An Introduction to Monitoring Network Assessment

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Focus of Training

- Provide an overview of what a network assessment is

- Describe a process for conducting network assessments

- Provide guidance on analytical techniques that can be used for the assessments

- Show some new tools OAQPS has been developing to assist states with some of the more complex analyses

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What is a Network Assessment?

- A review of existing monitoring networks in an effort to optimize the network:
  - Identify and removing "low value" monitors
  - Identify under monitored locations
- An opportunity to look for "found money" to implement new efforts
  - Shift funding from low priority monitoring to high priority monitoring
  - Increase efficiency/reduce costs

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Why are Network Assessments Needed?

- Air quality agencies need to re-evaluate and reconfigure monitoring networks because
    - Air quality has changed.
    - Populations and behaviors have changed.
    - New air quality objectives have been established (e.g., air toxics reductions, $PM_{2.5}$, regional haze).
    - Understanding of air quality issues and monitoring capabilities have both improved.
    - Priorities have changed
- Reconfiguring air monitoring networks can enhance their value to stakeholders, scientists, and the general public
- Required by new monitoring rule [40 CFR Part 58.10(d)]
    - Once every 5 years
    - First assessment due July 1, 2010

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What is the Difference Between a Network Plan and a Network Assessment?

- Network Plan
  - Not a new requirement [40 CFR 58.10(a)]
  - Due every year
  - Simple accounting of changes expected for that year

- Network Assessment
  - Once every 5 years
  - Detailed evaluation of networks and objectives

Elements of Network Assessments

- Re-evaluation of the objectives and budget for air monitoring
- Evaluation of a network's effectiveness and efficiency relative to its objectives and costs
- Development of recommendations for network reconfigurations and improvements
- Note: Network assessments are not "one size fits all"
  - Large networks require more complex assessments than small networks
- EPA guidance document available:
  - http://www.epa.gov/ttnamti1/files/ambient/pm25/datamang/network-assessment-guidance.pdf

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Considerations (1 of 2)

- Networks may
  - Have unnecessary or redundant monitors
  - Have ineffective and inefficient monitoring locations for some pollutants
  - Lack monitors for key pollutants
  - Need to refocus resources on pollutants that are new or persistent challenges (i.e., air toxics, $PM_{2.5}$, ozone)
  - Need to deemphasize monitoring for pollutants that are better understood and less problematic (i.e., CO, SO_2)
  - Need to adjust to protect today's population and environment

Considerations (2 of 2)

- Networks may
  - Be required to maintain the ability to understand long-term historical air quality trends
  - Need to take advantage of new monitoring technologies and improved scientific understanding of air quality issues
  - Need to address multiple, interrelated air quality issues
  - Have to better operate with other types of air quality assessments (e.g., photochemical modeling, emission inventory assessments)
  - Need to be better designed to track emissions changes

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Network Assessment Steps

| Step	Description	Examples
1	Prepare or update a regional description, discussing important features that should be considered for network design	Topography, climate, population, demographic trends, major emissions sources, and current air quality conditions
2	Prepare or update a network history that explains the development of the air monitoring network over time and the motivations for network alterations, such as shifting needs or resources.	Historical network specifications (e.g., number and locations of monitors by pollutant and by year in graphical or tabular format); history of individual monitoring sites
3	Perform statistical analyses of available monitoring data. These analyses can be used to identify potential redundancies or to determine the adequacy of existing monitoring sites.	Site correlations, comparisons to the NAAQS, trend analysis, spatial analysis, and factor analysis

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Network Assessment Steps

Step	Description	Examples
4	Perform situational analyses, which may be objective or subjective. These analyses consider the network and individual sites in more detail, taking into account research, policy, and resource needs.	Risk of future NAAQS exceedances, demographic shifts, requirements of existing state implementation plans (SIP) or maintenance plans, density or sparseness of existing networks, scientific research or public health needs, and other circumstances (such as political factors)
5	Suggest changes to the monitoring network on the basis of statistical and situational analyses and specifically targeted to the prioritized objectives and budget of the air monitoring program.	Reduction of number of sites for a selected pollutant, enhanced leveraging with other networks, and addition of new measurements at sites to enhance usefulness of data
6	Acquire the input of state and local agencies or stakeholders and revise recommendations as appropriate	

