Idaho
Department of Environmental Quality
Ambient Air Quality Monitoring Network
5-Year Assessment

State of Idaho
Department of Environmental Quality

September 8, 2015

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Boise, Idaho 83706

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Executive Summary

On October 17, 2006, the US Environmental Protection Agency (EPA) amended its ambient air monitoring regulations. This amendment requires states to conduct detailed assessments of their air monitoring networks every 5 years. This document describes the Idaho Department of Environmental Quality's (DEQ) 2015 Idaho state ambient air monitoring network assessment. This is the second assessment of the Idaho network under the requirement.

Purpose of the Assessment

DEQ's air quality protection efforts are designed to ensure compliance with federal and state health-based air quality standards and to inform the public and local, state, and federal decision-makers of air quality conditions in their areas**.** DEQ evaluated the effectiveness and efficiency of the Idaho state ambient air monitoring network in relation to this goal. DEQ's assessment provides decision-makers with information needed to maximize the effectiveness of Idaho's ambient air monitoring network. The assessment also ensures DEQ and its partners have the information needed to protect human health and the environment for current and future generations in Idaho.

Idaho's Ambient Air Monitoring Network

Most of Idaho's monitoring network is dedicated to characterizing levels of the two pollutants known to pose the greatest risk to public health—fine particulate matter ($PM_{2.5}$) and ozone (O_3). The remainder of the network is made up of monitors that measure larger particles (PM_{10}), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2) and reactive oxides of nitrogen (NO_x/NO_Y), fine particle chemical composition, and meteorological parameters.

As of January 1, 2015, DEQ's air monitoring network consisted of 65 monitors at 28 distinct monitoring sites. Data from these monitors serve a variety of needs:

- Determine if air quality is meeting federal standards
- Provide near-real-time air quality information for protecting public health
- Forecast air quality
- Make daily burn decisions and curtailment calls
- Assist with permitting activities
- Evaluate the effectiveness of air pollution control programs
- Evaluate the effects of air pollution on public health
- Determine air quality trends
- Identify and develop responsible and cost-effective pollution control strategies
- Evaluate air quality models

Assessment

To relate the value of its monitoring activities relevant to the policy goal, DEQ evaluated the state network on three separate scales: site-level, airshed-level, and state-level on a pollutant-by-pollutant basis. DEQ generally conducted its assessment in accordance with EPA guidance, mostly with tools other than those provided by EPA.

Findings

Overall, the Idaho state network is efficient and effective at meeting the monitoring objectives supporting DEQ's policy goals. Significant network changes are not needed. Anticipated future ambient air monitoring requirements mandated by EPA will result in substantial costs, which may cause resource conflicts across programs supported by DEQ's network.

Recommendations

Retain

Retain all of the existing monitoring network as currently configured.

Relocate

The Soda Springs SO_2 source impact monitor should be relocated to a position more downwind of the source facility.

Evaluate or Modify

At the site-level, the monitoring "scale of representativeness" for one monitoring site needs revised, and at another monitoring site the site type needs to be revised:

- Sandpoint—change scale of representation from urban to neighborhood
- Boise Eastman Garage—change site type from population exposure to source impact

Add New Monitors at Prioritized Locations

- Boise needs a $PM_{2.5}$ monitor to measure smoke impacts and population exposure in the low-lying area between the river and the foothills, below the upper bench level where the Meridian $PM_{2.5}$ monitor is currently located.
- Should funds become available to acquire and deploy new monitors, locations frequently impacted by smoke that are currently lacking $PM_{2.5}$ monitors should be prioritized; these include Orofino, Mountain Home, and Challis.

Provide for Technology Needs

- Convert to a robust network of federal equivalent method (FEM) monitors for National Ambient Air Quality Standards (NAAQS), special purpose, smoke, and Air Quality Index monitoring.
- Find alternative FEM for PM_{10} monitoring.
- Deploy additional monitors and sensors at NCore site if revised ozone NAAQS triggers nonattainment in Treasure Valley.
- Contract data acquisition system support services, hardware, and software.

Conclusion

Overall, Idaho operates an efficient monitoring network with limited resources; no sites are recommended for termination. If, in the future, Idaho needs to shut down any monitors due to resource constraints, those sites assigned a low value in the site ranking should be targeted first.

1 Introduction

The US Environmental Protection Agency (EPA) finalized an amendment to the ambient air monitoring regulations on October 17, 2006. As part of this amendment, EPA added a requirement for state monitoring agencies to conduct and submit ambient air monitoring network assessments once every 5 years (40 CFR Part 58.10(e)). At the core of this requirement is the need to assess the ability of existing and proposed monitoring sites to support air quality characterization for areas with relatively high populations of susceptible individuals (e.g., children with asthma), and, for any sites that are being proposed for discontinuance, the effect on data users other than the agency itself, such as nearby states, tribes, or entities conducting health effects studies.

The goal of an air monitoring organization should be to optimize air monitoring networks to achieve, with available resources, the best possible scientific value and protection of public and environmental health and welfare. A network assessment includes (1) re-evaluating the objectives and budget for air monitoring, (2) evaluating a network's effectiveness and efficiency relative to its objectives and costs, and (3) developing recommendations for network reconfigurations and improvements. In some cases, network assessments consist only of answering one or more straightforward questions. In others, detailed analytical techniques are necessary. A thorough technical assessment will help support decisions about reconfiguring a network. These decisions might include eliminating redundant monitors, reducing or expanding the monitoring season, moving monitors to better locations, switching a monitor at one location to different technology (e.g., to provide finer temporal resolution), adding monitors to the network, or switching monitoring at a site to a different pollutant. In practice, a combination of several types of analyses might provide the most useful information.

Much of the ambient air monitoring network managed and operated by the Idaho Department of Environmental Quality (DEQ) is comprised of single-pollutant continuous monitoring equipment. This assessment will follow mostly site-by-site and bottom-up techniques for evaluating the overall effectiveness of DEQ's air monitoring network.

Site-by-site analyses are those that assign a ranking to each individual monitor based on a particular metric. These analyses are helpful for assessing which monitors might be candidates for modification or removal. In general, the metrics at each monitor are independent of the other monitors in the network. Sites and monitors were evaluated according to respective importance and relevance in meeting the overall objectives of the ambient air monitoring network. Sites and monitors were also evaluated according to their suitability in supporting their individual objectives (site location, technology, etc.). The low-ranking monitors are examined carefully on a case-by-case basis. There may be regulatory or political reasons to retain a specific monitor. Also, the site could be made potentially more useful by monitoring a different pollutant or using a different technology.

Bottom-up methods examine the phenomena that are thought to cause high pollutant concentrations and/or population exposure, such as emissions, meteorology, and population density. For example, emissions inventory data can be used to predict the areas of maximum expected concentrations of pollutants directly emitted into the atmosphere (i.e., primary pollutants). Emissions inventory data are less useful to understand pollutants formed in the atmosphere (i.e., secondarily formed pollutants). Multiple data sets can be combined using spatial analysis techniques to determine optimum site locations for various objectives. Those optimum locations can then be compared to the current network. In general, bottom-up analyses indicate where monitors are best located based on specific objectives and expected pollutant behavior. However, bottom-up techniques rely on a thorough understanding of the phenomena that cause air quality problems.

This assessment addressed future air monitoring needs in the state of Idaho, whether caused by on-going and future revisions of the National Ambient Air Quality Standards (NAAQS) or by projected changes in population, land use, and emissions levels within Idaho's borders or nearby states.

2 Air Quality Monitoring in Idaho

This section provides an overview of how ambient air monitoring data are used to determine compliance with the NAAQS and how monitoring supports the goals for state implementation plans (SIPs) for areas that are or have been classified as nonattainment areas. An overview is also provided of Idaho's Air Quality Index (AQI) program and recent AQI history. The overview is followed by more detailed information about DEQ's ambient air monitoring program, including monitor locations. The programs and tools that provide primary users with monitoring data or information based on the data are identified.

2.1 Background

As ambient air monitoring objectives have shifted over time, air quality agencies have had to re-evaluate and reconfigure monitoring networks. A variety of factors contribute to these shifting monitoring objectives:

- Air quality has changed since adoption of the federal Clean Air Act and NAAQS. For example, the problems of high ambient concentrations of lead and carbon monoxide have largely been solved.
- Populations and behaviors have changed. For example, the US population has (on average) grown, aged, and shifted toward urban and suburban areas over the past four decades. In addition, rates of vehicle ownership and annual miles driven have increased, while emissions from individual vehicles have decreased.
- New air quality objectives have been established, including rules to reduce toxic air pollutants, fine particulate matter ($PM_{2.5}$), and regional haze.
- The understanding of air quality issues and the capability to monitor air quality have both improved. Together, the enhanced understanding and capabilities can be used to design more effective air monitoring networks.

Ambient air monitoring networks must be designed to meet the three basic monitoring objectives listed below. Each objective is important and must be considered individually.

- Provide air pollution data to the general public in a timely manner. Data can be presented to the public in a number of user-friendly ways, including through air quality maps, newspapers, internet sites, and as part of weather forecasts and public advisories.
- Support compliance with ambient air quality standards and emissions strategy development. Data from qualified monitors for NAAQS pollutants are used for comparing an area's air pollution levels against the NAAQS. Data from monitors of various types can be used in developing attainment and maintenance plans. Data from State and Local Air Monitoring Stations (SLAMs), and especially from National Core (NCore) stations, are used to evaluate the regional air quality models used in developing emission strategies and to track trends in air pollution resulting from implementing emissions reduction strategies. In monitoring locations near major air pollution sources, source-oriented monitoring data can provide insight into how well industrial sources are controlling their pollutant emissions.
- Support for air pollution research studies. Air pollution data from the NCore multipollutant monitoring network can be used to supplement data collected by researchers working on assessing health effects and understanding atmospheric processes or for work on developing monitoring methods.

2.2 Idaho's Air Quality—NAAQS Overview

To provide a quantifiable means for assessing air quality, EPA's Office of Air Quality Planning and Standards has established standards for six *criteria pollutants*. For each criteria pollutant, the standard includes a threshold, which is the maximum concentration above which adverse effects on human health may occur. These threshold concentrations are called *NAAQS*. NAAQS must be reviewed by EPA every 5 years. See Appendix A for this review schedule and proposed changes.

There are two types of standards: primary and secondary (Table 1). Primary standards set limits to protect public health, including the health of sensitive populations, such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility and damage to animals, vegetation, and buildings. Idaho has adopted the federal air quality standards in the *Rules for the Control of Air Pollution in Idaho* (IDAPA 58.01.01.575–587).

Table 1. Primary and secondary standards for the six criteria pollutants.

Pollutant	Primary Standard	Averaging Time	Metric	Secondary Standard
Carbon monoxide (CO)	9 ppm	8-hour [1]	The 8-hour average cannot exceed the level more than once per year.	None
Carbon monoxide (CO)	35 ppm	1-hour	The 1-hour average cannot exceed the level more than once per year.	None
Lead (Pb)	0.15 µg/m^3	3-month	The rolling 3-month average (12 average periods per year) cannot exceed the level. The standard was lowered October 15, 2008, from 1.5 µg/m^3.	Same as primary
Nitrogen dioxide (NO_2)	0.053 ppm	Annual (arithmetic mean)	The annual mean cannot exceed the level.	Same as primary
Nitrogen dioxide (NO_2)	0.100 ppm	1-hour	The 98th percentile of 1-hour values, averaged over 3 years, cannot exceed the level.	None
Ozone (O_3)	0.075 ppm	8-hour	The 3-year average of the 4th-highest daily maximum 8-hour average concentration cannot exceed the level measured at each monitor within an area over each year. The standard was lowered May 27, 2008, from 0.08 ppm.	Same as primary
Particulate matter — PM_{10}	150 µg/m^3	24-hour	The 24-hour average cannot exceed the level more than once per year on average over 3 years.	Same as primary
Particulate matter — $PM_{2.5}$	12.0 µg/m^3	Annual (arithmetic mean)	The 3-year annual average of the weighted annual mean concentrations cannot exceed the level. The standard was lowered to 15.0 µg/m^3 on December 17, 2006, from 15.4 µg/m^3. The standard was lowered further to 12 µg/m^3 in 2012.	Same as primary

[1] *www.epa.gov/air/criteria.html#1#1*

		35 µg/m^3	24-hour	The 3-year average of the 98th percentile (based on the number of samples taken) of the daily concentrations must not exceed the level. The 24-hour standard was lowered from 65 µg/m^3 on December 17, 2006.	None
Sulfur oxides (SO_x)		0.075 ppm	1-hour	The 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years, cannot exceed the level. The 1-hour standard was revised in 2010.	None
		—	3-hour	Not to be exceeded more than once per year.	0.5 ppm

Notes: parts per million (ppm), micrograms per cubic meter (µg/m^3)

Based on the level of air pollutants measured, geographic areas are classified by EPA as attainment or nonattainment areas. A geographic area with pollutant levels at or below the NAAQS, or where no measurements have been made, is called an attainment/unclassifiable area. An area with persistent air quality problems is designated a nonattainment area, which means the area has violated the federal health-based standards for outdoor air pollution. Each nonattainment area is designated for a specific pollutant. Nonattainment areas for different pollutants may overlap each other or share common boundaries.

In addition to areas classified as attainment and nonattainment, some areas are described as maintenance areas. Maintenance areas are those geographic areas that were classified as nonattainment but are now consistently meeting the NAAQS. Maintenance areas have been redesignated by the EPA from *nonattainment* to *attainment with a maintenance plan*, commonly called maintenance areas. Monitoring and modeling have demonstrated that these areas have sufficient controls in place to meet and maintain the NAAQS. Maintenance plans also establish contingency measures that would be implemented if these areas again have pollutant levels that exceed the NAAQS.

Five geographical areas in Idaho are classified as nonattainment or maintenance areas (Table 2; Figure 1). Figure 1 also identifies Federal Class I Areas, where regional haze levels must be addressed.

Table 2. Nonattainment and maintenance areas in Idaho.

Area	Description	Pollutant	Background
Sandpoint (Limited Maintenance Area)	Located in Bonner County, the area rests on the northwest corner of Lake Pend Oreille within the Idaho Panhandle National Forests	PM_{10}	The topography influences much of the PM buildup in the area. In 1997, the area was designated moderate PM_{10} nonattainment, and an emissions inventory identified the primary PM_{10} source as residential wood burning. Fugitive road dust and some industrial sources are also considered significant contributors. In December 2011, DEQ submitted a limited maintenance plan, which received EPA approval. The area was redesignated to attainment as a maintenance area in April 2013. The plan can be found at the following link: *Link to Maintenance Plan.*
Pinehurst - PM_{10} (Nonattainment Area)	Located in Shoshone County, the area rests in Pinehurst surrounded by the Coeur d'Alene and St. Joe National Forests	PM_{10}	The area's topography is a significant factor in the buildup of pollutants that result in poor air quality. The emissions inventory identified residential wood combustion as the primary PM_{10} source and fugitive road dust as a secondary source. More information can be found at the following link: *Link to Maintenance Plan*.
West Silver Valley – $PM_{2.5}$ (Nonattainment Area)	Located in Shoshone County, the area rests in the Silver Valley surrounded by the Coeur d'Alene and St. Joe National Forests	$PM_{2.5}$	The area's topography is a significant factor in the buildup of pollutants that result in poor air quality. Residential wood combustion is also the primary $PM_{2.5}$ emission source in addition to other types of biomass burning sources in the airshed.
Portneuf Valley (Maintenance Area)	96.6 square miles of Pocatello, Chubbuck, and surrounding areas in southeast Idaho	PM_{10}	The Portneuf Valley is a maintenance area for PM_{10}. Formerly the Power/Bannock County PM_{10} area, it was split into the Portneuf Valley and federal Fort Hall PM_{10} areas. The area includes federal land managed by the Bureau of Land Management and the Caribou National Forest, as well as privately owned land in the cities of Pocatello and Chubbuck. *Link to Maintenance Plan.*
Northern Ada County (Limited Maintenance Area)	Southwest Idaho	CO and PM_{10}	Northern Ada County is currently a limited maintenance area for CO. Mobile and area source emissions are the two major sources of CO. *Link to CO Maintenance Plan*. Northern Ada County is also a maintenance area for PM_{10}. The main sources of PM_{10} are fugitive road dust and agriculture. *Link to PM_{10} Maintenance Plan*.
Cache Valley (Nonattainment Area)	Franklin County, Southeast Idaho	$PM_{2.5}$	Franklin County shares this designation (2009) as the northern portion of the Logan UT- Franklin ID $PM_{2.5}$ nonattainment area. This designation was based on monitoring data measured in Logan, Utah. DEQ submitted an attainment plan in 2012 and amended the plan in 2014. *Link to Cache Valley Attainment Plan.*

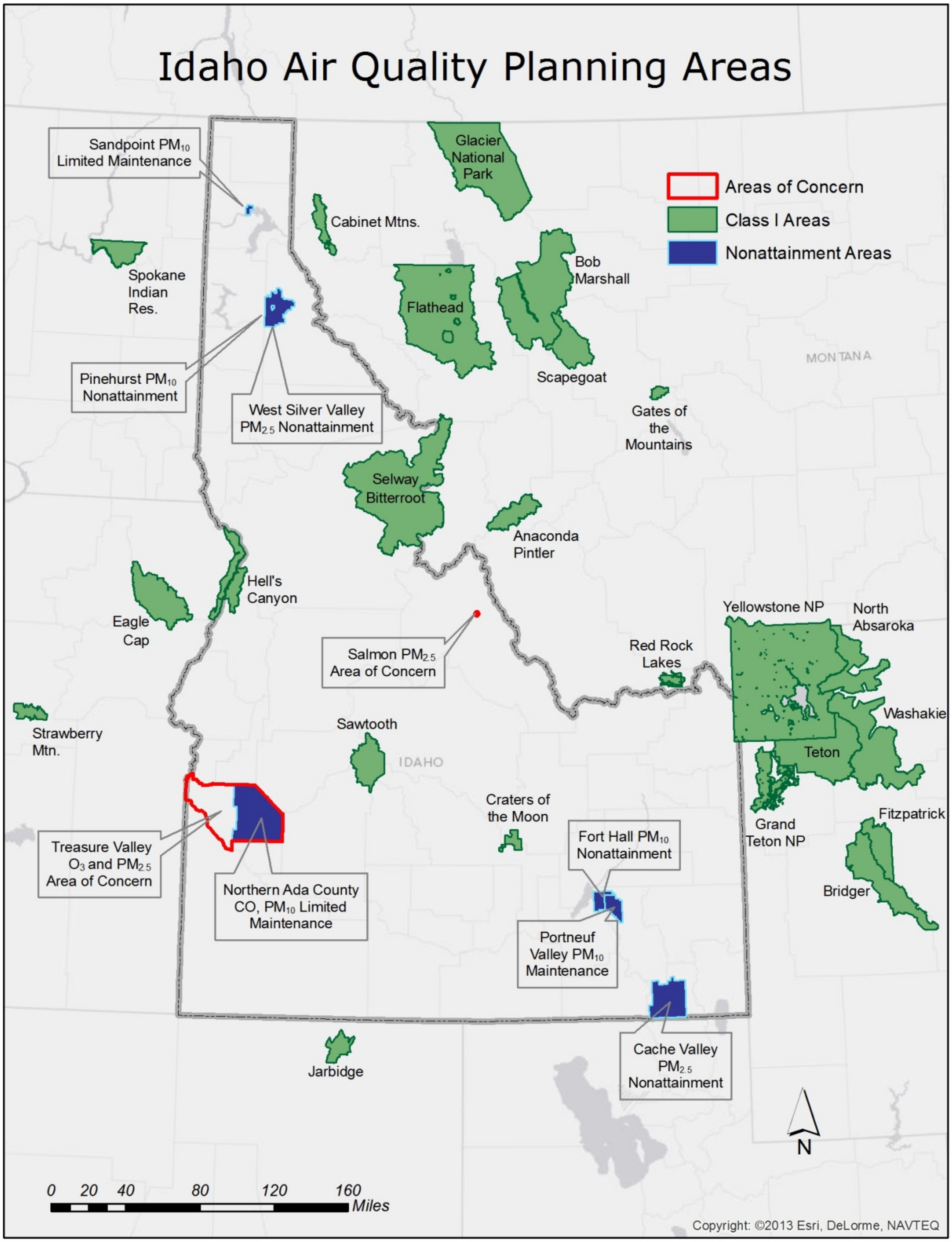

Figure 1. Idaho air quality planning map.

Note: Pinehurst PM_{10} NAA is the smaller of the two polygons in Pinehurst area.

2.3 Idaho's Air Quality—Air Quality Index (AQI) Overview

The AQI is a means for the daily reporting of air quality. It indicates how clean or polluted the air is in a particular area, identifies potential health impacts, and allows the levels of various pollutants to be evaluated using a common index. The AQI focuses on health effects that can happen within a few hours or days after breathing polluted air. DEQ uses the AQI for five major air pollutants regulated by the Clean Air Act: ground-level ozone (O_3), particulate matter (PM), carbon monoxide (CO), sulfur dioxide (SO_2), and nitrogen dioxide (NO_2).

The higher the AQI, the greater the potential for deleterious health effects. For example, an AQI value between 0 and 50 represents good air quality and little potential to affect public health, whereas an AQI value over 300 represents hazardous air quality with potentially serious health impacts. An AQI value of 100 generally corresponds to the NAAQS for the pollutant, which is the threshold EPA has set to protect public health. In cases where a pollutant has more than one form of a NAAQS (e.g., $PM_{2.5}$ has a 24-hour and an annual standard), the AQI is reported based on the shorter-term NAAQS. AQI categories and health precautions are summarized in Table 3. A list of additional health studies is provided in Appendix B.

DEQ is required to publish the AQI at least once per working day for areas with populations over 350,000. DEQ publishes this information for areas with lower populations as well, particularly in areas that may be impacted by wintertime wood smoke or smoke from various types of open burning (agricultural burning, residential open burning programs, prescribed fire, and wildfire).

When the AQI is above 100, DEQ also must report which groups (such as children, the elderly, and people with asthma or heart disease) may be sensitive to the specific pollutant. If two or more pollutants have AQI values above 100 on a given day, DEQ reports all the groups that are sensitive to those pollutants.

Tables 4 through 6 summarize Idaho's AQI data by county for 2011–2013. $PM_{2.5}$ levels drive the AQI for Ada and Canyon Counties during the winter months. During the summer, ozone has the biggest effect on the AQI in these counties. Since DEQ does not monitor ozone in the remaining counties listed in the tables below, $PM_{2.5}$ concentrations have the biggest effect on the AQI all year in those counties. Elevated $PM_{2.5}$ concentrations can be caused by localized residential wood combustion (RWC) during the winter. Smoke from various biomass burning (e.g., prescribed fire, wildland fire, agricultural burning) can impact $PM_{2.5}$ levels any time of the year, but primarily in the summer and fall. More detailed information about the AQI can be found on EPA's AirData website: *http://www.epa.gov/air/data/monaqi.html?st~ID~Idaho*.

Table 3. AQI categories and associated health precautions.

Air Quality	Protect Your Health	AQI
Good	No precautions necessary. Breathe deeply and enjoy!	0–50
Moderate	Sensitive people* should plan strenuous outside activities when air quality is better.	51–100
Unhealthy for Sensitive Groups	Sensitive people* should cut back or reschedule strenuous outside activities. Everyone else should consider limiting strenuous outdoor activities.	101–150
Unhealthy	Sensitive people* should avoid strenuous outside activities. Everyone else should cut back or reschedule strenuous outside activities.	151–200
Very Unhealthy	Sensitive people* should avoid all outside physical activities. Everyone else should significantly cut back on outside physical activities.	201–300
Hazardous	Everyone should avoid all outside physical activities.	301–500

* Sensitive people include children, the elderly, those with existing health conditions, and people who have high exposure (i.e., those who work, exercise, or spend extensive time outdoors).

Table 4. Idaho AQI summary for 2011.

2011		Number of Days in AQI Category				
County	Total Number of AQI Days	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	Highest AQI
Ada	365	315	47	3	—	115
Bannock	365	247	115	3	—	114
Benewah	361	320	41	—	—	99
Bonner	340	340	—	—	—	37
Butte	364	348	16	—	—	77
Canyon	358	336	21	1	—	110
Caribou	365	353	12	—	—	96
Cassia	195	192	3	—	—	58
Custer	91	89	2	—	—	75
Franklin	312	254	49	4	5	166
Idaho	306	306	—	—	—	50
Kootenai	183	182	1	—	—	51
Latah	365	354	11	—	—	70
Lemhi	359	222	125	11	1	152
Nez Perce	365	345	20	—	—	68
Shoshone	360	244	98	18	—	147
Twin Falls	350	335	15	—	—	66

* Sensitive people include children, the elderly, those with existing health conditions, and people who have high exposure (i.e., those who work, exercise, or spend extensive time outdoors).

Table 5. Idaho AQI summary for 2012.

2012		Number of Days in AQI Category					
County	Total Number of AQI Days	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	Very Unhealthy	Highest AQI
Ada	366	301	58	5	1	1	215
Bannock	366	231	126	6	3		172
Benewah	360	305	54	1			105
Bonner	356	356					36
Butte	340	308	29	2	1		154
Canyon	349	305	42		2		179
Caribou	365	363	1	1			112
Custer	109	94	11	2	2		165
Franklin	366	306	56	4			125
Idaho	361	326	26	1	6	2	268
Latah	347	314	27	2	4		173
Lemhi	362	198	118	16	20	10	264
Nez Perce	365	331	28	1	5		184
Shoshone	366	234	126	6			133
Twin Falls	355	318	34	2	1		155

* Sensitive people include children, the elderly, those with existing health conditions, and people who have high exposure (i.e., those who work, exercise, or spend extensive time outdoors).

Table 6. Idaho AQI summary for 2013.

2013		Number of Days in AQI Category				
County	Total Number of AQI Days	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	Highest AQI
Ada	365	301	52	9	3	183
Bannock	365	288	74	2	1	200
Benewah	359	289	69		1	160
Bonner	273	271	2			79
Butte	362	355	7			89
Canyon	312	284	24	3	1	185
Caribou	361	359	2			59
Custer	100	93	5	2		110
Franklin	357	285	40	21	11	175
Latah	34	34				27
Lemhi	346	210	122	12	2	157
Nez Perce	61	60	1			58
Shoshone	365	172	175	17	1	152
Twin Falls	305	292	13			86

* Sensitive people include children, the elderly, those with existing health conditions, and people who have high exposure (i.e., those who work, exercise, or spend extensive time outdoors).

2.4 Idaho DEQ's Ambient Air Monitoring Program

This section contains a brief description of DEQ's air monitoring program and the tools DEQ uses to determine the program's adequacy, along with a map showing each monitor's location.

The ambient air quality and meteorological data collected from DEQ's air monitoring network is used for a variety of purposes:

- Determining compliance with NAAQS and assessing trends
- Determining the location of maximum pollutant concentrations
- Forecasting air quality (AQI)
- Detecting smoke impacts (or smoke management)
- Determining the effectiveness of air pollution control programs
- Evaluating the effects of air pollution levels on public health
- Tracking the progress of SIPs
- Supporting pollutant dispersion models
- Developing responsible, cost-effective control strategies

The adequacy of an ambient air monitoring network may be determined by using a variety of tools, including the following:

- Federal monitoring requirements and network minimums
- Analyses of historical monitoring data
- Maps of pollutant emissions densities

- Dispersion modeling
- Special studies or saturation sampling
- SIP requirements
- Revised monitoring strategies (e.g., new regulations, re-engineering air monitoring network)
- Network maps and network descriptions with site objectives defined
- Best professional judgment

The appropriate location of a monitor can only be determined on the basis of stated objectives. Maps, graphical overlays, and GIS-based information are extremely helpful in visualizing or assessing the adequacy of monitor locations. Plots of potential emissions and/or historical monitoring data versus monitor locations are especially useful.

For each of DEQ’s air monitoring sites, this document contains a detailed assessment of the location, the monitor type (technology), and the sampling strategy. For each site, these assessments are reconciled with the site’s stated monitoring objectives. Factors affecting ambient pollution concentrations such as population, emissions densities, and meteorology are evaluated. Consideration is also given to changes in federal regulations that will impact DEQ’s monitoring priorities and needs during the next 5 years (see Appendix C for more information).

Figure 2 is a map of air monitoring stations managed by DEQ and the pollutants monitored at each station.

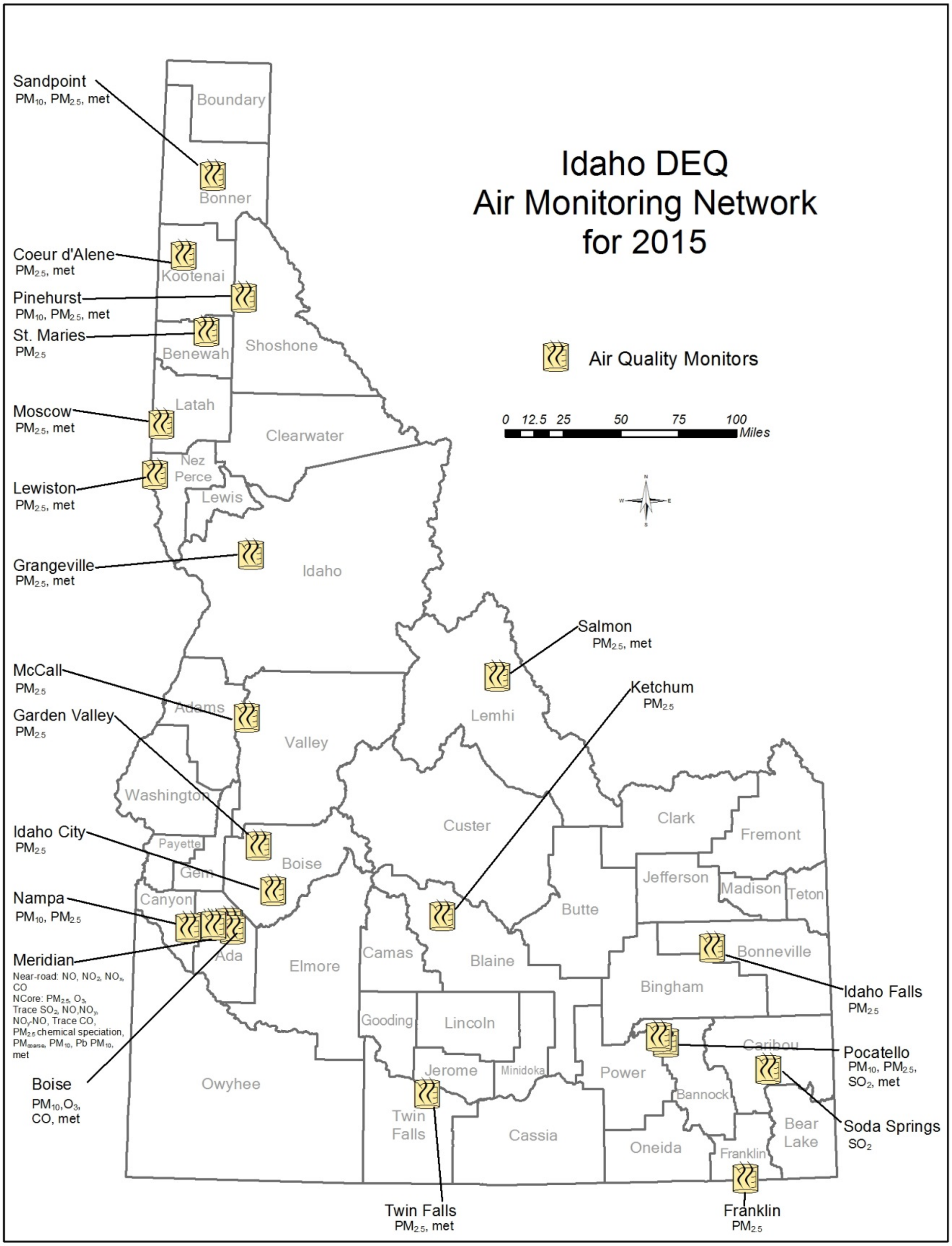

Figure 2. Idaho DEQ ambient air monitoring network—2015.

2.5 Primary Users of DEQ's Ambient Air Monitoring Data

Ambient monitoring data are used to support a variety of programs and tools for which daily decisions are required. From personal activities to agricultural and forestry practices, a number of tools exist to inform individuals and local, state, and federal organizations. These tools support credible decisions for specific actions. DEQ updates its website Monday through Friday with daily air quality (AQI) forecasts and applicable burn restrictions, which can be found at *www.deq.idaho.gov/air-quality/monitoring/daily-reports-and-forecasts*.

2.5.1 Local Ordinances

City and county ordinances related to air quality are described in the following sections. A number of local governments in Idaho have ordinances that prohibit open burning when forecasted AQI levels reach a specific numerical value.

2.5.1.1 Treasure Valley

Table 7 lists the open burning ordinances in the Treasure Valley.

Table 7. Local ordinances in the Treasure Valley: burn restrictions in cities and counties.

Location	If AQI is		These Burn Restrictions Apply	Ordinance Link
Ada County	≥60	No:	Open/outdoor burning.	*577*
		Okay:	Fireplaces and all woodstoves.	
	≥74	No:	Open/outdoor burning, fireplaces, and noncertified woodstoves.	*254*
		Okay:	Certified woodstoves.	
Boise City	≥60	No:	Open/outdoor burning.	*7-01-23*
		Okay:	Fireplaces and all woodstoves.	
	≥74	No:	Open/outdoor burning, fireplaces, and all woodstoves.	*4-06-04*
Eagle	≥60	No:	Open/outdoor burning.	*488*
		Okay:	Fireplaces and all woodstoves.	
	≥74	No:	Open/outdoor burning, fireplaces, and all woodstoves.	
Kuna	≥60	No:	Open/outdoor burning.	*922*
		Okay:	Fireplaces and all woodstoves.	
	≥74	No:	Open/outdoor burning, fireplaces, and noncertified woodstoves.	
		Okay:	Certified woodstoves.	
Garden City	≥60	No:	Open/outdoor burning.	*841-06*
		Okay:	Fireplaces and all woodstoves.	
	≥74	No:	Open/outdoor burning, fireplaces, and all woodstoves.	*808*
Meridian	≥60	No:	Open/outdoor burning.	*06-1221*
		Okay:	Fireplaces and all woodstoves.	
	≥74	No:	Open/outdoor burning, fireplaces, and all woodstoves.	
Star	≥60	No:	Open/outdoor burning.	*74*
		Okay:	Fireplaces and all woodstoves.	
	≥74	No:	Open/outdoor burning, fireplaces, and all woodstoves.	*85*
Canyon County	≥74	No:	Open/outdoor burning, fireplaces, and noncertified woodstoves.	*10-005*
		Okay:	Certified woodstoves.	
Caldwell	≥60	No:	Open/outdoor burning.	*2335*
		Okay:	Fireplaces and all woodstoves.	
Greenleaf	≥60	No:	Open/outdoor burning.	*196*
		Okay:	Fireplaces and all woodstoves.	
Middleton	≥60	No:	Open/outdoor burning.	*390*
		Okay:	Fireplaces and all woodstoves.	
	≥74	No:	Open/outdoor burning, fireplaces, and noncertified woodstoves.	
		Okay:	Certified woodstoves.	
Nampa	≥60	No:	Open/outdoor burning.	*2910*
		Okay:	Fireplaces and all woodstoves.	
Parma	≥60	No:	Open/outdoor burning.	*478*
		Okay:	Fireplaces and all woodstoves.	

2.5.1.2 North Idaho

The Coeur d'Alene Regional Office provides an Air Quality Advisory (AQA) for Bonners Ferry, Sandpoint, St. Maries, Pinehurst, and the Kootenai County areas. The advisory is for outdoor open burning and woodstove use curtailment. The advisory is issued year-round as necessary.

The City of Sandpoint adopted Ordinance 1258, which was incorporated into the Sandpoint limited maintenance plan (PM_{10}) and requires woodstove curtailment during a yellow burn advisory (issued by DEQ). The ordinance also requires EPA-certified woodstoves.

The City of Pinehurst adopted Resolution No. 68 (incorporated into the Pinehurst PM_{10} SIP), which requests individuals to voluntarily refrain from burning during times when poor air quality is forecast.

Kootenai County area fire districts voluntarily agreed to abide with a daily AQA program administered by DEQ. The AQA provides increasing types of burn restrictions with increasing deterioration of air quality and forecasted air stagnation.

2.5.1.3 Central Idaho

Twin Falls County has adopted County Ordinance 196: Part 4-4-6 Burn Permit Terminated. The fire chief, assistant chief, fire officer, or fire marshal has the authority to require that open burning be immediately discontinued (even if a valid permit has been issued) if smoke from burning becomes a nuisance or creates a hazardous condition or if a regional burn ban has been declared by a fire management agency or DEQ.

2.5.1.4 Southeast Idaho

The Portneuf Valley (cities of Pocatello and Chubbuck) was formerly a PM_{10} nonattainment area and is presently a maintenance area. Because of this designation, local ordinances are in effect to restrict burning. The City of Pocatello Ordinance 2726 and the City of Chubbuck Ordinance 582 give DEQ the authority to declare an "air quality alert" and notify the cities. In doing so, DEQ must also notify local print, radio, and television news media that an air quality alert is being declared. Thereafter, burn restrictions for RWC devices and outdoor open burning are in effect.

Because of the nonattainment designation for $PM_{2.5}$ given to Franklin County and surrounding areas, a number of recently adopted local ordinances are in effect to restrict burning when air quality is at a specific level (i.e., AQI $\geq$ 75) (Table 8).

Table 8. Burn restrictions in Franklin County and specific cities.

Location	If AQI is	These Burn Restrictions Apply		Ordinance Link
Franklin County	≥75	No:	Open/outdoor burning, fireplaces, and noncertified woodstoves.	*2012-6-25*
		Okay:	Certified woodstoves and devices granted exemption by county.	
Clifton		No:	Open/outdoor burning, fireplaces, and noncertified woodstoves.	*120*
		Okay:	Certified woodstoves and devices granted exemption by city.	
Dayton		No:	Open/outdoor burning, fireplaces, and noncertified woodstoves.	*287*
		Okay:	Certified woodstoves and devices granted exemption by city.	
Franklin		No:	Open/outdoor burning, fireplaces, and noncertified woodstoves.	*2012-9-12*
		Okay:	Certified woodstoves and devices granted exemption by city.	
Oxford		No:	Open/outdoor burning, fireplaces, and noncertified woodstoves.	*MOU & 2012-6-25*
		Okay:	Certified woodstoves and devices granted exemption by county.	
Preston		No:	Open/outdoor burning, fireplaces, and noncertified woodstoves.	*2012-1*
		Okay:	Certified woodstoves and devices granted exemption by city.	
Weston		No:	Open/outdoor burning, fireplaces, and noncertified woodstoves.	*2012-01*
		Okay:	Certified woodstoves and devices granted exemption by city.	

2.5.2 State Rules and Programs

2.5.2.1 Air Pollution Emergency Rule

Under sections 550–562 of the "Rules for the Control of Air Pollution in Idaho" (*IDAPA 58.01.01*), known as the Air Pollution Emergency Rule, DEQ is authorized to manage and remedy pollution levels that may constitute a health emergency. The rule is designed to guide the following:

- Defining criteria for an air pollution emergency
- Formulating a plan for preventing or alleviating such an emergency
- Specifying procedures for carrying out the plan

The Air Pollution Emergency Rule outlines the criteria that enable DEQ to take appropriate action when levels of regulated air pollutants cause or are predicted to cause a health emergency. The rule identifies four stages or levels of an emergency, with each successive stage addressing a progressively more serious air quality event (Table 9).

Table 9. Air Pollution Emergency Rule stages and criteria.

Stage	Title	Description
1	Forecast/Caution	The National Weather Service issues an Atmospheric Stagnation Advisory, or an equivalent local forecast is issued, triggering an internal watch by DEQ.
2	Alert	Air quality has degraded, requiring industrial sources to begin air pollution control actions.
3	Warning	Air quality has further degraded, requiring control actions to maintain or improve air quality.
4	Emergency	Air quality has degraded to a level that will substantially endanger public health, requiring implementation of the most stringent control actions.

Current and forecasted levels of pollutants in the atmosphere are determined by analyzing meteorological data and ambient air quality monitoring data gathered by DEQ. The four stages are triggered by specific criteria for the following pollutants: CO, NO_2, O_3, PM_{10} and $PM_{2.5}$, and SO_2. The criteria apply to any situation or circumstance in which pollutants reach, or are predicted to reach and persist at, potentially unhealthful levels.

2.5.2.2 Vehicle Inspection and Maintenance

In April 2008, the Idaho Legislature enacted and the governor signed into law *Idaho Code §39-116B*, entitled Vehicle Inspection and Maintenance Program. It required DEQ to enter into rulemaking to establish the minimum requirements for a vehicle inspection and maintenance program for airsheds located within a metropolitan statistical area (MSA) where ambient air quality design values are at or above 85% of a NAAQS and motor vehicle emissions constitute one of the top two contributing sources to the concentrations.

2.5.2.3 Crop Residue Burning (CRB)

In 2008, DEQ was assigned responsibility by the Idaho Legislature to manage crop residue burning (CRB) on lands other than the five Indian reservations in Idaho. The CRB program is designed to protect public health while enabling growers to burn under specific conditions. Under the program, growers must obtain approval from DEQ before burning by registering for a permit-by-rule at least 30 days in advance of the proposed burn date.

An acceptable burn day occurs when air quality is good and is expected remain good, as indicated by measured pollutant levels. Specifically, pollutant levels must not exceed 75% of any applicable federal air quality standard and must be projected to continue at no more than those levels during the subsequent 24 hours or must not exceed or be forecasted to reach and persist at 80% of the Stage 1 one-hour criteria for particulate matter (80 micrograms per cubic meter [$\mu g/m^3$] for $PM_{2.5}$).

Burn approval decisions are based on air quality conditions; proximity to towns, schools, roads, hospitals, or canyon rims; the order of burn requests received from applicants (first come, first reserved); and other relevant factors.

More information about the CRB program available at *www.deq.idaho.gov/air-quality/burning/crop-residue-burning*.

2.5.2.4 Montana/Idaho Airshed Group

In Idaho, certain land managers who conduct significant prescribed burning participate in a bi-state smoke management program with Montana. The program is managed by the *Montana/Idaho State Airshed Group*, which was formed to limit the impacts of smoke generated from necessary forest and rangeland burning.

2.5.2.5 Idaho Department of Lands

Individuals living outside city limits anywhere in Idaho who plan to burn for any reason—*including* crop residue burning and *excluding* recreational campfires—during closed fire season from May 10 to October 20 must obtain a fire safety burn permit from the *Idaho Department of Lands (IDL)*. There are a few exceptions to this rule in small, unincorporated areas in northern Idaho, which are protected through local fire departments that have their own permitting programs. Fire safety burn permits can be obtained online with Idaho Department of Land's new online statewide self-service fire safety burn permit system, *http://burnpermits.idaho.gov/*. Additional information and instructions are also provided concerning current fire restrictions and how to apply for additional or alternate required permits from cities and other jurisdictions—including local or county fire departments, DEQ, tribal reservations, and others.

2.5.2.6 State Implementation, Attainment, and Maintenance Plans

Air quality improvement plans (SIPs) and air quality maintenance (in some cases limited maintenance) plans provide a commitment to conduct ambient air monitoring, typically for 10 years from the approval date of the SIP and up to 20 years during implementation of the plans. Monitoring ensures compliance for the pollutant the plan is written for. Idaho currently has three nonattainment areas for which SIPs are being developed and five airsheds for which attainment or maintenance plans are in effect that have ambient air monitoring commitments:

1. Portions of Power and Bannock Counties (Pocatello and nearby) in Idaho were designated a moderate nonattainment area for PM_{10} by operation of law upon enactment of the Clean Air Act Amendments of 1990. On November 5, 1998, EPA granted a request by the state to divide the Power-Bannock Counties nonattainment area, which included a portion of the Fort Hall Indian Reservation, into two nonattainment areas: one that included only reservation lands (Fort Hall nonattainment area) and a second (Portneuf Valley area) under the regulatory jurisdiction of the state.

   On June 30, 2004, the State of Idaho submitted a plan that meets the planning obligations for both the nonattainment and maintenance plans. In addition, the state requested redesignation of the Portneuf Valley to attainment for PM_{10}.

   On May 20, 2005, EPA proposed in the Federal Register to approve the plan and grant the redesignation request, which EPA did on July 13, 2006 (see *71 FR 39574*). The area is now designated as attainment under a maintenance plan.

2. Northern Ada County (Boise), Idaho, was designated as a moderate PM_{10} nonattainment area upon enactment of the Clean Air Act Amendments of 1990. Idaho submitted a maintenance plan and redesignation request on September 27, 2002, and provided supplemental information on July 10 and July 21, 2003. EPA proposed

approval of the maintenance plan and redesignation request on July 30, 2003 (*68 FR 44715*). On October 27, 2003, EPA approved the Northern Ada County (Boise) PM_{10} maintenance plan and redesignation request (*68 FR 61106*). The area is now designated as attainment under a maintenance plan.

3. Northern Ada County (Boise), Idaho, was designated nonattainment for CO and designated as "not classified" upon enactment of the Clean Air Act Amendments in 1990. Idaho submitted a CO maintenance plan on January 17, 2002, and EPA approved the CO maintenance plan and redesignation request on October 28, 2002 (*67 FR 65713*). The second maintenance plan was submitted to EPA on February 10, 2011, and EPA approved the plan on October 1, 2012 *(77 FR 45962).* The area is now designated as attainment under a maintenance plan.
4. The Sandpoint area in Bonner County, Idaho, was designated as a nonattainment area for PM_{10} and classified as moderate upon enactment of the Clean Air Act Amendments in 1990. Idaho submitted a PM_{10} attainment plan in May 1993. On August 16, 1996, Idaho submitted a revised plan, and EPA approved the plan on June 26, 2002 (*67 FR 43006*). On December 14, 2011, DEQ submitted a limited maintenance plan and redesignation request, which EPA approved on May 3, 2013 *(78 FR 20001).* The area is now designated as attainment under a limited maintenance plan.
5. The Shoshone County, Pinehurst, Idaho, area was designated nonattainment for particulate matter (PM_{10}) and classified as moderate upon enactment of the Clean Air Act Amendments of 1990. Idaho submitted a PM_{10} attainment plan on April 14, 1992, and EPA approved the plan on August 25, 1994 (*59 FR 43745*). On April 14, 1992, Idaho also submitted a PM_{10} attainment plan revision for the portion of the Shoshone County, Idaho, nonattainment area just outside the city of Pinehurst. This area was designated nonattainment in January 1994. EPA approved the plan revision on May 26, 1995 (*60 FR 27891*). The area of Pinehurst is still designated as nonattainment but DEQ plans to submit a limited maintenance plan and redesignation request in a similar time frame as the West Silver Valley attainment plan (see item 7 below).
6. Cache Valley was designated as part of the cross border Logan, Utah-Idaho nonattainment area for $PM_{2.5}$, effective December 14, 2009 (*74 FR 58688*, published November 13, 2009). This area is now known as the Cache Valley nonattainment area. Because this plan has cross-state implications, EPA has approved several portions of the plan submitted but complete approval has not occurred. For more information on EPA's approval of the emissions inventory, control measures, and SIP strengthening measures see *79 FR 16201* and *79 FR 41904*. The area is still designated nonattainment.
7. The West Silver Valley, including the areas around Pinehurst, Kingston, Smelterville, and Kellogg, was designated nonattainment (*80 FR 2206*) on December 18, 2014, when the EPA administrator took final action and promulgated initial designation for the 2012 $PM_{2.5}$ annual NAAQS. DEQ is in the process of developing a $PM_{2.5}$ attainment plan for the area.

Sunset dates, or end dates for monitoring requirements, are not specified in the air quality improvement or maintenance plans. DEQ presumes that the monitoring commitments for demonstrating attainment are 20 years from the date the airshed is reclassified to attainment.

2.5.3 Public Information

DEQ provides updates on real-time or near real-time air quality conditions to the public in two ways: EPA's AirNow webpage and DEQ's real-time air quality map. Links to both of these tools are provided on DEQ's air quality webpage: *www.deq.idaho.gov/air-quality/monitoring/daily-reports-and-forecasts*. DEQ also provides daily AQI forecasts, allowing sufficient time for citizens, industry, and governments to plan their activities accordingly.

2.5.4 Databases

DEQ's monitoring data are submitted to EPA's Air Quality System (AQS) database in a timely manner as required by the Clean Air Act. Data from AQS is accessible through EPA's public website (AirData): *http://www.epa.gov/air/data/*.

Preliminary, uncorrected pre-quality assured air quality monitoring data can also be accessed by the public through DEQ's air quality webpage: *http://airquality.deq.idaho.gov/*.

2.5.5 Air Quality Modeling and Forecasting Tool

Monitoring data are used by the University of Washington and Washington State University for incorporation into tools that are used to forecast local meteorology and real-time air quality. These tools are discussed in section 3.2.

3 Air Quality and Idaho's Physical Environment

This section provides detailed information about Idaho's topography and meteorology and how they affect air quality in Idaho's airsheds. It also provides information about data and tools available for air quality forecasting and the sources of air pollutants in Idaho, including overviews of emissions inventories and a summary of recent air quality trends.

3.1 Topography and Meteorological Summary

Local topography and meteorological conditions influence air quality significantly and in complex ways. The same characteristic can be beneficial to air quality in one season but detrimental in another. Furthermore, the same characteristic can have opposite effects on air quality at different times of the day.

The following descriptions of Idaho's topographic and meteorological characteristics and their influences on air quality are paraphrased from more detailed discussions developed and published by the Western Regional Climate Center (NOAA 1985), as well as from input by the DEQ air quality meteorologist. More detailed descriptions of how climate and topography influence the specific airsheds in Idaho are in section 3.3.

3.1.1 Topographic Features

Topography provides a structure that directs or impedes air and pollutant flows in an area. The same structure can have a positive influence on air quality during some seasons and a negative influence during others. Winds can advect or trap pollutants in some seasons and provide a cleansing effect in others. Diurnal winds, caused by differential heating and cooling of sloped surfaces, can advect pollutants in from a source or trap them in an area during one part of the day and drain them out of the area during another time of day. This effect is maximized on clear, sunny days with high solar radiation. During winter and nighttime hours, cold air pooling is typically experienced in valleys and is conducive to inversion conditions that can trap pollutants at ground level and result in poor air quality. Such an inversion is usually eroded by mid-morning but can persist for multiple days during particularly strong events.

The elevation in Idaho varies dramatically from 738 feet at the confluence of the Clearwater and Snake Rivers to as high as 12,655 feet at the peak of Mt. Borah. The large variation in elevation provides many barriers to the free flow of air. The varied terrain also provides for a wide range of climates across the state, with the northern area influenced by maritime air while the southern and eastern portions follow a more continental climate.

3.1.2 Temperature

Temperature has a direct and indirect influence on pollutant concentrations. Most air quality impacts related to temperature are observed on each end of the spectrum—during the cold winter or hot summer. Air quality influences by temperature tend to be more favorable during the transition times of the year (spring and fall).

Ozone is typically known as a summertime pollutant because it is most easily formed in warm temperatures under high sunlight. The highest ozone concentrations in Idaho occur during the hottest months (July and August). Particulates ($PM_{2.5}$ and PM_{10}) most commonly increase during wintertime inversions when pollutants are trapped in an area and accumulate; however, particulate concentrations can increase in both hot and cold conditions when extremely dry. Depending on the season, different sources of particulates become the dominant contributing component.

Elevation plays an important role in the average annual temperatures and the amount of diurnal temperature variation throughout the state. In general, temperature decreases with increasing elevation. Diurnal temperature variation is lowest during winter months when increased cloud cover and higher relative humidity stabilize temperatures.

3.1.3 Precipitation

Precipitation typically has a beneficial influence on air quality. Rain and snow both can absorb and remove pollutants from the air, and they influence atmospheric turbulence that results in dilution of pollutants from the increased mixing.

The largest source of moisture is from the Pacific Ocean, and it is particularly evident across the northern portion of the state. During the height of the North American Monsoon (NAM) season—June through September—moist, warm air masses from the Gulf of Mexico and the Gulf of California can become entrained in the mean flow and advect into southern and southeastern Idaho. Subtropical and extratropical cyclones in the eastern Pacific further complicate the weather pattern by providing moist, unstable air masses into the mean flow.

Average precipitation varies significantly across the state. In general, northern regions receive more precipitation as there are fewer topographical barriers to the west coupled with a more active winter storm track. Higher elevations tend to have higher average precipitation, with much of it received as snowfall.

3.1.4 Humidity

Humidity impacts air quality in varying ways based on the season. In the summer, high humidity reduces sunlight intensity and facilitates atmospheric chemical reactions that inhibit ozone formation, thereby improving air quality. However, high humidity in the winter can act as a catalyst for small chemical species in the air to coalesce and react to form secondary particulates. When combined with very low temperatures, high humidity can result in rime ice or hoar frost, which is very effective at removing pollutants from the air. Low humidity in the summer allows full sunlight intensity and does not inhibit the ozone formation reaction, thus leading to higher ozone concentrations. Low humidity in the winter slows the formation of secondary particulates but also allows dust from road-sanding operations to dry out, increasing the likelihood of the dust becoming airborne and subsequently being measured as particulates. Humidity varies within each season but tends to be higher in the winter and lower in the summer due to the intrinsic effects of temperature on the ability of air to hold water vapor.

3.1.5 Fog

Fog is typically only an influence in colder months. Light fog provides the same influences on air quality as high humidity; however, heavy fog can work similarly to precipitation in that water droplets can become large enough that they actually remove pollutants from the air. Similarly, hoar frost or rime ice that form ice crystals on trees, power lines, or other structures during times of heavy fog and cold conditions often scrub pollutants from the air. Strong valley inversions typically lead to dense fog formation at the surface.

3.1.6 Storms

Windstorms are not uncommon in Idaho. While the state has no destructive storms such as hurricanes, and an extremely small incidence of tornadoes, windstorms of various types impact the area year-round. Mid-latitude cyclones with accompanying low pressure systems, cold fronts, or baroclinic troughs may occur year-round. During the summer months, strong winds are driven by decaying thunderstorms and their associated outflows or large, thermally driven pressure gradients. Summer thunderstorms are more frequent in mountainous areas, where orographic lift promotes their development and enhancement. Lightning strikes from these storms can start forest and range fires.

Storms can provide mixing and instability with their associated winds, which are needed to clean the air after a period of pollutant accumulation such as during an inversion. They can also direct pollutants away from an area such as a community impacted by wildfire smoke via a change in the steering flow; however, winds can also transport high particulate concentrations by directing pollution from its source to an airshed.

3.1.7 Sunshine (Solar Radiation)

O_3 is a gas composed of three oxygen atoms. It is not usually emitted directly into the air, rather, it is created by a chemical reaction between oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) in the presence of sunlight. Increases in solar radiation generally allow a more efficient reaction and lead to higher ozone concentrations, which can be a benefit in the upper levels of the atmosphere or a concern at the surface.

Typically, winter months in Idaho have sunshine roughly 40% of the time. During summer months, that rises to about 80%, particularly in the southern part of the state. The increased summertime sunshine and warmer temperatures makes Idaho's climate very efficient in producing ozone.

3.1.8 Forested Lands

Forested lands provide fuels for a variety of biomass burning that leads directly to increased particulate levels. Trees are harvested to supply fuel for home heating. Lumber harvest produces waste products such as limbs and other slash. Forest management practices involve under-brush clearing through prescribed burning. And of course there are wildfires. Additionally, various types of vegetation emit biogenic VOCs that contribute to ozone formation.

Approximately 2 million acres of forest lie within the eastern part of the state, mostly in the higher mountainous areas, and lumber harvest is done only on a small scale. The southwestern portion of the state has a greater forested area, running into several million acres. Lumber harvest is a more important phase of the economy in southwestern Idaho than in eastern Idaho. The northern part of Idaho, because of its greater annual precipitation, is more heavily forested than the southern portion of the state, and lumber harvest has long occupied a prominent place in the economy of north Idaho. Lewiston, Potlatch, and Coeur d'Alene are home to forest product industries.

3.2 Meteorological Data and Tools Available for Air Quality Forecasting

DEQ uses meteorological data and tools to support the data and information provided to primary users. Information is provided below for the data and tools most commonly used by DEQ to forecast air quality and meteorological conditions: the CART ozone forecasting tool, the National Weather Service Air Quality Guidance Model, UniSys models, skew-T diagrams of atmospheric conditions (observational data from University of Wyoming and modeled data from the University of Washington), the AIRPACT-4 air quality model, outputs from the ARW-WRF model at the University of Washington, and National Weather Service forecasts.

Certain regional modeling and air quality forecasting tools require real-time DEQ ambient monitoring data. Boise City (Treasure Valley airshed) is Idaho's only MSA that meets the population criteria for determining and reporting a daily AQI, per the Code of Federal Regulations. However, in accordance with Clean Air Act planning requirements for areas that have violated the NAAQS, DEQ has implemented AQA programs in several designated (or formerly designated) nonattainment areas. Agricultural and other open burning, smoke from wildfire and prescribed fire, strong winter inversions, and other sources of pollution have prompted DEQ to extend the AQI program to a number of different areas in the state.

Forecasting AQI for an AQA program requires informed decisions that consider the most recent air quality conditions and the expected meteorological conditions over the forecast period. The various resources used by DEQ forecasters to determine changes in meteorological conditions and project impacts on local air quality are described below.

3.2.1 CART Ozone Forecasting Tool

Idaho DEQ has developed a classification and regression tree (CART) forecasting system as a tool for the Boise Regional Office to use in developing its AQI forecast during the ozone season. Historical ozone monitoring data and meteorological parameters for the previous 5 years were analyzed using the CART module in the R Statistical software package. This analysis helped DEQ select meaningful predictive parameters to generate a classification tree that uses the previous day 8-hour ozone concentration, temperature, wind speed, relative humidity, and 850-millibar (mb) temperature. AQI categories and control measure trigger points have been integrated into the tree so it can be used to determine the probability of reaching each category or trigger point for the Treasure Valley airshed. The resulting tree is automated with forecast meteorological inputs from the University of Washington WRF simulations (described below) and updated twice daily. The CART tool includes ozone and meteorological monitoring data from the DEQ monitoring network to help interpret the forecast and is used along with other available tools, as described below.

3.2.2 National Weather Service Air Quality Guidance Model

The National Weather Service provides a map that predicts ozone, dust, and smoke concentrations for use by the public and state and local air quality forecasters (located at *http://airquality.weather.gov/sectors/pacnorthwest.php*). These data are updated twice daily at 0600 and 1200 UTC (Coordinated Universal Time).

Ozone is shown as 1-hour and 8-hour concentrations (in parts per billion, or ppb) (Figure 3). Dust is displayed as 1-hour average surface dust (micrograms per cubic meter) and column averages. Surface and column average concentrations of predicted smoke are displayed as 1-hour averages (in micrograms per cubic meter). The model provides a visualization of how weather information and pollutant monitoring information come together to predict air quality conditions. Figure 3 is an example.

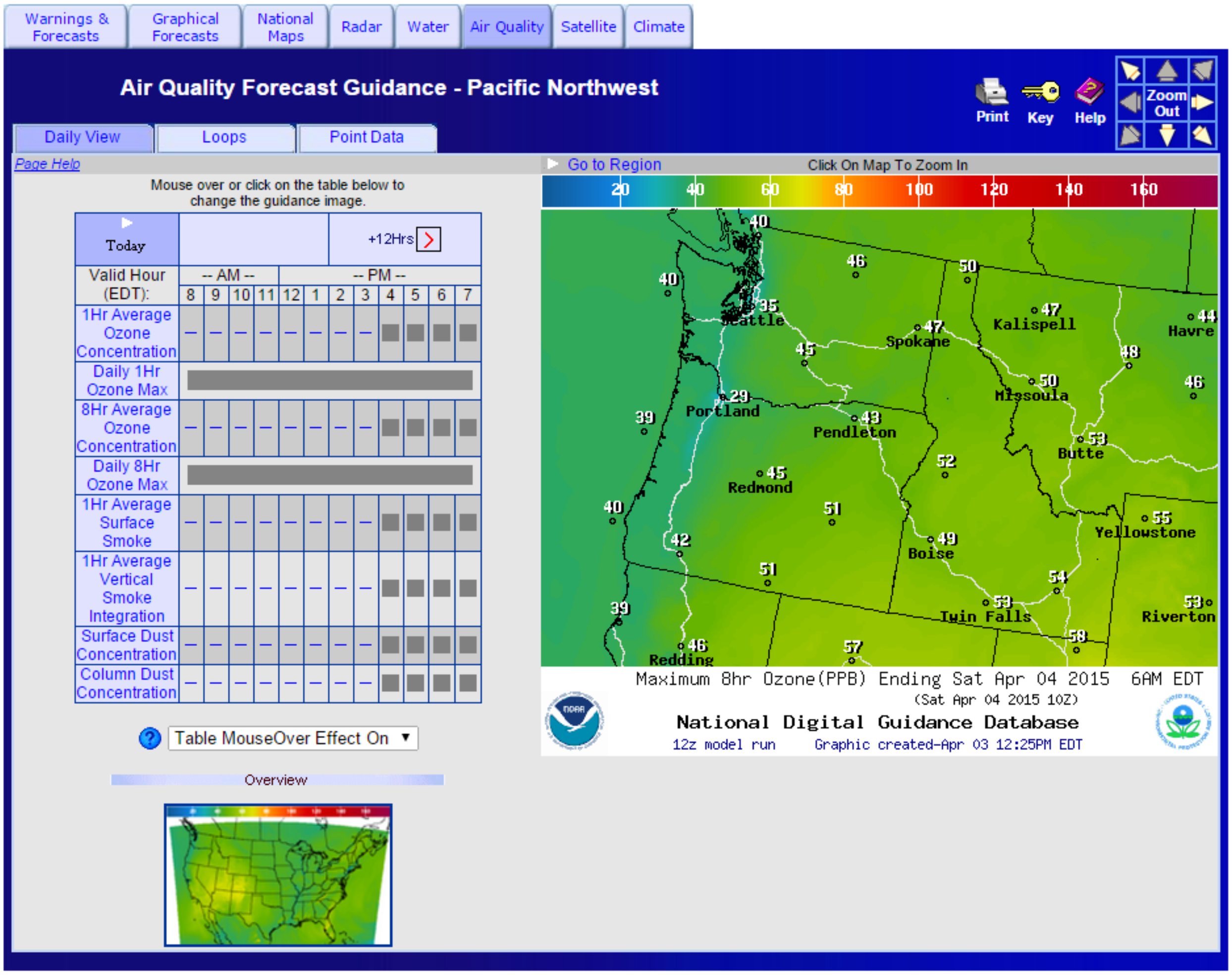

Figure 3. National Weather Service air quality guidance model example.

3.2.3 UniSys 500-mb Level Weather Forecast Model

The 500-mb level is approximately 18,000 feet above sea level. On the UniSys 500-mb charts (located at *http://www.weather.unisys.com/ecmwf/ecmwf_500p_4panel.gif*), pressure at the 500-mb level is in color and the sea-level, or surface, pressure is represented by thin black lines. Figure 4 shows an example. The ridge in the example is east of Idaho. The trough approaching Idaho is located off the California/Oregon coast. When ridges are overhead, high-pressure, stagnant conditions at the surface are likely due to the nature of subsidence. DEQ uses the 500-mb level model to understand predicted upper atmosphere conditions that can influence air quality for the forecast period.

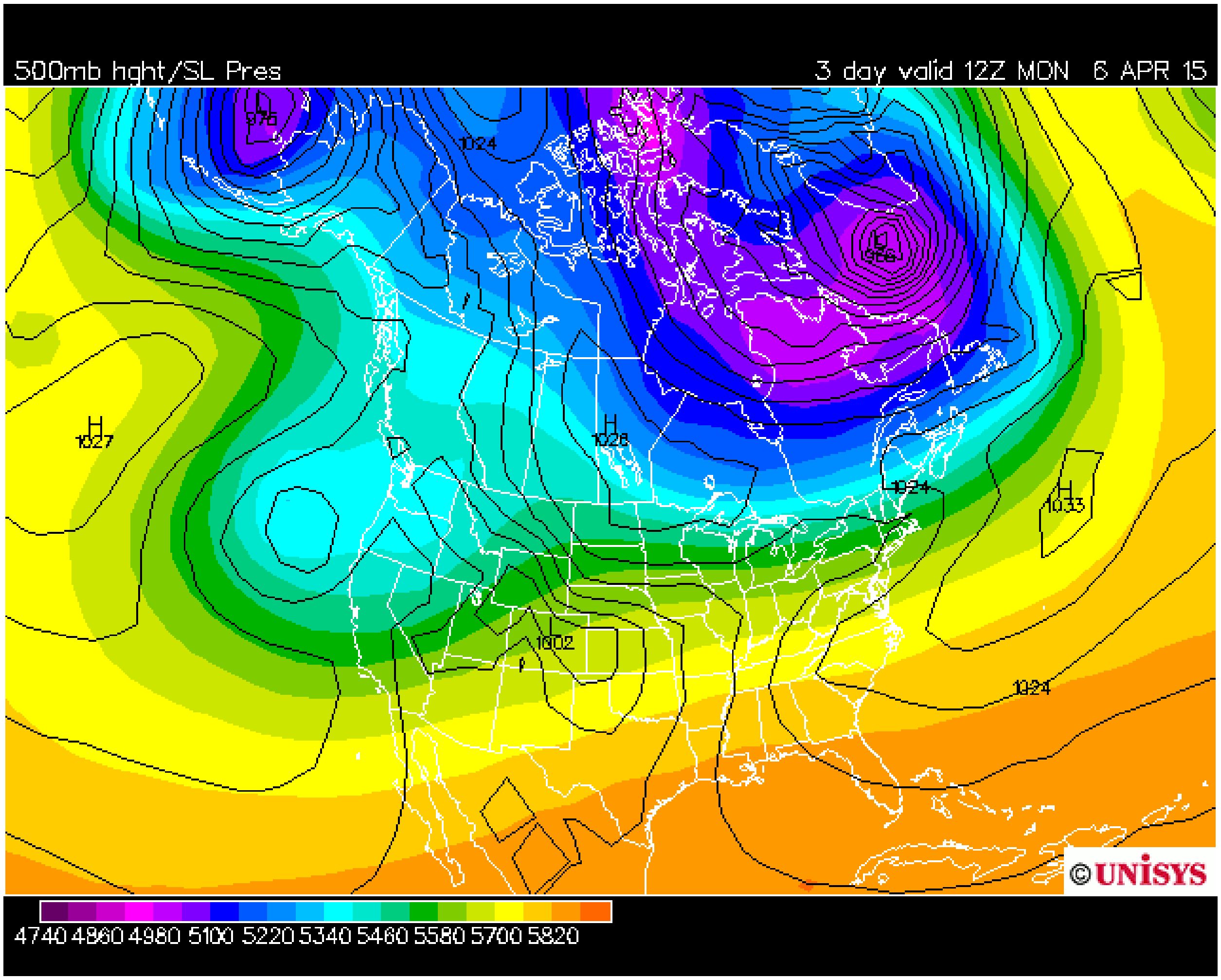

Figure 4. UniSys 500-mb forecast model example.

3.2.4 UniSys 850-mb Level Weather Forecast Model

The 850-mb level is approximately 5,000 feet above sea level. On the UniSys 850-mb charts (located at *http://www.weather.unisys.com/nam/4panel/nam_850_4panel.gif*), temperature is indicated by color scale. An 850-mb temperature chart provides a good indication of the expected cold or warm air advection into the forecast region. In Figure 5, the temperature over Boise is expected to be approximately 4–6 °C. DEQ uses the 850-mb forecast model to understand predicted near-surface or surface conditions that can influence air quality for the forecast period. Due to the elevated terrain of Idaho, the 850-mb level can represent the surface level.

