Gorge Emission Inventory Report

I. Background

The Emission Inventory (EI) work is part of the Gorge Air Quality Study, which is designed to provide an assessment of the causes of visibility impairment in and around the Columbia River Gorge National Scenic Area. There are three key ways we learn about AQ: through monitoring, modeling and emission inventory. This document is a high level summary describing what an EI is, how it fits into the Gorge technical study, and provides information on sources and pollutants that contribute to air quality in the Gorge.

II. Purpose of an Emission Inventory

An emissions inventory is important for a number of reasons. An emission inventory is an itemized list of emission estimates for sources of air pollution in a given area for a specified time period. Present and future year inventories are critical components of air quality planning and modeling. The emissions inventory helps to assess the level of pollutants released into the air from various sources. For example, based on the types and amounts of emissions it can be used to develop an understanding of the sources that may impact the Scenic Area. These sources may come from both man-made and natural sources.

Secondly, the emissions inventory is used to conduct air dispersion modeling. The air dispersion model is considered to be performing well when it can simulate actual monitored air concentrations that have already occurred. The better a model simulates the past, the better the confidence of predicting future-year scenarios and any resulting strategy development.

One other purpose of an emission inventory is to get an estimate of future air quality. This is done by using growth assumptions from various aspects of our lives. This includes things like estimating what future population growth will be, how much driving will be occurring (vehicle miles traveled (VMT)), and economic growth to make a prediction of what future emissions will be. Depending on the category, emissions will either increase or decrease based on population habits, industry growth or slowdown, and environmental conditions such as increased wildfires. The EI is a catalog of the best estimate of current emissions, and a good prediction of what is likely to happen in the future. Additionally, because of the complex chemistry, meteorology, and air movement that occurs in the Gorge area, there are a number of different factors that can translate emissions into air quality impacts. Therefore, judging any source category’s contribution to impairment may require that we evaluate emissions and the impacts from chemical and meteorological conditions.

III. How was the Gorge EI Developed?

A. Emission Inventories Used in the Gorge EI

i. U.S. EPA - National Emissions Inventory (NEI)

Emissions inventories have been critical for the efforts of state, local and federal agencies to attain and maintain the National Ambient Air Quality Standards (NAAQS) that EPA has established for criteria pollutants such as ozone, particulate matter, and carbon monoxide. In the past, mobile, area and biogenic emission inventories have been completed as needed to support activities such as nonattainment/maintenance planning efforts or as time and resources allowed. Point source inventories have been developed each year by the state and local agencies and submitted to EPA for major sources annually. Beginning in 2002 state and local agencies were required to submit emissions information to EPA as part of the National Emissions Inventory (NEI). These emission inventories include information about point, area, on-road mobile, nonroad, and natural sources. EPA compiles the information and adds emissions category data that may not have been submitted, such as fugitive dust. Agencies then review and comment on the revised inventory, EPA makes further revisions, and a final NEI is available for use. The most current inventory data available was used for modeling and haze assessment purposes for the Scenic Area.

ii. WRAP EI

The Western Regional Air Partnership (WRAP) is an organization composed of state, federal, and tribal governments formed to address the federal regional haze rules and other air quality issues in the western U.S. The air quality agencies in Oregon and Washington participate regularly in the Emissions Forum of the WRAP. WRAP developed an emissions inventory for the 14 Western states based on EPA's final 2002 NEI, and used it as the WRAP 2002 "base year" inventory from which it could project future year emissions for 2008, 2013, and 2018 for regional haze purposes.

B. Gorge Project EI

To run an air dispersion model, specific timeframes must be selected in order to create and compare modeling output information to observed monitoring results. This helps create a "base case" modeling output to confirm that the "base case" scenario simulates actual monitored air concentrations that have already occurred. The better a model simulates the past (base case), the better the confidence of predicting future-year scenarios.

The Gorge Technical Team decided that air quality monitoring would take place from July 2003 through February 2005, therefore the emissions inventory estimate needed to be developed for 2004 in order to quantify the emissions in the air that the air monitors would be sampling. The Gorge Technical Team selected 2004 as the "base year" because the emissions information could be input to a model and the output concentrations compared to actual 2004 monitoring data conducted in the Gorge. The "base-year" emissions inventory (EI) was created to document actual emissions occurring in the airshed. For the "future year" comparison, the Team selected 2018 because the WRAP EI was already projected to that year. It allowed for the Gorge modeling to tie in with the WRAP regional modeling for visibility and regional haze.

The Gorge Technical Team reviewed the collected monitoring data. Two summertime (July and August 2004) and two wintertime (Feb 2004 and Nov. 2004) episodes were initially identified for further study based on the monitoring data and analysis presented in the Columbia River Gorge Haze Gradient Study and Causes of Haze in the Gorge (CoHaGo) reports. Because of limited funding, only one wintertime and one summertime episode could be modeled. August and November 2004 were chosen because of the greatest visibility impairment and emissions inventory availability. Additionally, for the purposes of looking at the emission inventory and in performing quality assurance on the model, two specific days were chosen within the modeling episodes. For the August and November events, a specific day was chosen (August 18 and November 12). These days were chosen as "representative" days that would be indicative of conditions for either the summertime or wintertime event.

i. Creating the 2004 EI

Using the 2002 WRAP EI as the foundation, Oregon and Washington provided 2004 annual emissions data for point sources and selected area sources, as point sources are required to report their emissions each year. For the remaining area sources, Oregon and Washington took the 2002 submitted emissions data and grew the emissions to 2004. Information on the basis and methodology for the emissions growth process from 2002 to 2004 is detailed in the 2004 Gorge Emissions Inventory for Modeling report (DEQ, 2006). For nonroad mobile sources Oregon and Washington ran EPA's nonroad model to generate daily emissions. To make comparisons for the episode days the inputs for the model had to be specific to the episode.

However, because most of the emissions were calculated on an annual basis, these emissions needed to be adjusted to reflect seasonal, daily, and hourly emissions to correlate the information to the selected "representative" episode days. Oregon and Washington generated annual county emissions estimates which are processed with a commonly used software package called SMOKE (Sparse Matrix Operator Kernel Emissions) that distributes the emissions data to specific hours of a day, days of a month, and months of the year based on accepted time profiles of the activities that generated the emissions. For example, residential use of lawnmowers occurs more in the evening than the day during the week, but more during the weekend than the weekday, and more between May through October than in December and January. This type of "temporal profile" is established for each source of emissions in the inventory. The SMOKE processing system also uses land type (residential, forest, agricultural) to assign the emissions to certain areas of the county. For example, home heating/cooling and lawnmower use are located in residential areas and farm tractor emissions are placed in agricultural areas. These two activities allow the technical team to disperse the annual emissions estimate to a representative day in August and November for the purposes of examining the data sampled at the monitors and to evaluate the visibility in 2004 and 2018.

ENVIRON (the modeling contractor to the air agencies) estimated the 2004 on-road mobile emissions by running MOBILE 6 within the air dispersion model using model inputs provided by Oregon and Washington. This provided hourly and daily emissions information. On-road mobile emissions are typically characterized as motor vehicles. For the remaining emissions categories where the states could not provide updated 2004 inventory information, Alpine Geophysics (a modeling subcontractor to the air agencies) took the 2002 WRAP inventory and filled those data gaps by growing the emissions to 2004.

Further adjustments to the 2004 inventory were made, including reducing the calculated particulate matter emissions from residential wood smoke and increasing ammonia emissions from agricultural operations. For more detailed information on how the adjustments were calculated, please see the Gorge Modeling Report.

This 2004 emissions inventory was used as one of the inputs to the CAMx dispersion model. The dispersion model was used to simulate the conditions that the year of monitoring recorded for the two chosen episodes. The model is run in an iterative fashion until it represents the monitored data with a known degree of uncertainty. These uncertainty parameters are discussed in detail in the modeling report.

ii. Creating the 2018 EI

In assembling the 2018 EI for the Gorge air quality study, information was used from the WRAP 2018 inventory. When WRAP developed the 2018 EI, it projected its 2002 "base year" inventory. Emissions from various source categories were evaluated and adjusted accordingly to reflect an appropriate inventory of emissions. Various growth factors were used to estimate future year emissions. These included population growth, economic forecasts, increases in motor vehicle travel (vehicle miles traveled, or VMT) and permitted emissions for major industrial sources. The VMT growth assumptions for on-road mobile reflect the region's local travel forecast. Point source (industry) and area source emissions were grown based on EPA's Economic Growth and Analysis System (EGAS) growth factor model. EGAS generates an EPA Source Classification Code (SCC)-specific growth factor for a specified geographic area using various socio-economic data. More specific county-level growth factors were not applied because the county level socio-economic data was not available at the time. Therefore, the EGAS model only generated growth factors at the state level, resulting in default growth factors for source categories and less specific growth information that could be applied if grown by the States.

The WRAP also factored in emissions reductions expected from EPA rules that had been promulgated as of December 2005. Other EPA rules, such as the Best Available Retrofit Technology (BART) rule for the BART sources (which would include PGE Boardman), did not have its expected emissions reductions factored into the 2018 inventory. Other source categories, such as emissions for wildfires and windblown dust were held constant from 2004 to 2018. Although the WRAP did revisit its 2018 inventory and provide updates to include expected emissions reductions from EPA rules (promulgated as of March 2007) and BART controls, this inventory was not completed until June 2007. Because the Gorge Technical Team needed to compile the Gorge 2018 inventory prior to the WRAP's latest update, the Gorge 2018 EI reflects information from the best available WRAP 2018 inventory estimate. For a detailed description of how WRAP grew the emissions inventory including how the EGAS model was applied to the growth factors, please refer to the WRAP Point and Area Source Emissions Projections for the 2018 Base Case Inventory (January 2006).

Additional adjustments were made to the 2018 WRAP inventory to incorporate expected impacts from EPA rules (including BART) that had been promulgated since WRAP developed its 2018 inventory. Alpine Geophysics also corrected errors found in the WRAP 2018 inventory to make it more consistent with local conditions. The Gorge Modeling Report (2007) details what adjustments were made to the 2018 inventory.

IV. What are the Pollutants of Concern?

A good emission inventory (EI) is necessary to understand impacts to air quality, perform source attribution, and evaluate alternative emission reduction scenarios. Each pollutant or compound has a unique set of characteristics that contribute to visibility impairment. The higher the concentration of the pollutants, the more visibility is impaired. Air monitoring on bad visibility days shows the main pollutants impacting the Gorge are: organic carbon, nitrates, and sulfates. These pollutants all have the ability to scatter light, which affects visibility. The sulfates and nitrates are formed from sulfur oxides (SOx) and oxides of nitrogen (NOx), which are products of fossil fuel combustion (coal burning power plants, automobiles, smelters, industrial boilers, and refineries). Ammonia plays a key role in the air chemistry that forms sulfates and nitrates. Sources typically associated with ammonia emissions include livestock farming, application of fertilizer, and microbiological degradation (bacteria). Organic carbon comes from smoke (such as wildfires and woodsmoke) and elemental carbon also comes from combustion activities (such as vehicle engine exhaust). Particulate matter is comprised of both organic and elemental carbon; particulate matter is often further defined in various sizes such as PM2.5 (particulate matter less than 2.5 microns in diameter).

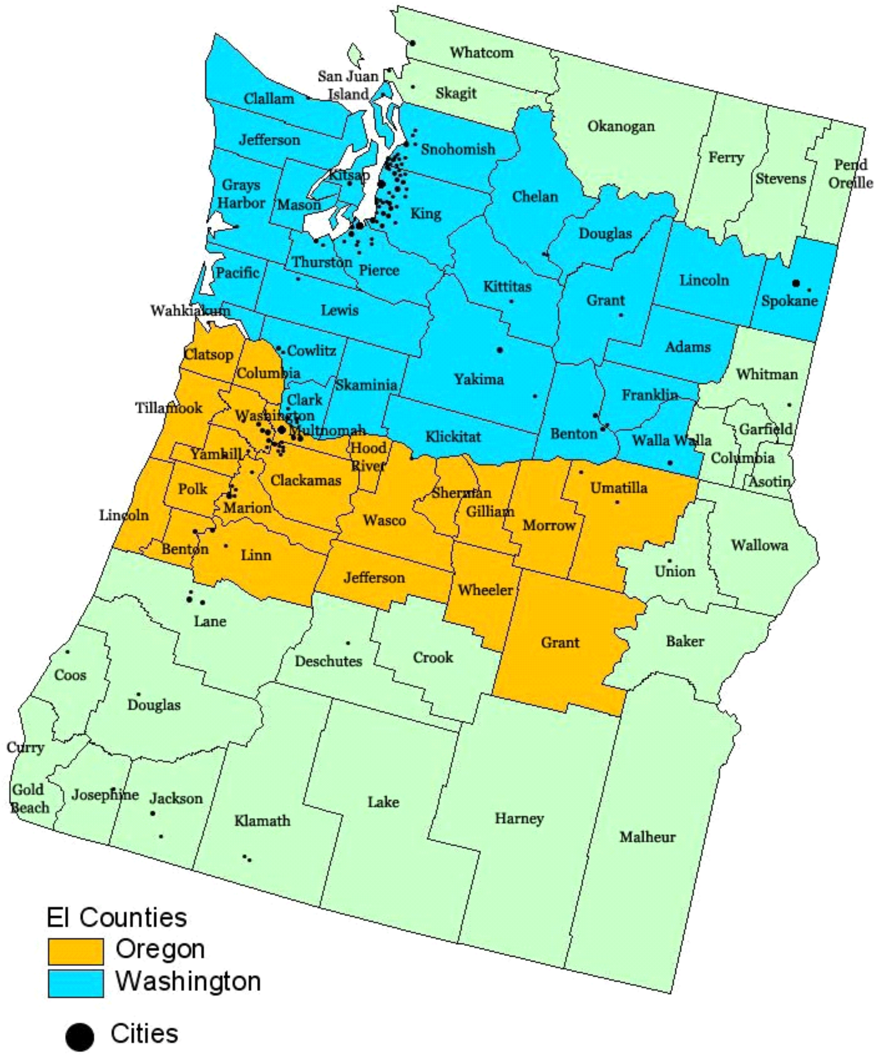
An emission inventory including SOx, NOx, NH3, VOC, and speciated primary PM is needed for the Gorge. This includes emissions from all potential source types affecting the Scenic Area – point sources (e.g., industry), mobile sources (e.g., vehicles, ships, trains, aircraft, diesel vehicles), area sources (e.g., woodstoves, outdoor burning, paint and solvent use, agriculture), and natural sources (e.g., emissions from sources such as vegetation and volcanic activity).

V. EI Areas

Based on information presented in the Causes of Haze in the Columbia Gorge Report the long range transport of visibility impairing pollutants is in the East to West direction in the winter and the West to East direction in the summer. Emissions generated outside the 4-km modeling domain are accounted for through initial and boundary conditions emissions. CAMx employs multiple numerical algorithms that track the horizontal transport of pollutants generated outside of the EI domain. For modeling, a suitable geographic domain must be selected to characterize conditions. Once the domain is chosen, the emissions inventory is compiled for that modeling domain.

The Gorge Technical team selected a modeling domain to capture what could be affecting conditions in the Gorge. The area included in the emission inventory was focused within a 4-km (6.44 mile) grid modeling area, encompassing most of Washington and Oregon. Twenty-eight counties in Washington and twenty-four counties in Oregon were determined to be most likely to influence visibility in the Scenic Area, and therefore, a comprehensive inventory was performed for the counties highlighted below in blue or yellow.

Figure x. Counties Studied


Whatcom
San Juan
Island
Skagit
Clallam
Okanogan
Jefferson
Snohomish
Ferry
Stevens
Pend
Oreille
Kitsap
Grays
Harbor
Mason
King
Chelan
Douglas
Thurston
Pierce
Pacific
Kittitas
Lincoln
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Spokane
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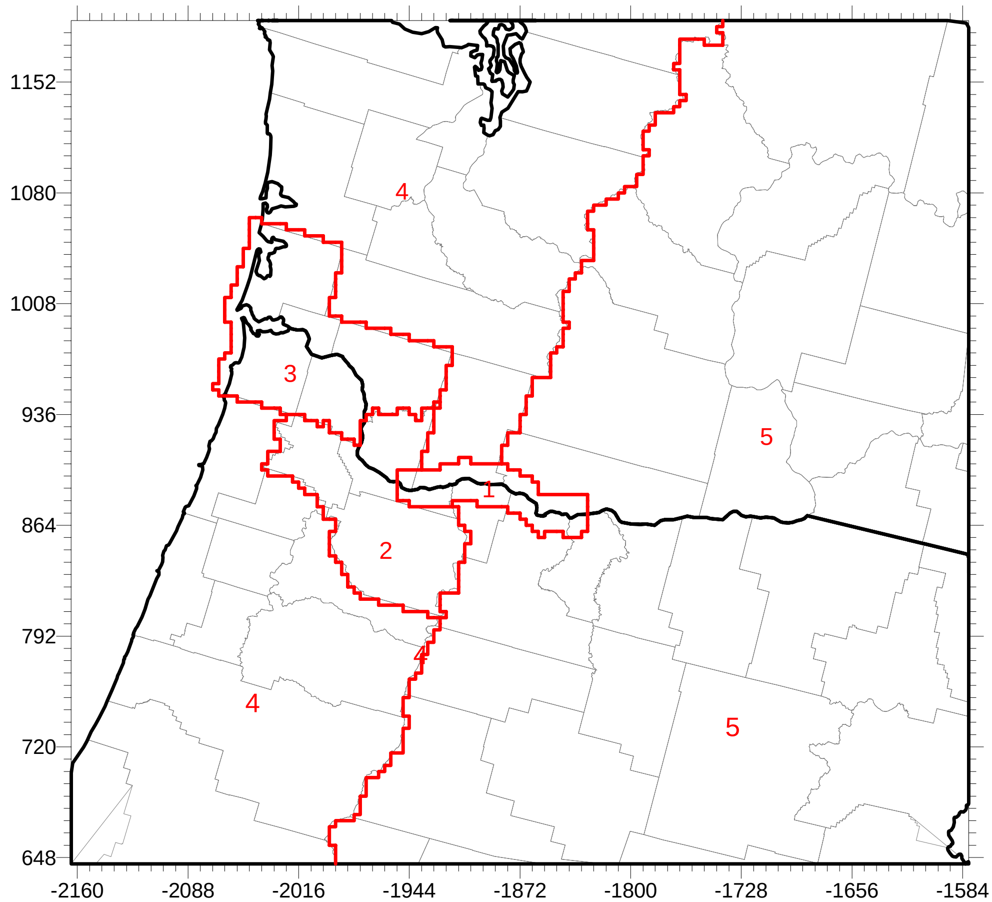
Yamhill
Asotin
Clackamas
Polk
Umatilla
Sherman
Marion
Gilliam
Lincoln
Wasco
Morrow
Wallowa
Benton
Linn
Union
Jefferson
Wheeler
Lane
Baker
Grant
Deschutes
Crook
Coos
Douglas
Curry
Gold
Beach
Josephine
Jackson
Lake
Klamath
Harney
Malheur
EI Counties
Oregon
Washington
Cities

VI. Overview of Emissions by PSAT Region

In order to obtain a better understanding of source contribution from specific areas, a modeling tool was employed. The CAMx PSAT (PM Source Apportionment Technology) tool could attribute sulfate, nitrate, organics, and primary particulates to regions within the Gorge. This information can be used to better identify what specific emissions are coming from different regions affecting the Gorge. For example, it provides a snapshot of what emissions are coming from the Portland metropolitan area, what emissions are coming from an area specifically within the Columbia River Gorge, and what the contributions of these emissions are. The Technical Team divided up the Gorge modeling area into 5 regions, as shown in Figure x. Region 1 encompasses the Gorge Scenic Area, Region 2 - metropolitan Portland and surrounding areas, Region 3 – areas directly northwest of the central Gorge area, Region 4 – all other areas west of the Gorge area, and Region 5 – all other areas east of the Gorge area. Both 2004 and 2018 emissions were calculated for these areas using the PSAT modeling tool.



Source Region Map - 4km domain

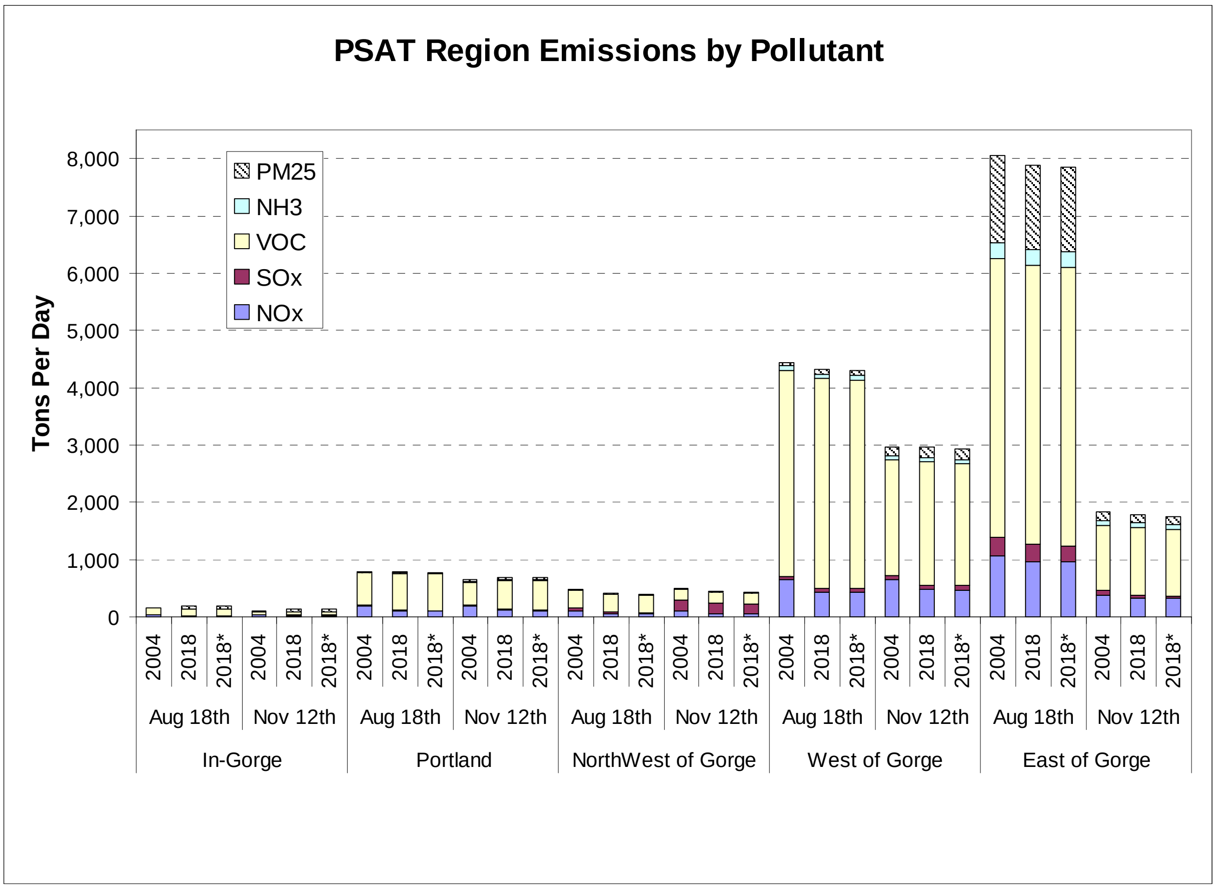
1. In-Gorge
2. Portland
3. NorthWest of Gorge
4. West of Gorge
5. East of Gorge

(LCP Definition: -97, 40, 45, 33)

Figure x. Modeling domain map of the Columbia River Gorge air quality area

To help gain a better understanding of source contribution from the various regions in the Gorge modeling area, Figure x shows the emissions by pollutant distributed amongst the five PSAT regions. The areas "West of Gorge" and "East of Gorge" have high pollutant contributions, primarily due to the larger area that it encompasses. For example, emissions from the Puget Sound area (Seattle, Tacoma, Olympia) and the Southern Willamette Valley (Salem, Eugene, Corvallis) are included in "West of Gorge" emissions.