Update a Regional Description

- Topography
- Climate
- Population
- Demographic trends
- Major emissions sources
- Current air quality conditions
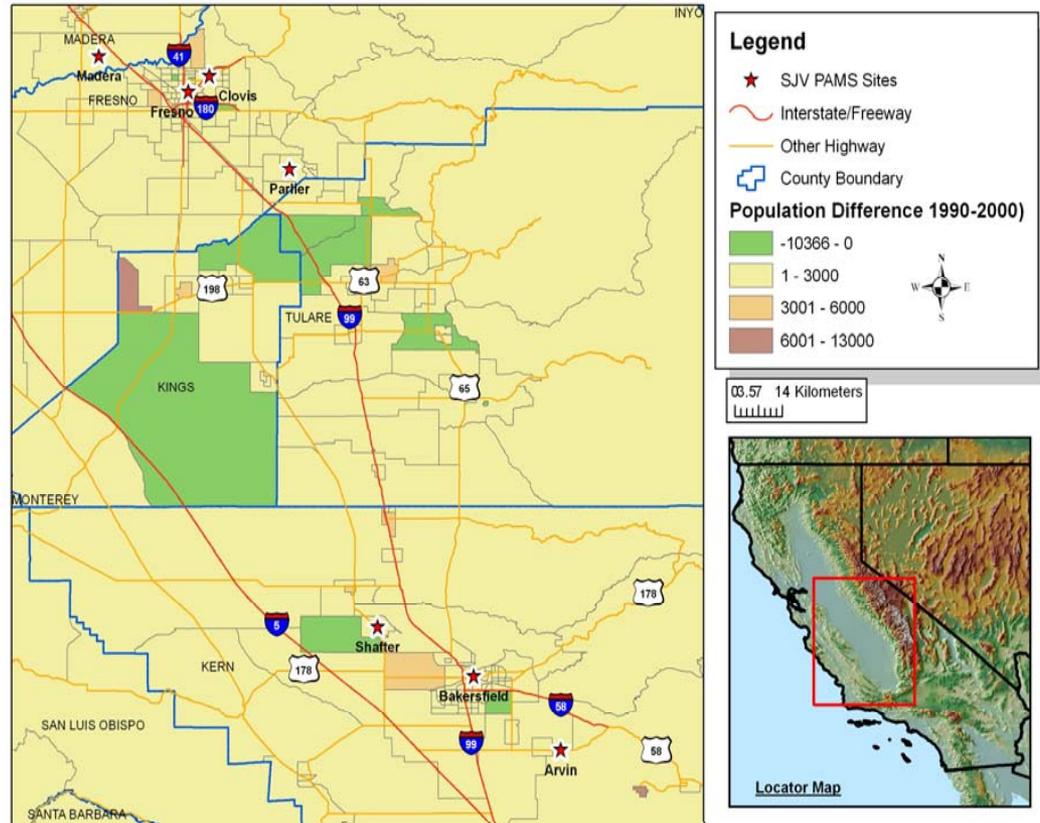
Prepare a Network History

California PAMS and PAMS-like data (1990-1997)

City	1990	1991	1992	1993	1994	1995	1996	1997
Elk Grove-Bruceville							7/8-9/30	7/2-10/1
Del Paso Manor					7/1-9/29	7/1-9/30	7/2-9/30	7/2-10/1
Folsom						7/28-10/30		
New Folsom							7/5-9/30	7/2-10/1
Bakersfield Golden St. Ave.					7/1-9/29	7/2-9/30	7/1-9/30	7/2-10/1
Arvin						7/1-9/30	7/1-9/30	7/2-10/1
Clovis-Villa				6/24-10/16[2]	7/6-9/29	7/1-9/30	7/1-9/30	7/2-10/1
Fresno – 1st Street	6/10-9/29[1]		6/5-10/15[2]	6/15-10/31[3]	7/1-9/30	7/1-9/30	7/1-9/30	7/1-10/1
Parlier						7/1-9/30	7/3-9/30	7/2-10/1
El Cajon						7/8-10/30	7/2-9/29	7/3-10/4
Overland						7/8-10/30	7/2-10/27	7/3-10/4
Alpine						7/8-10/27	7/2-9/29	7/3-10/4
San Diego - 12th Street	6/1-9/26[4]	6/14-10/15[1]	6/5-10/15[2]	6/15-10/1[2]	7/1-9/29[2]	7/2-10/3[2]	7/2-9/30[2]	7/3-10/1[2]
L.A.-North Main St.	6/4-9/26[4]	6/18-10/15[1]	6/5-9/30[2]	6/15-10/4[2]	7/7-10/5[2]	7/2-10/6[2]	7/2-9/30[2]	7/3-10/1[2]
Emma Wood State Beach							7/26-9/24	6/3-9/29
El Rio						6/5-10/30	6/2-9/24	6/3-10/31
Simi Valley						6/5-10/30	6/20-9/24	6/3-10/31

