Evolution of a network: How NADP stays reliable and relevant after nearly 40 years

Pamela Padgett
US Forest Service

Intelligent design

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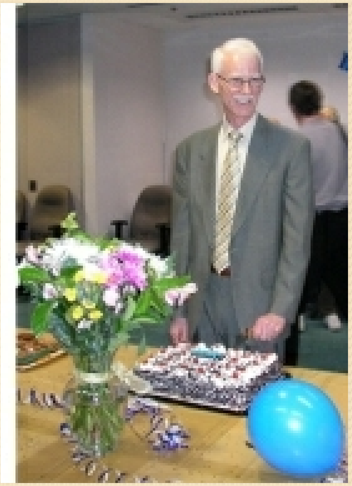
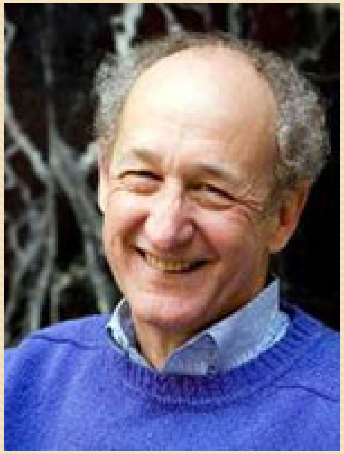
US Forest Service

1978

Ellis Cowling,
1st Chair of Atmospheric
Deposition Program

Doug Whelpdale
Canadian
representative





Jim Galloway

Doug Fox

Gary Stensland

Organizational structure

- Board of Directors (Executive committee)
  - Subcommittees with specific duties
    - Data Management
    - Ecological Responses and Outreach
    - Network Operations
    - Quality Assurance Advisory
    - Budget Advisory
  - Ad Hoc committees
  - Science committees

The first NADP data set

SiteID	Ca	Mg	K	Na	NH4	NO3	Inorg. N	Cl	SO4	H+(Lab)
CA88	0.12	0.064	0.053	0.652	0.91	2.06	1.17	0.76	1.49	0.01
CO21	0.08	0.016	0.02	0.117	0.07	0.33	0.13	0.07	0.31	0
FL00	0.18	0.125	0.152	1.466	0.04	0.57	0.16	1.68	2.45	0.02
FL03	0.21	0.122	0.173	1.393	0.05	0.61	0.17	1.53	1.9	0.01
GA41	0.18	0.115	0.053	0.988	0.25	1.05	0.43	1.3	3.1	0.06
MI53	0.71	0.352	0.182	3.839	1.09	6.6	2.34	1.86	11.34	0.15
MN16	0.89	0.156	0.21	0.475	0.84	3.54	1.45	0.33	3.96	0.03
NC03	0.19	0.277	0.062	0.674	0.09	0.84	0.26	0.93	1.99	0.03
NC25	0.21	0.113	0.063	1.533	0.18	2.04	0.6	1.49	5.04	0.1
NC34	0.17	0.089	0.081	0.724	0.37	2.08	0.76	0.94	5.18	0.08
NC35	0.16	0.113	0.055	1.066	0.21	1.11	0.41	1.49	2.98	0.06
NC41	0.14	0.09	0.074	0.741	0.43	1.9	0.76	0.99	3.98	0.08
NE15	0.57	0.064	0.047	0.317	0.65	1.4	0.82	0.14	1.87	0
NH02	0.46	0.26	0.08	0.576	0.5	7.64	2.11	2.26	9.13	0.25
NY20	0.14	0.023	0.023	0.303	0.1	2.76	0.7	0.26	2.44	0.09
OH17	0.46	0.081	0.075	1.033	0.94	4.38	1.72	0.52	8.7	0.17
OH49	0.85	0.077	0.091	0.663	0.54	4.44	1.42	0.69	10.19	0.19
OH71	0.65	0.081	0.078	1.107	0.87	4.18	1.62	0.51	9.91	0.15
PA29	0.62	0.207	0.127	0.442	1.19	9.67	3.11	5.03	17.15	0.5
VA13	0.58	0.178	0.108	1.158	0.21	2.53	0.73	0.68	5.65	0.09
WV18	1.09	0.145	0.203	1.489	1.31	9.58	3.18	0.96	21.75	0.4

Current NADP networks

- 5 networks – 6 if you count the electronic precipitation data
  - ~250 NTN
  - 7 AIRMoN
  - ~110 MDN
  - ~20 AMNet
  - ~50 AMon

Design
of the
National Trends Network
for Monitoring the Chemistry of
Atmospheric Precipitation