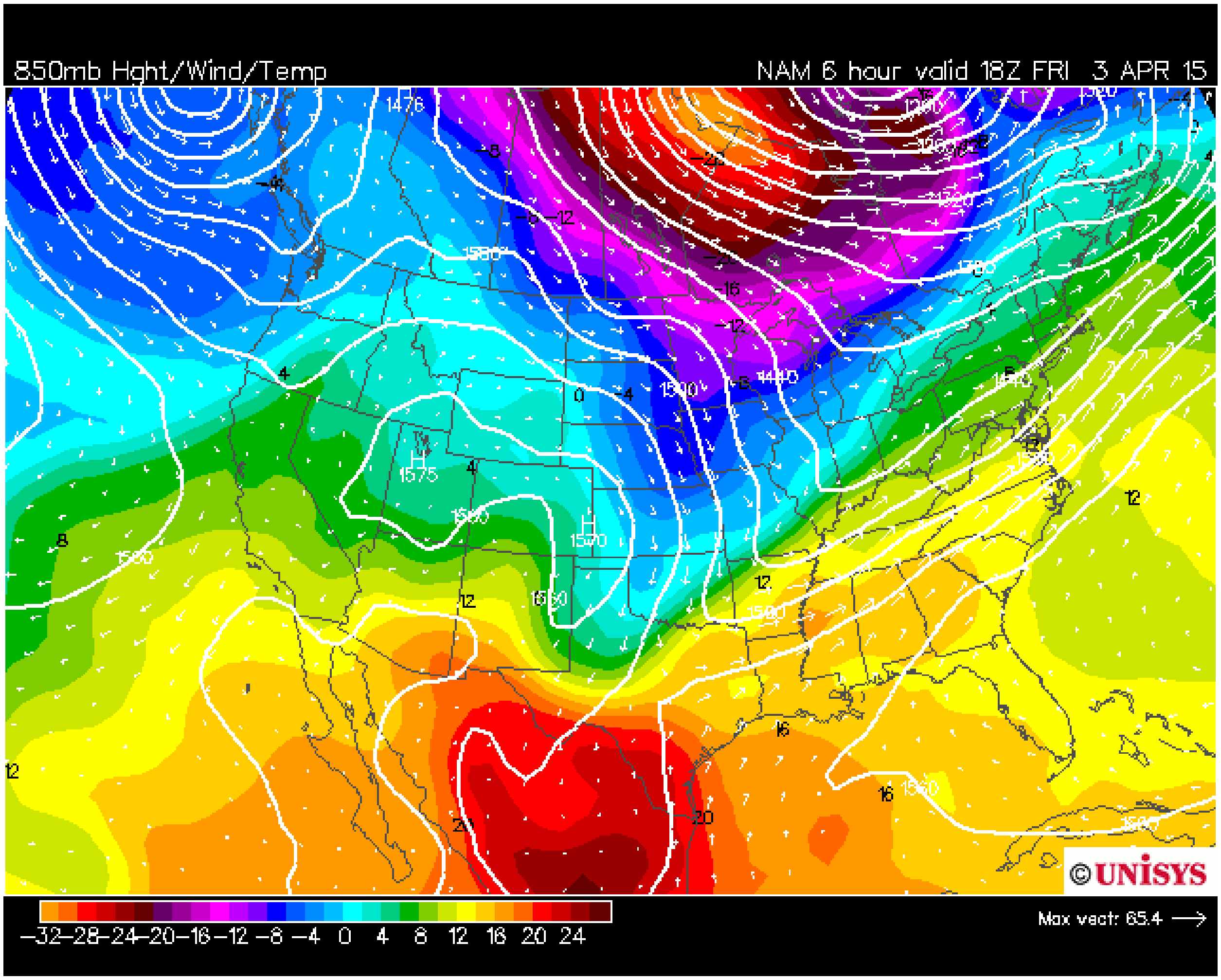

Figure 5. UniSys 850-mb forecast model example.

3.2.5 University of Wyoming Skew-T Diagram

Skew-T diagrams chart atmospheric measurements that are obtained at regional airports every 12 hours at 00:00 and 12:00 UTC around the globe. These charts (located at *http://weather.uwyo.edu/upperair/sounding.html*) present many forms of information for a weather forecaster—winds, cloud formation, atmospheric stability, and temperatures. Figure 6 indicates that a surface inversion exists up to about 890-mb and that cloud formation (if any) is most likely to occur around the 750-mb to 700-mb level with another upper level subsidence inversion around the 600-mb level (which has likely developed due to the ridge of high pressure over the area at that time).

DEQ uses these skew-T diagrams to better understand the vertical profile of the atmosphere. This information provides guidance on whether forecasters can expect atmospheric instability; breaking of inversion conditions; formation of cloud cover, dew, or frost; and other conditions that could impact pollutant concentrations.

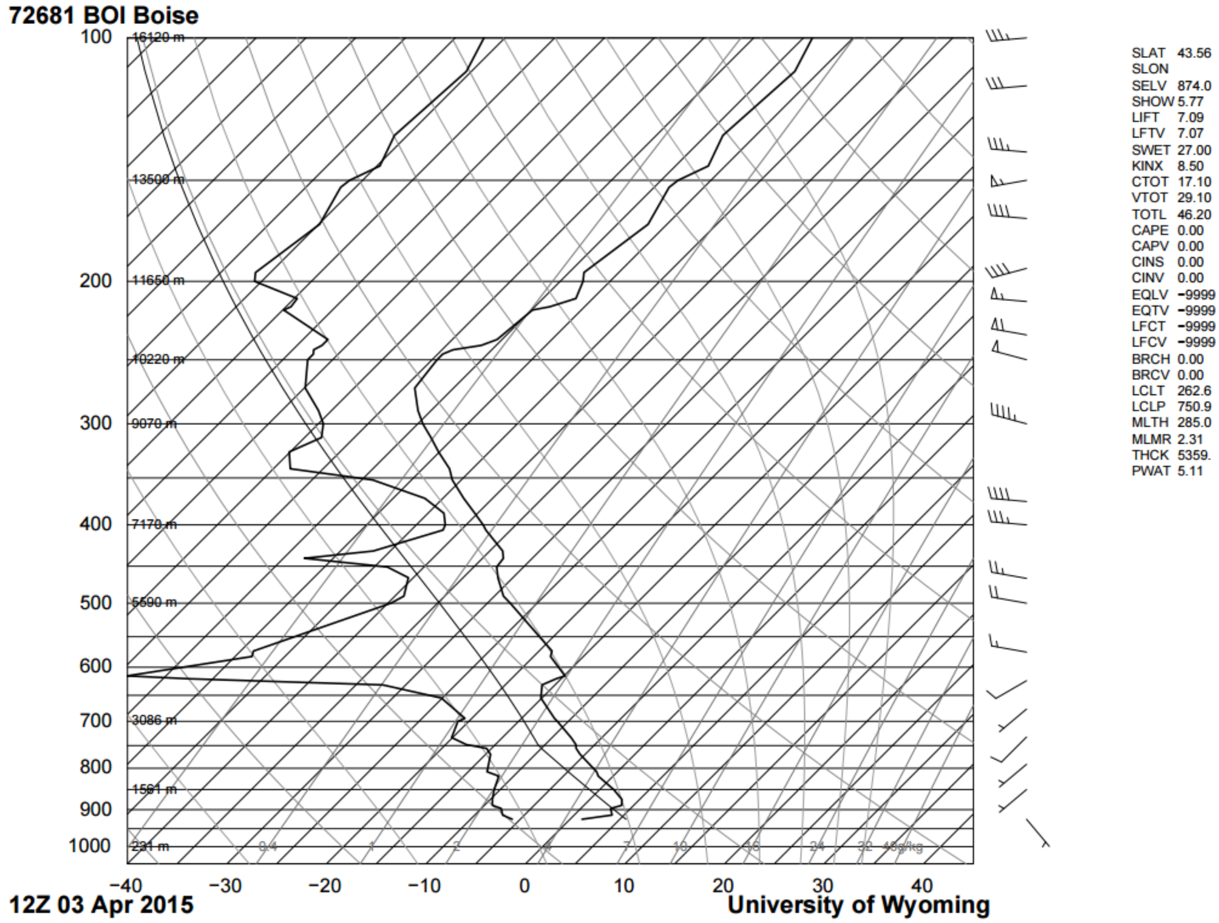

Figure 6. University of Wyoming skew-T diagram example.

3.2.6 AIRPACT-4

AIRPACT-4 is a photochemical grid modeling system (accessible at *http://lar.wsu.edu/airpact/*) used for predicting air quality out to 48 hours for Idaho, Oregon, and Washington. Figure 7 shows an example.

AIRPACT predicts air quality by calculating the chemistry and physics of air pollutants as determined by pollutant emissions within the context of background conditions, natural air chemistry, and predicted meteorology. Meteorology and pollutant emissions are used to provide a visualization of air quality conditions in the immediate future.

AIRPACT's project name, the Air Information Report for Public Access and Community Tracking, reflects the goal of bringing meaningful information on air quality (or the level of air pollutants) to the public from a variety of sources, including both model results and monitoring stations. AIRPACT is one tool that may be used by air quality forecasters in Idaho to judge expected changes in air quality levels predicted over the next 48 hours.

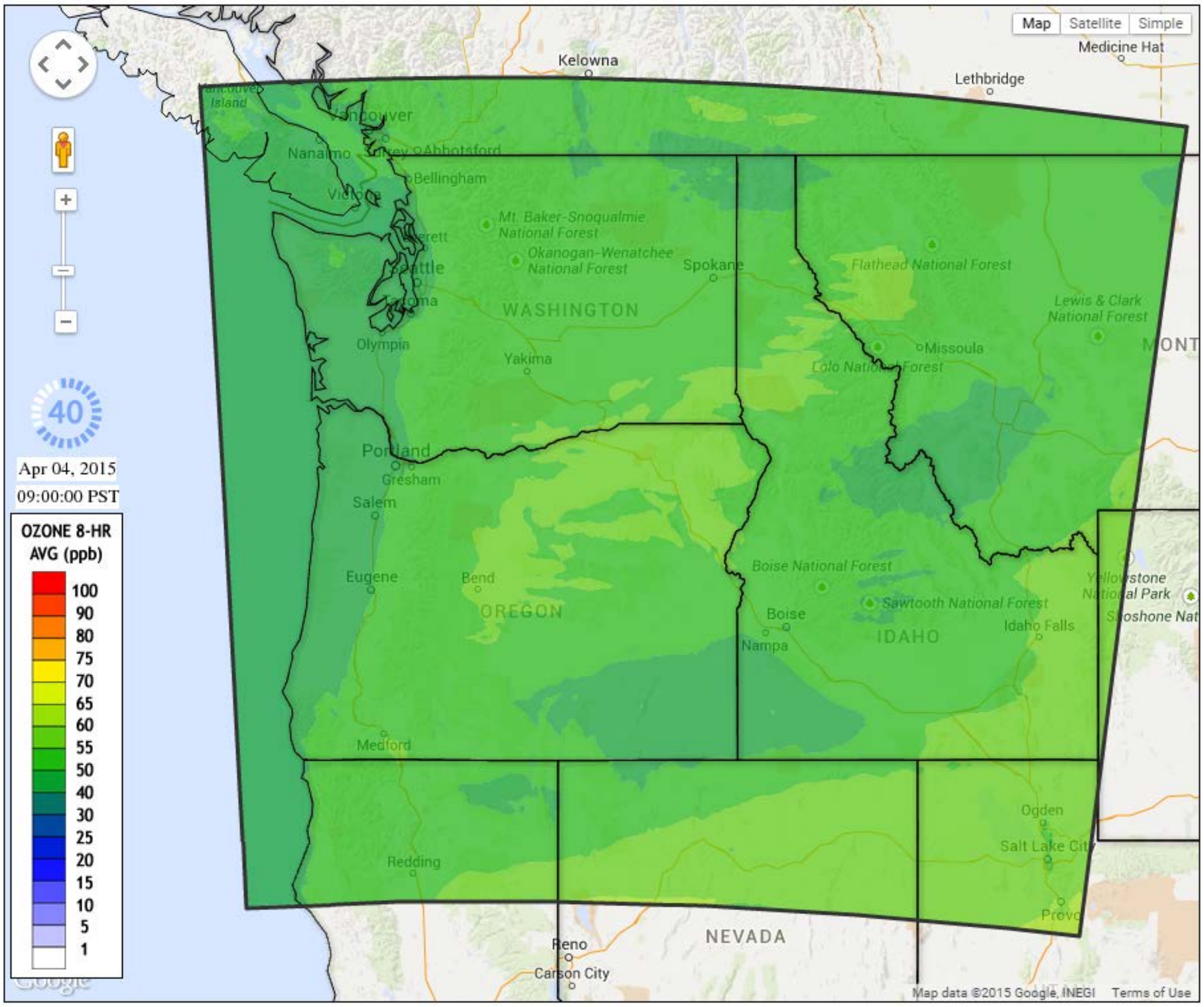

Figure 7. AIRPACT-4 model output example.

3.2.7 ARW-WRF

DEQ uses output from the weather prediction model ARW-WRF (Advanced Research WRF) hosted by the University of Washington. Figure 8 shows an example.

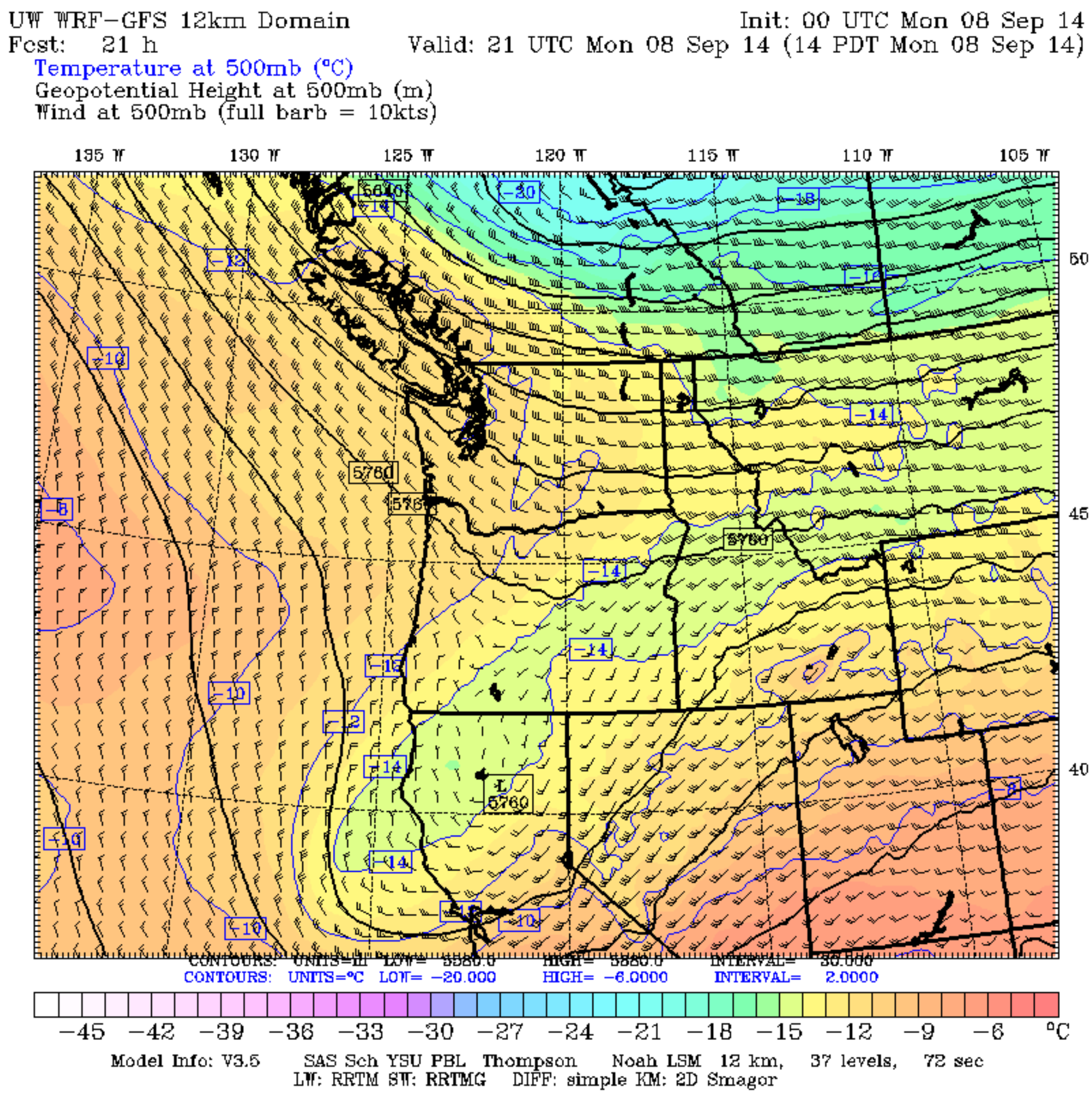

Figure 8. ARW-WRF model output example.

Certain outputs from the ARW-WRF models are sponsored by the Northwest Regional Modeling Consortium (available at *http://www.atmos.washington.edu/mm5rt/*). The activities of the consortium include the following:

- Creating one of the highest-resolution operational weather prediction systems in the US
- Purchasing and maintaining a 915-megahertz (MHz) radar wind profiler with radio acoustic sounding system temperature-sounding capability that is located at the National Oceanic and Atmospheric Administration Sand Point facility in Seattle
- Gathering real-time observational data from operational networks in the Northwest to create a detailed description of atmospheric conditions over the region
- Running regional air quality and distributed hydrological forecast models coupled with the ARW-WRF model
- Producing smoke, ventilation, and fire control guidance driven by ARW output
- Running a regional ensemble weather prediction system

Furthermore, DEQ is a contributing member of the Northwest AIRQUEST group. NW-AIRQUEST seeks to maintain and enhance a sound scientific basis for air quality management decision making in the Pacific western North America region. It is composed of federal, state, regional, and local air quality agencies; federal land managers; and Native American tribes. Activities of NW-AIRQUEST include the following:

- Providing sound scientific advice to, and receiving appropriate input or direction from, decision-makers for the management of air quality issues within the region
- Developing and operating regional numerical air quality forecast systems
- Coordinating emissions inventory and air quality observational databases for regional model application and evaluation
- Developing, evaluating, and applying tools for specific measurement and modeling studies
- Providing education, technology transfer, and communication to enhance understanding of current air quality issues
- Collaborating with other scientific groups and organizations involved in the science disciplines associated with air quality and related environmental resources

DEQ uses WRF model predictions to better understand forecast weather parameters and develop daily air quality forecasts. In addition, DEQ downloads and archives the WRF outputs for use in driving our regional and airshed modeling efforts. By combining observed pollutant levels at specific sites with modeling results, we are able to create the best possible depiction of air quality at locations throughout the state that are not near a monitoring site.

3.2.8 National Weather Service Forecasts

The National Weather Service operates offices in Boise, Pocatello, Spokane, and Missoula that provide detailed point forecast information for Idaho. Seven-day forecasts, area forecast discussions, hazardous weather outlooks (when applicable), and stagnation warnings (when applicable) are provided to further assist forecasters in understanding the immediate weather conditions.

3.3 Idaho's Airsheds

Idaho's delineated airsheds, and some nondelineated areas, are described in this section. The airsheds have been established to correspond with certain air quality concerns. All population estimates in section 3.3 are 2013 estimates from the US Census Bureau 2009–2013 5-year American Community Survey (*www.census.gov/programs-surveys/acs*).

3.3.1 Treasure Valley Airshed

Idaho's Treasure Valley occupies the western end of the broad Snake River valley where the Payette, Boise, Weiser, Malheur, and Owyhee Rivers drain into the Snake River. It includes the valley areas from Vale and Ontario, Oregon, in the west to Mountain Home, Idaho, in the east. The Boise City–Nampa MSA accounts for the greatest population in the valley, with approximately 628,966 residents estimated in 2013, compared to Caldwell, Idaho (48,957), and Ontario, Oregon (11,091), in the western end of the airshed.

Synoptic (on the scale of 1000 km) winds arrive at the Treasure Valley from the west and southwest; however, terrain-driven valley flows largely determine the surface wind patterns. The Boise Range to the northeast and the Owyhee Mountains to the southwest channel valley drainage winds into a very consistent southeasterly flow in the night and morning, while upslope winds from the northwest predominate during the afternoon and early evening. The mountains and foothills immediately to the north and east of Boise appear to provide a blocking action when stagnant air persists in the wintertime, causing a deep stable layer condition (Wolyn and McKee 1989) and a trapped cold air pool. When these conditions persist, pollutants are not advected out of the area and begin to build from one day to the next. In the most severe cases, the buildup of pollutants blocks incoming solar radiation, causing the surface to cool further and the inversion to strengthen. Since this occurs during cold and often foggy conditions, the secondary aerosols ammonium nitrate and ammonium sulfate dominate the $PM_{2.5}$ aerosol composition, often reaching 60–70% of the total.

During the past decades, carbon monoxide from cars and particulate matter from RWC were problem pollutants; however, new car standards and a reduction in RWC have reduced these problems. PM_{10} concentrations have remained well below the NAAQS for over 10 years. The secondary aerosol formed during wintertime inversions continues to contribute to air quality in the *unhealthy for sensitive groups* category at times. During winter 2013, the Treasure Valley experienced an unusually strong and persistent inversion that caused the Meridian monitor to violate the 24-hour $PM_{2.5}$ NAAQS. Automotive traffic is the largest source of NO_x, which contribute to both nitrate aerosol formation in the winter and ozone formation in the summer. NO_2 monitoring data indicate that compliance with the 1-hour NO_2 standard is not threatened. Industrial boilers in Caldwell and Nampa are the largest sources of sulfur dioxide in the area, contributing to secondary aerosol formation during winter inversions, although to a lesser extent than nitrates. The region is ammonia-rich so that secondary aerosol formation is limited only by the availability of NO_x and SO_2. Biogenic emissions and automotive exhaust and fuels contribute the majority of the VOCs in the airshed. Ozone formation has been shown (Kavouras et al. 2008) to be lowest at the western edge of the airshed and to increase toward Boise, with the 2013 design value remaining below the NAAQS at the White Pine and Meridian sites.

3.3.2 Coeur d'Alene–Spokane Airshed

The Coeur d'Alene–Spokane airshed includes most of western Kootenai County, most of Spokane County, portions of Pend Oreille County, Washington, and Bonner County, Idaho. The upper 2/3 of Coeur d'Alene Lake and the City of Coeur d'Alene (population 46,402) is located in the southeastern portion of the airshed. The City of Spokane, Washington (population 210,721), is near the western end. The Rathdrum Prairie slopes gently from the northeast toward the Spokane River to the south and turns into the Spokane Valley to the west. In the eyes of the U.S. Census Bureau, Spokane and Coeur d'Alene have been merged into a single metropolitan area with a population of 609,000 people based on 2010 census data. The combined statistical area Spokane-Coeur d'Alene ranks as the 87th most-populous metropolitan area in the United States.

Synoptic winds arrive at this airshed from the west and the south. The valley terrain imposes a prominent northeasterly drainage flow during the night and early morning hours and a westerly or southwesterly flow during the afternoon, bringing ozone precursors to the Coeur d'Alene area from the Spokane, Washington, and Post Falls, Idaho, urban areas.

Major sources of pollutants in this airshed are motor vehicle traffic exhaust and fuels and prescribed forest burning. Top industrial contributors to $PM_{2.5}$ or $PM_{2.5}$ precursor emissions in the airshed are Plummer Forest Products in Post Falls, Idaho Forest Group Riley Creek lumber mill in Laclede, and the TransCanada GTN compressor station in Athol.

3.3.3 Lewiston Airshed

Lewiston, Idaho (population 32,401), sits at the confluence of the Clearwater and Snake River canyons at 238 meters in elevation, the lowest point in Idaho, and shares the valley with the City of Clarkston, Washington (population 7,355). River canyons and mountains are found to the west, south, and east of Lewiston, including Nez Perce tribal lands, while the rolling hills of the Palouse agricultural area lie at 780 meters in elevation at the top of the canyon to the north. While the canyon walls are steep to the west and north, the terrain south of Lewiston slopes gently toward the southeast.

The only major industrial facilities in the Lewiston area are a large pulp and paper mill located on the south side of the river, just east of the city, and an ammunition manufacturing facility. Agricultural burning can influence $PM_{2.5}$ conditions near the urban-rural interface southeast of Lewiston.

Synoptic winds approach Lewiston generally from the northwest during the summer and from the south during the winter. The steep Snake River and Clearwater River canyons that lead into the Lewiston Valley dominate the surface flow patterns with a predominant down-valley drainage flow from the east, along the Clearwater River, supplemented by a southeasterly drainage component flowing down the gently sloping land to the southeast of Lewiston. Both PM_{10} and carbon monoxide were found to be well below their respective NAAQS levels in 2002 when monitoring for these two pollutants was suspended.

3.3.4 Idaho Falls Airshed

The upper Snake River Plain extends from American Falls in the south to St. Anthony in the north. Idaho Falls (population 58,292) lies on the eastern edge of this broad plain. Synoptic flows are channeled from the southwest toward the northeast in this portion of the plain, resulting in afternoon winds largely from the southwest. At a smaller terrain scale, the Snake River meanders through Idaho Falls from the north toward the south, resulting in prominent northerly nighttime drainage winds. An absence of any significant terrain results in a well-ventilated airshed that has historically exhibited no major air pollution problems. A number of food processing facilities are located along the Snake River valley from Rexburg to American Falls, and a major phosphate fertilizer manufacturing facility is located near Pocatello, but no other significant industry influences the Idaho Falls airshed.

3.3.5 Pocatello Airshed

Pocatello (population 54,350) and the nearby cities of Inkom (856) and Chubbuck (14,125) lie along the Portneuf River valley, just upstream from the area where it joins the Snake River Plain and flows into American Falls Reservoir. The southwesterly synoptic winds, best represented by the Pocatello Airport wind rose, are channeled across the northern edge of the airshed by the broad Snake River Plain, while the downtown Pocatello surface winds, best represented by the

DEQ station at the Garrett and Gould site, are dominated by the southeasterly drainage flows along the Portneuf River valley.

The Pocatello airshed has long been dominated by two industrial phosphate manufacturing facilities located to the northeast of the city, resulting in primary particulate and ammonium sulfate secondary aerosol. The FMC/Astaris elemental phosphorous plant closed in December 2001 and maximum PM_{10} concentrations have since declined to less than 75% of the NAAQS.

3.3.6 Twin Falls Airshed

Twin Falls (population 45,981) is the largest city in the central Snake River Plain, also known as the Magic Valley of Idaho. The Magic Valley is dominated by agricultural production, including sugar beets, wheat, corn, dairy, and potatoes. Some dairy and cheese processing occurs in this area, in addition to two sugar beet processing facilities located near the cities of Twin Falls and Paul.

The larger-scale winds in this area arrive from both the broad Snake River Plain to the west and from the Salmon Falls Creek drainage to the south. Thanks to these well-ventilated valley flows and an absence of any blocking terrain and any significant emissions source activity, the Twin Falls area has traditionally been an area of low air pollutant levels for all pollutants and continues to be so today.

3.3.7 Franklin County/Cache Valley Airshed

The Cache Valley straddles Idaho's southeastern border with Utah and has been designated nonattainment for $PM_{2.5.}$ The major portion of the valley is in Utah, and Utah is the lead state in developing a SIP for the area, with Idaho's participation involving the Franklin County portion of the valley. The $PM_{2.5}$ problem in the Cache Valley largely results from secondary ammonium sulfate and ammonium nitrate aerosol, primarily from transportation-related NO_x and agriculture-related ammonia.

The Cache Valley is a close-ended, north-south trending valley that develops severe winter inversions due to cold air pooling, especially when a snow-covered floor exists during the onset of a high pressure system over the valley. Extremely stable air during these winter inversion episodes results in a day-to-day buildup of pollutants and conditions that are highly conducive to secondary aerosol production. No other air pollutant problems have been identified for the Franklin County portion of the Cache Valley.

3.3.8 West Silver Valley Airshed

The small mountain town of Pinehurst, in Shoshone County, lies in a nearly close-ended, north-south mountain valley located on Pine Creek, a minor tributary of the Coeur d'Alene River. The Pine Creek valley widens into the town of Pinehurst (population 1,619) and constricts again before it connects with the broader east-west oriented Silver Valley through a narrow ¼ mile-wide opening. Due to its blocking terrain in a north-south configuration, the Pine Creek valley is subject to cold air pooling during wintertime inversions, especially when a snow-covered floor exists. Extremely stable air during winter inversion episodes results in a day-to-day buildup of pollutants. While the synoptic winds typically approach the area from the south and west, and the main Silver Valley exhibits east-west valley flows, drainage winds from Pine Creek generally follow a south-southwesterly flow through the center of Pinehurst.

Although the nearby Silver Valley was the site of a major mining and smelting complex in the past, little industry currently impacts the ambient air quality. However, Pinehurst has suffered from excessive levels of organic carbon (i.e. smoke) from RWC and was designated nonattainment for PM_{10} in 1990. In 2015, a larger area, including Pine Creek valley and the other valley drainages entering the main Silver Valley from Cataldo to Osburn, were designated nonattainment for the annual $PM_{2.5}$ NAAQS. The PM_{10} problem in the Pinehurst airshed was largely due to residential wood combustion for heating, residential open burning, and road dust from winter anti-skid applications. The larger West Silver Valley airshed is impacted by RWC and residential outdoor burning in the populated areas. Slash burning outside the city boundaries in the fall also contribute to the $PM_{2.5}$ levels in the airshed.

3.3.9 Salmon Airshed

Salmon, Idaho (population 3,027), sits at the confluence of the north-flowing Salmon River and the northwesterly trending Lemhi River valley. As a result, surface wind patterns are dominated by drainage flows in these directions. Salmon has little industry, but its location predominantly downwind of the largest contiguous area of forested land in the lower 48 states frequently causes wildfire smoke impacts. Smoke impacts may be directly advected over Salmon or may be trapped by the nighttime surface inversion in the Salmon or Lemhi River valleys upstream from Salmon, only to drain down-valley into the Salmon area during the stable nighttime period. The frequent wildfire impacts at Salmon can be seen in the smoke frequency map (see Figure 80).

3.3.10 Sandpoint Airshed

The City of Sandpoint (population 7,577) sits just north of the Rathdrum Prairie on the northeastern outlet of Lake Pend Oreille in Bonner County. Sandpoint was designated in 1990 as a moderate nonattainment area for PM_{10} and is currently a limited maintenance area. While Sandpoint is a winter and summer vacation destination with some RWC impacts, other areas of Bonner County have become more populated, and associated RWC, prescribed fire, and residential open burning may be increasing countywide. A major facility in the area during the period when PM_{10} violations occurred in the 1990s is no longer in operation. However, there are many light industrial facilities in the airshed, a number of which are permitted by DEQ.

Due to its position within the Purcell Trench, Sandpoint experiences predominant northeast to southwest valley flows similar to those in the upper Rathdrum Prairie. However, since Sandpoint is also located between mountains to the northwest and the 148-square mile Lake Pend Oreille to the east, it also experiences northwesterly morning drainage flows in the wintertime and easterly lake-breeze flows in the summertime.

3.3.11 Soda Springs Airshed

Soda Springs (population 2,975) lies in the Bear River valley at the southern end of Caribou County. A large electric arc-elemental phosphorous plant is located near the northern edge of the city, and significant phosphate mining and fertilizer production is located in the Aspen Range 5–10 miles away to the northeast. Soda Springs has historically been affected by industrial SO_2

impacts, and SO_2 has been monitored here for over 10 years. However, a major flue gas desulfurization project was implemented in 2001 and SO_2 emissions dropped to well below the annual, 24-hour, and 3-hour NAAQS. In 2002, the SO_2 monitor at the Soda Springs High School was shut down. The site located near the Monsanto facility became the primary monitoring location for SO_2. The monitoring objective changed from population-based to a hot spot determined by dispersion modeling, and in 2013, the short-term SO_2 concentrations remained well below the level of the new 1-hour SO_2 NAAQS of 75 ppb.

3.3.12 Other Mountain Airsheds

In addition to Salmon, a number of other mountain airsheds throughout Idaho have $PM_{2.5}$ monitors, including McCall in Valley County (population 2,925); Garden Valley (unincorporated) in Boise County; Idaho City, also in Boise County (population 459); and Ketchum in Blaine County (population 2,706). The McCall, Garden Valley, and Ketchum airsheds are all in mountain valley terrain with little or no industry, and they all experience frequent wildfire smoke impacts (see Figure 80). In these valleys, the winds follow the traditional up-valley/down-valley flow patterns expected in a mountain valley.

3.3.13 Other Airsheds

Finally, a number of airsheds in Idaho are monitored for $PM_{2.5}$ largely to address crop residue burning in agricultural areas. While some monitors are deployed seasonally, the sites described below are operated throughout the year. These airsheds are frequently impacted by both wildfire and agricultural smoke, as indicated by the smoke frequency map (see Figure 80).

Grangeville (population 3,123), which often experiences both wildfire and agricultural burning smoke, sits at the upper end of the Camas Prairie plateau in Idaho County and is well ventilated by synoptic winds from the south and west or by afternoon, up-slope winds coming up the plateau from the northwest.

Moscow, Idaho, is a college town of 24,534 surrounded by the rich wheat-producing area of the Palouse, just north of Lewiston. Synoptic winds approach Moscow from the west and southwest. Moscow has no significant industry but may at times be influenced by crop residue burning in both Whitman County, Washington, and Latah County, Idaho.

St. Maries (population 2,333) lies along the St. Joe River near its inlet to Coeur d'Alene Lake. While there is no meteorological station in St. Maries, its location at the confluence of the St. Joe River valley and the St. Maries River is believed to result in easterly and southerly drainage flows, which are replaced by synoptic flows in the afternoon, often bringing agricultural burning smoke from a westerly or southwesterly direction.

3.4 Emissions Inventory—Sources Affecting Air Quality in Idaho

This section describes air pollutant sources in each of four categories. The emissions inventories help determine the air monitoring network requirements and configuration.

Emissions inventories identify the types and quantities of air pollutants that influence air quality. The quantities and locations of the greatest air pollutant emissions are often the locations where the air quality impacts are the greatest, although terrain, wind patterns, and other factors may also influence the actual air quality levels observed in any area. As a result, the needs and locations for any air monitoring network are largely determined by the emissions inventory and its spatial distribution throughout the state.

Emissions inventories are developed periodically by each state for submittal to EPA. Periodic emissions inventories were developed by DEQ in 2005, 2008, and, most recently, in 2011. Emissions inventories for previous years are available as part of EPA's National Emissions Inventory (EPA 2010). The 2011 emissions inventory for Idaho is available from DEQ upon request. Each inventory includes all known significant sources of the criteria pollutants and their precursors (CO, Pb, NO, NO_2, O_3, PM_{10}, $PM_{2.5}$, SO_2, VOCs, and NH_3). The emissions are categorized into four broad categories: point sources, nonpoint sources, onroad sources, and nonroad sources.

3.4.1 Point Sources

Point sources are stationary industrial facilities that are required to obtain an air quality permit for their construction and operation and that have a potential to release or emit pollutants of more than 10 tons per year of any of the criteria air pollutants. Pollutants from point sources traditionally are those that pass through a stack or vent; however, fugitive emissions that may be released without passing through a stack or vent are also included in the emissions inventory. Point sources often involve combustion processes, which are the source of significant levels of CO, NO, NO_2, and SO_2. Lesser quantities of PM_{10}, $PM_{2.5}$, VOCs, and NH_3 are also typically released in combustion sources. Fugitive emissions usually involve particulate matter from materials handling and processing, usually in the PM_{10} size range rather than $PM_{2.5}$. VOCs from organic materials processing or from industrial uses of cleaners, degreasers, paints, adhesives, or other surface coatings also contribute to fugitive emissions.

Due to its remoteness and terrain, Idaho does not have as much heavy industry as many other states. Thus, in the overall Idaho emissions inventory, point sources are a relatively minor source of most of the criteria pollutants except for SO_2, which is released in significant quantities in any process that involves combustion of coal, coke, or any other sulfur-containing fuel or raw material. Nevertheless, in the immediate vicinity of a major point source, pollutant levels may rise to the level that requires a source-oriented monitor. In Idaho, such situations are typically restricted to PM_{10} or SO_2.

3.4.2 Nonpoint Sources

The nonpoint source category is a very broad category with a number of subcategories, including area sources and biogenic sources.

Area Sources. Area sources represent a broad category of sources that cannot typically be specifically located and generally should not release enough pollutant at any one location to significantly influence a specific monitor. Only when the density of area sources cumulatively contribute to increasing pollutant levels (decreasing air quality) does this category of sources cause a significant impact at an air quality monitor. Important area sources that affect air quality in Idaho include RWC, which produces $PM_{2.5}$ that accumulates during winter stagnation episodes in mountain valleys (e.g., Pinehurst), and ozone-forming VOCs from fuel storage and distribution and consumer and commercial solvent and paint uses.

The largest area sources of CO, PM_{10}, $PM_{2.5}$, VOCs, and NO_x that affect air quality levels in Idaho are wildfires and prescribed fires, a result of the huge area of forested lands in the state, larger than any other in the lower 48 states. Agricultural crop residue burning also contributes significant quantities of these pollutants. A number of Idaho monitoring sites were selected due to wildfire impacts and a number of others support the Crop Residue Burning Program in the state. The frequency of smoky days in populated areas resulting from both forest and agricultural fires can be seen in Figure 80.

Biogenic Sources. Biogenic sources include nonanthropogenic emissions of VOCs and nitric oxide (NO) from trees, plants, and soils. These pollutants are primarily precursors to ozone formation and act only in a very broad pattern to elevate the regional background ozone levels, or, on an airshed scale, when they combine with urban NO_x emissions to produce excess ozone that may exceed the NAAQS in larger urban areas.

3.4.3 Onroad Sources

Onroad sources include motor vehicles that are licensed to operate on the roadways, including light-duty gas and diesel vehicles, heavy-duty diesel vehicles, buses, and motorcycles. The primary emissions from onroad sources include VOCs from fuel evaporation, onroad fugitive dust (largely PM_{10}) from material present on the roadway and from brake and tire wear, and significant quantities of CO, NO_x, VOCs, and $PM_{2.5}$ from the exhaust systems. In addition, smaller quantities of SO_2 emissions and NH_3 are included in the exhaust gas as a result of trace quantities of sulfur and nitrogen in fuel.

Onroad sources typically influence air quality levels cumulatively on an urban scale or neighborhood scale. Monitors should not be located close enough to any one roadway to be influenced by it (with the exception of the near-roadway NO_2 monitors required under the 1-hour NAAQS promulgated by EPA). As a result of new car emission standards implemented over the last 15 years, and the vehicle inspection and maintenance program in Ada and Canyon Counties, onroad CO impacts have trended steadily downward and CO is no longer a problem in Idaho. Particulate emissions from onroad motor vehicles are believed to contribute somewhat to elevated wintertime $PM_{2.5}$ episodes in urban areas. However, VOC and NO_x emissions from onroad mobile sources are the most important emissions as precursors to ozone formation, which is becoming one of the most critical ambient air quality problems in urban areas, particularly the Treasure Valley airshed.

3.4.4 Nonroad Sources

Nonroad refers to all moving vehicles or equipment that do not normally operate on a roadway, including agricultural, logging, and construction heavy equipment; aircraft and railroad equipment; and recreational equipment such as boats, snowmobiles, and off-road, all-terrain vehicles not licensed for highway operation. These sources are usually widely dispersed and occur mostly where farming or new real estate development or recreation are taking place, rather than near urban centers. Nonroad pollutants are primarily CO, NO, NO_2, and SO_2. These pollutants derive from internal combustion of gas and diesel fuels, diesel particulate matter, a carbonaceous form of $PM_{2.5}$ associated with diesel combustion, and VOCs associated with fuel evaporation and combustion.

3.5 Summary of Recent Air Quality Trends

This section includes general descriptions of recent air quality trends for the criteria pollutants. While Idaho generally enjoys good air quality, Idaho airsheds are being faced with new challenges. Some of these challenges are related to long-term economic and population growth, particularly in terms of the numbers of vehicles on roadways and growth in new construction. Additionally, weather plays a key role in determining air quality. Prolonged periods of any sort of weather pattern can have either a positive or negative impact on local air quality conditions. The following sections describe the various pollutants and trends in some areas of special interest.

3.5.1 Carbon Monoxide (CO)

Carbon monoxide (CO) is an odorless, colorless gas that can enter the bloodstream through the lungs and reduce the amount of oxygen that reaches organs and tissues. Carbon monoxide forms when the carbon in fuels does not burn completely. The majority of CO comes from vehicle exhaust. In cities, 85–95% of all CO emissions may come from motor vehicle exhaust. Elevated levels of CO in the ambient air can occur in urban canyon areas with heavy traffic congestion, and the highest levels typically occur during the colder months when temperature inversions are more frequent.

Idaho currently monitors CO in Boise as a condition of the EPA-approved Northern Ada County CO maintenance plan. Beginning in 2009, trace CO monitoring began at the NCore site at St. Luke’s Meridian. Trace monitoring provides the ability to determine whether variations in observed concentrations below 1.0 ppm are due to actual changes in atmospheric concentration or due to poor sensitivity of older instruments at those low levels. In 2012, monitoring of CO began at the near-roadway site in Meridian.

Figure 9 shows the second highest 8-hour concentrations at Idaho’s monitoring sites in relation to the NAAQS from 2004 through 2013. The second-highest concentration is displayed on these graphs because under the federal rule, the 8-hour standard cannot be exceeded more than once per year. Thus, if the second highest concentration does not exceed the NAAQS then the standard has been met. Sustained low concentrations have been measured over the last 10 years. No 8-hour concentrations measured at any sites exceeded the NAAQS of 9.4 ppm. The maximum 8-hour concentration for CO in 2013 was 1.7 ppm, well below the 8-hour standard.

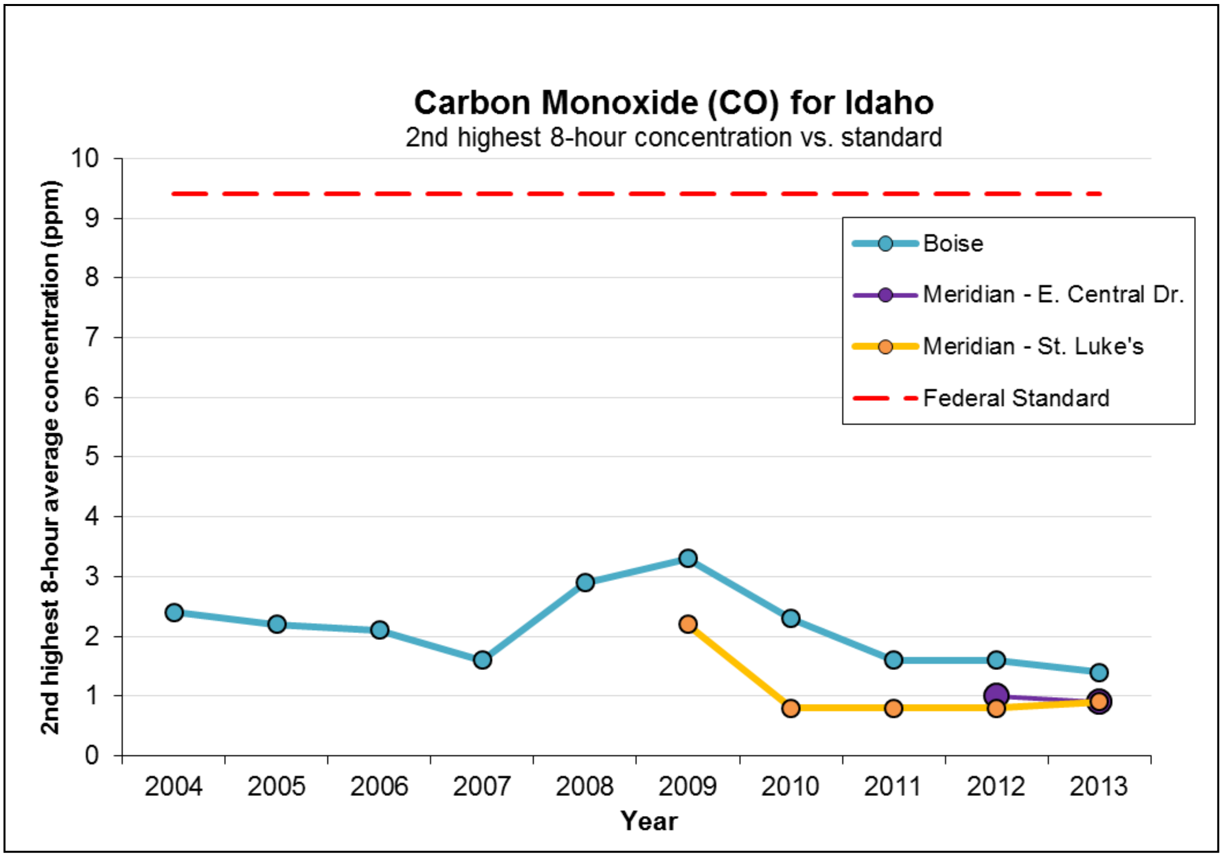

Figure 9. Carbon monoxide measured by Idaho's CO network.

3.5.2 Lead (Pb)

Lead is a highly toxic metal that was used for many years in household products, automobile fuel, and industrial chemicals. Airborne lead was associated primarily with automobile exhaust and lead smelters. The large reductions in lead emissions from motor vehicles have resulted in great decreases in ambient lead levels across the United States. Industrial processes, particularly primary and secondary lead smelters and battery manufacturers, are now responsible for most of the lead emissions.

Lead has not been monitored in Idaho since 2002. With the phase-out of lead in fuel and the closure of the Bunker Hill lead smelter in Kellogg, airborne lead measurements were so far below the NAAQS, DEQ terminated monitoring at its only lead site.

On October 15, 2008, EPA substantially strengthened the NAAQS for lead. EPA revised the level of the primary (health-based) standard from 1.5 $\mu g/m^3$ to 0.15 $\mu g/m^3$ and revised the secondary (welfare-based) standard to be identical in all respects to the primary standard. This level cannot be exceeded during any rolling 3-month average. In conjunction with strengthening the lead NAAQS, EPA promulgated new monitoring requirements in 2012. Monitoring is now required near lead sources that may contribute to violations of the lead NAAQS. Source-oriented monitoring is required near any source that emits more than 0.5 tons per year. Idaho does not have any sources of lead that trigger source-oriented monitoring.

The monitoring regulations also required nonsource-oriented monitoring in MSAs exceeding a 500,000 population at NCore multipollutant monitoring sites, beginning January 2012. DEQ began lead monitoring at the Meridian NCore site in January 2012. The standard states that a rolling 3-month average shall not exceed the level of 0.15 µg/m^3. The four highest values recorded during 2013 ranged from 0.004 to 0.007 µg/m^3, well below the standard.

3.5.3 Nitrogen Dioxide (NO_2)

Nitrogen dioxide (NO_2) is a reddish brown, highly reactive gas that forms from the reaction of nitrogen oxide (NO) and oxygen in the atmosphere. The term NO_x, which is frequently used, refers to both NO and NO_2. NO_y refers to total reactive nitrogen, which includes NO_x as well as some additional reactive nitrogen species. NO_2 will react with VOCs and can result in ozone formation. Onroad vehicles are the major sources of NO_x in many airsheds. Industrial boilers and processes, home heaters, and gas stoves can also produce NO_x. NO_2 pollution is greatest during the cold weather seasons.

Motor vehicle manufacturers have been required to reduce NO_x emissions from cars and trucks since the 1970s. NO_x is not considered a significant pollutant in Idaho.

On January 22, 2010, EPA established a new 1-hour NO_2 NAAQS at the level of 100 ppb. This level defines the maximum allowable concentration anywhere in an area. EPA set a new form for the standard. The form is the air quality statistic used to determine if an area meets the standard. The form for the 1-hour NO_2 standard is the 3-year average of the 98th percentile of the annual distribution of daily maximum 1-hour average concentrations. EPA has also retained the current annual average NO_2 standard of 53 ppb.

DEQ previously was not required to monitor NO_2 and therefore NO_2 data in Idaho are not very robust. NO_2 monitoring at the Meridian St. Luke's site ended in 2011 and started at the Meridian near-road (East Central Drive) site in 2012. Figure 10 shows that the risk of violating the annual standard is very low.

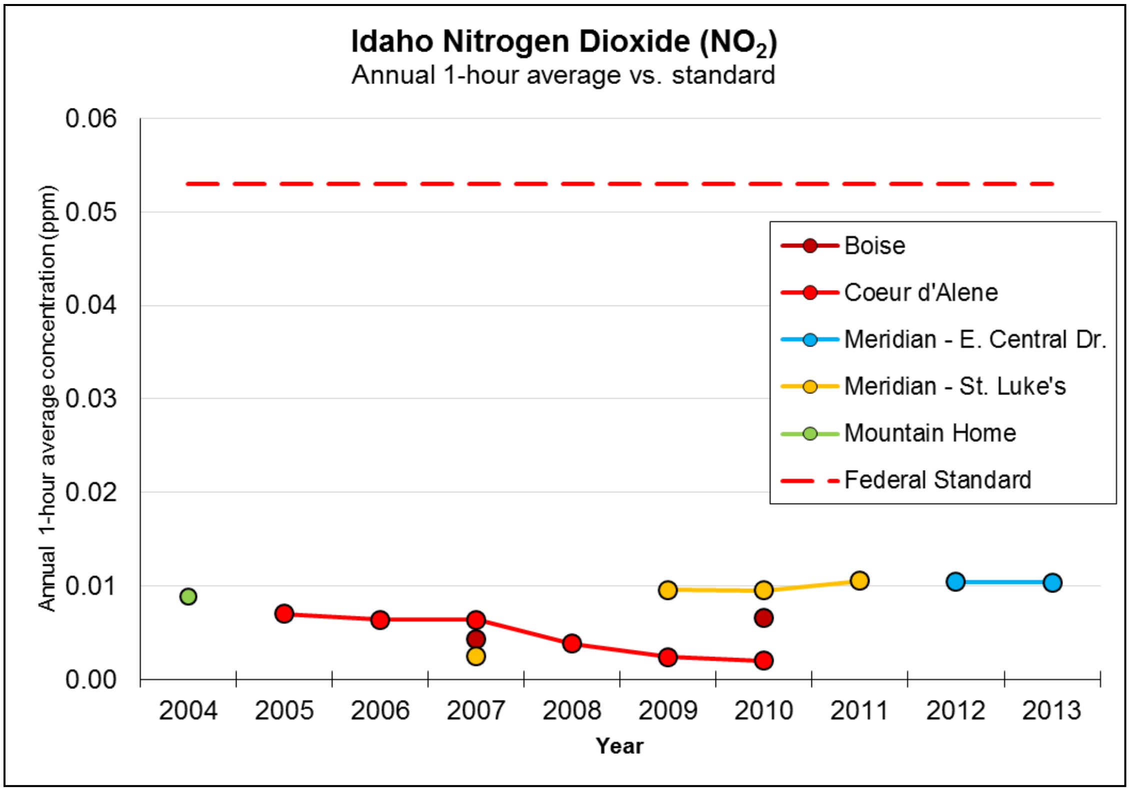

Figure 10. NO_2 annual average of all available data.

Beginning in January 2013, at least one new NO_2 monitor was required to be located near a major road in any urban area with a population greater than or equal to 500,000 people, which applies to the Boise City–Nampa MSA (the 2013 estimated population was 628,966 as provided by the US Census Bureau). These NO_2 monitors must be placed near those road segments ranked with the highest traffic levels by annual average daily traffic (AADT) counts. Consideration must be given to fleet mix, congestion patterns, terrain, geographic location, and meteorology in identifying locations where the peak concentrations of NO_2 are expected to occur. Monitors must be placed no more than 50 meters (about 164 feet) away from the edge of the nearest traffic lane. The Meridian near-road site on East Central Drive was established in 2012 to fulfill these monitoring obligations.

3.5.4 Ozone (O_3)

Ozone is typically a summertime air pollution problem that forms when pollutants from internal combustion engines and industrial sources (e.g., paints, solvents, gas vapors) react with sunlight. It can also be formed by materials that are released into the air from wildfires. Generally speaking, the hotter and drier the summer, the higher the ozone concentrations will be because the ozone-forming reaction occurs faster and because additional precursor materials are often present from wildfires throughout the western United States.

The ozone standard is defined such that the three highest daily maximum 8-hour average ozone concentrations in any particular year can exceed the level of the standard while the area still maintains an attainment classification. However, if the 3-year averages of the fourth-highest concentrations exceed the level of the standard (0.075 ppm), then the area is classified as nonattainment.

Figure 11 and Figure 12 demonstrate the ozone concentrations measured over time at the Meridian St. Luke's and Boise White Pine monitoring sites. The bars represent the four highest 8-hour average concentrations measured for each monitoring season starting in 2004. The yellow circles indicate the 3-year average used to compare to the NAAQS (i.e., the design value). The black dashed line represents the old NAAQS of 0.08 ppm (allowing for rounding rules specified by EPA) while the red dashed line represents the current NAAQS of 0.075 ppm. The new ozone standard is expected to be lower than 0.075 ppm.

As seen in Figure 11 and Figure 12, the ozone design values at both sites remain just below the NAAQS concentration. Any lowering of the ozone standard will increase the risk for the Treasure Valley going into nonattainment for ozone.

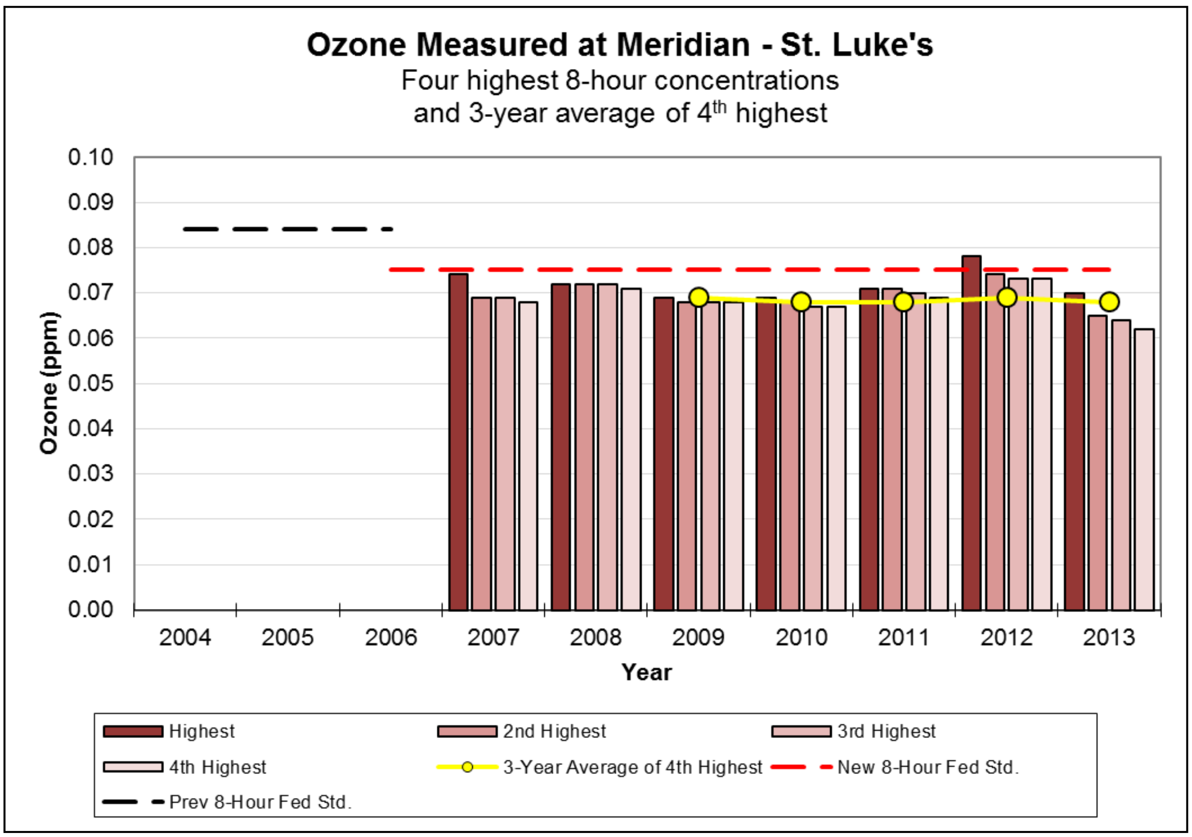

Figure 11. Treasure Valley ozone design values—St. Luke's Meridian monitor.

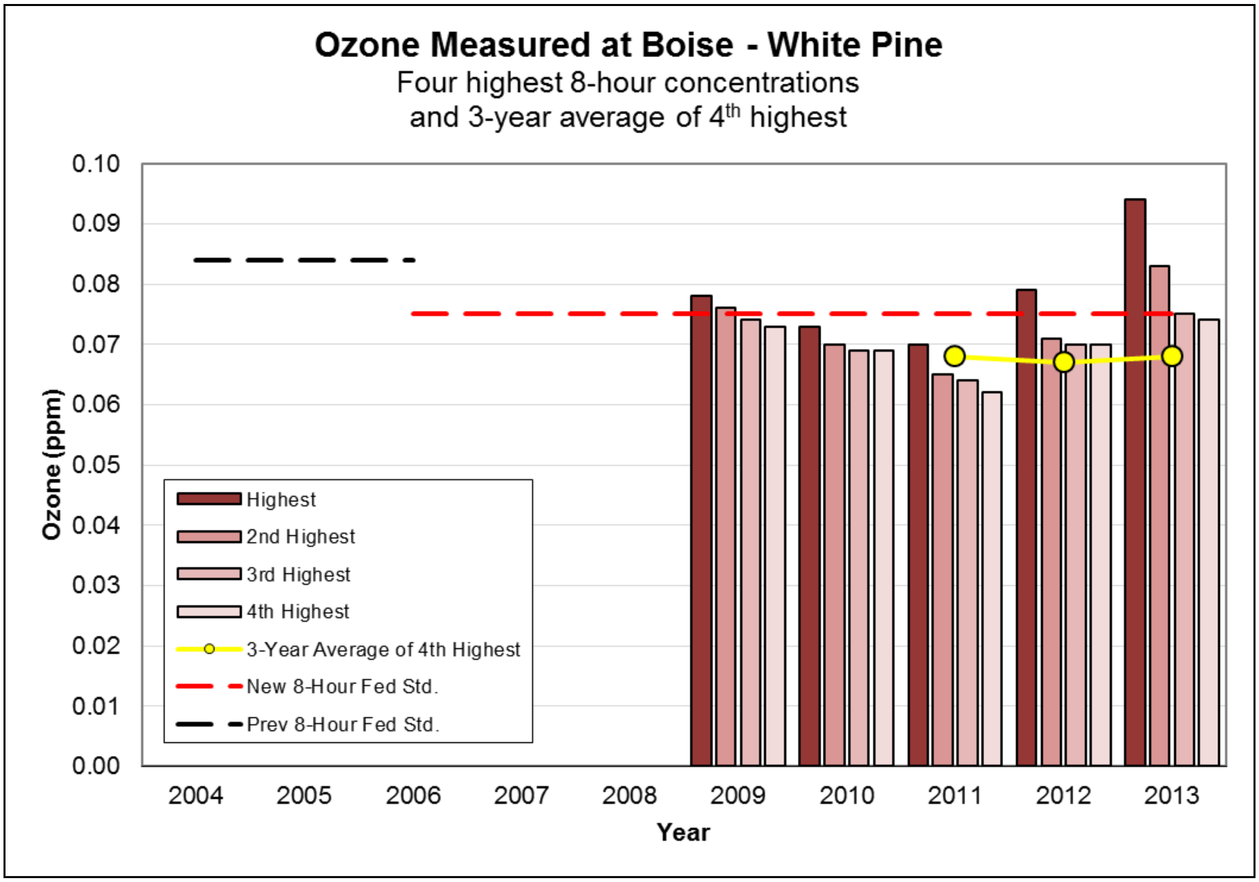

Figure 12. Treasure Valley ozone design values—White Pine monitor.

3.5.5 Course Particulate Matter (PM_{10})

Particulate matter includes both solid matter and liquid droplets suspended in the air. Particles smaller than 2.5 micrometers in diameter are called fine particles, or $PM_{2.5}$. Particles between 2.5 and 10 micrometers in diameter are called coarse particles. PM_{10} includes both fine and coarse particles. Coarse particles typically come from crushing or grinding operations and dust from roads.

Figure 13 shows the maximum daily concentration (24-hour averages) observed for PM_{10} from 2004 through 2013. Maximum daily values confirm that Idaho has generally stayed steady since 2004, although the Boise and Nampa values jumped during 2012 and 2013. Although the maximum PM_{10} measured at both monitors in 2012 and 2013 exceeded the 24-hour NAAQS, the NAAQS is only violated if there are more than three total exceedances over 3 consecutive years. For example, Idaho could experience two exceedances in year 1, none in year 2, and one in year 3, and not violate the NAAQS. No monitored sites in Idaho have violated the 24-hour PM_{10} NAAQS during the last 10 years.

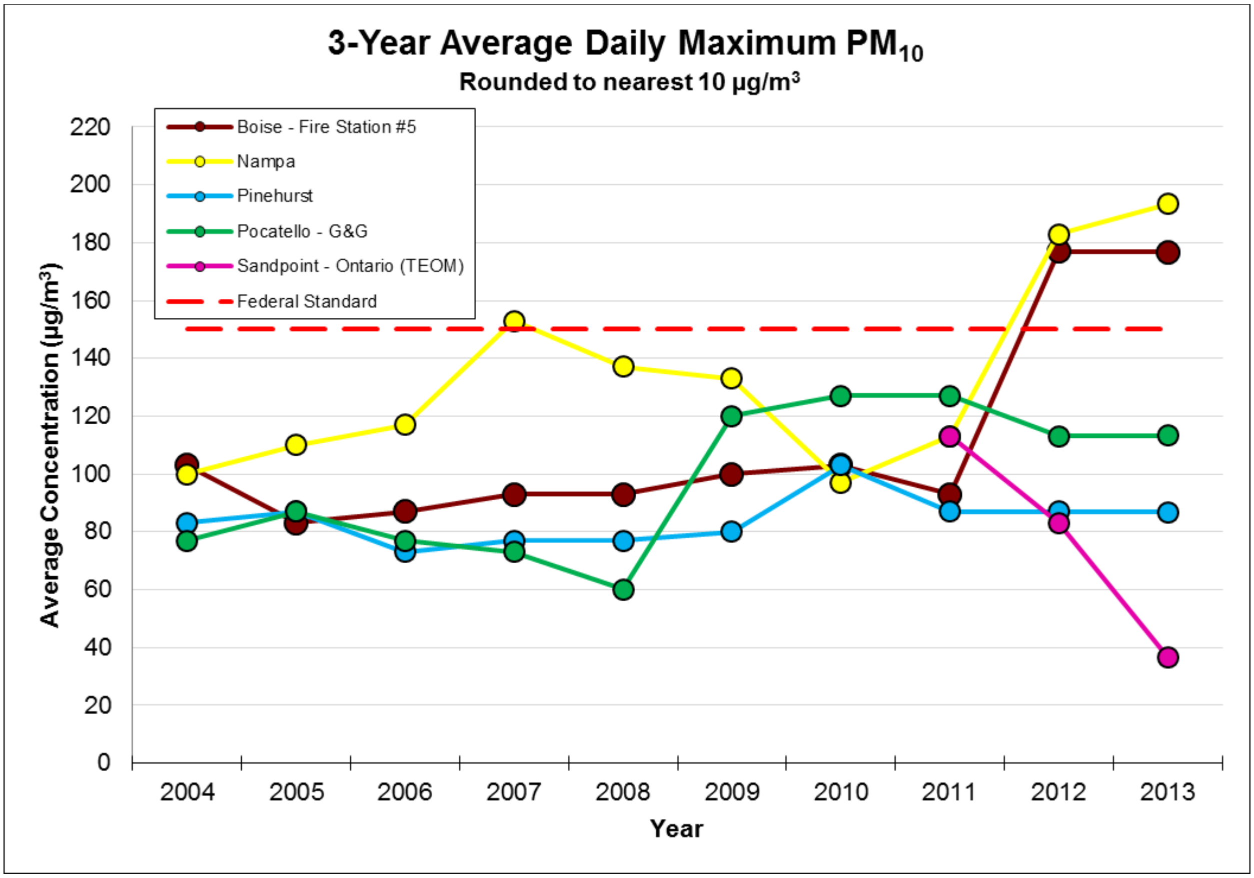

Figure 13. PM_{10} trends in Idaho.

3.5.6 Fine Particulate Matter ($PM_{2.5}$)

Particles 2.5 micrometers in diameter or less are called fine particles, or $PM_{2.5}$. DEQ considers $PM_{2.5}$ to be one of the major air pollution concerns affecting a number of airsheds in Idaho. $PM_{2.5}$ generally comes from RWC, agricultural burning, and other area sources; industrial boilers; and exhaust from vehicles including cars, diesel trucks, and buses. Fine particulates can also be formed secondarily in the atmosphere by chemical reactions of pollutant gases.

In 1997, EPA adopted two primary or health-based standards for $PM_{2.5}$. The daily (or 24-hour) NAAQS was established at 65 µg/m^3, while the annual standard was established at 15 µg/m^3. In 2006, EPA revised the daily standard to 35 µg/m^3. In 2012, the annual standard was lowered to 12 µg/m^3. An area is in violation of the daily NAAQS when in 3 consecutive years the average of each year's 98th percentile 24-hour average $PM_{2.5}$ concentration is greater than 35 µg/m^3. The annual standard is violated when the annual mean, averaged over 3 consecutive years, is greater than 12 µg/m^3.

Figure 14 shows the 3-year average of the 98th percentile 24-hour averages (or design values) at Idaho's monitoring stations in relation to the federal standard. Franklin has violated the daily standard for 4 years, including 2013. Pinehurst has done the same. Salmon violated the standard during 2009, 2011, and 2013, while Meridian violated the standard only during 2013. All of these sites remain designated in attainment until a SIP determination is made by EPA for the 24-

hour NAAQS, except for Franklin, which was included in the Cache Valley nonattainment area in 2010.

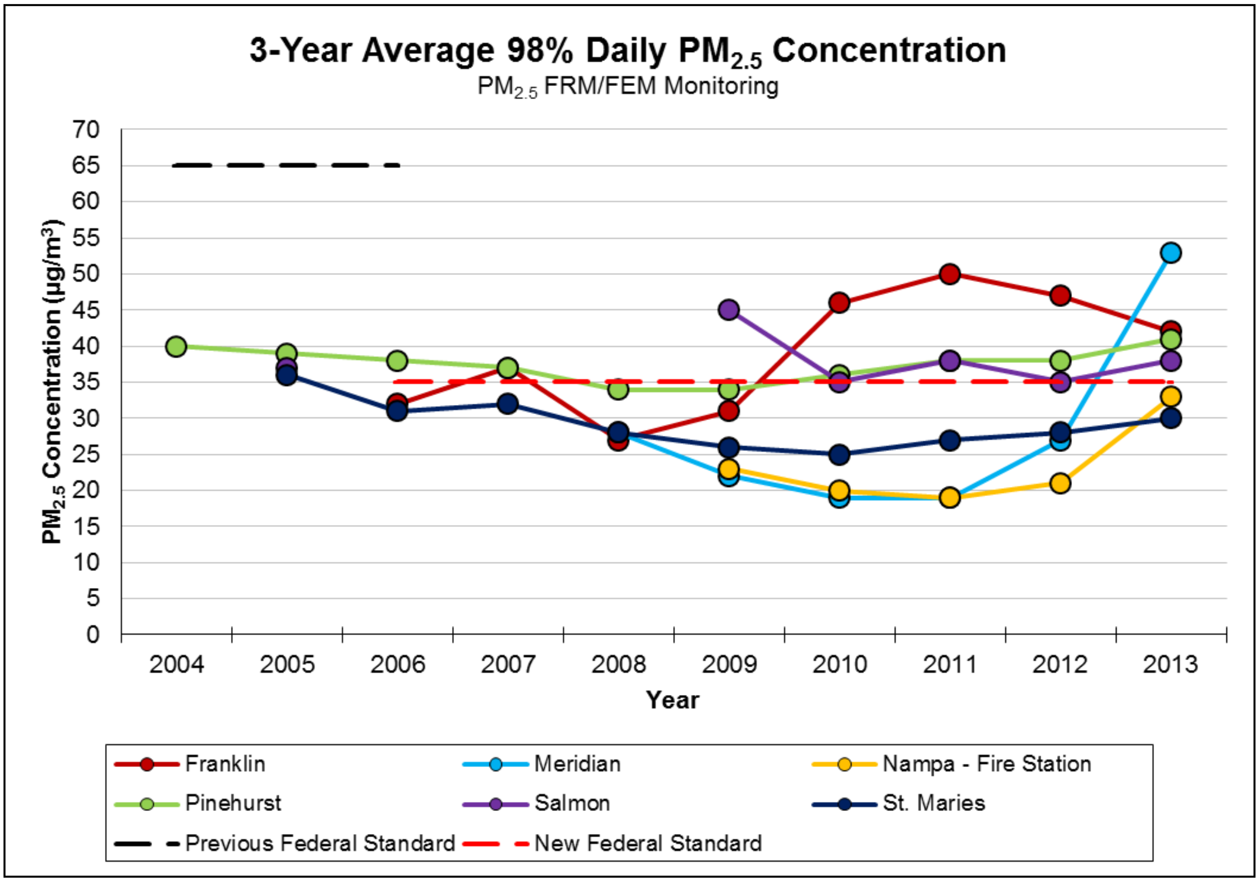

Figure 14. 3-year 24-hour design values for $PM_{2.5}$ compliance network.