1 = one sample per day, every third day
2 = two samples per day, every third day
3 = eight samples per day, every third day
4 = one sample per day, every sixth day

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Perform Statistical Analyses

- Site by Site Analyses
  - Site correlations,
  - Comparisons to the NAAQS,
  - Trend analysis,
  - Spatial analysis
  - Etc.
- Bottom-Up Analyses
  - Emission inventory
  - Population density
  - Population change
  - Etc.
- Statistical analyses are the focus of later training

Population Served

Overview

Large populations are associated with high emissions. Sites are ranked based on the number of people they represent. Area of representation can be determined using the Thiessen polygons technique or a more sophisticated method (see Area Served). Populations at the census-tract or block-group level that fall within the area of representation of a monitor are assigned to that monitor. This technique gives the most weight to sites that are in areas of high population and have large areas of representation.
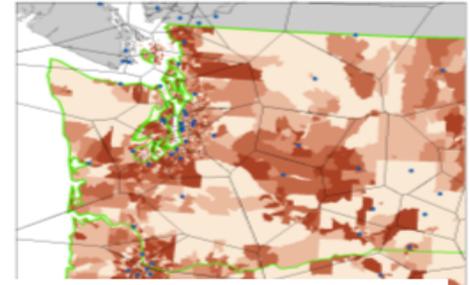
Population density and ozone monitor areas of representation in western Washington. Darker colors represent greater population.

Type: Site-by-site analysis
Complexity: ***
Size of network: Moderate or larger
Pollutants: O_3, $PM_{2.5}$, SO_2, some toxics

Objectives Assessed

- Population exposure
- Environmental justice

Resources

	Tools		Data						
	GIS	Statistical Software	Concentrations	Site Locations	Population	Historical Data	Site Information	Emission Inventory	Other
Required	✓			✓	✓				
Helpful									Demographics

Advantages

- Assesses site importance for population exposure, an important regulatory goal
- Flexible (a few possible methods)

