NADP Site Classification Progress Report
12 April 2002

BACKGROUND

The proposed scheme is as follows:

$Xn_1n_2n_3n_4Z$

Where

X = **U**rban, **S**uburban, **R**ural, or **I**solated
n_1 = factor for population density within 15 km
n_2 = factor for road density within 5 km
n_3 = factor for SO_2 emissions within 25 km
n_4 = factor for NOx emissions within 25 km
Z = S if site is within 100 km of an ocean, blank otherwise.

The supplementary factors n_1 through n_4 can be values from 0 to 9. These values are derived by comparing the local, site-specific value of the factor to the distribution of values from the conterminous United States.

MAIN CLASSIFICATION

All 314 active, inactive, and pending NADP sites were categorized using a scheme that was slightly modified from what the joint committee approved at the Spring 2001 interim meeting. The modification involved decreasing the population density that defines urban areas from 1000 to 400 people/km^2. This change was made because the original scheme underrepresented urban areas. In addition, the new value matches a definition the US Census Bureau now uses for urban areas.

Scheme as implemented (population density rounded to the whole number)

Classification	1990 census population density within 15 km (persons/km^2)
Isolated	< 10
Rural	10 – 99
Suburban	100 – 399
Urban	≥ 400

The results of this analysis are displayed in figure 1 and are listed in Appendix 1. Urban Sites include MA13, IL19, and a new MDN site, CA72, San Jose. The following table provides a summary of the results.

Distribution of NADP Sites by Classification

Classification	Number of NADP sites	Percent of NADP Sites
Isolated	134	42.7
Rural	147	43.2
Suburban	31	9.6
Urban	3	< 0.1

SUPPLEMENTARY FACTORS

Population

1990 population census data were obtained and used to determine the population within 15 km of each site. These data were also gridded to determine the distribution of values. A cell size of 26.6 x 26.k km, was used to give each cell the same area as the 15 km radius used to determine the site population density values. Gridded population density values are shown in figure 2. The population density values for sites and grid cells are plotted in figure 3.

The cells of the population grid were also classified into the four categories (I, R, S, U) to determine the percentage of the conterminous United States in each category.

Distribution of Grid Cells by Population Classifications

Classification	Percent of conterminous United States
Isolated	59.3
Rural	34.0
Suburban	6.2
Urban	0.5

Road Density

The 1995 Tiger/Line road data GIS data were obtained and used to determine road density values within 5 km of each site. This same data was used to determine the distribution of road density values within the conterminous United States. However, the amount of data involved (approximately 40 million records) made it impractical to grid the data using an equivalent cell size. Instead, the population grid was used, which has a cell size of 26.6 x 26.6 km.

Gridded road density values are shown in figure 4 and are plotted with the site road density values in figure 3b.

SO_2 and NOx Emissions

1996 emission data were obtained from the USEPA. This database considers three types of emission sources; point areal, and mobile. Point sources included latitudes and longitudes and could be directly used. The areal and mobile data were available by county. The county level data were normalized by area and converted to a grid with a cell size of 2.5 km x 2.5 km. This assured that the county level was proportional to the relative area of the counties included within a given radius or cell.

Total SO_2 and NOx emission were determined within 25 km of each site. Emissions were also determined for a grid with an equivalent cell area. SO_2 and NOx grids are shown in figures 5 and 6, respectively. Site emission values and cooresponding exceedance frequencies are plotted in figure 7.

Distance to Oceans

Sites within 100 km of an oceans was determined by a straitforward, but sometimes subjective technique. A 100 km radius was drawn around each site. Each was examined to determine which intersected an ocean. For a few sites, the intersection occurred in an estuary, and the analysts judgement determined if this constituted saltwater or freshwater.

Composite Index Values

Individual factor values for each site are listed in Attachment 1, an Excel spreadsheet file. For each site, the following values are listed:

SiteID
Major Classification (U, S, R or I)
Population Density within 15 km, people/km^2
Population Percentile ranking
Road Density with 5 km, km/ km^2
Road Density Percentile ranking
SO_2 Emission within 25 km, tons/year
SO_2 Emission percentile ranking
NOx Emission within 25 km, tons/year
NOx Emission percentile ranking
Within 100 km of ocean (L if true, blank if not)
Population density factor (0-9)
Road density factor (0-9)
SOx emission factor (0-9)
NOx emission factor (0-9)
Composite Index ($Xn_1n_2n_3n_4Z$)

The percentile rankings indicate the ranking of the site relative to the nationwide grid. Percentile values were rounded down to the next lowest percent, and thus range

from 0 to 99. For example, the population density within 15 km of FL11 is 5 people/km2. The corresponding percentile ranking of 47 indicates that this site's population density is greater than 47% of the population grid cells. Decile values were computed by dividing the corresponding percentile values by ten and rounded down. Plots showing the number of sites in each decile are given in Figure 8.

PROPOSED DATA DISPLAY

A proposed method of displaying the expanded site classification is shown in figure 9. In addition to the nationwide percentile rankings, data specific to a sites ecoregion is shown. For each of the four numeric factors, the distribution of grid values within the ecoregion was determined. The percentile rank of each site in the ecoregion is then determined relative to the gridded values.