Figure 15 shows the 3-year average of the annual averages at each monitoring station against the federal standard. The data show that the annual standard of 12 $\mu g/m^3$ was exceeded at the Pinehurst monitor during 2012 and 2013 and exceeded at Salmon in 2013. Pinehurst was designated nonattainment for $PM_{2.5}$ in 2015. Salmon remains an area of concern for $PM_{2.5}$.

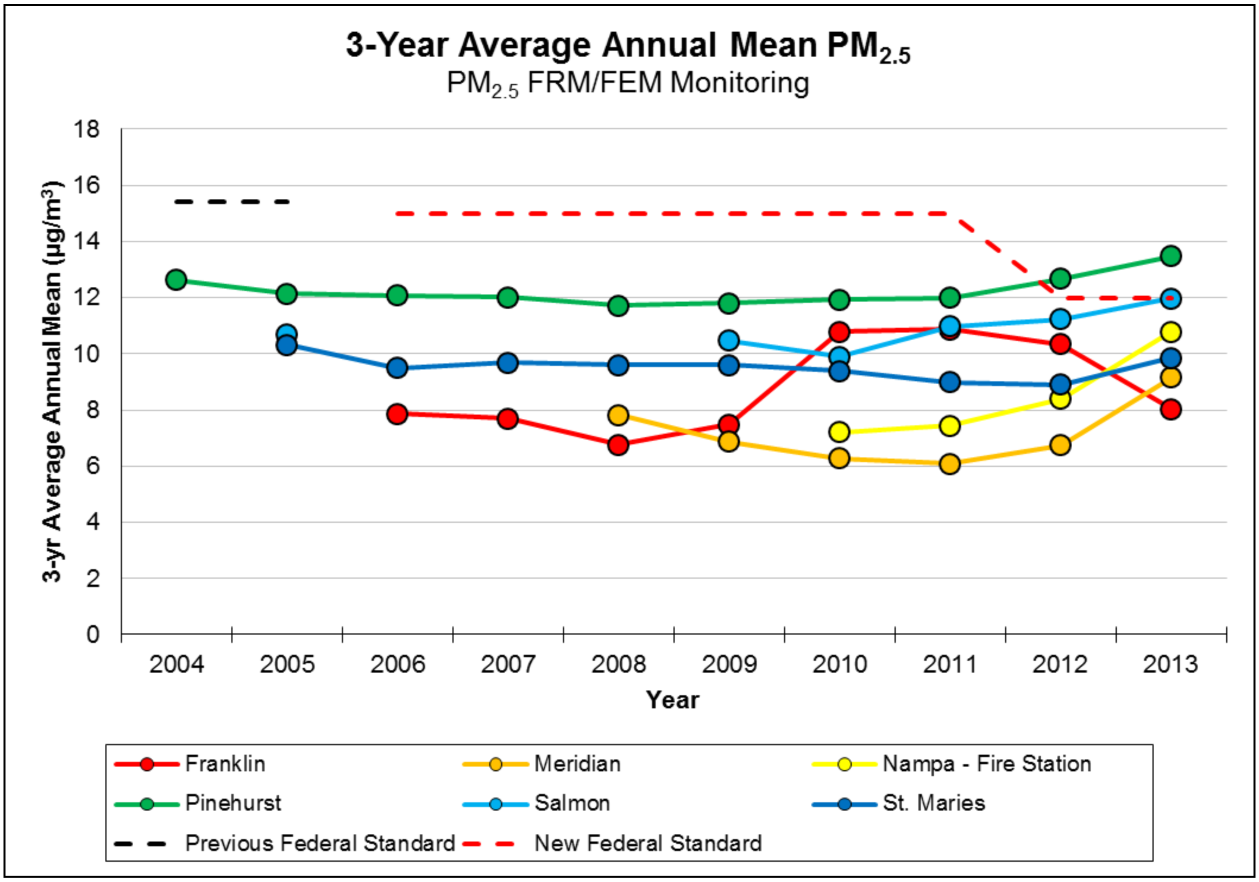

Figure 15. 3-year annual design values for $PM_{2.5}$ compliance network.

3.5.7 Sulfur Dioxide (SO_2)

Sulfur dioxide (SO_2) is a colorless, reactive gas produced by burning fuels containing sulfur, such as coal and oil, and by industrial processes. Historically, the greatest sources of SO_2 were industrial facilities that derived their products from raw materials like metallic ore, coal, and crude oil or that burned coal or oil to produce process heat (e.g., petroleum refineries, cement manufacturing, and metal processing facilities).

DEQ performs hotspot monitoring at the Pocatello and Soda Springs sites. Hotspot monitoring is designed to investigate pollution sources on a local scale. This monitoring assesses impacts from discreet sources to ambient air, rather than emissions monitored directly from a stack or chimney. In 2009, DEQ began trace SO_2 monitoring at the NCore site in Meridian. Trace monitoring determines whether variations in observed concentrations below 0.05 ppm are from actual changes in atmospheric concentration or from poor sensitivity of older instruments at those low levels.

Figure 16 shows the monitoring results from 2013 versus the daily standard for SO_2. The 99th percentile of the 1-hour daily concentrations, averaged over 3 years, is below the NAAQS standard of 0.075 ppm. Data are only available for 2013 because 3 years of data are needed for the average, and the standard was first implemented in 2010.

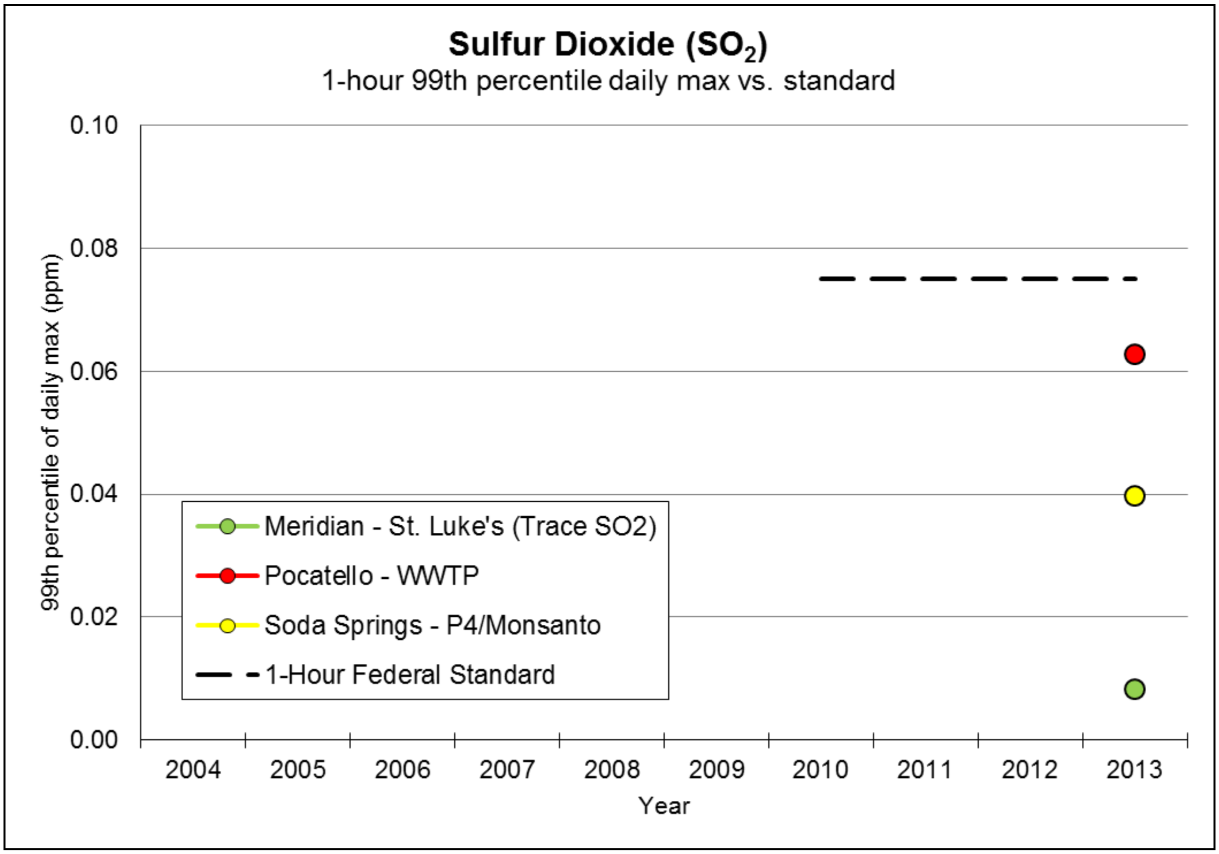

Figure 16. Maximum daily (1-hour) SO_2 levels in Idaho.

4 Network Assessment

Network assessment is required at the site scale, airshed scale, and statewide scale by pollutant. This section includes those assessment and recommendations and rankings for sites in DEQ's monitoring network.

4.1 Site Scale

The following section describes each monitor at the site scale and characterizes the local geography. The appropriateness of the designated scale of representation relative to land use, population density, and prevailing winds is discussed and the relationship between monitoring objectives, site types, and geographic location are assessed. The referenced figures are included after the recommendations summary, at the end of section 4.1. Summary tables, including physical locations of the monitors, are provided in Appendix D.

4.1.1 Boise—Eastman Garage

The Boise Eastman Garage site (Figure 17), located in the urban core of Boise in the Treasure Valley airshed, aims to measure the source impact of mobile emissions on CO. The monitor is designed to capture the concentrations required for assessing limited maintenance in the Northern Ada County CO limited maintenance area (Figure 1). The micro scale of representation (several meters to 100 meters) is appropriate for a source impact site type (CFR 2009). The monitor project type and objective type in the EPA Monitor Description Report (AMP 390) is listed as population exposure. This should be changed to source impact. Land use within the micro area is consistently urbanized and the population is uniformly high. Winds from all directions, including along the prevailing northwest-southeast axis, blow pollutants from mobile sources, but its location amongst tall buildings, as an urban canyon site, undoubtedly influences the pollution vectors as well. The CO concentrations measured at the site decreased from 2010 to 2011 and held steady in 2012–2013 (DEQ 2015c). CO values are currently well below the 8-hour NAAQS federal standard (DEQ 2015c). No exceedances were measured in 2011, 2012, or 2013 (DEQ 2015a, 2015b, 2015c).

4.1.2 Boise—Fire Station #5

The Boise Fire Station #5 site is another urban monitor located in downtown Boise and the Treasure Valley airshed (Figure 18*)*. A population exposure site, its objective is to measure PM_{10} concentrations for NAAQS compliance and for assessing the limited maintenance of the Northern Ada County PM_{10} limited maintenance area. The neighborhood scale of representation is appropriate for the site type (CFR 2009). Distance to Interstate 184 and annual daily traffic (ADT) on the nearest lane to the monitor comply with 40 CFR Part 58, Appendix E, Figure E-1. Land use in the neighborhood is developed, medium-intensity, and the population is uniformly dense. Winds from the northwest, west, and southeast bring typical concentrations experienced throughout the neighborhood to the monitor. This site is located adjacent to Interstate 184 and aims to capture these mobile emissions. The monitor measured 3-year average daily maximums well below the NAAQS for 2010 and 2011 but exceeded the standard in 2012 and 2013 (DEQ 2015c). The exceedances recorded in 2012 and 2013 caused the 3-year average to rise, but the NAAQS was not violated in either year.

4.1.3 Boise—White Pine Elementary

The Boise White Pine site (Figure 19), located at the southeastern end of the Treasure Valley airshed in Boise, aims to measure the highest concentrations of ozone in the airshed. The neighborhood scale of representation (0.5–4 kilometers [km]) is appropriate for a maximum concentration site type (CFR 2009). Land use is mostly developed and population density is uniformly high within the neighborhood area. White Pine's location in the southeast end of the airshed allows the monitor to receive ozone blown by prevailing northwesterly winds across the entire airshed, including the city center of Boise and the high traffic central valley and interstate areas. The monitor was installed in May 2009 and regularly measures values that hover near the NAAQS 8-hour standard. During the 2013 ozone season (May through September), the three highest 8-hour concentrations were at or above the 8-hour NAAQS (DEQ 2015c).

4.1.4 Coeur d'Alene—Lancaster Road

The Coeur d'Alene Lancaster Road site (Figure 20), located on the northern edge of the Coeur d'Alene urban area, aims to measure concentrations of $PM_{2.5}$ for AQI forecasting, smoke management, and modeling and meteorological support. The monitor is co-located with a meteorology station. This population exposure site has a neighborhood scale of representation (0.5 km–4 km). This designation is appropriate for the site type (CFR 2009). The site is on the Rathdrum Prairie where land use consists of cultivated crops and grassland. The urban area to the south is developed, as is the Highway 95 corridor connecting Coeur d'Alene with Sandpoint to the north. The further surroundings are mountainous evergreen forest. The monitor is adjacent to but not within relatively densely populated areas; 30% of the annual winds blow pollutants from the more populated south and southwest. This monitor may capture some pollutants from two major point sources to the north-northeast and southwest. During the summer months when synoptic or regional winds bring air from the west and northwest, the monitor probably captures some pollution from major point sources to the west and northwest as well (Figure 21). Lancaster began monitoring $PM_{2.5}$ in 2009 and concentrations are not a concern.

4.1.5 Franklin

The Franklin monitor is at a rural site, located in the northern end of the Cache Valley near the city of Franklin (Figure 22). The monitor measures $PM_{2.5}$ for NAAQS compliance and AQI forecasting. This site has a neighborhood scale of representation and the population exposure site type is appropriate (CFR 2009). The land use varies between cultivated crops, pasture, water, and developed. The population density is low. Local winds tend to blow north-south, along the axis of the Cache Valley. Synoptic winds in the valley blow from the south in the winter and are calm and variable during the summer (Figure 23 and Figure 24). The Franklin monitor is within the Cache Valley $PM_{2.5}$ Nonattainment Area, designated in 2009. This nonattainment designation occurred because the Logan, Utah, monitor violated the 3-year average 98th-percentile daily concentration standard in 2007. In 2011, three exceedances of the annual average NAAQS occurred at Franklin (DEQ 2015a). In 2012, one exceedance occurred, and in 2013 there were six exceedances of the annual average (DEQ 2015b, 2015c). The daily NAAQS has been violated every year at this site since 2010.

4.1.6 Garden Valley

The Garden Valley monitor is located in a small rural valley in Boise County (Figure 25). The site aims to measure $PM_{2.5}$ for smoke management and AQI forecasting. The urban scale of representation (4 km to 50 km) is appropriate for a population exposure site (CFR 2009). The area is very sparsely populated. Land use is a mixture of pasture, evergreen forest, grassland, and shrubland. Synoptic-level winds blow from the south during the winter and from the west during the summer (Figure 26 and Figure 27). However, as a small mountain valley, Garden Valley is particularly affected by local winds draining from surrounding mountains, so significant air parcels can arrive from the north, flowing down the Middle Fork Payette River or Anderson Creek, or from the east down the South Fork Payette River. The Garden Valley monitor typically measures very low concentrations, unless wildfire smoke is impacting the area.

4.1.7 Grangeville

The Grangeville monitor is located in a small town perched on the southern edge of an agricultural plateau, the Camas Prairie, above the Clearwater and Snake River canyons (Figure 28). This population exposure site aims to measure $PM_{2.5}$ for AQI forecasting, smoke management, and modeling and meteorological support. It is co-located with a meteorological station and has a neighborhood scale of representation, a designation appropriate for the site type (CFR 2009). Land use in the town is developed, ranging in intensity from low to high, and the surrounding environs are dedicated to cultivated crops. Population density reflects the land use: dense in town and scattered throughout the farmland. The local wind rose indicates annual average winds tend to come from the west and east. The summer season sees synoptic-level winds blowing from the northwest regularly (Figure 29). The monitor was established in 2000. Concentrations at the Grangeville monitor tend to be low, unless the area is experiencing impacts from CRB or wildfire smoke.

4.1.8 Idaho City

The Idaho City $PM_{2.5}$ monitor is located in a small town in a mountain valley affected by wildfire smoke in the summer, RWC in the winter, and prescribed fire in the spring and fall (Figure 30). The monitor measures air quality in a small developed area surrounded by evergreen forest and mountainous terrain. Very few people live in the area but it is a popular recreation site. The monitoring objectives are smoke management and AQI forecasting. Synoptic winds come from the south in winter and from the northwest in summer (Figure 26 and Figure 27). The neighborhood scale of representation is appropriate for a population exposure site type (CFR 2009). The Idaho City monitor recorded a handful of moderate or yellow days and two days in the *Unhealthy for Sensitive Groups* or orange AQI category in 2013 (DEQ 2015c).

4.1.9 Idaho Falls

The Idaho Falls site is located in a residential area at the southern edge of the city (Figure 31). $PM_{2.5}$ is monitored here for AQI forecasting. The neighborhood scale of representation is a reasonable designation for this population exposure site (CFR 2009). Land use in the neighborhood is developed to the north of the monitor and is agricultural to the south. Population density is relatively high. It is windy throughout the Idaho Falls airshed as synoptic flows that have traveled the Snake River Plain arrive from the southwest throughout the year. Calmer local winds from the north are also important. The Idaho Falls monitor seems reasonably placed to fulfill its objective to forecast air quality for the neighborhood population base. Concentrations at this monitor are typically low throughout the year.

4.1.10 Ketchum

The Ketchum monitor is located in the Wood River valley (Figure 32). The town of Ketchum is densely populated and is surrounded by population-free national forests and high mountains. The monitor measures $PM_{2.5}$ for AQI forecasting and smoke management. Land use is highly developed in town and along the valley, while evergreen forest and shrubland dominate the hills beyond. The urban scale of representation is an appropriate scale at which to measure the air quality impacts of smoke and provide AQI forecasts for the population (CFR 2009). Local winds predominantly blow from the northwest, descending from the high terrain to the north and channeling through the valley. Synoptic winds prevail from the west during the winter and are calm and variable during the summer (Figure 33 and Figure 34). Similar to other high mountain valleys in Idaho, like Garden Valley or McCall, Ketchum is particularly affected by local drainage flows, such as Warm Springs Creek or Trail Creek. The Ketchum monitor was established in 2009 and typically records low values throughout the year. In 2013, wildfire smoke from the Beaver Complex wildfire severely impacted air quality (DEQ 2015c).

4.1.11 Lewiston

The Lewiston site is on the eastern edge of town in a local park in the Lewiston airshed (Figure 35). The monitor is co-located with a meteorology station and aims to measure $PM_{2.5}$ for AQI forecasting, smoke management, and modeling and meteorological support. The site type is population exposure and the neighborhood scale of representation is an appropriate designation (CFR 2009). The land use in the immediate area of the monitor is developed open space with low- to high-intensity development to the north, south, and west. There is one Title V point source in the airshed. To the east are cultivated crops and shrubland. Population is dense to the south and less so to the north. The wind in this small city is particularly affected by the local topography. Synoptic-level winds tend to blow from the south in the winter and from the northwest during the summer (Figure 36 and Figure 37). However, as the local wind rose shows, easterly, southeasterly, and southerly winds predominate at the monitor site, presumably flowing downhill from the surrounding upland terrain. The strongest winds arrive from the west. The location of the monitor seems representative of a neighborhood in which pollutant concentrations are reasonably similar (CFR 2009). In 2011, the monitor recorded 1 day in the moderate (or yellow) range of the AQI for $PM_{2.5}$ (DEQ 2015a). In 2012, 28 yellow, 1 orange, and 5 red (unhealthy) days were recorded (DEQ 2015b), and 20 yellow days were recorded in 2013 (DEQ 2015c).

4.1.12 McCall

The McCall monitor is located at the western end of this mountain resort town (Figure 38). Situated at the northern end of Long Valley and on the southern shore of Payette Lake, McCall is a small mountain valley community impacted by wildfire smoke in the summer and RWC emissions in the winter. The monitor measures $PM_{2.5}$ for AQI forecasting and smoke management purposes. This population exposure site is designated an urban scale of representation. Land use around the monitor is varied and includes developed land, pasture, shrubland, and evergreen forested mountains. Population density is low, but it is a popular recreation area. Synoptic winds generally flow up valley from the south but local terrain is an important influence, and significant flow can come from the north and west. The McCall monitor tends to record low concentrations except when impacted by wildfire smoke.

4.1.13 Meridian—St. Luke's (NCore)

The Meridian St. Luke's site is located in the center of the Treasure Valley airshed, about 200 meters to the north of Interstate 84 (I-84) (Figure 39). The monitor distance from the roadway complies with 40 CFR Part 58, Appendix E, Table E-2. This is an NCore site that measures all the pollutants currently monitored in Idaho. It is co-located with a meteorology station. Monitoring objectives include NAAQS compliance for O_3, $PM_{2.5}$, and Pb; AQI forecasting for all criteria pollutants measured; trace gas measurements for CO and SO_2; chemical speciation for $PM_{2.5}$; and support for modeling and research studies. The neighborhood scale of representation is appropriate for a population exposure site type (CFR 2009). The neighborhood area within 4 km is mixed use, with highly developed transportation corridors (I-84, Eagle Road, Franklin Road) interspersed with agriculture and lower intensity residential development. The population density in the surrounding area is high. The local wind rose indicates that the majority of the wind arrives at the monitor from the southeast, which is not the most populated part of the valley. Synoptic winds are southeasterly in the winter and northwesterly in the summer (Figure 40 and Figure 41). Ozone recorded at this site remains just below the standard (DEQ 2015c). The daily $PM_{2.5}$ NAAQS was violated in 2013 (DEQ 2015c). CO and trace SO_2 measurements are low at this site. Pb monitoring began in 2012 and measurements are well below the standard (DEQ 2015c).

4.1.14 Meridian—East Central Drive (Near-Road)

The Meridian near-road site is located on the north side of Interstate 84, along one of the busiest stretches of road in Idaho (Figure 42). The objective of this site is to monitor NAAQS compliance for NO_2 from mobile sources. The monitor also measures CO, NO, and NO_x. The site has a middle scale of representation. The area surrounding the monitor includes a combination of low- to high-intensity development and the population is dense. Local winds blow most often from the southeast, which is over the roadway to the monitor. The monitor was established in 2011 and has recorded similar, low values of CO and NO_2 to those at Meridian St. Luke's during 2012–2013 (DEQ 2015c). All measurements have been well below the NAAQS.

4.1.15 Moscow

The Moscow monitoring site is located in the southeast corner of the city, surrounded by agricultural lands (Figure 43**).** Land use in the area is a mixture of cultivated crops and low-intensity development. The more densely populated part of the city lies to the west and northwest. This population exposure site has an urban scale of representation. Local winds blow mostly along an east-west axis, which brings air to the monitor from both outside and inside the city. Synoptic winds blow from the northwest for 7 months of the year (April through October, Figure 37), phenomena which are not reflected in the local wind rose. The monitor, therefore, seems to be located in a reasonable place to accomplish the monitoring objectives of AQI forecasting, smoke management, and modeling and meteorological support. The monitor is co-located with a meteorological station and was established in 2001. In 2011, the Moscow monitor recorded 11 days in the moderate, or yellow, AQI range (DEQ 2015a). In 2012, 27 moderate, 2 unhealthy for sensitive groups, and 4 unhealthy days were recorded (DEQ 2015b), and in 2013, all days were good (DEQ 2015c).

4.1.16 Nampa

The Nampa site is located in the western part of the Treasure Valley but is centrally situated within the airshed (Figure 44). A population exposure site, it is designated a neighborhood scale of representation, which is appropriate for the site type (CFR 2009). The neighborhood is densely populated and highly developed. Winds tend to blow from all quarters except south, but mostly from the northwest. The site is well-situated to represent neighborhood concentrations of $PM_{2.5}$ and PM_{10} for NAAQS compliance and AQI forecasting. The 3-year average daily maximum for PM_{10} registered exceedances in 2012 and 2013 but did not violate the NAAQS (DEQ 2015c). The Nampa site began monitoring $PM_{2.5}$ in June 2008. The 3-year average daily concentration increased in 2012 and 2013 but did not violate the standard.

4.1.17 Pinehurst

The Pinehurst monitor is located in a small community nestled among the mountains in the Silver Valley (Figure 45). Sitting just south of I-90, this small valley is particularly susceptible to wintertime inversions where the pollutants are trapped for days. Winds are typically low and blow mostly from the southwest. The monitor is situated centrally in town and is designated a neighborhood scale. This location and scale of representation is appropriate for a population exposure monitor (CFR 2009). The Pinehurst monitor measures $PM_{2.5}$ for NAAQS compliance and AQI forecasting and PM_{10} for SIP and NAAQS compliance, AQI forecasting, and modeling and meteorological support. It is co-located with a meteorological monitor. Land use in the neighborhood is developed in town and along the interstate corridor and the farther surroundings are mountains covered in stands of ponderosa pine. Population is concentrated within the city limits and is otherwise sparse. The 3-year average daily maximum PM_{10} concentrations have been since holding steady from 2011 through 2013 (DEQ 2015c). These concentrations remain well below the NAAQS. The 3-year average 98th-percentile daily $PM_{2.5}$ concentrations violated the NAAQS in 2010–2013 (DEQ 2015c). Pinehurst violated the $PM_{2.5}$ annual NAAQS in 2012 and 2013 and was subsequently designated nonattainment for $PM_{2.5}$ in 2015.

4.1.18 Pocatello—Garrett and Gould

The Pocatello Garrett and Gould site is urban in character, located centrally in Pocatello amongst commercial development near a rail yard (Figure 46). The monitor measures $PM_{2.5}$ for AQI forecasting and PM_{10} for SIP maintenance, NAAQS compliance, and modeling and meteorological support. It is co-located with a meteorological station. A neighborhood scale of representation is appropriate for a population exposure site type (CFR 2009). Land use in the neighborhood is developed, medium- to high-intensity and population density is high. Synoptic winds from the southwest are funneled through the local terrain to blow from the southeast through the Portneuf Valley. PM_{10} concentrations decreased in 2012–2013 from a decadal high in 2010, but the 3-year average daily maximum is well below the NAAQS (DEQ 2015c). For $PM_{2.5}$, this monitor typically records values in the good, or green, AQI category.

4.1.19 Pocatello—Sewage Treatment Plant

The Pocatello Sewage Treatment Plant monitor is located on the northeastern edge of the sewage treatment facility (Figure 47). It aims to measure the maximum concentration of SO_2 emitted from the sewage treatment plant. The middle scale of representation is appropriate for the site type (CFR 2009). This is a windy location, with the majority of the air traveling over the facility from the southwest. The 2013 1-hour design value was below the new NAAQS set in 2010 (DEQ 2015c). The standard requires a 3-year average, so the first design value was available in 2013.

4.1.20 Salmon

The Salmon $PM_{2.5}$ monitor is in a narrow mountain valley along the Salmon River (Figure 48). The small community is surrounded by high mountains and rugged terrain. The neighborhood scale of representation is appropriate for this population exposure site type (CFR 2009). Land use in the area is a mixture of developed, pasture/hay, and grassland or shrub-covered hills. Population density is low. The diverse geography causes local wind patterns to be quite variable, but wind more often arrives from the southern quadrants. Wind speeds are normally low and air drainage from the high country surrounding the valley is prevalent. Salmon experiences similar sources of poor air quality as Pinehurst: RWC trapped by cold pool inversions in winter and wildfire smoke impacts in summer. Salmon had an especially tough year in 2012 (DEQ 2015b). The annual average daily concentrations for $PM_{2.5}$ have been at or above the NAAQS since monitoring began in 2009.

4.1.21 Sandpoint

The Sandpoint monitor is located in an urban area on the northwest shore of Lake Pend Oreille (Figure 49). The city occupies a flat, north-south trending valley surrounded by evergreen-covered mountains. The urban scale of representation is appropriate for a population exposure site type (CFR 2009). The monitor, which is collocated with a meteorological monitor, measures PM_{10} for SIP and NAAQS compliance, AQI forecasting, and modeling and meteorological support. The monitor also measures $PM_{2.5}$ for AQI and smoke management. The area surrounding the monitor is generally urban, along with water features, pasture, scrub, and forest. The monitor is located in a relatively dense census block group, to the north of the denser city center. Two major point-source facilities exist within the scale of representation, and they are situated along the same southwest-northeast axis along which local winds tend to blow, so these facilities may have some impact on the monitor. Synoptic winds are directionally similar to the local winds because the valley topography is oriented in the same direction. Sandpoint daily PM_{10} values show low and decreasing concentrations from 2011 through 2013 (DEQ 2015c). There have been no violations.

4.1.22 Soda Springs

The Soda Springs monitor is located at the northwest corner of the Monsanto P4 Title V facility (Figure 50). It is a source impact monitor designed to measure SO_2 concentrations emitted from the P4 facility. The middle scale of representation is appropriate for this site type (CFR 2009). The facility is southeast of the monitor and most of the wind arrives from the north and northeast. Prevailing local winds should blow across the facility towards the monitor, so, if the wind rose data are correct, the monitor is in the wrong spot. This discrepancy should be examined and the monitor re-sited if necessary. The 2013 1-hour design value was below the new NAAQS standard set in 2010.

4.1.23 St. Maries

The St. Maries site is in a small mountain valley town on the south bank of the St. Joe River (Figure 51). St. Maries is in the Coeur d’Alene airshed, positioned at the southernmost tip of Coeur d’Alene Lake. The monitor measures $PM_{2.5}$ for NAAQS compliance and AQI forecasting. Synoptic winds blow from the south in the winter and from the west in the summer (Figure 21). These winds are funneled through the east-west and southeast trending valleys by the surrounding hills. The neighborhood scale of representation is appropriate for this population exposure site (CFR 2009). Land use surrounding the monitor is developed and the population is dense. The monitor seems well-positioned to capture ambient air quality concentrations experienced by the area population. Design values for the annual $PM_{2.5}$ NAAQS have remained at or below 10 $\mu g/m^3$ since the monitor was established in 2005.

4.1.24 Twin Falls

The Twin Falls monitor is at an urban site, centrally located in the Twin Falls airshed on the Snake River Plain (Figure 52). The monitor measures $PM_{2.5}$ for AQI forecasting and smoke management purposes. The neighborhood scale of representation is appropriate for a population exposure site type (CFR 2009). Land use in the neighborhood is highly developed to the east with some agriculture to the northwest. Population is uniformly dense. The terrain is flat, so wind speeds are relatively high and local geographic features do not play a large part in wind direction. Westerly winds prevail in the summer, and winter winds blow from the south and southwest. Lack of terrain features makes this a well-ventilated site. In 2011, the Twin Falls monitor recorded 15 days in the moderate AQI range (DEQ 2015a). In 2012, 34 days were yellow, 2 were unhealthy for sensitive groups, and 1 was unhealthy (DEQ 2015b); in 2013, 13 yellow days were recorded (DEQ 2015c).

4.1.25 Recommendations

Following is the summary of monitor network recommendations derived from the site scale assessment:

- Boise Eastman Garage—change site type to source impact from population exposure
- Soda Springs—re-site monitor to be downwind of facility

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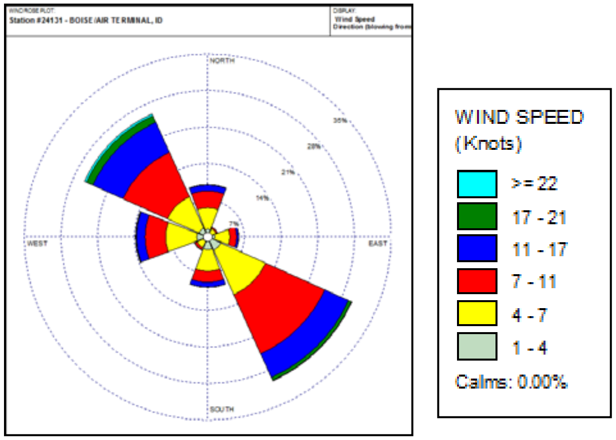
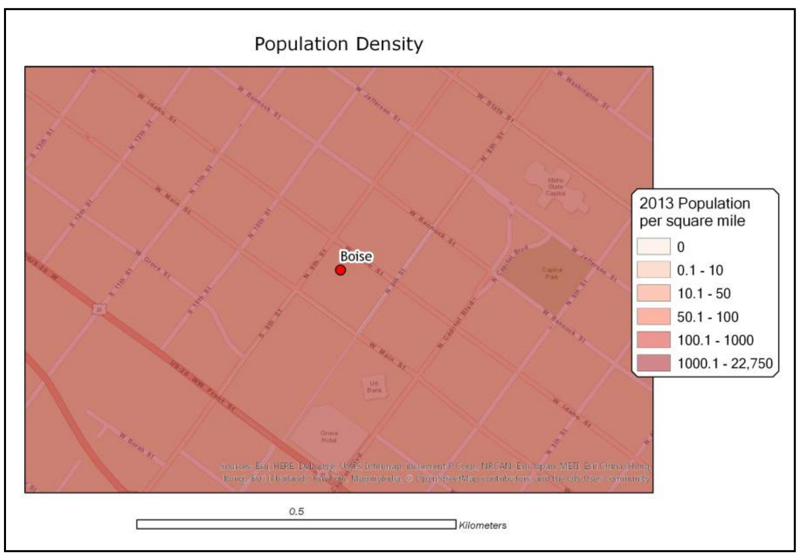
Figure 17. Boise—Eastman Garage.

Site Type	Population exposure
Scale of Representation	Micro
Area Represented	Northern Ada County
Airshed	Treasure Valley
Pollutant(s) Monitored	CO
Monitoring Objectives	CO NAAQS, CO SIP





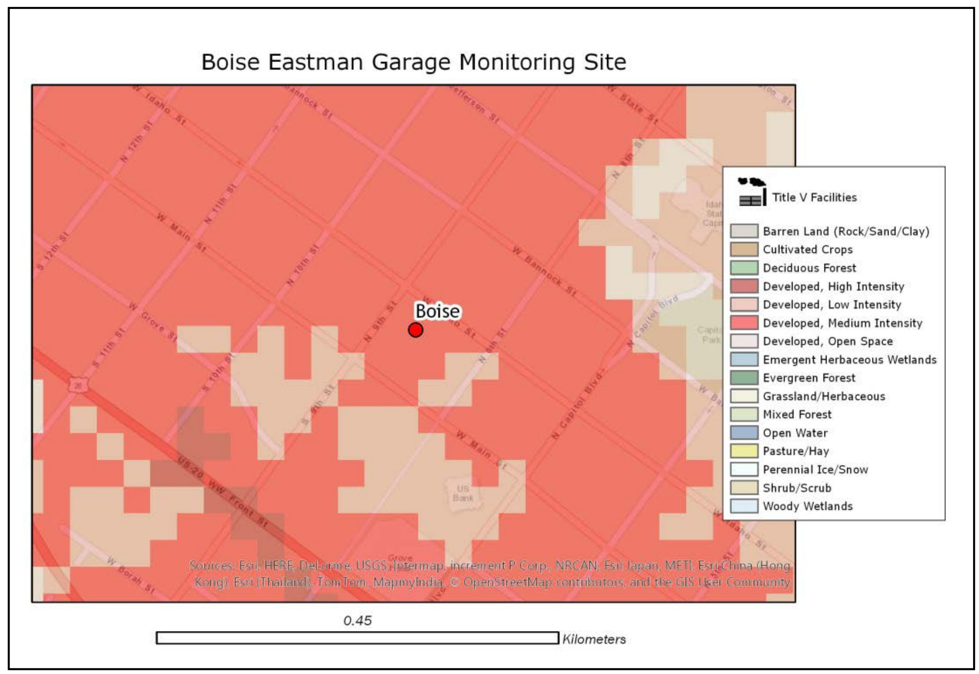
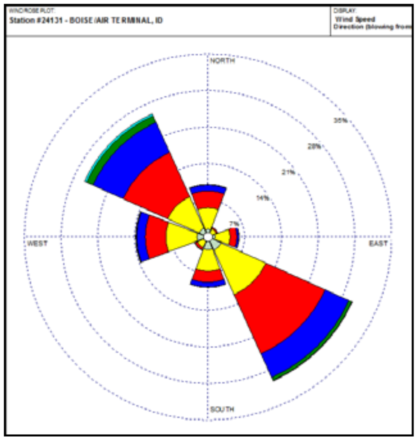
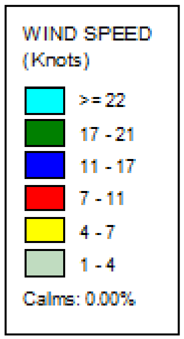
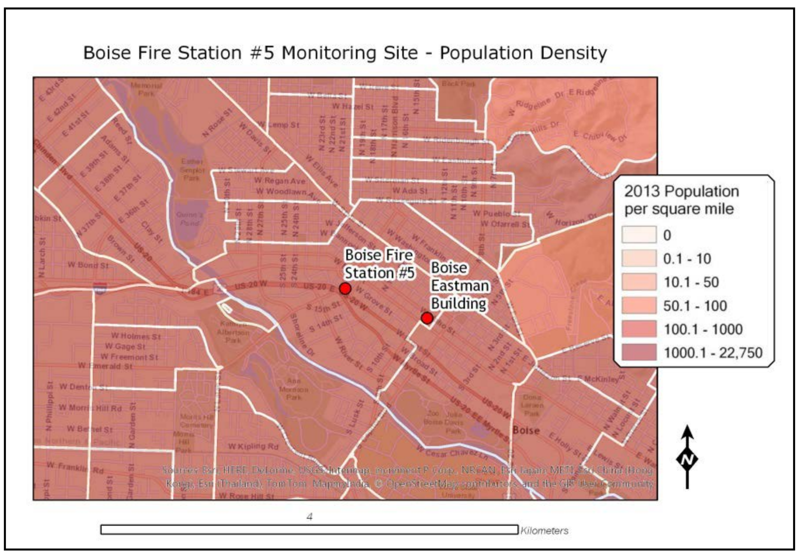


Figure 18. Boise—Fire Station #5.

Site Type	Population exposure
Scale of Representation	Neighborhood
Area Represented	Northern Ada County
Airshed	Treasure Valley
Pollutant(s) Monitored	PM_{10}
Monitoring Objectives	PM_{10} NAAQS, PM_{10} SIP







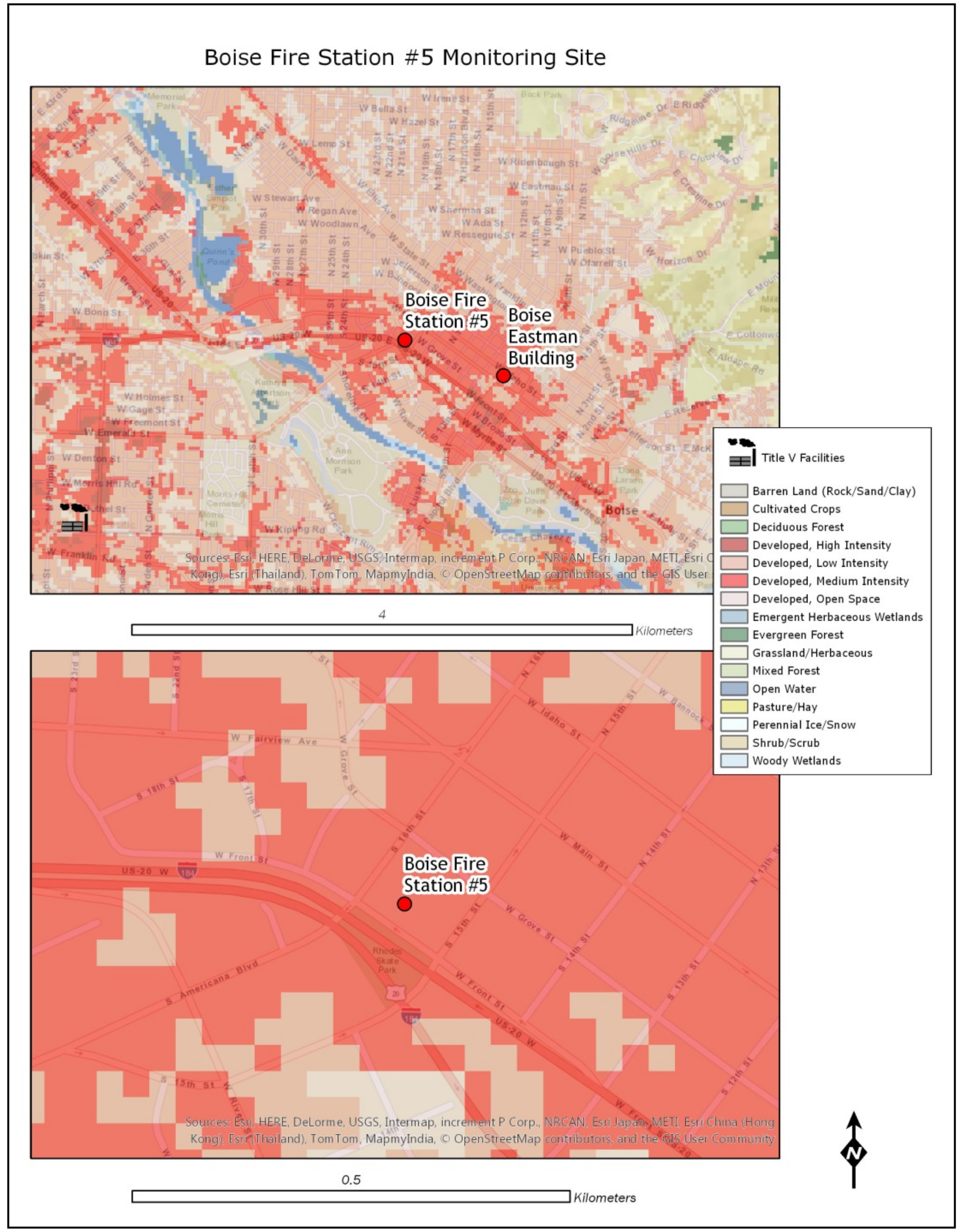
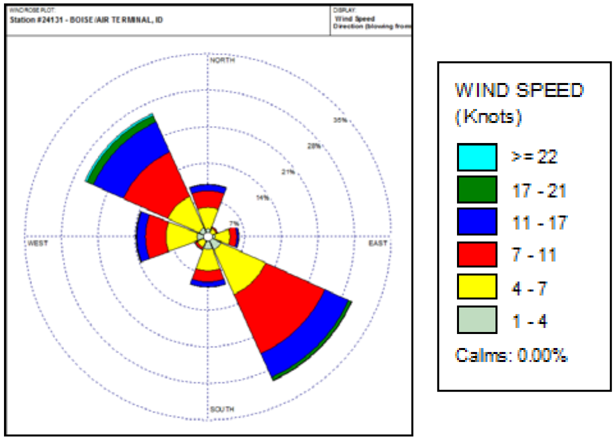
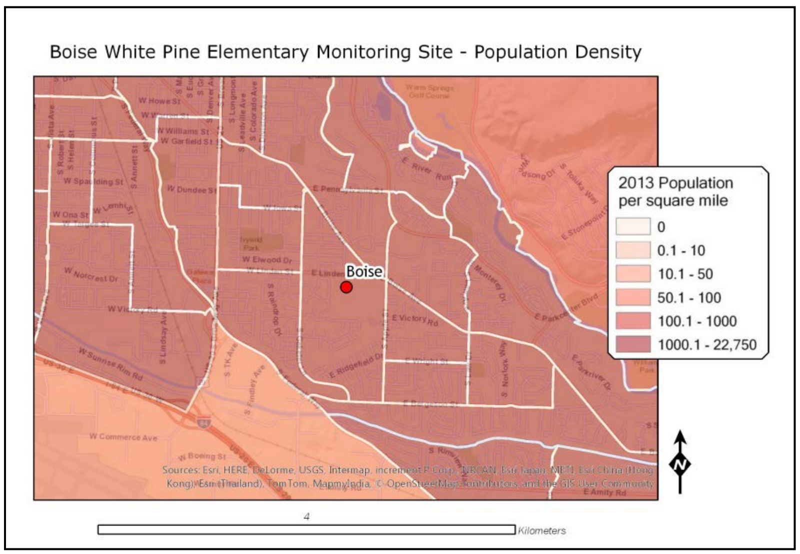


Figure 19. Boise—White Pine Elementary.

Site Type	Maximum concentration
Scale of Representation	Neighborhood
Area Represented	Boise City-Nampa, ID MSA
Airshed	Treasure Valley
Pollutant(s) Monitored	O_3
Monitoring Objectives	O_3 NAAQS





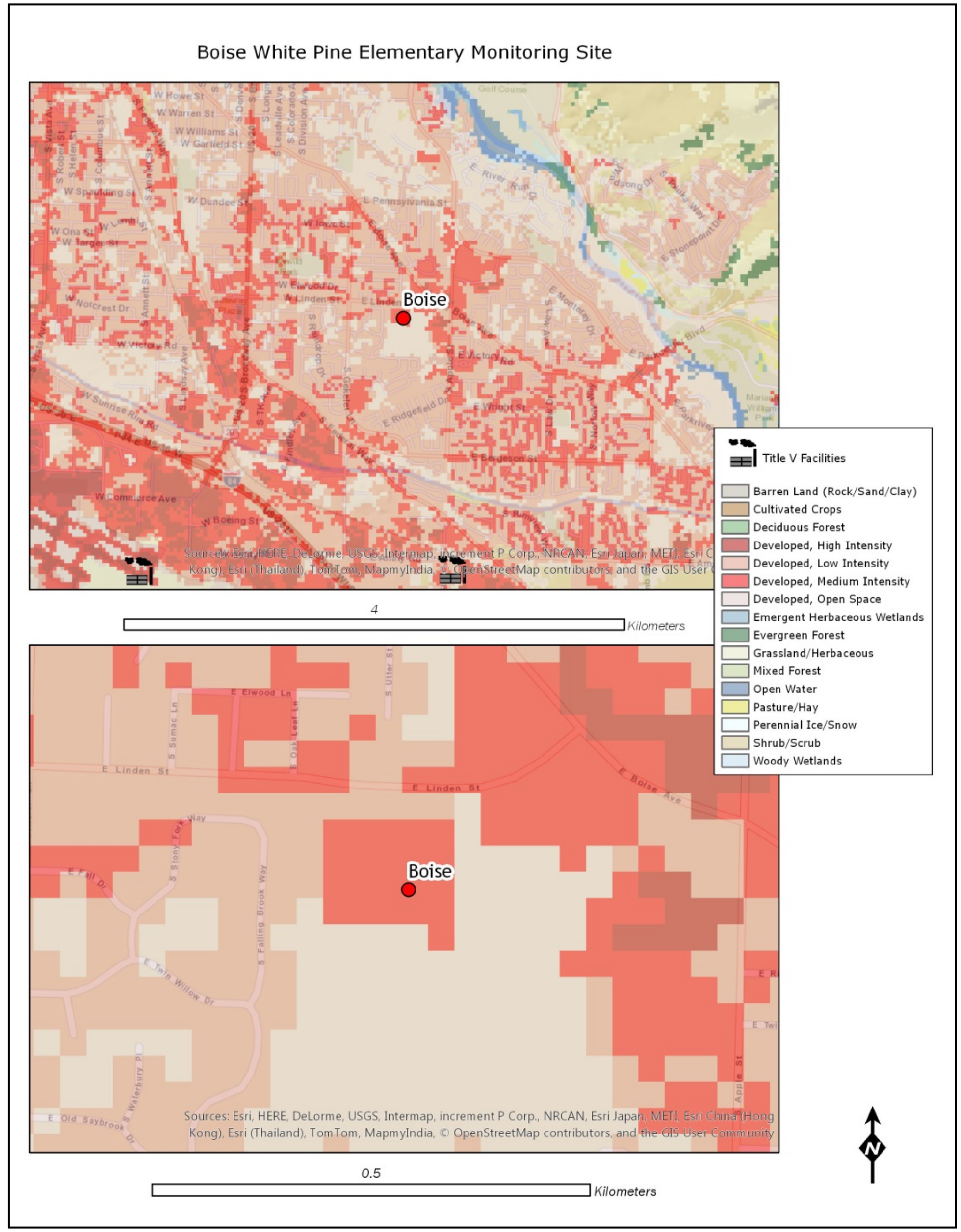
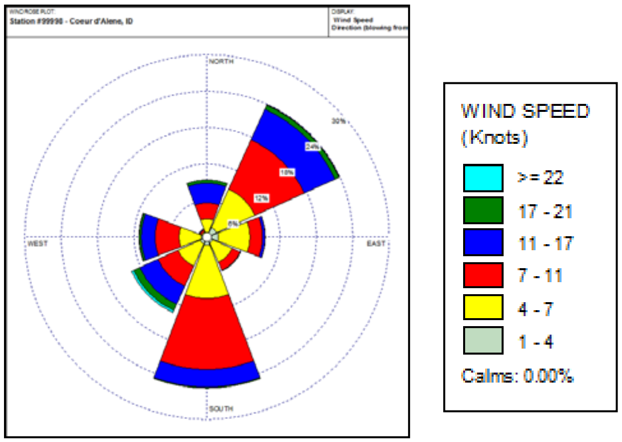
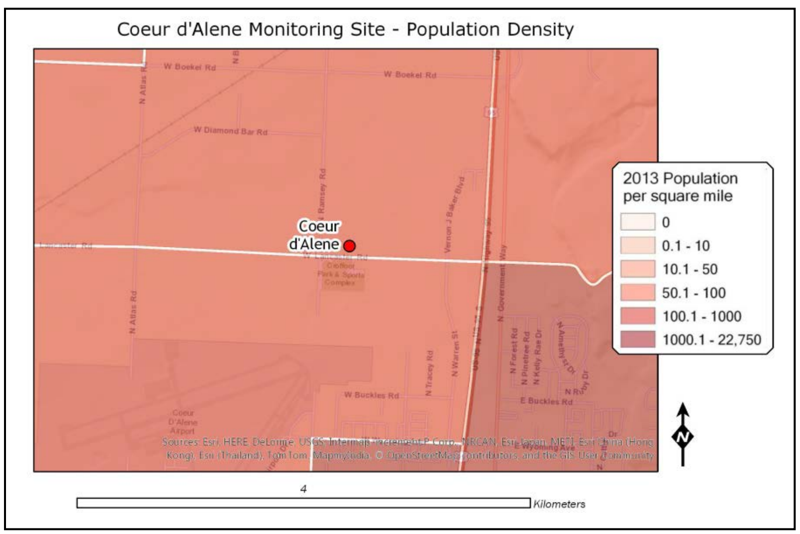
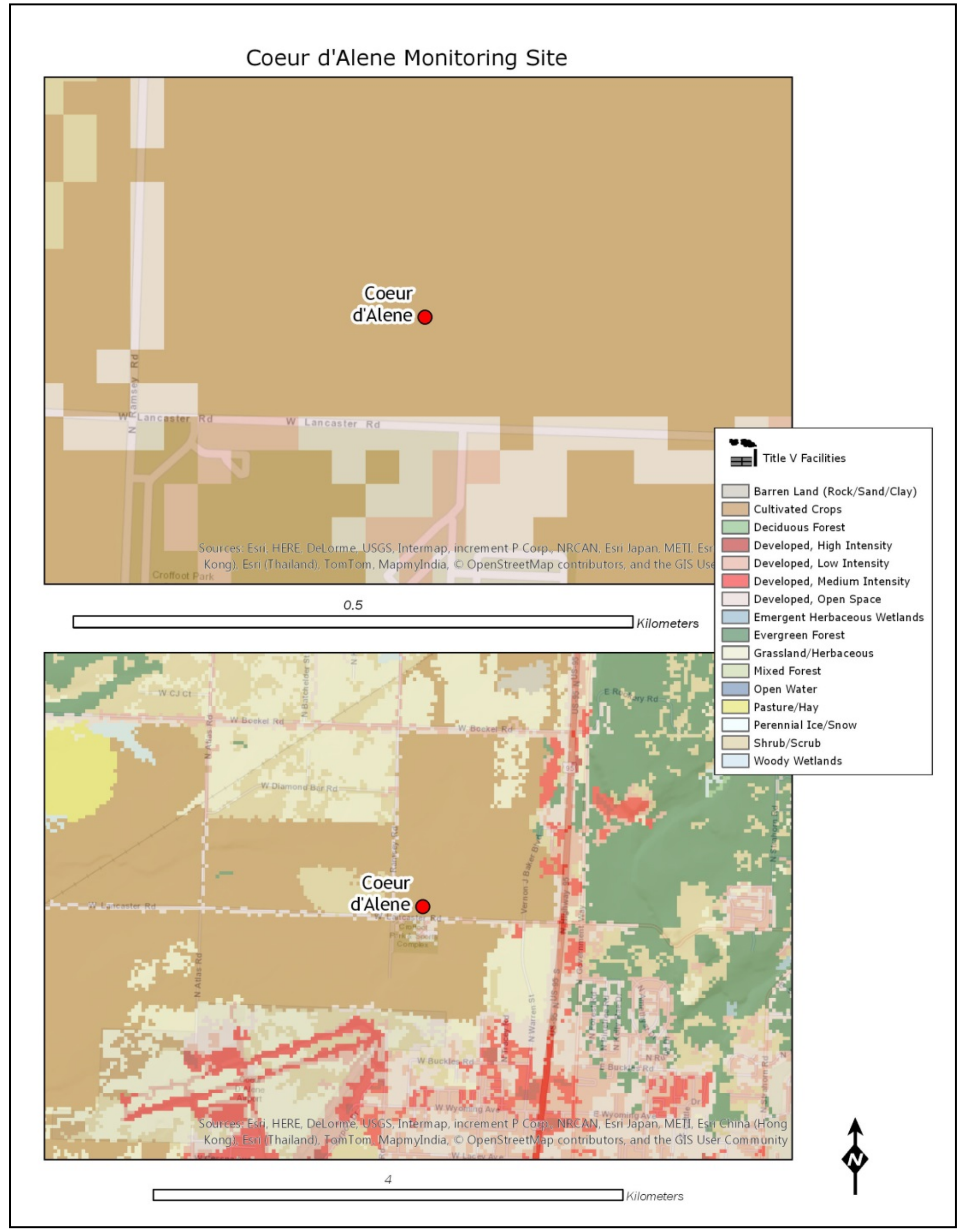


Figure 20. Coeur d'Alene—Lancaster Rd.

Site Type	Population exposure
Scale of Representation	Neighborhood
Area Represented	Coeur d'Alene MSA
Airshed	Coeur d'Alene
Pollutant(s) Monitored	$PM_{2.5}$, meteorology
Monitoring Objectives	AQI, smoke management, modeling-met







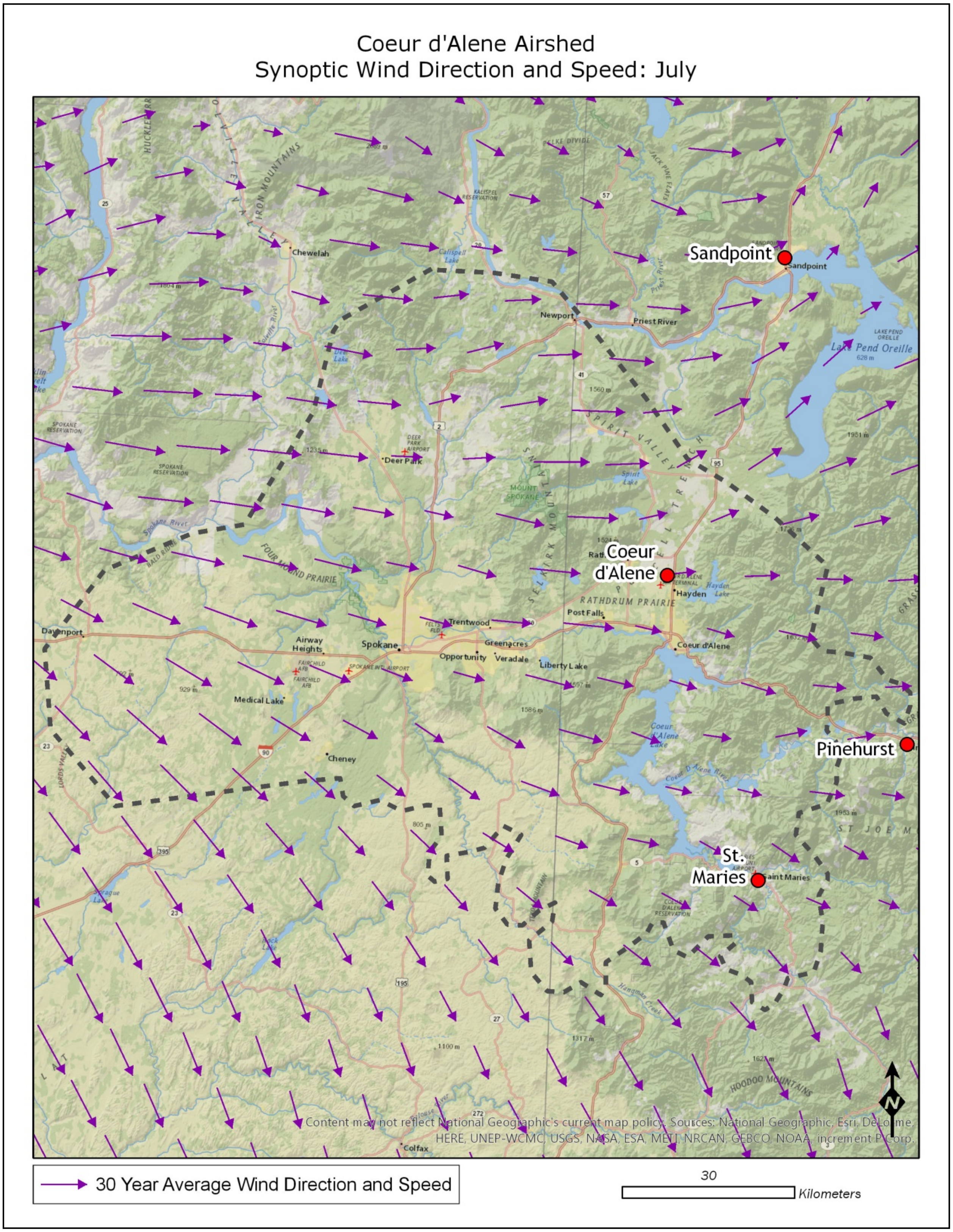


Figure 21. Coeur d'Alene Airshed summertime synoptic winds.

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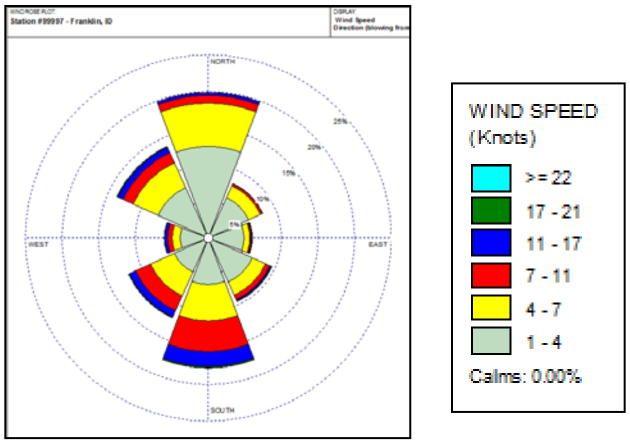
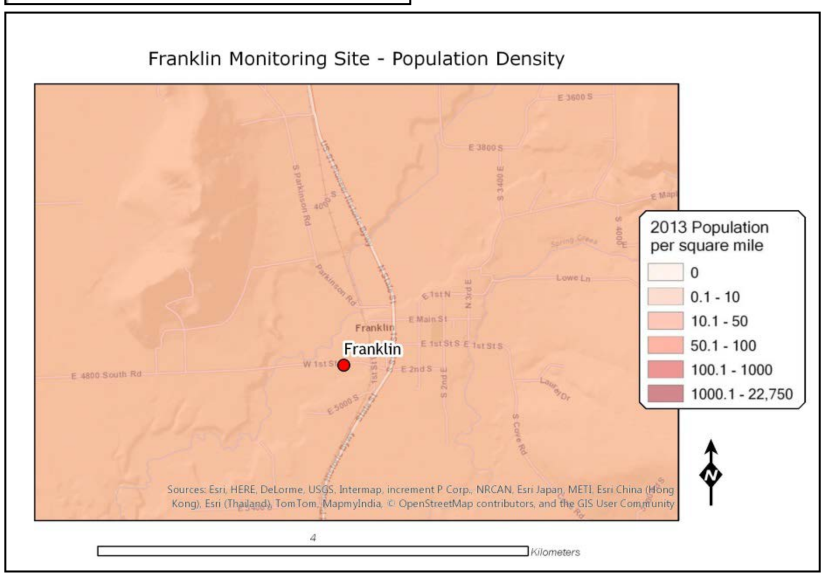
Figure 22. Franklin.

Site Type	Population exposure
Scale of Representation	Neighborhood
Area Represented	Logan, UT-ID MSA
Airshed	Cache Valley (not defined)
Pollutant(s) Monitored	$PM_{2.5}$
Monitoring Objectives	$PM_{2.5}$ NAAQS, AQI





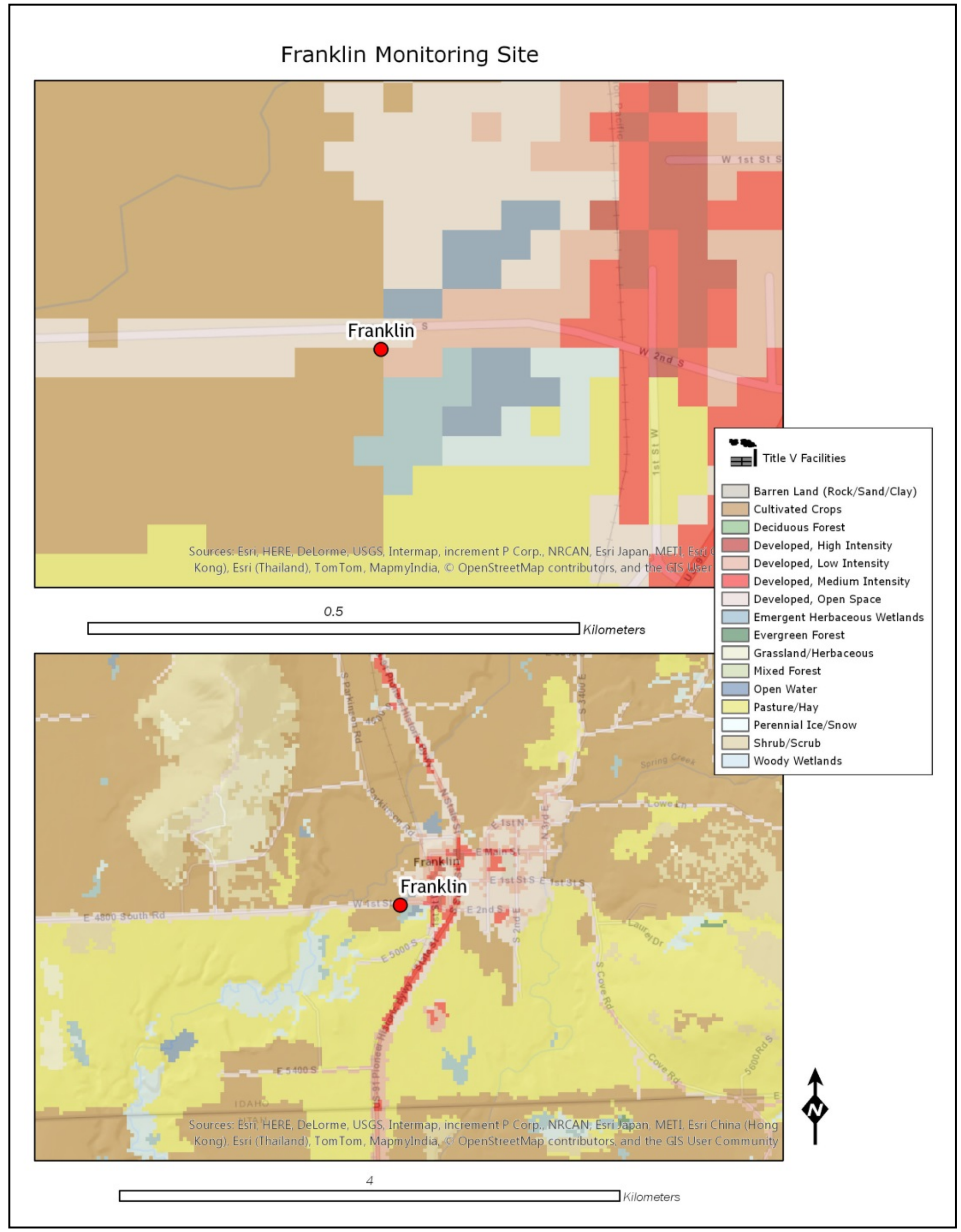


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Figure 23. Logan MSA wintertime synoptic winds.