1982 – 1985
First proposed at the 1980
Technical Committee meeting

By J. K. Robertson and J. W. Wilson

U. S. Military Academy at
West Point, New York

PROPOSED NTN SITES

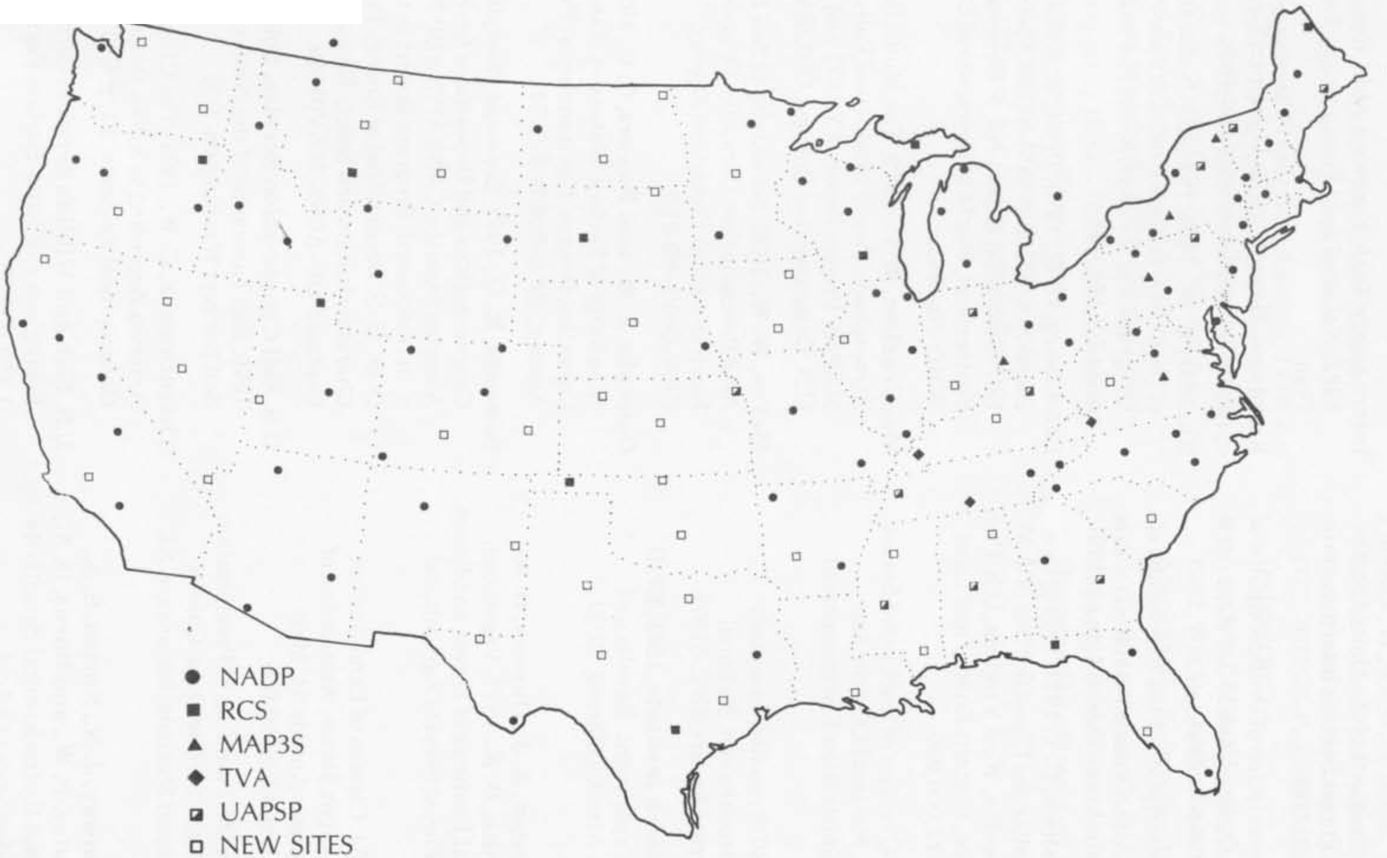
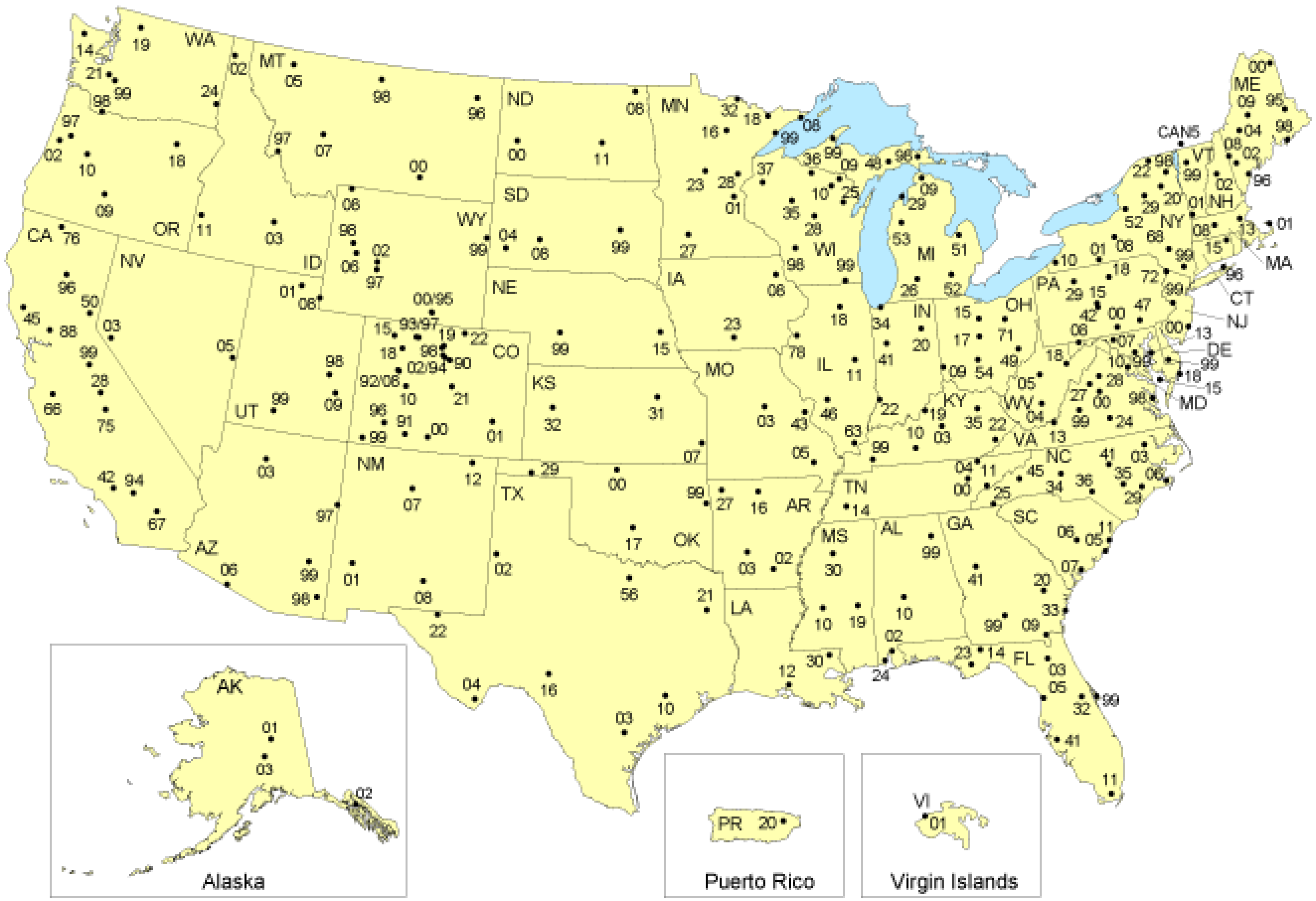


