

Supplemental Information:

Details on the 2008 NEI for Crop Residue Burning

Tables 1, 2 and 4 in SI units

Memo from State of Iowa Department of Natural Resources about EPA's Preliminary 2014 Agricultural and Grass/Pasture Burning Emissions

2008 NEI Details:

Year 2008-specific fire locations from SMARTFIRE version 1 (Raffuse et al., 2009) were read into the FCCS module and intersected with the FCCS fuel-loading dataset. The module assigned an FCCS code to each fire record that reflects the ecosystem geography and potential natural vegetation based on remote sensing data. Prescribed or unclassified fires having an FCCS code equal to zero (0) were assumed to be agricultural fires. Next, Arc GIS was used to categorize the fires as occurring on rangeland, cropland or other land use via USGS 2006 National Land Cover Database (NLCD). Activity data were analyzed to restrict to cropland fires and assign state and crop-specific emission factors. Emissions were then appropriately weighted based on known statistics about each state's crop mix. These SMARTFIRE-based crop residue burning emissions were provided in Excel sheets at 1km point source and day-specific resolution. State-county FIPS codes were assigned using GIS. We aggregated these emissions to county and monthly resolution and converted to SMOKE nonpoint FF10 format. This SMARTFIRE-based crop residue burning dataset includes emissions for all but these 7 of the lower 48 states: CT, DC, MA, ME, NH, RI and VT. These 7 states did not contain any cropland burning estimates for year 2008 based on this SMARTFIRE approach.

Table 1: Emission Factors, Fuel Loading, Combustion Completeness for Criteria Air Pollutants

Crop Type	Fuel Loading	Combustion Completeness	CO	NO _x	SO ₂	PM ₂₅	PM ₁₀	VOC	NH ₃
	kg/ha		g/kg	g/kg	g/kg	g/kg	g/kg	g/kg	g/kg
corn	9,415	0.75	53.05	2.30	1.19	4.97	10.68	3.30	9.66
wheat	4,259	0.85	55.14	2.38	0.44	4.04	7.05	3.80	16.87
soybean	5,604	0.75	63.85	3.17	1.57	6.19	8.87	5.99	22.47
cotton	4,887	0.65	73.06	3.45	1.57	6.19	8.87	5.99	24.46
fallow	4,887	0.75	63.90	2.80	1.17	6.16	8.50	5.99	8.12
rice	6,725	0.75	52.64	3.12	1.39	2.36	3.31	2.50	13.09
sugarcane	10,648	0.65	58.48	3.03	1.66	4.35	4.92	4.50	21.52
lentils	6,591	0.75	63.90	2.80	1.17	6.16	8.50	5.99	19.88
Other crops	4,259	0.85	91.06	2.16	0.40	11.62	15.82	5.35	6.26
Dbl. Crop WinWht/Corn	6,837	0.8	54.10	2.34	0.82	4.50	8.87	3.55	13.27
Dbl. Crop Oats/Corn	7,151	0.75	58.48	2.55	1.18	5.57	9.59	4.23	10.71
Dbl. Crop Lettuce/Upland Cotton	4,887	0.75	63.90	2.80	1.17	6.16	8.50	5.99	19.87
Dbl. Crop DurumWht/Sorghum	4,573	0.8	59.52	2.59	0.81	5.10	7.78	3.18	18.37
Dbl. Crop WinWht Sorghum	4,573	0.8	59.52	2.59	0.81	5.10	7.78	3.18	18.37
Dbl. Crop Barley/Corn	6,837	0.8	54.10	2.34	0.82	4.50	8.87	5.40	9.82
Dbl. Crop WinWht/Cotton	4,573	0.75	64.10	2.91	1.01	5.11	7.96	5.99	20.67
Dbl. Crop Soybeans/Cotton	5,246	0.7	68.46	3.31	1.57	6.19	8.87	5.99	23.47
Dbl. Crop Soybeans/Oats	5,246	0.75	63.88	2.98	1.37	6.18	8.68	5.99	21.18
Dbl. Crop Corn/Soybeans	7,510	0.75	58.45	2.73	1.38	5.58	9.78	5.99	11.47
Dbl. Crop WinWht/Soy	4,932	0.8	59.50	2.77	1.01	5.11	7.96	4.90	19.67
Dbl. Crop Lettuce/Durum Wht	4,573	0.8	59.52	2.59	0.81	5.10	7.78	4.90	18.37
Pasture_Grass	4,259	0.85	91.06	2.16	0.40	11.62	15.82	5.35	6.26