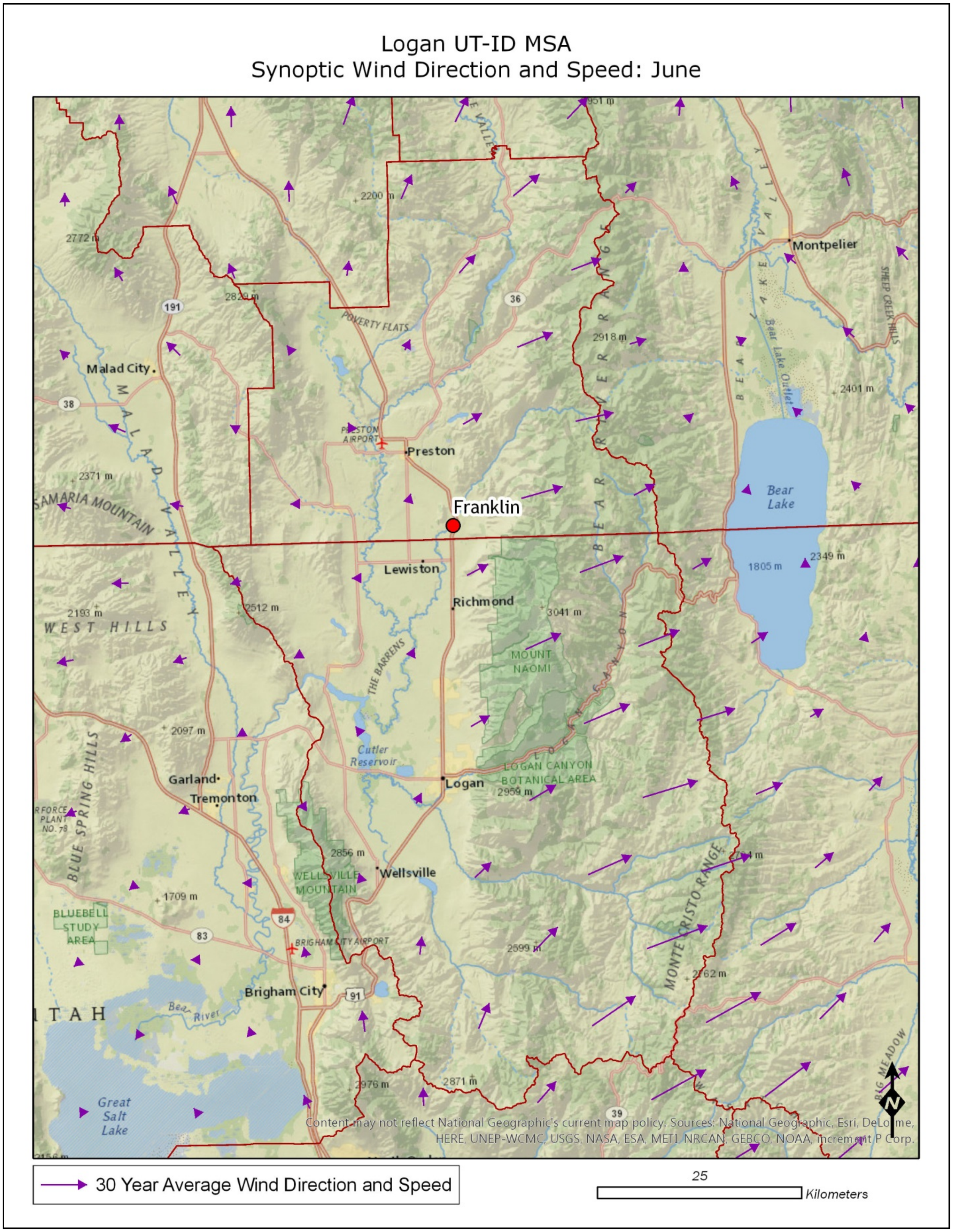
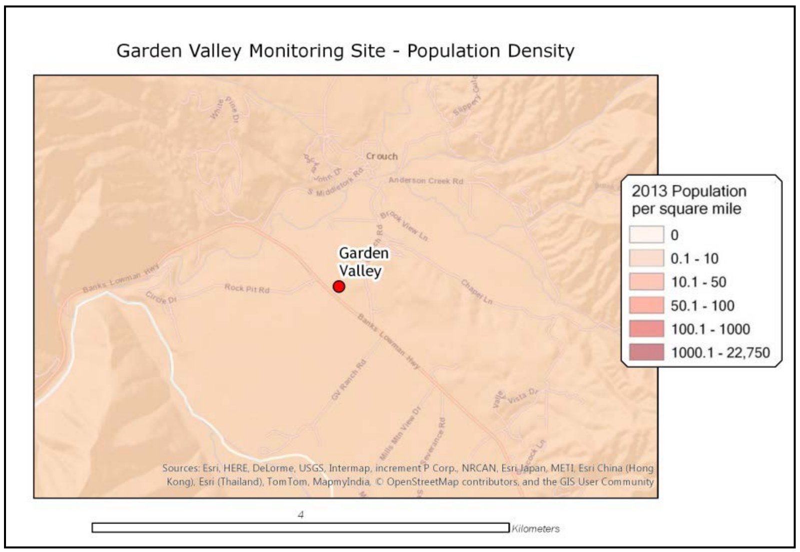
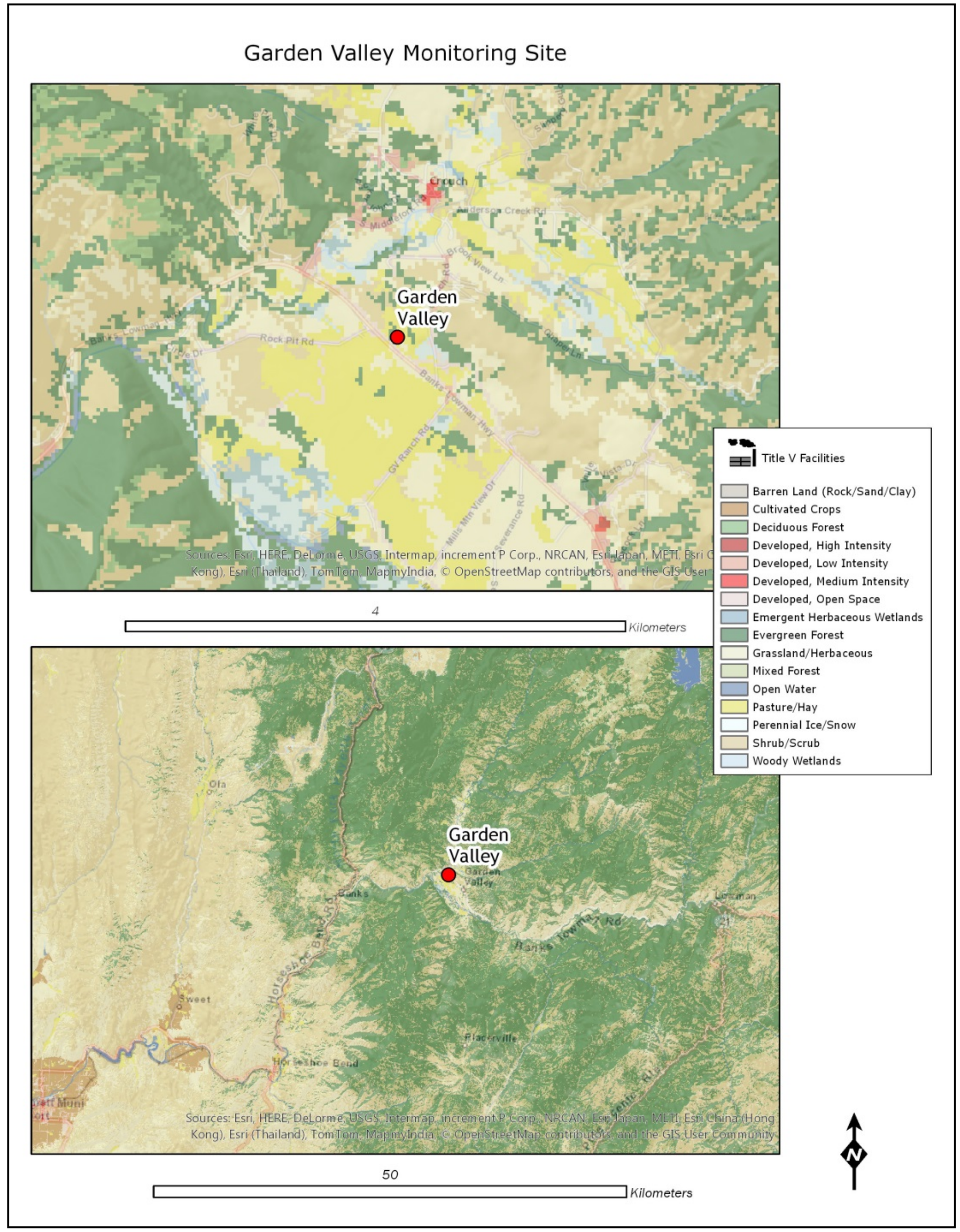


Figure 24. Logan MSA summertime synoptic winds.

Figure 25. Garden Valley.

Site Type	Population exposure
Scale of Representation	Urban
Area Represented	Boise County
Airshed	Not defined
Pollutant(s) Monitored	$PM_{2.5}$
Monitoring Objectives	AQI, smoke management





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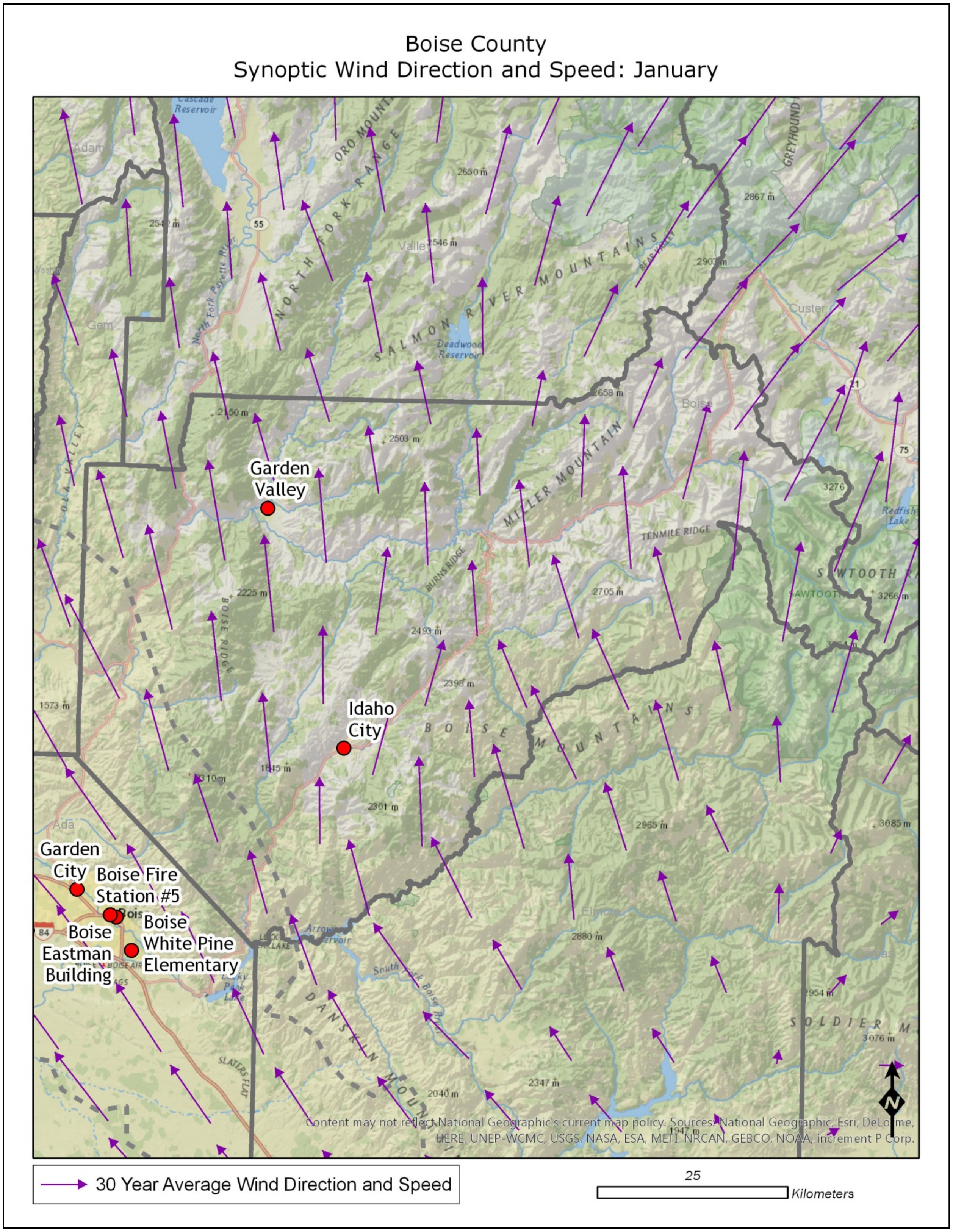


Figure 26. Boise County wintertime synoptic winds.

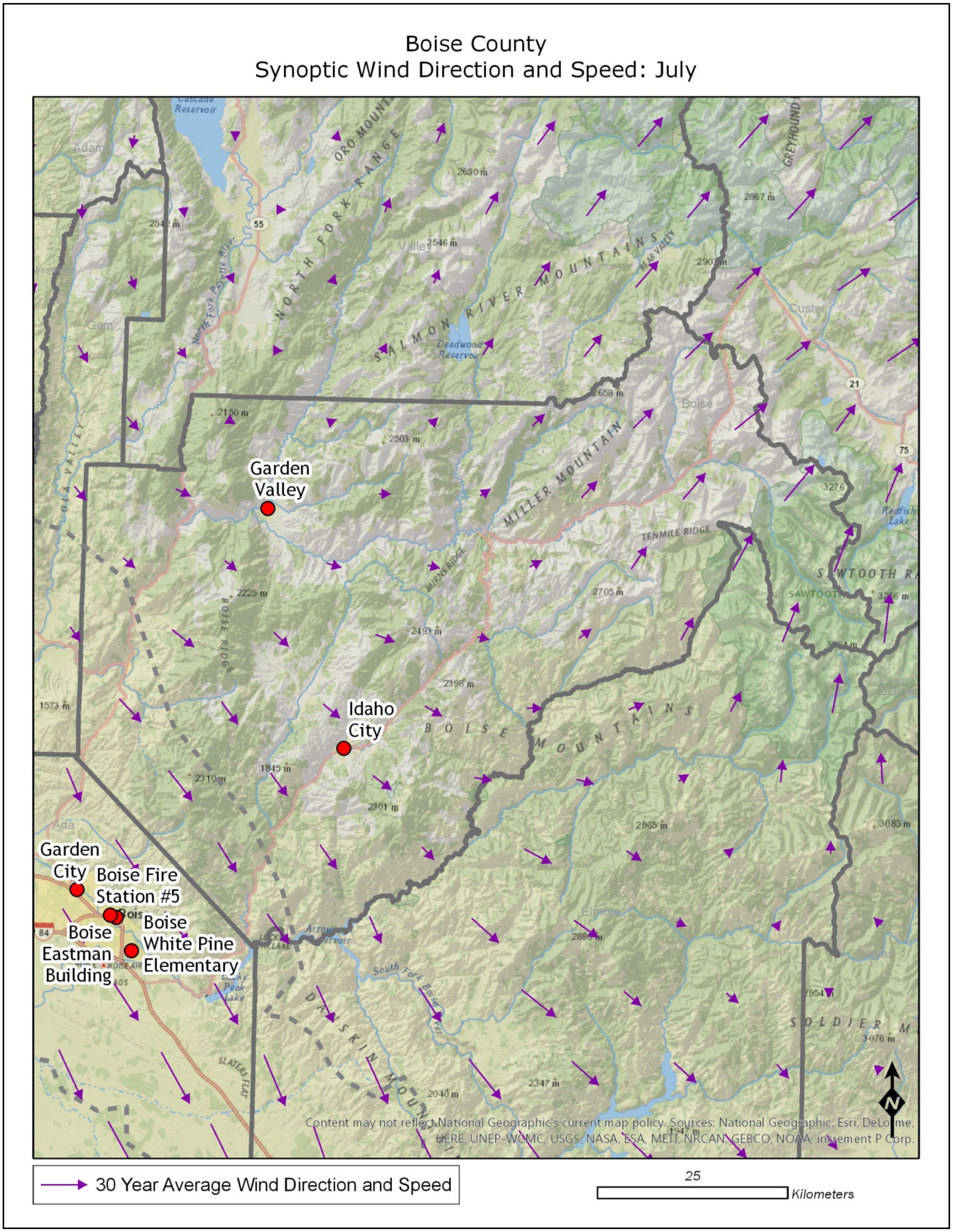
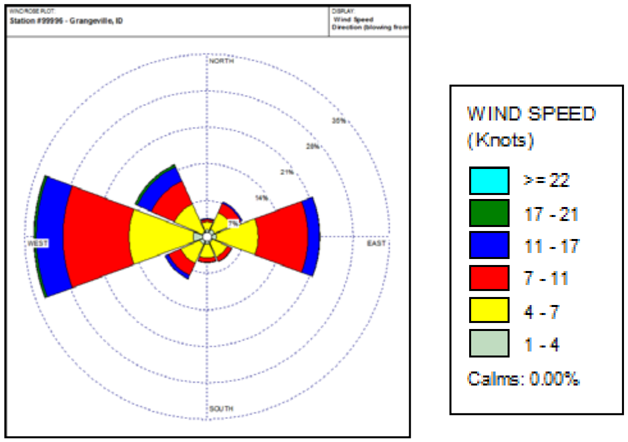
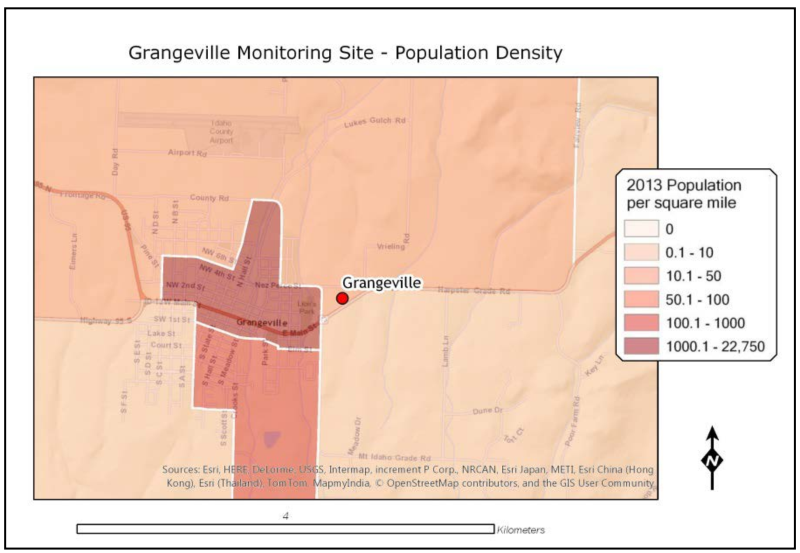


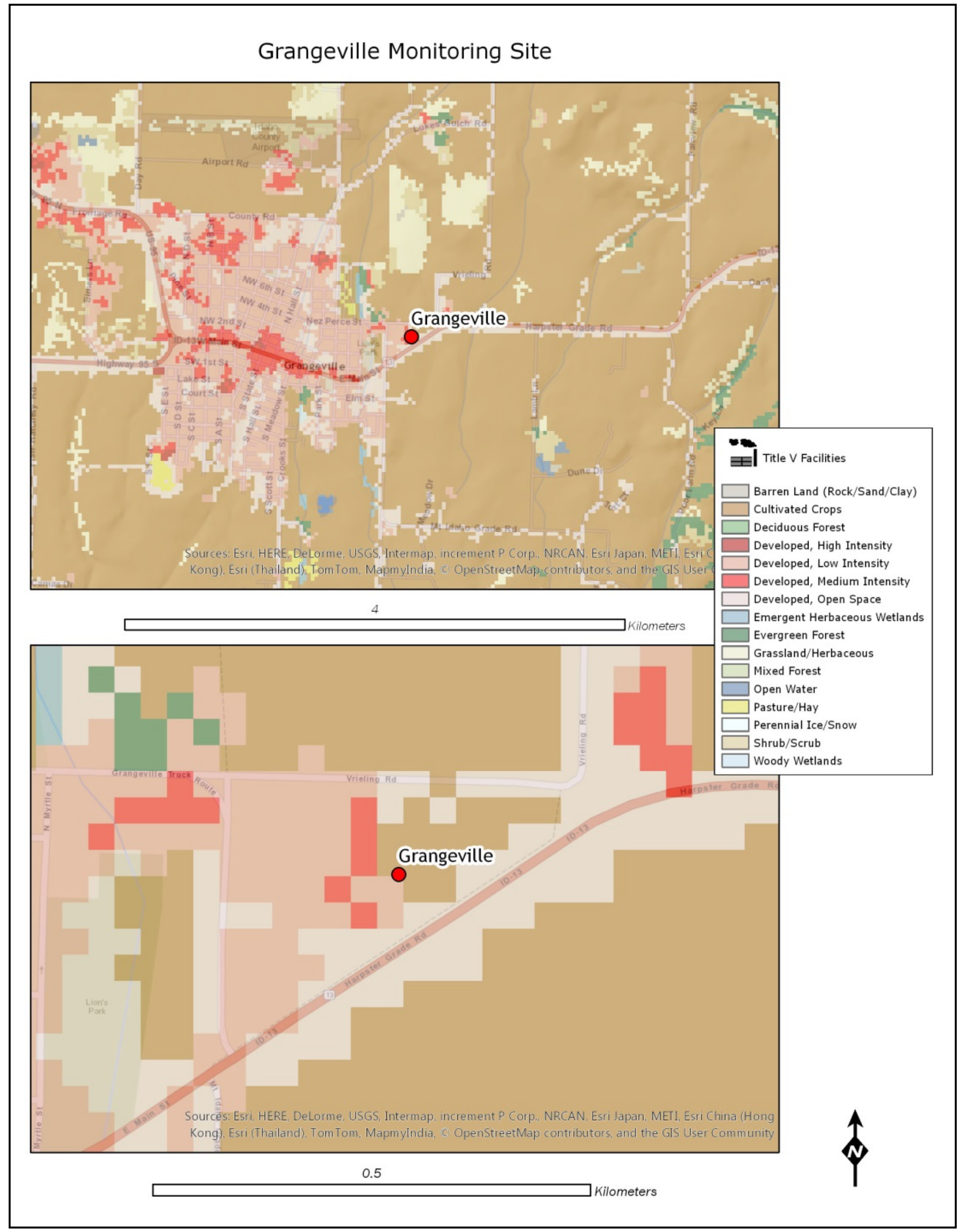
Figure 27. Boise County summertime synoptic winds.

Figure 28. Grangeville.

Site Type	Population exposure
Scale of Representation	Neighborhood
Area Represented	Idaho County
Airshed	Not defined
Pollutant(s) Monitored	$PM_{2.5}$, meteorology
Monitoring Objectives	AQI, smoke management, modeling-met







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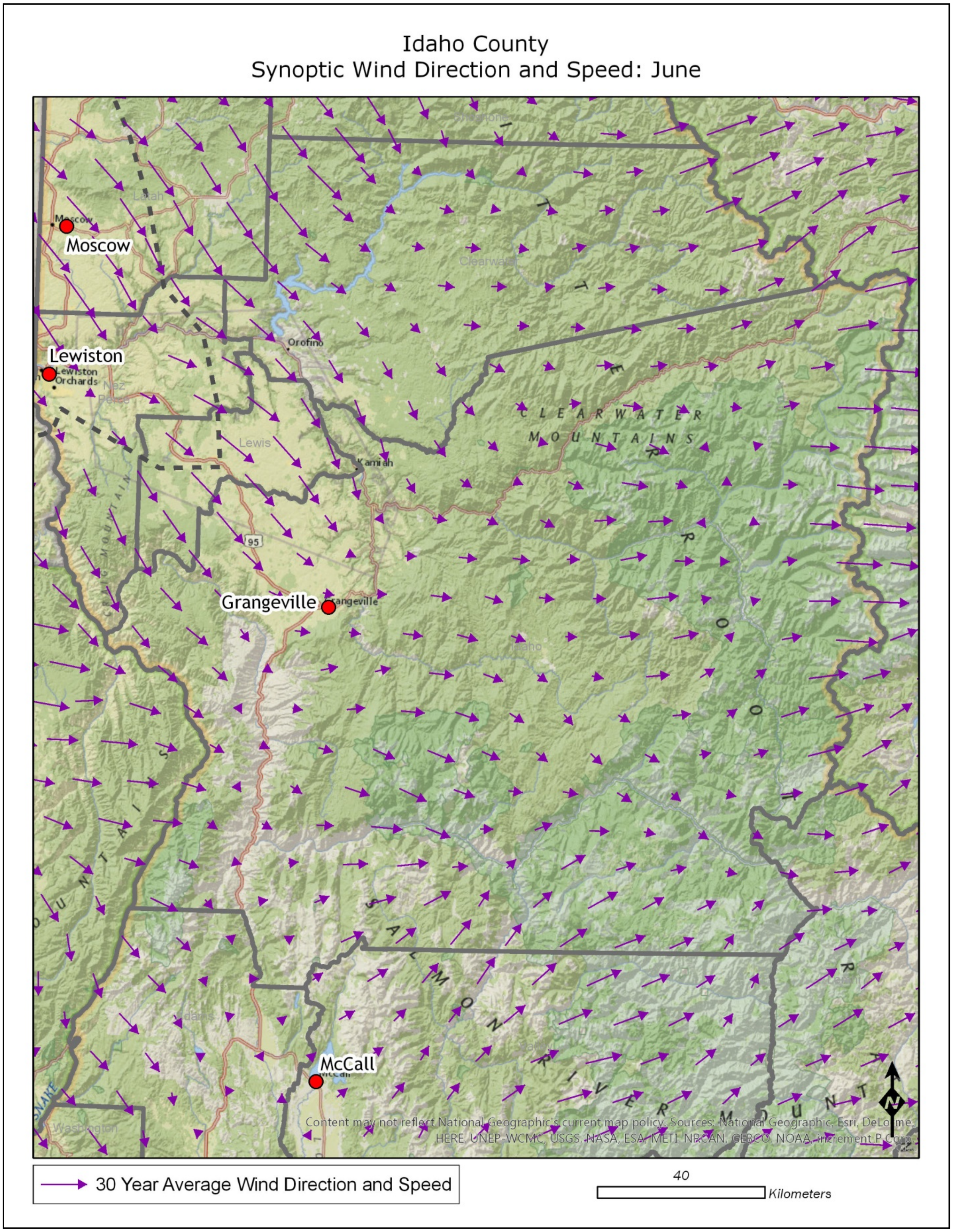

Figure 29. Idaho County summertime synoptic winds.

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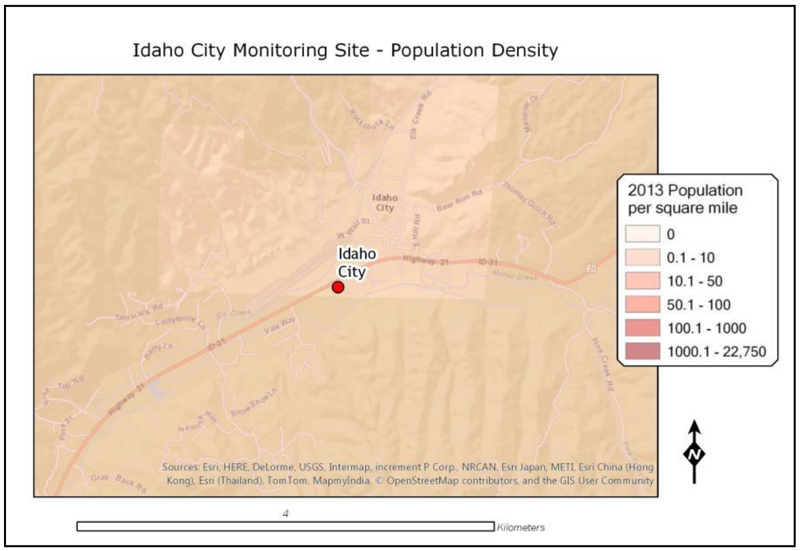
Figure 30. Idaho City.

Site Type	Population exposure
Scale of Representation	Neighborhood
Area Represented	Boise County
Airshed	Not defined
Pollutant(s) Monitored	$PM_{2.5}$
Monitoring Objectives	AQI, smoke management



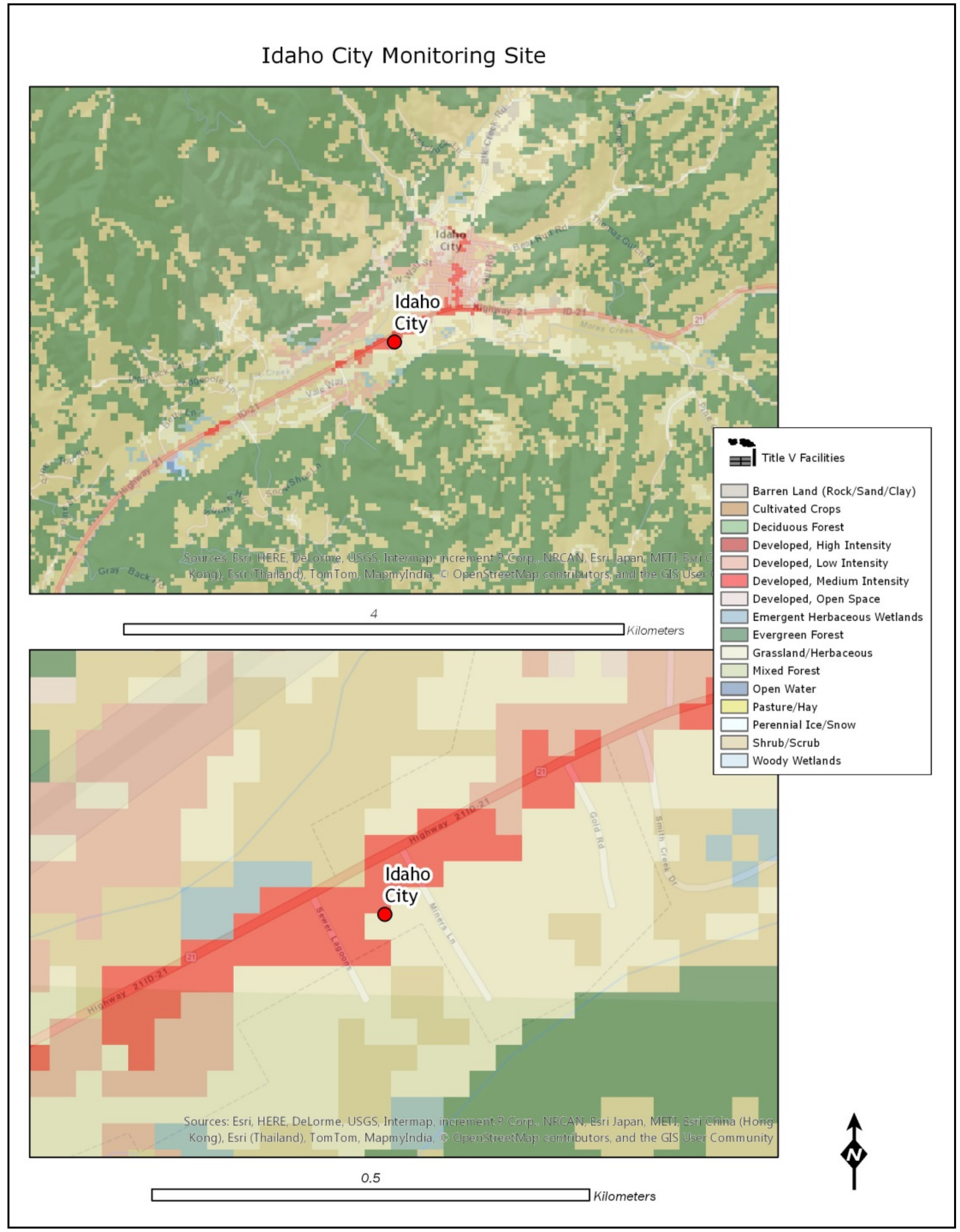
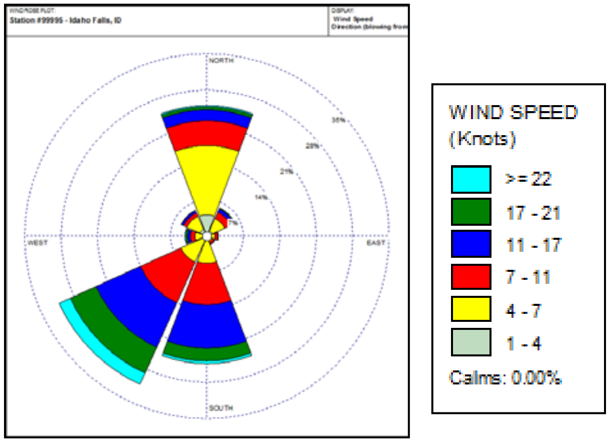
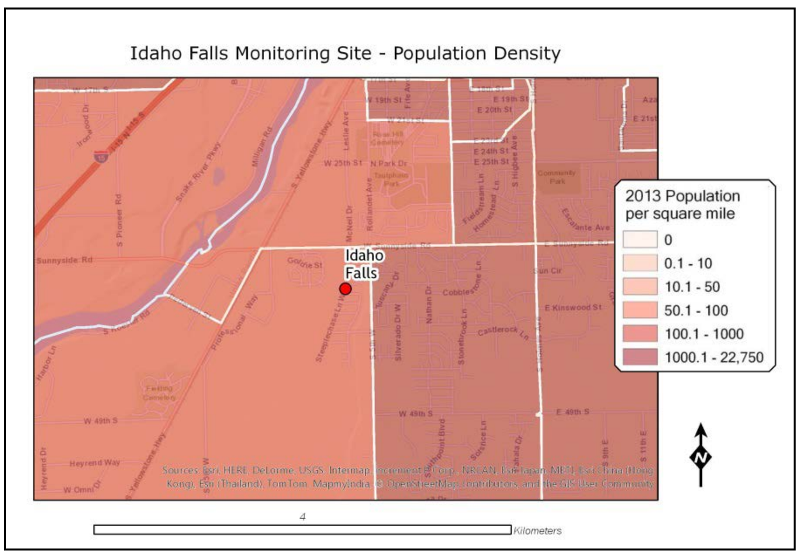


Figure 31. Idaho Falls.

Site Type	Population exposure
Scale of Representation	Neighborhood
Area Represented	Idaho Falls MSA
Airshed	Idaho Falls
Pollutant(s) Monitored	$PM_{2.5}$
Monitoring Objectives	AQI





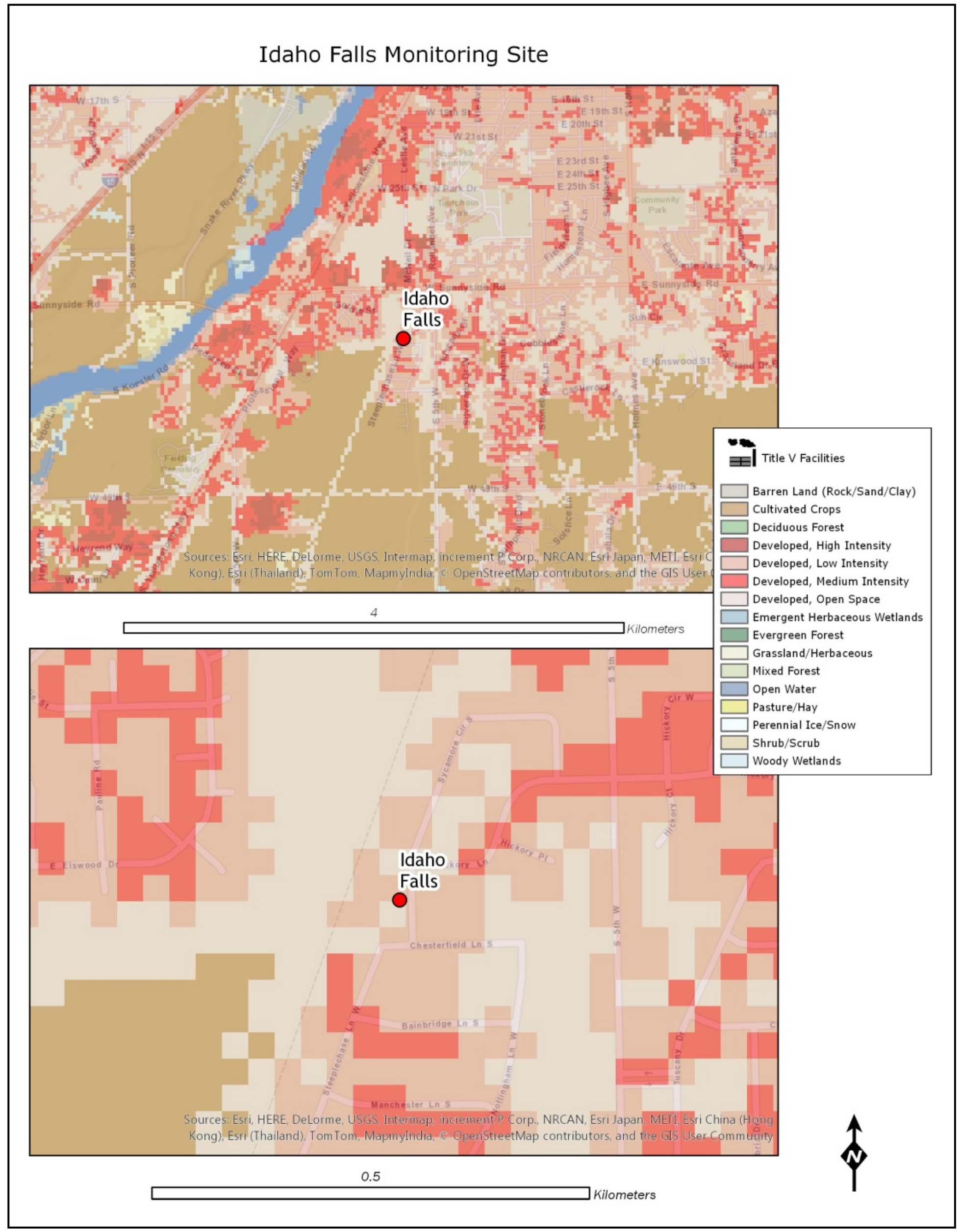
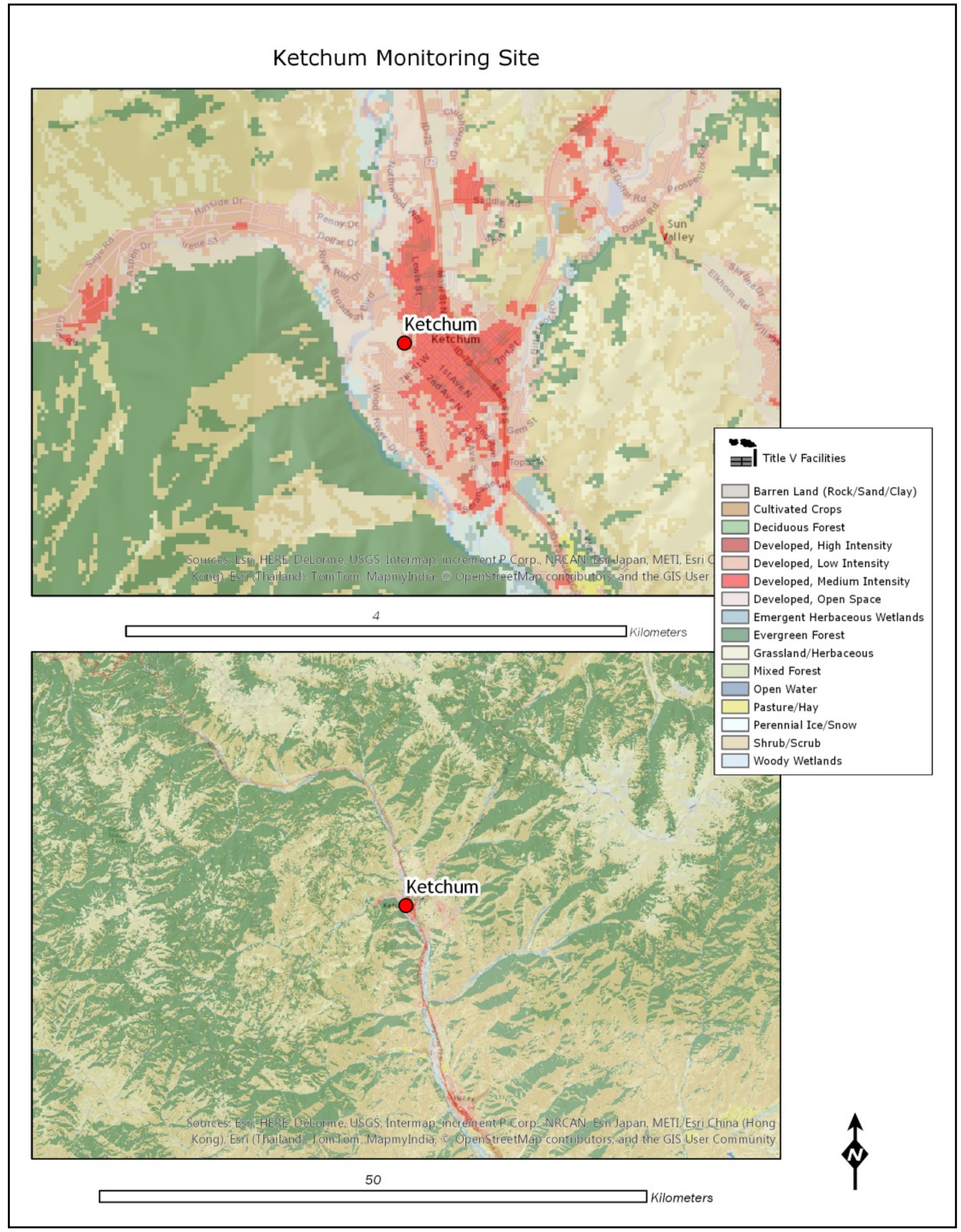
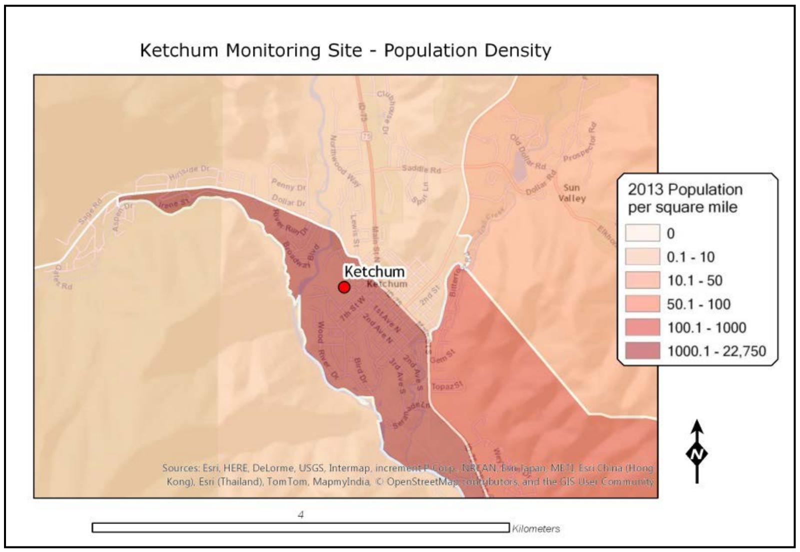


Figure 32. Ketchum.

Site Type	Population exposure
Scale of Representation	Urban
Area Represented	Blaine County
Airshed	Not defined
Pollutant(s) Monitored	$PM_{2.5}$
Monitoring Objectives	AQI, smoke management





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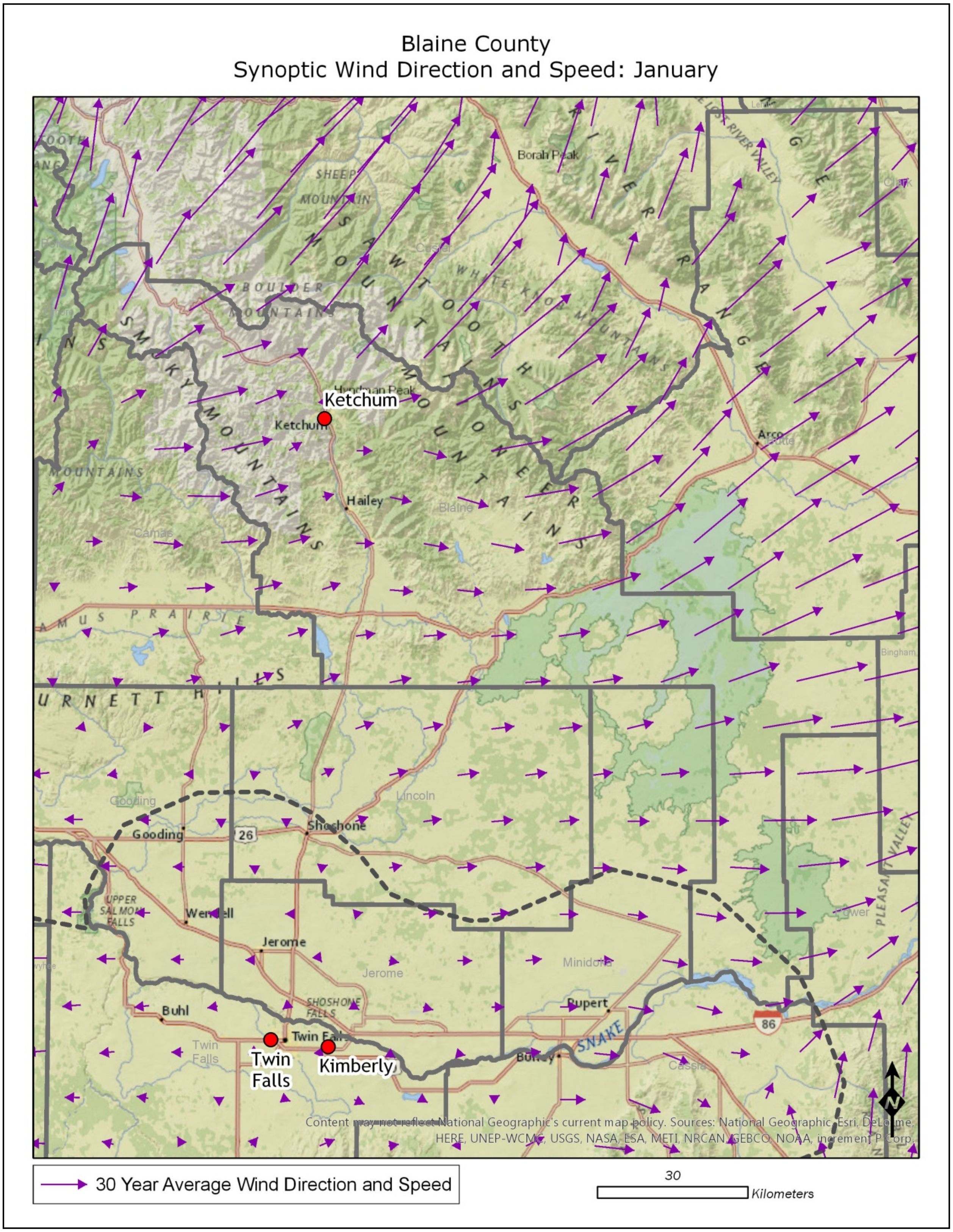


Figure 33. Blaine County wintertime synoptic winds.

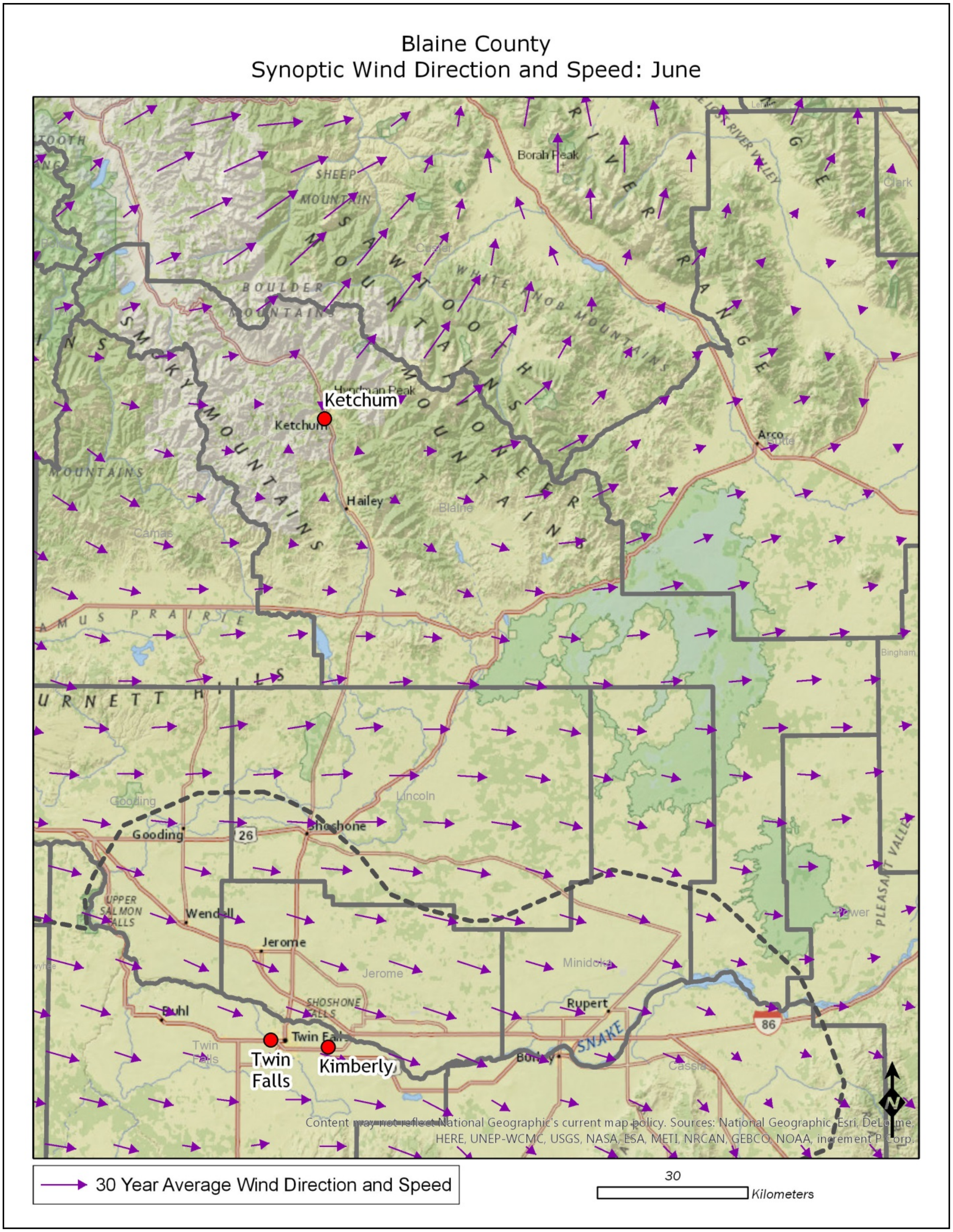
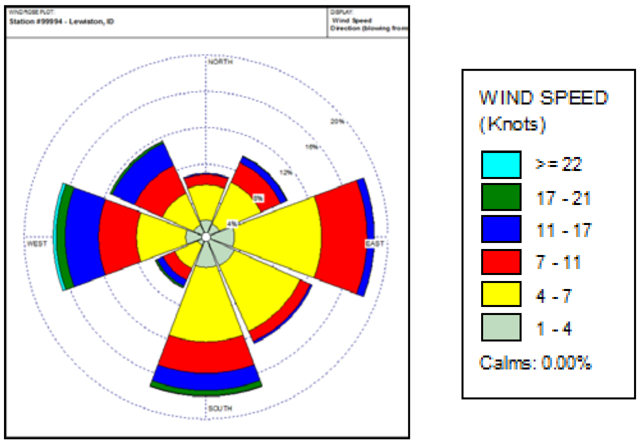
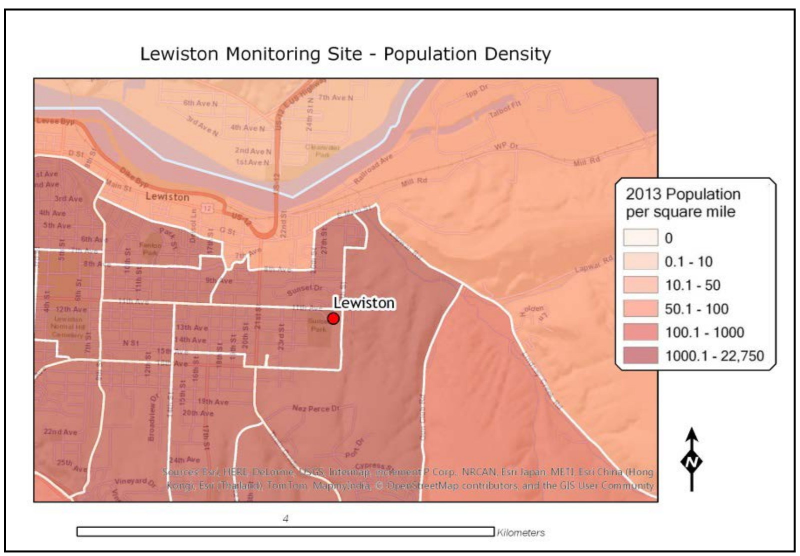


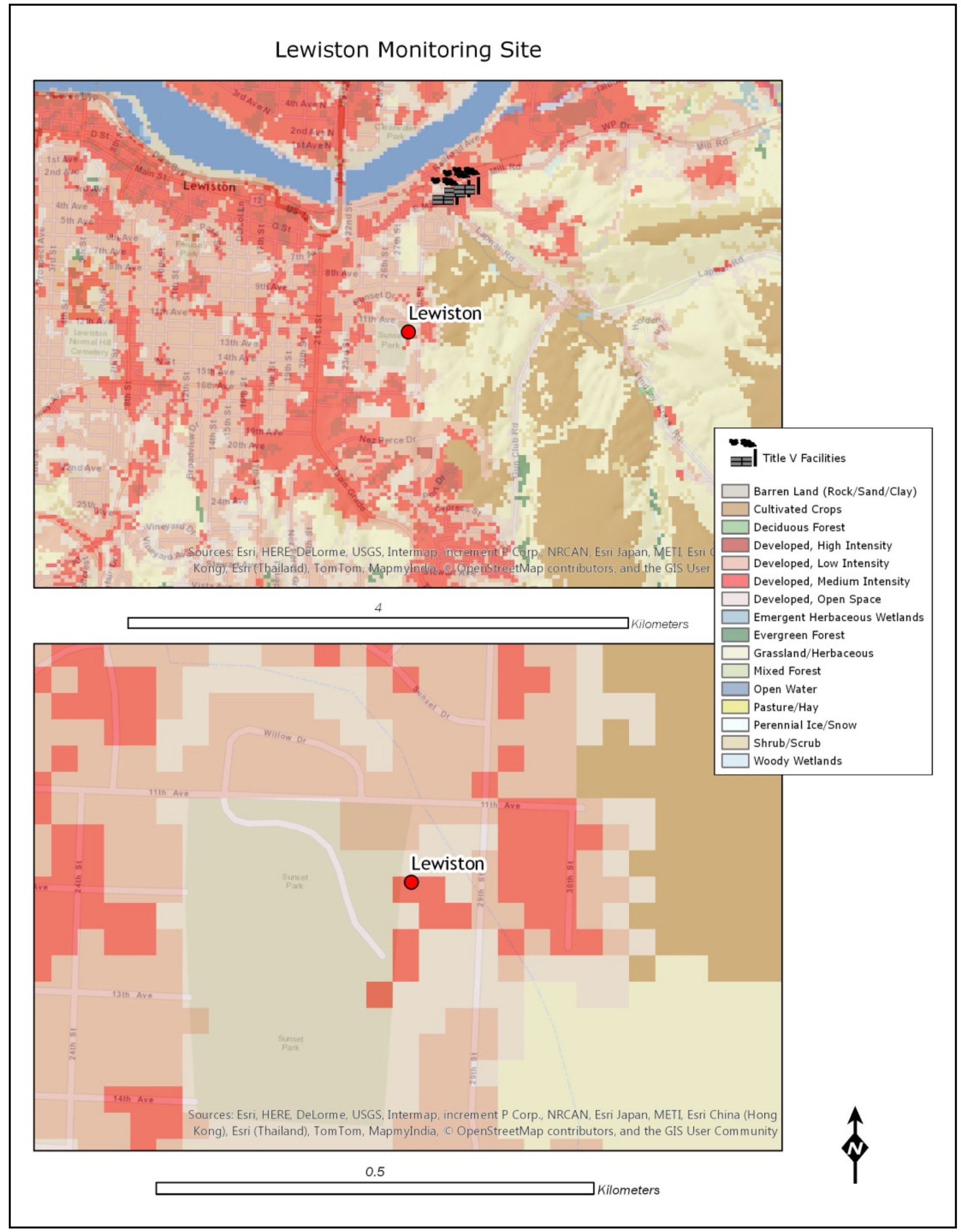
Figure 34. Blaine County summertime synoptic winds.

Figure 35. Lewiston.

Site Type	Population exposure
Scale of Representation	Neighborhood
Area Represented	Lewiston, ID-WA MSA
Airshed	Lewiston
Pollutant(s) Monitored	$PM_{2.5}$, meteorology
Monitoring Objectives	AQI, smoke management, modeling-met







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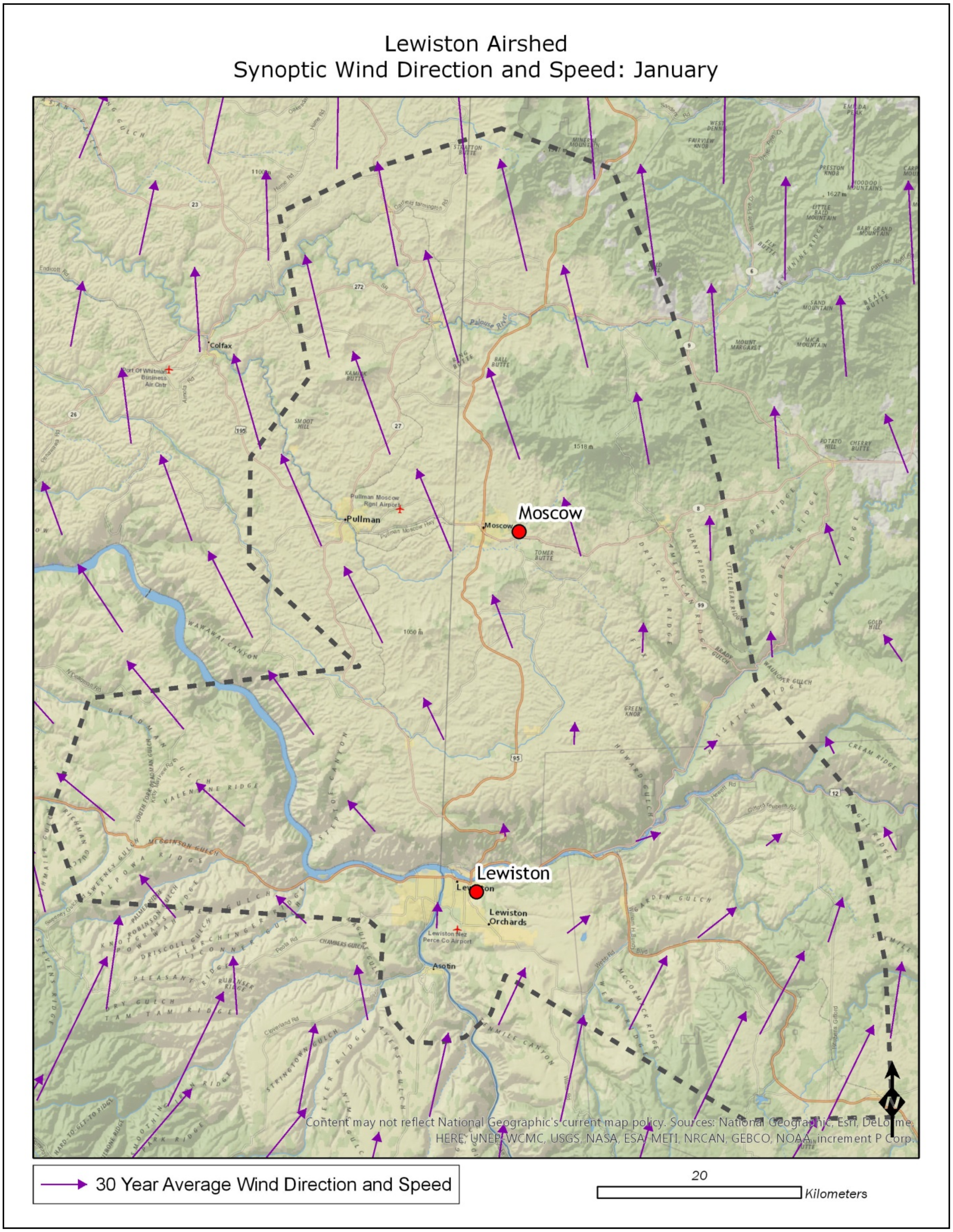


Figure 36. Lewiston Airshed wintertime synoptic winds.

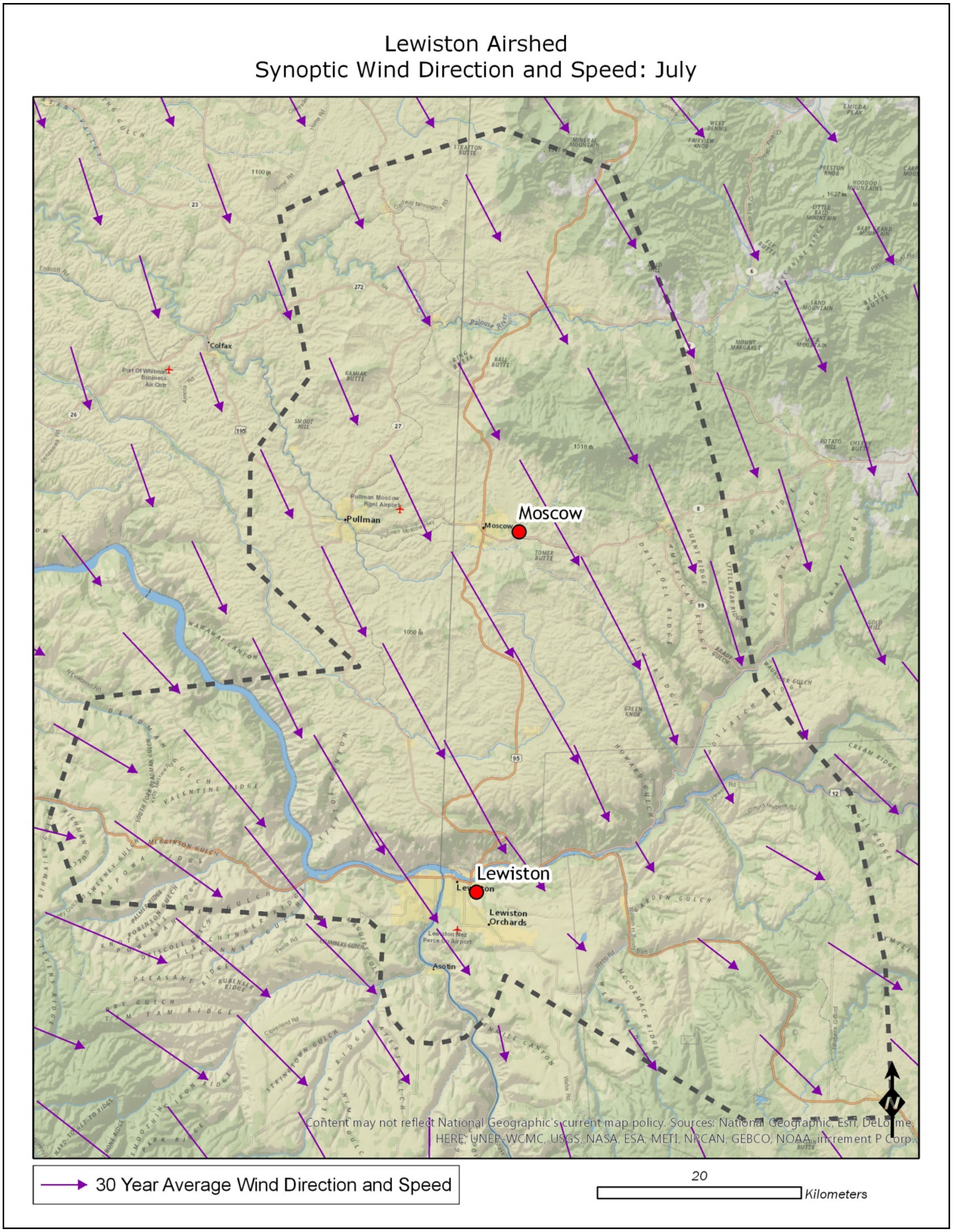
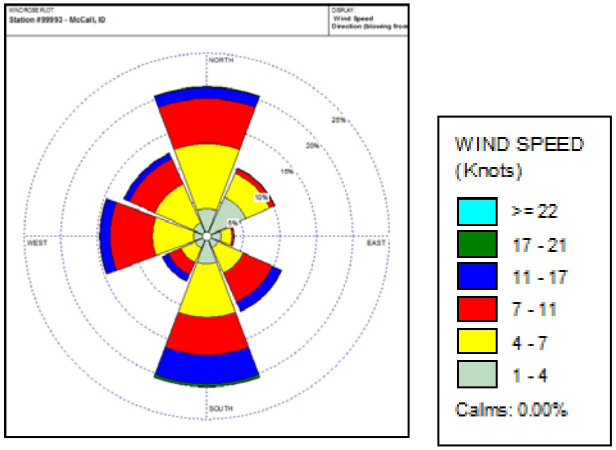
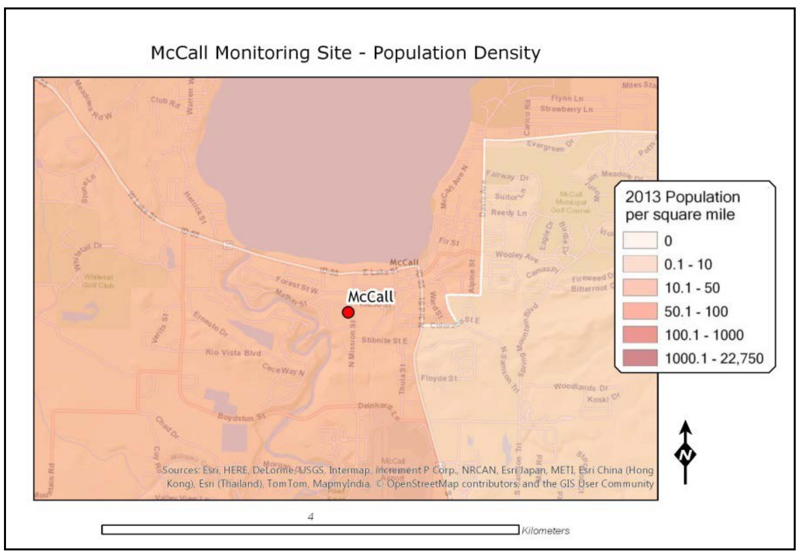


Figure 37. Lewiston Airshed summertime synoptic winds.

Figure 38. McCall.

Site Type	Population exposure
Scale of Representation	Urban
Area Represented	Valley County
Airshed	Not defined
Pollutant(s) Monitored	$PM_{2.5}$
Monitoring Objectives	AQI, smoke management





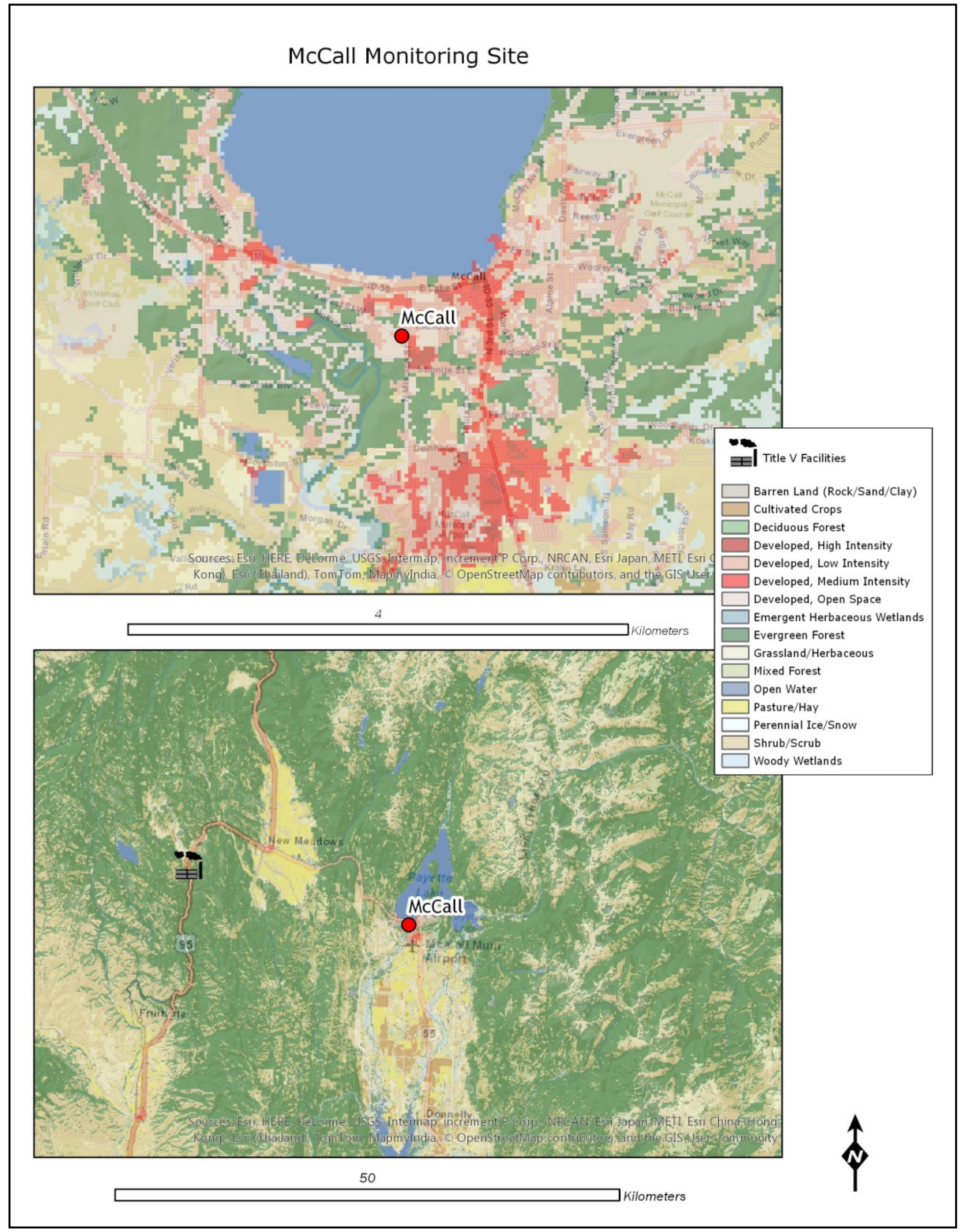
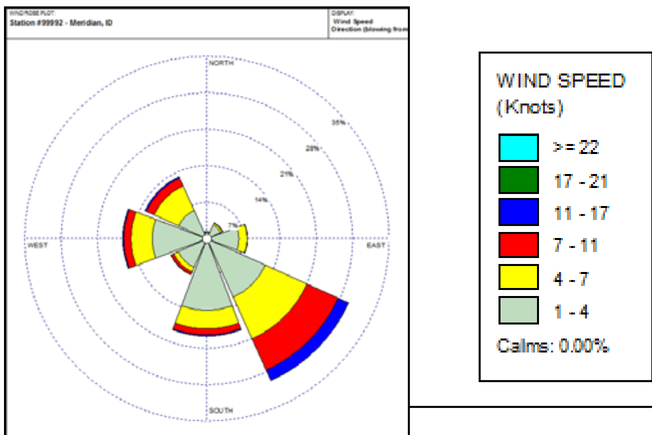
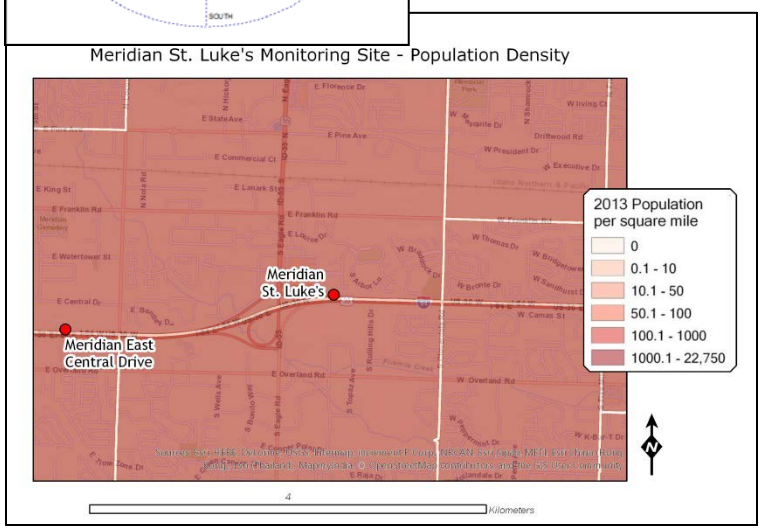
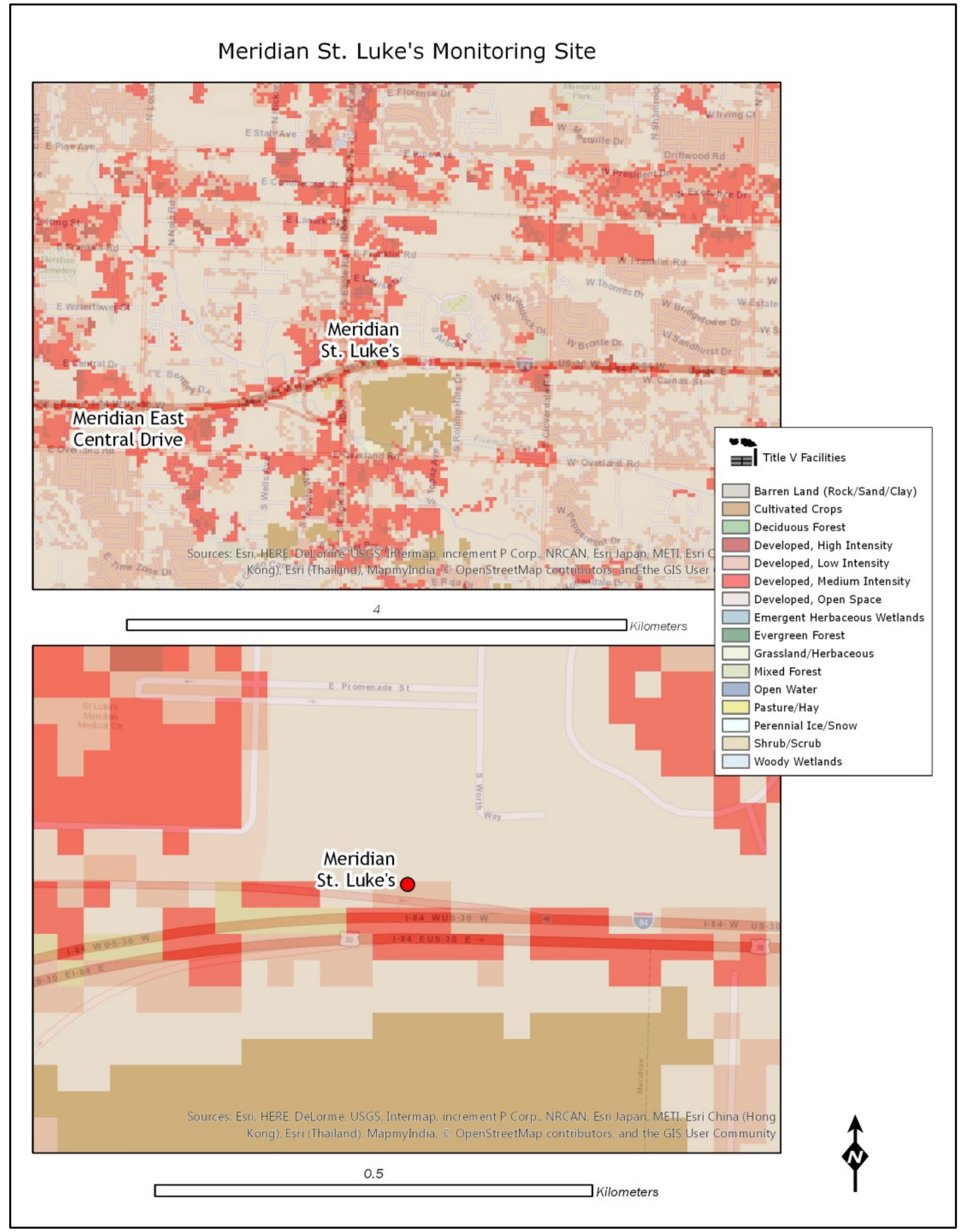


Figure 39. Meridian—St. Luke's.