Figure 18 - Proposed National Trends Network Sites.

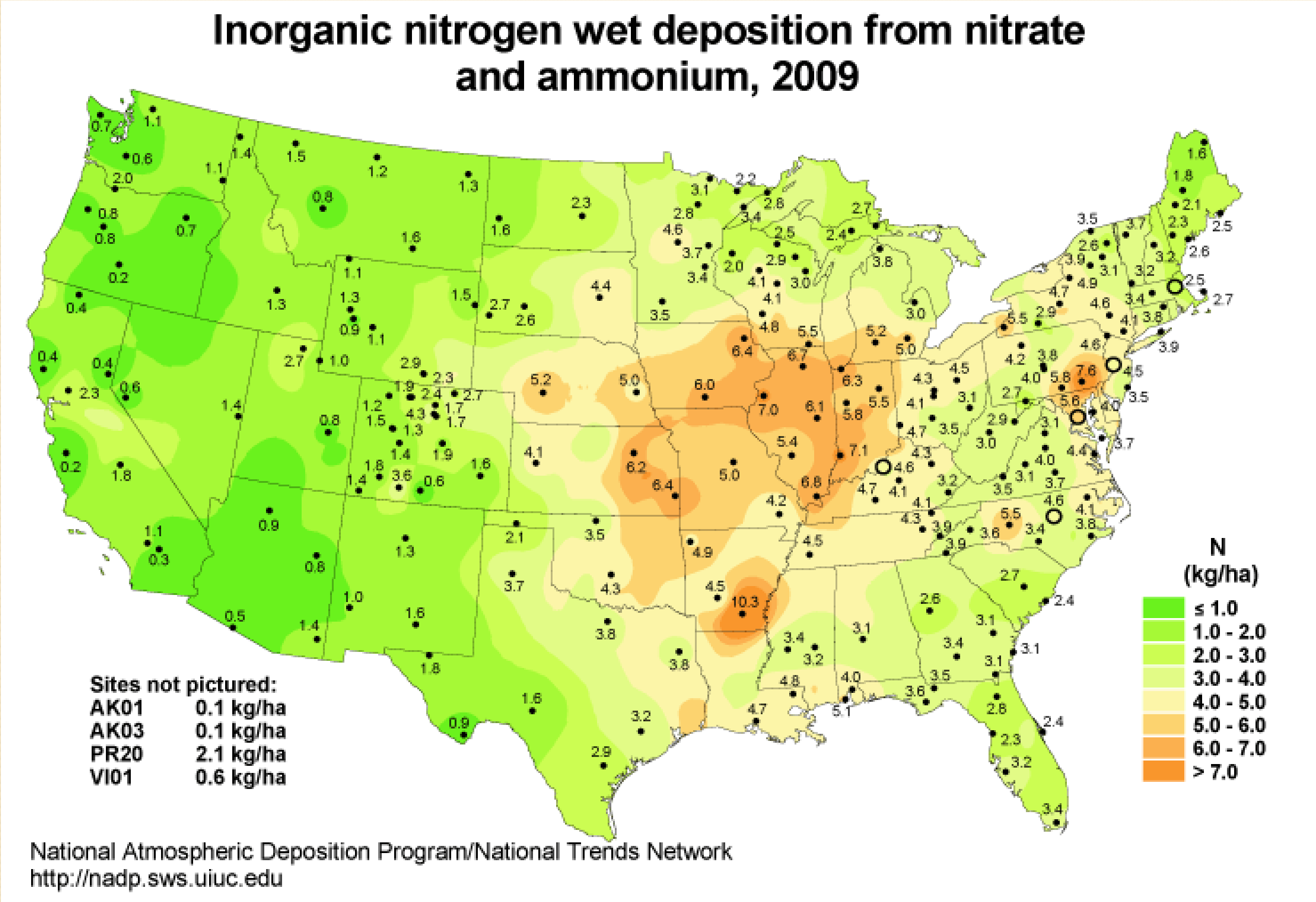
THE PROPOSED NATIONAL TRENDS NETWORK

Figure 18 represents the complete design of 151 NTN sites recommended to the Task Group on Deposition Monitoring. It embodies the best of the model

National Atmospheric Deposition Program
National Trends Network



Isopleth maps introduced in 1994
(after 15 years of discussion)



Rule #1: Build partnerships with as many organizations as possible.