Table 2: Emission Factors for Hazardous Air Pollutants

HAP	EF (g/kg)
butadiene13	0.177
acetaldehyde	0.722
anthracene	0.002
benzaanthracene	0.002
benzene	0.3565
benzoapyrene	0.0005
benzoepyrene	0.001
benzoghiperylene	0.0015
benzokfluoranthene	0.001
chrysene	0.002
fluoranthene	0.004
formaldehyde	1.685
indeno123cdpyrene	0.001
perylene	0.0005
phenanthrene	0.005
pyrene	0.0035
toluene	0.235

Table 4: Acres Burned and PM_{2.5} Emission Estimates for 2014

State	2014 Crop hectares	2014 Crop PM _{2.5} Mg/yr	2014 Grass/Pasture hectares	2014 Grass/Pasture PM _{2.5} Mg/yr
Alabama	8,498	279	13,047	548
Arizona	3,335	107	1,133	48
Arkansas	55,507	1,244	11,493	483
California	81,973	2,589	20,736	872
Colorado	1,716	57	1,554	65
Florida	59,707	1,944	32,148	1,351
Georgia	40,566	1,226	15,928	670
Idaho	20,590	590	14,326	602
Illinois	680	16	3,229	136
Indiana	267	6	1,408	59
Iowa	1,481	62	6,046	254
Kansas	73,135	2,002	186,803	7,852
Kentucky	3,237	100	3,140	132
Louisiana	35,580	954	8,094	340
Maryland	324	9	65	3

Massachusetts	32	1	16	1
Michigan	259	10	194	8
Minnesota	6,993	200	1,700	71
Mississippi	18,454	488	8,579	361
Missouri	12,942	297	29,089	1,223
Montana	13,258	388	13,209	555
Nebraska	12,068	380	10,198	429
Nevada	146	5	210	9
New Jersey	65	3	49	2
New Mexico	453	16	2,881	121
New York	243	9	129	5
North Carolina	12,950	368	3,318	139
North Dakota	47,543	1,272	12,019	505
Ohio	162	4	534	22
Oklahoma	20,008	459	121,244	5,096
Oregon	11,898	393	21,950	923
Pennsylvania	146	5	178	7
South Carolina	6,507	179	5,050	212
South Dakota	7,551	245	3,302	139
Tennessee	3,399	93	4,225	178
Texas	30,141	872	74,462	3,130
Utah	615	21	356	15
Vermont	16	1	0	0
Virginia	1,522	51	1,732	73
Washington	28,700	801	17,482	735
West Virginia	81	3	210	9
Wisconsin	291	12	1,068	45
Wyoming	1,101	43	906	38
	0			
TOTAL	624,139	17,802	653,446	27,466



STATE OF IOWA

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June 13, 2015

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RE: EPA’s Preliminary 2014 Agricultural and Grass/Pasture Burning Emissions

Dear Mr. Rao and Dr. Pouliot:

Thank you for this opportunity to comment on EPA’s preliminary agricultural and grass/pasture burning emissions for the 2014 National Emissions Inventory.¹ The Iowa DNR appreciates your efforts to improve the estimation methods for agricultural and grass/pasture burning so that emissions are more accurately reported and that tilled fields are not misidentified as burned fields. The Iowa DNR also thanks you for listening to our concerns during the previous NEI cycle, which resulted in a reduction in agricultural burning emissions of over 194,000 tons as shown in Table 1 below.