Site Type	Population exposure
Scale of Representation	Neighborhood
Area Represented	Boise City-Nampa, ID MSA
Airshed	Treasure Valley
Pollutant(s) Monitored	$PM_{2.5}$, $PM_{2.5\text{-}10}$, Pb PM_{10}, PM_{10}, O_3, NO_y-NO, NO, NO_y, SO_2, CO, meteorology
Monitoring Objectives	NCore-trace gas, NCore-PM_{coarse}, $PM_{2.5}$ NAAQS, $PM_{2.5}$ chemical speciation, O_3 NAAQS, Pb NAAQS, AQI, modeling-met







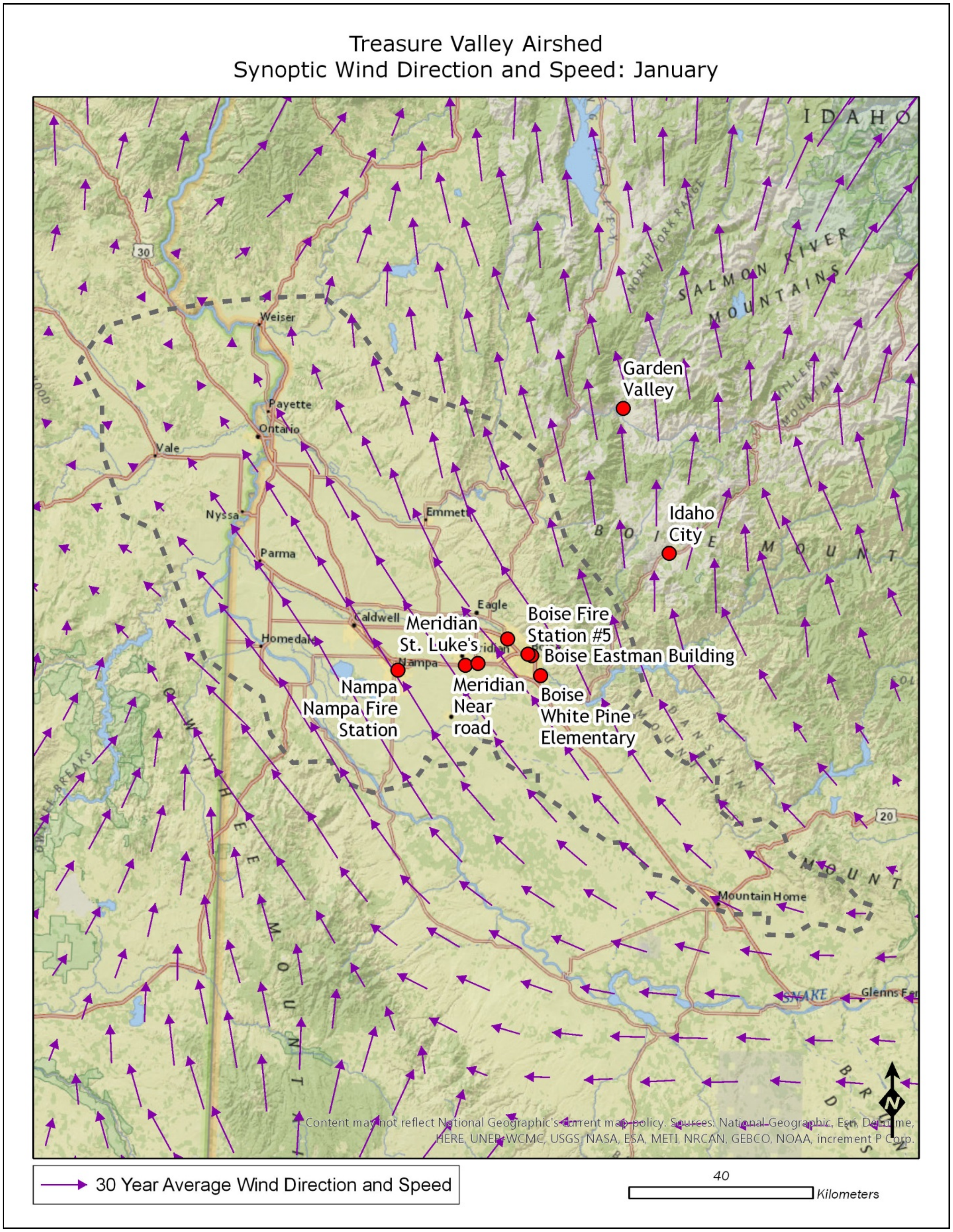


Figure 40. Treasure Valley Airshed wintertime synoptic winds.

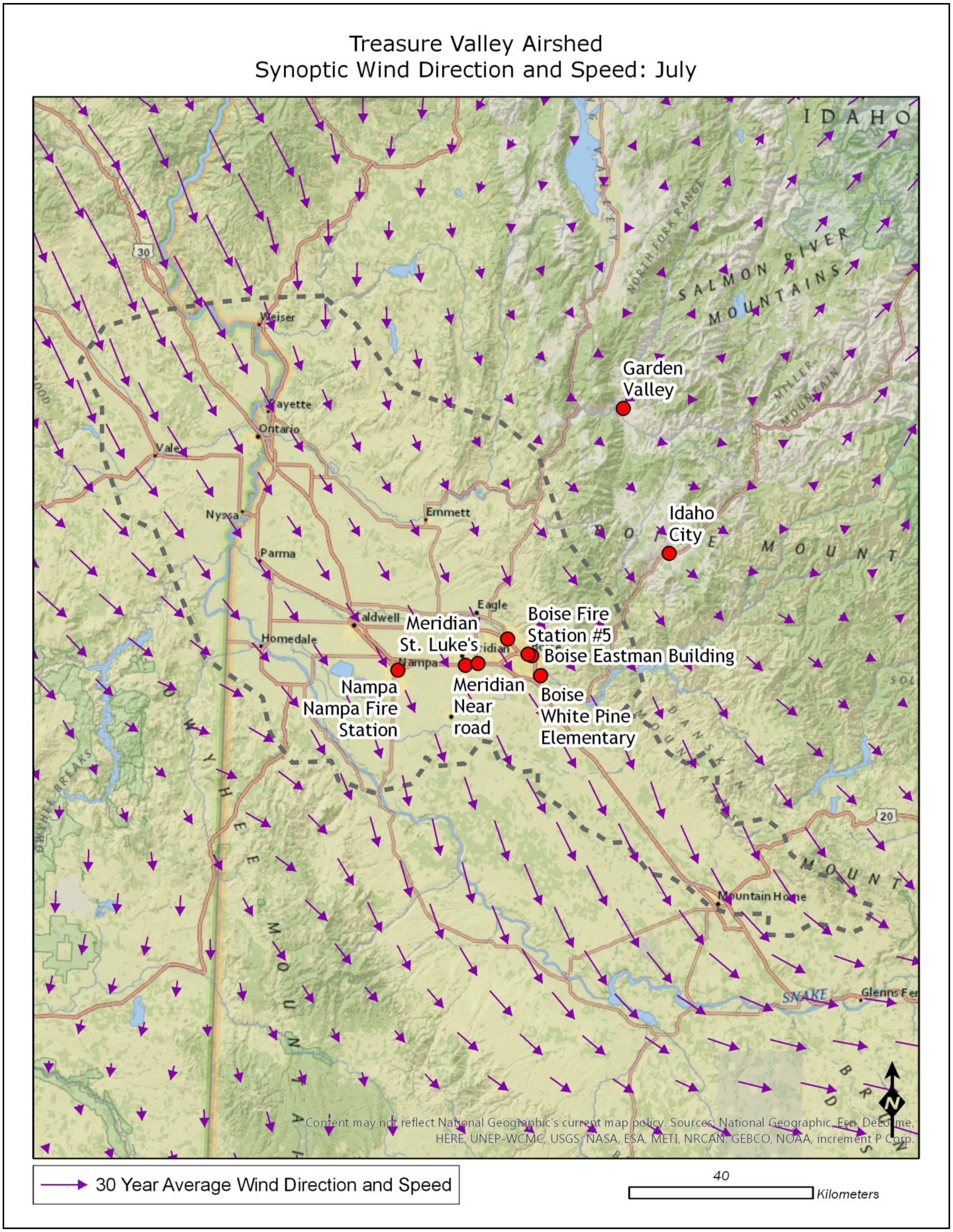
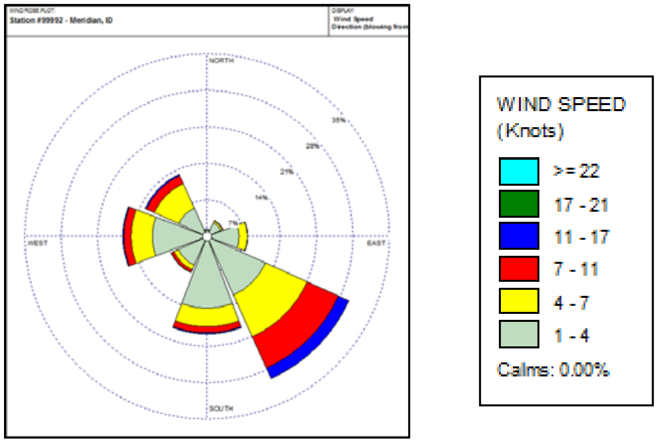
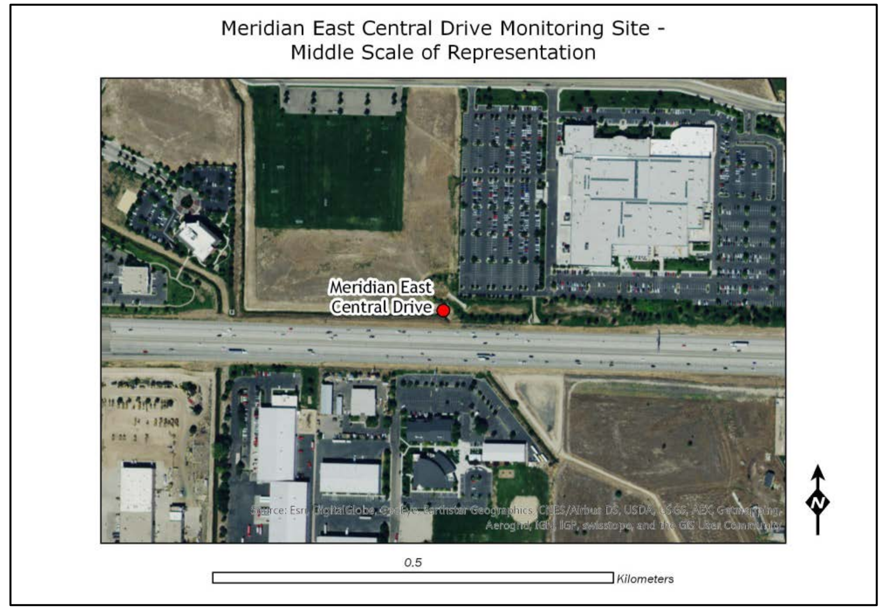


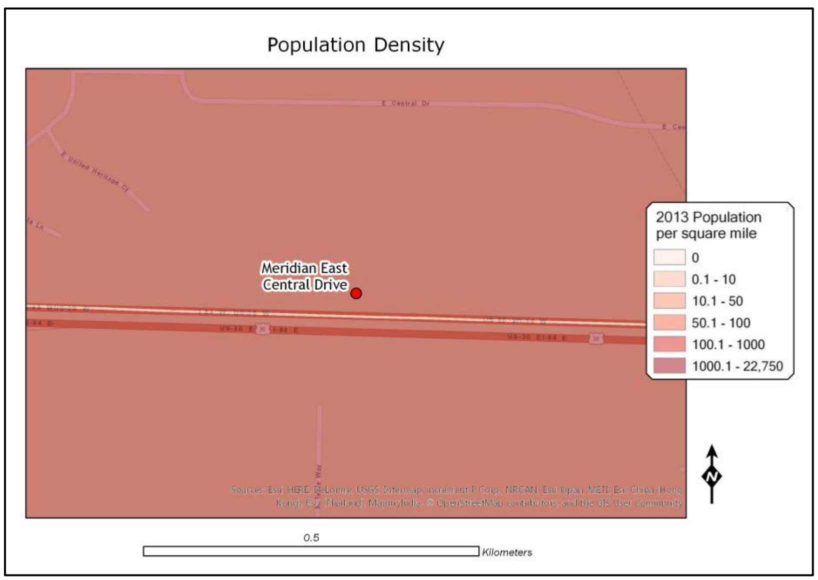
Figure 41. Treasure Valley Airshed summertime synoptic winds.

Figure 42. Meridian—East Central Drive.

Site Type	Near road
Scale of Representation	Middle
Area Represented	Boise City-Nampa, ID MSA
Airshed	Treasure Valley
Pollutant(s) Monitored	CO, NO, NO_2, NO_x
Monitoring Objectives	NO_2 NAAQS







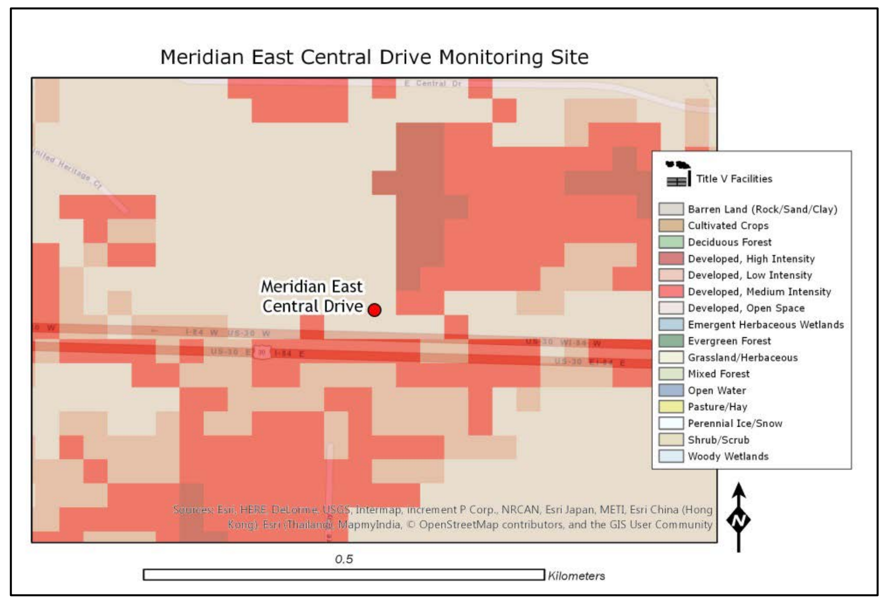
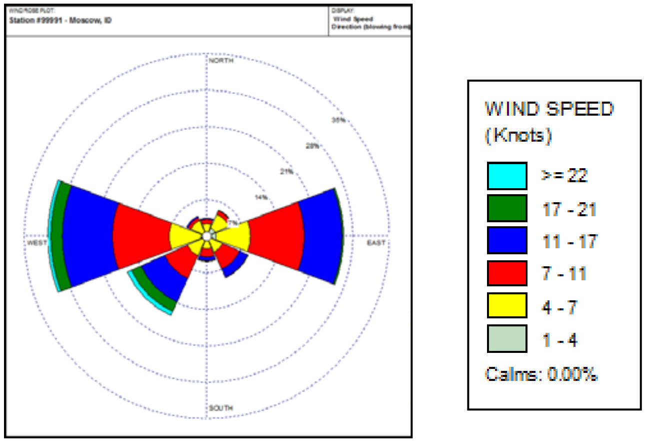
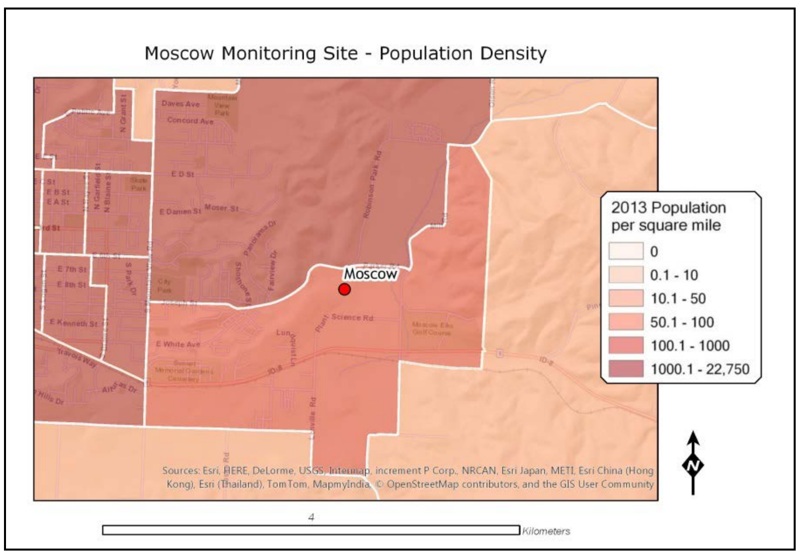


Figure 43. Moscow.

Site Type	Population exposure
Scale of Representation	Urban
Area Represented	Latah County
Airshed	Lewiston
Pollutant(s) Monitored	$PM_{2.5}$, meteorology
Monitoring Objectives	AQI, smoke management, modeling-met





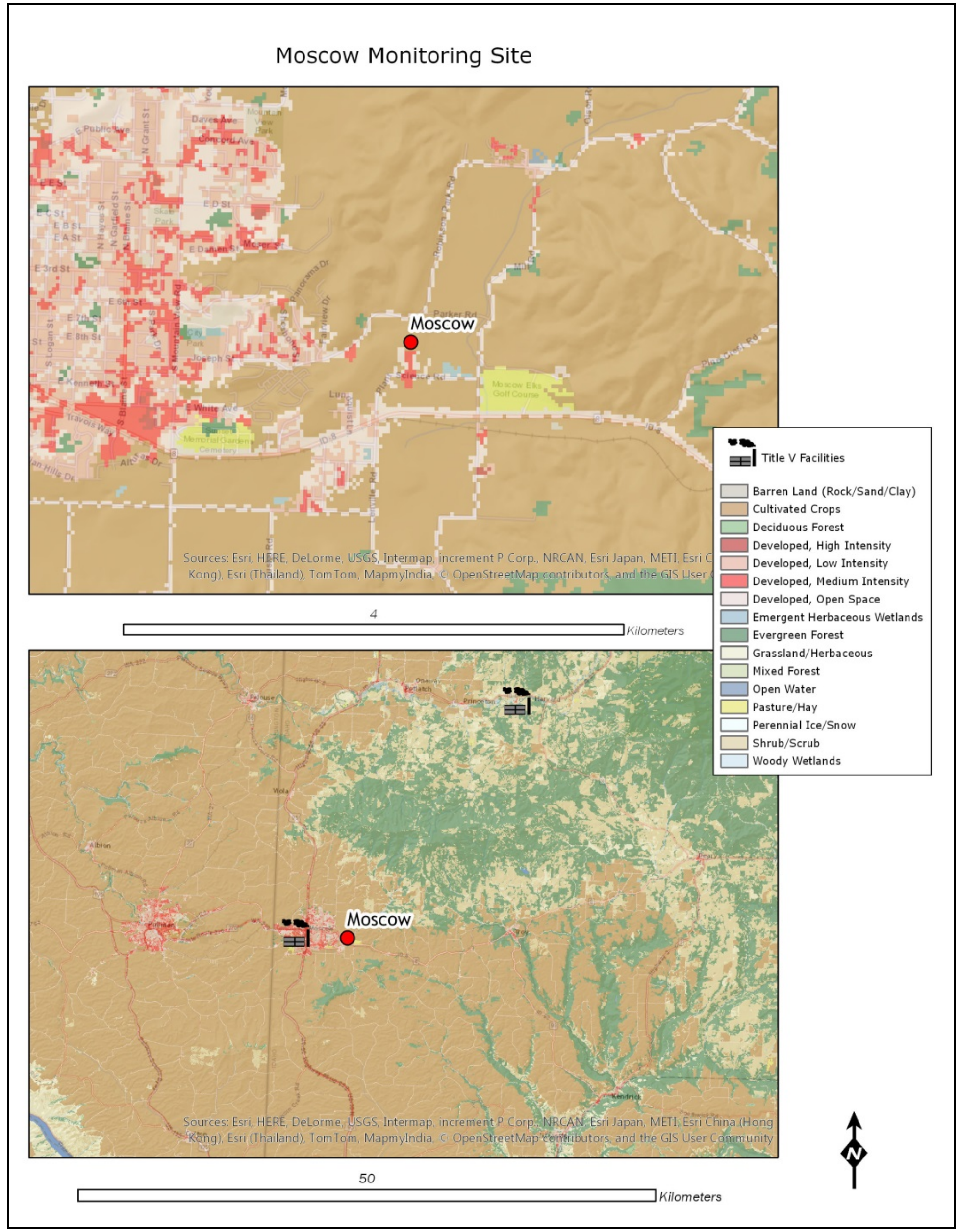
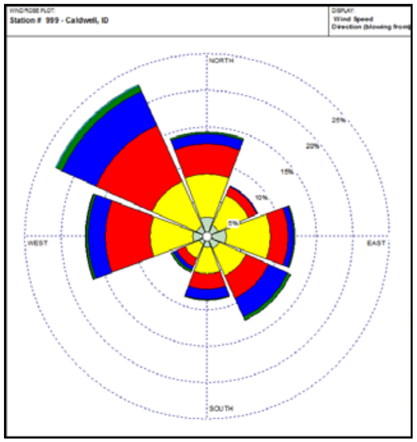
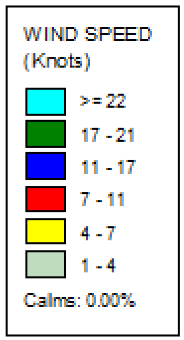
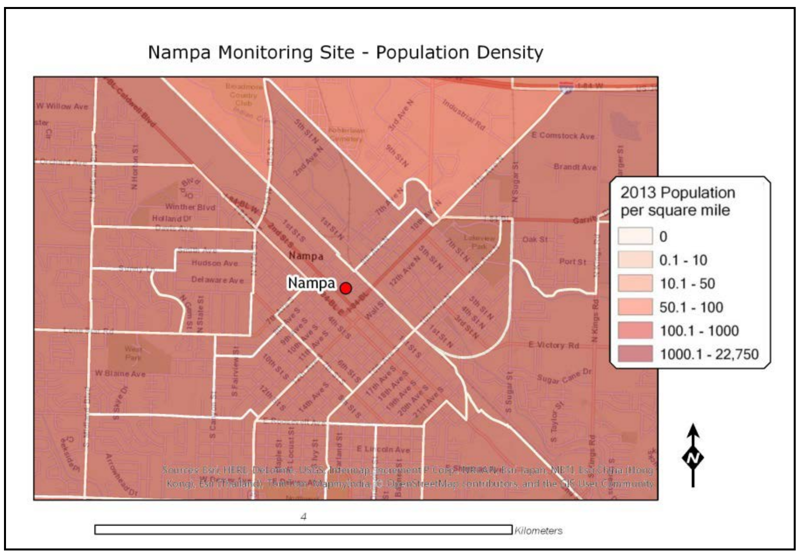


Figure 44. Nampa.

Site Type	Population exposure
Scale of Representation	Neighborhood
Area Represented	Boise City-Nampa, ID MSA
Airshed	Treasure Valley
Pollutant(s) Monitored	$PM_{2.5}$, PM_{10}
Monitoring Objectives	$PM_{2.5}$ NAAQS, PM_{10} NAAQS, AQI







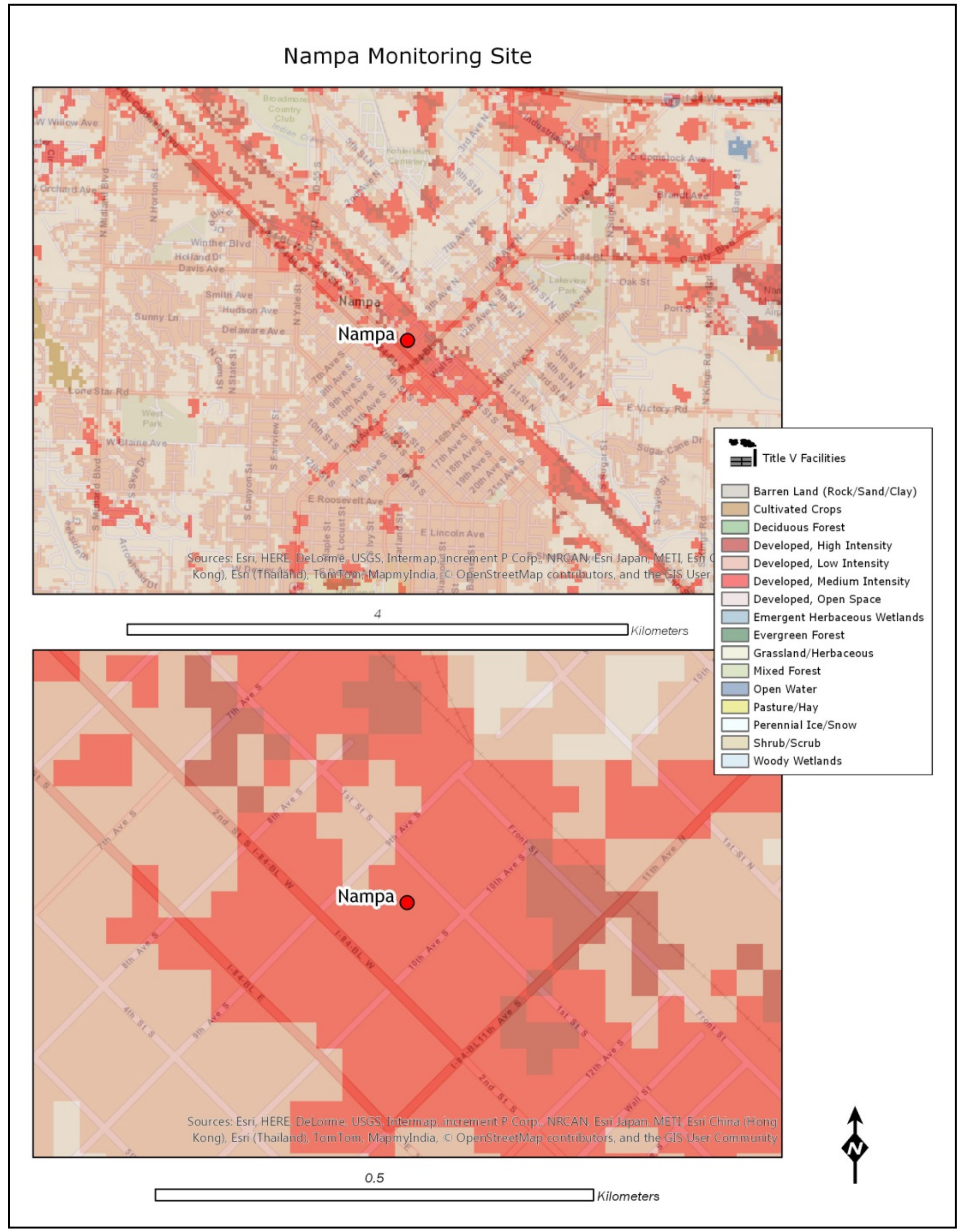
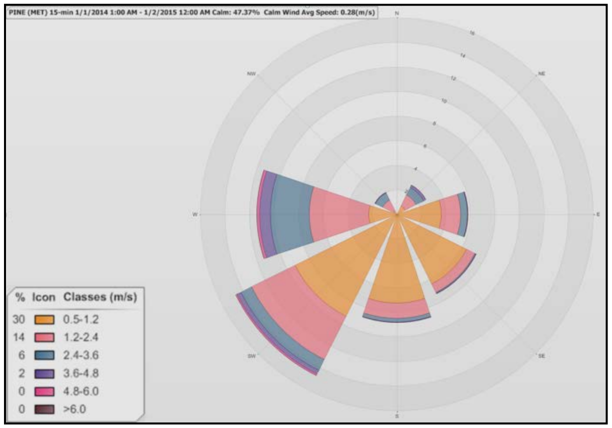
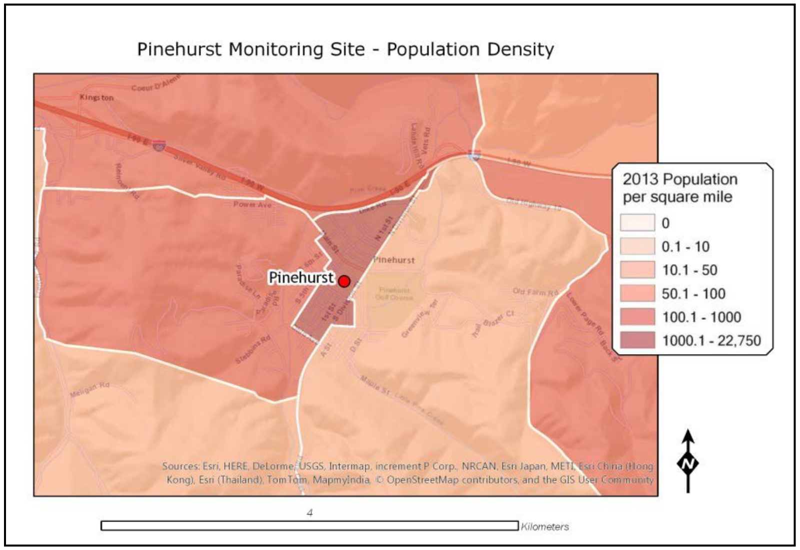


Figure 45. Pinehurst.

Site Type	Population exposure
Scale of Representation	Neighborhood
Area Represented	Shoshone County
Airshed	West Silver Valley (not defined)
Pollutant(s) Monitored	$PM_{2.5}$, PM_{10}, meteorology
Monitoring Objectives	PM_{10} SIP, $PM_{2.5}$ SIP, PM_{10} NAAQS, $PM_{2.5}$ NAAQS, AQI, modeling-met





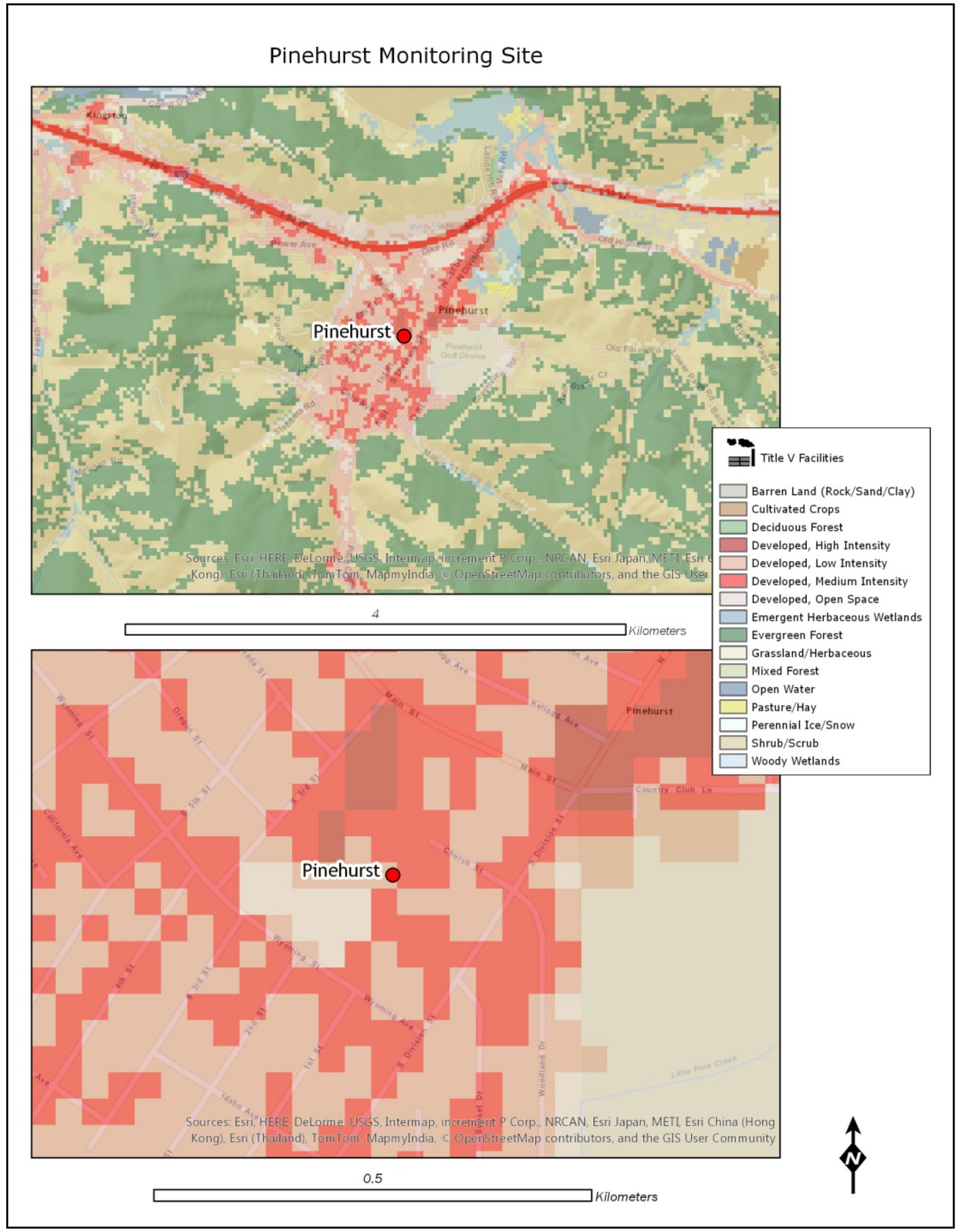
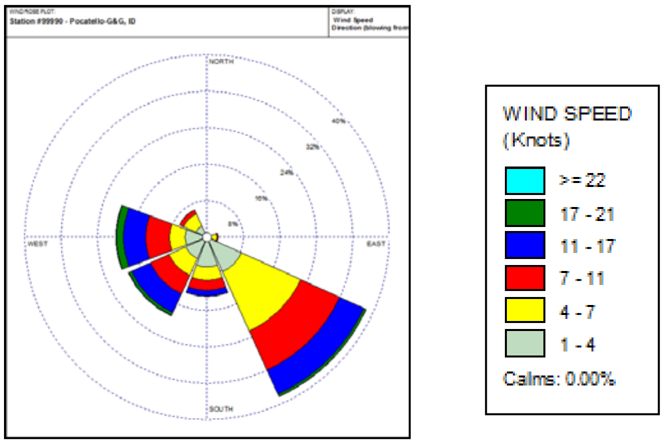
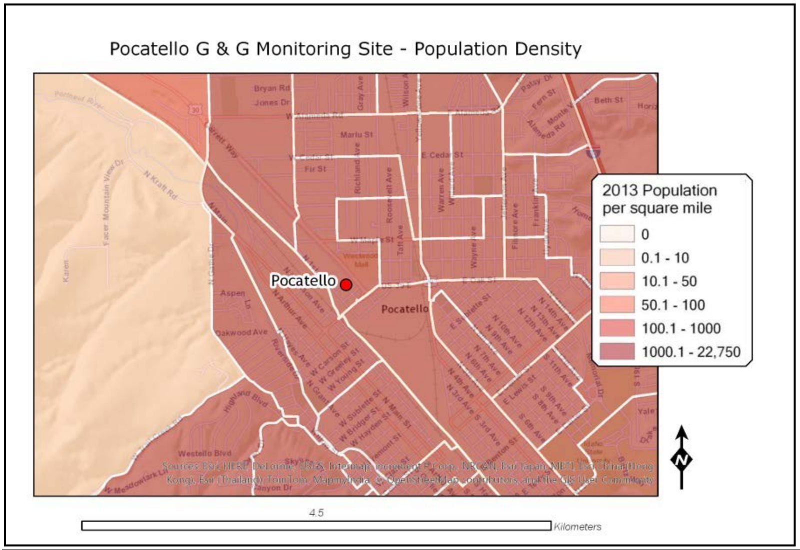


Figure 46. Pocatello—Garrett & Gould.

Site Type	Population exposure
Scale of Representation	Neighborhood
Area Represented	Pocatello, ID MSA
Airshed	Pocatello
Pollutant(s) Monitored	$PM_{2.5}$, PM_{10}, meteorology
Monitoring Objectives	PM_{10} SIP, PM_{10} NAAQS, AQI, modeling-met





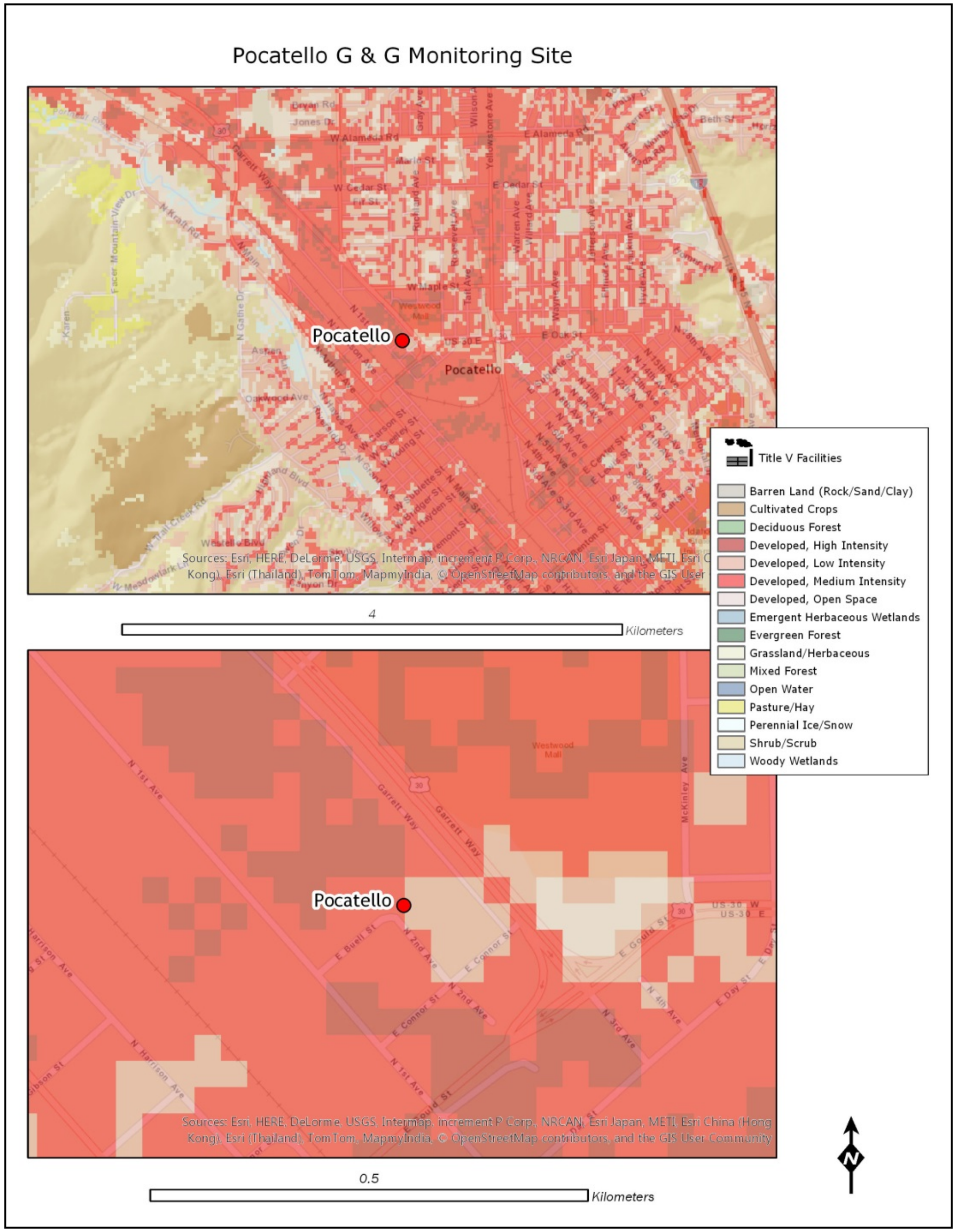
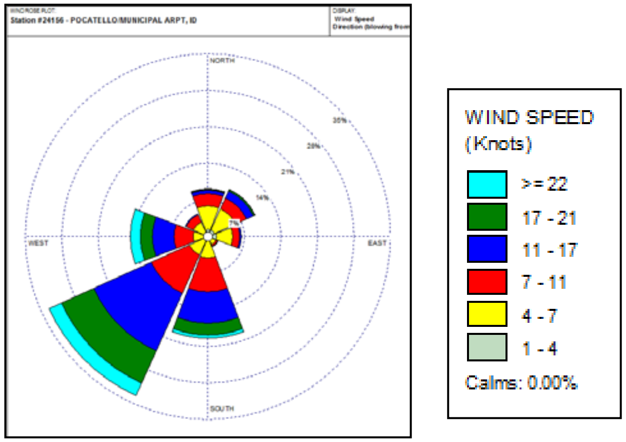
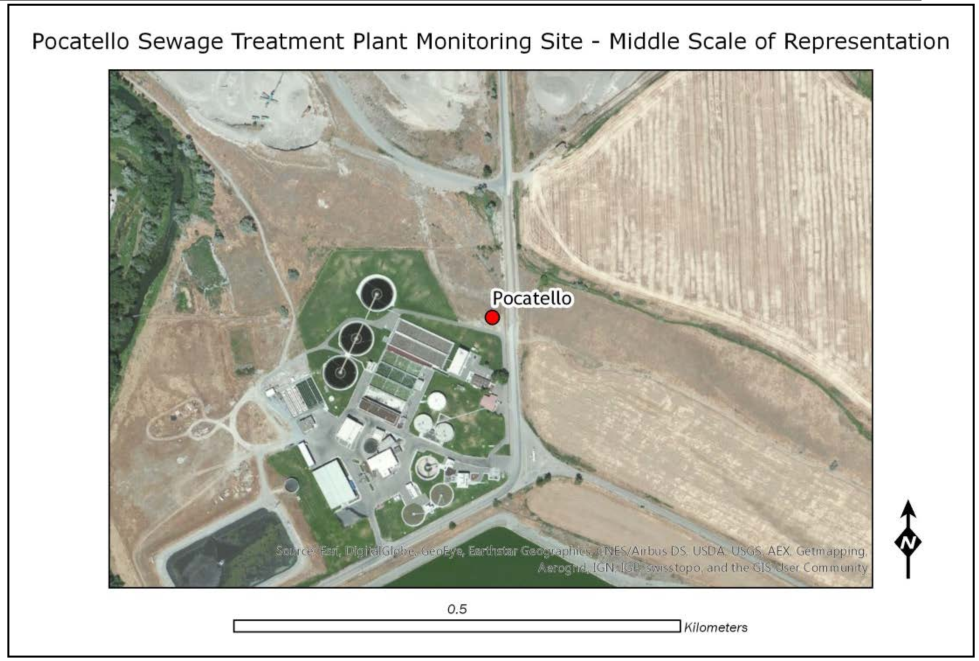
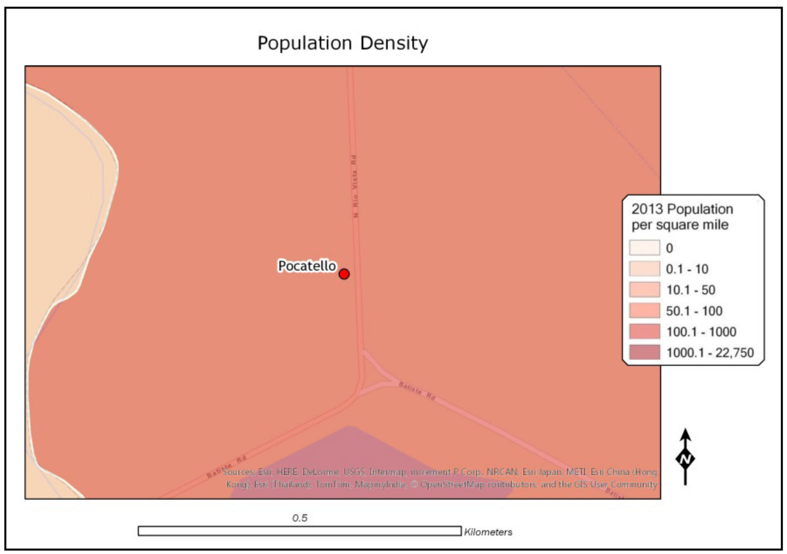


Figure 47. Pocatello—Sewage Treatment Plant.

Site Type	Maximum concentration
Scale of Representation	Middle
Area Represented	Pocatello, ID MSA
Airshed	Pocatello
Pollutant(s) Monitored	SO_2
Monitoring Objectives	SO_2 NAAQS







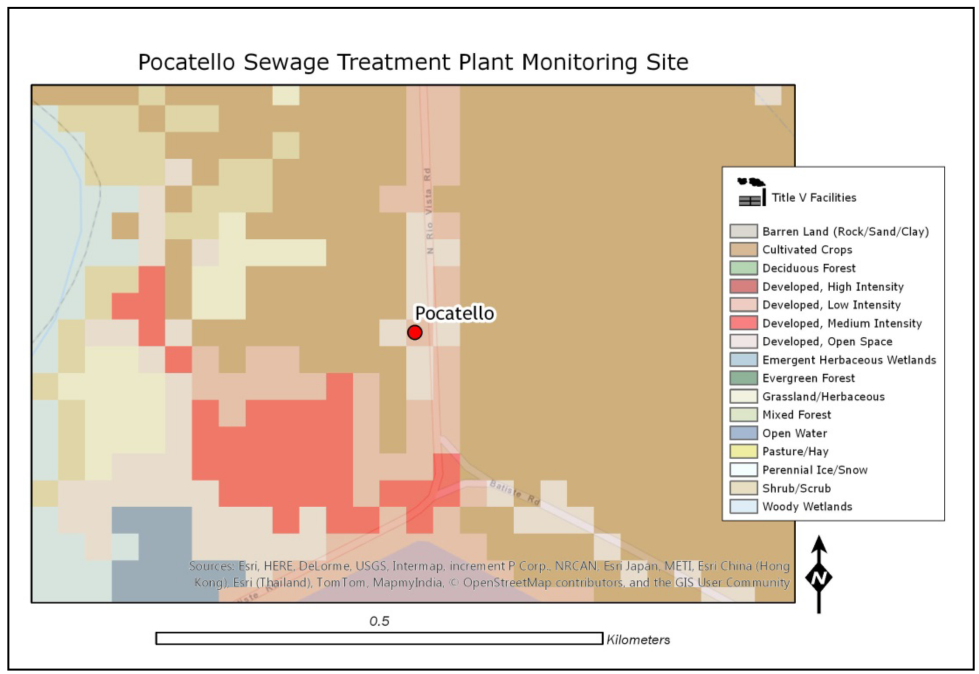
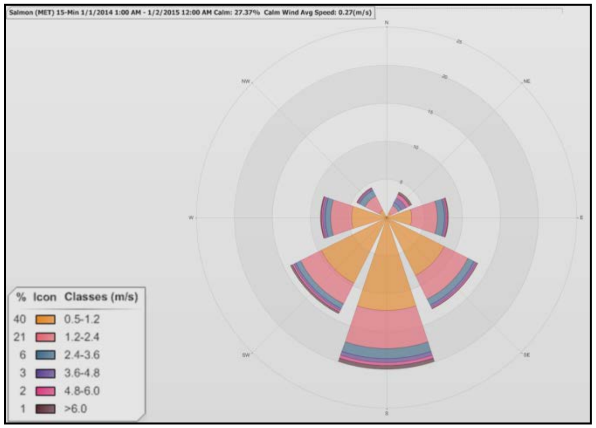
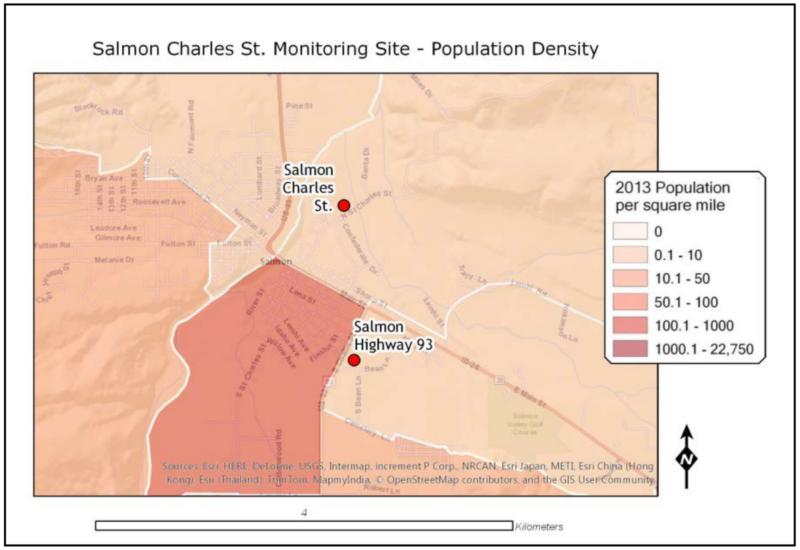


Figure 48. Salmon.

Site Type	Population exposure
Scale of Representation	Neighborhood
Area Represented	Lemhi County
Airshed	Not defined
Pollutant(s) Monitored	$PM_{2.5}$, meteorology
Monitoring Objectives	$PM_{2.5}$ NAAQS, AQI, modeling-met





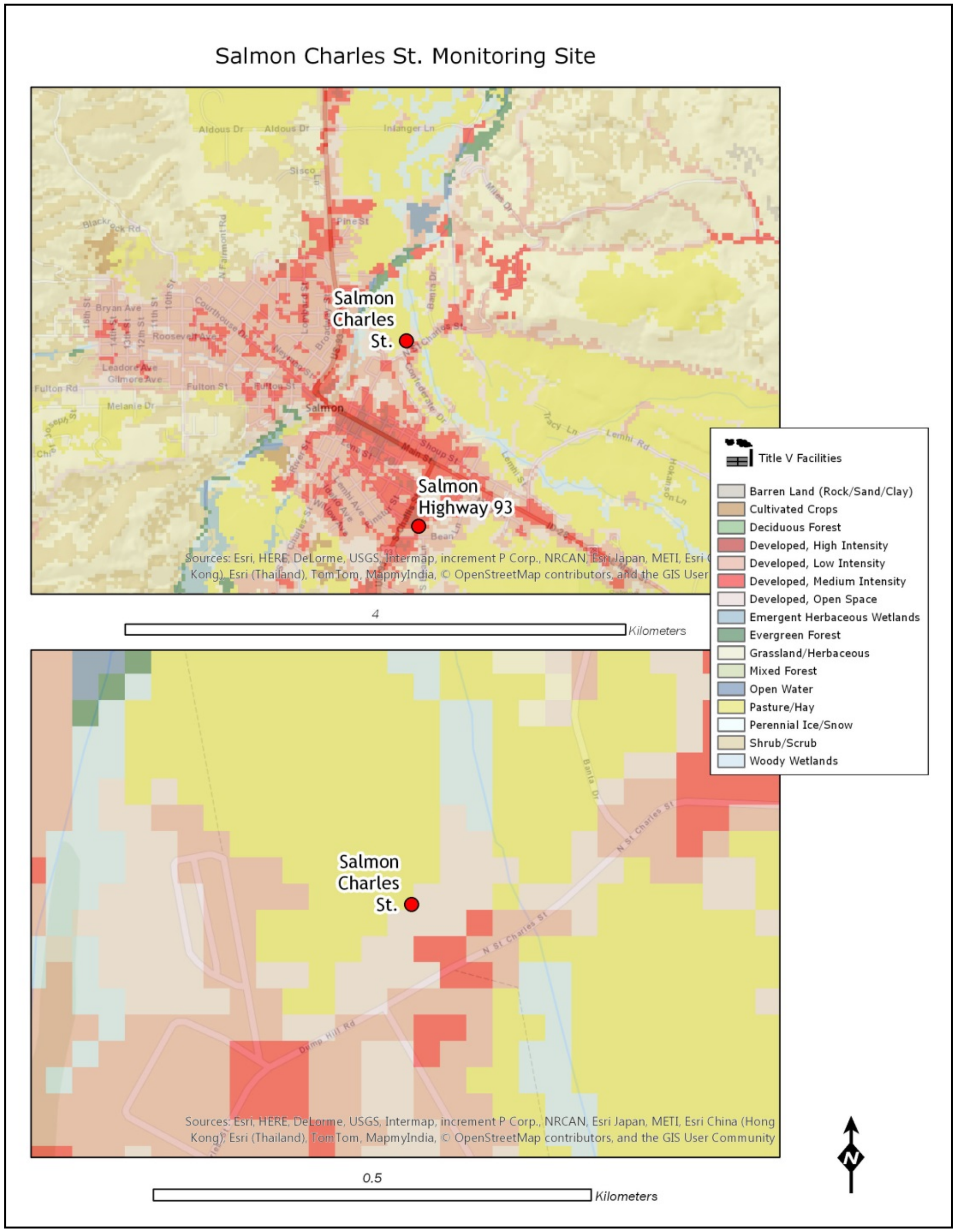
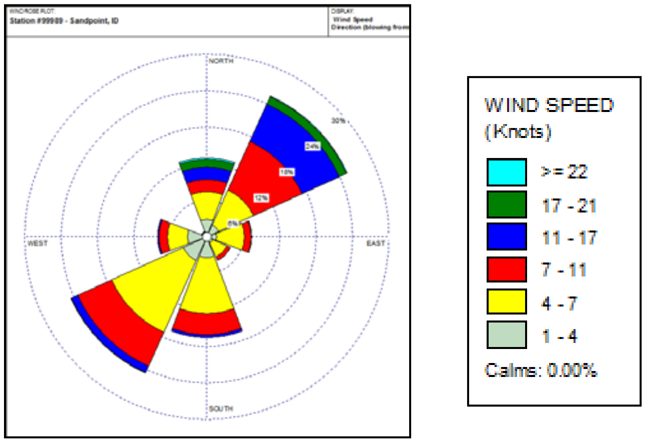
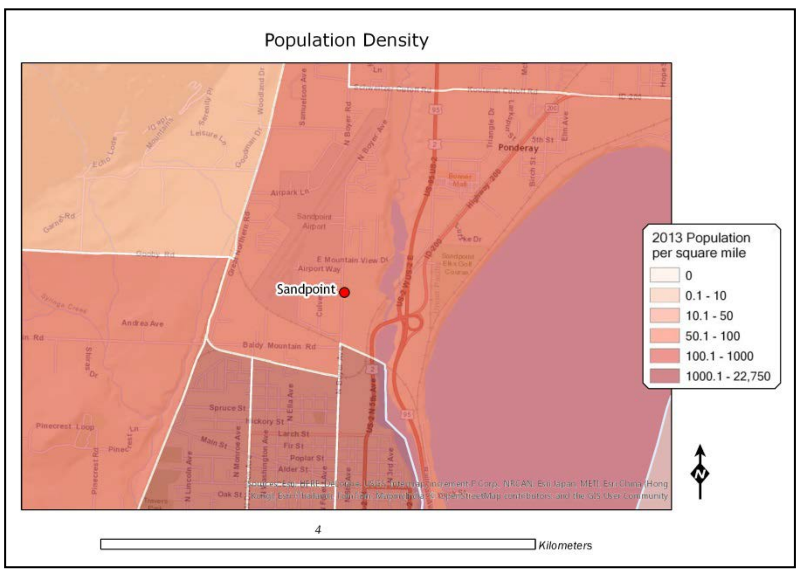


Figure 49. Sandpoint.

Site Type	Population exposure
Scale of Representation	Urban
Area Represented	Bonner County
Airshed	Not defined
Pollutant(s) Monitored	$PM_{2.5}$, PM_{10}, meteorology
Monitoring Objectives	PM_{10} SIP, PM_{10} NAAQS, AQI, modeling-met





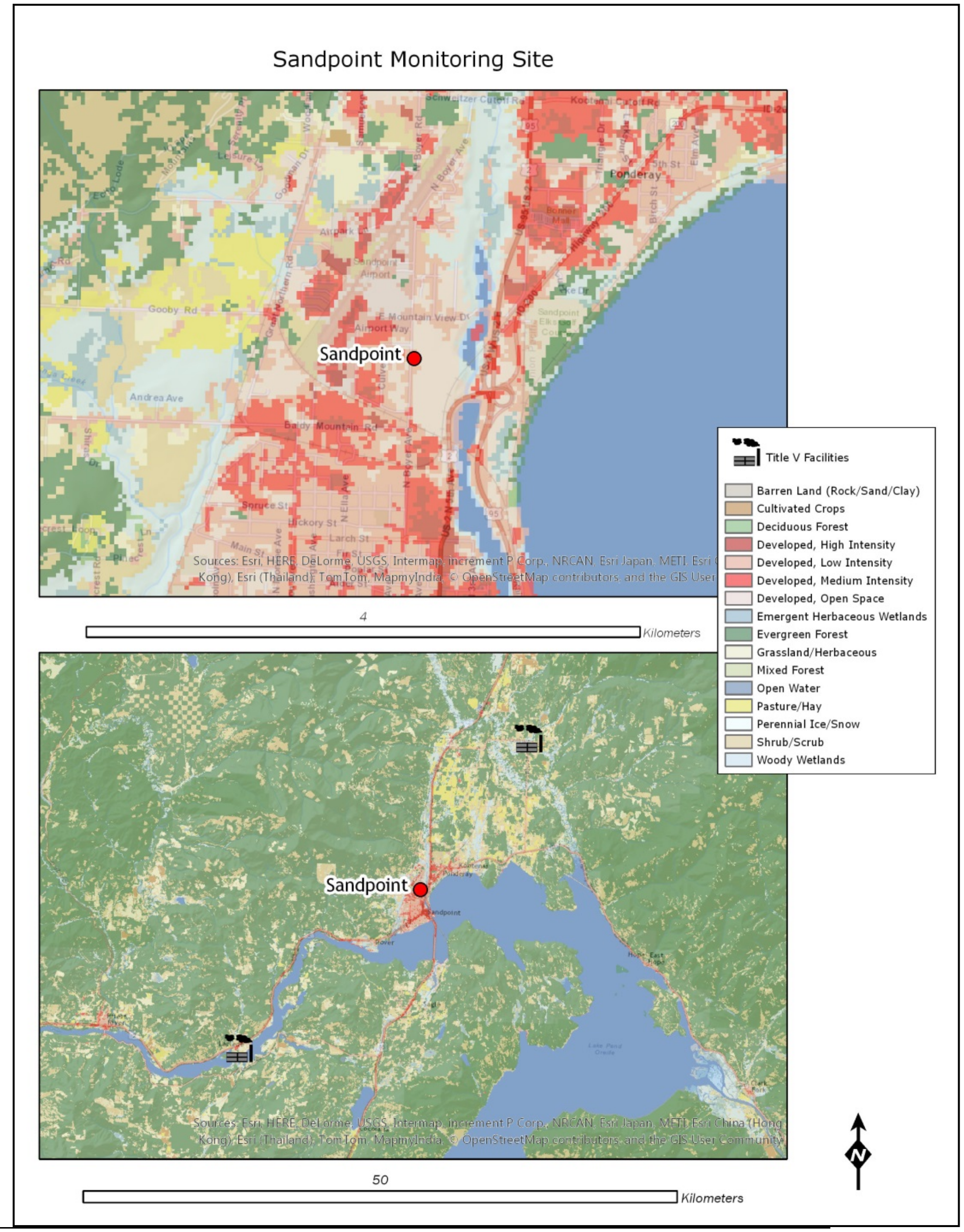
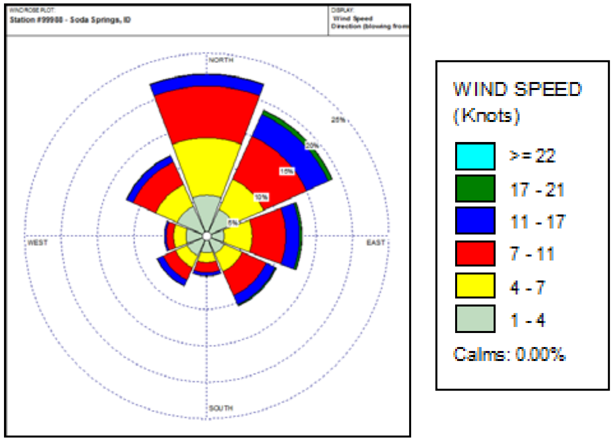
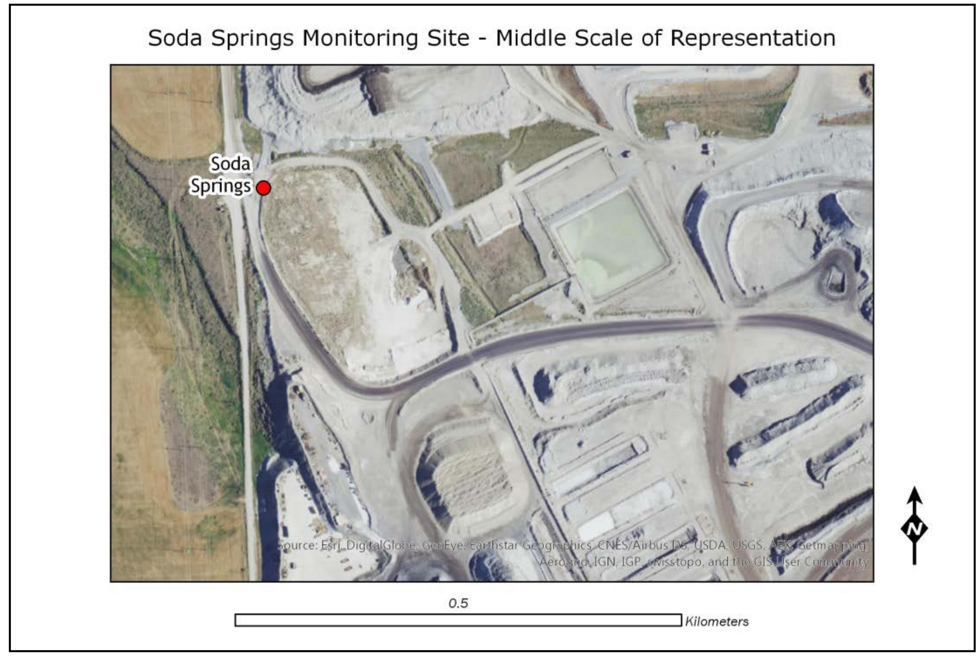
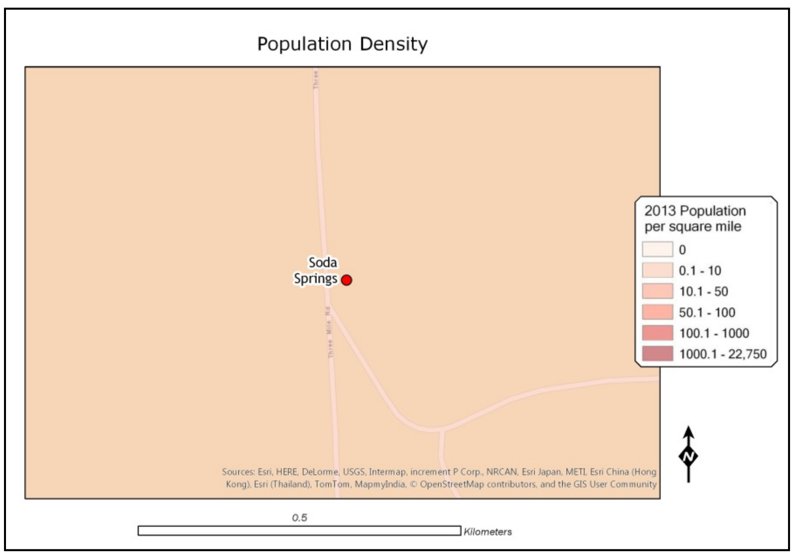


Figure 50. Soda Springs.