- Down side: Why isn’t NADP a grid-based network?

  Directing establishment of specific sites at specific locations would require a single or centralized administrative system.

- Upside: No single organization, agency, or entity can kill NADP

Rule #2: Adapt to changing needs: Growth of the network

- Addition of new sites
  - Initial goal: To understand the status and trends of acid rain
  - Expanded goal: Site-specific inquiries of the role deposition plays in the health of ecosystems and ecosystem services.

Responding to the national, regional, and local needs for deposition data

Growth in the number of NTN monitoring stations

Site ID	Site Name	Year Est.	Operating agency or entity	Forest or landowner	National Forest
CO21	Manitou	1978	RMRS	Manitou Experimental Forest	Pike and San Isbel National Forest
MI53	Wellston	1978	NRS	Wellston Field Lab	Huron-Manestee National Forest
MN16	Marcell Experimental Forest	1978	NRS	Marcell EF&R	Chippewa National Forest
NC25	Coweeta	1978	SRS	Coweeta Experimental Forest and Hydrological Lab	Nantahala National Forest
NH02	Hubbard Brook	1978	NRS	Hubbard Brook Experimental Forest	White Mountain National Forest
OH17	Delaware	1978	NRS	NRS/ Delaware Research Station	None
PA29	Kane Experimental Forest	1978	NRS	Kane Experimental Forest	Allegheny National Forest
WV18	Parsons	1978	NRS	Fernow Experimental Forest	Monongahela National Forest

NTN stations managed by the Forest Service

Site ID	Site Name	Year Est.	Operating agency	Forest or landowner	National Forest
MN18	Fernberg	1980	EPA/CAMD	Boundary Waters Canoe Area Wilderness	Superior National Forest
OR10	H. J. Andrews Experimental Forest	1980	WO	H.J. Andrews LTER	Willamette National Forest
CA42	Tanbark Flat	1982	WO	San Dimas Exp Forest	Angeles National Forest
OR09	Silver Lake Ranger Station	1983	USGS	Fremont-Winema NF	Fremont-Winema National Forest
PA72	Milford	1983	WO	Grey Towers Historical Site	
TX56	L.B.J. National Grasslands	1983	USGS	LBJ National Grasslands	Caddo-LBJ National Grassland
CO02	Niwot Saddle	1984	Niwot Ridge LTER	Niwot LTER	Roosevelt National Forest
CO97	Buffalo Pass - Summit Lake	1984	WO/R2	Routt/Medicine Bow National Forest	Routt National Forest
MI98	Raco	1984	EPA/CAMD	Hiawatha NF	Hiawatha NF
MS30	Coffeeville	1984	TVA	Tallahatchie Experimental Forest	Holly Springs National Forest
NM08	Mayhill	1984	USGS	Lincoln National Forest	Lincoln National Forest
OR18	Starkey Experimental Forest	1984	USGS	Starkey Experimental Forest	None
WY98	Gypsum Creek	1984	Exxon-Mobile	Pindale Ranger District	Bridger-Teton National Forest
PR20	El Verde	1985	WO	El Verde Field Station/International	El Yunque National Forest
WY97	South Pass City	1985	Exxon-Mobile	Shoshone National Forest	Shoshone National Forest
CO93	Buffalo Pass - Dry Lake	1986	WO/R2	Routt/Medicine Bow National Forest	Routt National Forest
CO96	Molas Pass	1986	WO	San Juan National Forest	San Juan National Forest
WY00	Snowy Range	1986	WO	Glacier Lakes Study Area	Medicine Bow National Forest
CO08	Four Mile Park	1987	EPA/CAMD	White River National Forest	White River National Forest
CO92	Sunlight Peak	1988	EPA/CAMD	White River National Forest	White River National Forest