Disadvantages

- Does not take into account topography or actual air basins (using basic method)
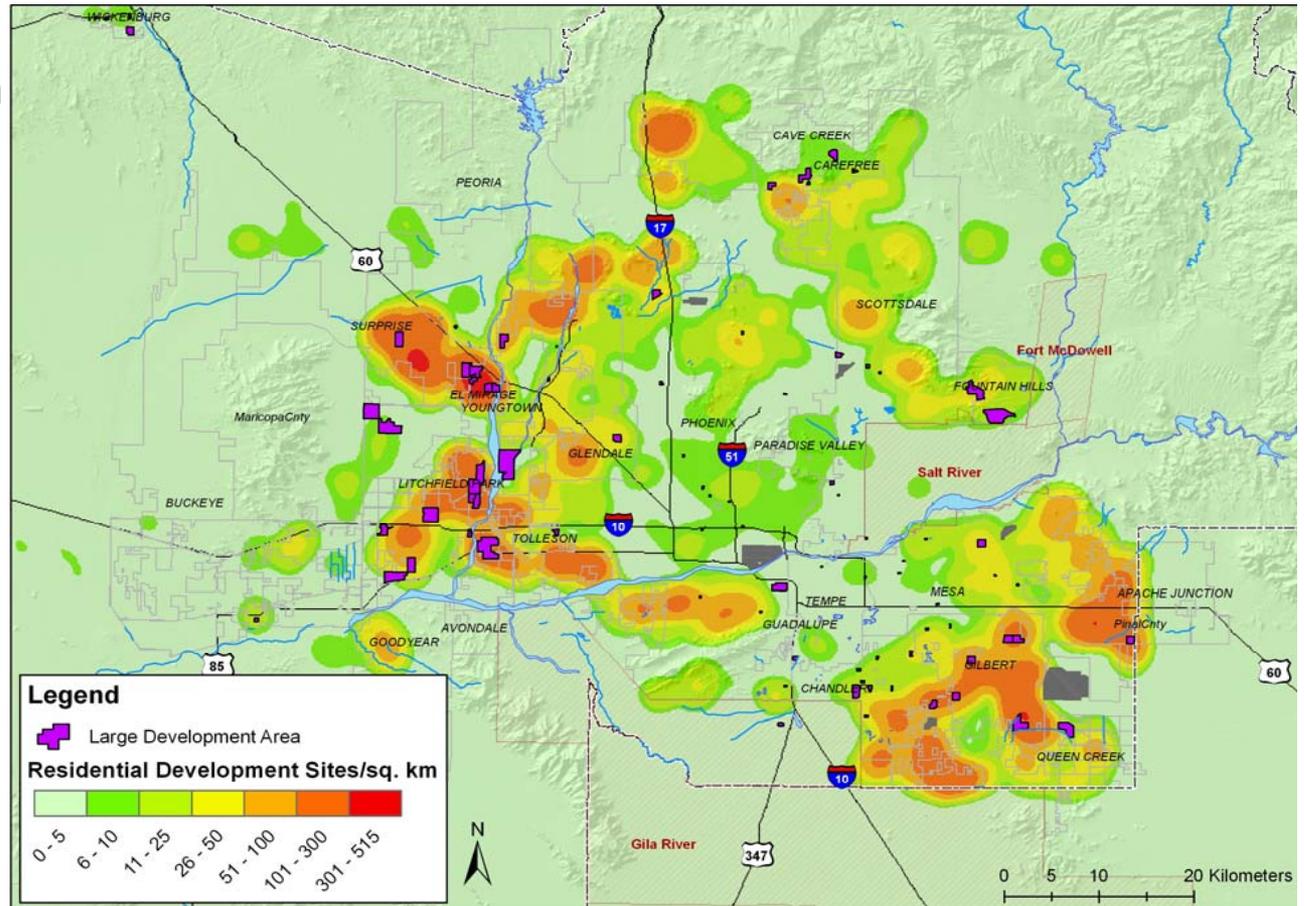- Highly resolved population data may be difficult to work with

Similar Analyses (Complexity)

- Area served (**)
- Counties served (**)
- Population change (***)
- Suitability modeling (****)