Site Type	Source oriented
Scale of Representation	Middle
Area Represented	Caribou County
Airshed	Not defined
Pollutant(s) Monitored	SO_2
Monitoring Objectives	SO_2 NAAQS







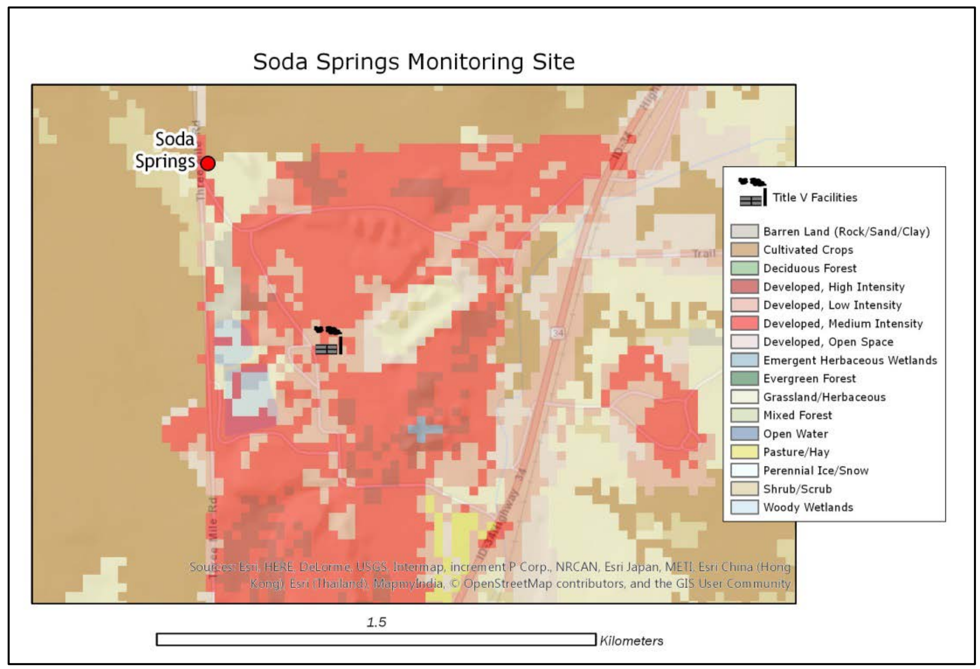
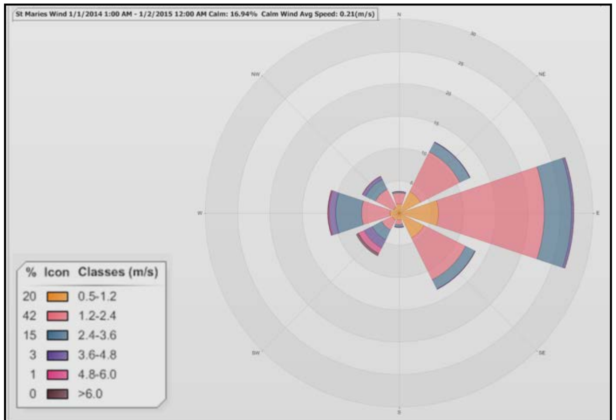
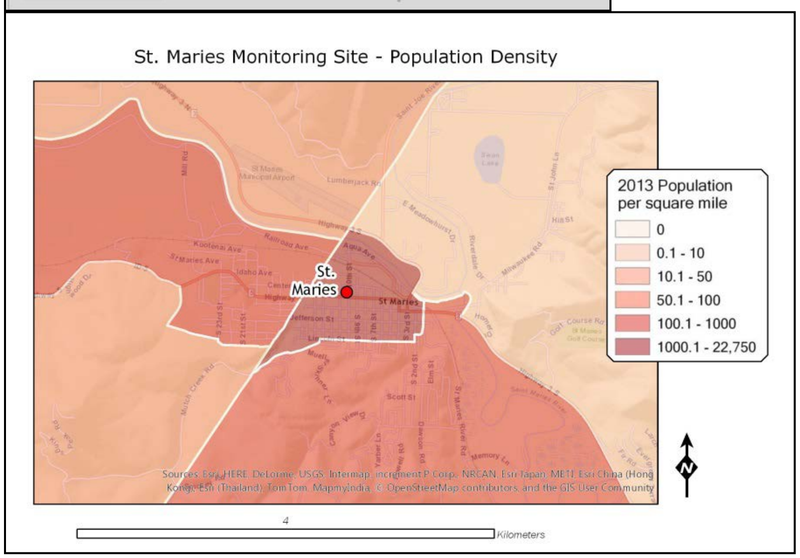


Figure 51. St. Maries.

Site Type	Population exposure
Scale of Representation	Neighborhood
Area Represented	Benewah County
Airshed	Coeur d'Alene
Pollutant(s) Monitored	$PM_{2.5}$
Monitoring Objectives	$PM_{2.5}$ NAAQS, AQI





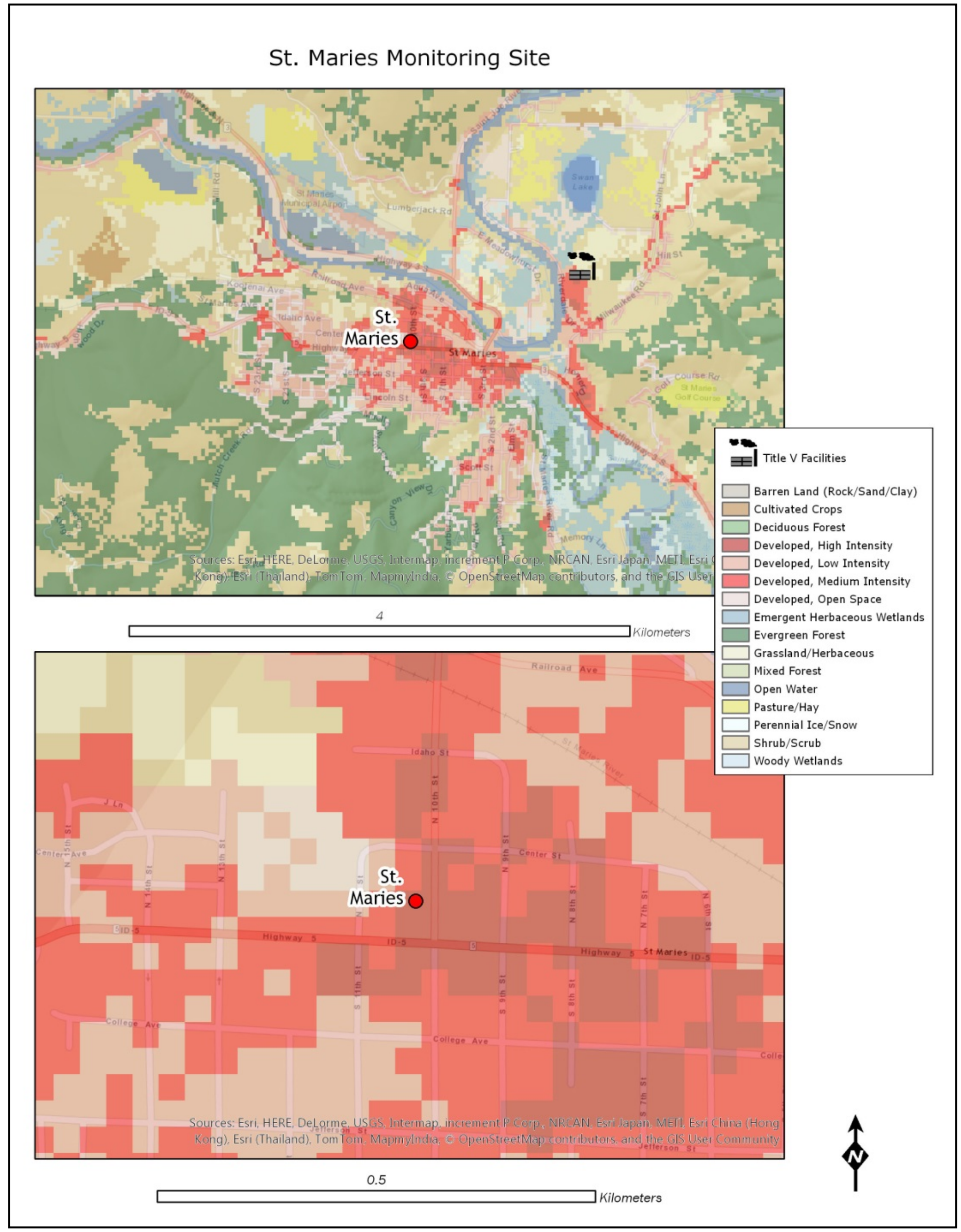
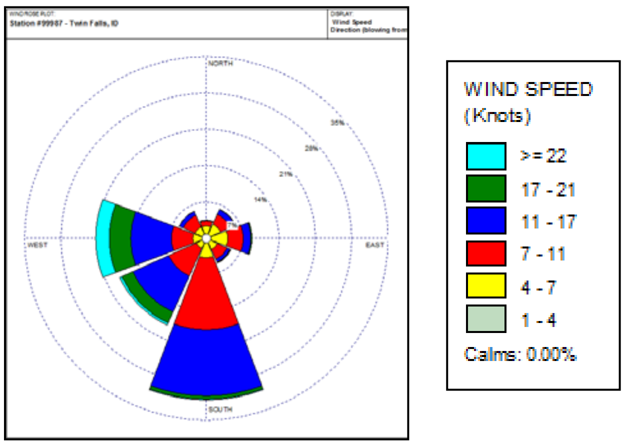
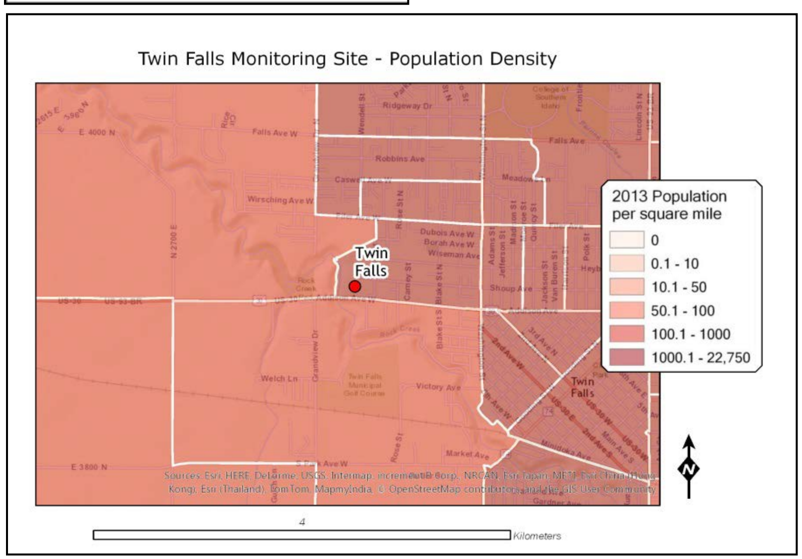
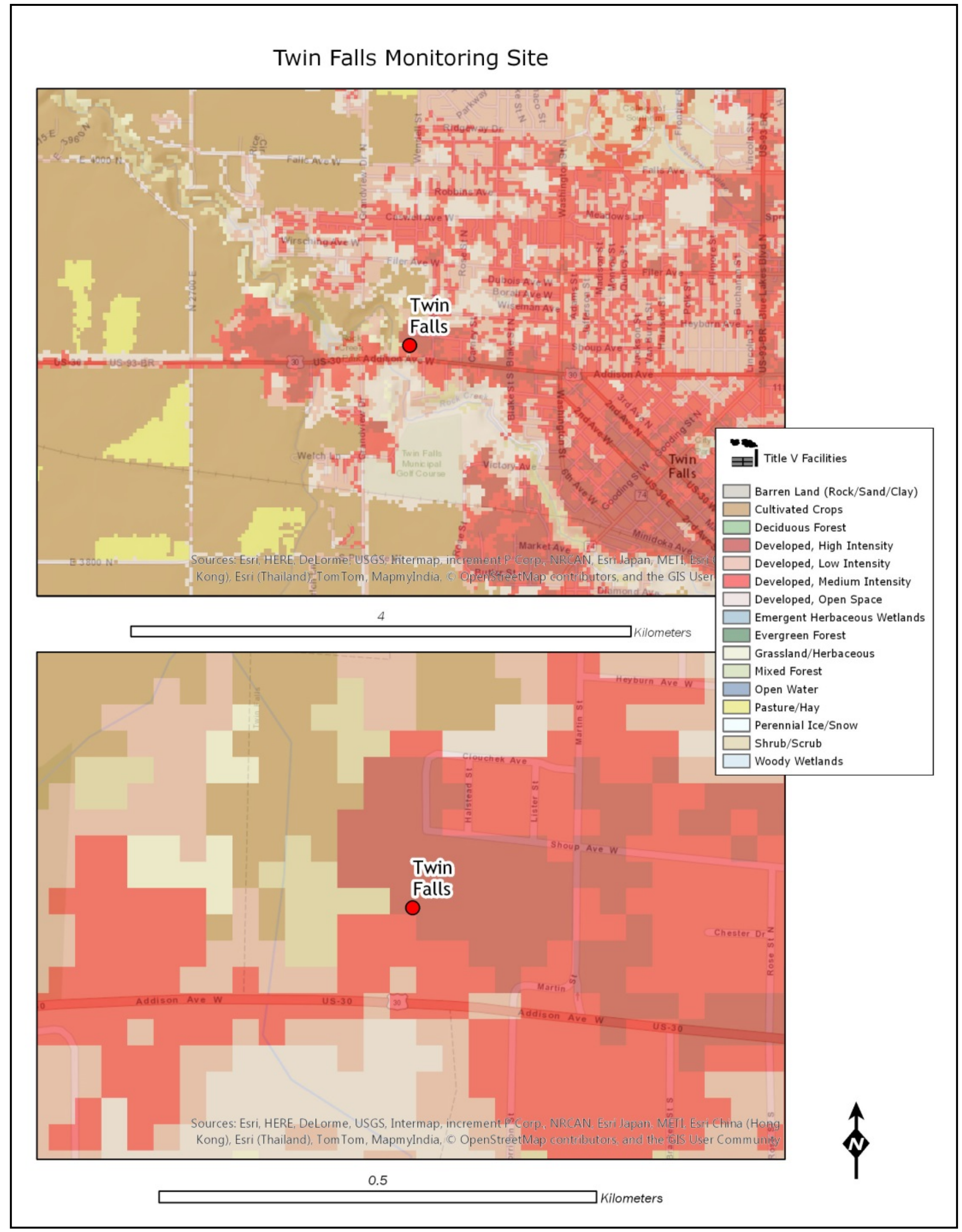


Figure 52. Twin Falls.

Site Type	Population exposure
Scale of Representation	Neighborhood
Area Represented	Twin Falls, ID MSA
Airshed	Twin Falls
Pollutant(s) Monitored	$PM_{2.5}$
Monitoring Objectives	AQI, smoke management







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4.2 Airshed Scale

The Treasure Valley is the only airshed wholly contained in Idaho containing multiple monitors measuring the same pollutant. This airshed is therefore discussed separately, at the airshed scale, in terms of recent demographic shifts. This discussion is not applicable to other monitoring areas in Idaho because most other monitors are at stand-alone, single-pollutant sites or, if not, are adjacent to monitors measuring different pollutants with dissimilar objectives.

The Treasure Valley airshed is the most populous place in Idaho. The largest cities within the airshed have grown in recent years (Figure 53). Nampa grew 1–3% each year between 2009 and 2013, while Meridian ranged from 3 to 5% during the same period. Boise grew 0–2% during these years. Cities within the airshed illustrate an interesting spatial story: population growth is rising fastest in the central and western regions of the valley.

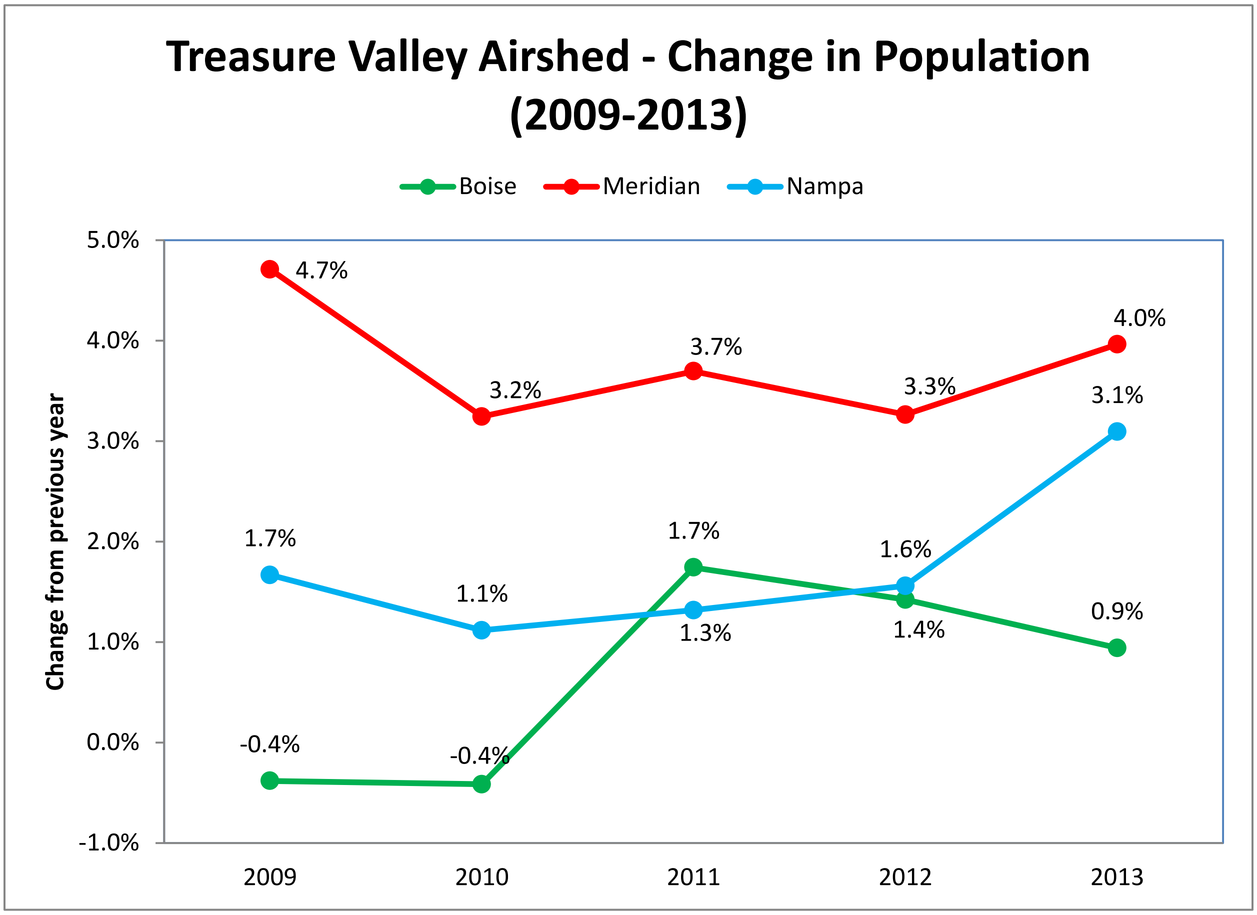

Figure 53. Population change in Treasure Valley cities.

The spatial shift of the population within the airshed is relevant to the network assessment. The following discussion focuses on the central core of the airshed, which contains the greatest part of the population, namely Canyon and northern Ada Counties. Figure 54 shows the 2013 population distribution in the airshed. Recent population growth rates notwithstanding, density remains highest in Boise. Recent growth has been greatest to the west and south of Boise, concentrated in the suburban areas around Meridian, Eagle, Nampa, and Kuna (Figure 55). The monitors within the Treasure Valley airshed are located centrally in the most densely populated zones in Boise, Meridian, and Nampa, and should, for the most part, capture the greatest population exposure to air quality pollutants in the airshed.

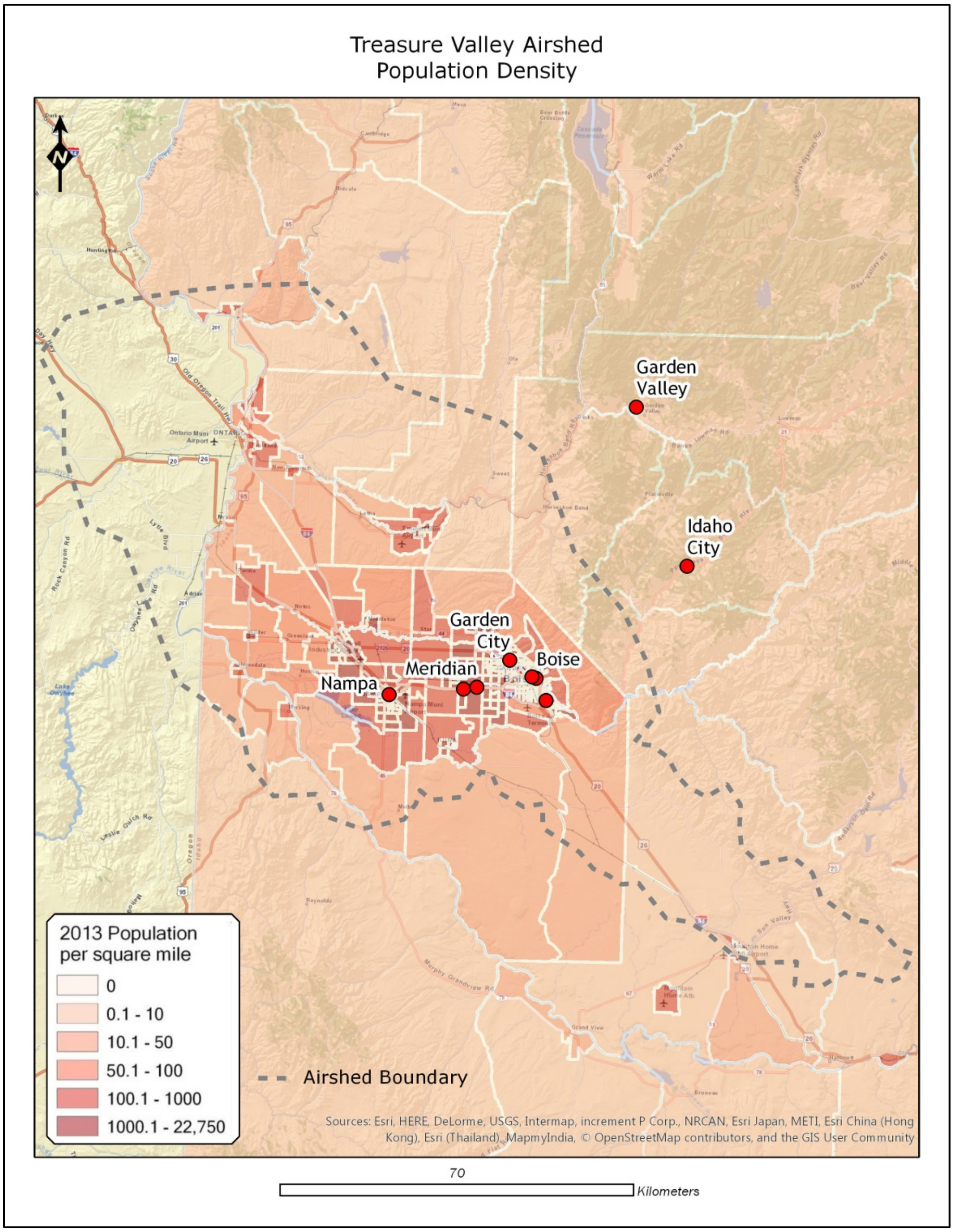

Figure 54. Treasure Valley population density.

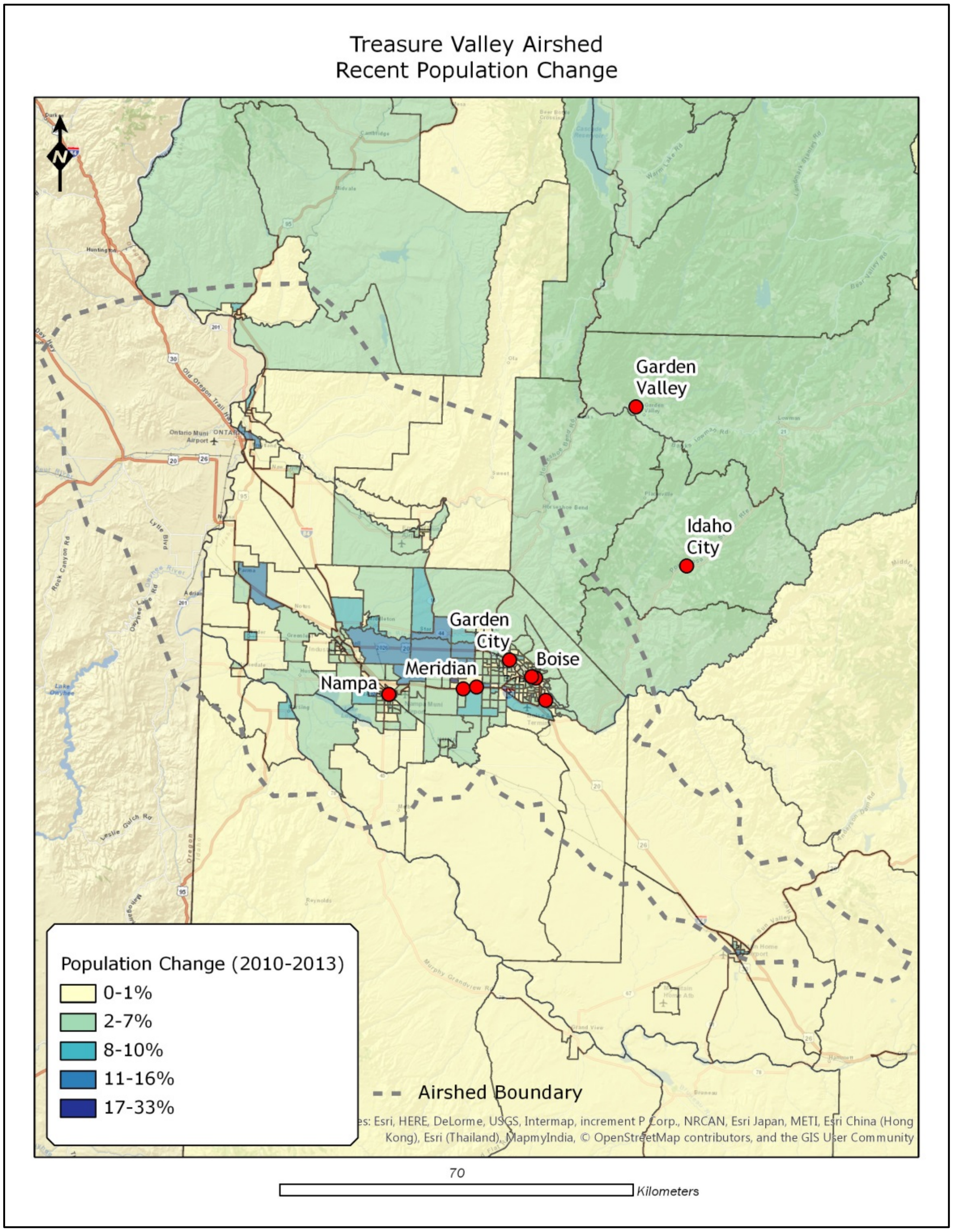

Figure 55. Treasure Valley population change.

For $PM_{2.5}$ monitors in the Treasure Valley, the current sites in Meridian and Nampa are correctly situated to capture mobile-related $PM_{2.5}$ during the main $PM_{2.5}$ season (December–February), when winds blow from the southeast. The PM_{10} monitors at the Nampa and Boise Fire Station sites give a dual perspective on mobile emissions in the population centers in the eastern and western sides of the valley. The O_3 monitor in Meridian fulfills the NCore requirements for ozone monitoring. The O_3 monitor in Boise captures the maximum concentration in a densely populated area that is not in the downtown core where NO_x titration would occur during the day.

4.3 Statewide Scale, by Pollutant

The statewide scale network assessment aims to answer two questions for each pollutant monitored by the network:

- Are the network requirements described in 40 CFR, Part 58, Appendix D (CFR 2009) fulfilled?
- Are locations with high emissions and high modeled concentrations covered by the network?

This section examines regulations, emissions, and modeled concentrations only. Any other considerations, such as unusual circumstances, value judgments, or phenomena not captured by emissions inventories, are addressed in the site ranking in the next section. The ranking sorts and summarizes the findings and analyses from the site scale, airshed scale, and statewide scale assessments. The rankings are followed by final recommendations for removal, addition, or relocation of monitors in Idaho's network.

4.3.1 Carbon Monoxide (CO)

Figure 56 shows the location of CO monitors in Idaho's network. No federal minimum requirements exist for the number of CO monitoring sites (CFR 2009). Micro- or middle scales of representation are most appropriate for measuring CO (CFR 2009). The Boise Eastman Garage monitor is a maximum concentration, urban canyon site. It is designated micro scale. The Eastman monitor fulfills the monitoring requirement for the Northern Ada County CO Maintenance Plan. The Meridian St. Luke's monitor measures trace CO to meet NCore site requirements. The Meridian East Central Drive monitor measures CO to meet near-road site requirements.

CO is primarily emitted from vehicle exhaust. Idaho has significant point sources of CO (Figure 57), but none within a micro- or middle scale of any monitors. Ada, Canyon, and Kootenai Counties have the highest onroad source emissions (Figure 58), which is not surprising since these counties include the two largest MSAs in the state. Ada, Blaine, and Kootenai Counties have the highest nonroad source emissions (Figure 59), and Ada, Canyon, and Kootenai Counties have the highest nonpoint source emissions (Figure 60). Overall, the CO network in Idaho targets the airshed with the highest CO emissions.

CO has been monitored in Boise since 1991, and concentrations have been trending downwards since then. Current measurements are well below the NAAQS (Figure 9). Discontinued CO monitors in Lewiston and Nampa followed similar trends. If current CO concentrations in Boise, the county with the highest CO emissions in the state, are so low, then it stands to follow that other areas of the state with lower CO emissions do not need CO monitors.

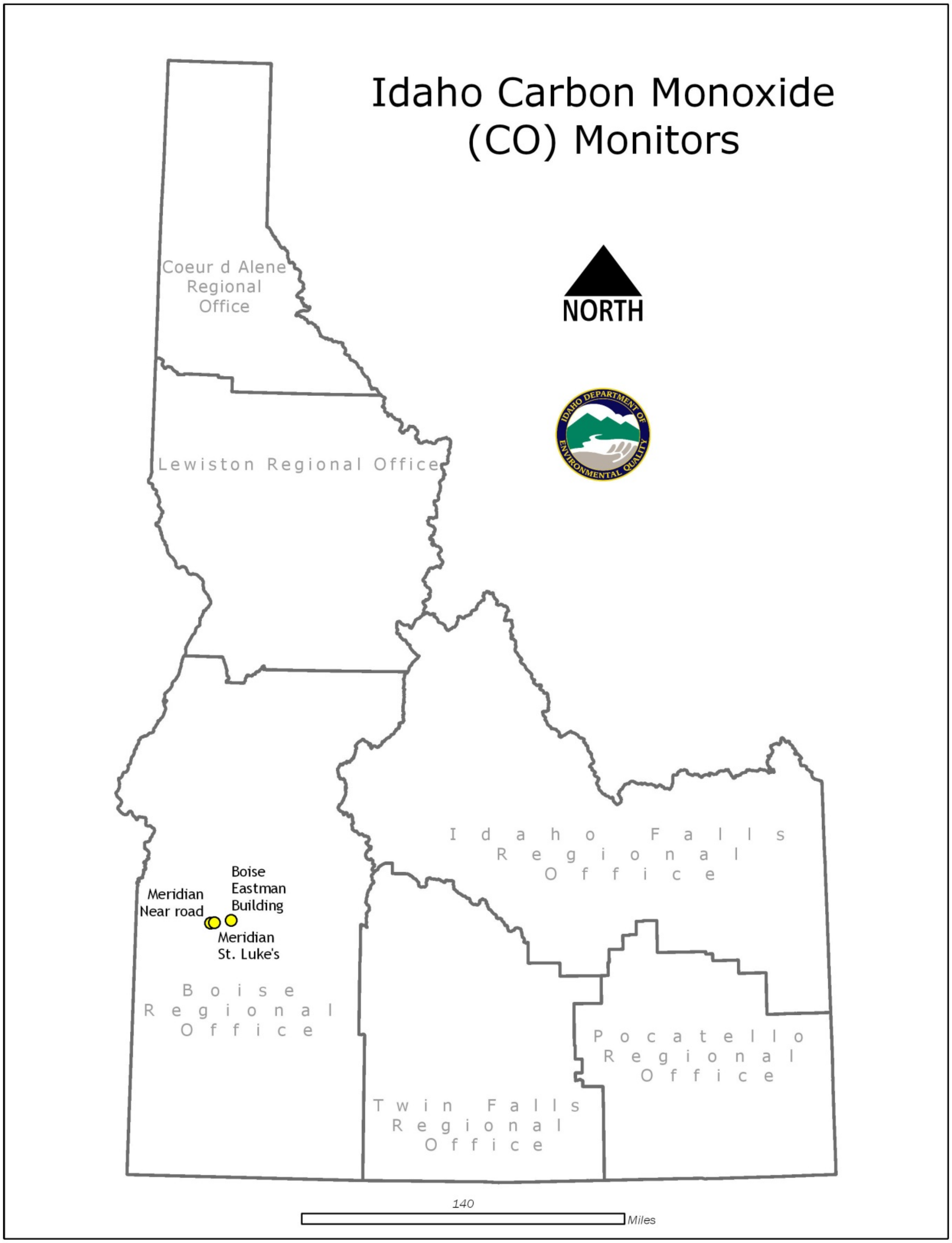

Figure 56. Idaho's CO monitoring network.

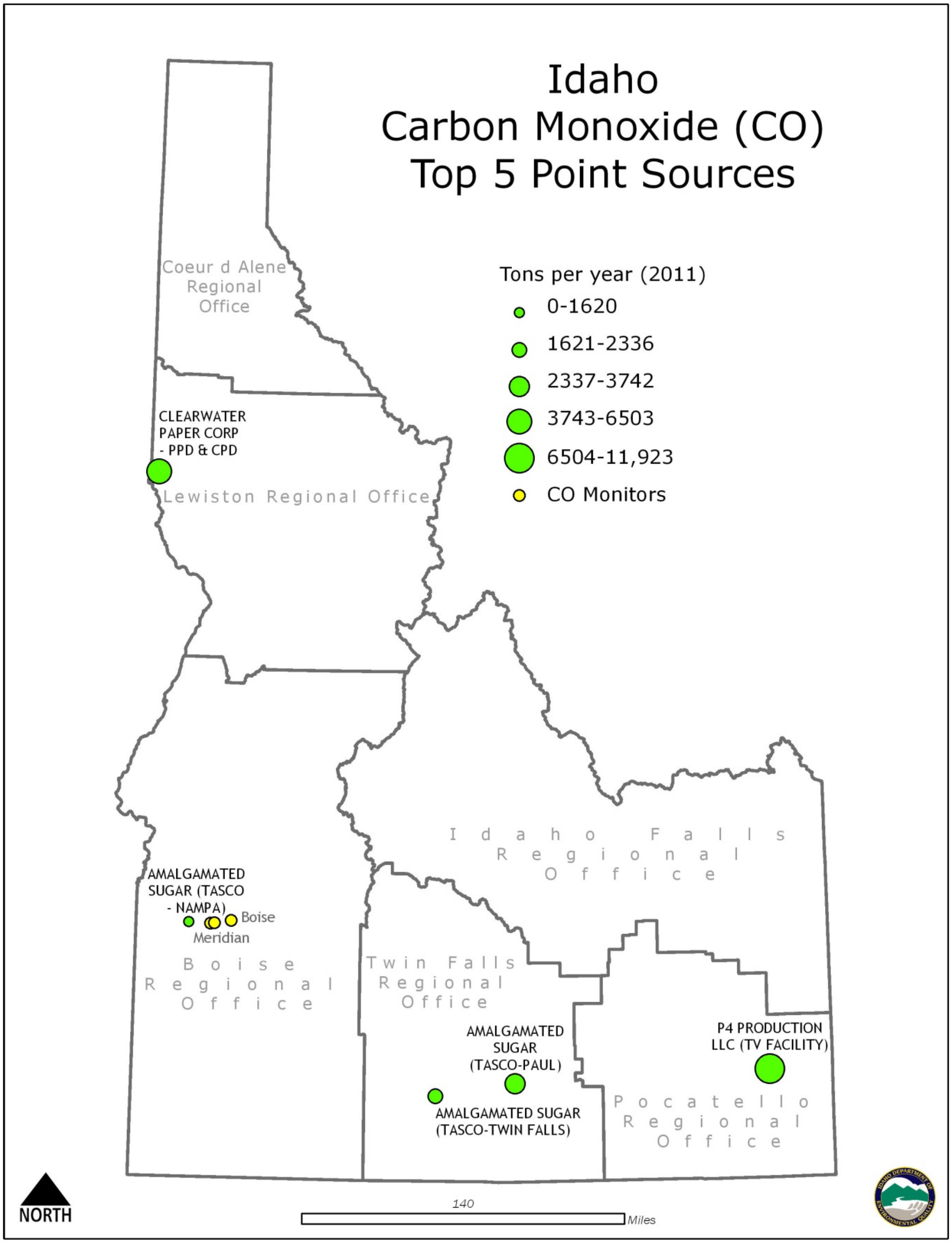

Figure 57. Top five CO emissions point sources in Idaho.

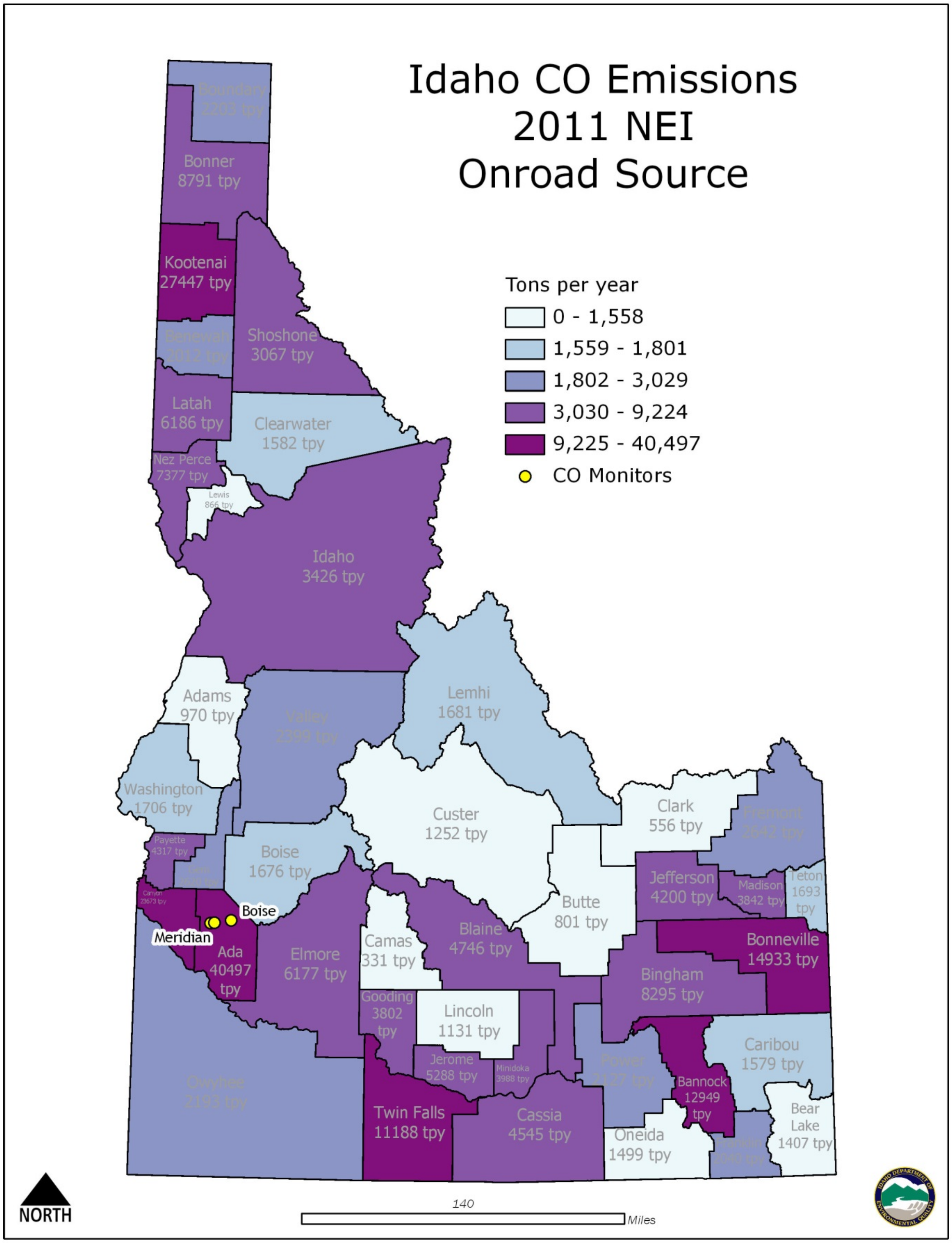

Figure 58. County-level onroad source emissions of CO.

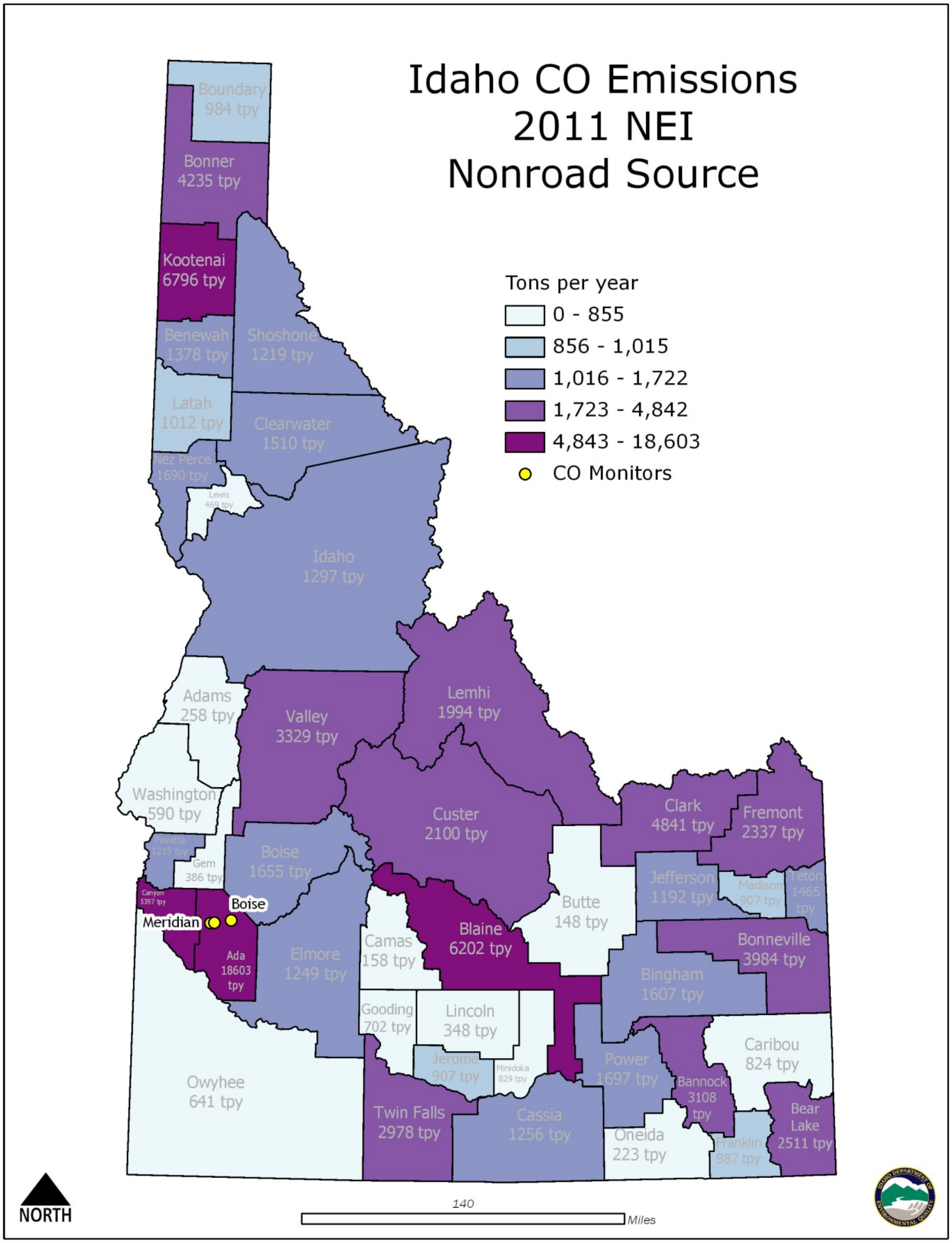

Figure 59. County-level nonroad source emissions of CO.

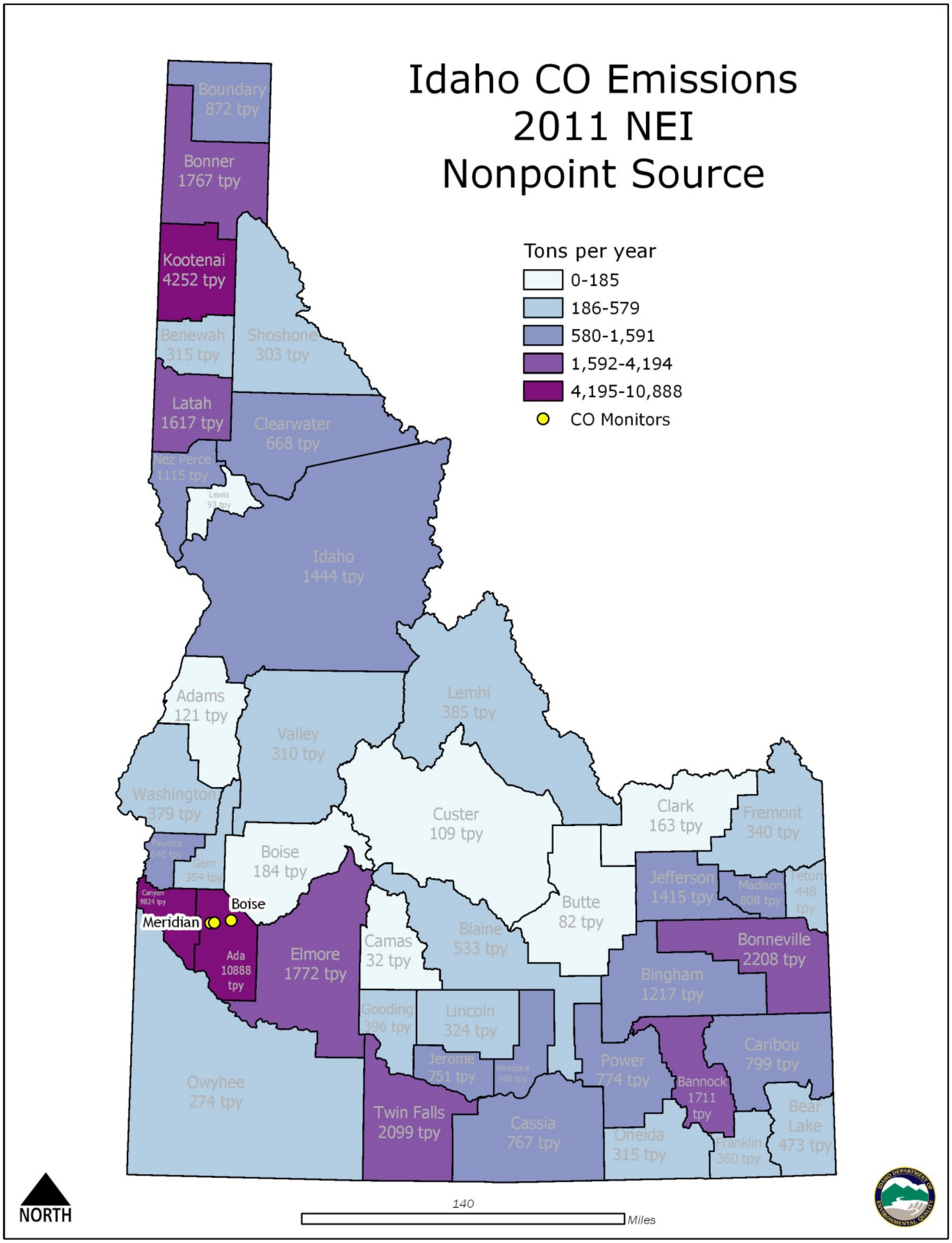

Figure 60. County-level nonpoint source emissions of CO.

4.3.2 Lead (Pb)

In October 2008, EPA strengthened the standard for lead to 0.15 $\mu g/m^3$. The revised NAAQS are 10 times lower than the previous NAAQS. The monitoring requirements for the 2008 standard were based on MSA population thresholds of 500,000 and based on facility (or clusters of facilities) emissions thresholds of greater than or equal to 1.0 tons per year. Therefore, monitors would have to be placed near facilities that meet those emissions thresholds.

In December 2009, EPA announced it was reconsidering the monitoring requirements, proposing that agencies monitor at NCore monitoring sites (in lieu of basing monitoring requirements on MSA population thresholds) and where point sources emit at least 0.5 tons per year. Monitoring for lead at the Meridian St. Luke’s site began in January 2012.

Lead emissions are very low in Idaho, and there are no significant point sources of lead in the state. Therefore, a sole monitor to fulfill the NCore requirements at Meridian is sufficient for this pollutant.

4.3.3 Nitrogen Dioxide (NO_2/NO_y)

No minimum requirements exist for the number of NO_2 monitoring sites (CFR 2009). The Meridian St. Luke’s site fulfills the requirement for NO_y monitoring at NCore sites. The Meridian Central Drive site aims to measure the maximum concentration of NO_2 within its scale of representation. This fulfills the required network design criteria (CFR 2009). Figure 61 shows the location of Idaho’s NO_x/NO_y monitoring network.

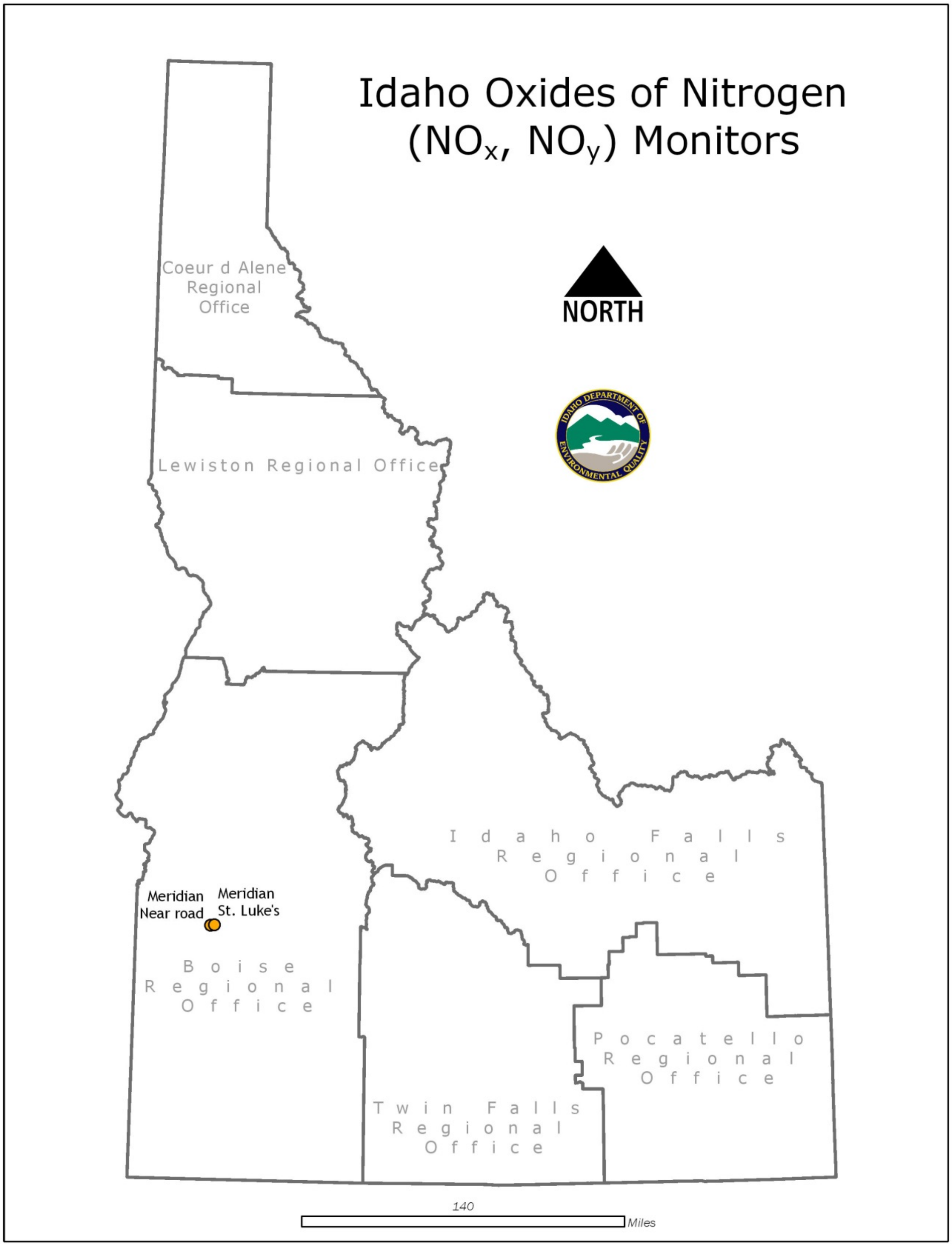

Figure 61. Idaho's NO_x/NO_y monitoring network.

NO_x is emitted from mobile sources and industrial combustion processes. It is released primarily as NO but rapidly oxidizes to NO_2, the pollutant that is responsible for health effects. Figure 62 shows the top five point sources of NO_x in Idaho. The Meridian monitors are in the same airshed as the fourth-largest NO_x point source in the state. There are no monitors near the other top point sources.

Figure 63 shows the distributions of onroad NO_x emissions by county in 2011. Ada, Canyon, and Kootenai counties are by far the largest emitters for this category. The Meridian monitors provide sufficient coverage for both Ada and Canyon Counties. There was a NO_x monitor in Kootenai County, but the measurements were so consistently low that the monitor was discontinued in 2010.

The NO_x source contribution chart indicates that nonroad and nonpoint sources contribute significant NO_x emissions as well (Figure 64). The nonroad category shows a similar dominance by Ada, Canyon, and Kootenai Counties (Figure 65). For the nonpoint category (Figure 66), the top emitters are Ada, Bonner, and Canyon Counties, with Kootenai County a close fourth. Overall, Idaho's NO_x monitoring network sufficiently covers areas with high emissions from the onroad, nonroad, and nonpoint source categories but insufficiently covers point source emissions.

Historical NO_2 monitoring in Idaho has recorded very low annual 1-hour average concentrations relative to the NAAQS. Figure 10 shows that Idaho monitors consistently measure concentrations at about 20% of the NAAQS. By itself, NO_2 is not considered a major pollutant in Idaho; however, it is an important precursor to O_3 formation.

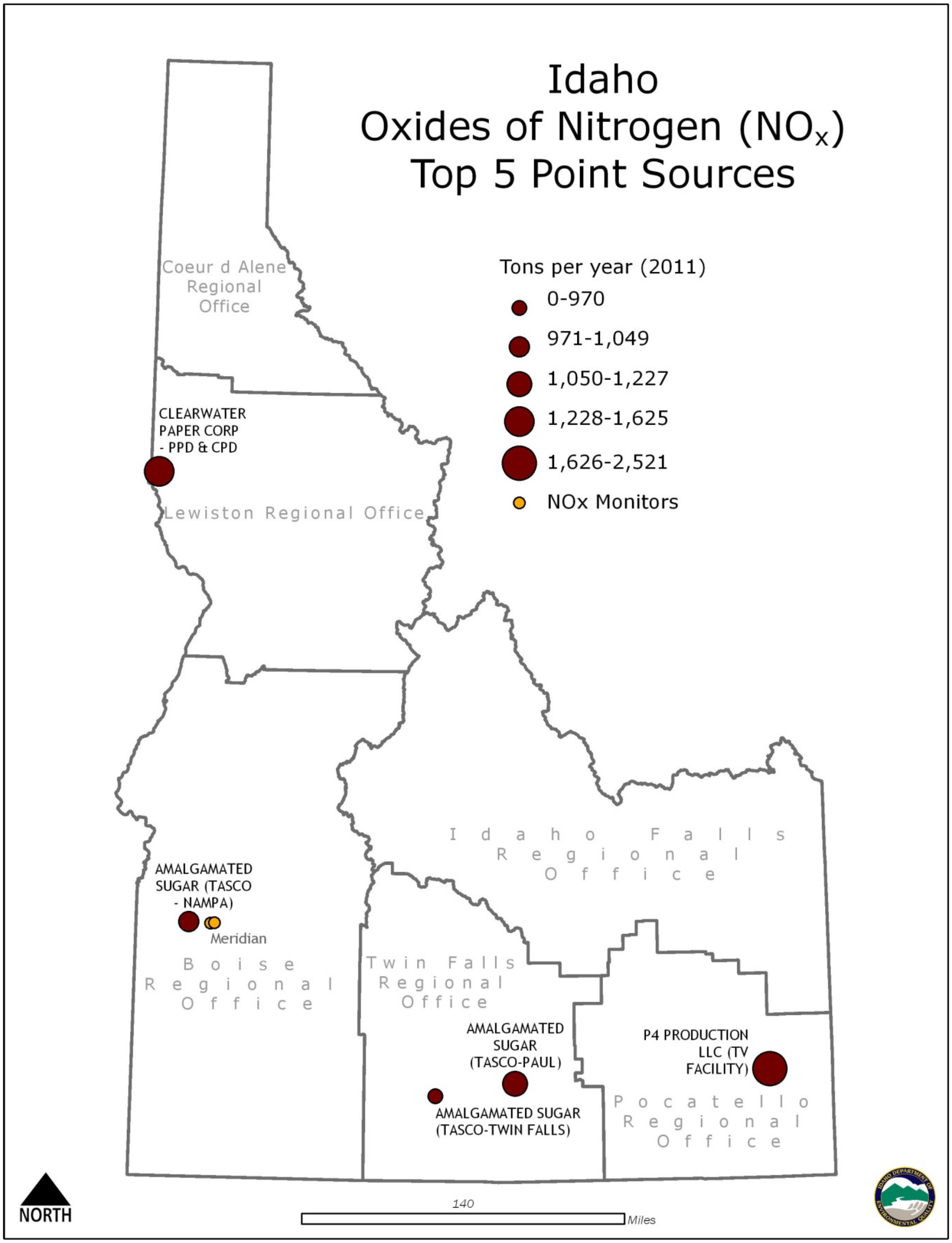

Figure 62. Top five NO_x emissions point sources in Idaho.

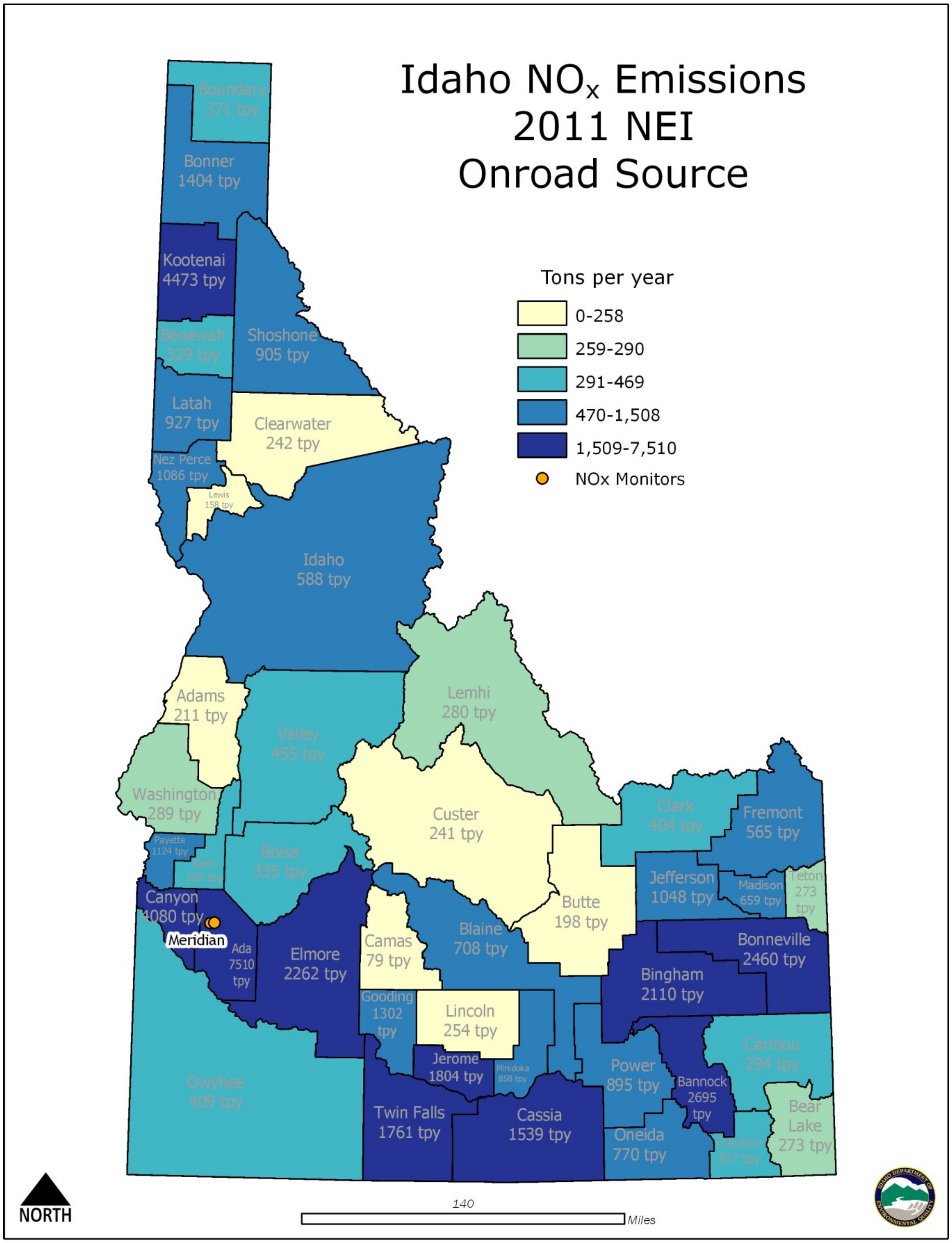

Figure 63. County-level onroad source emissions of NO_x.

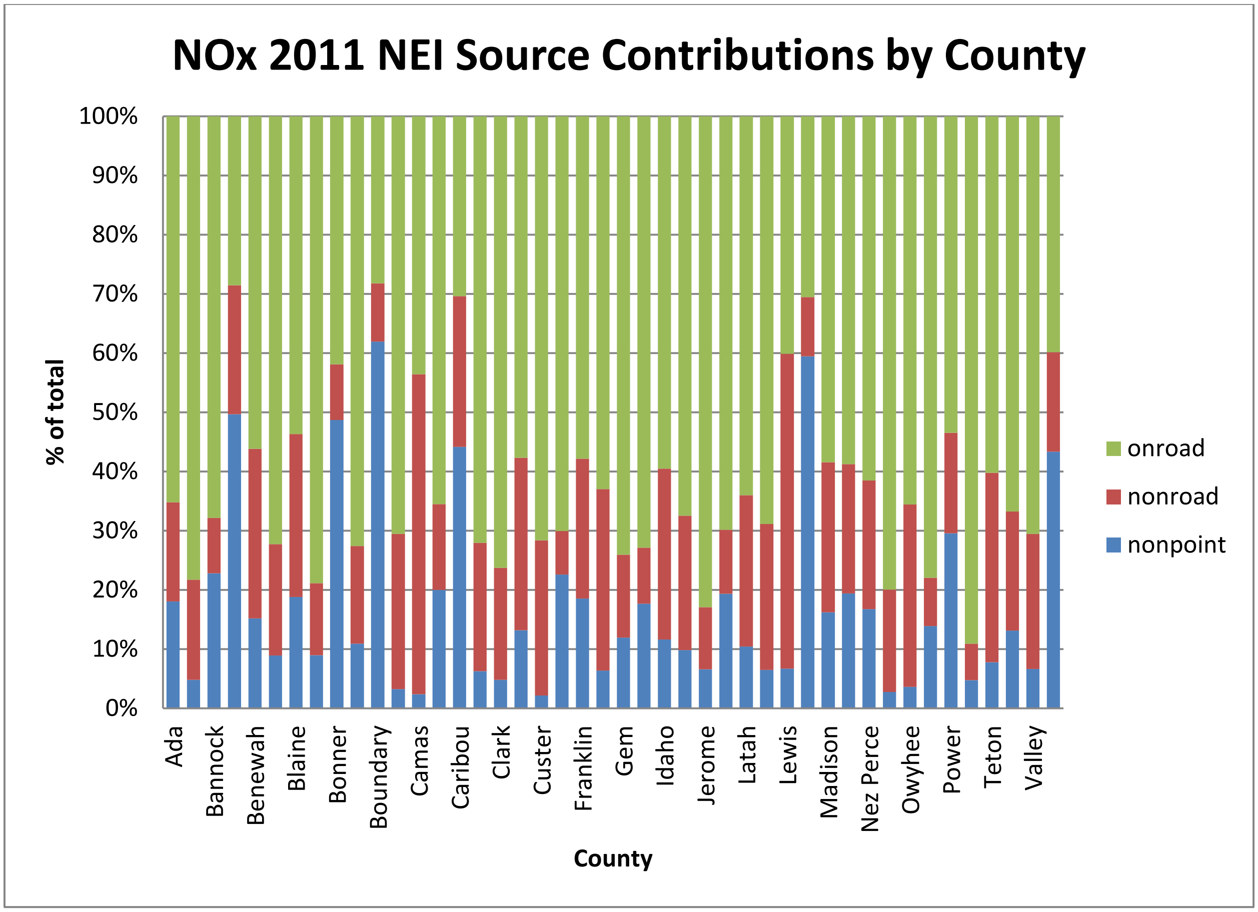

Figure 64. NO_x emissions by source category and county.

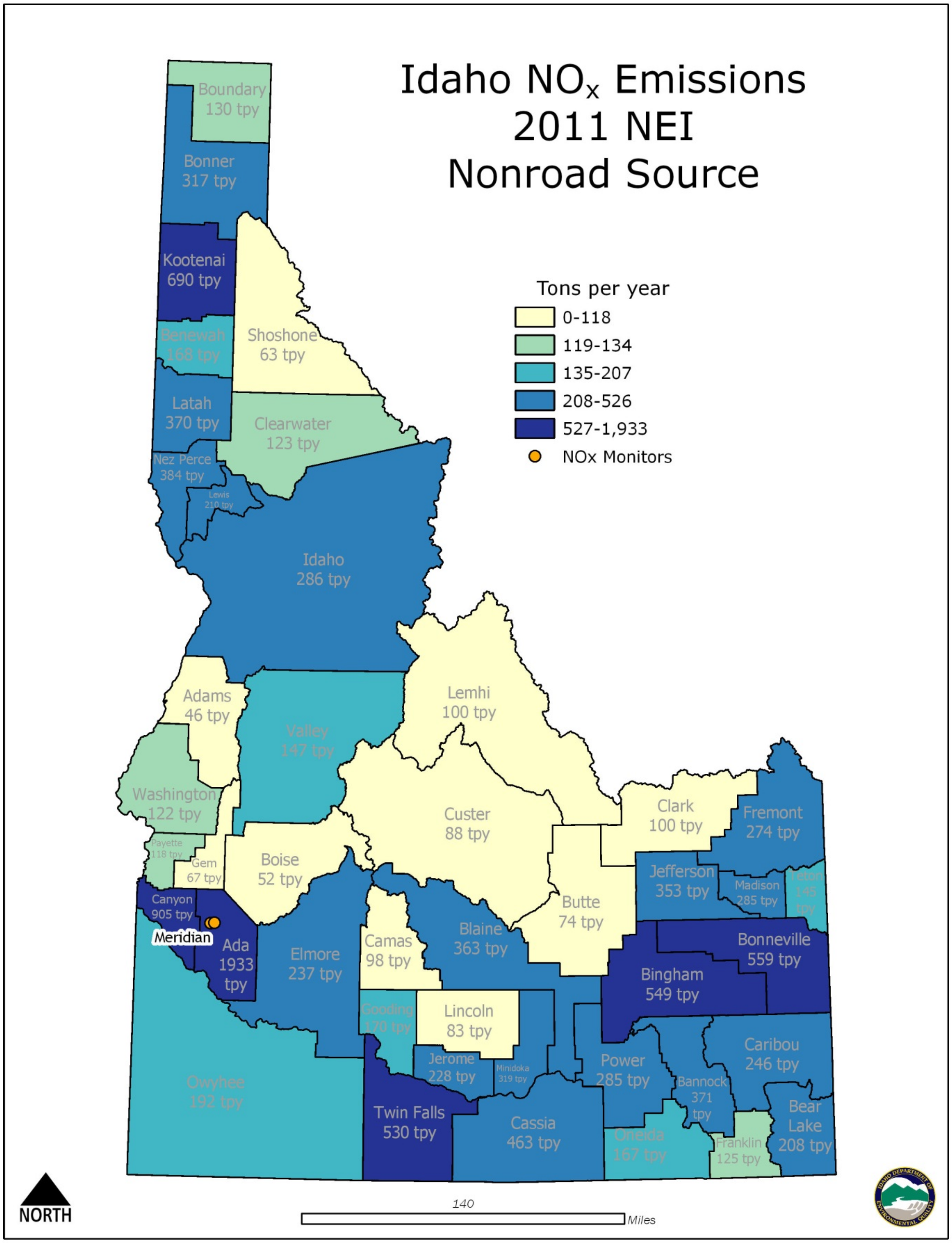

Figure 65. County-level nonroad source emissions of NO_x.