Figure x

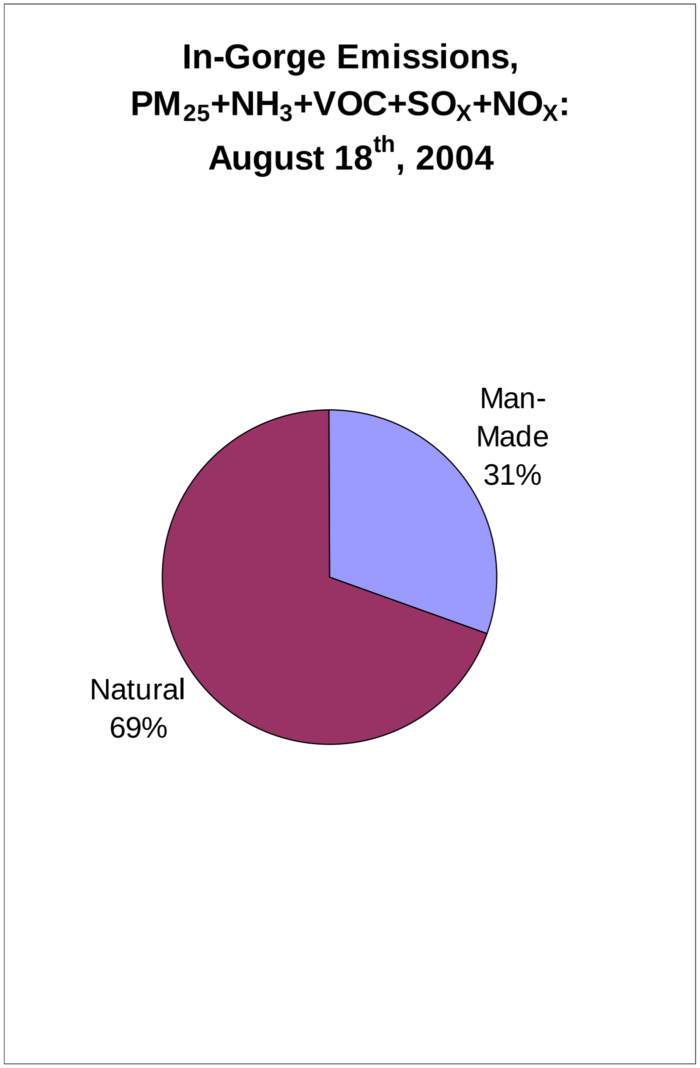


These emissions in Figure x reflect both natural and anthropogenic sources, however, for the purposes of discussing identifying sources that can be addressed as part of a Gorge visibility strategy, this section details the anthropogenic source contribution for all the pollutants combined. Information on the natural source contribution by pollutant is discussed in Section VI.

A. In-Gorge Source Contributions

The In-Gorge area (Region 1) comprises of the immediate Columbia Gorge Scenic Area including parts of Multnomah, Hood, Wasco, and Sherman counties in Oregon and Skamania, Klickitat, and Clark counties in Washington. The source categories were determined by identifying all the anthropogenic source categories that were contributing to In-Gorge emissions. DEQ identified and grouped these categories according to similar category groupings (e.g. the agricultural source category consists of nonroad – agricultural, fertilizer operations, and orchard heaters, etc.), the amount of emissions for each category, and source categories of interest. For further information on how the anthropogenic emission source categories were grouped, please refer to Appendix A.

Figure x shows source contributions for August 18, 2004, Region 1: In Gorge. Natural sources comprise 69% of the overall emissions In-Gorge, with 31% coming from man-made sources. A distribution of source categories that comprise the man-made contribution to In-Gorge emissions is shown in the accompanying pie chart. On-road mobile and rail emissions account for over 50% of the man-made source contribution. The "Other" source category includes emissions from degreasers, miscellaneous area sources (including commercial, household, and industrial), and fuel storage, etc.



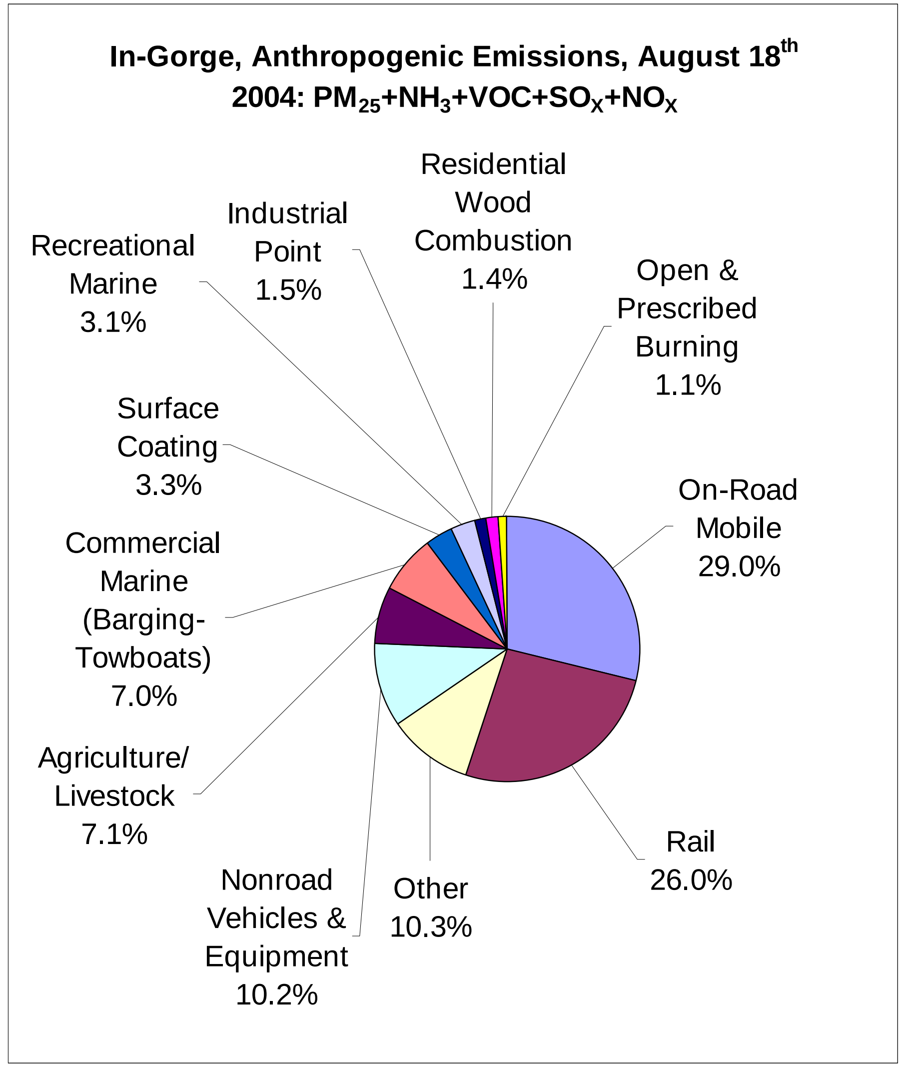
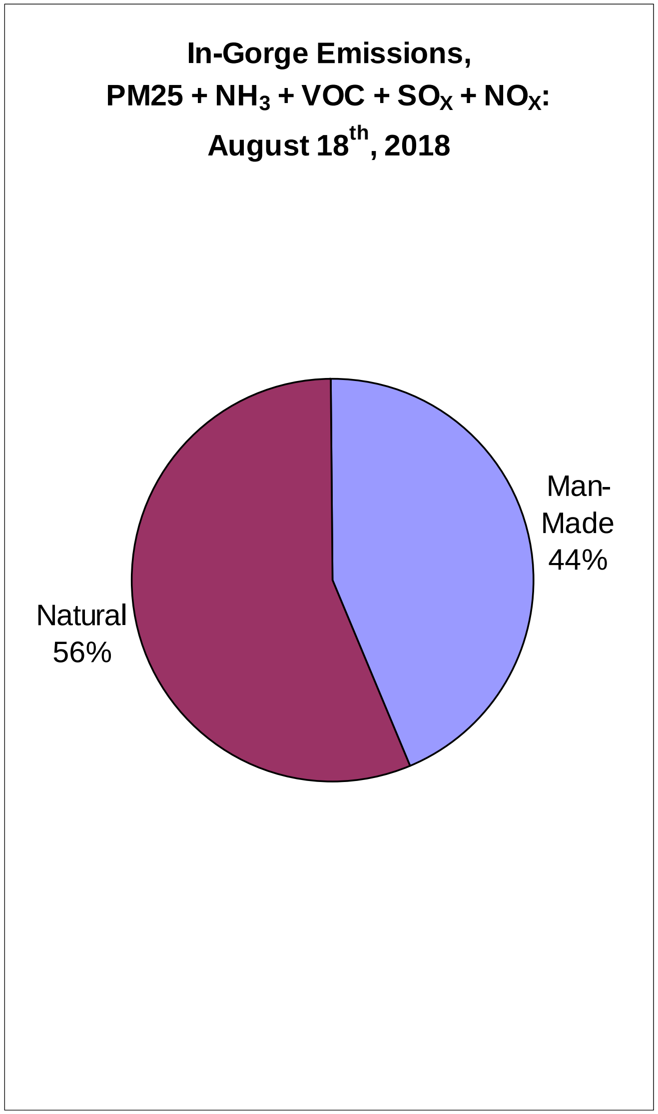


Figure x shows source contributions for August 18, 2018, Region 1 – In Gorge. Natural emissions are 56% and man-made emissions are 44% of the total source contribution to In-Gorge emissions. The accompanying pie chart shows the man-made emissions distributed by source category. Industrial point sources account for 50%, with on-road mobile, rail, and nonroad vehicle and equipment totaling about 25%. The category groupings are the same as what was used for August 2004.



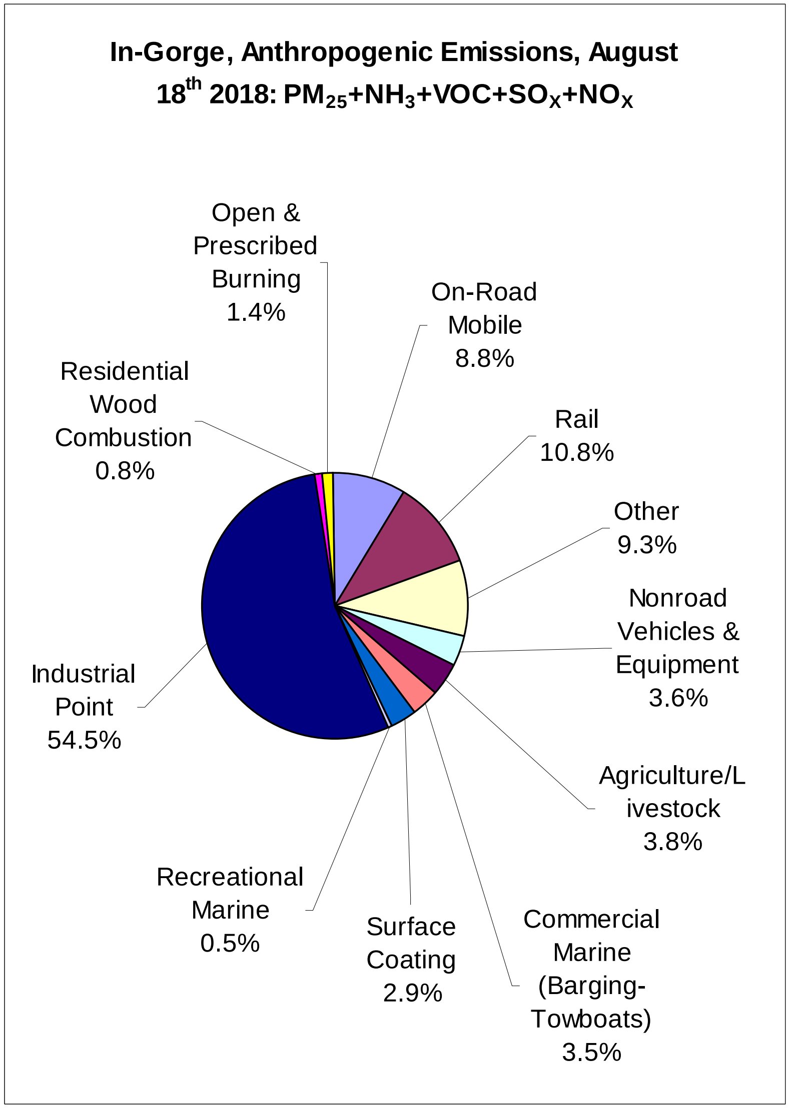


Figure x shows a comparison of source categories (man-made sources only) from August 18, 2004 to August 18, 2018. This is for In-Gorge sources only. From the chart, on-road mobile emissions decrease by 50% (14 tons/day to 7 tons/day) as a result of EPA rules for vehicle engines and ultra low-sulfur fuel. The ultra low sulfur fuel rules went into effect in 2007, resulting in a decreased amount of sulfur that is allowed in fuel, for nonroad equipment, locomotives, and marine vessels. Rail emissions also decrease by 25% (12 tons/day to 9 tons/day) due to EPA's ultra low-sulfur fuel regulations. Industrial point sources show a 4500% increase in emissions (1 ton/day to 45 tons/day) based on growth assumptions from EPA's Economic Growth and Analysis System growth factor model (EGAS). WRAP utilized this model when making the 2018 EI projections for industry. The Gorge Technical Team utilized these point source emissions for the model, but upon further examination determined the future projections might be incorrect because the expected growth will likely be minimal and the emissions increase primarily came from one source – secondary aluminum production. The "other" source category also shows growth from 2004 to 2018, due to expected population growth and increased use in degreasing and miscellaneous solvent use.

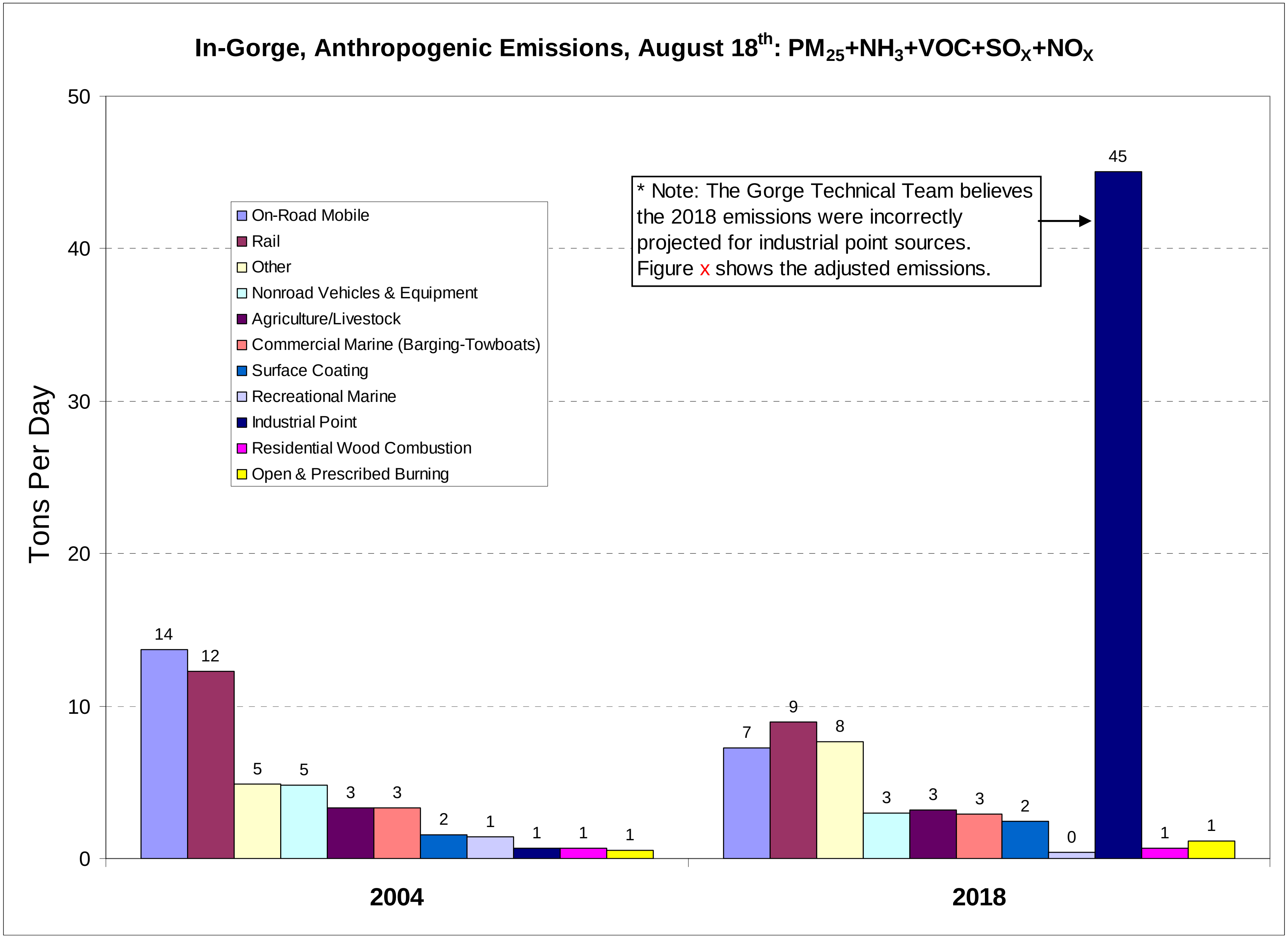

In-Gorge, Anthropogenic Emissions, August 18th: PM25+NH3+VOC+SOX+NOX
Tons Per Day
50
40
30
20
10
0
On-Road Mobile
Rail
Other
Nonroad Vehicles & Equipment
Agriculture/Livestock
Commercial Marine (Barging-Towboats)
Surface Coating
Recreational Marine
Industrial Point
Residential Wood Combustion
Open & Prescribed Burning
* Note: The Gorge Technical Team believes the 2018 emissions were incorrectly projected for industrial point sources. Figure x shows the adjusted emissions.
14
12
5
5
3
3
2
1
1
1
1
7
9
8
3
3
3
2
0
45
1
1
2004
2018

Figure x shows the adjusted emissions to the industrial point sources. The Gorge Technical Team noted there was one identified source showing a 44 ton increase in emissions from 2004-2018. After receiving information from the source (a secondary aluminum production plant) the emissions were adjusted to show a projected increase of three times the 2004 emissions. [Will need to reword this a bit.]

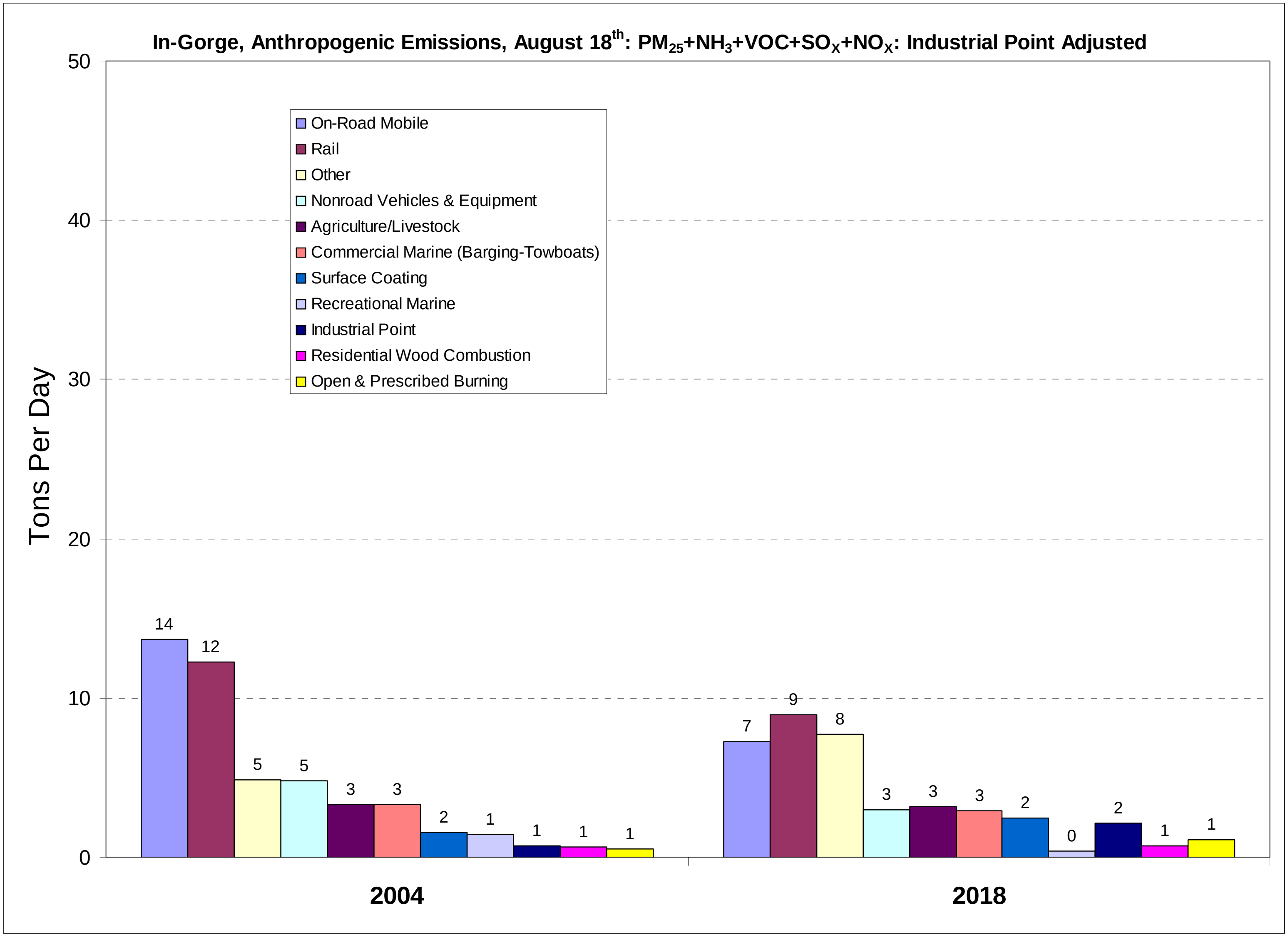
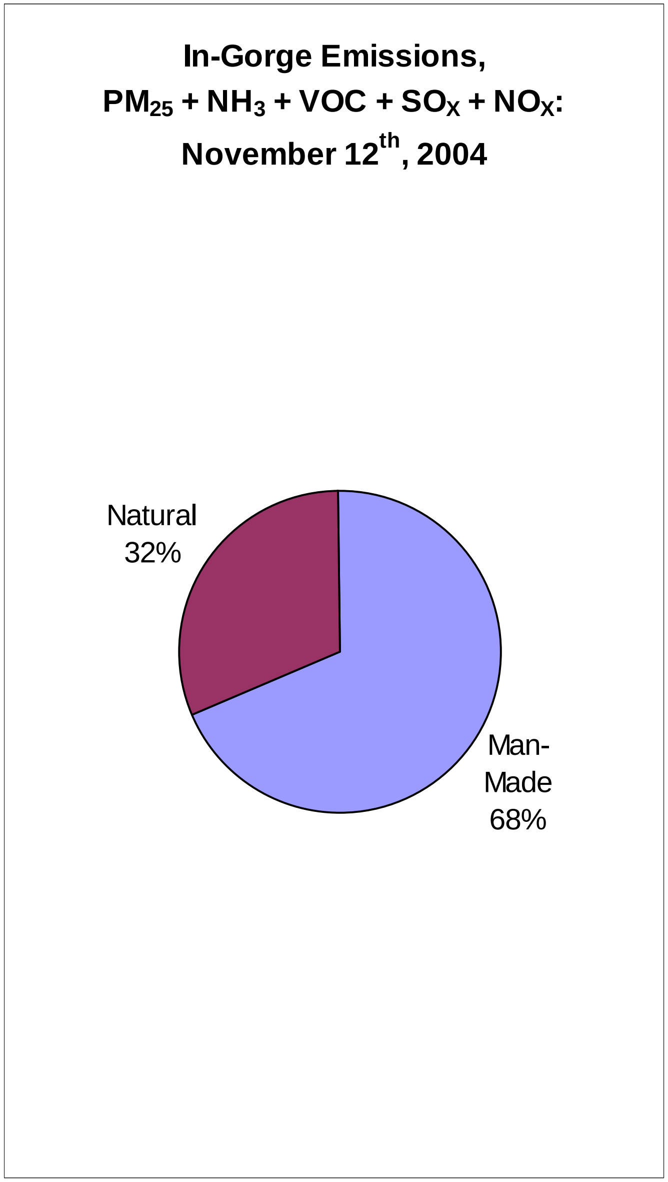


Figure x shows source contributions for November 12, 2004, Region 1 – In Gorge. Man-made sources account for 68% of the overall emissions for In-Gorge region, with natural sources comprising 32%. In the accompanying pie chart, it shows the distribution of source categories that contribute to man-made sources. Prescribed burning and on-road mobile each contribute almost 25%, rail emissions contributes 18% to man-made sources. The “Other” source category includes emissions from commercial and industrial solvent use, degreasers, fuel storage, and stationary source fuel combustion, etc.