Forest Service expansion of NTN stations during the 1980s
Mostly under NAPAP

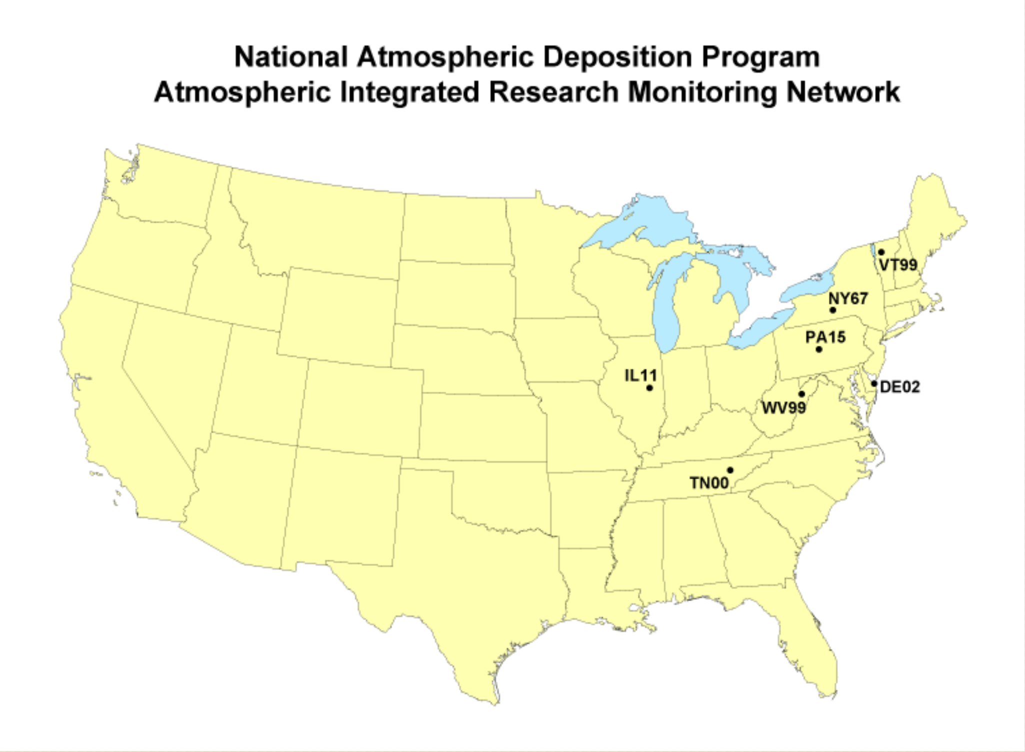
Site ID	Site Name	Year Est.	Operating agency or entity	Forest or landowner	National Forest
MT97	Lost Trail Pass	1990	R1	Bitterroot National Forest	Bitterroot National Forest
AK01	Poker Creek	1992	Univ. Alaska Fairbanks	Bonanza Creek LTER/Experimental Forest	Alaska State Land
CO91	Wolf Creek Pass	1992	Contract with ski area	San Juan National Forest	San Juan National Forest
WY95	Brooklyn Lake	1992	RMRS	Glacier Lakes Study Area	Medicine Bow National Forest
KY99	Mulberry Flat	1994	Murray State	LBL National Recreation Area	LBL National Recreation Area

Forest Service expansion slowed down in the 1990s

Site ID	Site Name	Year Est.	Operating agency	Forest or landowner	National Forest
CA50	Sagehen Creek	2001	UC Berkeley	Sagehen UC Reserve/Sagehen Exp.	Tahoe National Forest
ID02	Priest River Experimental Forest	2002	RMRS	Preist River Exp Forest	Idaho Panhandle National Forest
VA99	Natural Bridge Station	2002	R8	GW &Jefferson NF	George Washington & Jefferson National
WA98	Columbia River Gorge	2002	R6	National Scenic Area	Columbia River Gorge National Scenic Area
AK02	Juneau	2004	Univ. Alaska Juneau	Univ. Alaska Juneau	None
CA94	Converse Flats	2006	PSW Research	San Bernardino NF	San Bernardino NF
CO90	Niwot Ridge-Southeast	2006	Univ. of Colorado,	Niwot LTER	Roosevelt National Forest
CA28	Kings River Exp. Watershed	2007	PSW Research	Kings River Exp. Watershed	Sierra National Forest

… and picked up a bit in 2000 with new monitoring objectives.

AIRMoN became part of NADP in 1992



Although measuring the same chemicals as NTN, AIRMoN sampling is daily rather than weekly. These higher resolution samples enhance researchers' ability to evaluate how emissions affect precipitation chemistry using computer simulations of atmospheric transport and pollutant removal. methods.

What has been lost?

As with all evolutionary (*intelligent design*) processes, expansion was accompanied by losses.

- The National Trends Network (NTN) has been holding fairly steady at 250 site for about 10 years.
- 250 is the net result of growth and losses, including the loss of 70 sites over the years.
- Flexibility among the partners and the ability to shift funding and station management has saved stations deemed most valuable.

During this lull in the growth of the network size, great things were happening in expanding the breadth of what data NADP was being used for. And how the success of the organizational structure was being leveraged to add a new network.