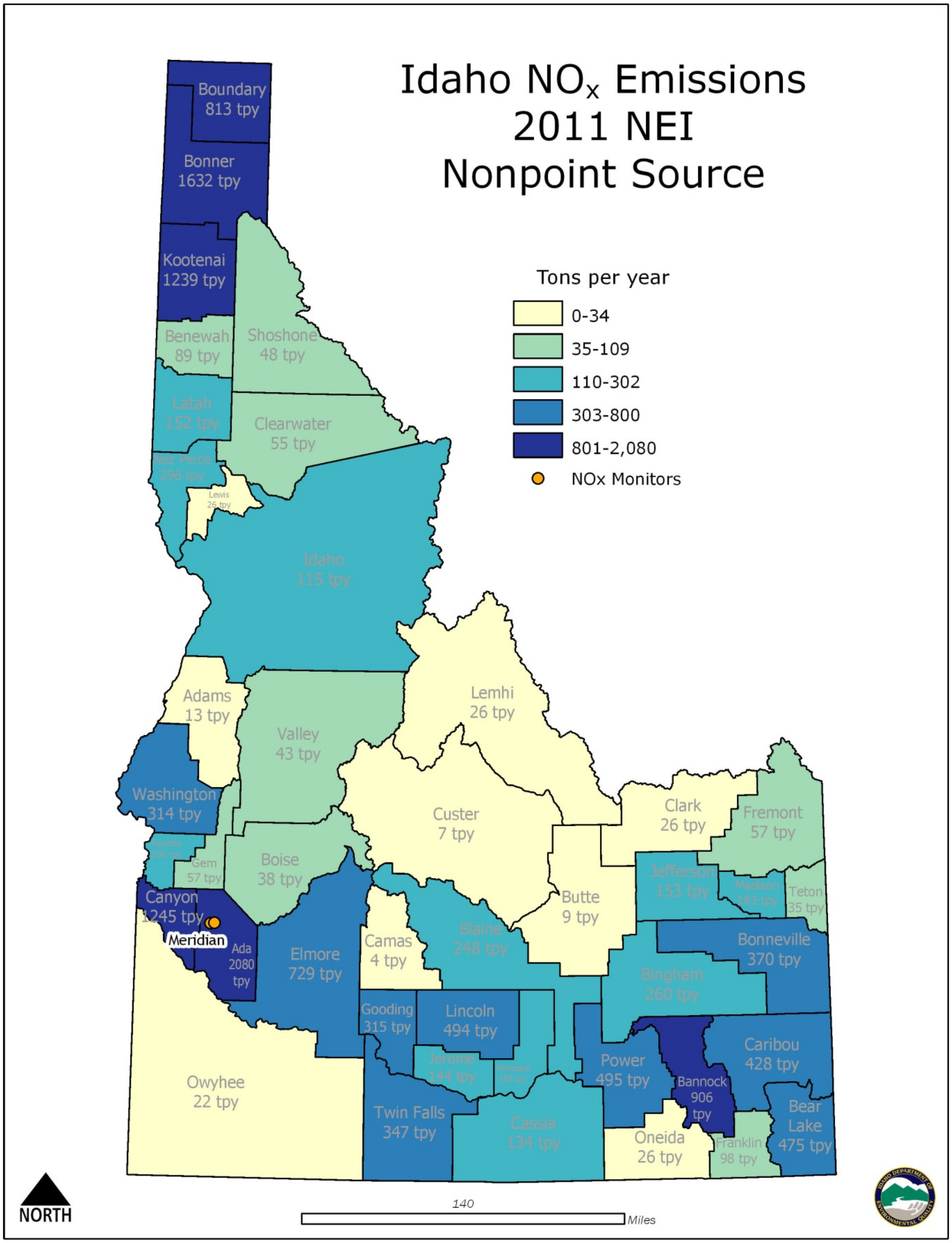

Figure 66. County-level nonpoint source emissions of NO_x.

4.3.4 Ozone (O_3)

Figure 67 shows the location of O_3 monitors in Idaho's network. Network design criteria for ozone require 0–1 monitoring stations in MSAs with populations between 50,000 and 350,000 (CFR 2009), depending on whether the most recent 3-year design value is above, below, or equal to 85% of the NAAQS. Idaho has five MSAs that meet these criteria, but O_3 monitoring has occurred only in the Coeur d'Alene MSA, where design values have dropped below 85% of the NAAQS and the monitoring therefore ceased. MSAs with populations between 350,000 and 4 million are required to have 1–2 monitors, depending on whether the most recent 3-year design values are above, below, or equal to 85% of the NAAQS. The Boise City MSA is required to have 2 monitors. The NCore monitoring requirements call for year-round ozone monitoring at NCore stations. NCore ozone stations can be leveraged toward minimum monitoring requirements. The two sites at Boise—White Pine and Meridian St. Luke's—fulfill the O_3 monitoring requirements in the Boise MSA.

One site in each MSA must be a maximum concentration site. Boise's White Pine site fulfills this requirement. Appropriate spatial scales are neighborhood, urban, and regional. All sites in the Treasure Valley are neighborhood. Aside from NCore stations, ozone monitoring is required only during ozone season, which is May through September in Idaho (CFR 2009). The ozone network requirements are satisfactorily fulfilled.

Ozone is formed by a reaction of NO_x and VOC triggered by solar ultraviolet light. Boise has both a top five NO_x point source and a top five VOC point source in its airshed (Figure 62 and Figure 68). However, Lewiston, south central Idaho, and southwest Idaho have important point sources for both precursors as well. VOC emissions are mostly derived from the nonpoint and nonroad source categories (Figure 69).

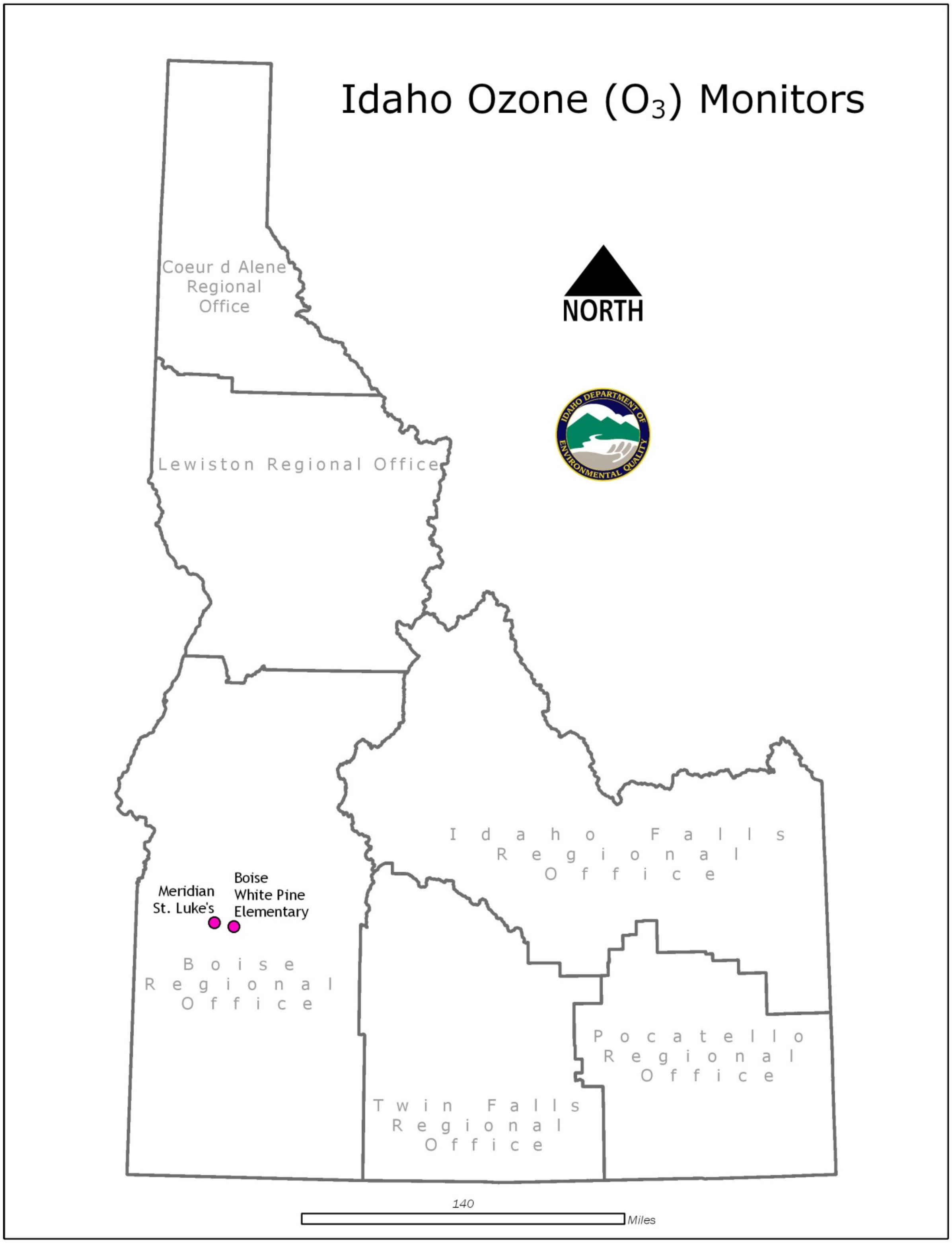

Figure 67. Idaho's ozone monitoring network.

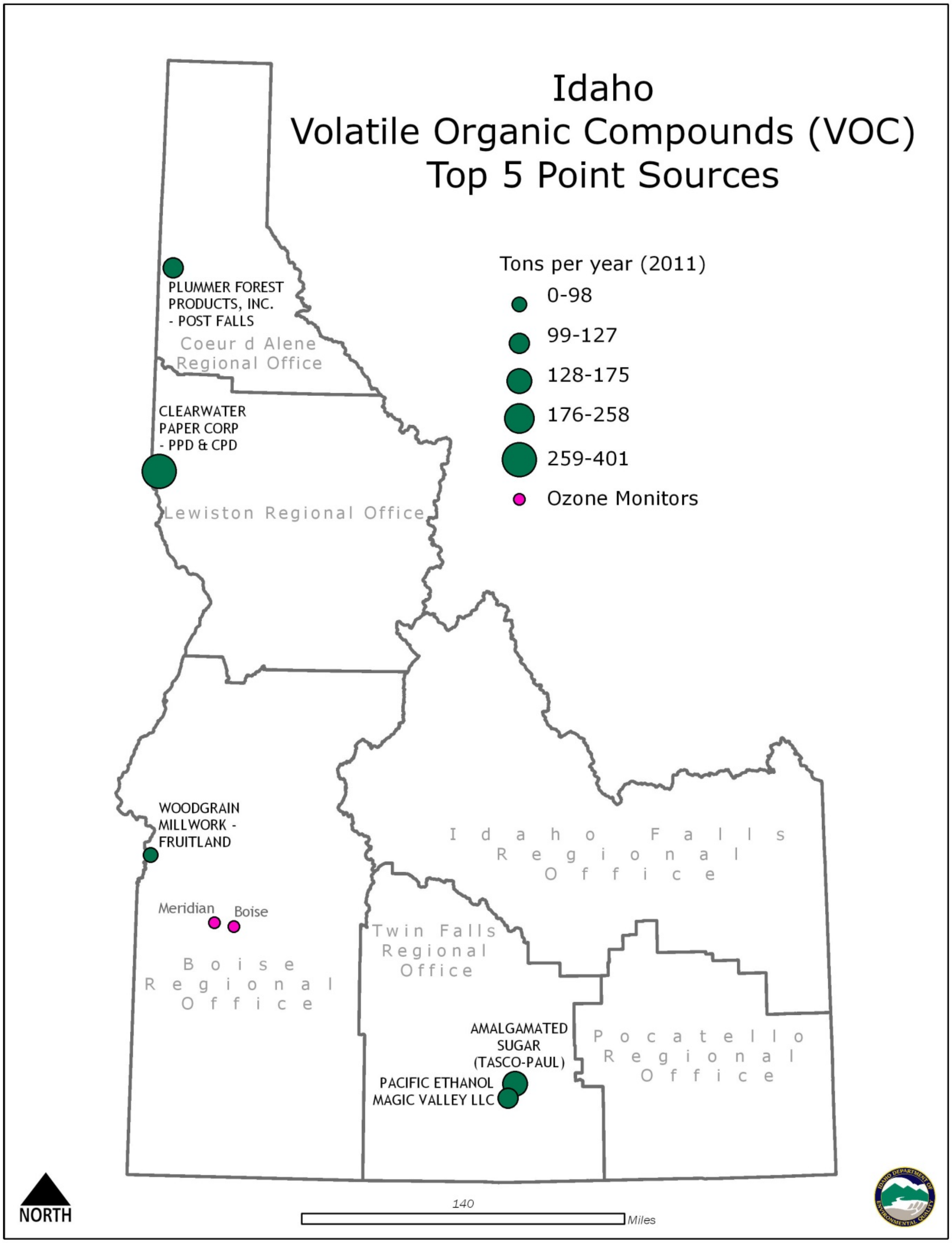

Figure 68. Top five VOC emissions point sources in Idaho.

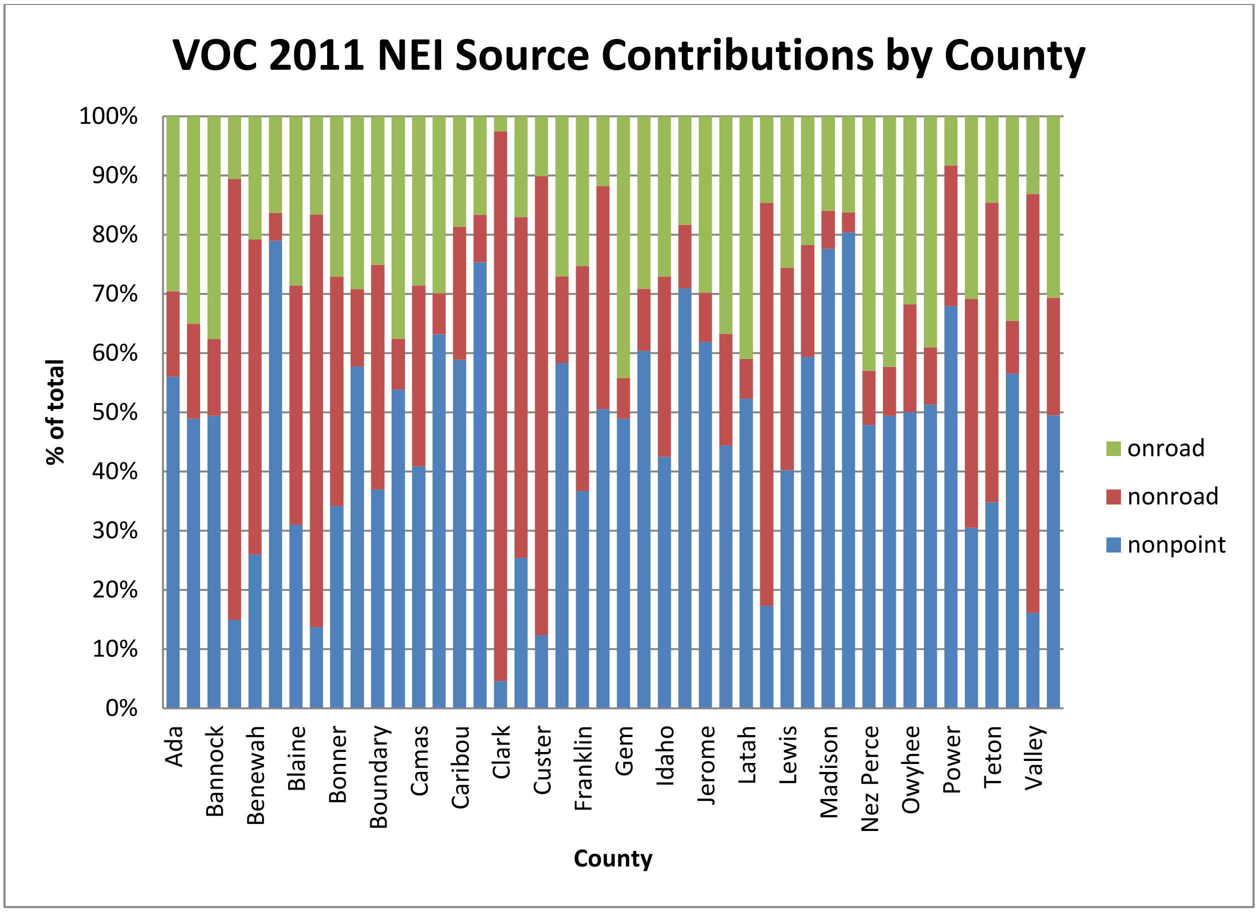

Figure 69. VOC emissions by category and county.

Ada and Canyon Counties have the highest VOC emissions, followed by the agricultural areas in the Snake River Plain and Kootenai County (Figure 70). Figure 63, Figure 65, and Figure 66 show that Ada and Canyon Counties have the highest NO_x emissions for all categories combined. Based on emissions sources alone, it appears that Idaho's ozone network covers the important locations.

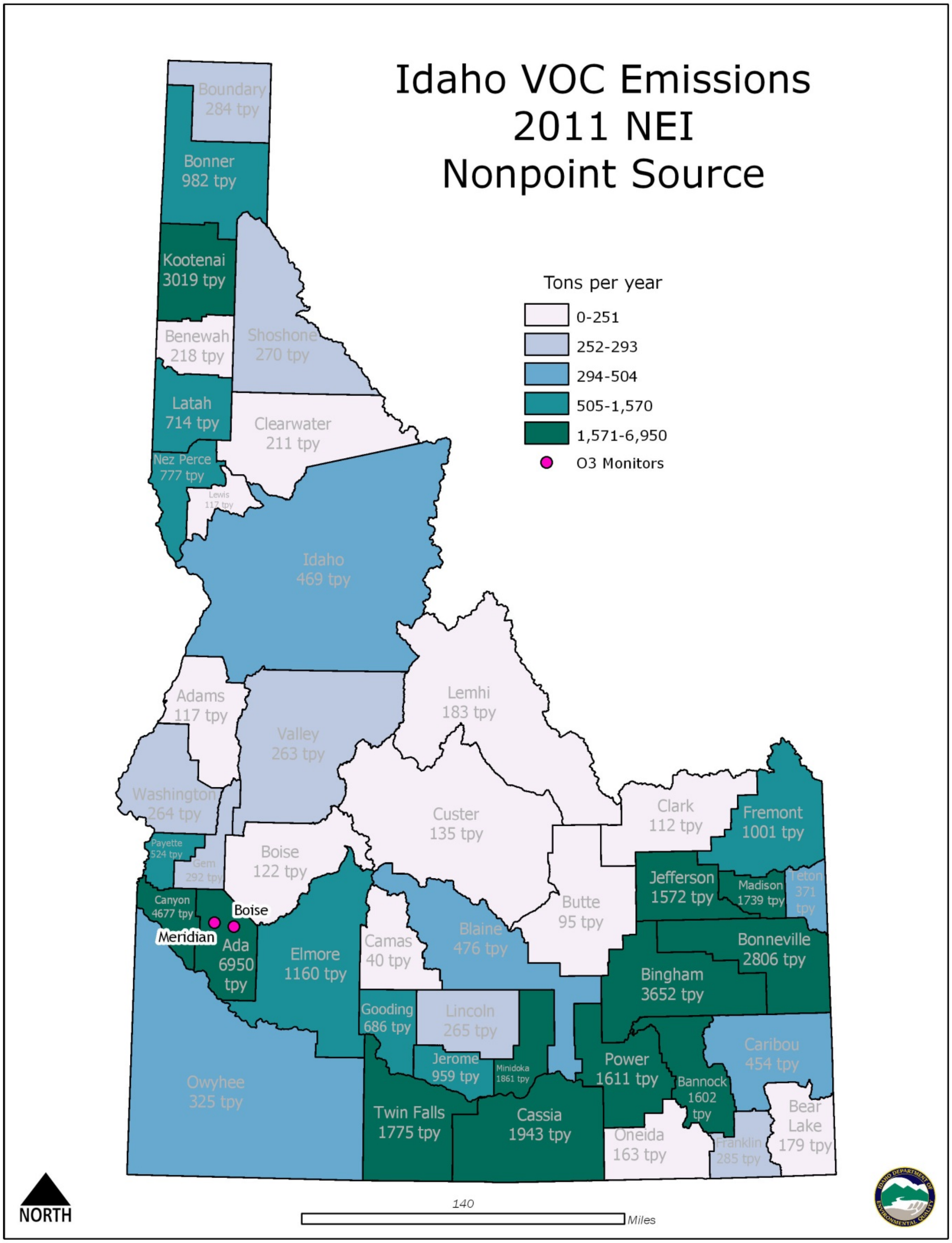

Figure 70. County-level nonpoint source emissions of VOC.

Modeled ozone concentrations should also be considered because they incorporate all emissions of both NO_x and VOC, as well as their interaction in the ozone formation photochemistry. AIRPACT3 modeled 8-hour average daily maximums interpolated with 2009–2011 monitored design values (Figure 71) show a regional increase in concentrations toward the south and a maximum in Ada and Canyon Counties. These modeled concentrations indicate that ozone pollution is a regional, multistate phenomenon and that southern Idaho generally experiences higher concentrations. Idaho’s ozone network targets the areas that experience high ozone concentrations and that have significant populations affected by this pollution.

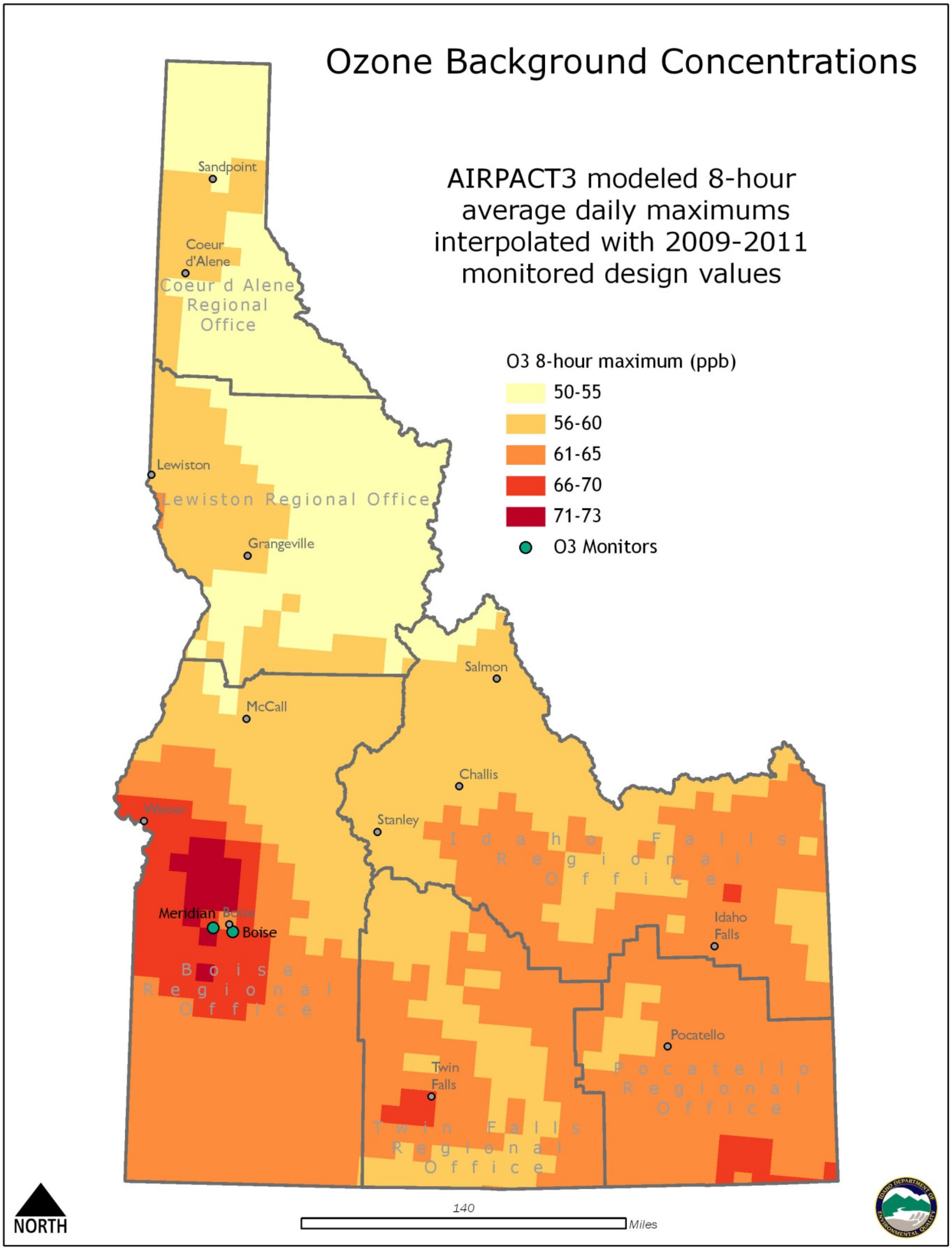

Figure 71. AIRPACT modeled 8-hour ozone maximum concentrations.

4.3.5 Coarse Particulate Matter (PM_{10})

Figure 72 shows the location of PM_{10} monitors in Idaho's network.

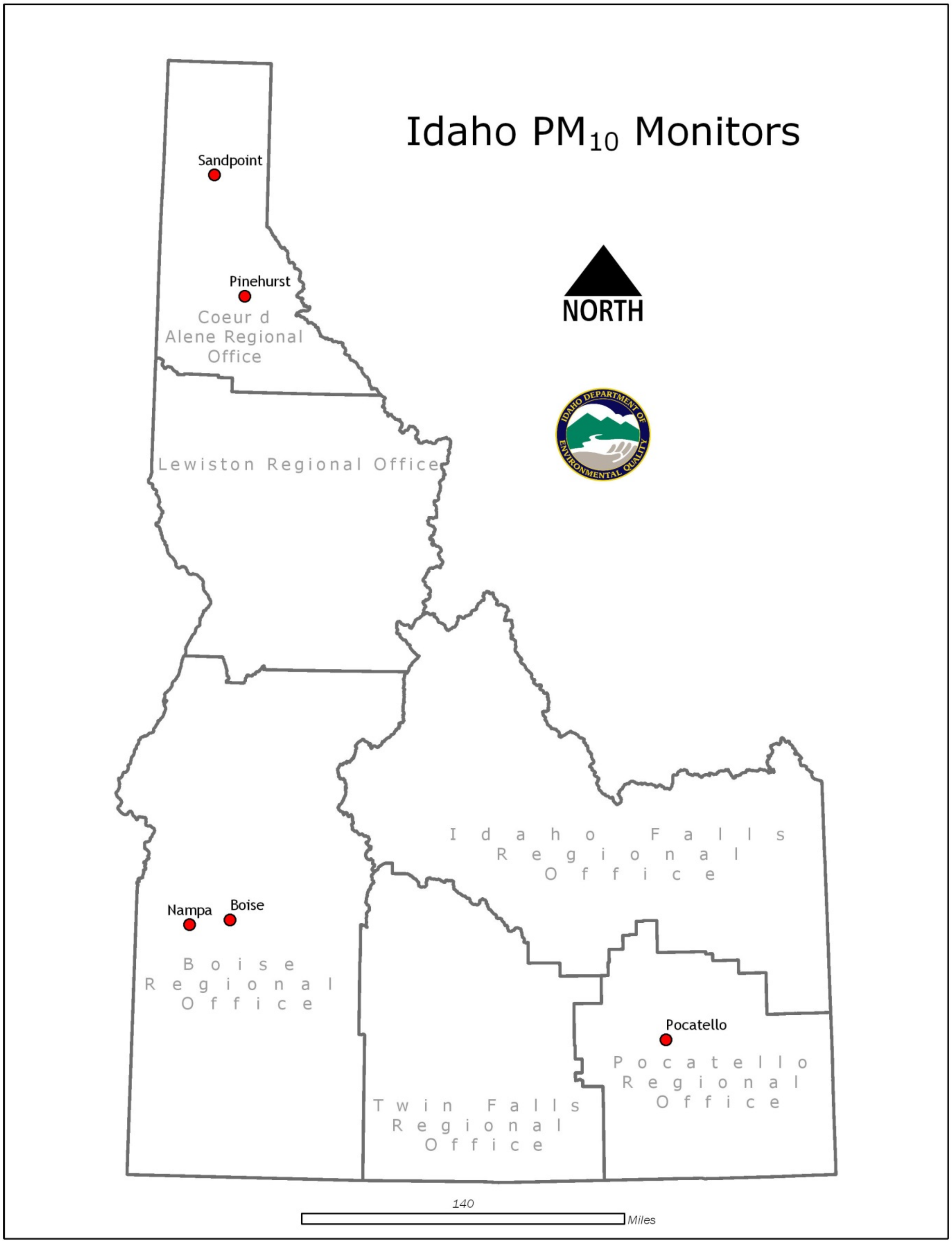

Figure 72. Idaho's PM_{10} monitoring network.

Design criteria for a PM_{10} network requires no more than two monitors in urban areas with populations less than 1 million (CFR 2009). Two PM_{10} stations are located in the Boise MSA. The other three monitoring sites are in PM_{10} maintenance areas (Figure 1). Appropriate scales of representation for PM_{10} monitors are middle and neighborhood (CFR 2009). All sites are neighborhood scale except for Sandpoint, which is urban. This site's scale should therefore be reevaluated.

PM_{10} is mainly produced by industrial crushing and grinding operations, RWC, and road dust. PM_{10} also includes the $PM_{2.5}$ components such as smoke and secondary sulfate, nitrate, and organic aerosol. Figure 73 shows the top five point source emitters of PM_{10}. Currently, only the Pocatello monitor is somewhat near a significant point source. The Idaho monitors are not source-oriented. Nonpoint source emissions dominate the other emissions inventory source categories (Figure 74).

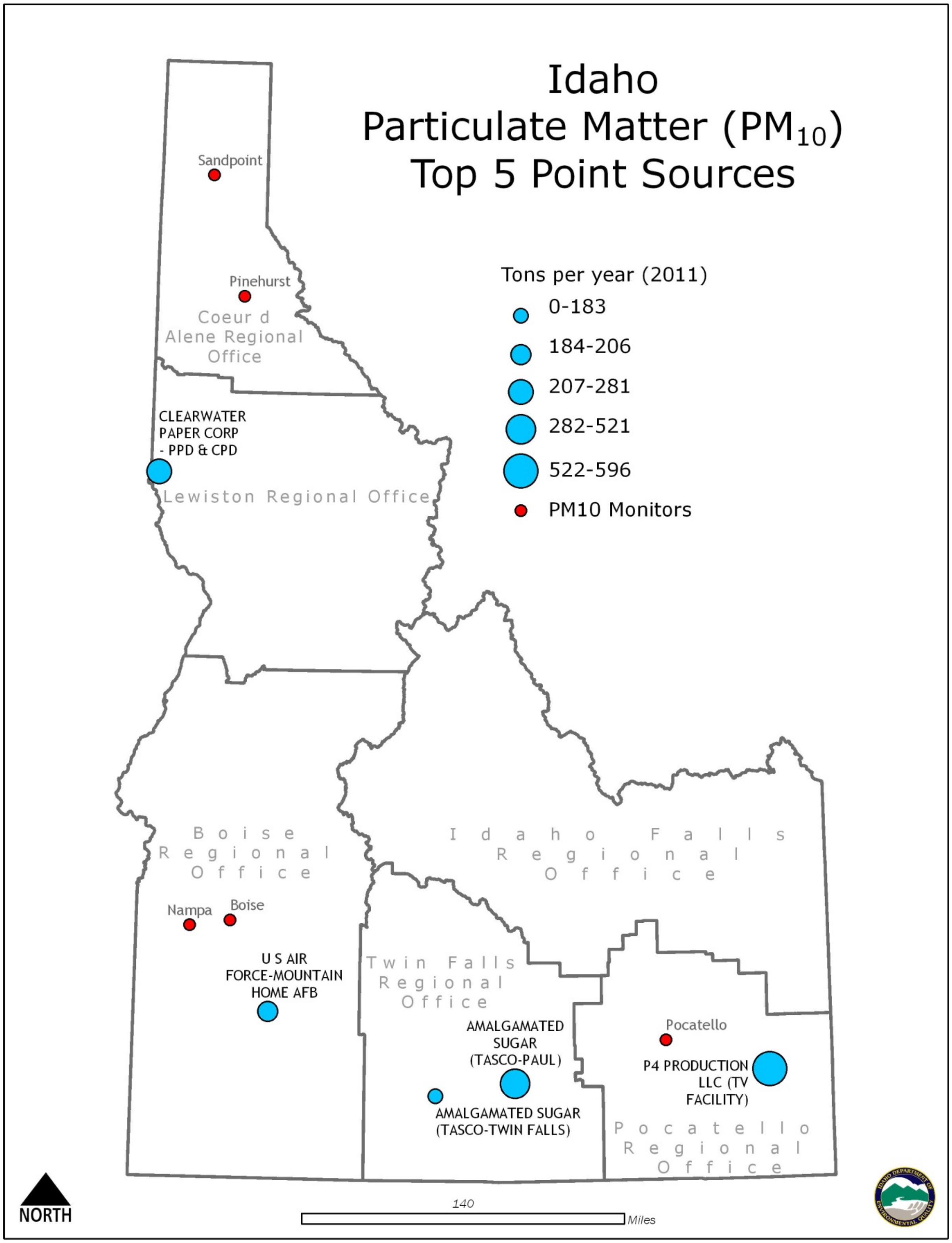

Figure 73. Top five PM_{10} emissions point sources in Idaho.

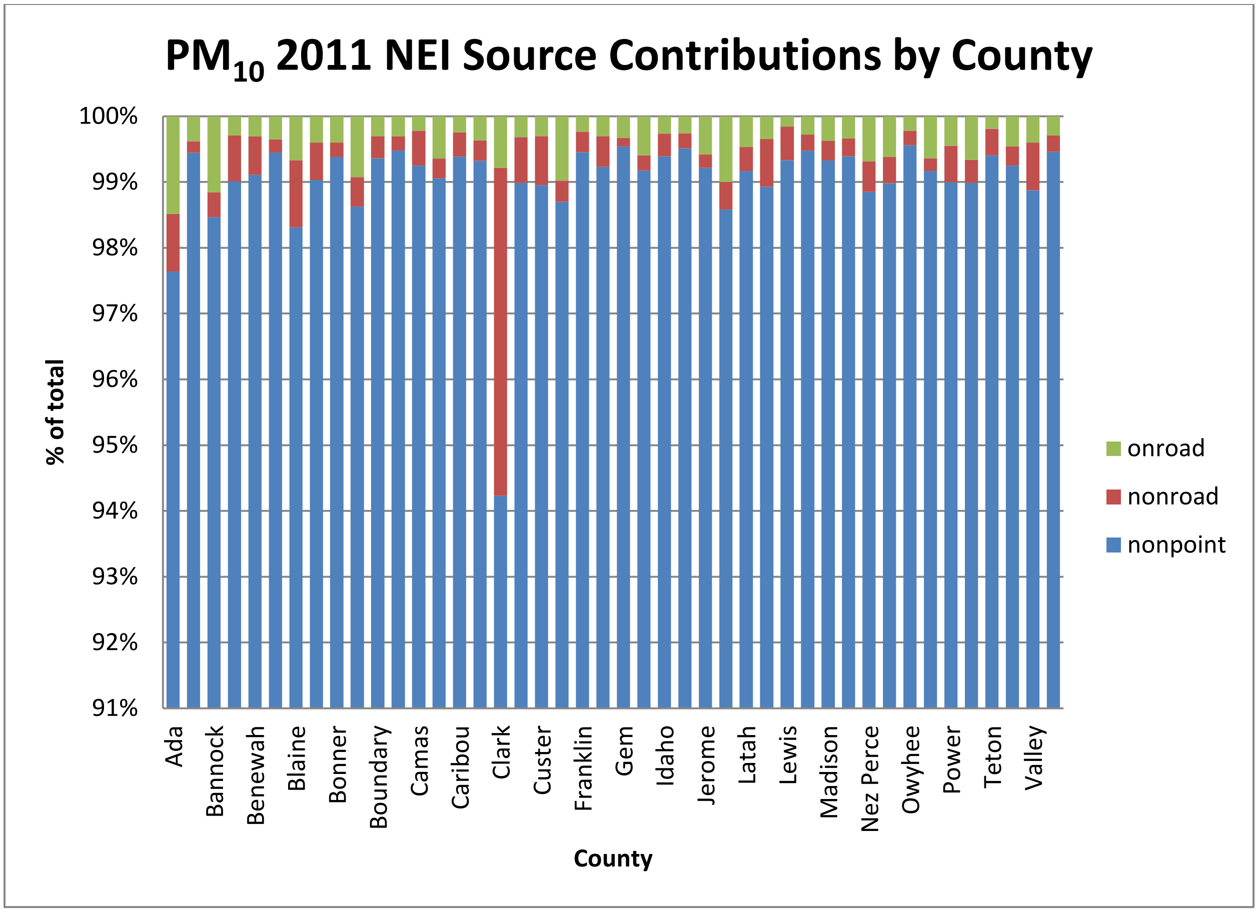

Figure 74. PM_{10} emissions by source category and county.

The three emissions figures (Figure 75, Figure 76, and Figure 77) show that Ada and Canyon Counties have relatively high emissions for all source categories. The other emissions data representing the counties where PM_{10} monitors are located (Bonner, Shoshone, and Bannock) do not fully explain the particular local conditions that caused these areas to be declared nonattainment originally. If current source emissions are considered to represent those areas where the monitoring network should focus, then Ada, Canyon, Bingham, and Kootenai Counties are where the resources should be located.

Trends in PM_{10} measurements since 2010 show Pocatello PM_{10} levels to be steady or decreasing, Sandpoint levels dropping precipitously, and Boise and Nampa concentrations spiking in 2012 and 2013 (Figure 13). Pinehurst concentrations dropped from 2010 to 2011, then remained level through 2013.

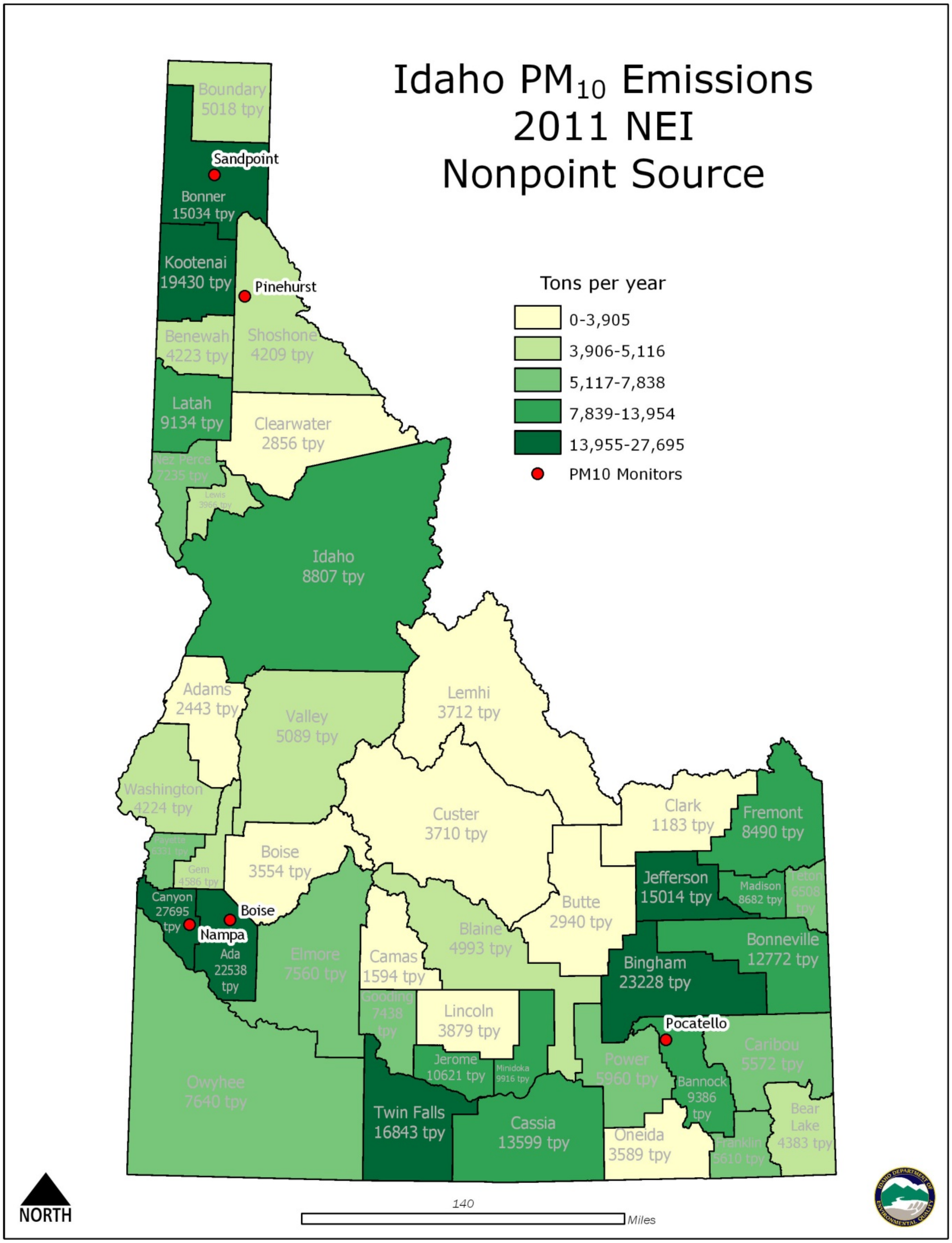

Figure 75. County-level nonpoint source emissions of PM_{10}.

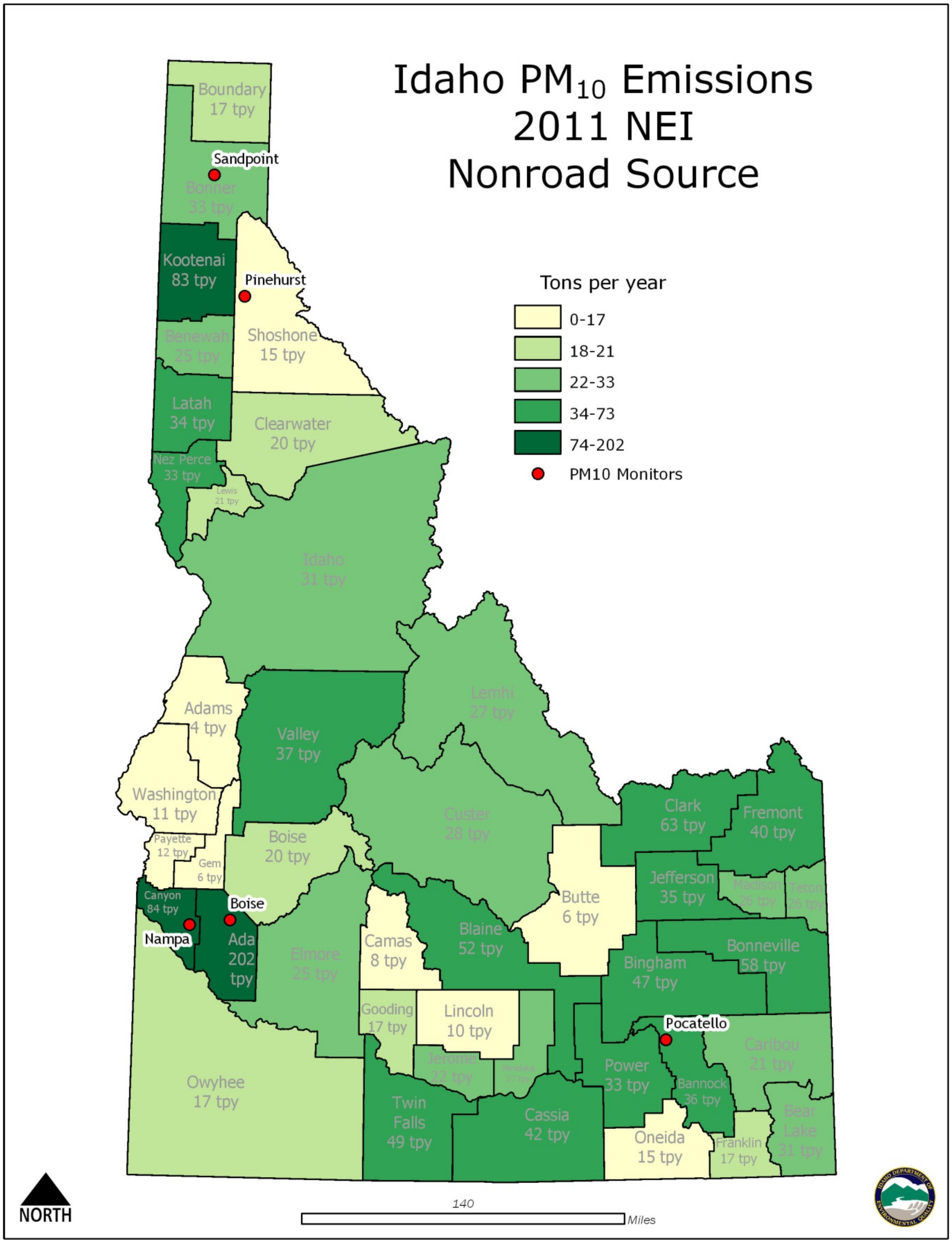

Figure 76. County-level nonroad source emissions of PM_{10}.

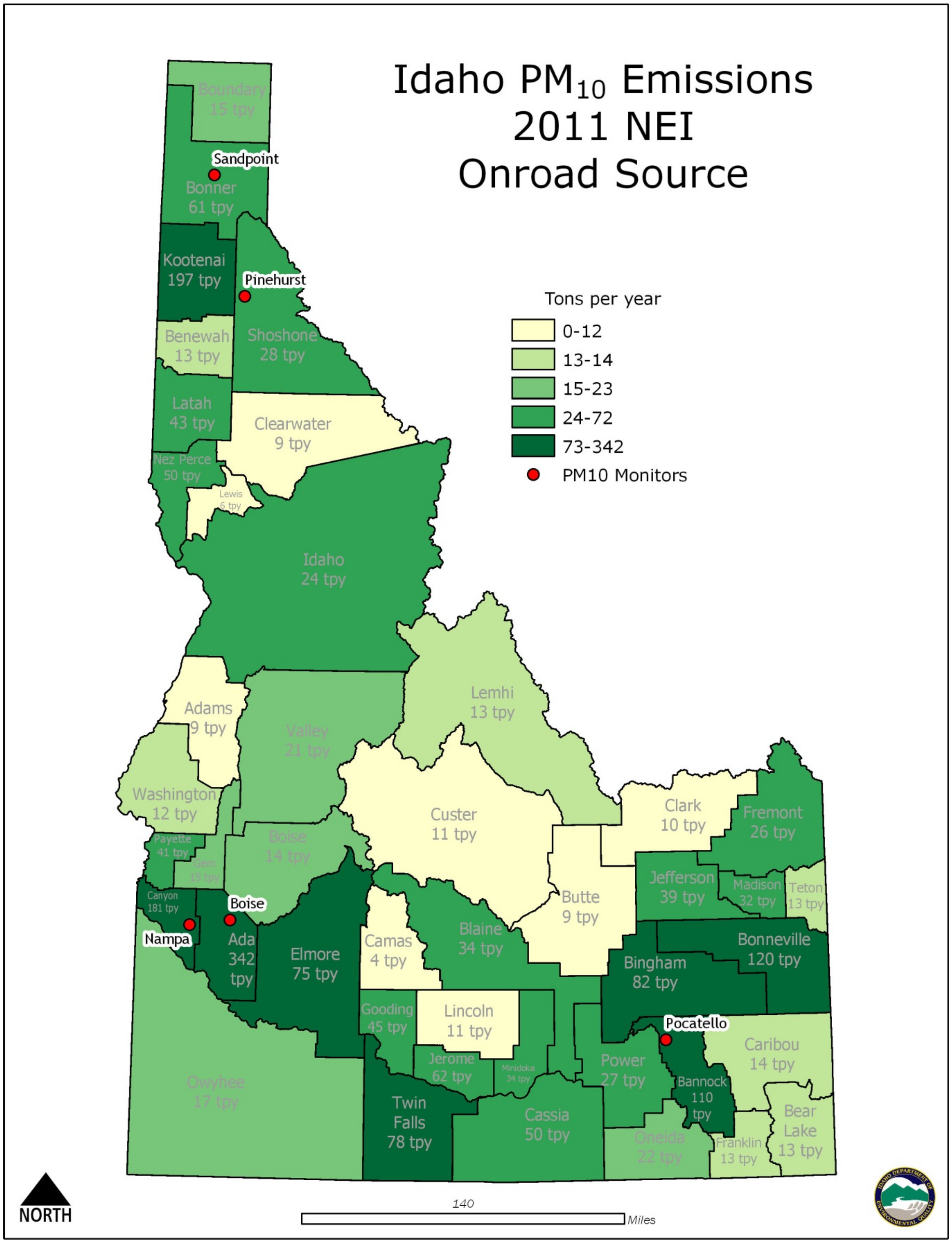

Figure 77. County-level onroad source emissions of PM_{10}.

4.3.6 Fine Particulate Matter ($PM_{2.5}$)

Figure 78 shows the location of $PM_{2.5}$ monitors in Idaho's network. Network requirements for $PM_{2.5}$ monitoring call for zero or one federal reference method (FRM) monitors in MSAs with populations between 50,000 and 500,000, depending on the design value (CFR 2009). Idaho Falls, Lewiston, Coeur d'Alene, Pocatello, and Twin Falls no longer have FRM monitors due to their low design values. Monitoring continues in these airsheds with special purpose continuous monitors. In the event the continuous monitors measure 98th percentile 24-hour average concentrations within 85% of the 24-hour standard, FRM or federal equivalent method (FEM) monitors will be re-installed in these airsheds.

MSAs with populations between 500,000 and 1 million require 1 or 2 monitors. The Boise-Nampa MSA has two. Scales of representation must be neighborhood or urban, which is the case in Idaho. Monitoring precision, determined using co-located samplers, is required at a minimum of 15% of the total number of sites, preferably at the site(s) with the highest design value(s). Idaho is required to assess precision at one site, which is the St. Luke's site. Each state must have at least one regional transport site and at least one regional background site. Two IMPROVE monitors are leveraged for these requirements: Hells Canyon is Idaho's regional transport site and Craters of the Moon is Idaho's regional background site. Idaho's $PM_{2.5}$ network requirements are fulfilled.

$PM_{2.5}$ is a product of smoke (wildfire, agricultural burning, RWC), vehicle exhaust, and industrial combustion sources. $PM_{2.5}$ is also a secondary pollutant formed in the atmosphere by photochemical reactions involving nitrates, sulfates, ammonium, and biogenic compounds. Figure 79 illustrates the locations of the top five point sources of $PM_{2.5}$ in Idaho. One of the largest is in Lewiston, where there is a $PM_{2.5}$ monitor. The largest point source, P4, is in an area with low population (Soda Springs). One other important point source in southern Idaho (TASCO-Paul) does not have a permanent monitor nearby, but a seasonal smoke monitor is deployed there during the field burning season.

Figure 80 shows the 5-year annual average fire detection frequency in Idaho. Calculated from MODIS satellite fire detects (USDA Forest Service 2014), the map shows the areas with greatest fire activity, which translates into smoke area sources. The origin of the smoke could be wildfire, prescribed burning, agricultural burning, or any other type large enough to be detectable by satellite. The central mountains of Idaho experience the greatest frequency of smoke, followed by north-central Idaho. $PM_{2.5}$ monitor network coverage of high smoke areas is reasonable. Seasonal smoke monitors are operating near Bonners Ferry at Copeland (Mt. Hall), Porthill, Athol, and Garwood in northern Idaho; at Potlatch, Kendrick, and Cottonwood in central Idaho; and in Weiser, Paul, Soda Springs, and Rexburg in southern Idaho. Clearwater River towns like Orofino or mountain valley towns like Challis might benefit from $PM_{2.5}$ monitoring. One option is EBAM wildfire $PM_{2.5}$ monitors. They can be deployed where needed within 24 to 48 hours and provide a more focused approach for wildfire-based smoke management monitoring. DEQ has six portable EBAM monitors.

The Treasure Valley airshed is regularly impacted by wildfire smoke during the summer. The Meridian monitor is located centrally in the airshed, but it is on a geographical bench and it does not capture the maximum impact from wildfire smoke on the densely populated areas along the Boise River and between the southern benches and the foothills to the north. Many commuters travel from the western part of the airshed to jobs in the downtown core during the day, and this swells the population in the eastern part of the airshed. Smoke from wildfires tends to sink from frequent high pressure subsidence in the summer months and follows the river corridor. The population would benefit from a smoke-oriented $PM_{2.5}$ monitor to support AQI forecasting in the lower elevation, eastern area of the airshed.

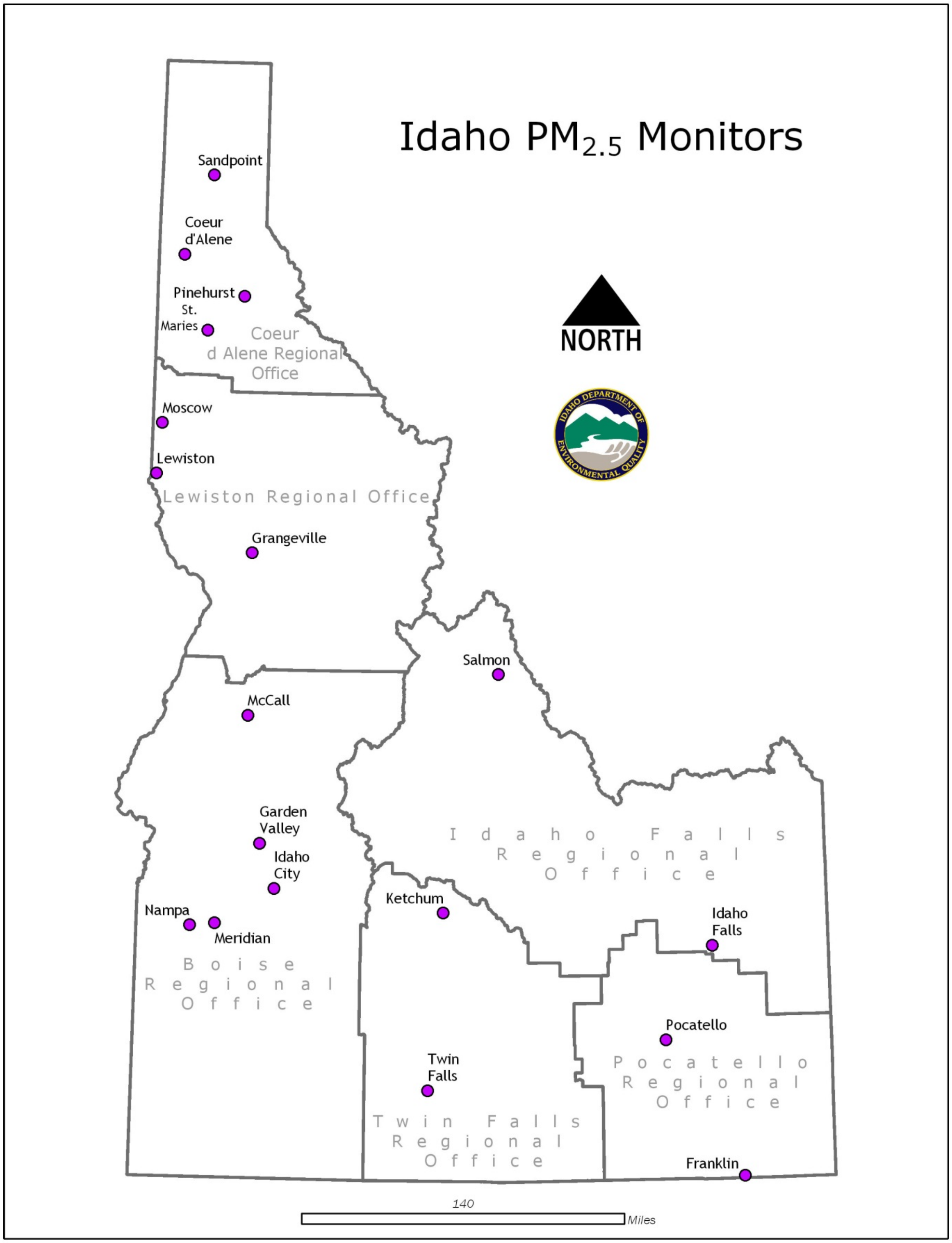

Figure 78. Idaho's $PM_{2.5}$ monitoring network.

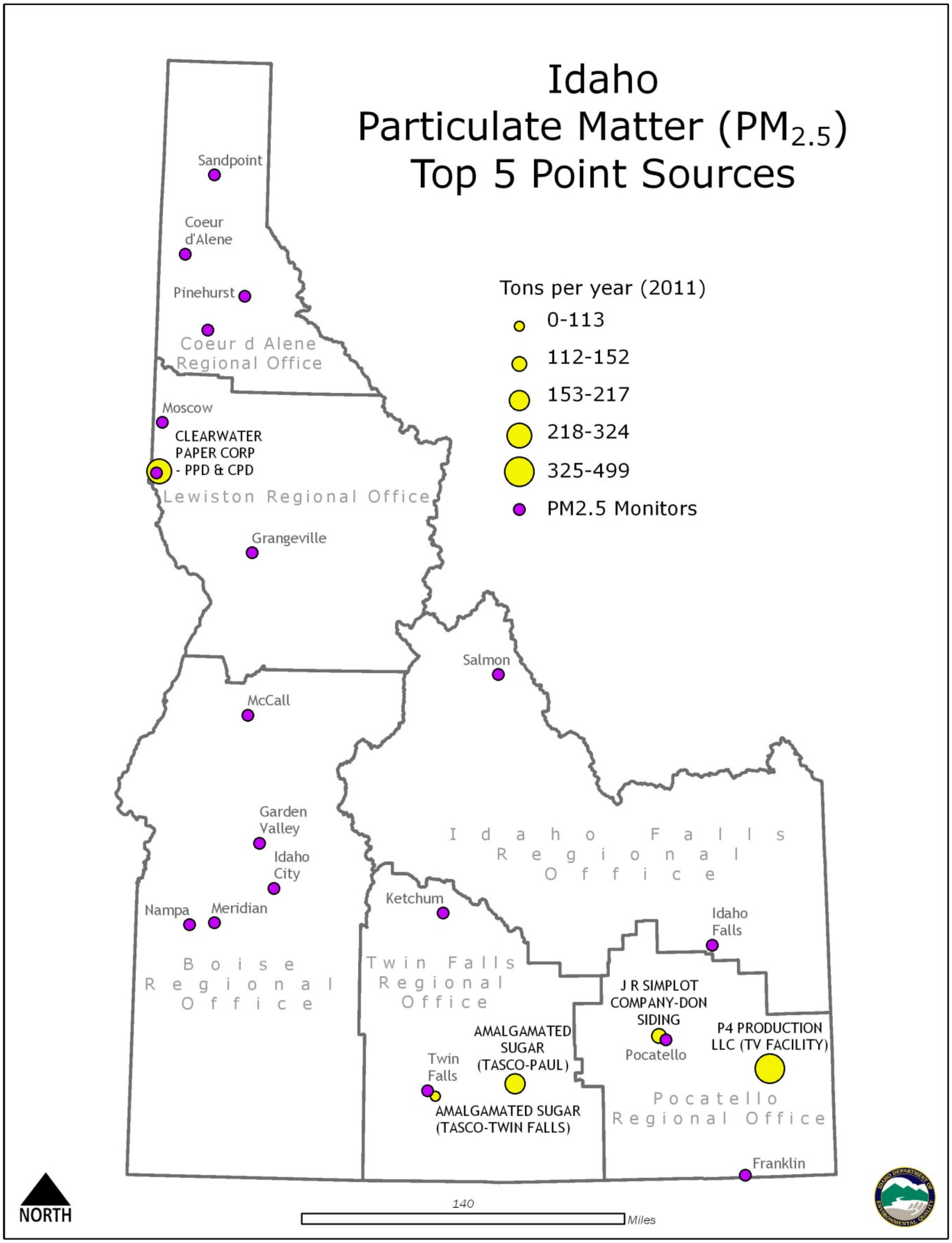

Figure 79. Top five $PM_{2.5}$ emissions point sources in Idaho.

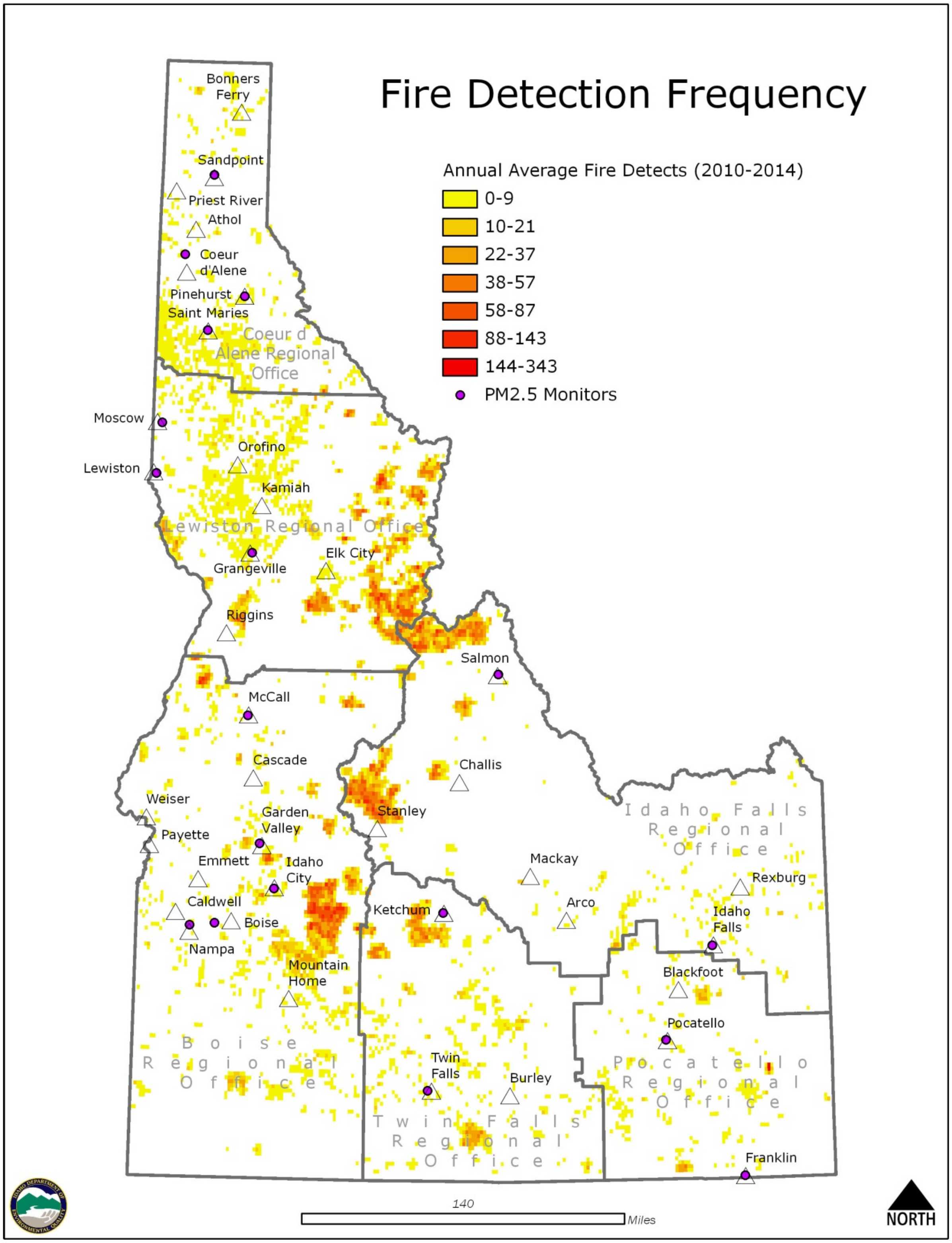

Figure 80. Frequency of fire occurrence in Idaho as an indication of smoke impacts.

Besides smoke, nonpoint emissions sources are important, as seen in Figure 81. Figure 82 describes levels of these emissions throughout Idaho.

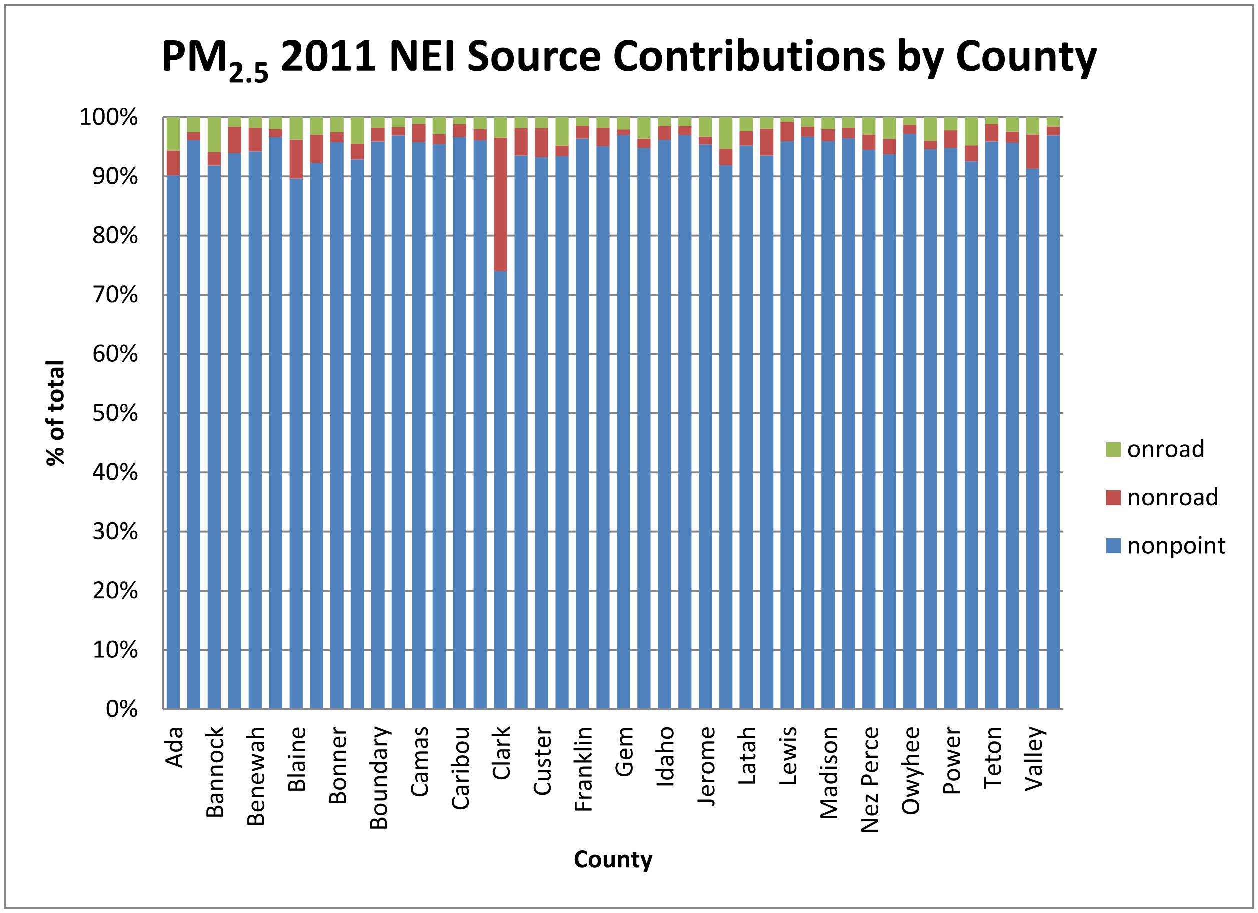

Figure 81. $PM_{2.5}$ emissions by source category and county.

