

Memorandum

To: File

CC:

From: Chris Garrett, SWCA

Date: June 4, 2013

Re: Air Quality Related Values – Deposition Data Used for Existing Conditions in EIS Analysis

The purpose of this memo is to provide details of deposition data that were provided by the Forest Service to SWCA for use to describe Existing Conditions in the Air Quality and Climate Change resource section of Chapter 3.

A conference call was held on May 22, 2013 involving Forest Service, SWCA, and National Park Service specialists and management, in order to discuss potential modeled impacts to air quality related values, specifically visibility and deposition. During this call, Claire O’Dea, an ecologist with the Forest Service Washington office specializing in deposition impacts, indicated that she could provide existing condition data for nitrogen and sulfur deposition.

Ms. O’Dea subsequently provided access to an ArcGIS geodatabase containing deposition values not only for the entire continental U.S., but also specifically for the Coronado National Forest (Title: CMAQ_Deposition.gdb. Metadata is included as Attachment 1.)

This data was produced using the Community Multi-Scale Air Quality (CMAQ) Model, developed by the U.S. Environmental Protection Agency (<http://www.epa.gov/asmdnerl/Research/RIA/cmaq.html>). Specifically, this model was used to estimate existing deposition of nitrogen and sulfur across the entire U.S. for the year 2006 (<http://www.epa.gov/amad/Data/wdtData.html>).

The dataset provided by Ms. O’Dea was clipped using ArcGIS to the three Class I areas of concern: Saguaro National Park East (see Attachment 2), Saguaro National Park West (see Attachment 3), and the Galiuro Wilderness (see Attachment 4).

These fields were used for the EIS analysis:

- TD_N – Total Annual Deposition of Nitrogen (Oxidized + Reduced) (kg-N/ha)
- TS_S_T – Total Annual Deposition of Total Sulfur (kg-S/ha)

ATTACHMENT 1

METADATA FOR CMAQ-DEPOSITION.GDB GEODATABASE

10/22/2012

Metadata for 2006 12km CONUS interimBiDi run of June 2012

Abstract: CMAQ annual deposition files for 2006 with adjusted wet deposition for the continental US using 12km grids. There are separate files for deposition in units of kg/ha and meq/m². The wet deposition has been adjusted by PRISM precipitation and by a bias adjustment field. The precipitation adjustment is based on increasing/decreasing the modeled wet deposition based on the bias in the modeled precipitation (bias=PRISM precipitation regridded to 12kmx12km CMAQ grid/modelled precipitation). The bias field is based on regionally smoothing the bias at NADP sites by averaging the bias across all sites within 500km of a given monitor (bias = observed value/model value). These new averaged bias values at each NADP site are then kriged across space to all of the CMAQ grid cells to produce a smooth spatial map of a regional bias correction field for the CMAQ wet deposition predictions. (Note that since we are dealing with ratios, the averaging and kriging procedures are done on the log scale and then back-transformed.) The dry deposition is added, without adjustment, to the adjusted wet deposition to calculate total deposition.

Purpose: Provide annual adjusted CMAQ deposition fields for 2006, with an interim bi-directional NH₃ formulation, for critical loads analyses and as input to other ecological models where the most accurate wet deposition fields are desired (via precipitation and bias adjustments).

Supplemental Information: 12km CONUS domain using a Lambert Conformal projection. Model version is CMAQ5.1beta with CMAQ5.1beta bi-directional NH₃ air-surface exchange using Massad formulation, CMAQ5.0beta lightning NO_x adjusted to lightning strike data, CMAQ5.0beta EPIC chemical fertilizer application schedule (5-year average) with simplified chemical form, BELD4 crop distributions in EPIC and CMAQ, and BELD3 biogenic emissions. Anthropogenic emissions are from the 2006am data set. Meteorology is for 2006 from WRFv3.3 (Weather Research Forecast) model with 2001 NLCD land cover data and using version2 four-dimensional data assimilation with no nudging in the planetary boundary layer and based on 3-hourly reanalysis fields (combination of 6-hour MADIS data and intermediate NAM 3-hour forecast) organized into 12km NDAS fields up to 50 hPa. Post-processing to create inputs for CMAQ was with MCIPv4.0.4. There are 35 vertical layers from the surface to the top of the free troposphere with layer 1 nominally 19m tall. June 2012 simulation date.