Rule #3: Adapt to changing needs: Growth within the NADP

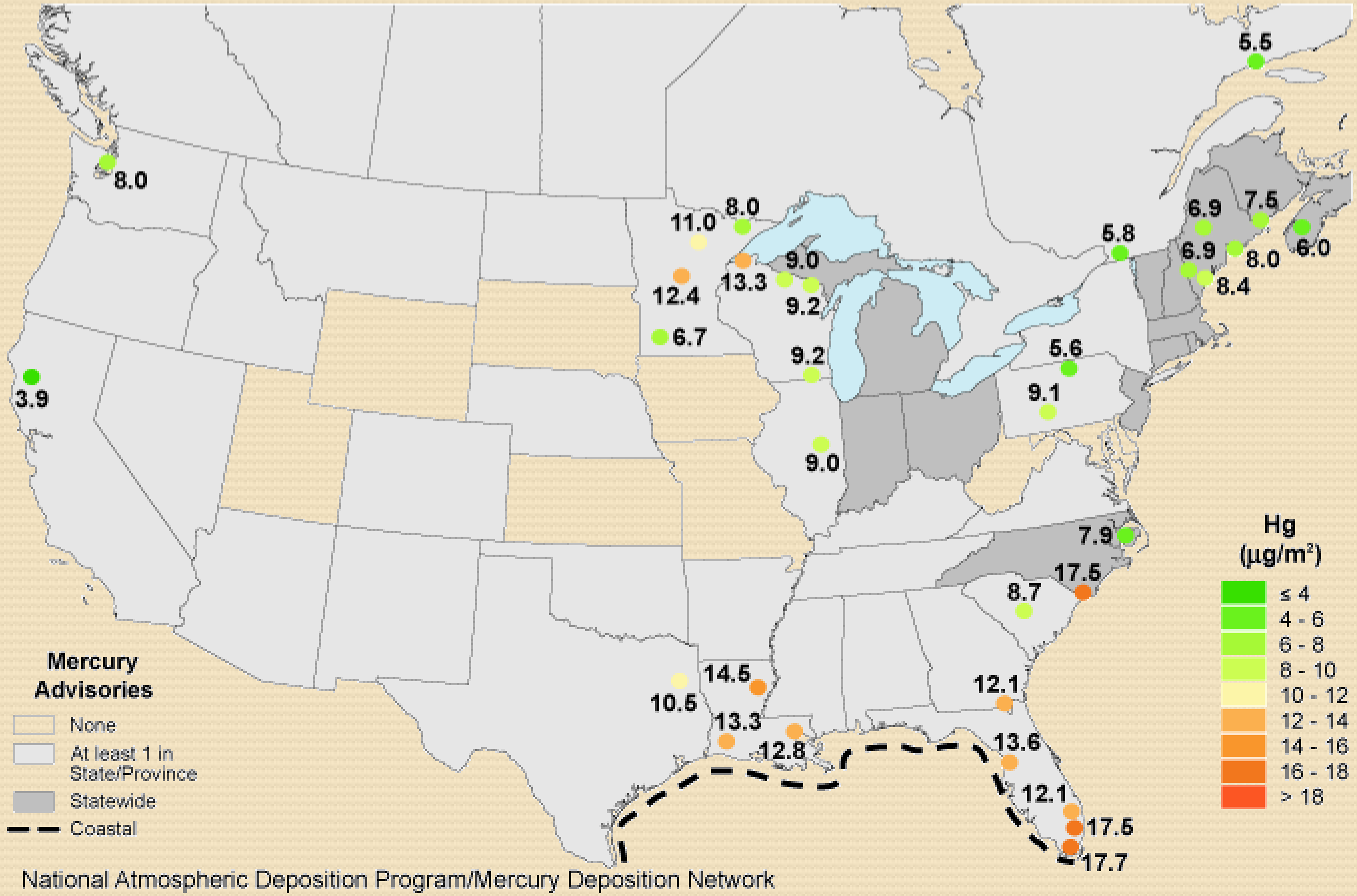
- Addition of whole new networks and new analytes
  - Initial goal: To measure acidity and related ions in rain
  - Expanded goal: To leverage the power of a high quality, well organized network to address a complicated patterns of multiple pollutants and their effect on the world.

Responding to the national, regional, and local needs for deposition data

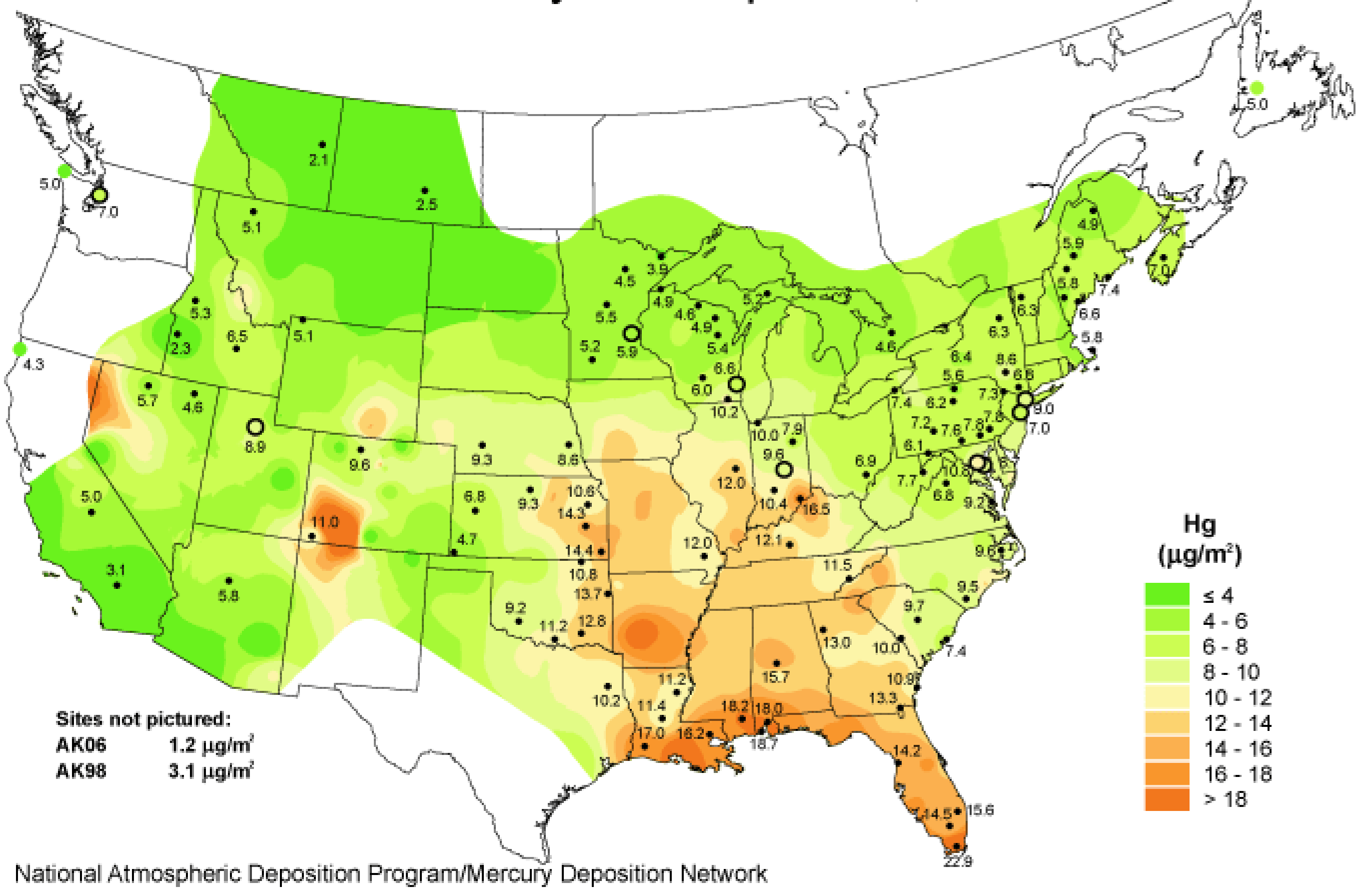
Addition of the Mercury deposition network