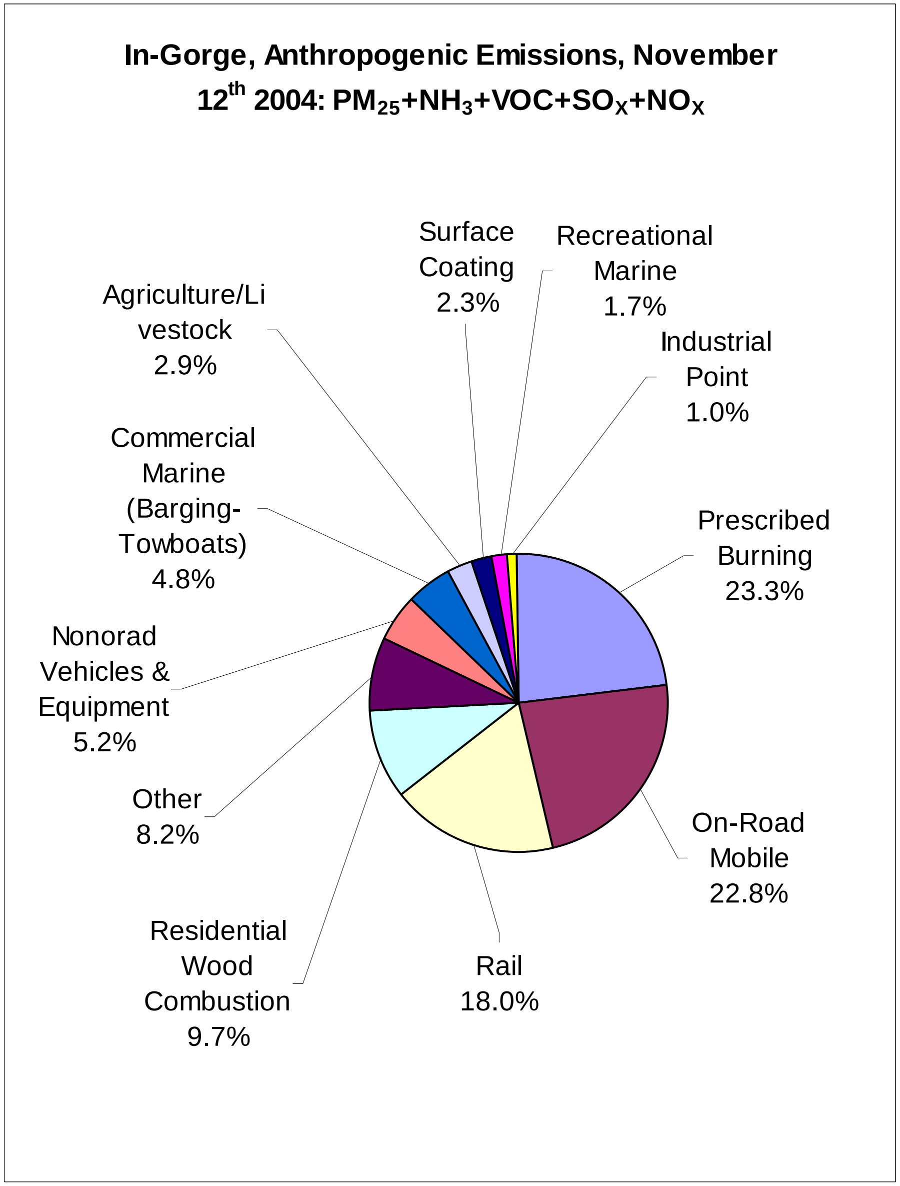
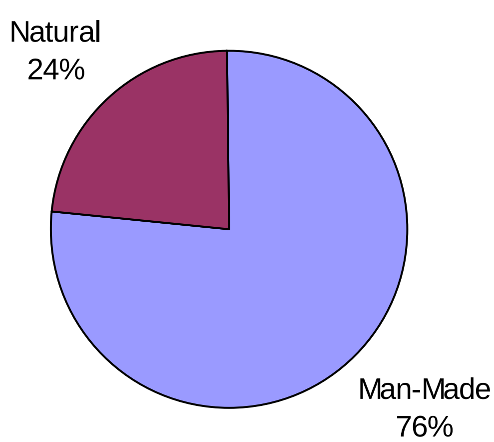


Figure x shows source contributions for November 12, 2018, Region 1 – In Gorge. Man-made emissions are 76% and natural emissions are 24% of the total source contribution to In-Gorge emissions. The accompanying pie chart shows the man-made emissions distributed by source category. Industrial point sources account for 40% with prescribed burning contributing 15%. The category groupings are the same as what was used for November 2004.

In-Gorge Emissions,
$PM_{25} + NH_3 + VOC + SO_X + NO_X$:
November 12th, 2018



In-Gorge, Anthropogenic Emissions, November 12th 2018: $PM_{25}+NH_3+VOC+SO_X+NO_X$

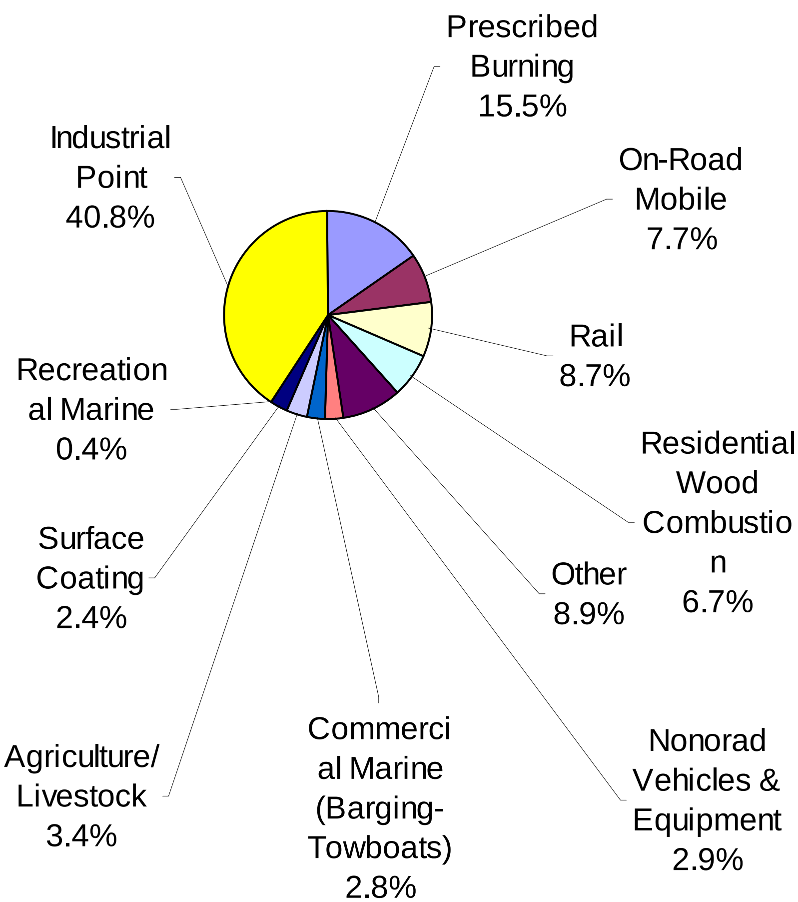


Figure x shows a comparison of man-made sources for November 12, 2004 and 2018. Prescribed burning remains constant from 2004 to 2018. On-road mobile emissions decrease by 50% (16 tons/day to 8 tons/day) and rail emissions decrease by 25% (12 tons/day to 9 tons/day) due to EPA's ultra low sulfur fuel rules. The ultra low sulfur fuel rules went into effect in 2007, resulting in a decreased amount of sulfur that is allowed in fuel, for nonroad equipment, locomotives, and marine vessels. Industrial point sources show a 4200% increase in emissions (1 ton/day to 42 tons/day). These growth assumptions were based on EPA's Economic Growth and Analysis System growth factor model (EGAS). WRAP utilized this model when making the 2018 EI projections for industry. As with the August episode, the Gorge Technical Team utilized these point source emissions for the model, but upon further examination determined the future projections might be incorrect because the expected growth will likely be minimal and the emissions increase primarily came from one source – secondary aluminum production. Agricultural emissions show an increase 150% (2 tons/day to 3 tons/day), due to a projected increase in livestock operations. The "other" source category also shows growth from 2004 to 2018, primarily due to expected increases in miscellaneous area source use (commercial and industrial) and open burning.

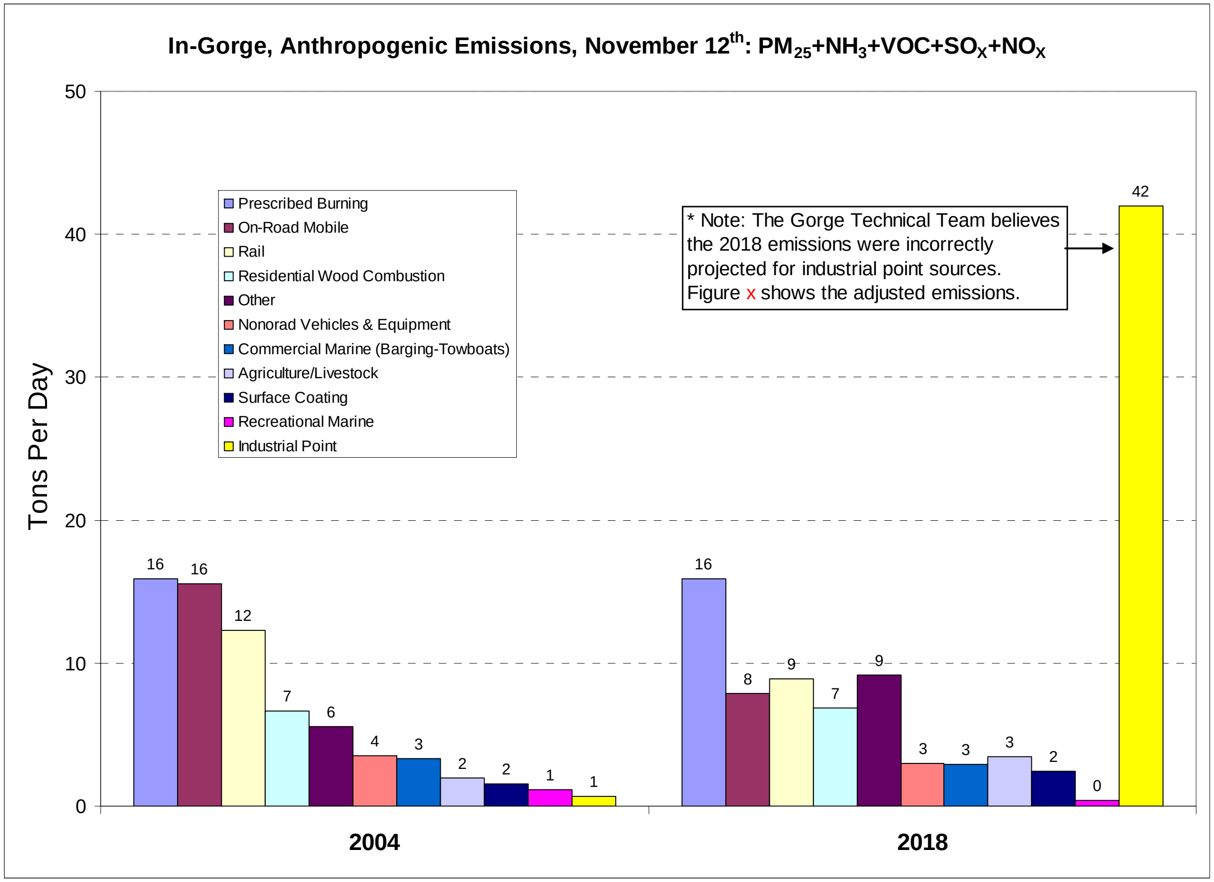
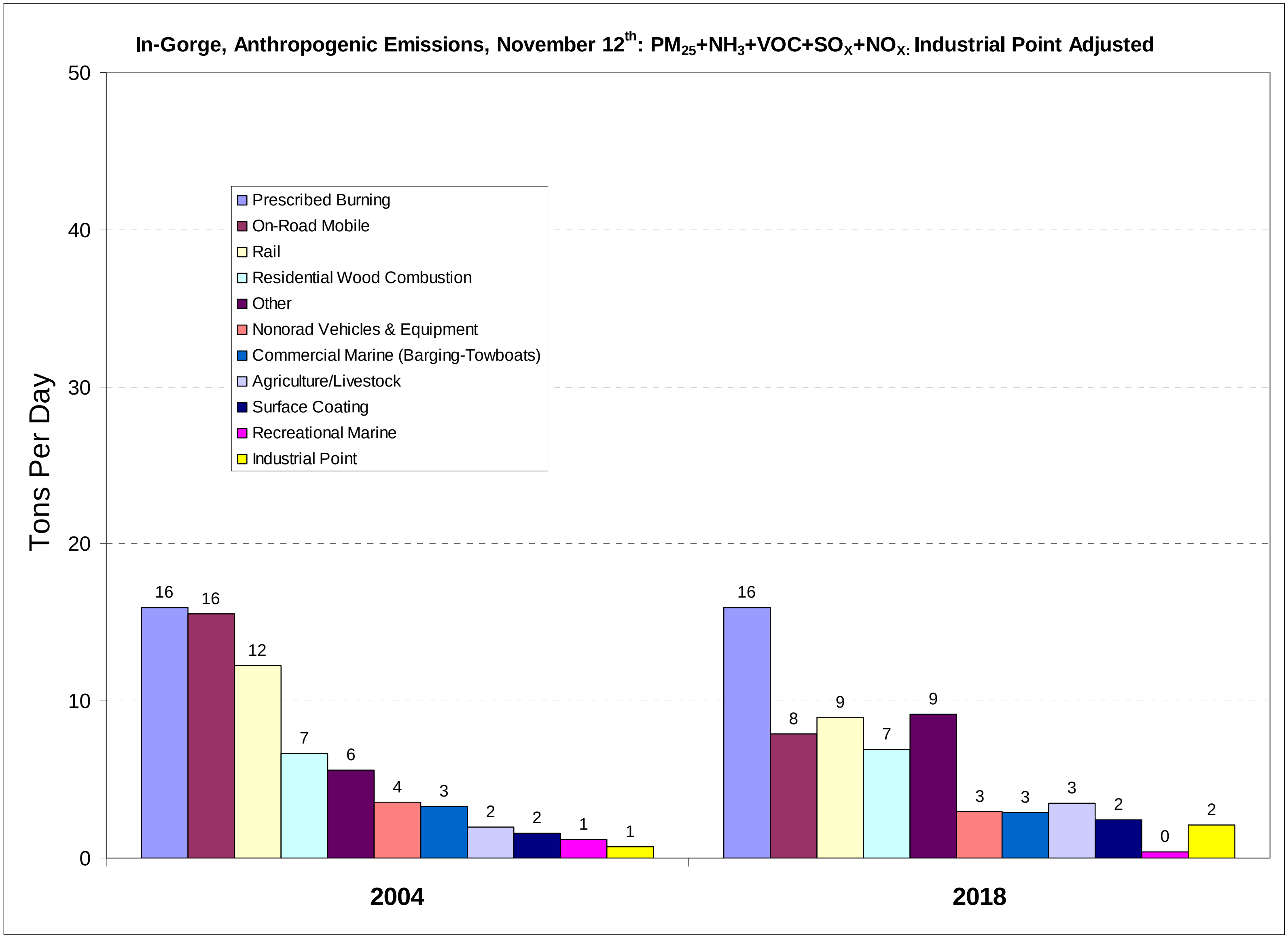


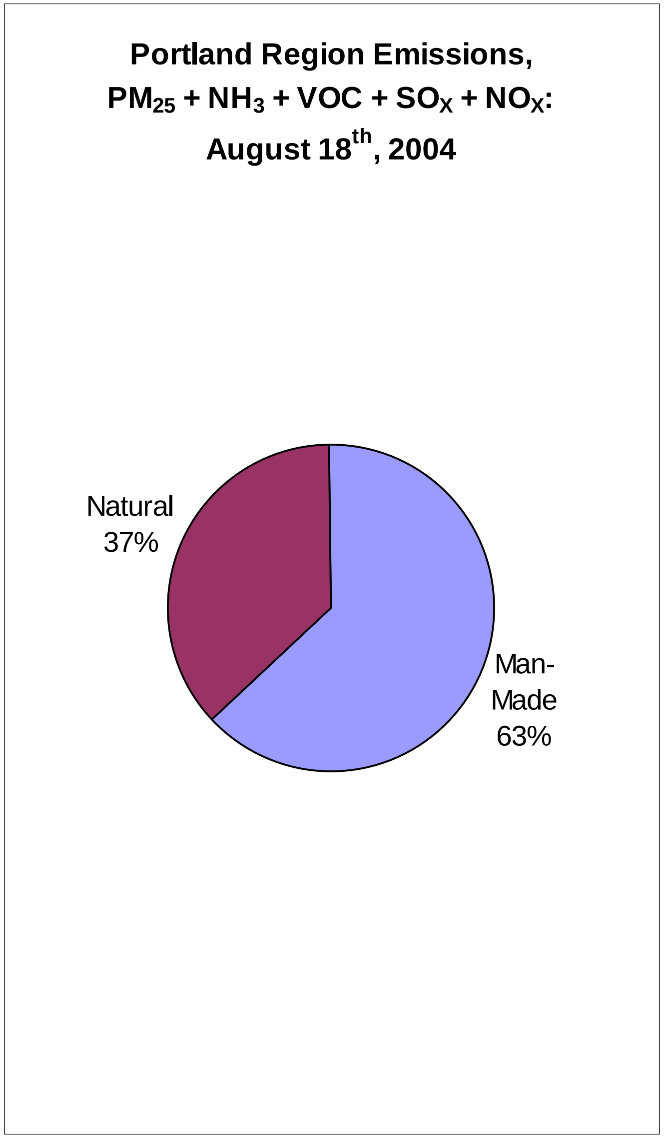
Figure x shows the adjusted emissions for November 2018. Industrial point emissions show a modest increase from 1 ton/day to 2 tons/day.



B. Portland Source contributions

The Portland area (Region 2) comprises metropolitan Portland area including Vancouver, Washington. As with the In-Gorge source category emissions, the source categories were determined by identifying all the anthropogenic source categories that contribute to Portland area emissions. DEQ identified and grouped these categories according to similar category groupings (e.g. the agricultural source category consists of nonroad – agricultural, fertilizer operations, and orchard heaters, etc.), the amount of emissions for each category, and source categories of interest. For further information on how the anthropogenic emission source categories were grouped, please refer to Appendix x.

Figure x shows source contributions for August 18, 2004, Region 2: Portland. Man-made sources account for 63% of the overall emissions for In-Gorge region, with natural sources comprising 37%. In the accompanying pie chart, it shows the distribution of source categories that contribute to man-made sources. On-road mobile contributes 34% and nonroad vehicles contribute 14% to man-made sources. "Miscellaneous Area Sources" source category is a combination of solvent applications, including graphic arts, and commercial and industrial uses. The "Other" source category includes emissions from residential wood combustion, fuel storage, open burning, and fugitive dust, etc.