Use Constraints: None

Contact Person: Robin L. Dennis (dennis.robin@epa.gov) or Kristen Foley (foley.kristen@epa.gov)

Currentness: May 2011 bias adjustment procedure (current); June 2012 CMAQ5.1beta; October 2009 WRF with 2001 NLCD

Update Frequency: Occasional

kg/ha units set

10/22/2012

AWD_OXN_T	= Bias+Precip Adjusted Wet Deposition of Oxidized N (kg-N/ha)
AWD_REDN_T	= Bias+Precip Adjusted Wet Deposition of Reduced N (kg-N/ha)
AWD_S_T	= Precip Adjusted Wet Deposition of Total Sulfur (kg-S/ha)
AWD_SS_S	= Precip Adjusted Wet Deposition of Sea Salt Sulfur (kg-S/ha)
AWDEP_CL	= Precip Adjusted Wet Deposition of chloride (kg-Cl/ha)
AWDEP_Na	= Precip Adjusted Wet Deposition of sodium (kg-Na/ha)
DD_OXN_T	= Dry Deposition of Total Oxidized N (kg-N/ha)
DD_REDN_T	= Dry Deposition of Total Reduced N (kg-N/ha)
DD_S_T	= Dry Deposition of Total Sulfur (kg-S/ha)
DD_SS_S	= Dry Deposition of Sea Salt Sulfur (kg-S/ha)
DDEP_CL	= Dry Deposition of Chloride (kg-Cl/ha)
DDEP_Na	= Dry Deposition of Sodium (kg-Na/ha)
TD_OXN_T	= Total Deposition of Total Oxidized N (kg-N/ha)
TD_REDN_T	= Total Deposition of Total Reduced N (kg-N/ha)
TD_S_T	= Total Deposition of Total Sulfur (kg-S/ha)
TD_SS_S	= Total Deposition of Sea Salt Sulfur (kg-S/ha)
TDEP_CL	= Total Deposition of Chloride (kg-Cl/ha)
TDEP_Na	= Total Deposition of Sodium (kg-Na/ha)
TD_N	= Total Deposition of Nitrogen (Oxidized + Reduced) (kg-N/ha)
SIM_DATE	= Simulation Date (June 2012)

File Names:

- precip_adj_bias_adj_500kmMW_2006_CMAQv5.1_Massad_bidi_12km_CONUS_kg_h
a_June2012sim.shp

ATTACHMENT 2
CLIPPED DATA FOR SAGUARO NATIONAL PARK EAST

OBJECTID *	Shape *	AREA	PERIMETER	COL	ROW	CR	AWD_OXN_T	AWD_REDN_T	AWD_S_T	AWD_SS_S	AWDEP_CL
1	Polygon	144000000	48000	106	81	106081	0.923637	0.960191	0.953874	0.016145	0.341813
2	Polygon	144000000	48000	107	81	107081	1.216518	1.197547	1.143468	0.016899	0.390121
3	Polygon	144000000	48000	108	81	108081	1.134861	1.17535	0.944102	0.009416	0.191777
4	Polygon	144000000	48000	106	80	106080	0.888238	0.930736	0.990643	0.0159	0.364409
5	Polygon	144000000	48000	107	80	107080	1.115538	1.128959	1.205228	0.020383	0.435067
6	Polygon	144000000	48000	108	80	108080	1.211583	1.240757	1.096142	0.011999	0.285272
7	Polygon	144000000	48000	108	79	108079	1.00691	1.12768	1.026012	0.011761	0.237827

AWDEP_Na	DD_OXN_T	DD_REDN_T	DD_S_T	DD_SS_S	DDEP_CL	DDEP_Na	TD_OXN_T	TD_REDN_T	TD_S_T	TD_SS_S	TDEP_CL
0.247372	2.201126	0.394095	0.668107	0.036571	0.28158	0.560344	3.124763	1.354286	1.62198	0.052716	0.623392
0.258921	1.877178	0.324075	0.513152	0.037681	0.343407	0.577345	3.093695	1.521622	1.65662	0.054579	0.733527
0.144266	1.771287	0.324569	0.469042	0.039024	0.345102	0.597933	2.906148	1.499919	1.413144	0.04844	0.536879
0.243625	2.173043	0.394125	0.666013	0.033377	0.265429	0.511402	3.061281	1.324861	1.656656	0.049277	0.629839
0.312311	2.106053	0.340717	0.572423	0.039992	0.348636	0.612752	3.221591	1.469676	1.777651	0.060375	0.783703
0.183845	1.813492	0.31772	0.507523	0.040266	0.36695	0.616962	3.025075	1.558477	1.603665	0.052265	0.652222
0.180209	1.638456	0.342696	0.432302	0.033288	0.284924	0.510039	2.645366	1.470375	1.458314	0.045049	0.522752

TDEP_Na	TD_N	SIM_DATE	Shape_Length	Shape_Area
0.807716	4.479049	Jun-12	0.148555	0.001027
0.836266	4.615317	Jun-12	0.321614	0.004175
0.742199	4.406068	Jun-12	0.158302	0.00129
0.755027	4.386143	Jun-12	0.240602	0.002191
0.925064	4.691268	Jun-12	0.478941	0.009152
0.800807	4.583552	Jun-12	0.303994	0.00478
0.690249	4.115741	Jun-12	0.036307	0.000018