Ahead of its time and the first in a series of network and program expansions

Total Mercury Wet Deposition, 1999



Total Mercury Wet Deposition, 2009



How did this happen?

- Sheer determination by a handful of advocates.
- Discussion evolved (*designed intelligently*) out a longstanding discussion of including heavy metals beginning at least in 1981.
- By 1996 MDN was a transition network. The usual discussion regarding utility and specific data users were recorded in the 1996 minutes.
- And the first map products were produced under the NADP banner in 1999.
- For the last decade MDN has been growing by 10% to 20% a year.

What has been lost?

As with all evolutionary (*intelligent design*) processes, expansion was accompanied by losses.

- Most significant: Dry deposition
  Almost from the beginning this was discussed in 1981 an ad hoc committee recommended discontinuation.
- Field pH and conductivity

Discontinuation of Support for Field Chemistry Measurements in the National Atmospheric Deposition Program National Trends Network (NADP/NTN)

Christopher Lehmann, NADP Program Office, Illinois State Water Survey, Champaign, IL
Natalie Latysh, Branch of Quality Systems, U.S. Geological Survey, Denver, CO
Cari Furiness, Dept. of Forestry, College of Natural Resources, NC State University, Raleigh, NC

Rule #4a Change takes time.

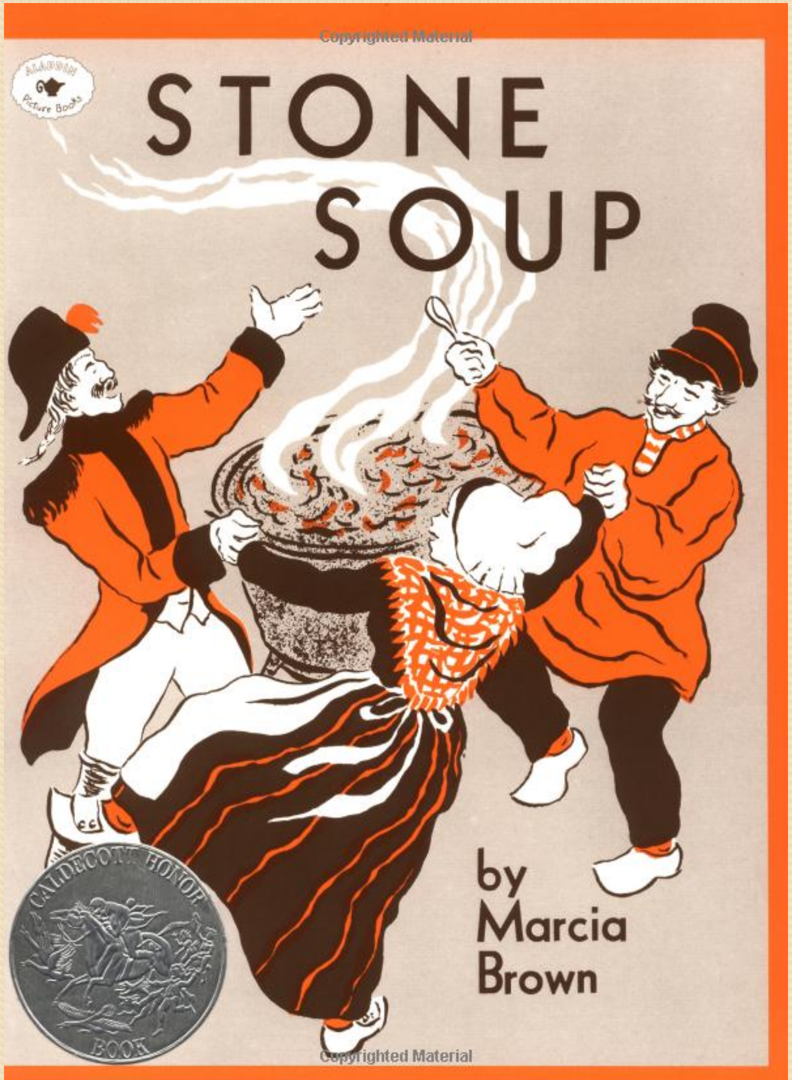
- Electronic rain gages

Rule #4b Change comes quickly

- **Addition of Science Committees**
  - Critical Loads And Deposition
    - The goals of CLAD are to:
    - Facilitate technical information sharing on critical loads topics within a broad multi-agency/entity audience;
    - Fill gaps in critical loads development in the US;
    - Provide consistency in development and use of critical loads in the US;
    - Promote understanding of critical loads approaches through development of outreach and communications materials.
  - Total Deposition
    - The mission of TDEP is to improve estimates of atmospheric deposition by advancing the science of measuring and modeling atmospheric wet, dry, and total deposition of species such as sulfur, nitrogen and mercury by providing a forum for the exchange and information on current and emerging issues within a broad multi-organization context including atmospheric scientists, ecosystem scientists, resource managers and policy makers.