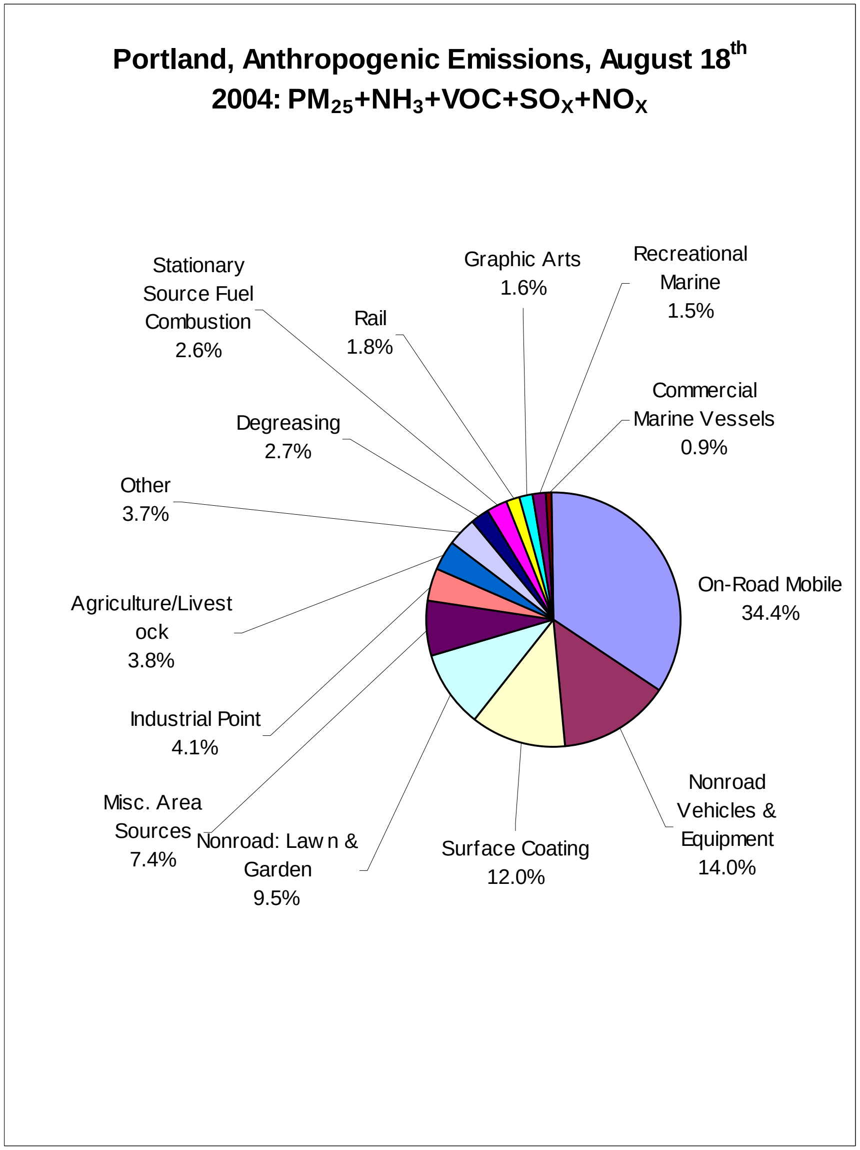
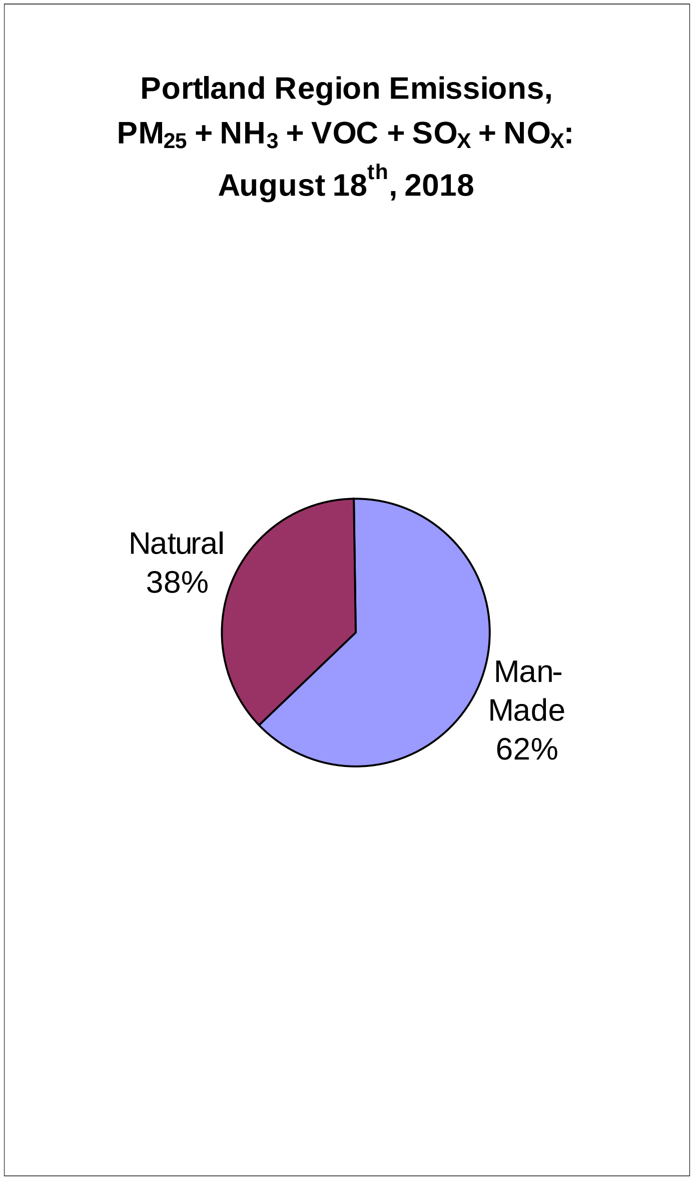


Figure x shows source contributions for August 18, 2018, Region 2: Portland. Natural emissions are 62% and man-made emissions are 38% of the total source contribution to Portland emissions. The accompanying pie chart shows the man-made emissions distributed by source category. Surface coating emissions account for 21%, on-road mobile emission account for 15%, and degreasing comprises 11% of the anthropogenic emissions. The category groupings are the same as what was used for August 2004.



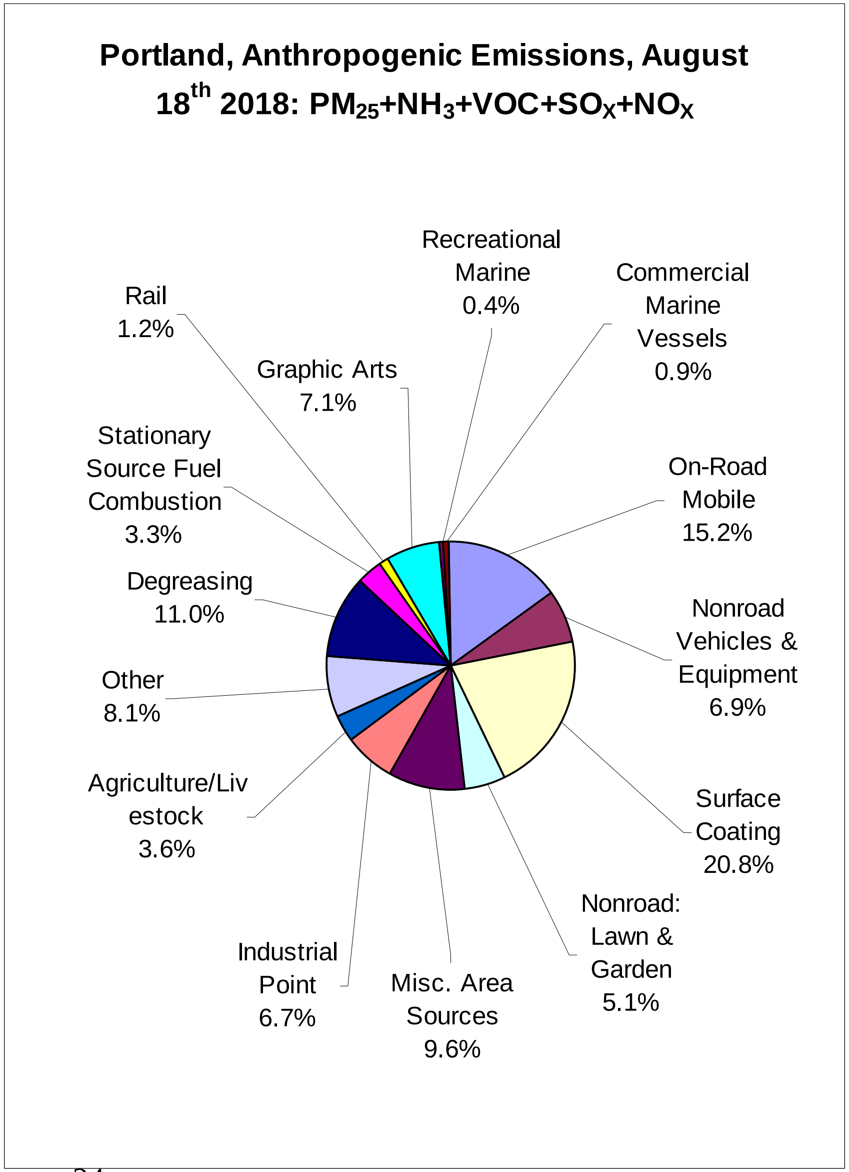


Figure x shows a comparison of man-made sources for August 18, 2004 and 2018. On-road mobile emissions decrease by 57% (172 tons/day to 75 tons/day), nonroad vehicles and equipment emissions decrease by 50% (70 tons/day to 34 tons/day), and nonroad: lawn and garden emissions also decrease by 50% (48 tons/day to 25 tons/day) due to EPA's ultra low sulfur fuel rules. The ultra low sulfur fuel rules went into effect in 2007, resulting in a decreased amount of sulfur that is allowed in fuel, for nonroad equipment (including lawnmowers), locomotives, and marine vessels. Surface coating sources show a 170% increase (60 tons/day to 103 tons/day), miscellaneous area sources increase by 129% (37 tons/day to 48 tons/day), degreasing emissions increase by 415% (13 tons/day to 54 tons/day), graphic arts increase by 437% (8 tons/day to 35 tons/day), and industrial point sources show a 157% increase in emissions (21 ton/day to 33 tons/day) all due to growth assumptions based on WRAP's utilization of EPA's Economic Growth and Analysis System growth factor model (EGAS). The "other" source category also shows growth from 2004 to 2018, primarily due to expected increases in dry cleaning use, emissions increases in commercial food preparation, and open burning.

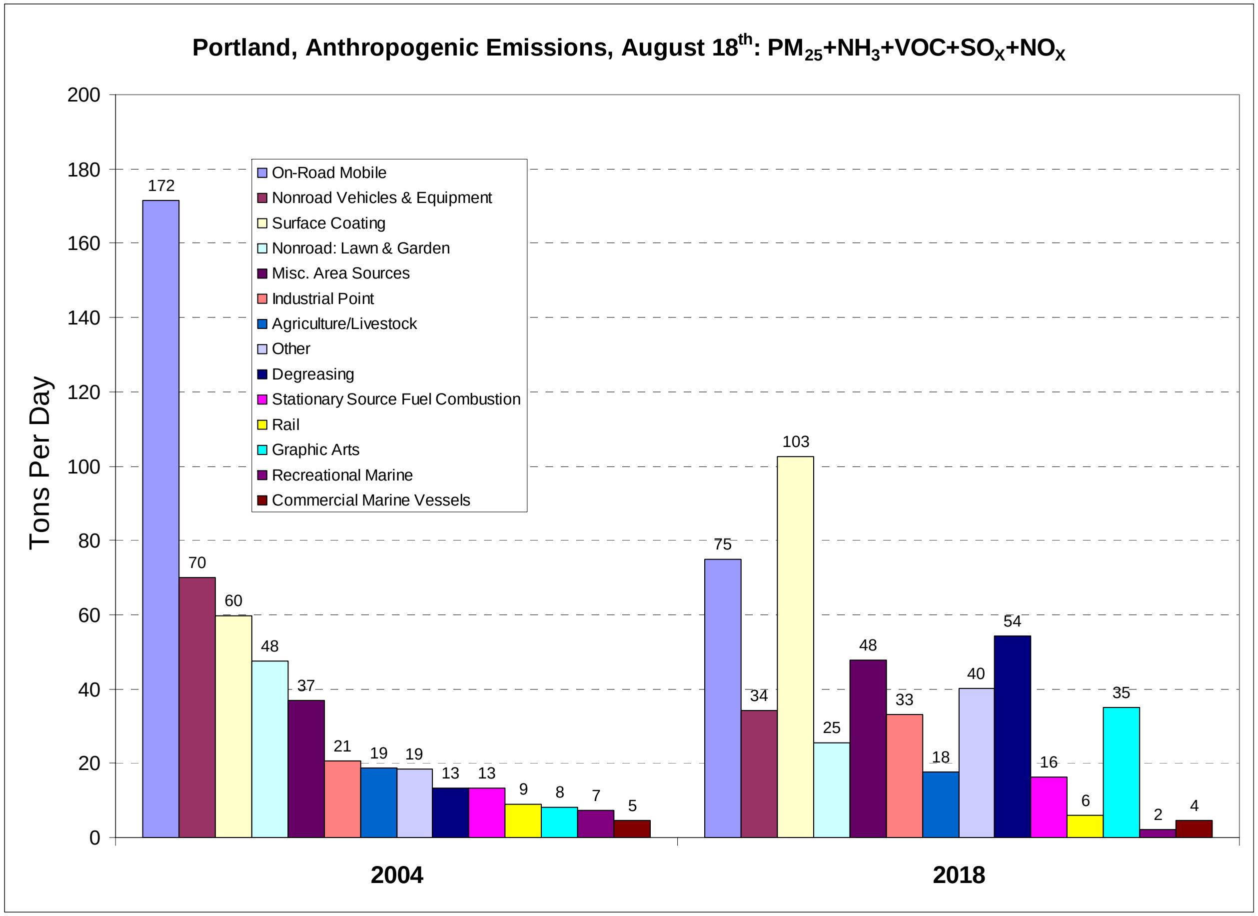
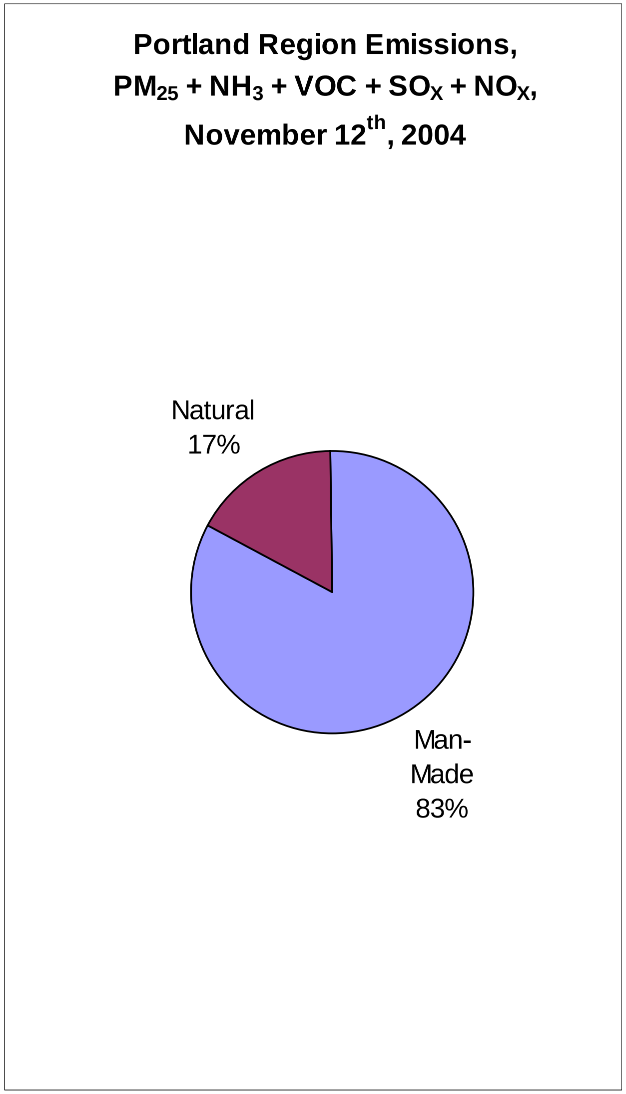


Figure x shows source contributions for November 12, 2004, Region 2 – Portland. Man-made sources account for 83% of the overall emissions for Portland area region, with natural sources comprising 17%. In the accompanying pie chart, it shows the distribution of source categories that contribute to man-made sources. On-road mobile each contribute 36%, residential wood combustion and surface coating together contribute 25% of emissions from man-made sources. "Miscellaneous Area Sources" are commercial and industrial solvent use including degreasing. The "Other" source category includes emissions from open and prescribed burning, fuel storage, and fugitive dust, etc.



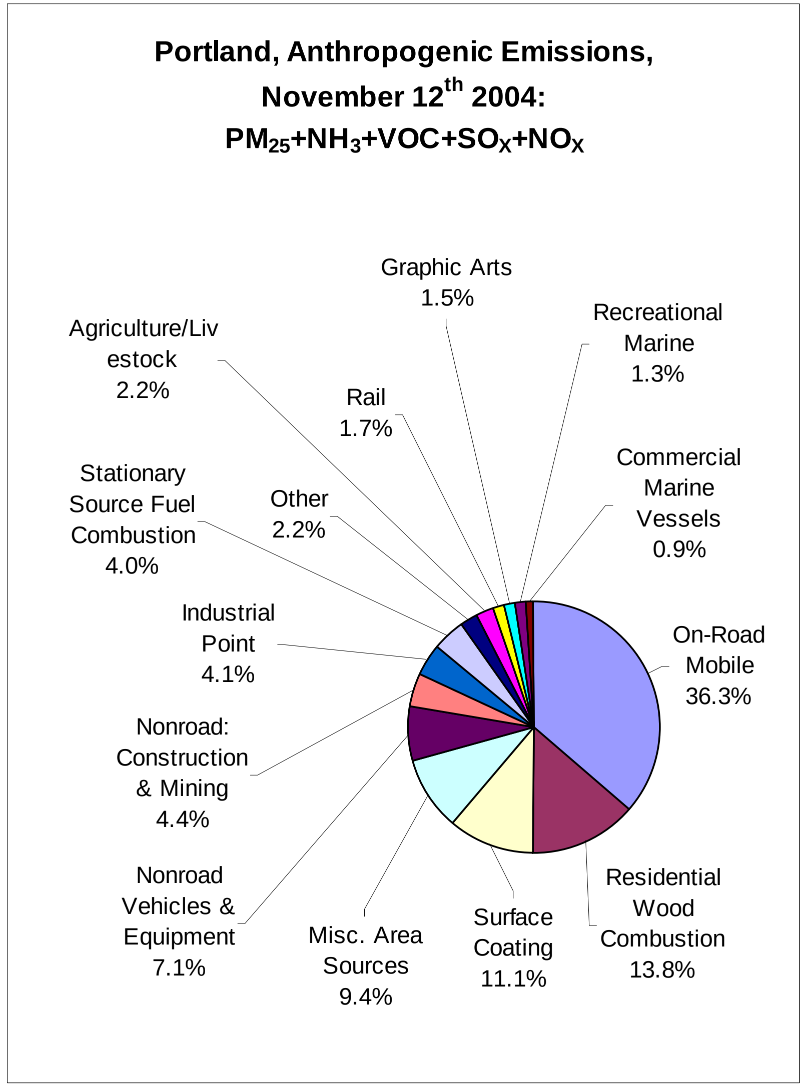
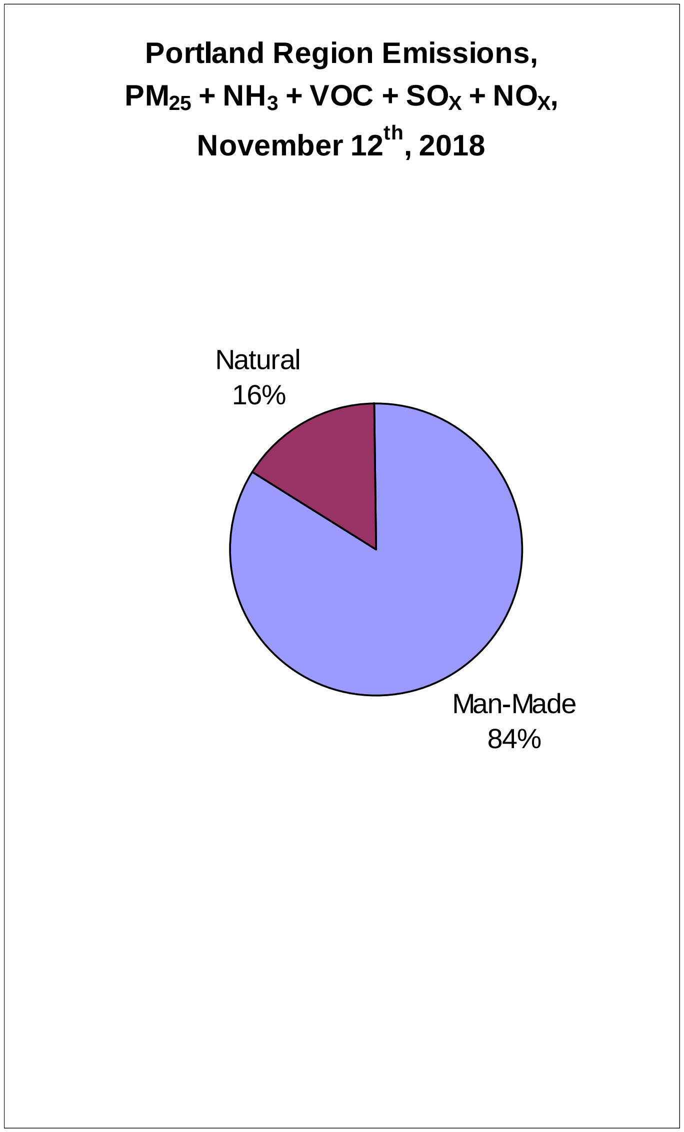


Figure x shows source contributions for November 12, 2018, Region 2 - Portland. Man-made emissions are 84% and natural emissions are 16% of the total source contribution to Portland area emissions. The accompanying pie chart shows the man-made emissions distributed by source category. Surface coating and miscellaneous area sources each contribute 18%, with on-road mobile (14%) and residential wood combustion (13%) contributing to the man-made portion of the pie. The category groupings are the same as what was used for November 2004.



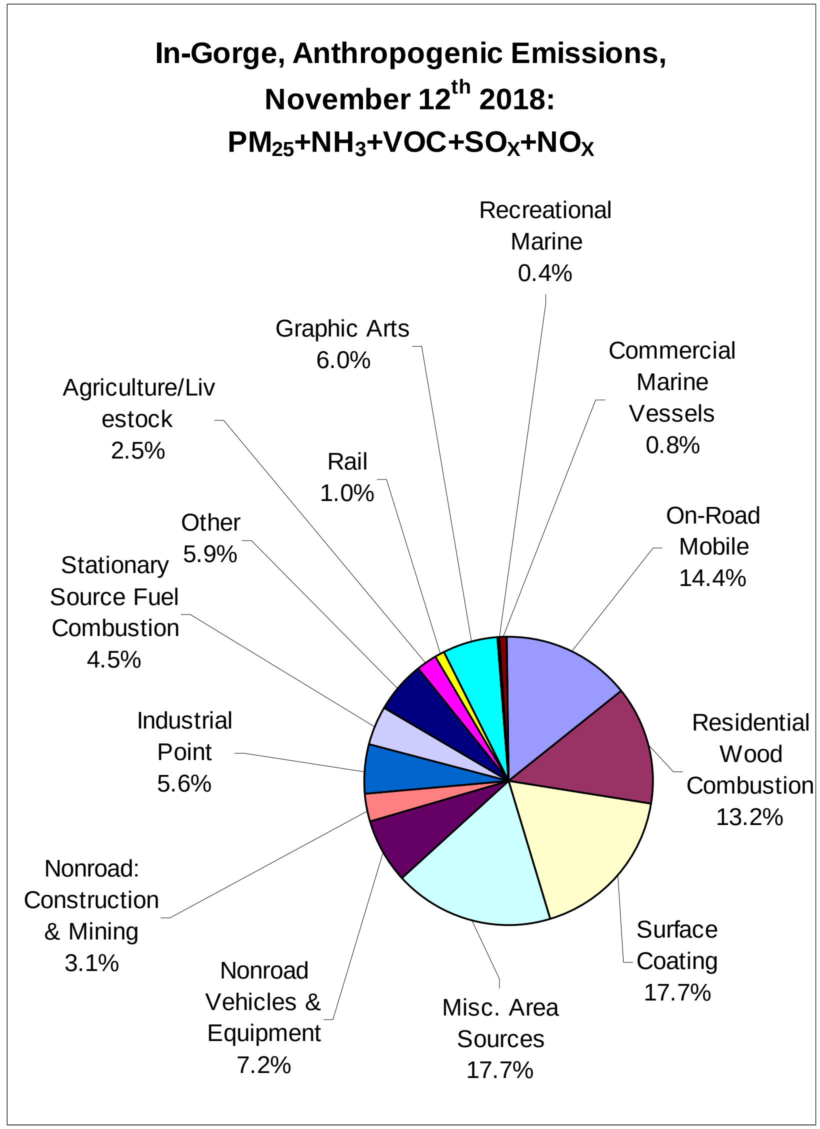
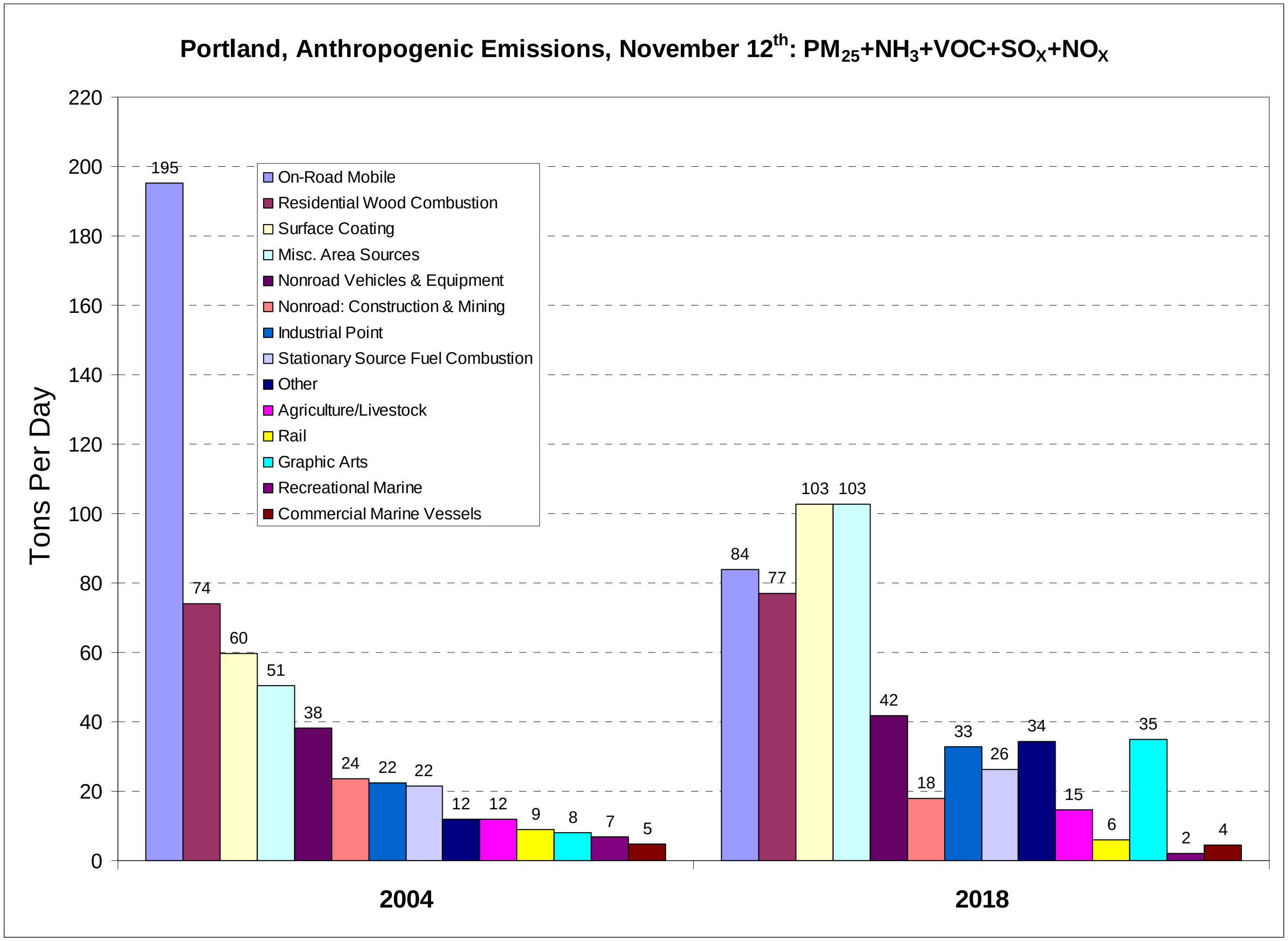


