've been doing.
 - Additionally, thinking of climate issues, we're looking at touring one of the local alternative energy sources, whether it be solar farm, there's a nuclear reactor on campus here, there is one of the oldest hydroelectric dams in the area.
 - There will be rooms at the flu and nearby hotels

Consideration of Motions (continuation from Joint Session 1) (Doug Burns)

Motion 1

The Executive Committee (EC) requests that the Program Office (PO) ensure that raw 15-minute, hourly, and daily precipitation depth data be made available graphically and in tabular form for viewing on the new version of the NADP web site.

Motion 2

The Executive Committee (EC) requests that the Program Office (PO) ensure that quality assured 15-minute, hourly, and daily precipitation depth data be made available for download on the new version of the NADP web site. The EC additionally requests that the PO make these data available in as timely a manner as possible after completion of all quality assurance steps.

Discussion

Doug Burns: The general intent is to ask the Program Office to make the data available in as timely manner as possible given the steps it feels it has to go through before you consider it approved.

Zac Najacht: And Richard can correct me if I'm wrong on this, but just to clarify one point that was brought up when we talked about this the first time. The current functions in the old system that people are using are not going away until we can get this into the new system. Is that correct? I mean, we're looking to put the 15 minute hourly daily onto the new website that's in the works with Casey and Justin, correct. So as far as we hope that old system isn't going away until we get it into the new, so to be usable: Richard can comment.

Richard Tanabe: So from my understanding from the program office, and discussions with Mike Anderson, and it's been a while since I've talked to him about this, but what's happening is the existing data review for precipitation that Dana uses is on the old server, and currently that is being rewritten in Java and it will be a web application. I don't know whether it will be on our website server or whether it will be on another OS server, which I think could be the plan, but once that is complete, my understanding is that the our old server, NADP2, will be discontinued because they're they do not want to maintain it just for parts of the old website that we still use, so I think motion #1, we can probably get that done – it would be rolled into with the API stuff that Dolt will be doing with us, so that's my comment.

DB: And you said how long, Richard? The second motion will take a while to implement?
(Garbled conversation in the room...not all was picked up by the mic)

RT: I would envision that, you know where you go to the website you're not going to visit. Network. But then they'll pull up a page where you'll fill in your start date, end date, your site. We're not going to have that. People that want 20 years of data.

DB: All right. Yeah, good. Can we do 2 motions at once or does each one require a separate vote? OK, how about the first one?

**Motion 1 moved by Richard Tanabe, Eric Hebert second.
Motion Passed**

**Motion 2 moved by Richard Tanabe, unknown second
Motion Passed**

DB: Thanks for being willing to take this on. I think this adds another like little dimension to the value of the network. I know with my agency that this will be viewed as a good thing, so I appreciate it.

ZN: One other thing is I mentioned about DMAG: we invited a couple new members. I see Aaron has stepped out of the room, but Aaron Pena from Forest Service has some good ideas about the precipitation data on what format we have it in and future topics for DMAG, about how to make that easier to use for data users. You know where we want that data going? What kind of column headings and formatting and all of that. So future stuff for us to talk about related to this.

Final Discussion/Questions/Wrap-up (Tim Sharac)

Tim Sharac: Are there any final comments from the group or online?

Greg Wetherbee: I'll just mention one thing, Tim. So Doug mentioned that our agency will be enthusiastic about these two motions and that's correct. One of the things that I've been asked to do is to try to merge the NADP data with the

National water dashboard. And so I can't promise that this is going to get done this fiscal year or before the fall meeting, but I'm working toward trying to get our NWIS folks to allow a user to go on the national water dashboard, click on the NADP site and then it will go to the NADP website. So, I'm hoping that it's just going to be the links that will be clickable basically on that map and then route the user to the NADP website. So this could increase a lot of traffic and visibility for NADP and maybe more use of the data. It doesn't require any involvement on the part of the program office, unless there's a desire for that involvement, that's fine. You guys let me know if I'm stepping on toes here, but that's something that my supervisors tasked me with for this fiscal year: to try to make that happen and try to make that link occur so that people can basically jump right from the national water dashboard. If you haven't looked at the national water dashboard is pretty cool and so if you can and there are some NADP sites that are on there, but you can't click on them and they don't go anywhere. But in the future, that's something that we're trying to achieve so I'll update that at the fall meeting, maybe even sooner. Who knows, maybe at (the) budget (meeting) we'll have something done by then.

TS: Great. Thank you.

Richard Tanabe: So I just want to, on behalf of program office, say thank you for everyone for coming. We did this last year, but it was mainly a virtual meeting with an in-person hybrid option. So this is the opposite. It's good to see everybody. If you have any feedback on the rooms, on the lack of food, the coffee, the drinks. Let us know. We may or may not do a survey, but if you by all means talk to David or me. It was good to see everyone. We could probably all still fit in one of those the stadium rooms.

Tim Sharac: A big, big thank you to David Gay, Richard, Anita and many others here to make this happen. And to all of you in the room and virtually, especially the presenters, you guys have done so much work. This is incredible and incredible quality of presentations here and discussion. So thank you all for coming.

GW: Great job, Tim. Thank you, Tim.

TS: If you signed up outside for the lab tour, right after this, we'll start the lab tour. If you signed up.

David Gay – And some of you guys are not off the hook. There's exec tomorrow at 8:30 start. It's going to be in 335, the same room we were in.

RT: One other thing for the committee exec officers, Secretaries, I will have the recordings up on the SharePoint website probably early next week, so I'll send out an e-mail reminder that it's there. The virtual participants will be recorded and they'll be in a file.

TS: Thank you. I think we have to take a vote to adjourn. So moved.

Joint Session 2

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