Perform Situational Analyses

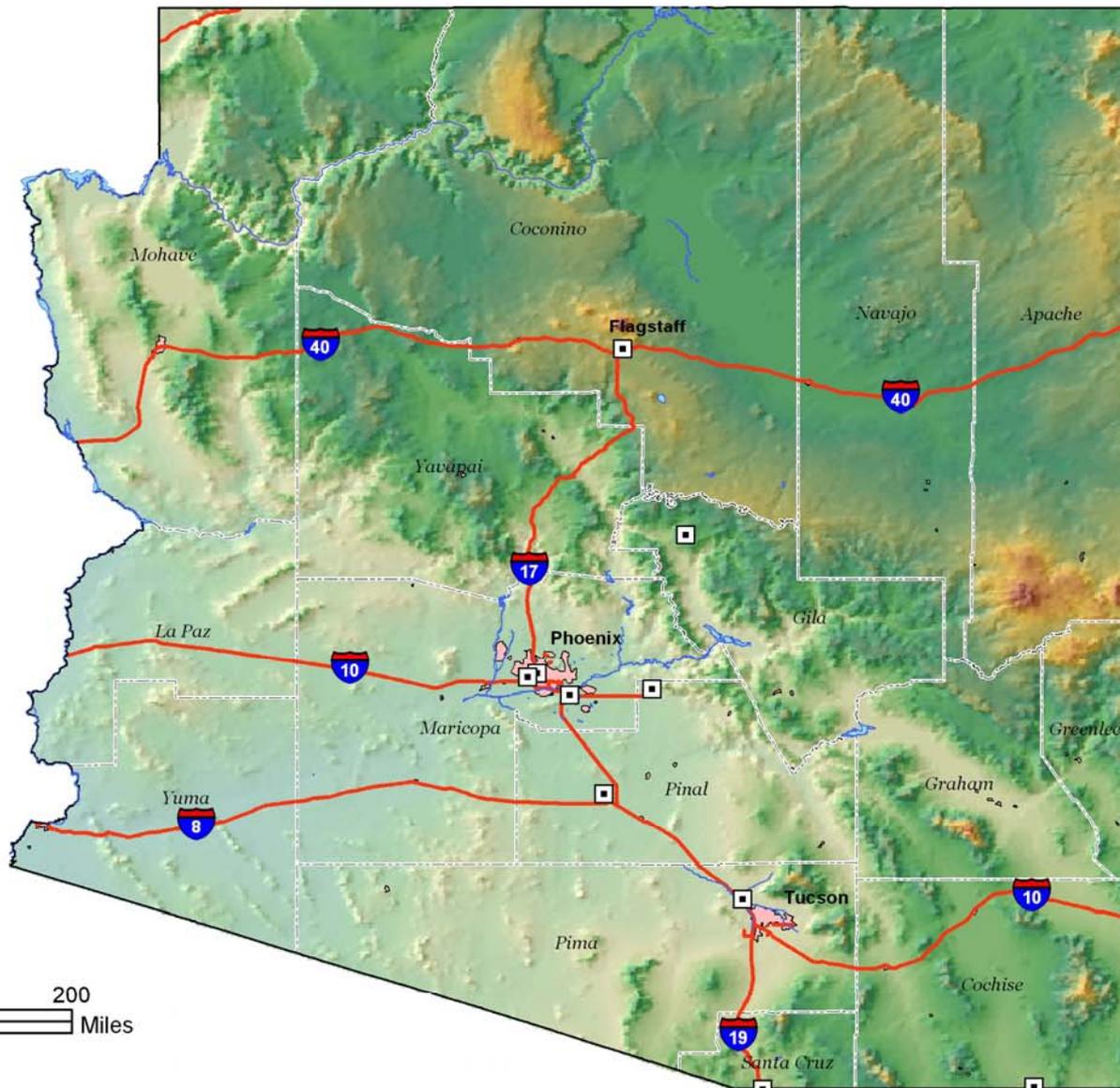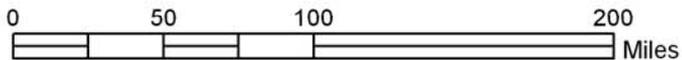New construction in the Phoenix area

Recommend Changes

- Using results from analyses, recommend changes to the network specifically targeted to the prioritized objectives and budget of the air monitoring program
    - Reduce number of sites for a selected pollutant
    - Enhance leveraging with other networks
    - Add new measurements at sites to enhance usefulness of data

PM 2.5 Monitor Locations

Legend

- ▣ PM 2.5 Monitor
- ⟋\⟍ Interstate/Highway
- ▨ Urban Boundary
- ▢ County Boundary
- ▢ State Boundary