Figure x shows a comparison of man-made sources for November 12, 2004 and 2018. On-road mobile emissions decrease by 57% (195 tons/day to 84 tons/day) due to EPA's ultra low sulfur fuel rules. Residential wood combustion remains steady (74 tons/day to 77 tons/day). Surface coating sources show a 170% increase (60 tons/day to 103 tons/day), miscellaneous area sources increase by 201% (51 tons/day to 103 tons/day), graphic arts increase by 437% (8 tons/day to 35 tons/day), and industrial point sources show a 157% increase in emissions (22 tons/day to 33 tons/day) based on growth assumptions using EPA's Economic Growth and Analysis System growth factor model (EGAS). The "other" source category also shows growth from 2004 to 2018, due to expected increases in commercial food preparation and open burning emissions.

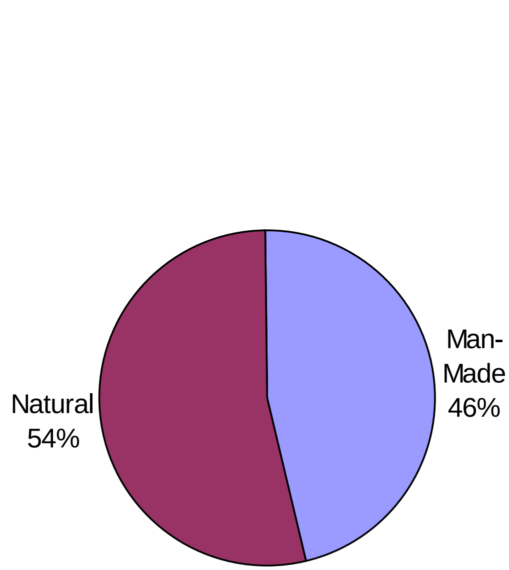


C. Northwest of Gorge Source Contribution

The Northwest of Gorge area (Region 3) comprises the area just northwest of metropolitan Portland. This consists of Clatsop and Columbia counties in Oregon and Pacific, Wahkiakum, and Cowlitz counties in Washington. As with the In-Gorge source category emissions, the source categories were determined by identifying all the anthropogenic source categories that contribute to the Northwest of Gorge area emissions. DEQ identified and grouped these categories according to similar category groupings (e.g. the agricultural source category consists of nonroad – agricultural, fertilizer operations, and orchard heaters, etc.), the amount of emissions for each category, and source categories of interest. For further information on how the anthropogenic emission source categories were grouped, please refer to Appendix x.

Figure x shows source contributions for August 18, 2004, Region 3: Northwest of Gorge. Natural sources account for 54% of the overall emissions for the Northwest of Gorge region, with man-made sources comprising 46%. In the accompanying pie chart, it shows the distribution of source categories that contribute to man-made sources. Industrial point sources contribute 58% of the man-made source pie. On-road mobile, commercial marine vessels, and nonroad vehicles and equipment cumulatively contribute over 25% of man-made emission in the Northwest of Gorge area. The “Other” source category includes emissions from fuel storage, and stationary source fuel combustion, residential wood combustion, and commercial food preparation, etc. The “miscellaneous area source” category includes industrial and commercial area sources.

Northwest of Gorge Emissions, PM_{25} + NH_3 + VOC + SO_X + NO_X, August 18th, 2004



Northwest of Gorge, Anthropogenic Emissions, August 18th 2004: PM_{25}+NH_3+VOC+SO_X+NO_X

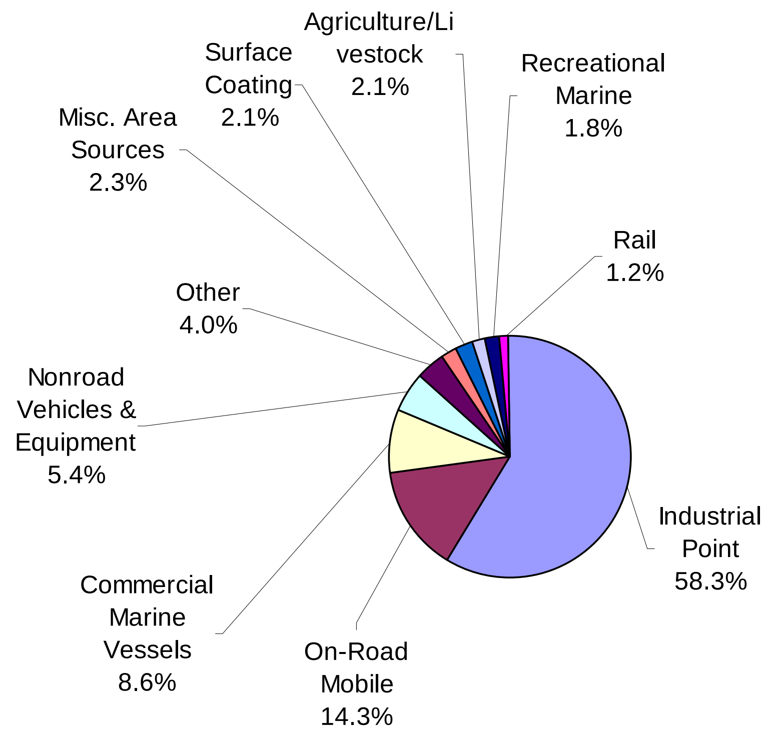
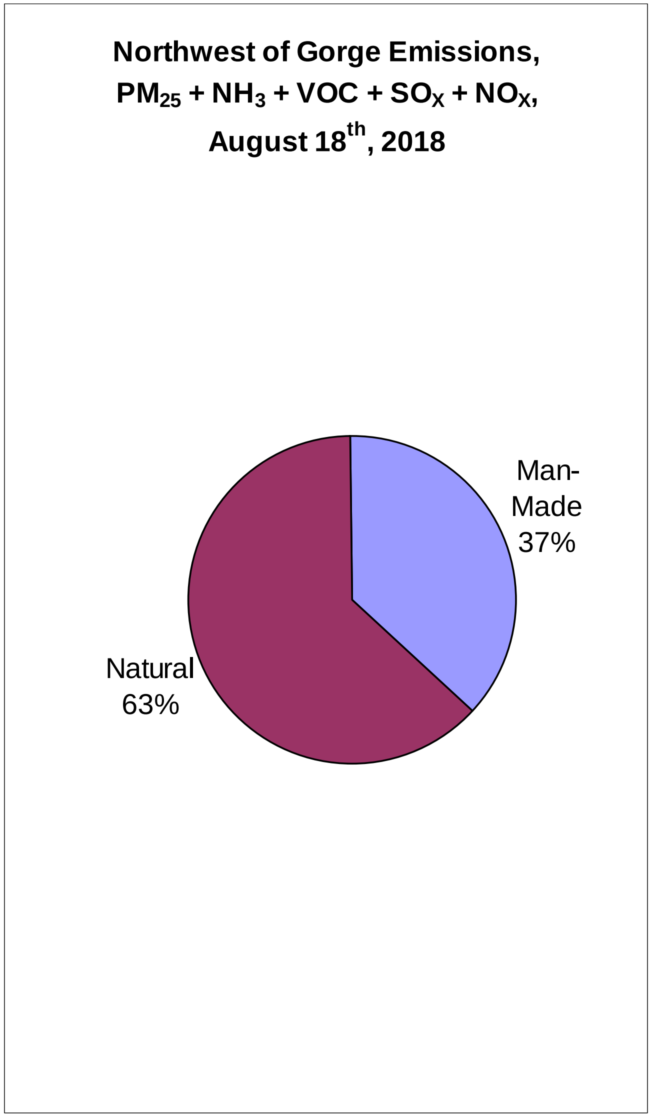


Figure x shows source contributions for August 18, 2018, Region 3: Northwest of Gorge. Natural emissions are 63% and man-made emissions are 37% of the total source contribution to Northwest of Gorge emissions. The accompanying pie chart shows the man-made emissions distributed by source category. Industrial point sources account for 47%, with on-road mobile, commercial marine vessels, and nonroad vehicles and equipment totaling over 25%. The category groupings are the same as what was used for August 2004.



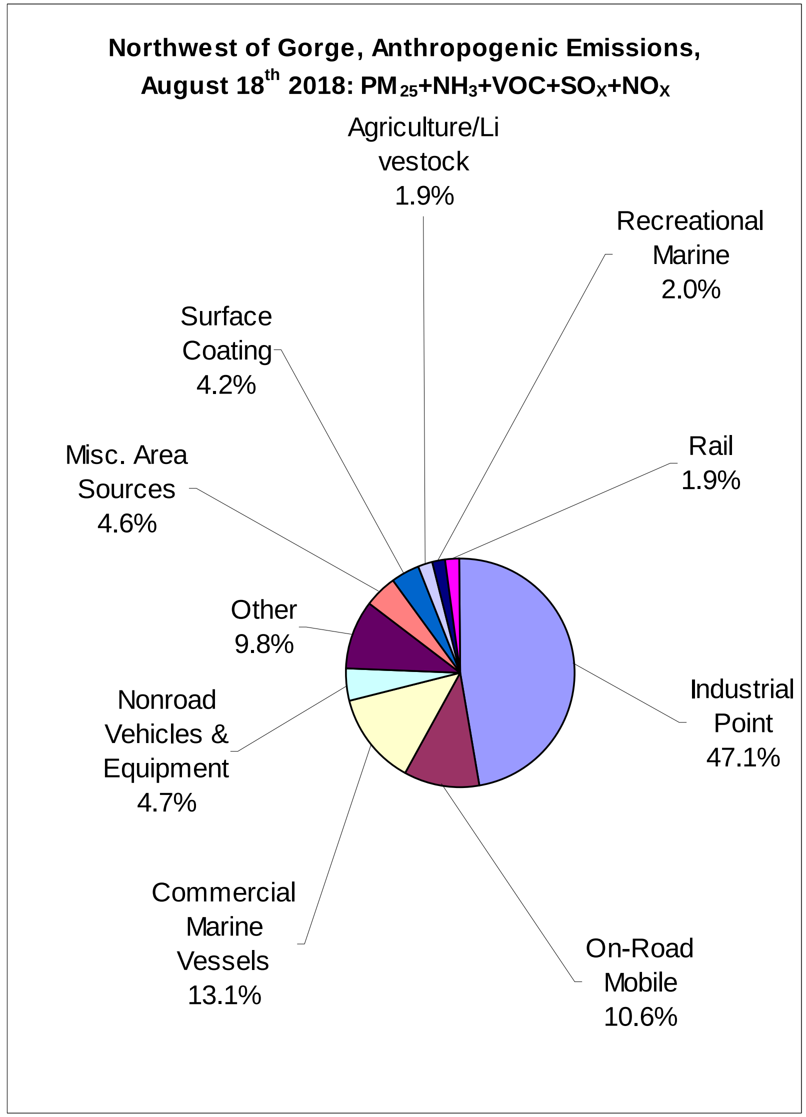


Figure x shows a comparison of source categories (man-made sources only) from August 18, 2004 to August 18, 2018. This is for Northwest of Gorge sources only. From the chart, industrial point emissions decrease by 45% (128 tons/day to 71 tons/day). The Gorge Technical Team discovered one of the industrial point sources, which is located in the "West of Gorge" area had its 2004 emissions incorrectly attributed to the Northwest of Gorge area. In 2018, however, its emissions were correctly attributed to its correct location in the "West of Gorge" area.   As a result, the industrial point source emissions for 2004 in this region are higher than they should be and why there is a decrease in emissions from 2004 to 2018. On-road mobile emissions decrease by 50% (31 tons/day to 16 tons/day) and nonroad vehicles & equipment decrease by 42% (12 tons/day to 7 tons/day) due to EPA's ultra low sulfur fuel rules. Commercial marine vessels remain relatively constant from 2004 to 2018.

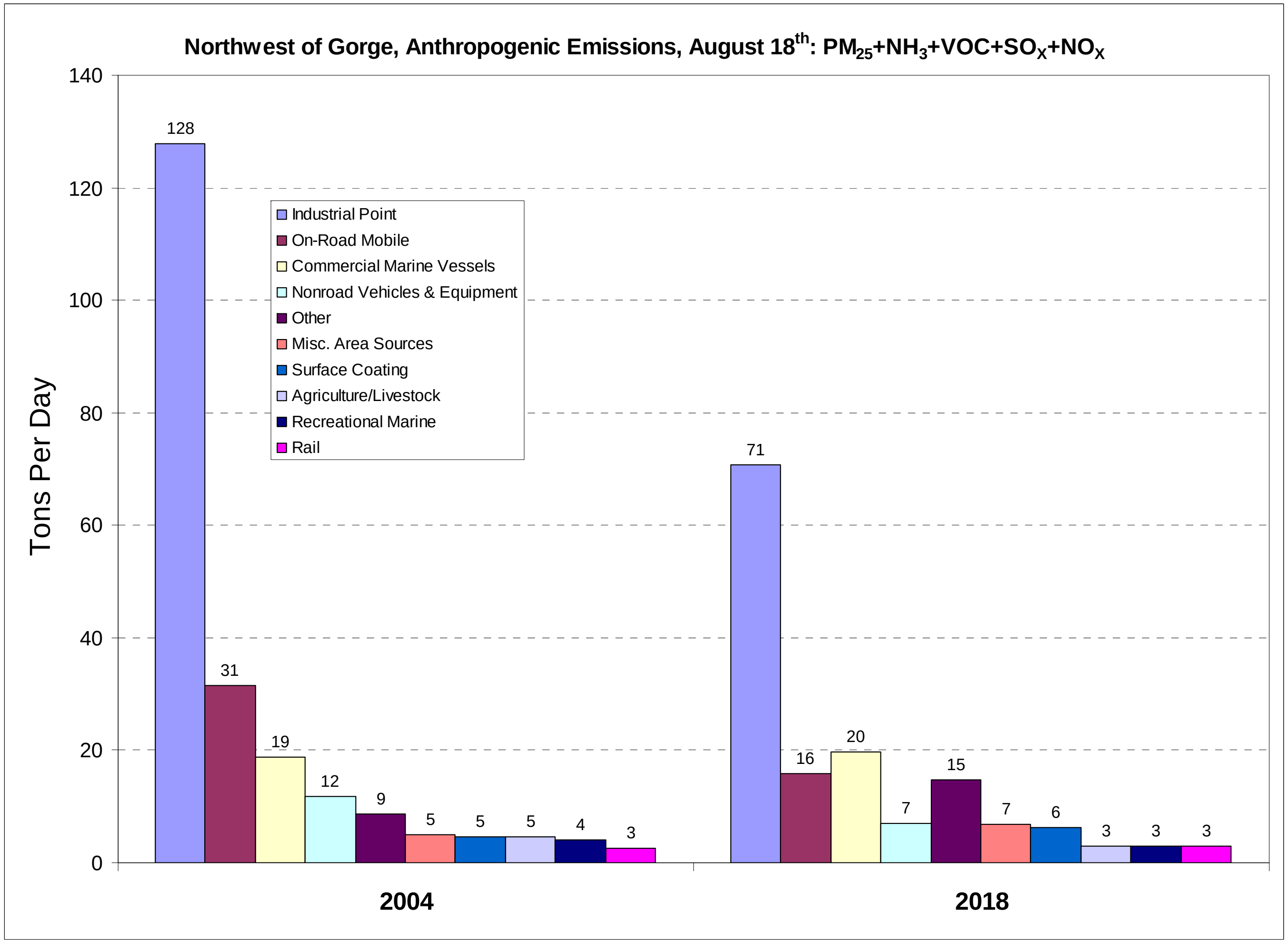
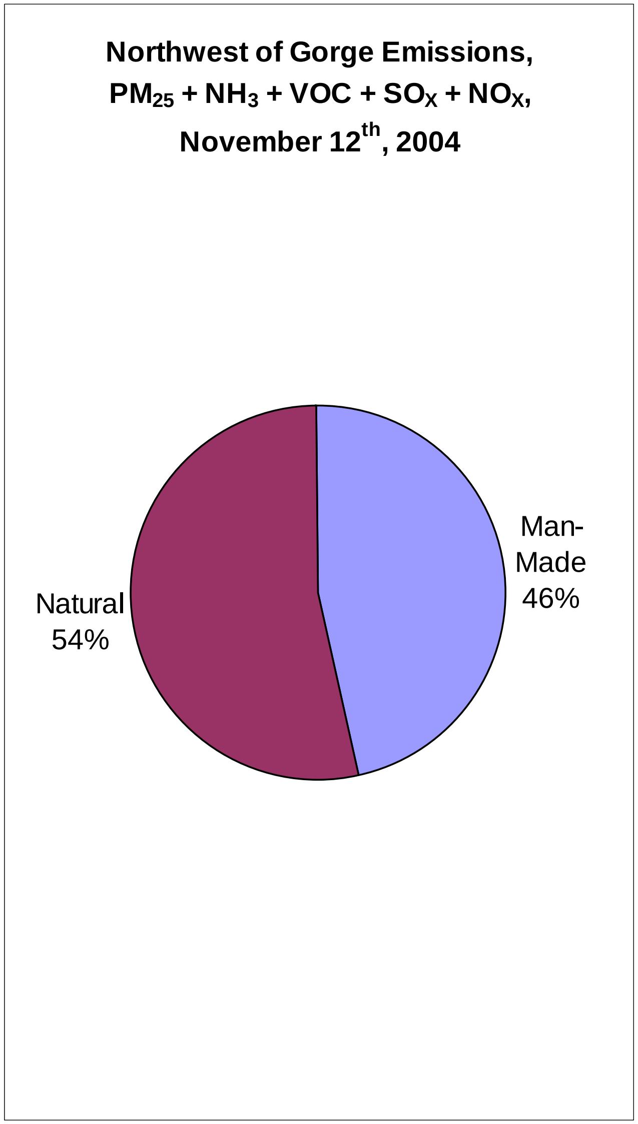


Figure x shows source contributions for November 12, 2004, Region 3 – Northwest of Gorge. Natural sources account for 54% of the overall emissions for the Northwest of Gorge region, with man-made sources comprising 46%. In the accompanying pie chart, it shows the distribution of source categories that contribute to man-made sources. Industrial point sources account for 52% or the source contribution with on-road mobile and commercial marine vessels contributing 22%. Residential wood combustion contributes 8% to the man-made source pie. The "Other" source category includes emissions from stationary source fuel combustion, livestock operations, and degreasing, etc.