Table 1 – Iowa Agricultural Burning Emissions by Data Set

Pollutant	2011 NEI v. 1 (tons)	2011 Emissions Iowa DNR (tons)	2011 NEI v.2 (tons)
CO	137,310	6	26
NO _x	6,302	0.28	1
PM ₁₀	24,029	1	5
PM _{2.5}	13,065	1	2
SO ₂	3,190	0.14	1
VOC	10,355	0.46	2
NH ₃	-	-	-
HAP	-	0.34	-

¹ draft_2014_ag_grasspasture_emissions_nei_may62015.xlsx

For the 2014 NEI, EPA has provided Iowa DNR with preliminary burning emissions estimates. This data was provided as split into agricultural burning emissions and grass/pasture burning emissions as shown in Table 2 below.

Table 2 – Preliminary 2014 Iowa Burning Emissions per EPA

Pollutant	Agricultural Burning (tons)	Grass/Pasture Burning (tons)	Total (tons)
CO	11,386	3,414	14,801
NO _x	500	81	581
PM ₁₀	2,042	593	2,635
PM _{2.5}	1,107	435	1,542
SO ₂	248	15	263
VOC	820	201	1,021
NH ₃	2,596	235	2,831
HAP	629	120	748

The Iowa DNR believes that EPA has over-estimated 2014 emissions from agricultural burning and grass/pasture fires, particularly corn and soybean field fires. The Iowa DNR acknowledges that not every fire that occurs in Iowa is reported to the Iowa DNR by local fire departments. However, EPA’s estimates are based on 100,680 acres of fires as shown in Table 4, nearly 51 times more than the burned acreage reported to DNR as shown in Table 3.

Iowa DNR has pointed out in multiple discussions with EPA that it is not a common agricultural practice to burn corn and soybean fields in Iowa. Iowa State University Extension and Outreach says,

“Burning corn and soybean fields is just NOT a practice that is used in Iowa or many other Midwest states as a way of preparing the fields for planting a subsequent crop. Yes, there are rare occasions where corn residue is burnt off a field but it would not even be 1% of the crop acres. An example would be if the residue washed and piled up in an area it may be burnt to allow tillage, planting and other practices to occur. Another rare occasion is when accidental field fires occur during harvesting of the corn crop. But again this would be less than 1% of the crop acres.”²

EPA appears hesitant to accept the fact that the burning of corn and soybean fields is simply not an agricultural practice in Iowa. Therefore Iowa DNR staff spend time during each NEI cycle to prove to EPA that burning is not occurring as a common agricultural practice. We hope these comments, considered in conjunction with the data Iowa DNR submitted to EPA on 02/06/2015³ and 04/28/2015⁴ will clarify that EPA’s draft estimates of 2014 emissions from agricultural burning in Iowa are over-estimated and lead to more reasonable estimates in the final 2014 National Emissions Inventory and future inventories.

² Email from Mark Licht, ISU Extension Cropping Systems Specialist to Marnie Stein, Iowa DNR, on June 6, 2015.

³ Email from Marnie Stein, Iowa DNR, to Dr. Jessica McCarty, Venkatesh Rao, and George Pouliot on February 6, 2015.

⁴ Email from Marnie Stein, Iowa DNR, to ‘fires@epa.gov’ on April 28, 2015.