Appendix 1. NADP Site Classifications

Urban Sites

Site ID	Pop Density
MA13	1822
CA72	1051
Il19	661

Suburban Sites

Site ID	Pop Density	Site ID	Pop Density	Site ID	Pop Density
NC41	368	NY51	205	AR27	129
NJ99	365	NY99	198	IN34	126
MO43	347	WA18	171	VA00	126
CA42	333	NJ00	170	PA13	123
NJ29	324	NH05	166	CA88	119
TX39	323	LA05	165	SC18	109
FL98	318	IN41	157	PA15	106
FL18	298	IN28	145	MD03	103
MS10	273	IL11	143		
PA30	265	OR97	138		
NC33	251	OR99	138		

Rural Sites

Siteid	Pop Density	Siteid	Pop Density	Siteid	Pop Density
TN00	98	ME96	65	IN20	43
TX53	89	NY67	65	IN22	42
OH71	86	MI26	61	MT07	42
PA60	83	OH09	61	PA72	42
MI52	79	CT15	59	CA67	41
IL35	78	IL18	58	IN21	39
UT01	78	WI99	58	MN01	39
LA12	77	NY97	54	DE99	38
GA23	76	SC19	53	FL05	38
MS14	74	OH17	52	NV00	38
KS31	72	WA24	51	VT01	38
NC34	71	MA08	49	ME00	36
LA28	68	GA50	48	OH15	36
AL24	67	GA41	44	FL14	35
NH00	67	GA99	44	GA40	35
TX21	66	PA00	44	NE99	35

Siteid	Pop Density	Siteid	Pop Density	Siteid	Pop Density
MI99	33	SD00	21	VA28	14
FL00	32	MO50	20	AR02	13
TN98	32	SC06	20	CO15	13
WI31	32	SD99	20	CO94	13
FL03	31	MD18	19	FL41	13
MN05	31	MT98	19	KY03	13
NC35	31	NC45	19	NY52	13
MI22	30	NY08	19	TN04	13
NY10	30	CO00	18	TN11	13
KY22	29	NY22	18	VA29	13
NY12	28	PA42	18	CA50	12
OR98	28	GA20	17	CO93	12
SC11	28	IL46	17	FL99	12
VA33	28	ME99	17	LA06	12
AL02	27	MO03	17	NC36	12
FL34	26	PA29	17	NE15	12
IL47	26	VA13	17	VA24	12
NM07	26	ME98	16	AL03	11
OR17	26	MS19	16	CO21	11
KY35	25	OH49	16	IA23	11
PA90	25	OH54	16	MA01	11
TX03	25	WI28	16	NC03	11
PA37	24	CA34	15	NC11	11
VT99	24	CA76	15	WI37	11
DE02	23	CO92	15	WI97	11
LA10	23	UT08	15	CA45	10
MD13	23	WV04	15	CA68	10
ME97	23	CO08	14	MI09	10
MI51	22	FL04	14	MO05	10
NC25	22	LA30	14	NM10	10
AL99	21	ME02	14	OK08	10
AR03	21	OK17	14	TX10	10
IL78	21	TN99	14	WV05	10

Isolated Sites

Siteid	Pop Density	Siteid	Pop Density	Siteid	Pop Density
CO19	9	CA98	8	WY02	7
CO97	9	IA08	8	CO01	6
IL99	9	KY38	8	CO98	6
MI29	9	NY65	8	GA09	6
MN28	9	WI98	8	ME08	6
NC06	9	IL63	7	MN27	6
NH02	9	MN23	7	MS30	6
WA21	9	TN14	7	NY98	6
WV18	9	TX38	7	OR08	6

Siteid	Pop Density	Siteid	Pop Density	Siteid	Pop Density
SC05	6	MN16	2	CO91	<1
SC07	6	NC42	2	CO95	<1
WY99	6	ND00	2	FL23	<1
AL10	5	NV03	2	ID03	<1
CO02	5	OK00	2	ID11	<1
FL11	5	OK25	2	ID15	<1
KY99	5	TX51	2	MI25	<1
NC08	5	WA15	2	MI97	<1
ND08	5	WI08	2	MN08	<1
PA18	5	WI35	2	MN32	<1
TX56	5	CA75	1	MT13	<1
WI25	5	CA99	1	MT97	<1
WV99	5	CO22	1	MT99	<1
KS07	4	CO96	1	ND07	<1
MI53	4	ID04	1	ND11	<1
MN99	4	KS32	1	NM01	<1
MS22	4	MD15	1	NV01	<1
NY68	4	MN18	1	NV05	<1
WI36	4	MT96	1	OR09	<1
AR16	3	NM08	1	OR18	<1
CA97	3	NM12	1	SC03	<1
CO10	3	NY20	1	SD08	<1
ME09	3	OR10	1	TX04	<1
MT00	3	OR11	1	TX16	<1
MT05	3	TX02	1	TX18	<1
NM09	3	UT98	1	TX22	<1
OK29	3	UT99	1	UT02	<1
OR02	3	WA14	1	UT09	<1
WA99	3	WI09	1	WA19	<1
WY06	3	AZ06	<1	WY00	<1
AZ01	2	AZ98	<1	WY08	<1
AZ03	2	AZ99	<1	WY95	<1
CO99	2	CA66	<1	WY96	<1
LA23	2	CA85	<1	WY97	<1
MI48	2	CA95	<1	WY98	<1
MI98	2	CA96	<1		