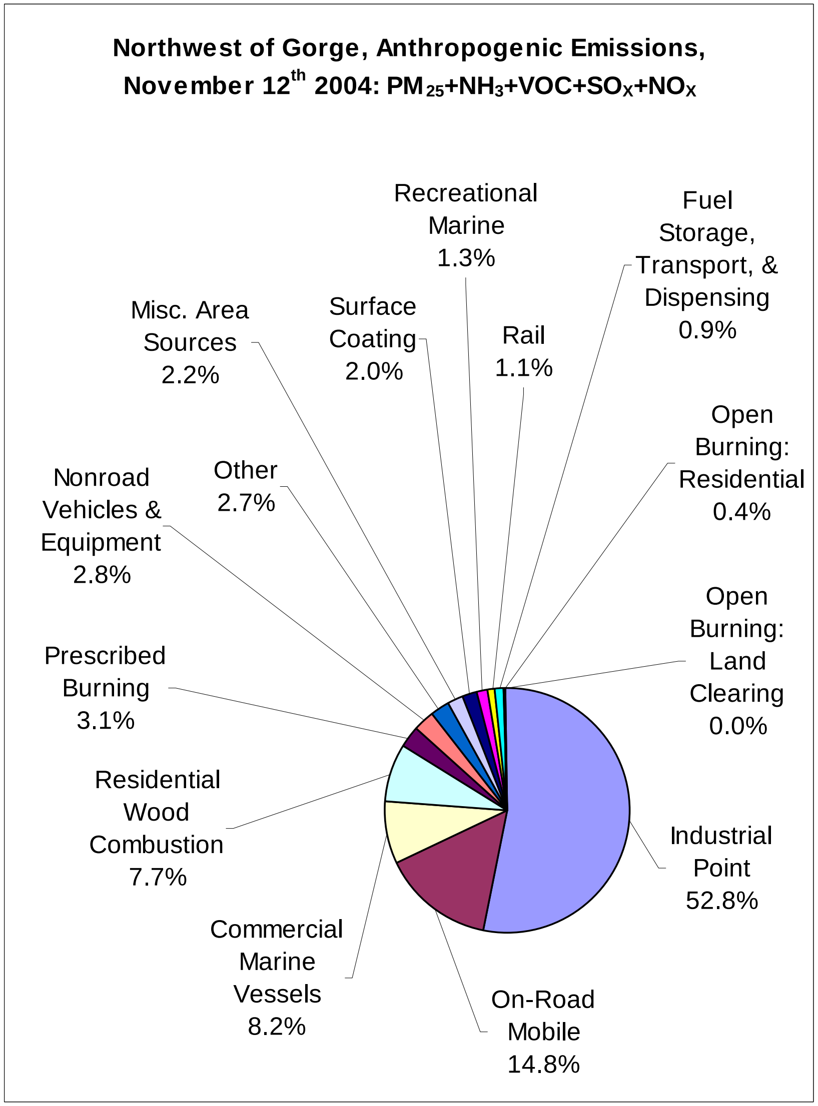
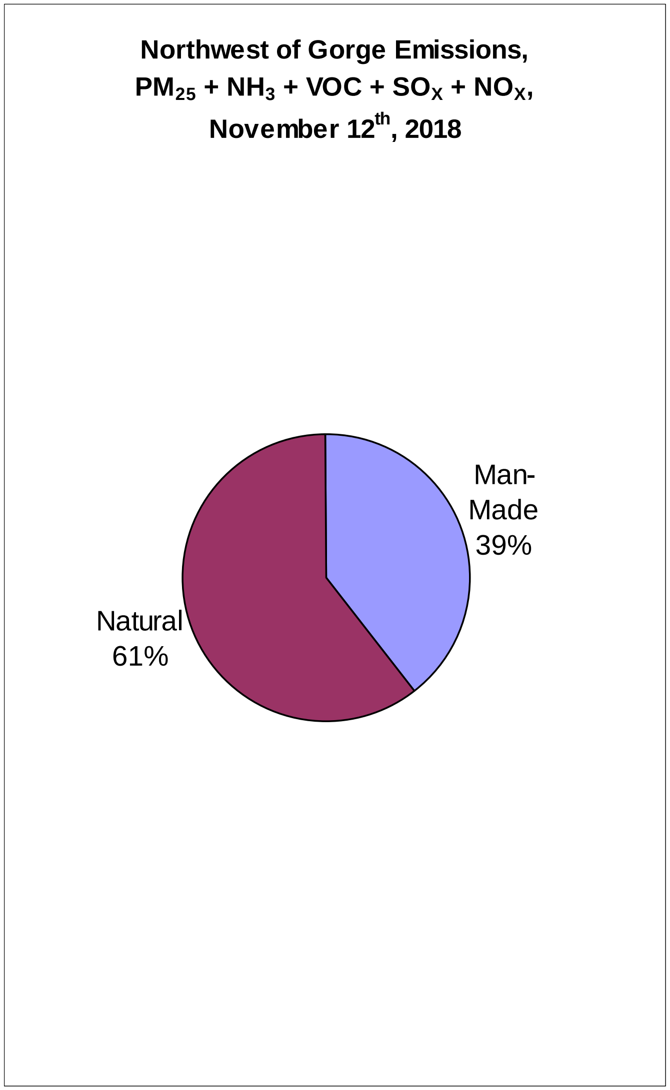


Figure x shows source contributions for November 12, 2018, Region 3 – Northwest of Gorge. Natural emissions are 61% and man-made emissions are 39% of the total source contribution to Northwest of Gorge emissions. The accompanying pie chart shows the man-made emissions distributed by source category. Industrial point sources account for 40%, with on-road mobile, commercial marine vessels, and nonroad vehicles and equipment totaling about 25%. Residential wood combustion and prescribed burning contribute 15% to the man-made source pie. The category groupings are the same as what was used for November 2004.



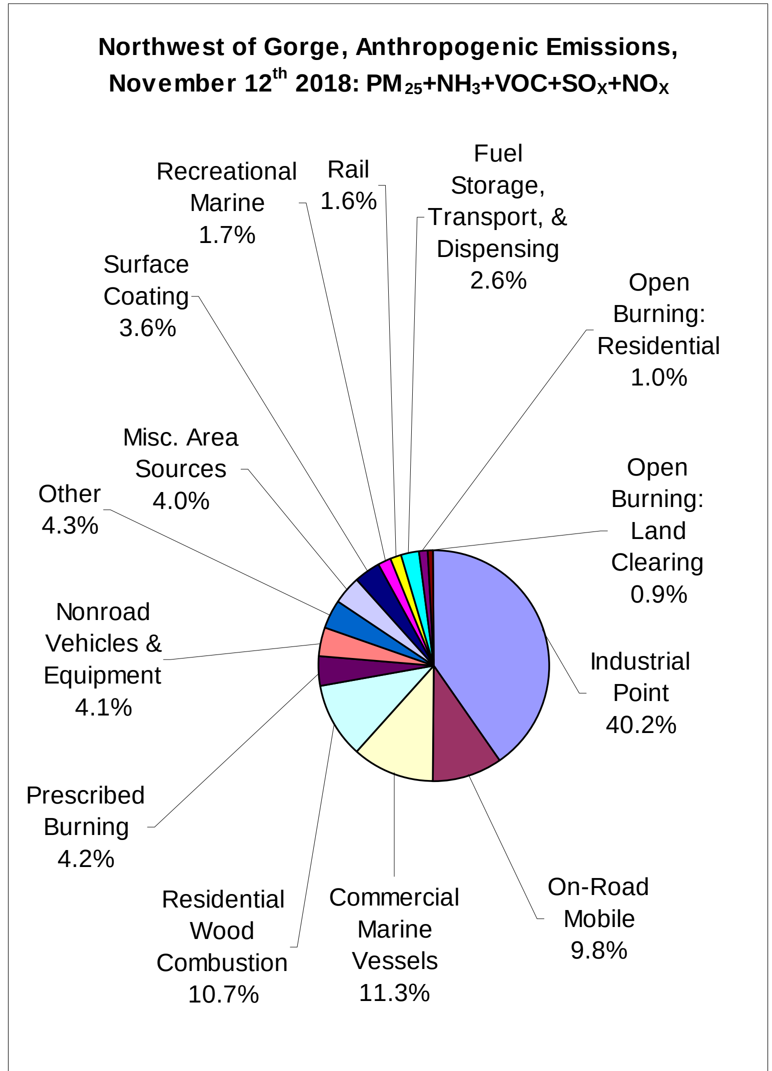
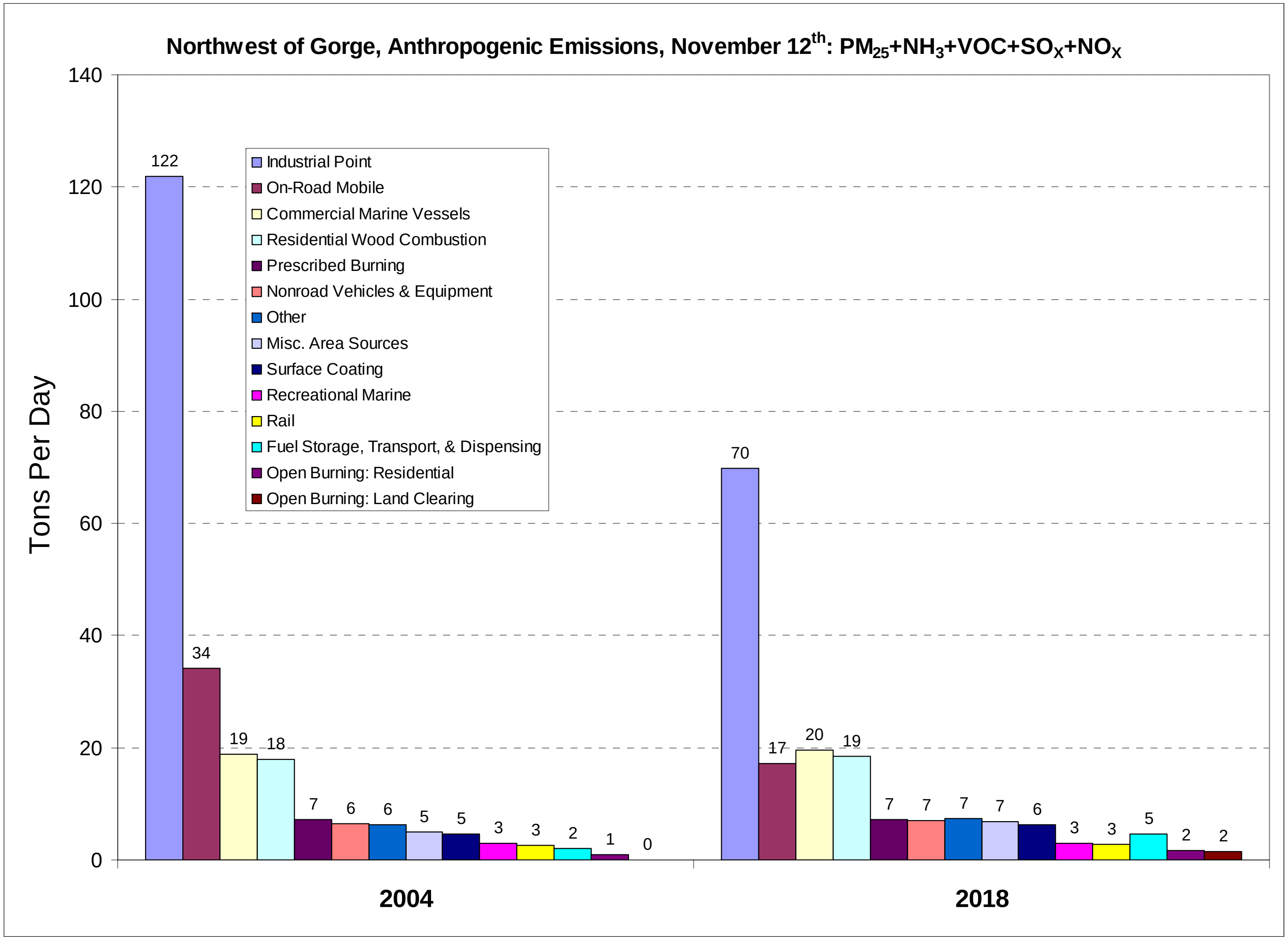


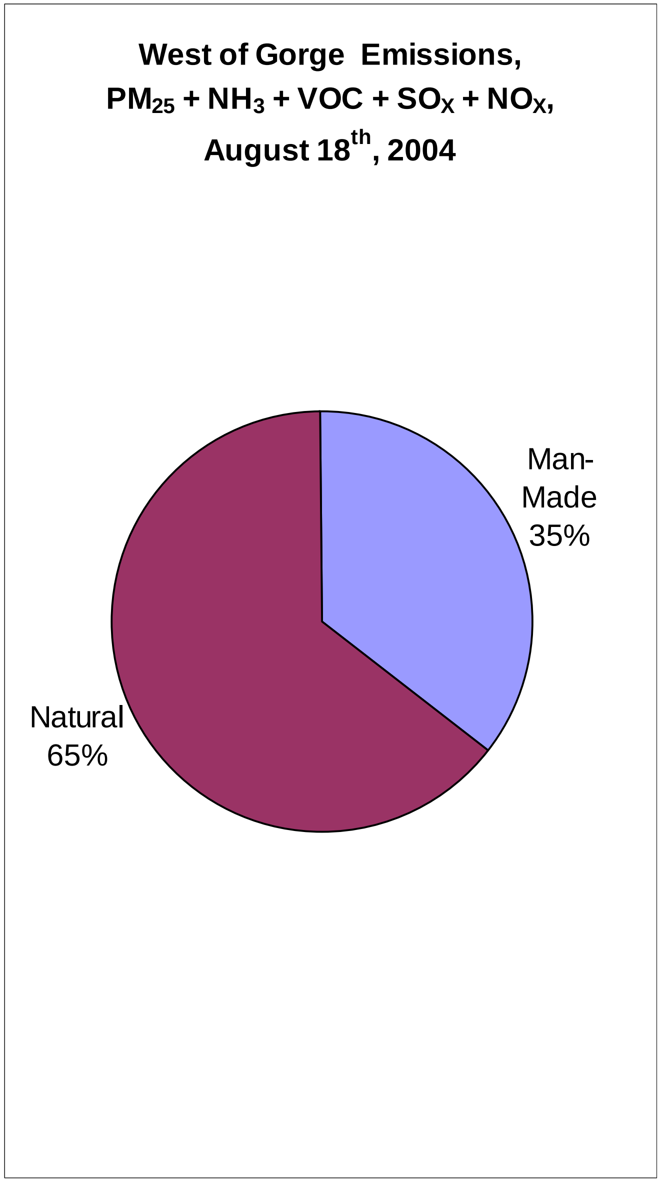
Figure x shows a comparison of source categories (man-made sources only) from November 12, 2004 to November 12, 2018. This is for Northwest of Gorge sources only. From the chart, industrial point emissions decrease by 45% (122 tons/day to 70 tons/day) as a result of the misreporting of emissions for one of industrial point sources, as described in Figure x. On-road mobile emissions decrease by 50% (34 tons/day to 17 tons/day) due to EPA's ultra low sulfur fuel rules. Nonroad commercial marine vessels and residential wood combustion, and the remaining source categories are relatively constant from 2004 to 2018.



D. West of Gorge Source Contribution

The West of Gorge area (Region 4) comprises all other areas west of the Cascades. It includes the Seattle, Tacoma, and Olympia metropolitan areas and includes parts of Southern Oregon including Salem, Corvallis, and Eugene/Springfield. As with the In-Gorge source category emissions, the source categories were determined by identifying all the anthropogenic source categories that contribute to West of Gorge area emissions. DEQ identified and grouped these categories according to similar category groupings (e.g. the agricultural source category consists of nonroad – agricultural, fertilizer operations, and orchard heaters, etc.), the amount of emissions for each category, and source categories of interest. For further information on how the anthropogenic emission source categories were grouped, please refer to Appendix x.

Figure x shows source contributions for August 18, 2004, Region 4: West of Gorge. Natural sources account for 65% of the overall emissions for the West of Gorge region, with man-made sources comprising 35%. In the accompanying pie chart, it shows the distribution of source categories that contribute to man-made sources. On-road mobile emissions contribute almost 45%, nonroad vehicles 11%, and industrial point sources 8% to man-made sources. The "Other" source emissions are comprised of residential wood burning, incineration, dry cleaning, and commercial food preparation, etc. "Misc. Area Sources" emissions consist of solvent use from industry and commercial activity, including degreasing and graphic arts.



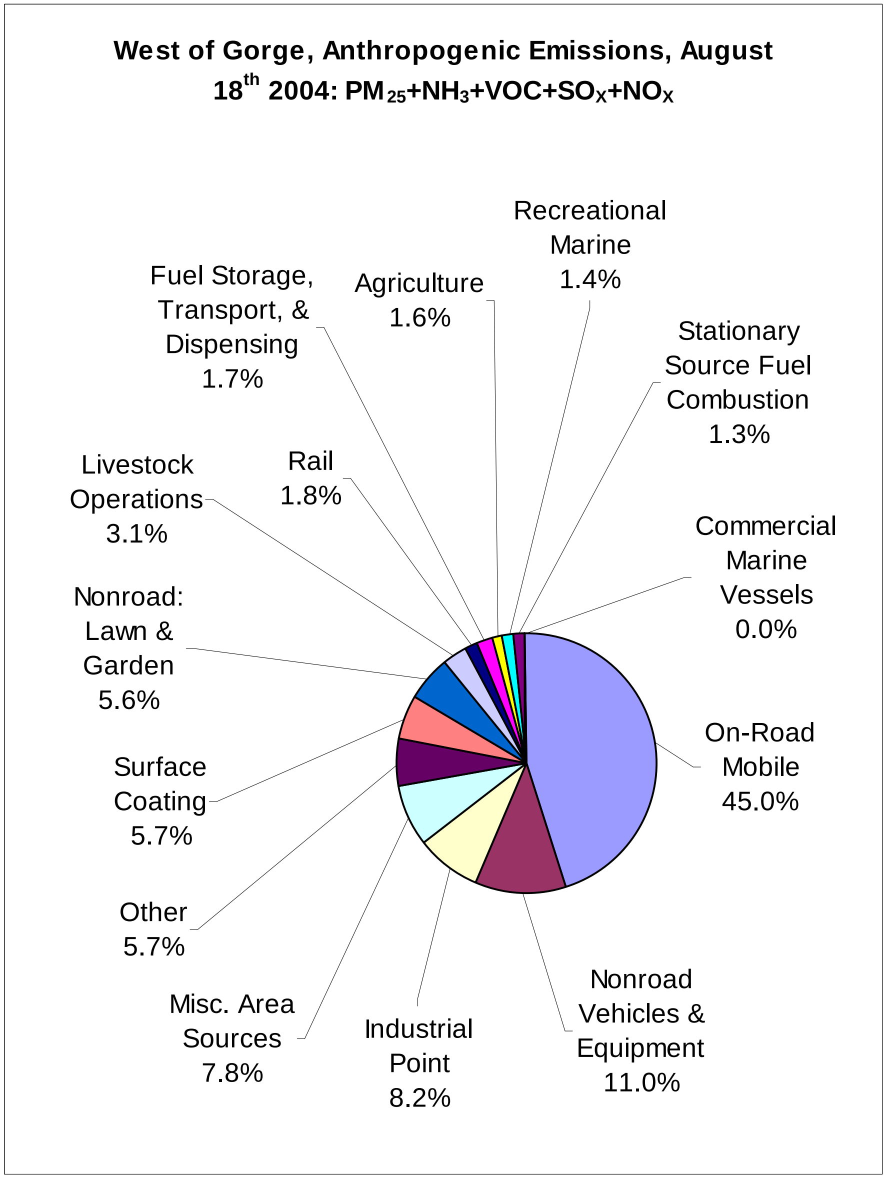
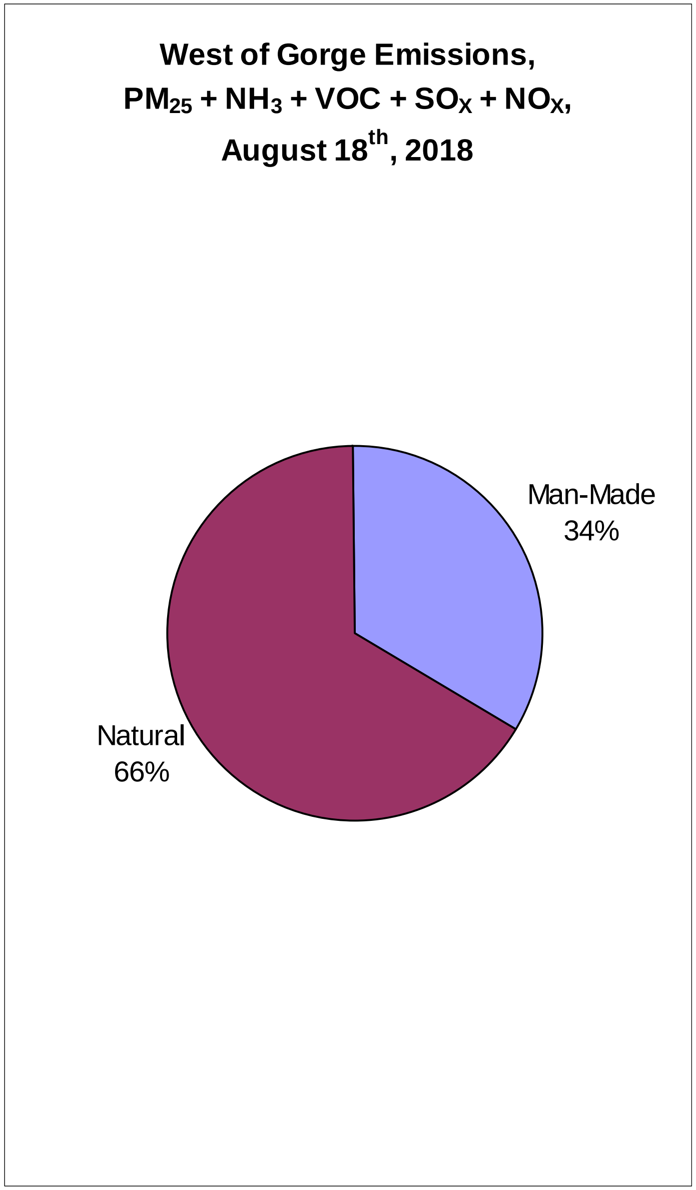


Figure x shows source contributions for August 18, 2018, Region 4: West of Gorge. Natural emissions are 66% and man-made emissions are 34% of the total source contribution to West of Gorge emissions. The accompanying pie chart shows the man-made emissions distributed by source category. On-road mobile and industrial point sources each account for 18%, with miscellaneous area sources, surface coating, and other each accounting for approximately 10% of the man-made source pie. The category groupings are the same as what was used for August 2004.



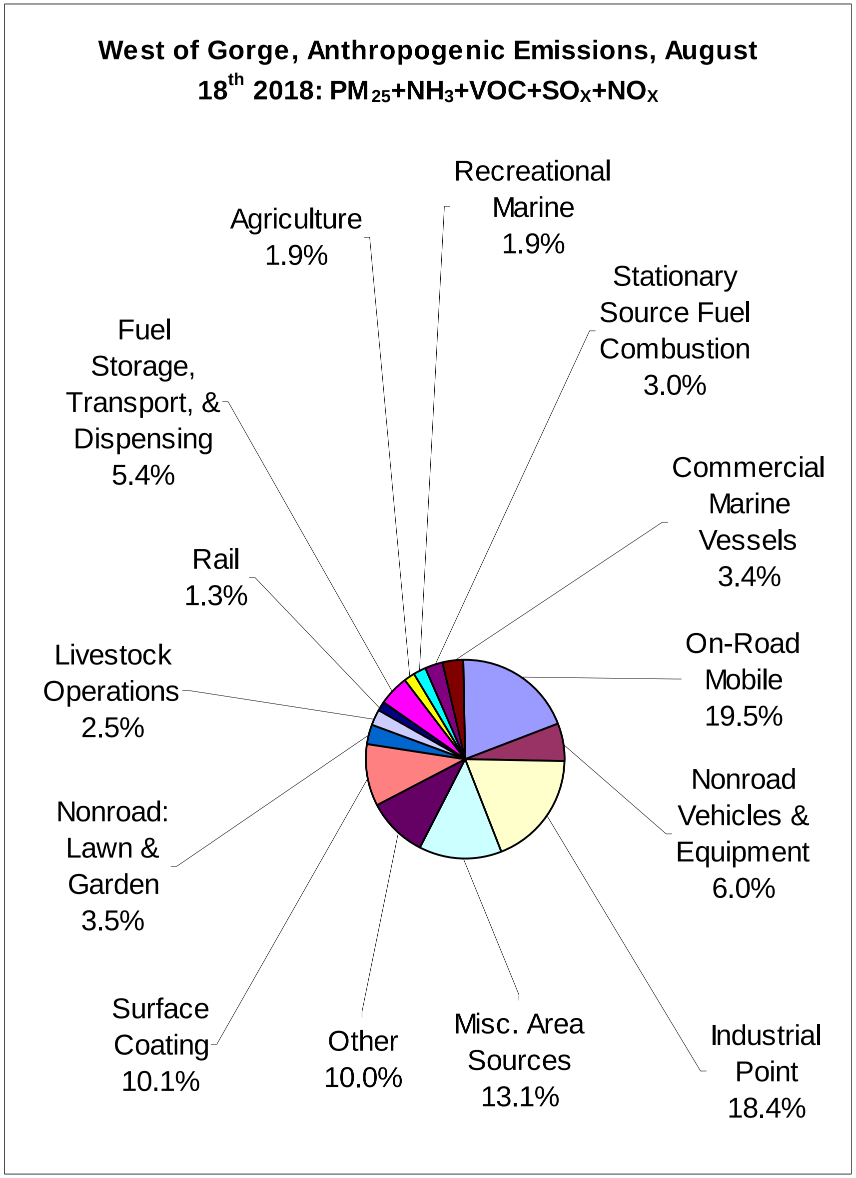


Figure x shows a comparison of source categories (man-made sources only) from August 18, 2004 to August 18, 2018. This is for West of Gorge sources only. On-road mobile emissions decrease by 71% (709 tons/day to 283 tons/day) and nonroad vehicles and equipment emissions decrease by 50% (174 tons/day to 87 tons/day), and nonroad: lawn and garden decrease by 43% (89 tons/day to 51 tons/day) due to EPA's ultra low sulfur fuel rules and improvements in engine manufacturing. From the chart, industrial point emissions increase by 206% (130 tons/day to 268 tons/day) and miscellaneous area sources increase by 154% (123 tons/day to 190 tons/day) based on WRAP's use of growth assumptions using EPA's Economic Growth and Analysis System growth factor model (EGAS). The "other" source category also shows some growth from 2004 to 2018, primarily due to expected population growth and use with regards to open burning, dry cleaning and commercial food preparation.