Analysis of the Data

Iowa DNR staff reviewed the details of 1,008 fires that were reported to Iowa DNR by local fire departments as shown in Table 3. The dates, latitude/longitude, size, and details of each fire were provided to EPA on April 28, 2015.⁵ Staff found that:

- 39 of the fires were truly agricultural fires, with 38 of 39 being fires being purposely set on grass lands enrolled in the Conservation Reserve Program, and 1 fire in a field of millet. No corn field or soybean field fires were reported to DNR. Sean Raffuse from Sonoma Tech, recommended that Iowa DNR classify these fires as agricultural, not prescribed.⁶
- 309 of the fires were identified as being prescribed fires (fires ignited by management actions to meet specific objectives). 166 were on state land, 101 on private land, 37 on county land, 5 were on federal land.
- 660 of the fires were identified as being wildfires. 7 were accidental fires in cornfields that were started by overheated harvesting equipment. Several were wildfires that spread when trash or brush burning spread out of control to a nearby field or ditch.

Table 3 – Fires in 2014 Reported to Iowa DNR

Type of Fire	No. of Fires in 2014 Reported to Iowa DNR	Total Acres Reported	Average Acres Burned
Agricultural Fires	39	1,981.4	50.8
Prescribed Fires	309	14,701.7	47.6
Wildfires	660	12,218.6	18.5
Total	1,008	28,901.7	28.7

Iowa DNR staff then analyzed EPA’s preliminary agricultural burning estimates as shown in Table 4. EPA separated out grass/pasture fires and did not consider them as agricultural fires. EPA also assumed that every fire was 60 acres.

Table 4 – Iowa Fires in 2014 by Crop Type per EPA

Crop Type	No. of Fires in 2014 per EPA	Total Acres	Average Acres Burned
Alfalfa	32	1,920	60
Corn	689	41,340	60
Durum Wheat	1	60	60
Oats	2	120	60
Other Hay (Non Alfalfa)	61	3,660	60
Soybeans	506	30,360	60
Subtotal Agricultural Fires	1,291	77,460	60
Grass/Pasture	387	23,220	60
Total Agricultural and Grass/Pasture Fires	1,678	100,680	60

⁵ Email from Marnie Stein, Iowa DNR, to ‘fires@epa.gov’ on April 28, 2015.

⁶ Email from Sean Raffuse, Sonoma Tech, to Marnie Stein, Iowa DNR, on April 24, 2015.

The data from Iowa DNR and EPA does show agreement in one area – the temporal distribution of the fires. Both data sets show that the majority of fires occur in April as shown in Figures 1 and 2 below. They also agree that few, if any, fires occur from June – September.

Figure 1 – No. of Fires per Month per EPA

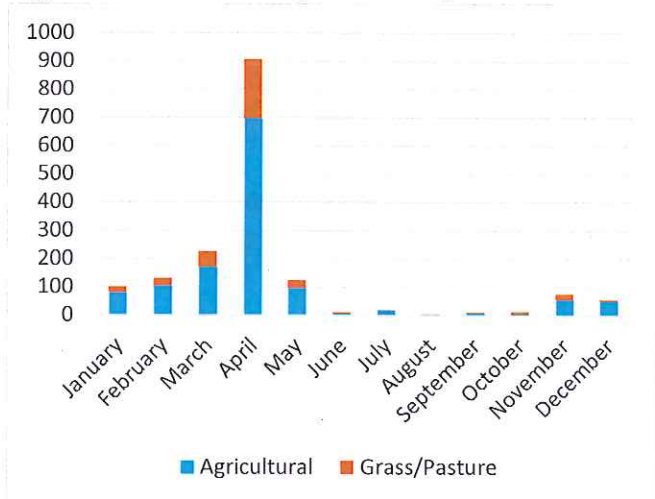
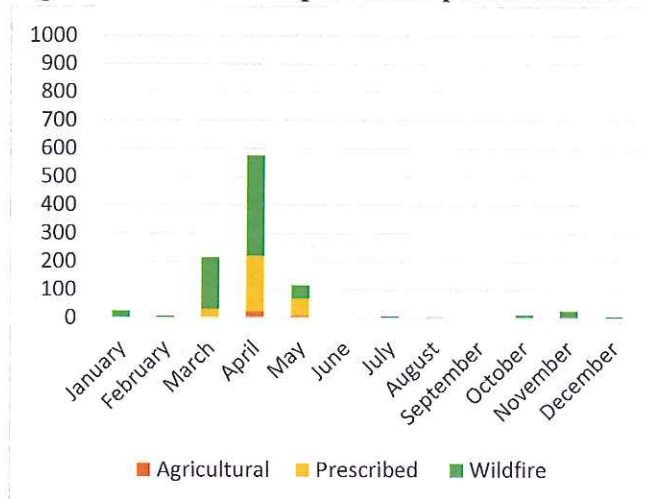