Mohave

Coconino

Navajo

Apache

Flagstaff

Yavapai

La Paz

Phoenix

Gila

Greenlee

Maricopa

Pinal

Graham

Yuma

Tucson

Pima

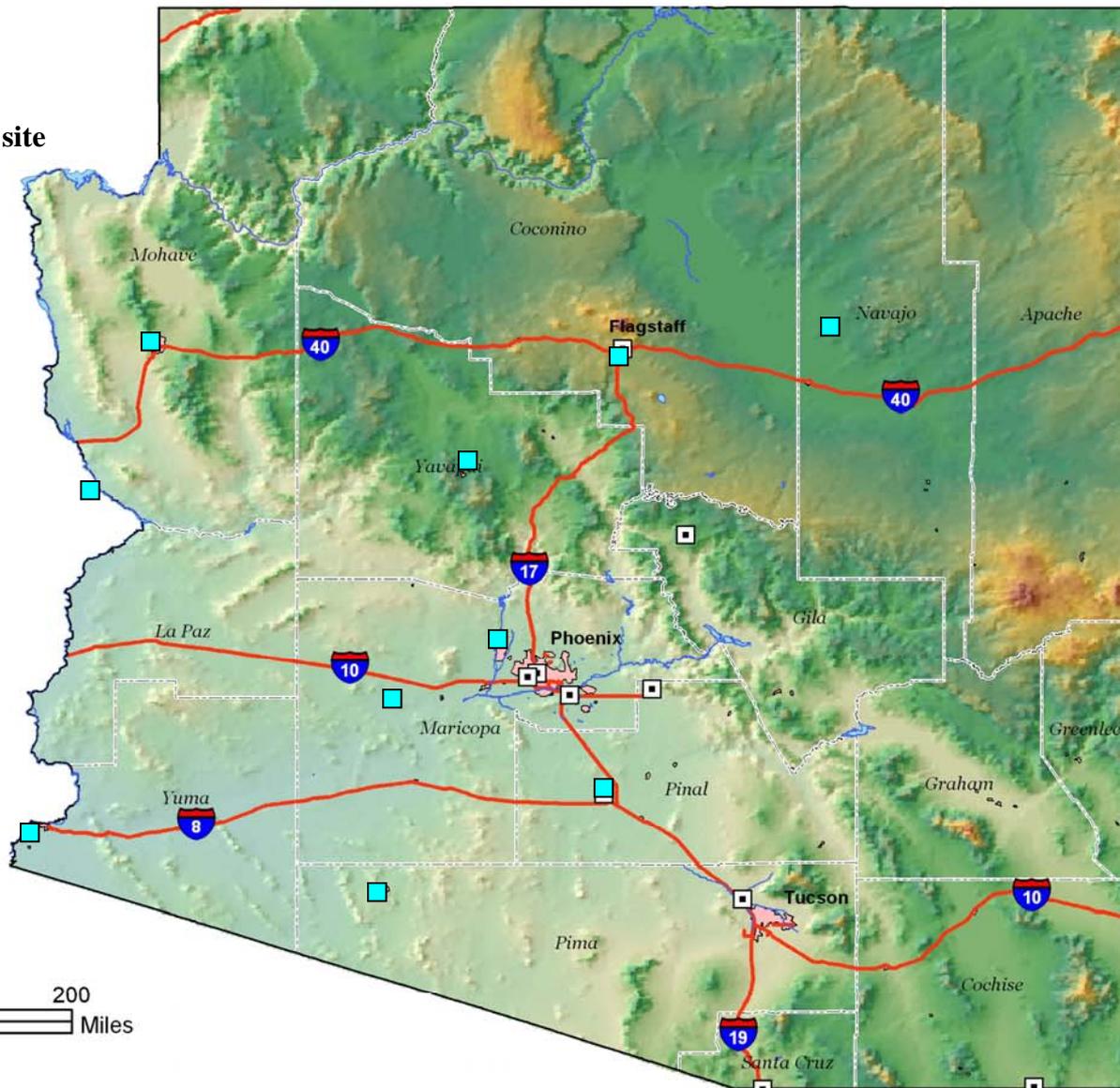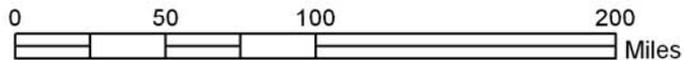*Cochise*

Santa Cruz

0   50   100   200
Miles

N

PM 2.5 Monitor Locations

Suggested additional PM$_{2.5}$ FRM site

Legend

- PM 2.5 Monitor
- Interstate/Highway
- Urban Boundary
- County Boundary
- State Boundary

Mohave

Coconino

Flagstaff

Navajo

Apache

Yavapai

La Paz

Phoenix

Gila

Greenlee

Maricopa

Pinal

Graham

Yuma

Tucson

Pima

Cochise

Santa Cruz

N

| 0 | 50 | 100 | 200 |

Miles

Obtain Feedback

- Acquire the input of state and local agencies or stakeholders
- Revise recommendations as appropriate

Questions?