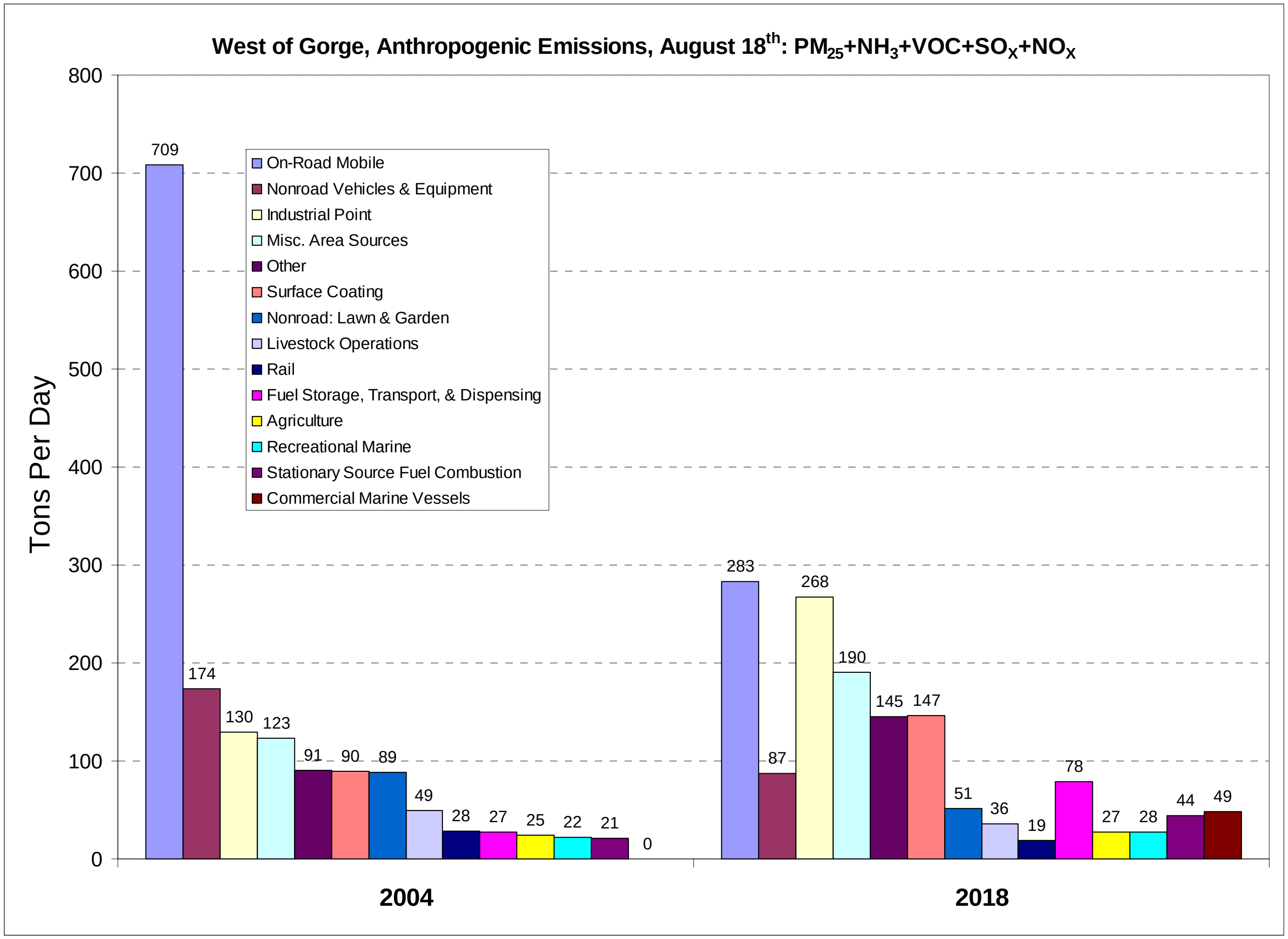
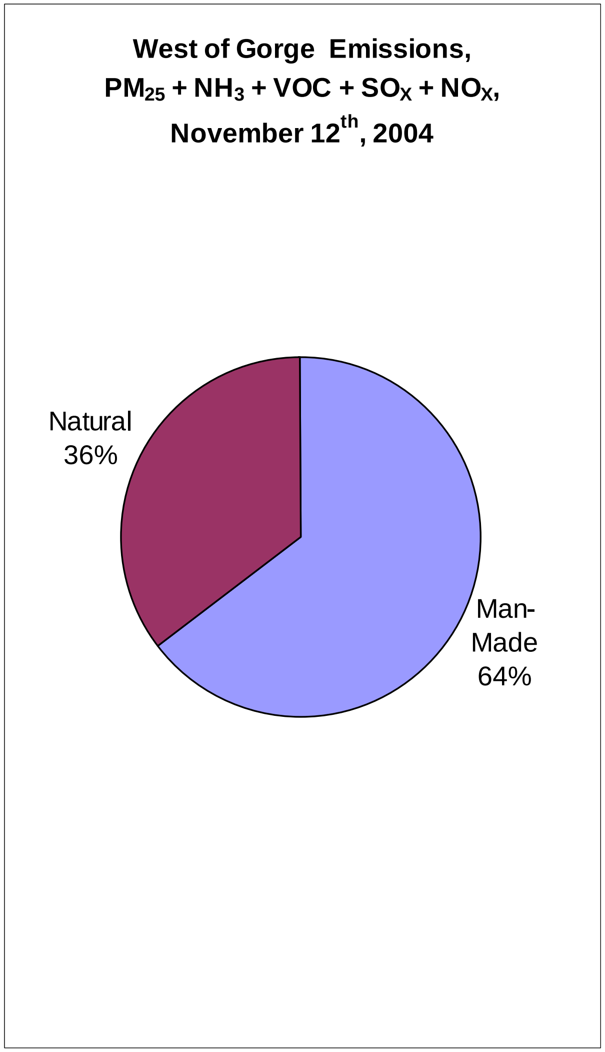


Figure x shows source contributions for November 12, 2004, Region 4 –West of Gorge. Man-made sources account for 64% of the overall emissions for In-Gorge region, with natural sources comprising 36%. In the accompanying pie chart, it shows the distribution of source categories that contribute to man-made sources. On-road mobile contributes 39% and residential wood combustion contributes 19% to man-made sources. "Misc. Area Sources" emissions include solvent use from commercial and industrial activity. The "Other" source category emissions include sewage treatment, drycleaners, and commercial food preparation.



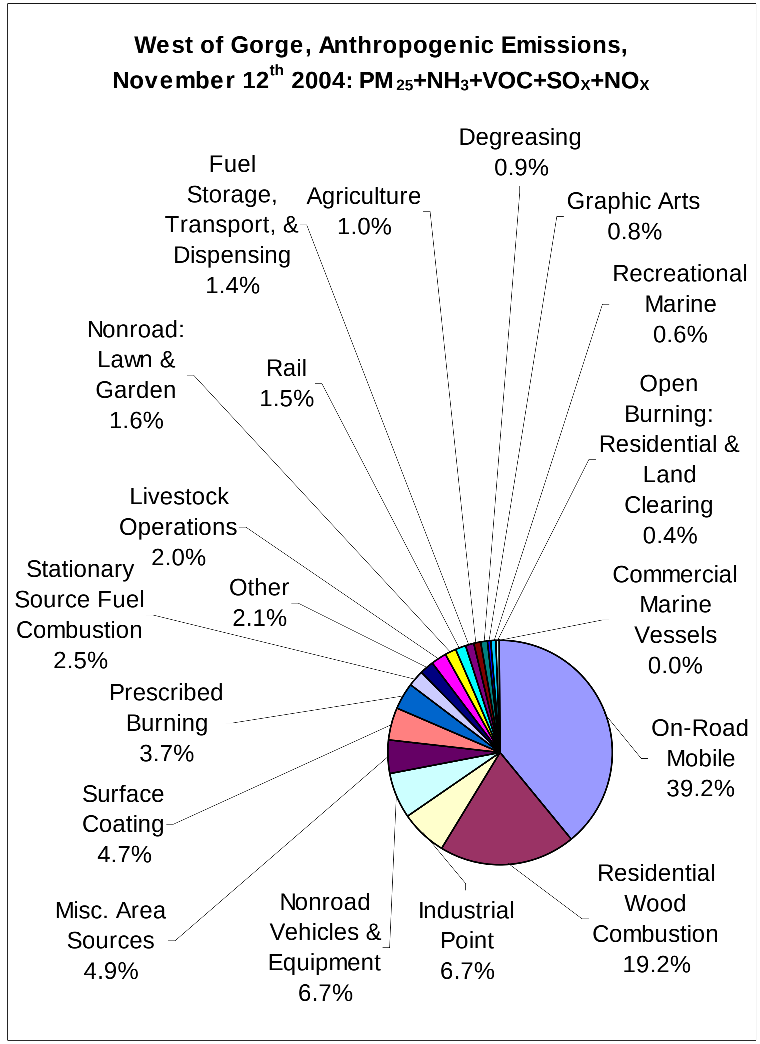
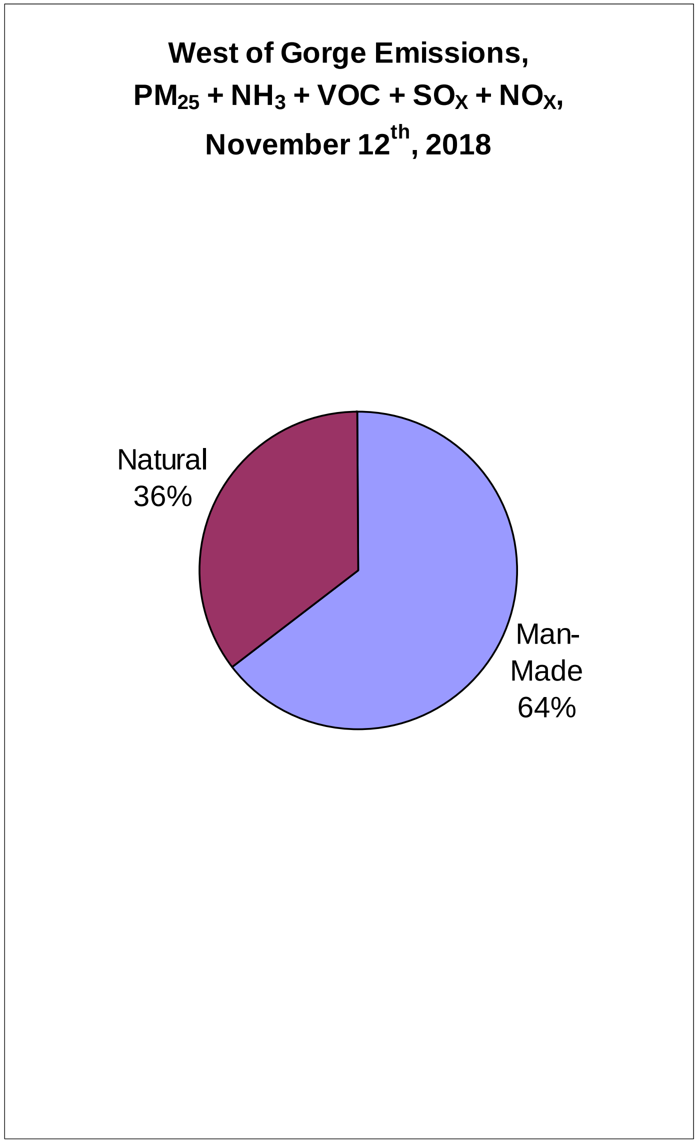


Figure x shows source contributions for November 12, 2018, Region 4 - West of Gorge. Man-made emissions are 64% and natural emissions are 36% of the total source contribution to West of Gorge emissions. The accompanying pie chart shows the man-made emissions distributed by source category. Residential wood combustion accounts for 20% of man-made emissions, on-road mobile emissions are 16% and industrial point source emissions are 14%. The category groupings are the same as what was used for August 2004.



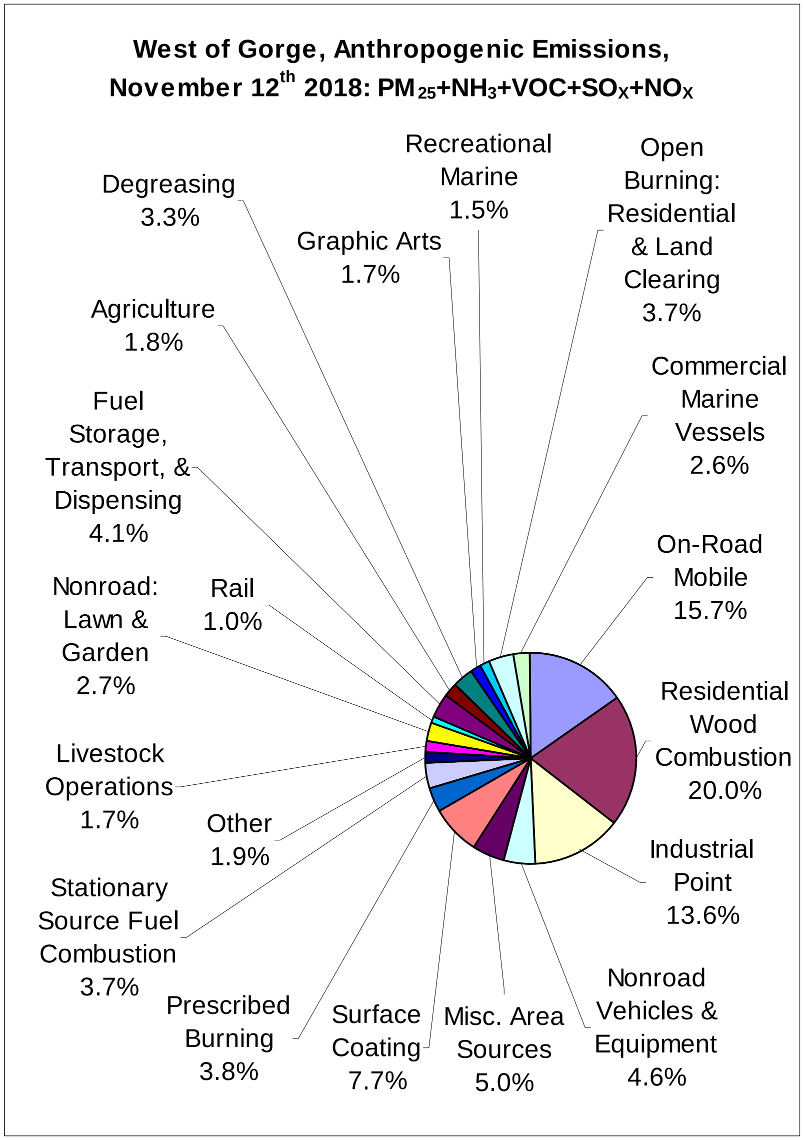
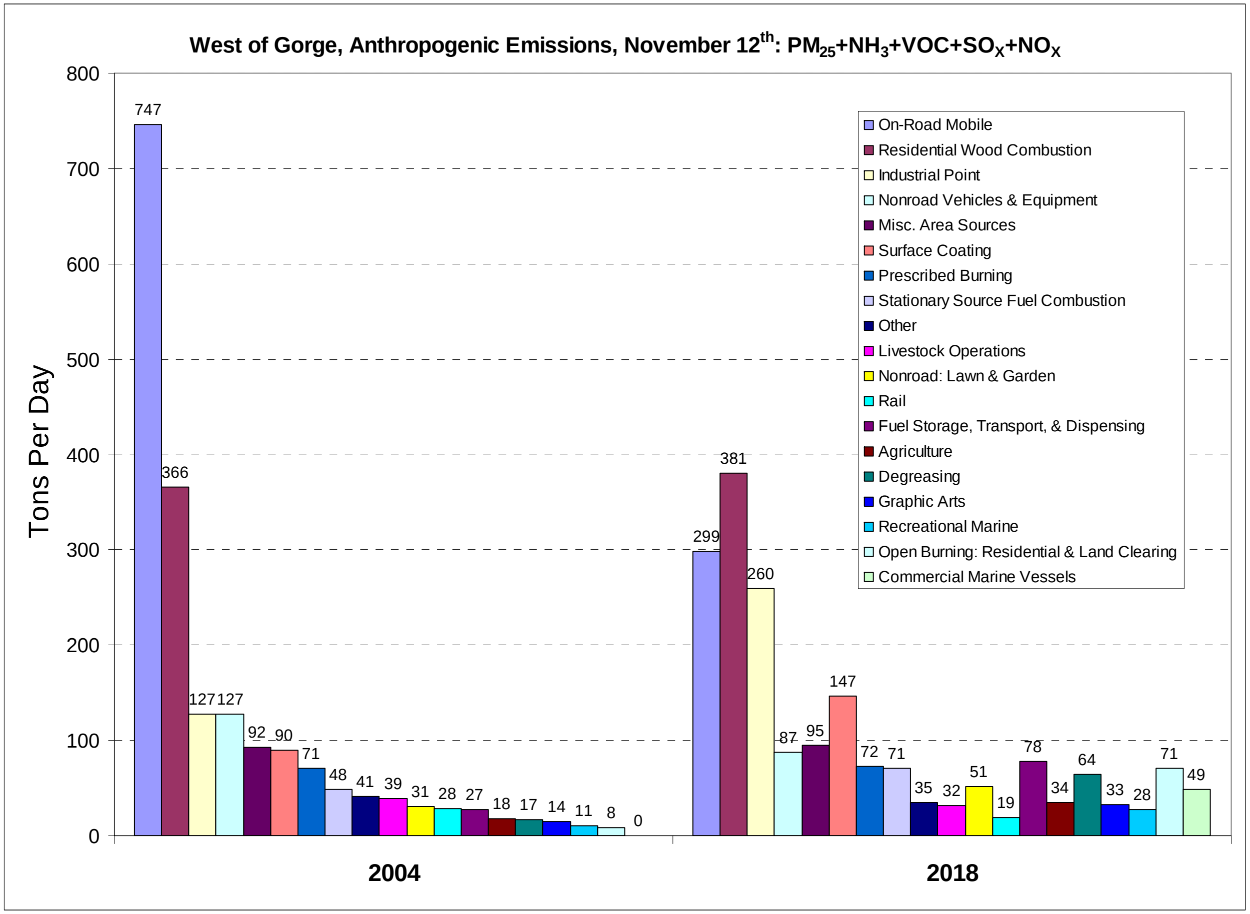


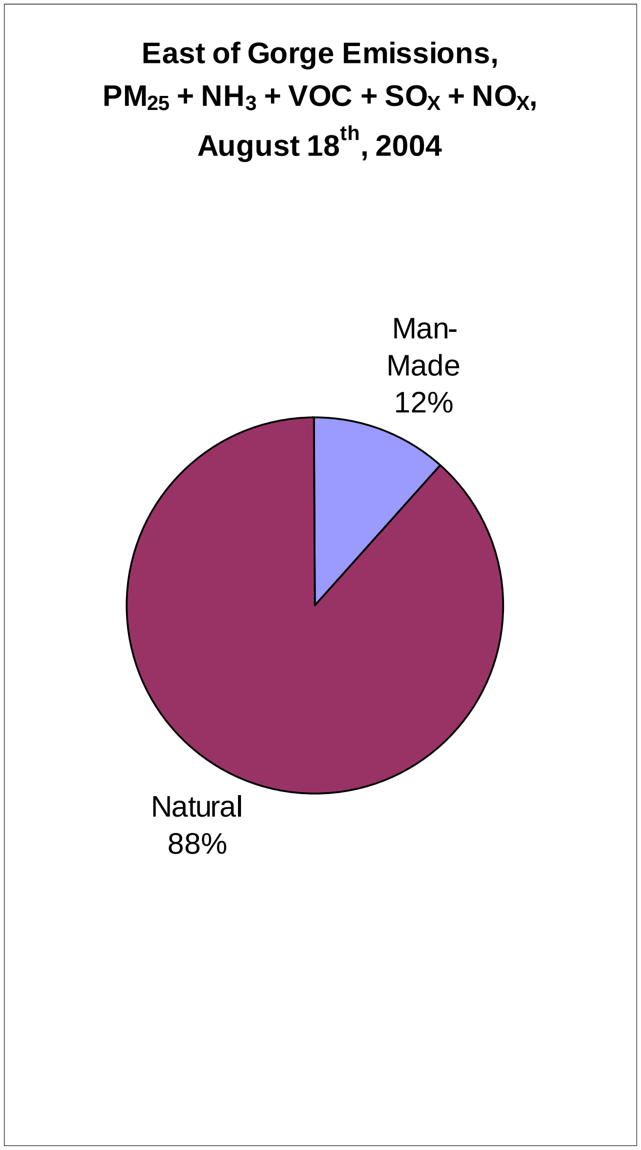
Figure x shows a comparison of source categories (man-made sources only) from November 12, 2004 to November 12, 2018. This is for West of Gorge sources only. On-road mobile emissions decrease by 60% (747 tons/day to 299 tons/day) and nonroad vehicles and equipment emissions decrease by 32% (127 tons/day to 87 tons/day) due to EPA's ultra low sulfur fuel rules. Residential wood combustion remains relatively constant (366 tons/day to 381 tons/day). From the chart, industrial point emissions increase by 204% (127 tons/day to 260 tons/day), surface coating increases by 163% (90 tons/day to 147 tons/day) based on WRAP's use of growth assumptions using EPA's Economic Growth and Analysis System growth factor model (EGAS). Additionally, as the population increases, categories that are contingent upon population increase also show an increase in emissions including fuel storage and transport, stationary fuel source combustion, residential and land clearing open burning.



E. East of Gorge Source Contribution

The East of Gorge area (Region 5) comprises all other areas east of the Cascades. As with the In-Gorge source category emissions, the source categories were determined by identifying all the anthropogenic source categories that contribute to East of Gorge area emissions. DEQ identified and grouped these categories according to similar category groupings (e.g. the agricultural source category consists of nonroad – agricultural, fertilizer operations, and orchard heaters, etc.), the amount of emissions for each category, and source categories of interest. For further information on how the anthropogenic emission source categories were grouped, please refer to Appendix x.

Figure x shows source contributions for August 18, 2004, Region 5: East of Gorge. Natural sources account for 88% of the overall emissions for the East of Gorge region, with man-made sources comprising 12%. In the accompanying pie chart, it shows the distribution of source categories that contribute to man-made sources. On-road mobile and agriculture each contribute almost 25%, and industrial point emissions contribute 12% to man-made sources. The "Other" category emissions include landfills, residential wood combustion, open and prescribed burning, etc. In this chart, "Livestock operations" is its own category, separate from "Agriculture" emissions because of its significance in the Eastern part of the Gorge.