ATTACHMENT 3
CLIPPED DATA FOR SAGUARO NATIONAL PARK WEST

OBJECTID *	Shape *	AREA	PERIMETER	COL	ROW	CR	AWD_OXN_T	AWD_REDN_T	AWD_S_T	AWD_SS_S	AWDEP_CL
1	Polygon	144000000	48000	102	82	102082	0.517444	0.508822	0.456964	0.009302	0.199779
2	Polygon	144000000	48000	103	82	103082	0.647143	0.598029	0.633983	0.014645	0.302428

AWDEP_Na	DD_OXN_T	DD_REDN_T	DD_S_T	DD_SS_S	DDEP_CL	DDEP_Na	TD_OXN_T	TD_REDN_T	TD_S_T	TD_SS_S	TDEP_CL
0.14252	1.884225	0.493515	0.500683	0.042247	0.322776	0.647312	2.401669	1.002337	0.957647	0.051549	0.522555
0.224396	2.585616	0.576279	0.714753	0.036796	0.296592	0.563785	3.232759	1.174308	1.348736	0.051441	0.59902

TDEP_Na	TD_N	SIM_DATE	Shape_Length	Shape_Area
0.789832	3.404007	Jun-12	0.192616	0.00063
0.78818	4.407067	Jun-12	0.580884	0.004426

ATTACHMENT 4
CLIPPED DATA FOR GALIURO WILDERNESS

OBJECTID *	Shape *	FID_USA_ProclaimedForest_Grassland	ID	FOREST_GRA	UNITCLASSI	GIS_ACRES	FID_US_CMAQ	
1	Polygon		122	2.95374E+11	Coronado	National Forest	1784628.813	46939
2	Polygon		122	2.95374E+11	Coronado	National Forest	1784628.813	46940
3	Polygon		122	2.95374E+11	Coronado	National Forest	1784628.813	47202
4	Polygon		122	2.95374E+11	Coronado	National Forest	1784628.813	47203
5	Polygon		122	2.95374E+11	Coronado	National Forest	1784628.813	47462
6	Polygon		122	2.95374E+11	Coronado	National Forest	1784628.813	47463
7	Polygon		122	2.95374E+11	Coronado	National Forest	1784628.813	47720

AREA	PERIMETER	COL	ROW	CR	AWD_OXN_T	AWD_REDN_T	AWD_S_T	AWD_SS_S	AWDEP_CL	AWDEP_Na	DD_OXN_T
144000000	48000	109	85	109085	0.881062	0.845832	0.956676	0.017178	0.31738	0.263207	1.822846
144000000	48000	110	85	110085	0.891865	0.879159	0.950199	0.014667	0.279527	0.224724	1.627141
144000000	48000	109	84	109084	0.956067	0.980915	0.942263	0.015656	0.281526	0.239881	1.775455
144000000	48000	110	84	110084	1.164668	1.129748	1.114125	0.016166	0.341036	0.247703	2.23868
144000000	48000	109	83	109083	0.931977	0.976899	0.91325	0.014916	0.269302	0.228548	1.563183
144000000	48000	110	83	110083	1.127055	1.154502	1.122264	0.017033	0.341268	0.260985	2.040786
144000000	48000	110	82	110082	1.051784	1.127834	1.036698	0.014408	0.297306	0.220756	1.67687

DD_REDN_T	DD_S_T	DD_SS_S	DDEP_CL	DDEP_Na	TD_OXN_T	TD_REDN_T	TD_S_T	TD_SS_S	TDEP_CL	TDEP_Na	TD_N
0.305588	0.719252	0.03595	0.276613	0.550827	2.703909	1.15142	1.675928	0.053128	0.593993	0.814034	3.855328
0.303624	0.632889	0.033739	0.262453	0.516952	2.519006	1.182783	1.583088	0.048406	0.54198	0.741676	3.701789
0.328927	0.595946	0.033331	0.248749	0.510704	2.731521	1.309842	1.538209	0.048987	0.530275	0.750585	4.041364
0.299979	0.674181	0.050667	0.413387	0.776321	3.403349	1.429727	1.788307	0.066833	0.754423	1.024024	4.833076
0.324229	0.466552	0.028547	0.210861	0.437397	2.49516	1.301128	1.379802	0.043463	0.480163	0.665945	3.796288
0.310007	0.566676	0.045083	0.354947	0.690768	3.167841	1.46451	1.68894	0.062117	0.696214	0.951753	4.63235
0.363857	0.451923	0.03422	0.262466	0.524322	2.728655	1.491691	1.488621	0.048628	0.559772	0.745077	4.220346

SIM_DATE	Shape_Length	Shape_Area
Jun-12	0.232096	0.001876
Jun-12	0.18266	0.001493
Jun-12	0.372115	0.005219
Jun-12	0.43397	0.009839
Jun-12	0.249183	0.001204
Jun-12	0.425524	0.009494
Jun-12	0.150211	0.000985