Rule #5 Be open to off-the-wall ideas

- Stable isotopes
- Particulate composition
- Reactor fission products
- Plant diseases
- Total nitrogen deposition
- Bromide as an regular analyte

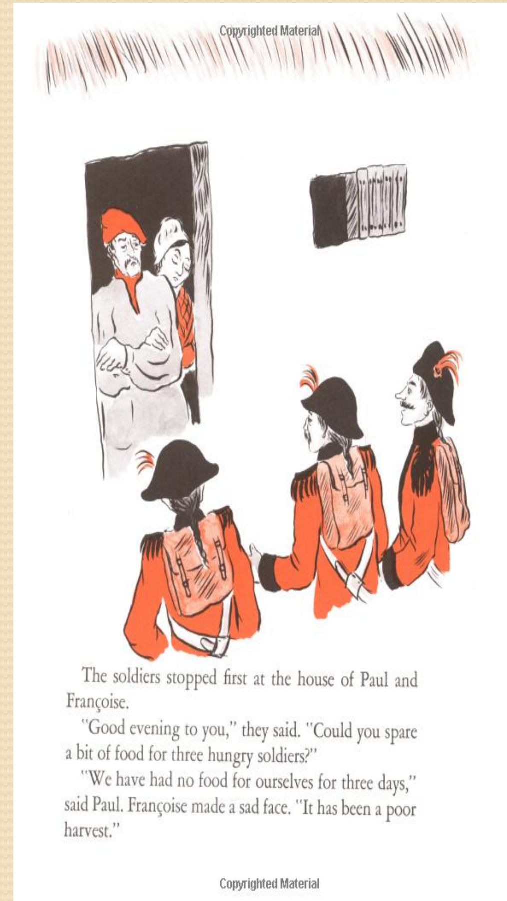


Stone Soup Principle

They spread old quilts over the carrot bins. They hid their cabbages and potatoes under the beds. They hung their meat in the cellars.

They hid all they had to eat. Then—they waited.

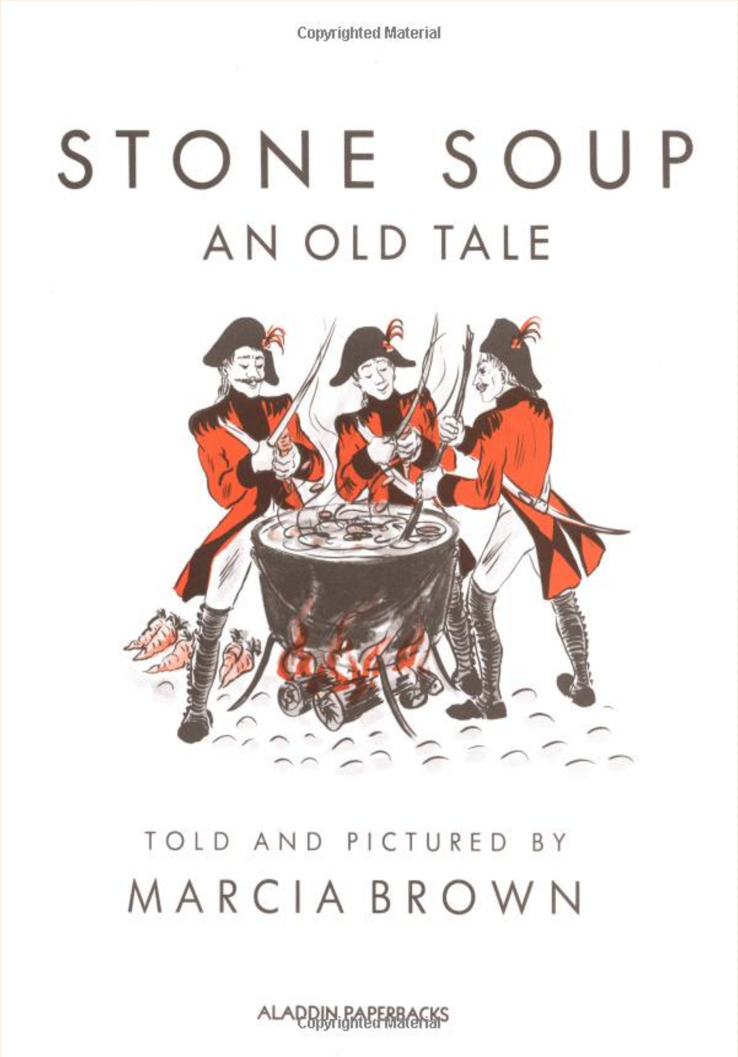
The Story goes like this:



The soldiers stopped first at the house of Paul and Françoise.

"Good evening to you," they said. "Could you spare a bit of food for three hungry soldiers?"

"We have had no food for ourselves for three days," said Paul. Françoise made a sad face. "It has been a poor harvest."



No single organization, agency or entity has all the tools or all the resources to manage a monitoring network the size and scope of NADP .

But, when skills, tools and resources are pooled, the sum is much, much greater than the parts.

Thanks !

CA94 Converse Flats