Figure 2 – No. of Fires per Month per Iowa DNR



Concerns

Iowa DNR has identified several issues of concern:

1. *The number of corn (689) and soybean (506) fires identified by EPA when this is not a common agricultural practice.* The burning of roadside ditches, however, does occur in spring. Is it possible that the satellites are identifying fires in roadside ditches that are then attributed to the adjacent corn or soybean field? Do the USDA NASS Cropland maps used by EPA identify roadside ditches? The majority of Iowa is divided by gravel roads (and some paved roads) into one square mile sections, so there are a significant number of roadside ditches. Did EPA also consider wildfires that spread from trash or brush burning to an adjacent crop field to be agricultural burning?

2. *The lack of overlap between the two data sets.*

For instance, in the month of July 2014, the EPA satellite data identified fires on the 2nd, 7th, 10th, 16th, 18th, 20th, 22nd, 23rd, 25th, 26th, and 28th, but no fires were reported to Iowa DNR on these dates. Fires were reported to Iowa DNR as occurring on the 4th, 19th, 21st, 30th, and 31st, but none of these fires were identified by EPA. Iowa DNR staff attempted to match individual fires between the Iowa DNR and EPA data sets, but was unable to review each fire due to time constraints. However, after reviewing eleven months of EPA’s agricultural fire data, staff were only able to identify 46 fires that possibly match. These fires are listed in the attached spreadsheet “Iowa_DNR_EPA_Overlap_Fires.xlsx”.

3. *EPA's assumption that every fire is 60 acres.*

DNR data shows that the average of the average of all fires reported to DNR (agricultural, prescribed, and wildfire) was 28.7 acres and the average fire on Conservation Reserve land was 50.8 acres.

4. *The number of agricultural fires identified by EPA in October and November.*

Iowa DNR data shows that that all agricultural fires reported to DNR in the months of October and November were accidental fires caused by overheated or malfunctioning harvesting equipment. These fires should be classified by EPA as wildfires and be removed from the agricultural burning data set.

5. *The number of agricultural fires and grass/pasture fires identified by EPA during the winter.*

For instance, the Iowa DNR is concerned by the large number of fires (103) that EPA lists as occurring during the month of February. Winter weather conditions in Iowa in February are typically not conducive to the burning of either roadside ditch fires or cropland. In fact, the National Weather Service's data shows that on February 10, 2014, 91.2% of the Midwest region was covered by snow, with an average depth of 4.6 inches as shown in Figure 3 below.⁷ The average snowpack temperature on February 10, 2014 was between -4 and 14° F. However, the EPA fire data shows 16 agricultural fires and 5 grass/pasture fires occurring in Iowa that day.