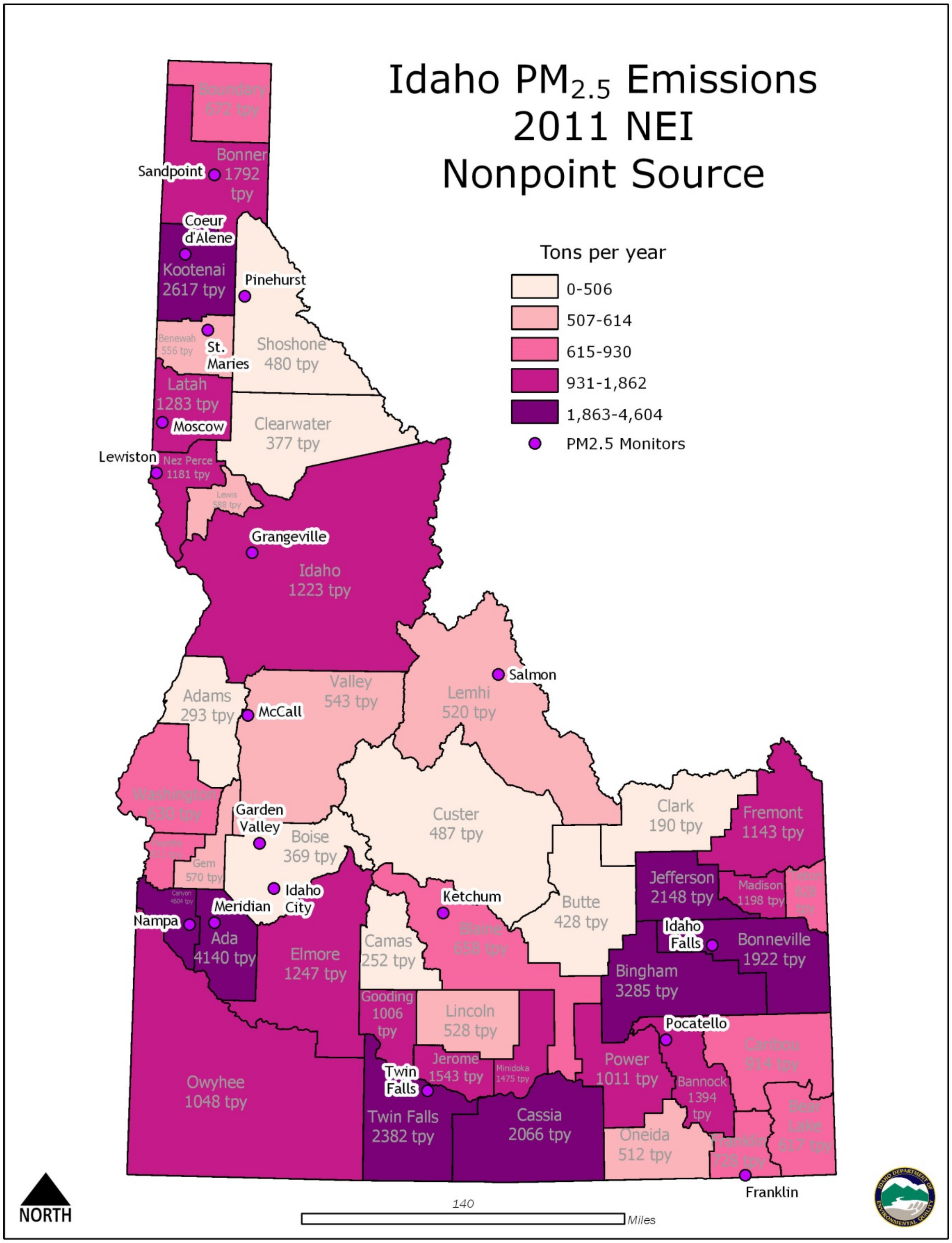

Figure 82. County-level nonpoint emissions of $PM_{2.5}$.

There are two AIRPACT3 maps of modeled concentrations interpolated with 2009–2011 monitored design values: annual average and daily average. The maximum concentrations support the current distribution of monitors, though the area between the Treasure Valley and Twin Falls could use coverage, perhaps in Mountain Home (Figure 83 and Figure 84).

The monitoring trends for $PM_{2.5}$ show why this pollutant is considered Idaho's top priority for monitoring. The 3-year average 98% daily concentrations for FRM monitors show all monitors near the federal standard and at least four sites (Salmon, Pinehurst, Meridian, and Franklin) registering violations and/or exceedances between 2010 and 2013 (Figure 14).

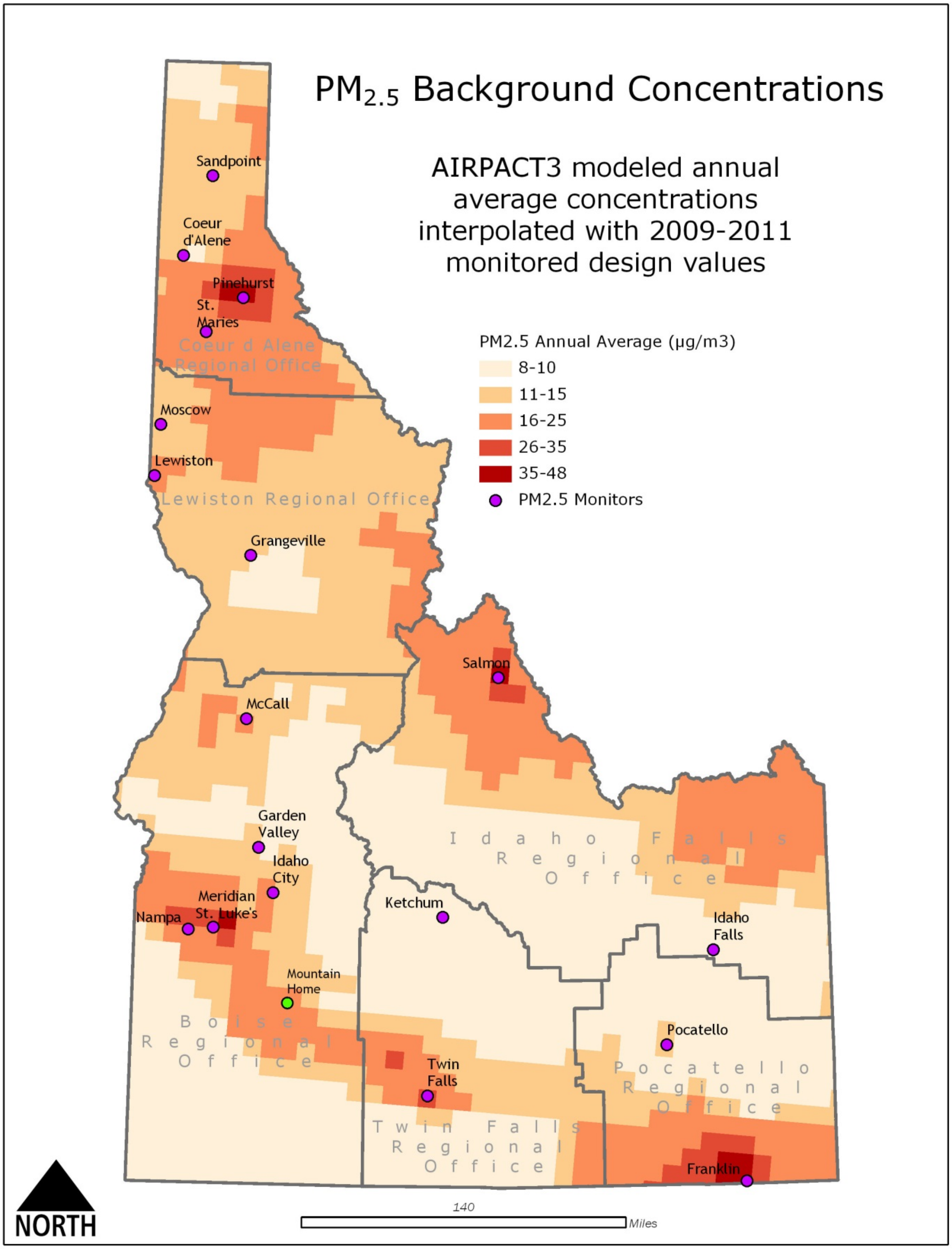

Figure 83. PM$_{2.5}$ annual average modeled design values.

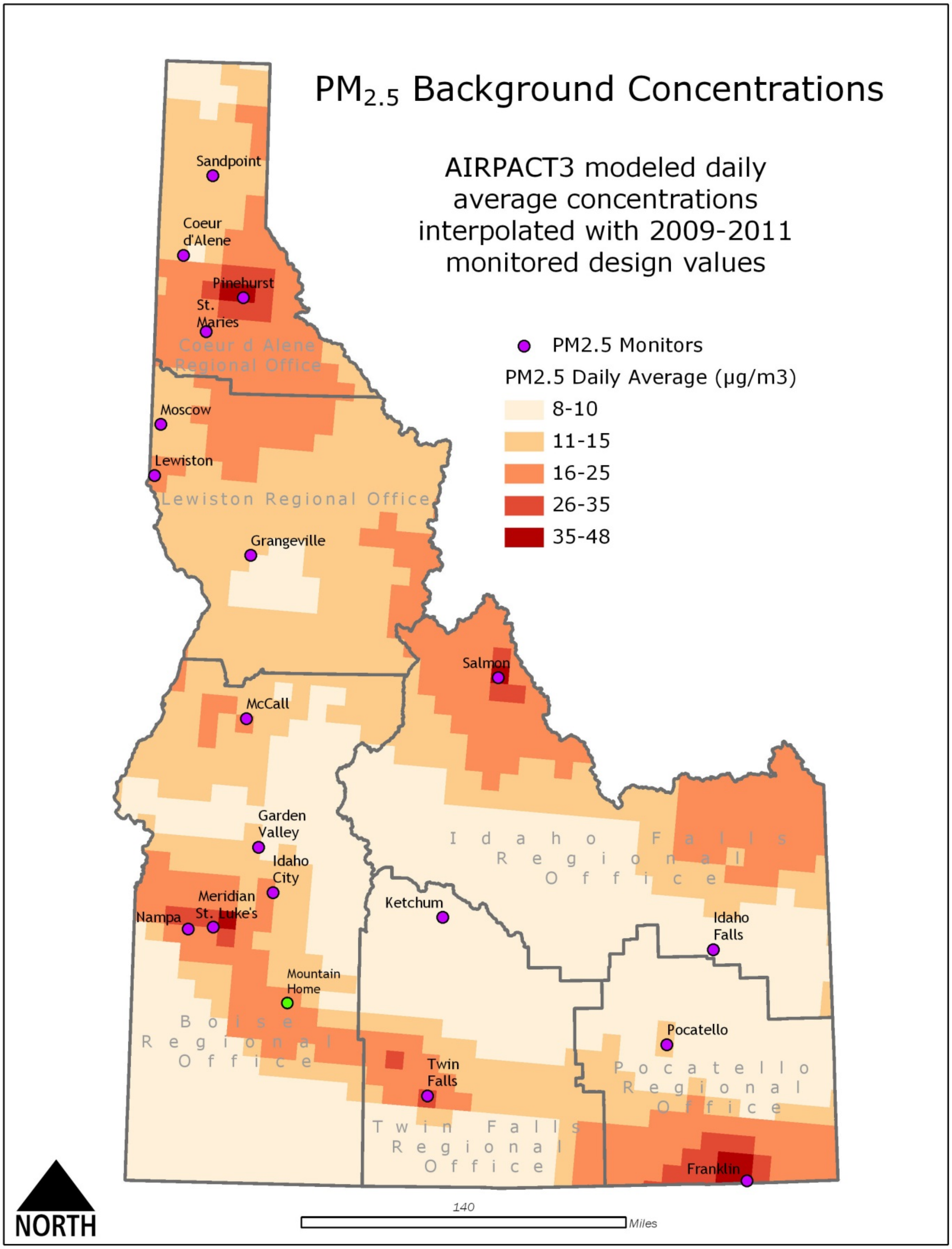

Figure 84. PM$_{2.5}$ daily average modeled design values.

4.3.7 Sulfur Dioxide (SO_2)

Figure 85 shows the location of SO_2 monitors in Idaho's network. Based on population alone, there are no minimum requirements for the number of SO_2 monitoring sites (CFR 2009). Appropriate spatial scales of representation are micro, middle, and neighborhood (CFR 2009). The Pocatello Sewage Treatment Plant and Soda Springs sites are middle scale, and Meridian, which measures trace SO_2, is neighborhood scale. Monitoring of SO_2 is required at NCore sites (CFR 2009); the Meridian NCore monitor fulfills this obligation. The network requirements are satisfied for SO_2 monitoring.

In June 2010, EPA adopted a new 1-hour SO_2 NAAQS: the 3-year average of the 99th percentile daily maximum 1-hour average concentration. The NAAQS was set at 75 ppb. Minimum monitoring requirements according to the new standard are based on a population-weighted emissions index (PWEI). According to the PWEI, Idaho is not required to monitor SO_2. However, the new SO_2 NAAQS have provisions for modeling as a tool to assess compliance, and if subsequent modeling indicates nonattainment, then monitoring will be required as a part of the SIP process.

Monitoring SO_2 typically focuses on measuring pollution from specific stationary sources. Figure 86 shows the location of the top five point sources of SO_2 in Idaho. The Soda Springs site monitors the fourth-largest point source, P4 Production (Monsanto). The Meridian trace SO_2 monitor is in the same airshed (Treasure Valley) as Idaho's largest point source (Amalgamated Sugar–Nampa), but the site is not source oriented. The Pocatello Sewage Treatment Plant monitor is in the same airshed (Pocatello) as the second-largest SO_2 emitter in the state (Simplot). The locations in Idaho with the largest stationary SO_2 emission sources appear to be adequately covered by the network.

Other than point sources, the dominant emissions category for SO_2 is nonpoint (area) sources (Figure 87). Figure 88 indicates that Ada and Canyon Counties have significant emissions of nonpoint source SO_2, as does Bonneville County. In this case, the network does not seem to fully cover locations with high emissions of nonpoint sources.

An assessment of the SO_2 network based purely on emissions would conclude that the monitoring network is inadequate. However, those areas that are monitored remain below the NAAQS (Figure 16), and those sites seem to be well-targeted at the highest emissions sources.

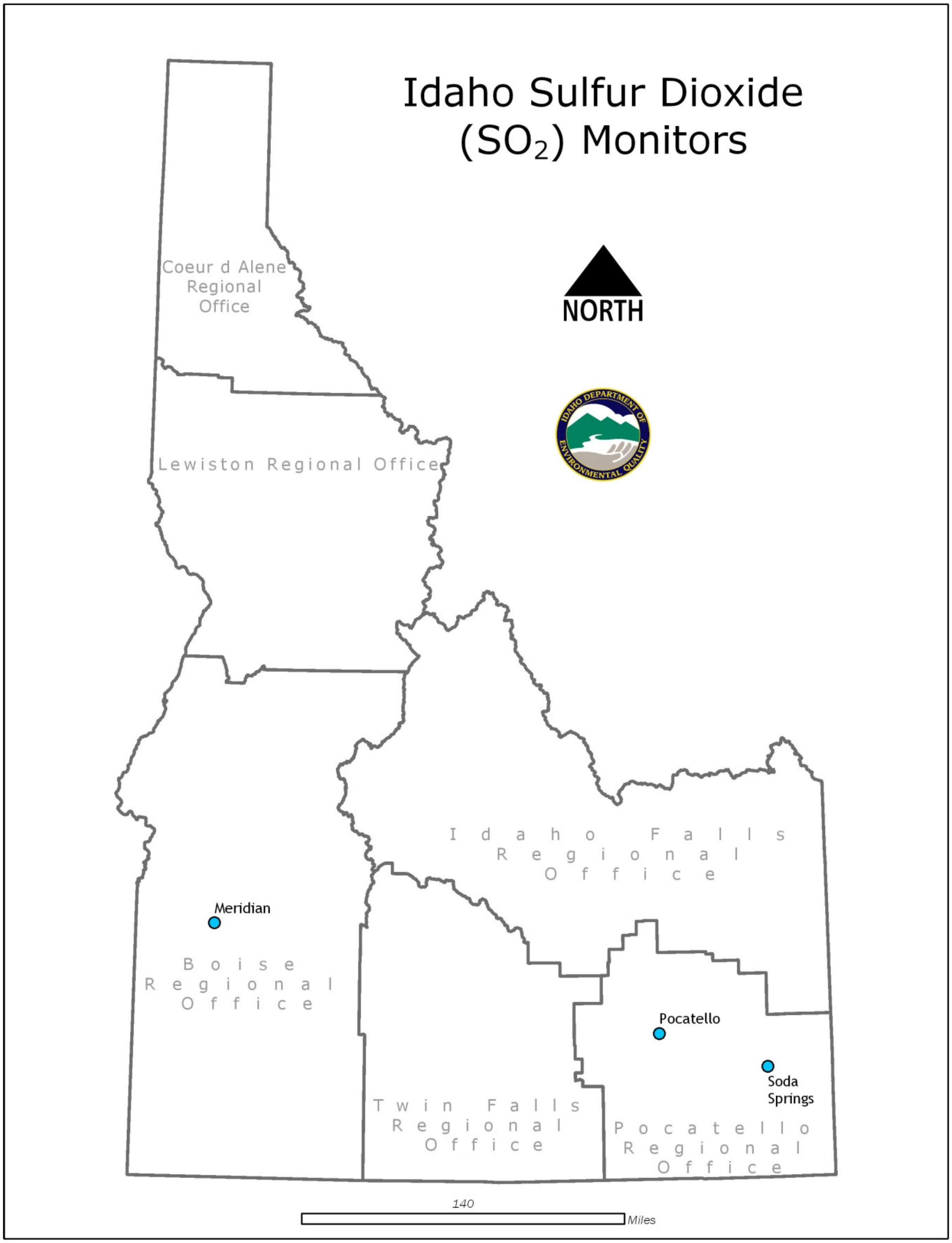

Figure 85. Idaho's SO_2 monitoring network.

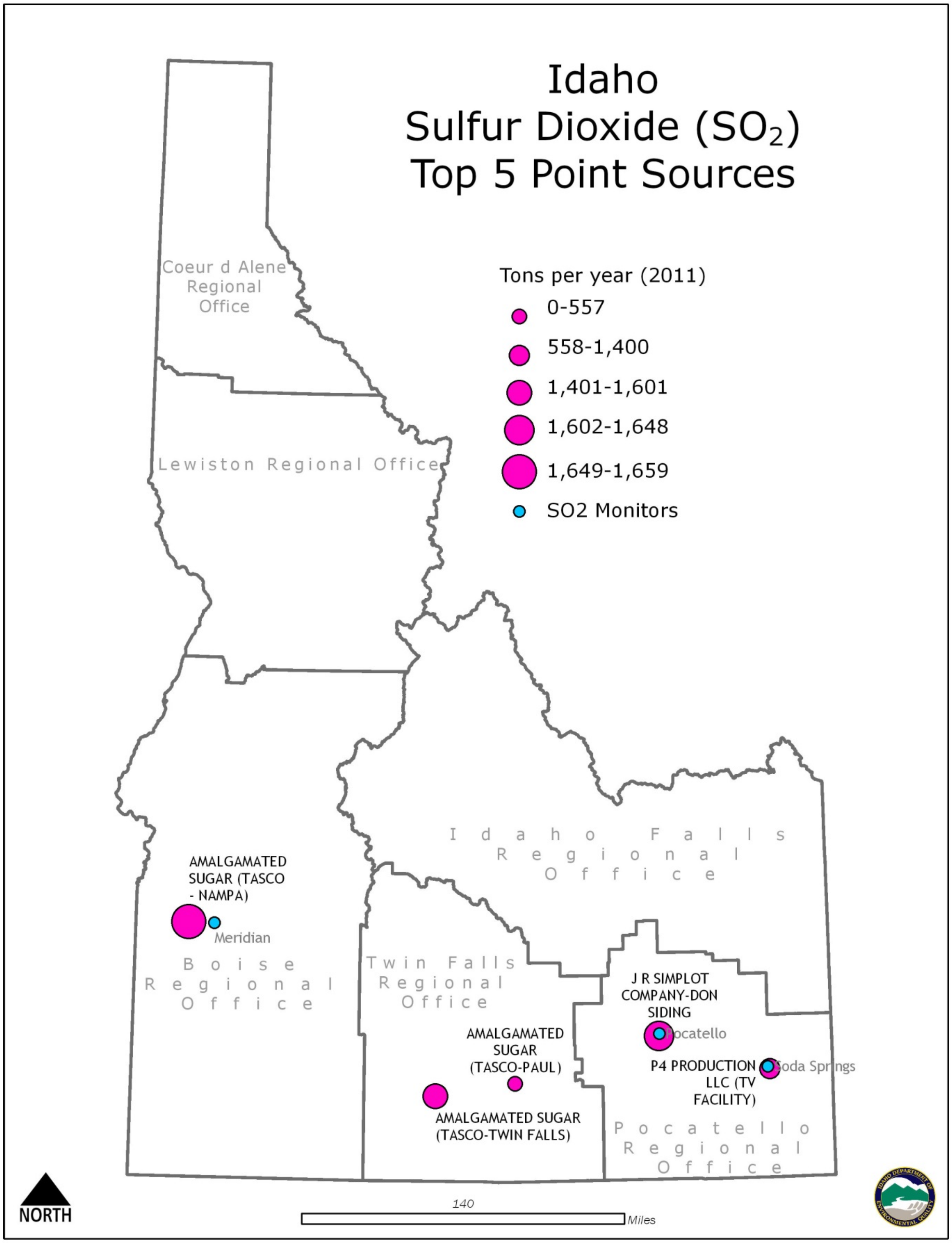

Figure 86. Top five SO_2 emissions point sources in Idaho.

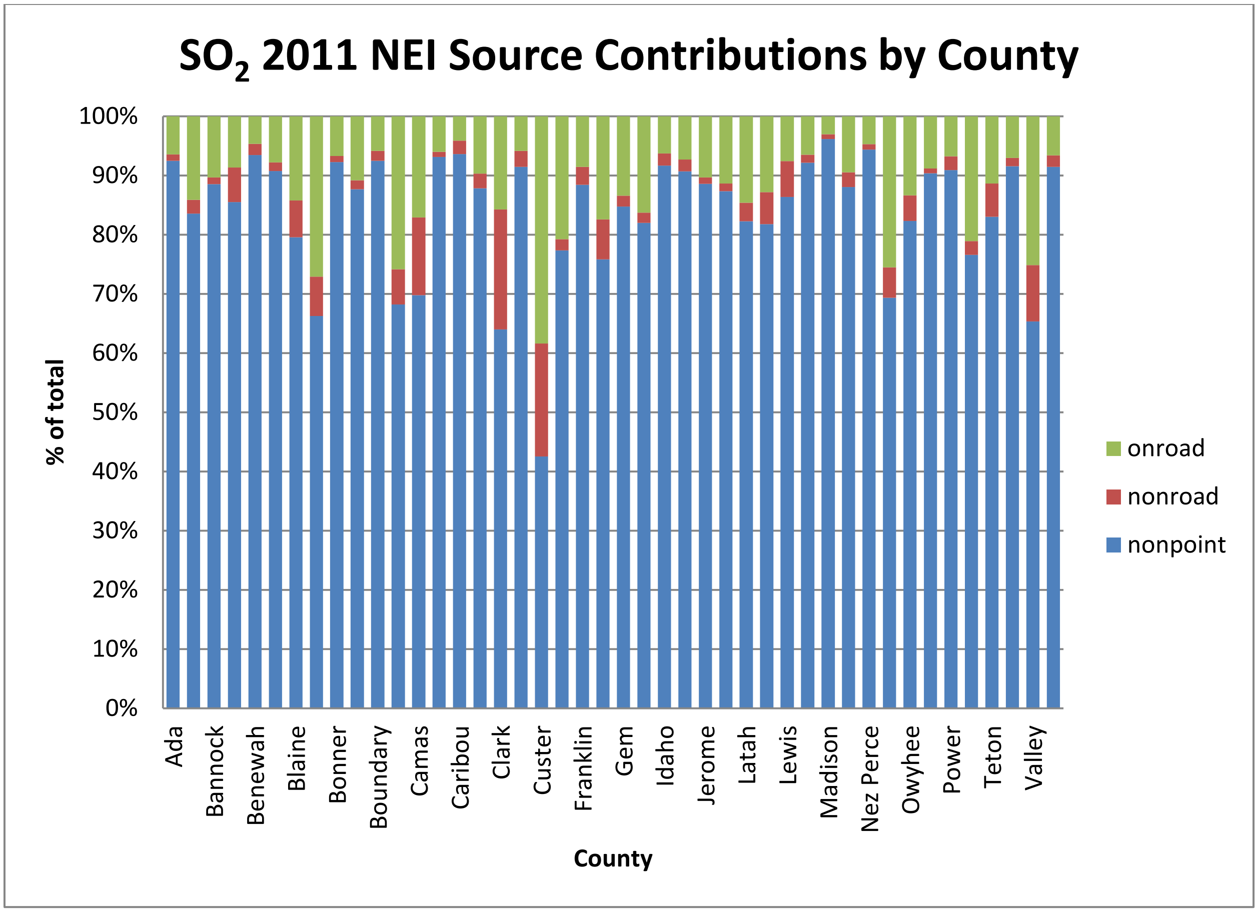

Figure 87. SO_2 emissions by source category and county.

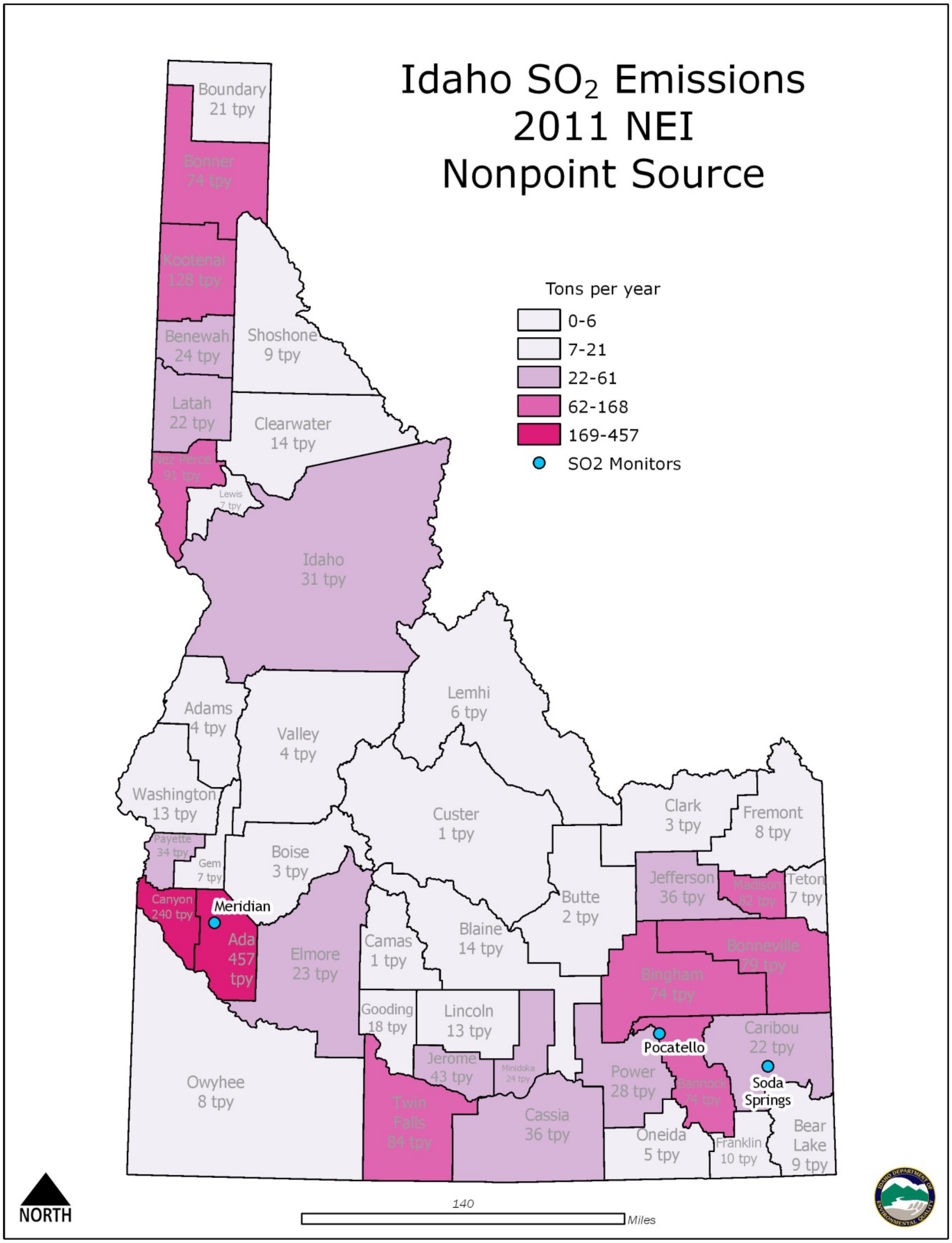

Figure 88. County-level nonpoint source emissions of SO_2.

4.4 Summary and Site Rankings and Recommendations

This section briefly summarizes the network assessment, then provides the site rankings and recommendations.

The network assessment analyzes Idaho's monitoring network at three spatial scales and presents a site ranking. Individual sites are assessed at the site scale by examining the scales of representation, demographics, geography, meteorology, and monitoring objectives. At the airshed scale, only one airshed (Treasure Valley) maintains multiple monitors that measure the same pollutant. This airshed is investigated at the airshed scale by exploring recent demographic shifts within the area. At the statewide scale, the network is examined by pollutant; for each criteria pollutant, the network requirements, sources of emissions, and modeled concentrations were considered.

The site ranking matrix weighs categories of values determined to be important by DEQ. The result applies one of four value categories to each site: critical, high, moderate, or low (Table 10).

Table 12 summarizes the recommendations from each of the network assessment sections and provides a final recommendation for each site.

- One site will require a re-evaluation of its scale of representation.
- One site is recommended to change from population exposure site type to source impact.
- Another site may require re-siting to be downwind of the source facility.
- It is recommended that a $PM_{2.5}$ monitor be placed in Boise for monitoring population exposure to smoke.

Overall, Idaho operates an efficient monitoring network with limited resources. No sites are recommended for termination at present. Should funds become available to deploy new monitors, after equipment replacement needs are addressed, new sites will be determined by factors identified in this table.

Table 10. DEQ ambient air monitoring network site ranking.

Site	Site Leveraged for Smoke Management?	Site Required for Local Ordinance?	Site Required for AQI Support?	Site Paired with Met Station?	Weighted Sum, Columns 1-4	Rank Based on Monitoring Objective	Population Served	Rank Population Served <20,000 =1 <50,000 =2 <100,000=3 <200,000 =4	Combined Rank (CR)	**Site Value** CR ≤2.5=Low CR ≤5.0=Med CR≥5.0=High
Coeur d' Alene	1	1	1	1	3.0	1	140,786	4	7.00	**High**
Garden Valley	1		1		1.5	3	6,944	1	2.50	**Low**
Grangeville	1		1	1	2.0	2	16,269	2	4.00	**Medium**
Idaho City	1		1		1.5	3	6,964	1	2.50	**Low**
Idaho Falls	1		1		1.5	3	134,766	4	5.50	**High**
Ketchum	1		1		1.5	3	21,193	2	3.50	**Medium**
Lewiston	1		1	1	2.0	2	62,026	3	5.00	**High**
McCall	1		1		1.5	3	9,698	1	2.50	**Low**
Moscow	1		1	1	2.0	2	37,988	2	4.00	**Medium**
Twin Falls	1		1		1.5	3	100,468	4	5.50	**High**
Weight	0.75	1.00	0.75	0.5						

Table 11. Sites not ranked, mandated by Federal and State Rules.

	Site Required for NAA?	Site Required for NAAQS?	Site Required for Permit?	Site Value
Boise Eastman Garage	CO	CO		**Critical**
Boise Fire Station #5	PM_{10}	PM_{10}		**Critical**
Boise White Pine Elementary		O_3		**Critical**
Franklin	$PM_{2.5}$	$PM_{2.5}$		**Critical**
Meridian St. Luke's		$PM_{2.5}$, O_3, NCore		**Critical**
Meridian Central Drive		NO_2		**Critical**
Nampa		PM_{10}, $PM_{2.5}$		**Critical**
Pinehurst	PM_{10}, $PM_{2.5}$	PM_{10}, $PM_{2.5}$		**Critical**
Pocatello Garrett and Gould	PM_{10}	PM_{10}		**Critical**
Pocatello Sewage Treatment Plant			SO_2	**Critical**
Salmon		$PM_{2.5}$		**Critical**
Sandpoint	PM_{10}	PM_{10}		**Critical**
Soda Springs			SO_2	**Critical**
St. Maries		$PM_{2.5}$		**Critical**

Table 12. Final site recommendations.

Site	Site Scale	Airshed Scale	Statewide Scale	Site Ranking	Final Recommendation
Boise Eastman Garage	change site type from population exposure to source impact			Critical	Keep
Boise Fire Station #5			add $PM_{2.5}$ monitor for smoke AQI	Critical	Keep
Boise White Pine Elementary				Critical	Keep
Coeur d' Alene				High	Keep
Franklin				Critical	Keep
Garden Valley				Low	Keep
Grangeville				Medium	Keep
Idaho City				Low	Keep
Idaho Falls				High	Keep
Ketchum				Medium	Keep
Lewiston				High	Keep
McCall				Low	Keep
Meridian Central Drive				Critical	Keep
Meridian St. Luke's				Critical	Keep
Moscow				Medium	Keep
Nampa				Critical	Keep
Pinehurst				Critical	Keep
Pocatello Garrett and Gould				Critical	Keep
Pocatello Sewage Treatment Plant				Critical	Keep
Salmon				Critical	Keep
Sandpoint	change to neighborhood scale			Critical	Keep
Soda Springs	resite to be downwind of facility			Critical	Keep
St. Maries				Critical	Keep
Twin Falls				High	Keep

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5 Technology

The ambient air monitoring network in Idaho includes several types of monitors that have been purchased over time to meet monitoring needs. Because monitoring equipment is often exposed to weather and operates continually, instrument lifetime is generally accepted as 7 years of service. As budget allows, replacement equipment is purchased on a cycle as close to every 7 years as possible.

5.1 Ambient Air Monitoring Methodology

The analytical method selected for monitoring a specific criteria pollutant is dependent on the monitoring technology used. For the gaseous criteria pollutants—SO_2, CO, NO_2, and O_3—the analyzers are designed as self-contained monitoring units that do not require additional analysis. For the particulate matter criteria pollutants—PM_{10} and $PM_{2.5}$—some of the units use analytical methods that establish concentrations within a self-contained system while other units require additional analytical methods that evaluate the captured sample (i.e., filter weighing) to establish the pollutant concentrations present in the environment.

In general, DEQ employs the following measurement methods:

Nondispersive Infrared Photometry for CO—The detection and measurement of CO uses this chemical's propensity to absorb infrared (IR) radiation at wavelengths near 4.7 microns. Broadband IR radiation is generated using a high-energy heated element. The IR radiation is modulated using gas filter correlation technology. Gas filter correlation uses a rotating wheel containing two gas-filled cells that selectively modulate the IR radiation. One cell contains nitrogen (the measure cell), while the other contains CO (the reference cell). Concentrations are proportional to the differences observed between the two cells.

Fluorescence for SO_2—The physical principle used in SO_2 molecule measurement relies on exciting an electron shell, which occurs in the presence of a specific wavelength (214 nanometers [nm]) of ultraviolet (UV) radiation, and the subsequent relaxation, which produces a photon of light. A photo multiplier tube allows the light emissions to be measured as the SO_2 molecule returns to the ground state. The intensity of this light is proportional to the quantity of SO_2 present in the sample.

Chemiluminescence for NO, NO_2, NO_x, NO_y—The principle of measurement is based on the reaction of a nitrogen monoxide (NO) molecule with an internal source of O_3 in an evacuated reaction cell that results in the emission of light. The resulting light emitted by the reaction is monitored and correlated to the concentration of NO in the sample. Secondary measurement of other oxides of nitrogen (NO_2, NO_x, NO_y) is accomplished by catalytic conversion (via a molybdenum converter) of those species to NO during a separate measurement cycle.

Photolytic Conversion for NO, NO_2, NO_x—Even low-temperature molybdenum converters transform other nitrogen-containing compounds, such as HNO_3 or peroxyacyl nitrates (PAN), to a considerable extent. Simultaneous measurements of NO_2 performed with molybdenum and photolytic converters have shown significantly different results in the presence of such compounds.

In the photolytic process, the sample gas passes through a cell where it is exposed to light at a specific wavelength from an LED array. This causes the NO_2 to be selectively converted to NO with negligible interference from other gases. It provides ultra-sensitive performance, with a lower detectable limit of 0.1 ppb or better, and is ideally suited for NCore research sites and the low-level direct NO_2 measurements required for near-road monitoring.

Ultraviolet Photometry for O_3—The physical principle used to measure ozone relies on the absorption of UV radiation by the O_3 molecule at approximately 255 nm. The concentration of ozone present in the sample stream is proportional to the amount of light absorbed.

Time-Integrated Samplers for PM—This methodology uses precisely weighed filters that are placed in a carefully controlled volumetric flow for a specified period of time. The combination of flow and duration identifies a controlled volume that has passed through the clean filter. The mass added to the filter, determined by subsequent weighing, determines the particulate concentration of the air. Further speciation analysis is occasionally used to characterize the composition of the particulate matter. Intermittent filter-based methods require using an independent analytical testing laboratory that DEQ contracts with for these services.

Continuous Operation for PM—Multiple techniques are used for the near-real-time measurement of particulate matter.

- **Tapered Element Oscillating Microbalance (TEOM)—**The TEOM units use an inertial mass measurement technique for making real-time, direct measurement of particle mass collected on a filter. This measuring equipment can determine the fine changes in mass that accumulate on the filter through changes in the frequency of the filter oscillations.
- **Nephelometry and E-Samplers—**Light is emitted from an internally mounted, variable-rate flashing light source. The light's wavelength is limited to 475 nm by an optical filter. Particulate concentrations are proportional to the amount of light scattered onto the optical detector.
- **Beta-attenuation—**In a beta-attenuation monitor (BAM), a small carbon-14 element emits a constant source of high-energy electrons known as beta particles. An external pump pulls a measured amount of dust-laden air through a filter tape. The difference in the attenuation of the beta particle signal before and after particle accumulation is proportional to the particulate concentration in the air.

5.2 Monitoring Technology Benefits and Challenges

Over time, advancements in technology have provided both benefits and challenges for monitoring organizations. Benefits include the availability of near real-time instruments available from multiple manufacturers for nearly all pollutants. Real-time instruments provide timely data on ambient concentrations making the feedback more useful for public health advisories.

Additionally, modern computing and digital capabilities are increasingly being integrated into instruments, which provides more reliable access to measurements and instrument diagnostic and control information. Combined with data acquisition or smart DAS systems, significant efficiencies and quality improvement processes can be implemented at monitoring organizations.

The advances do not come without challenges. The training and level of maintenance it takes to upkeep these systems is substantially greater than older systems. And due to the increasing complexity and sophistication of monitoring instruments, capital costs have increased dramatically. Because of this, monitoring organizations tend to acquire new instrumentation in small increments, resulting in a monitoring network with instruments of varying maturities and capabilities. This reality increases operational complexity in technical infrastructure, procedure development, and equipment maintenance.

DEQ uses EPA-approved FEM or FRM monitors for determining pollutant concentration for all NAAQS compliance determinations. However, for special-purpose monitoring (such as smoke monitoring or community-specific AQI determination), DEQ typically uses less expensive special purpose monitors (SPMs). These SPMs often provide data that are not comparable to the FRM due to differences in their design. In these cases, it is desirable to co-locate these instruments with an FEM or FRM monitor for a specified duration, typically a year, and develop correction factors to make the data “FRM-like.” This process is resource intensive, and it also introduces a degree of uncertainty when the SPM data are used for determining background concentrations for a given area (e.g., dispersion modeling for air quality permits). To overcome this, DEQ is purchasing continuous FEM monitors for $PM_{2.5}$ and operating them as SPMs and using the data for AQI purposes only. This change is accomplished by making a minor modification to the inlet on the sampler. So far, DEQ has made this change at 12 of the monitoring sites used for reporting and forecasting daily AQIs.

5.3 Ambient Air Monitoring Technology Needs

A robust monitoring network of continuous SPM $PM_{2.5}$ monitors that can produce “FRM-like” data without correction is a goal for DEQ’s AQI and smoke monitoring programs. This goal also applies to DEQ’s seasonal CRB monitoring program.

DEQ has evaluated two types of $PM_{2.5}$ FEM monitors and has even used the FEM as the primary NAAQS reporting monitor at two monitoring sites. However, due to high bias in the FEM, when compared to the FRM, DEQ has returned to designating the FRM as the primary $PM_{2.5}$ NAAQS monitor at its 6 core $PM_{2.5}$ sites. DEQ’s goal is still to use a single continuous FEM at these 6 sites for assessing NAAQS and for the AQI program. Hourly data are certainly more robust and practical for a wider audience of data users, including health researchers.

In the near future, DEQ’s vendor will be phasing out support for DEQ’s network of 5 PM_{10} TEOMs. DEQ will need to find an alternative FEM for PM_{10} measurements.

The 8-hour ozone NAAQS is currently under consideration, and EPA is expected to announce a new standard in October 2015. The proposed range of the new 8-hour ozone NAAQS is 65–70 $\mu g/m^3$. This standard will put the Treasure Valley very close to nonattainment for 8-hour ozone. EPA is also proposing that airsheds that do violate the new standard, and have an NCore station in the affected airshed, begin monitoring for VOCs and nonmethane hydrocarbons at those NCore sites. Upper-air sounding measurements for determining atmospheric mixing heights may also be required. DEQ currently has no resources to comply with this requirement.

DEQ uses DR DAS for its central data acquisition and data management software and database. The inherent design of this network poses many challenges, including the complexity of the system's routine operations, the many entities linked within the software, and the many choices available for the hardware used to enable the transfer of data from the site to the database. Technology is constantly changing—software and operating systems are updated and modems, routers, and switches are upgraded or re-engineered—and because of this, it is difficult to maintain a steady state of operations. Special training and skills are needed to maintain the communications network and can require contracting services to specialists, at added cost to DEQ.

6 Cross-Cutting Network Considerations

6.1 Program Standardization

Standardizing equipment and processes offers many advantages to monitoring agencies. Due to the complexity and sophistication of analyzers, telecommunications equipment, data management systems, and other operational processes, efficiencies can be achieved and quality improved. However, the practicality of standardization offers challenges.

Because of budget constraints, monitoring organizations tend to acquire new instrumentation in small increments over time and end up with a network of instruments with varying maturities and capabilities. During this time, new manufacturers emerge, others no longer support air monitoring, and others simply update and improve their equipment offerings. Standardization at the instrument level is difficult. At a minimum, DEQ applies the following considerations when acquiring new air monitors:

- For criteria pollutant monitoring (NAAQS), instruments are approved and designated by EPA as either FRM or FEM monitors.
- Equipment is commercially available and is used by other air quality monitoring organizations. DEQ does not use experimental/research equipment for routine monitoring.
- Equipment is reasonably priced.
- Equipment vendors provide installation, operation, and maintenance documentation and training with equipment purchases.
- Proprietary communication software, if required, is provided with the equipment at the time of purchase.
- Monitors use serial or Ethernet connectivity to external data loggers or telemetry equipment. Analog-only communications abilities are being phased out of operation.

Some vendors have a long history and are strong in the air monitoring industry. Lines of instruments from these vendors typically contain similar features and structure, easing their introduction into a network with older instruments. Although DEQ uses equipment from multiple vendors, DEQ has benefited from maintaining as much consistency in instrumentation as possible. Familiarity with instruments provides operational efficiency in areas such as staff training, procedure documentation and compliance, maintenance costs, and incident response times.

One area where DEQ has pursued standardization at the instrument level is in meteorological measurements (Table 13). Meteorological sensors generally have a very long service life and are relatively inexpensive to replace. As such, DEQ has developed what it considers a standard meteorological tower configuration and infrastructure to make meteorological measurements consistent across the state.

Another area of standardization has come in documentation. Clear, thorough, and consistent documentation is the core of the DEQ training program. The DEQ Air Quality Monitoring Training Plan identifies training objectives, roles and responsibilities, and a number of resources available to staff and managers for staff development. Additionally, DEQ's quality assurance project plan (QAPP) and standard operating procedures (SOPs) are written using a requisite, department-approved template as a framework for all QAPPs and SOPs. This framework ensures consistency of subject matter and content detail so the documents are both useful for initial training and efficiently used as reference material.

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Table 13. Typical meteorological measurements and sensors in DEQ meteorological monitoring network.

Measurement Type	Model	Operating Range (units)	Resolution / Accuracy	Applicable Measurement Quality Objectives				
				PAMS	NCore	SLAMS/SPM	PSD	Modeling
Wind speed/wind direction	05305-AQ	0.4–50 (m/s)	± 0.2 m/s or 1%	X	X	X	X	X
Barometric pressure	PTB110	500–110 (mb)	± 0.03 mb @ 20 °C	X	X	X	X	X
Barometric pressure	PTB101B	600–1,060 (mb)	± 0.05 mb @ 20 °C	X	X	X	X	X
Aspirated temperature	43347 (plus shield)	-50–50 (°C)	± 0.1 °C w/ NIST calibration	X	X	X	X	X
Ambient temperature	107 (plus shield)	-35–50 (°C)	± 0.2 °C	N/A	N/A	X	N/A	N/A
Solar radiation	LI200X	0–3,000 (Watts/m^2)	± 0.2 Watts/m^2	X	X	N/A	X	X
Relative humidity	HMP45C	0–100 (%)	± 0.1% / °C	X	X	X	X	X
Relative humidity	CS215	0–100 (%)	± 0.2% / °C	X	X	X	X	N/A
Precipitation	TE525	Indefinite (inches rain)	0.01 inches / ± 5%	X	X	N/A	X	X

Notes: National Institute of Standards and Technology (NIST), Photochemical Assessment Monitoring Network (PAMS), State and Local Ambient Monitoring Station/special purpose monitor (SLAMS/SPM), Prevention of Significant Deterioration (PSD)

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6.2 Leveraging Other Monitoring Networks

The Air Quality Research Subcommittee (AQRS) of the Committee for Environment and Natural Resources (CENR) has developed the following list of the major routine operating air monitoring networks (Table 14). More information on AQRS and CENR can be obtained at *www.epa.gov/ttn/amtic/cenvnat*.

The networks highlighted yellow have monitoring sites operating in Idaho. When applicable, data from these monitoring sites are obtained to supplement DEQ's monitoring network (e.g., Hells Canyon and Craters of the Moon IMPROVE sites are used to supplement DEQ's $PM_{2.5}$ network for transport and background sites).

7 Conclusions

Overall, the Idaho state network is efficient and effective at meeting the monitoring objectives supporting DEQ's policy goal. Significant network changes are not needed, although some recommendations have been made for improving certain monitoring sites. Anticipated future ambient air monitoring requirements mandated by EPA will result in substantial costs, which may cause resource conflicts across programs supported by DEQ's network.

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Table 14. Other major routine operating air monitoring networks.

Network	Lead Fed. Agcy.	Number of Sites	Initiated	Measurement Parameters	Location of Information and/or Data
State/Local/Federal Networks					
NCore—National Core Monitoring Network	EPA	75	2008	CO, $NO/NO_2/NO_Y$, O_3, $PM_{2.5}/PM_{10-2.5}$, $PM_{2.5}$ speciation, SO_2, NH_3, HNO_3, surface meteorology	*www.epa.gov/ttn/amtic/monstratdoc*
SLAMS—State and Local Ambient Monitoring Stations	EPA	~3,000	1978	CO, Pb, NO_x/NO_2, O_3, $PM_{2.5}/PM_{10}$, SO_2	*www.epa.gov/ttn/airs/airsaqs/aqsweb/aqswebhome*
STN—$PM_{2.5}$ Speciation Trends Network	EPA	300	1999	$PM_{2.5}$, $PM_{2.5}$ speciation, major Ions, metals	*www.epa.gov/ttn/airs/airsaqs/aqsweb/aqswebhome*
PAMS—Photochemical Assessment Monitoring Network	EPA	75	1994	O_3, NO_x/NO_Y, CO, speciated VOCs, carbonyls, surface meteorology & upper air	*www.epa.gov/ttn/airs/airsaqs/aqsweb/aqswebhome*
IMPROVE—Interagency Monitoring of Protected Visual Environments	NPS	110 plus 67 protocol sites	1988	$PM_{2.5}/PM_{10}$, major ions, metals, light extinction, scattering coefficient	*http://vista.cira.colostate.edu/IMPROVE/*
CASTNet—Clean Air Status and Trends Network	EPA	80+	1987	O_3, SO_2, major ions, calculated dry deposition, wet deposition, total deposition for sulfur/nitrogen, surface meteorology	*www.epa.gov/castnet*
NADP/NTN—National Atmospheric Deposition Program / National Trends Network	USGS	200+	1978	Major ions from precipitation chemistry	*http://nadp.sws.uiuc.edu/*
NADP/MDN—National Atmospheric Deposition Program / Mercury Deposition Network	None	90+	1996	Mercury from precipitation chemistry	*http://nadp.sws.uiuc.edu/mdn/*
AIRMoN—National Atmospheric Deposition Program / Atmospheric Integrated Research Monitoring Network	NOAA	8	1984	Major ions from precipitation chemistry	*http://nadp.sws.uiuc.edu/AIRMoN/*

Network	Lead Fed. Agcy.	Number of Sites	Initiated	Measurement Parameters	Location of Information and/or Data
Air Toxics Monitoring Networks					
NATTS—National Air Toxics Trends Stations	EPA	23	2005	VOCs, carbonyls, PM_{10} metals, Hg	*www.epa.gov/ttn/airs/airsaqs/aqsweb/aqswebhome*
Tribal Monitoring Networks					
Tribal Monitoring	EPA	120+	1995	CO, Pb, NO_x/NO_2, O_3, $PM_{2.5}/PM_{10}$, SO_2	*www.epa.gov/ttn/airs/airsaqs/aqsweb/aqswebhome*
Industry/Research Networks					
New Source Permit Monitoring	None	Variable	Variable	CO, Pb, NO_x/NO_2, O_3,$PM_{2.5}/PM_{10}$, SO_2	Contact specific industrial facilities
National/Global Radiation Networks					
RadNet—formerly Environmental Radiation Ambient Monitoring System (ERAMS)	EPA	200+	1973	Radionuclides and radiation	*www.epa.gov/enviro/html/erams*
Other Networks					
UV Index—EPA Sunwise Program	EPA	~50 US cities	2002	Calculated UV radiation index	*www.epa.gov/sunwise/uvindex*

8 References

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Appendix A. NAAQS summary

Clean Air Act §7409 requires EPA to review criteria pollutant NAAQS at 5-year intervals. Typically a revised NAAQS will include changes in ambient monitoring requirements. This has been the case in recent years and will likely continue in coming years. Table A1 provides a list of recently completed plus ongoing and upcoming NAAQS review schedules.

Table A1. EPA NAAQS review schedule.

Pollutant	NAAQS Level	Status of Current NAAQS Review	Proposed Changes	Expected Date of Final Decision
CO	9 ppm 8-hour 35 ppm 1-hour	Near-road requirements are being implemented	Phased approach will be used to implement the required near-road CO monitoring. 1 monitor was required in CBSA's of 2.5 million or more persons by Jan. 1, 2015. 1 monitor is required in CBSA's of 1 million or more persons (and less than 2.5 million persons) by Jan. 1, 2017. These near-road CO monitors are to be co-located with near-road NO_2 monitors.	Final rule was signed in August 2011
Pb	0.15 $\mu g/m^3$ rolling 3-month average	Reconsideration of monitoring requirements per 40 CFR Part 58 proposed changes	Lead monitoring no longer required at NCore sites	Fall 2015
NO_2	53 ppb annual mean 100 ppb 1-hour	Current review ongoing, in addition to near-road requirements being implemented	Near-road network Phase 3 to begin Jan. 1, 2017—monitoring to take place in CBSA's with population between 500,000 and 1.0 million persons.	Proposal expected fall 2016
Ozone	0.075 ppm 8-hour	In final review	Proposed changes include: lowering of NAAQS level; changes to ozone monitoring season for 33 states; changes to PAMS network; addition of a new FRM; and revisions to the FEM testing requirements.	Proposal signed Nov. 25, 2014. Final rule required no later than Oct. 1, 2015.
PM_{10}	150 $\mu g/m^3$ daily	Near-road requirements are being implemented	$PM_{2.5}$ near-road monitoring will be required in CBSA's of 1 million or more persons. Monitors are to be co-located with near-road NO_2 and CO monitors. Monitoring will be phased in between Jan. 2015 and Jan. 2017.	Final rule signed Dec. 14, 2012.
$PM_{2.5}$	12 $\mu g/m^3$ annual average 35 $\mu g/m^3$ daily			
SO_2	0.075 ppm 1-hour	Data requirements final rule in review	States will be asked to choose between monitoring and/or modeling for meeting air quality data requirements.	Final rule expected summer 2015

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Appendix B. Index of Health Studies and Publications Based on Associated Ambient Air Monitoring Data

Public Health Consultations Published by Agency for Toxic Substances and Disease Registry (ATSDR)
Available at: *www.atsdr.cdc.gov/HAC/PHA/HCPHA.asp?State=ID*

1. Evaluation of Air Exposure Potlatch Pulp Mill; September 19, 2003
2. Evaluation of Benzene Air Contamination in Lewiston Area, Idaho; February 16, 2005
3. Evaluation of Air Contaminants in the Treasure Valley Area, Ada and Canyon Counties, Idaho; September 30, 2006
4. Portneuf Valley Air Toxics Ambient Air Data Evaluation & Health Assessment; August 21, 2007
5. Evaluation of Potential Health Effects from Air Toxics Lewiston Air Toxics Monitoring 2006-2007; February 18, 2009; Revised: September 3, 2009
6. Evaluation of Potential Health Effects from Air Toxics: Treasure Valley Air Monitoring 2007-2008, Ada and Canyon Counties; September 1, 2010

Non-Published Studies

1. Particulate Matter and Health Effects in North Idaho: An Evaluation of Air Monitoring and Health Insurance Data. Jim Vannoy, Chris Johnson, Joe Pollard, Kara Stevens, June 2007
2. Correlation between Adverse Air Quality and Short-Term Human Health Effects, Treasure Valley, Idaho, USA 2002-2004; Lee Hannah, DVM, MS, MPH; Peter Curran, MD; Dale Stephenson, Boise State University; Chris Johnson, MPH, Idaho Cancer Data Registry; Jim Vannoy and Joe Pollard, Idaho Dept. of Health and Welfare
3. 2007 Treasure Valley Idaho Air Toxics Study, Final Report, Idaho DEQ; November 2009
4. Wet Deposition of Mercury in Idaho: Analysis of Results from Mercury Deposition Network and Comparisons to the REMSAD Model, Idaho DEQ; March 2013

Published in Journals

1. Koracin, D., D. Podnar, J.C. Chow, V. Isakov, Y. Dong, A. Miller, and M. McGown. 2000. “PM_{10} Dispersion Modeling for Treasure Valley, Idaho.” *J. Air & Waste Manage. Assoc.* 50(8):1335–1344.
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6. Kavouras, I.G., DuBois, D.W., Etyemezian, V., and Nikolich, G. 2013. "Spatiotemporal Variability of Ground-Level Ozone and Influence of Smoke in the Treasure Valley, Idaho." *Atmospheric Research* 124:44–52.
7. Wigder, N. L., Jaffe, D. A., Herron-Thorpe, F. L., and Vaughan, J. K. 2013. "Influence of Daily Variation in Baseline Ozone on Urban Air Quality in the United States Pacific Northwest." *Journal of Geophysical Research: Atmospheres* 118:3343–3354.
8. Vargas, V., Chalbot, M., O'Brien, R., Nikolich, G., Dubois, D.W., Etyemezian, V., and Kavouras, I.G. 2014. "The Effect of Anthropogenic Volatile Organic Compound Sources on Ozone in Boise, Idaho." *Environmental Chemistry* 11:445-458.

Annual Reports

1. American Lung Association State of the Air 2015, American Lung Association National Headquarters; 1301 Pennsylvania Ave NW, Suite 800, Washington, DC 20004-1725. *www.lungusa.org*.
2. Air Quality Monitoring Data Summaries; Idaho Department of Environmental Quality. *www.deq.idaho.gov/air-quality/monitoring/monitoring-network*.

DEQ Special Studies

1. Ozone and its Precursors in the Treasure Valley, Idaho. Final Report, May 2008; Ilias G. Kavouras, David W. DuBois, Vicken Etyemezian and George Nikolich; Division of Atmospheric Sciences, Desert Research Institute; *www.deq.idaho.gov/media/352767-ozone_treasure_valley_report.pdf*.
2. *Precursors and Sources of Fine Particulate Matter ($PM_{2.5}$) in the Treasure Valley, Idaho Airshed.* Final Report, December 2009. Ilias G. Kavouras, David W. DuBois, Vicken Etyemezian and George Nikolich; Division of Atmospheric Sciences, Desert Research Institute.
3. *Rathdrum Prairie Ozone Precursor Study*. Final Report, June 2009; Laboratory for Atmospheric Research; Washington State University; *www.deq.idaho.gov/media/353271-rathdrum_prairie_ozone_precursor_study.pdf*.

Appendix C. Potential Monitoring Requirements Associated with Revised NAAQS Monitoring Networks

Both recent and upcoming NAAQS revisions will impact DEQ's monitoring program. In most cases, additional monitors and new monitoring sites will be required in Idaho. Adding new sites will come at substantial cost and could force reductions in monitoring resources for nonessential monitors. Funding sources for new monitoring requirements have yet to be identified.

The following discussion of potential ambient air monitoring impacts is based on recent or proposed monitoring requirements, by pollutant.

Lead (Pb)

In fall 2015, EPA is expected to finalize the proposed revisions to the 40 CFR Part 58 monitoring requirements. The expectation is that Pb monitoring will no longer be required at NCore sites in cases where there are no sources emitting 0.5 tons per year (tpy) or greater of Pb. Idaho has no such sources. DEQ will wait for the proposed revisions and coordinate with EPA on approval to divest Pb monitoring at NCore.

If this is approved, DEQ will save approximately $20,000 in annual monitoring costs.

Nitrogen Dioxide (NO_2)

The ozone NAAQS revision, required to be final no later than October 1, 2015, may have an impact on NO_2 monitoring in DEQ's network if the NAAQS is low enough to place the Treasure Valley in nonattainment for ozone. If this is the case, a NO_x analyzer (including the ability to assess true NO_2) will likely be required at NCore, in addition to the NO_y analyzer already present.

This addition will cost DEQ approximately $50,000 for initial purchase and annual monitoring costs.

Ozone (O_3)

As stated above, the ozone NAAQS revision is required to be final no later than October 1, 2015. If the NAAQS is low enough, it has the potential to place the Treasure Valley in nonattainment for ozone. If this is the case, a variety of analyzers will be required to operate at DEQ's NCore site as part of an expansive PAMS network, which would include the NO_x analyzer already accounted for above, hourly concentrations of VOC by an auto gas chromatograph sampler, analysis of semivolatile compounds via Poly-Urethane Foam sampler, and other meteorological sensors beyond what are presently represented. Excluding the cost of the true NO_2 analyzer, the costs for purchase, installation, training, operation, maintenance, data management, and hiring an additional person to accommodate this PAMS network would amount to approximately $250,000. This cost would be higher if the ozone season is lengthened for Idaho.

$PM_{10\text{-}2.5}$ (PM_{coarse})

No changes are expected to take place with PM_{coarse} monitoring. DEQ will reference the revised monitoring requirements once the 40 CFR Part 58 changes become final in fall 2015.

Sulfur Dioxide (SO_2)

The SO_2 data requirements final rule is expected to be announced in summer 2015. This rule will likely allow states general flexibility in a modeling and/or monitoring approach to SO_2 data analysis. DEQ does not anticipate this final rule will result in any incurred monitoring costs but will reference the final rule when available.

Carbon Monoxide (CO)

No changes are anticipated for CO monitoring.

PM_{10} and $PM_{2.5}$

No changes are expected to take place with PM_{10} and $PM_{2.5}$ monitoring. DEQ will reference the revised monitoring requirements once the 40 CFR Part 58 changes become final in fall 2015.

Appendix D. Monitor and Station Network Summary

Table D1 is a list of DEQ's air monitoring sites, including addresses, global positioning system (GPS) coordinates, and Air Quality System (AQS) identifiers. Note: Coeur d'Alene LMP, Garden City, Kimberly, and Salmon Highway 93 are standalone meteorology sites and are not examined in this document.

Table D1. DEQ monitoring stations, locations, and AQS identification codes.

Site	Address	Latitude/ Longitude	AQS Identification
Sandpoint—University of Idaho	U of I Research Center, 2105 N. Boyer Ave., Sandpoint, ID 83864	+48.291820/ - 116.556560	160170003
Coeur d'Alene— Lancaster Rd.	Lancaster Road Hayden, ID 83835	+47.788908/ -116.804539	160550003
Coeur d'Alene LMP	Camp Cross, McDonald Point, Lake Coeur d'Alene, ID	+47.555253/- 116.817331	160550004
St. Maries	Forest Service Building St. Maries, ID 83666	+47.316667/ -116.570280	160090010
Pinehurst	106 Church St. Pinehurst, ID 83850	+47.536389/ -116.236667	160790017
Moscow	1025 Plant Sciences Rd. Moscow, ID 83843	+46.728000/ -116.955667	160570005
Lewiston	1200 29th St. Lewiston, ID 83501	+46.404722/ -116.968889	160690012
Grangeville	USFS Compound Grangeville, ID 83530	+45.9274167/ -116.105944	160490002
McCall	500 N. Mission St. McCall, ID 83638	+44.542486/ -116.062358	160850002
Garden Valley	946 Banks Lowman Rd. Garden Valley, ID 83622	+44.104675/ -115.973084	160150002
Nampa	923 1st St. S. Nampa, ID 83651	+43.580310/ -116.562676	160270002
Meridian St. Luke's	Eagle Rd & I-84 Meridian, ID 83642	+43.600699/ -116.347853	160010010
Meridian Near-road	1311 East Central Dr. Meridian, ID 83642	+43.593929/ -116.38125	160010023
Boise— Eastman Garage	166 N. 9th Boise, ID 83702	+43.616379/ -116.203817	160010014
Boise— Fire Station #5	16th & Front Boise, ID 83702	+43.618889/ -116.213611	160010009
Boise— White Pine Elementary	401 East Linden St. Boise, ID 83706	+43.577603/ -116.178156	160010017
Garden City	Ada County Fairgrounds Garden City, ID 83714	+43.647819 -116.269514	160010020
Idaho City	3851 Hwy 21 Idaho City, ID 83631	+43.823017/ -115.838557	160150001
Ketchum	111 West 8th St. Ketchum, ID 83340	+43.682558/ -114.371094	160130004
Twin Falls	650 W. Addison Twin Falls, ID 83301	+42.56505/ -114.494767	160830007
Kimberly	50 Highway 50 Kimberly, ID 83341	+42.553325/ -114.354853	160830009

Pocatello	Corner Garrett & Gould Pocatello, ID 83204	+42.876725/ -112.460347	160050015
Pocatello— Sewage Treatment Plant	Batiste Chubbuck Rd. Pocatello, ID 83204	+42.916389/ -112.515833	160050004
Franklin	East 4800 South Road Franklin, ID 83237	+42.013333/ -111.809167	160410001
Soda Springs	5-Mile Rd. Soda Springs, ID 83276	+42.695278/ -111.593889	160290031
Idaho Falls	Hickory and Sycamore St. Idaho Falls, ID 83402	+43.464700/ -112.046450	160190011
Salmon— Charles St.	N. Charles St. Salmon, ID 83467	+45.181893/ -113.890285	160590004
Salmon— Hwy 93	0.8 miles south of Hwy 93/48 intersection, Salmon, ID 83468	+45.161682/ -113.892212	160590005

Table D2 lists the pollutants monitored, the site designation, and the monitoring frequency for Idaho’s monitoring sites.

Table D2. Pollutants/monitor designation/sampling frequency.

Site	Pollutant Monitored	Monitor Designation	Monitoring Frequency
Boise— Eastman Garage	CO	SLAMS	Continuous
Boise— Fire Station #5	PM_{10} TEOM	SLAMS	Continuous
Boise— White Pine Elementary	O_3	SLAMS	Continuous
Coeur d’Alene— Lancaster Rd.	$PM_{2.5}$—BAM 10-meter meteorology	SPM SPM	Continuous Continuous
Franklin	$PM_{2.5}$—FRM $PM_{2.5}$—BAM	SLAMS SPM	Every third day (1/3) Continuous
Garden City	10-meter meteorology	SPM	Continuous
Garden Valley	$PM_{2.5}$—TEOM	SPM	Continuous
Grangeville	$PM_{2.5}$—TEOM 10-meter meteorology	SPM SPM	Continuous Continuous
Idaho City	$PM_{2.5}$—TEOM	SPM	Continuous
Idaho Falls	$PM_{2.5}$—BAM	SPM	Continuous
Ketchum	$PM_{2.5}$—TEOM	SPM	Continuous
Kimberly	10-meter meteorology	SPM	Continuous
Lewiston	$PM_{2.5}$—TEOM 10-meter meteorology	SPM SPM	Continuous Continuous
McCall	$PM_{2.5}$—TEOM	SPM	Continuous

Meridian	PM_{10}—FRM - Pb	Precision	Every twelfth day (1/12)
St. Luke's	PM_{10}—FRM - Pb	NCore	Every sixth day (1/6)
	$PM_{10-2.5}$—FRM	NCore	Every third day (1/3)
	$PM_{2.5}$—FRM	NCore	Every third day (1/3)
	$PM_{2.5}$—FRM	Precision	Every sixth day (1/6)
	$PM_{2.5}$—TEOM 1405-F	SPM	Continuous
	$PM_{2.5}$ Chemical Speciation	NCore	Every third day (1/3)
	O_3	NCore	Continuous
	SO_2	NCore	Continuous
	NO_Y	NCore	Continuous
	CO	NCore	Continuous
	10-meter meteorology	NCore	Continuous
Moscow	$PM_{2.5}$—TEOM	SPM	Continuous
	10-meter meteorology	SPM	Continuous
Nampa	PM_{10}—TEOM	SLAMS	Continuous
	$PM_{2.5}$—FRM	SLAMS	Every sixth day (1/6)
	$PM_{2.5}$—BAM	SPM	Continuous
Pinehurst	$PM_{2.5}$—FRM	SLAMS	Every day (1/1)
	$PM_{2.5}$—BAM	SLAMS	Continuous
	PM_{10}—TEOM	SLAMS	Continuous
	10-meter meteorology	SPM	Continuous
Pocatello—Garrett and Gould	$PM_{2.5}$—TEOM	SPM	Continuous
	PM_{10}—TEOM	SLAMS	Continuous
	10-meter meteorology	SPM	Continuous
Pocatello—Sewage Treatment Plant	SO_2	SLAMS	Continuous
Salmon—Charles St.	$PM_{2.5}$—FRM	SLAMS	Every third day (1/3)
	$PM_{2.5}$—BAM	SPM	Continuous
Salmon—Hwy 93	10-meter meteorology	SPM	Continuous
Sandpoint—University of Idaho	10-meter meteorology	SPM	Continuous
	PM_{10}—TEOM	SLAMS	Continuous
	$PM_{2.5}$—BAM	SPM	Continuous
Soda Springs	SO_2	SLAMS	Continuous
St. Maries	$PM_{2.5}$—FRM	SLAMS	Every sixth day (1/6)
	$PM_{2.5}$—BAM	SPM	Continuous
Twin Falls	$PM_{2.5}$—TEOM 1405	SPM	Continuous
Meridian Near-Road	NO_2 (Photolytic)	SLAMS/Near-Road	Continuous
	CO	SLAMS/Near-Road	Continuous
Coeur d'Alene LMP	10-meter meteorology	SPM	Continuous