Figure 3 – Average Midwest Snow Depth on 02/10/14

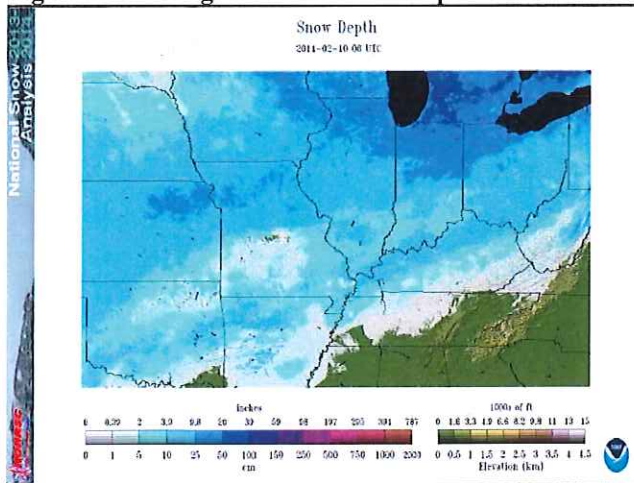
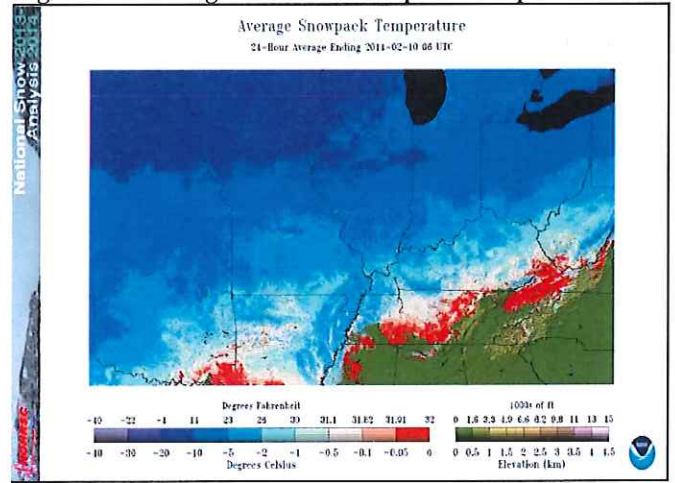


Figure 4 – Average Midwest Snowpack Temp.02/10/14



Recommendations

Iowa DNR requests that EPA adjust its emissions estimations for Iowa as follows:

Agricultural Burning Emissions

1. Remove all corn and soybean field fires from the data set. This is of highest priority for Iowa DNR. If these fires are roadside ditch or accidental fires from trash or brush burning, they might be reclassified as wildfires, but should not all be assumed to be 60 acres in size.

⁷ <http://www.nohrsc.noaa.gov/nsa/index.html?region=Midwest&year=2014&month=2&day=10&units=e>

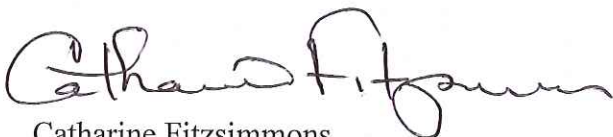
2. Open a dialogue between U.S. EPA and colleagues at the USDA to discuss common agricultural practices in the Midwest.
3. Reduce the size and number of fires of alfalfa, oats, wheat, and other hay by a certain factor to account for any fires that may actually be roadside ditch fires or fires that have spread accidentally from trash or brush burning.
4. Further investigate the remaining winter fires to determine if weather conditions would allow burning.
5. Accept the data for the 39 agricultural fires that Iowa DNR has identified. This data will be submitted to EPA via EIS by December 31, 2015.
 - Please advise if the 38 of 39 fires that were on Conservation Reserve Program land should be re-classified as grass/pasture fires.

Grass/Pasture Burning Emissions

1. Compare the grass/pasture fire data to Conservation Reserve Program data to derive a more accurate size of fire.
2. Further investigate winter fires to determine if weather conditions would allow burning.
3. Reduce the size and number of fires by a certain factor to account for any fires that may actually be roadside ditch fires or fires that have spread accidentally from trash or brush burning.

Again, Iowa DNR appreciates the opportunity to comment on this preliminary data set and requests that EPA use Iowa DNR's recommendations to improve EPA's emission estimates. Please contact Marnie Stein of my staff at (515) 725-9555 or marnie.stein@dnr.iowa.gov for any questions or additional information.

Sincerely,



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w/attachment - "Iowa_DNR_EPA_Overlap_Fires.xlsx"