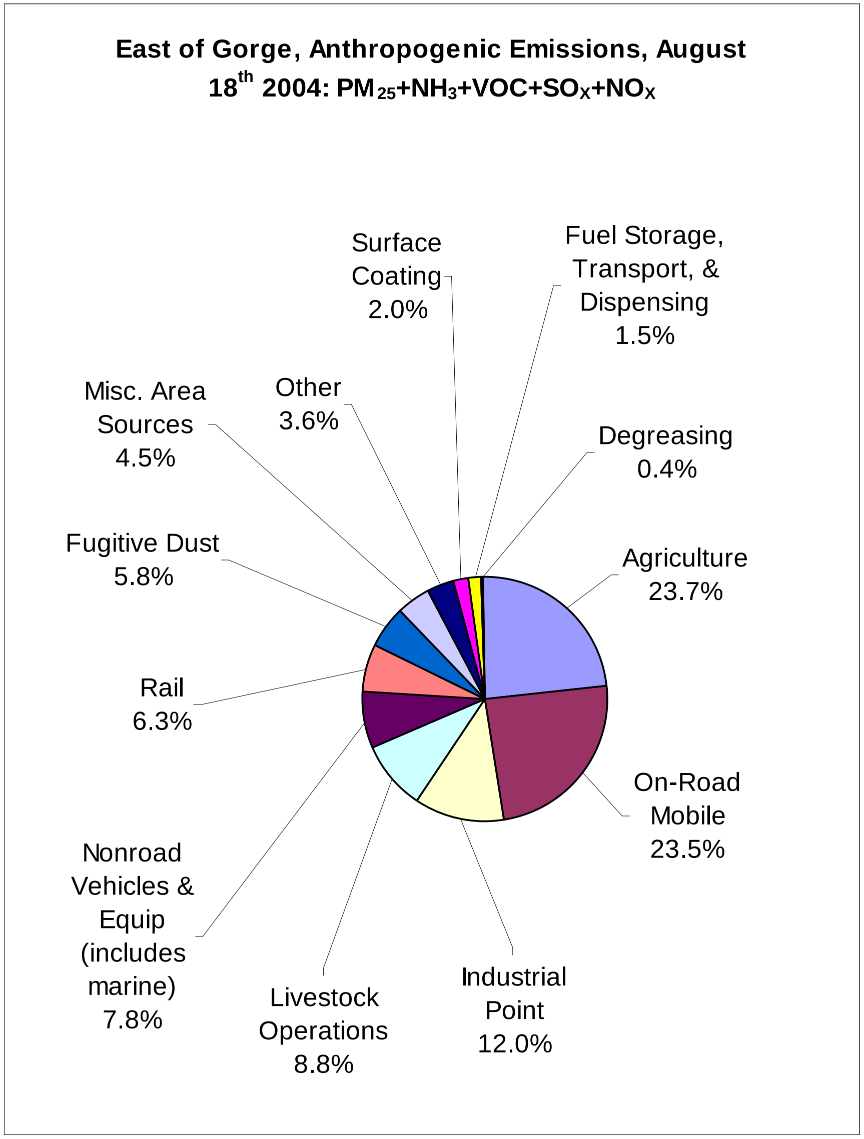
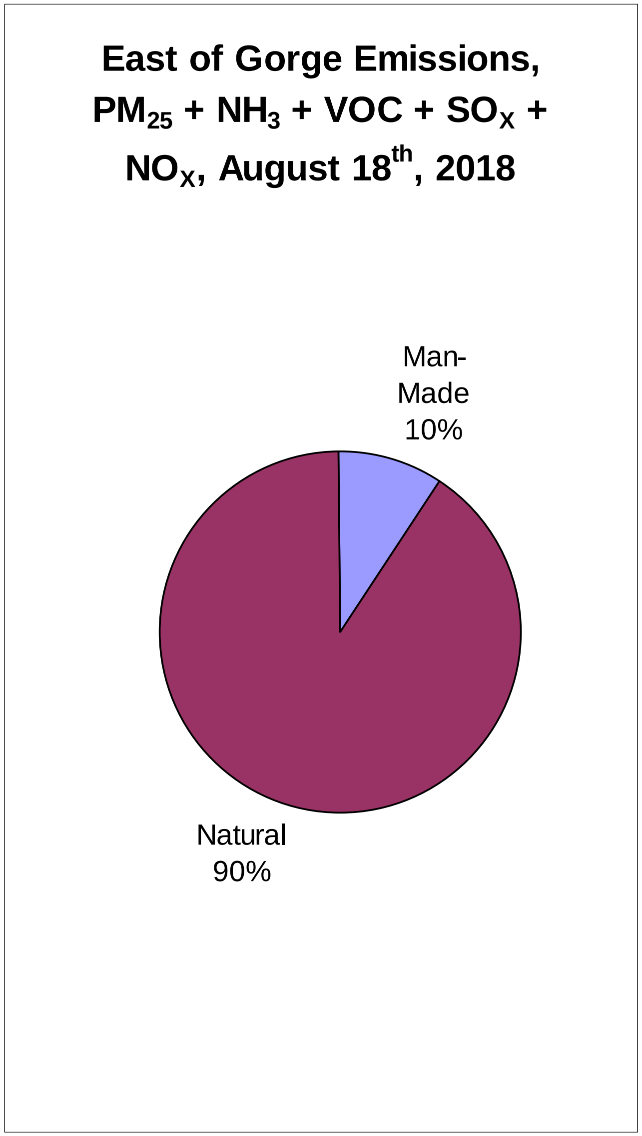


Figure x shows source contributions for August 18, 2018, Region 5 - East of Gorge. Natural emissions are 90% and man-made emissions are 10% of the total source contribution to East of Gorge emissions. The accompanying pie chart shows the man-made emissions distributed by source category. Agriculture emissions account for 28%, with on-road mobile emissions contributing 12% and industrial point emissions contributing 16%. The category groupings are the same as what was used for August 2004.



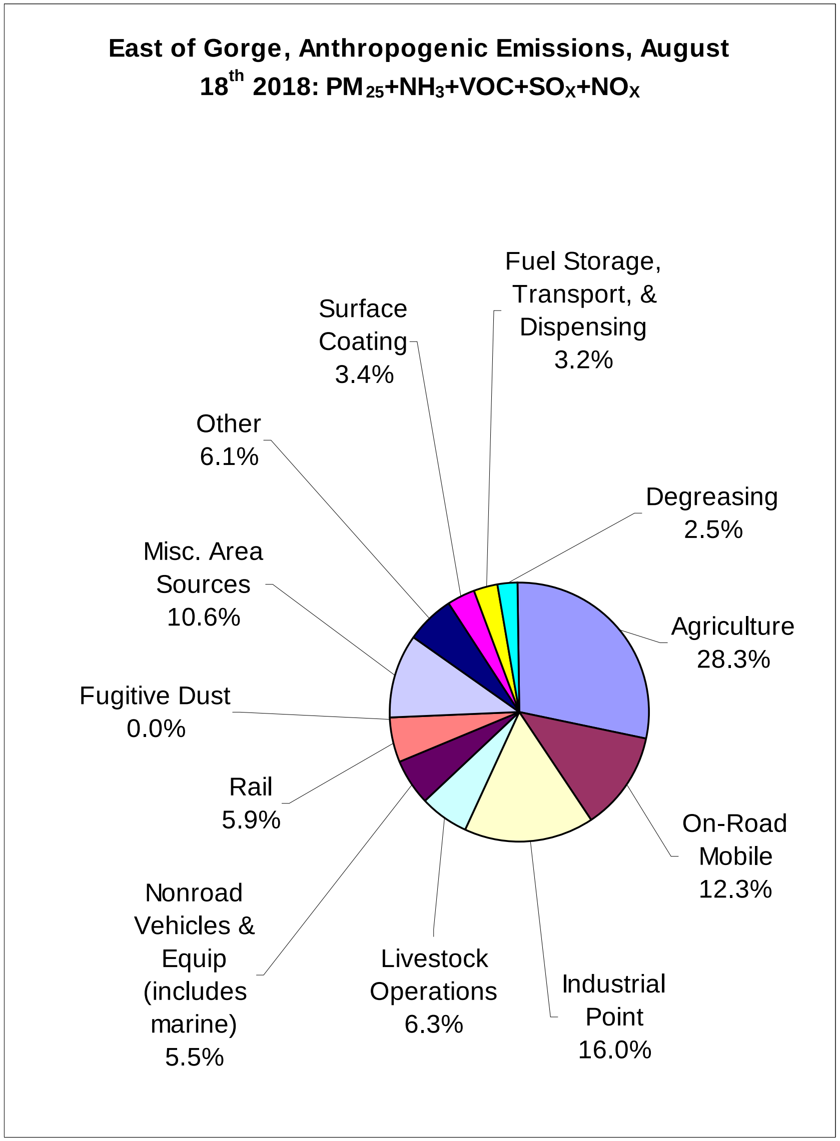


Figure x shows a comparison of source categories (man-made sources only) from August 18, 2004 to August 18, 2018. This is for East of Gorge sources only. On-road mobile emissions decrease by 58% (220 tons/day to 93 tons/day) due to EPA's ultra low sulfur fuel rules. Industrial point emissions and agriculture emissions remain constant. Livestock operations emissions decrease by 43% (83 tons/day to 48 tons/year) and nonroad vehicles and equipment (including marine emissions) decrease by 44% (73 tons/year to 41 tons/year). Fugitive dust emissions are nonexistent in 2018, potentially as a result of an EI error. Miscellaneous area source emissions increase by 190% (42 tons/year to 80 tons/year) due to projections from EPA's EGAS model. As the population increases, categories that are contingent upon population increase also show an increase in emissions including fuel storage and transport and degreasing.

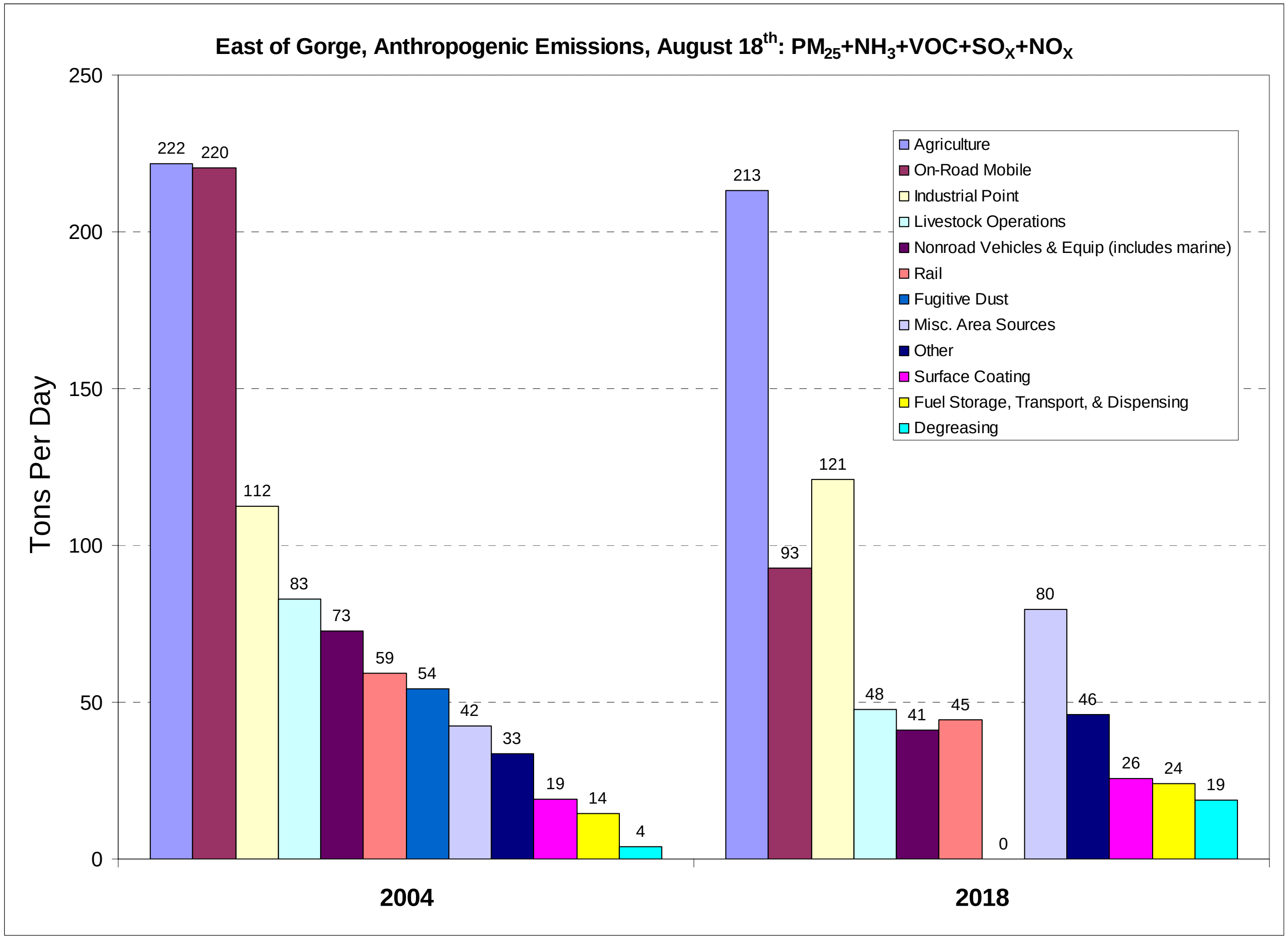
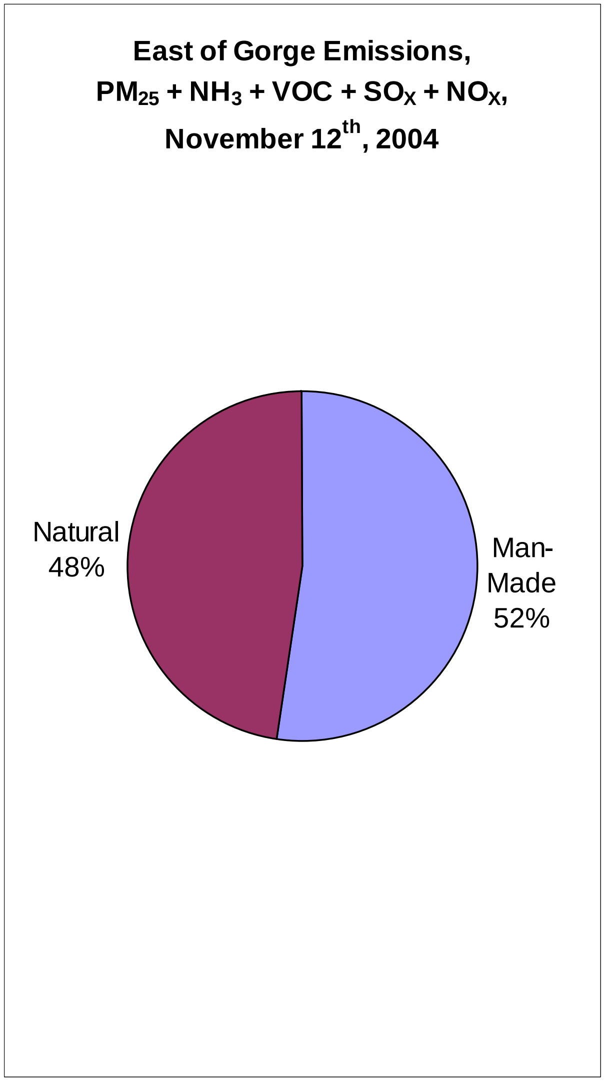


Figure x shows source contributions for November 12, 2004, Region 5: East of Gorge. Man-made sources account for 52% of the overall emissions for East of Gorge region, with natural sources comprising 48%. In the accompanying pie chart, it shows the distribution of source categories that contribute to man-made sources. Prescribed burning and on-road mobile each contribute 18% and 24% respectively, industrial point and other emissions each contribute 12% to man-made sources. The "Other" category emissions include landfills, stationary fuel combustion, and incineration, etc. In this chart, "Livestock operations" is its own category, separate from "Agriculture" emissions.



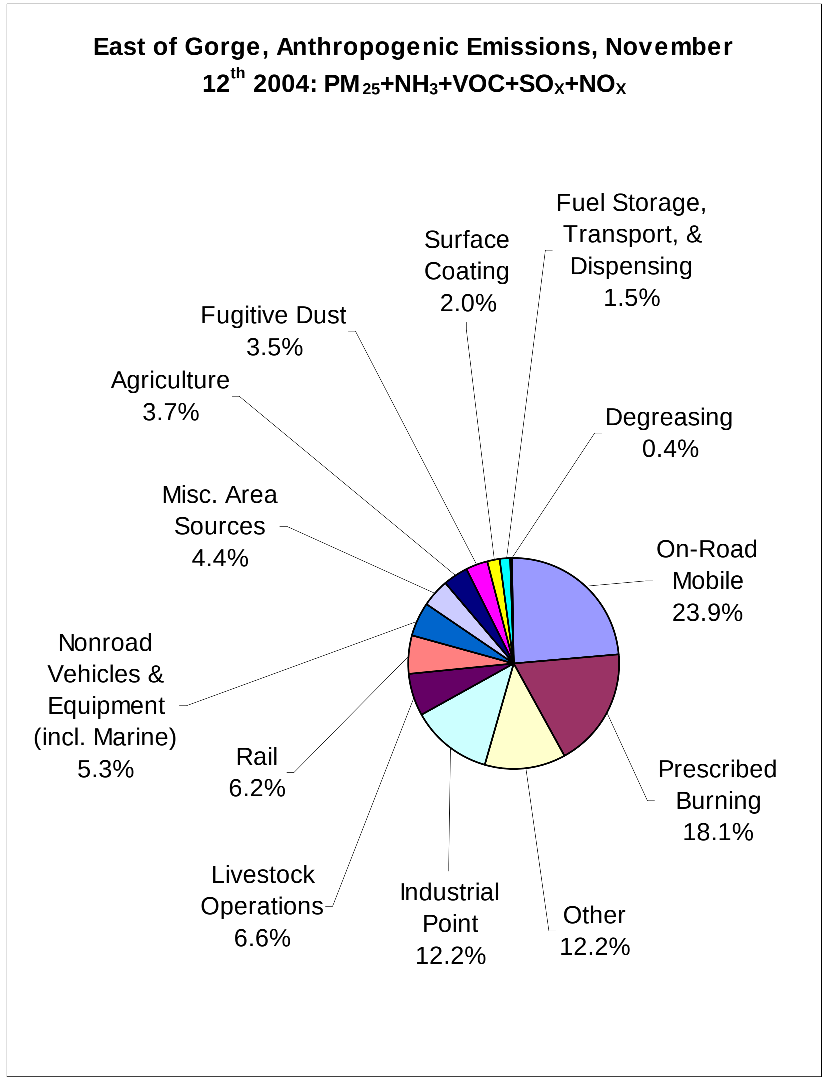
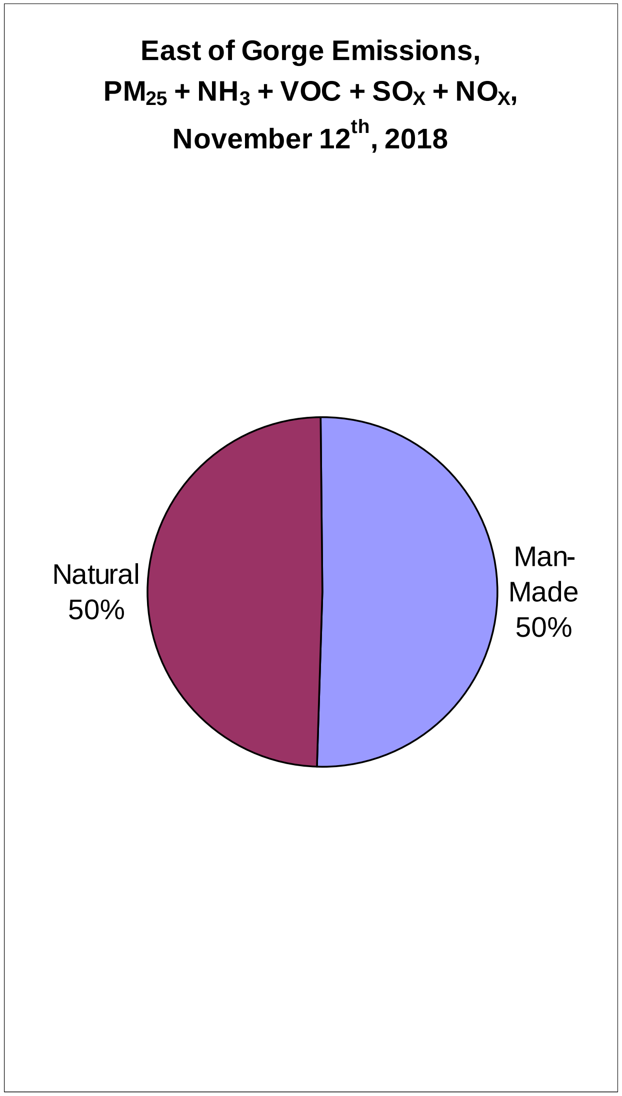


Figure x shows source contributions for November 12, 2018, Region 5 - East of Gorge. Natural emissions are 50% and man-made emissions are 50% of the total source contribution to In-Gorge emissions. The accompanying pie chart shows the man-made emissions distributed by source category. Prescribed burning contributes 19% of emissions, with industrial point sources, other sources, and on-road mobile totaling 35% of the contribution to the man-made source pie. The category groupings are the same as what was used for August 2004.



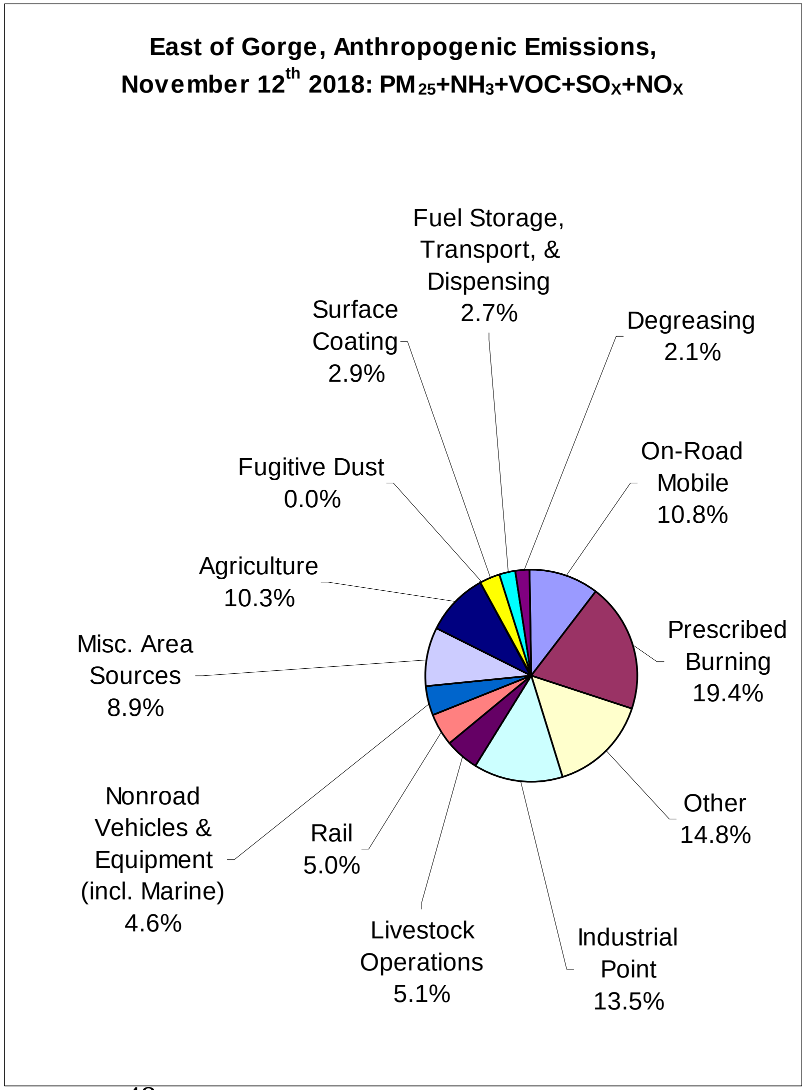
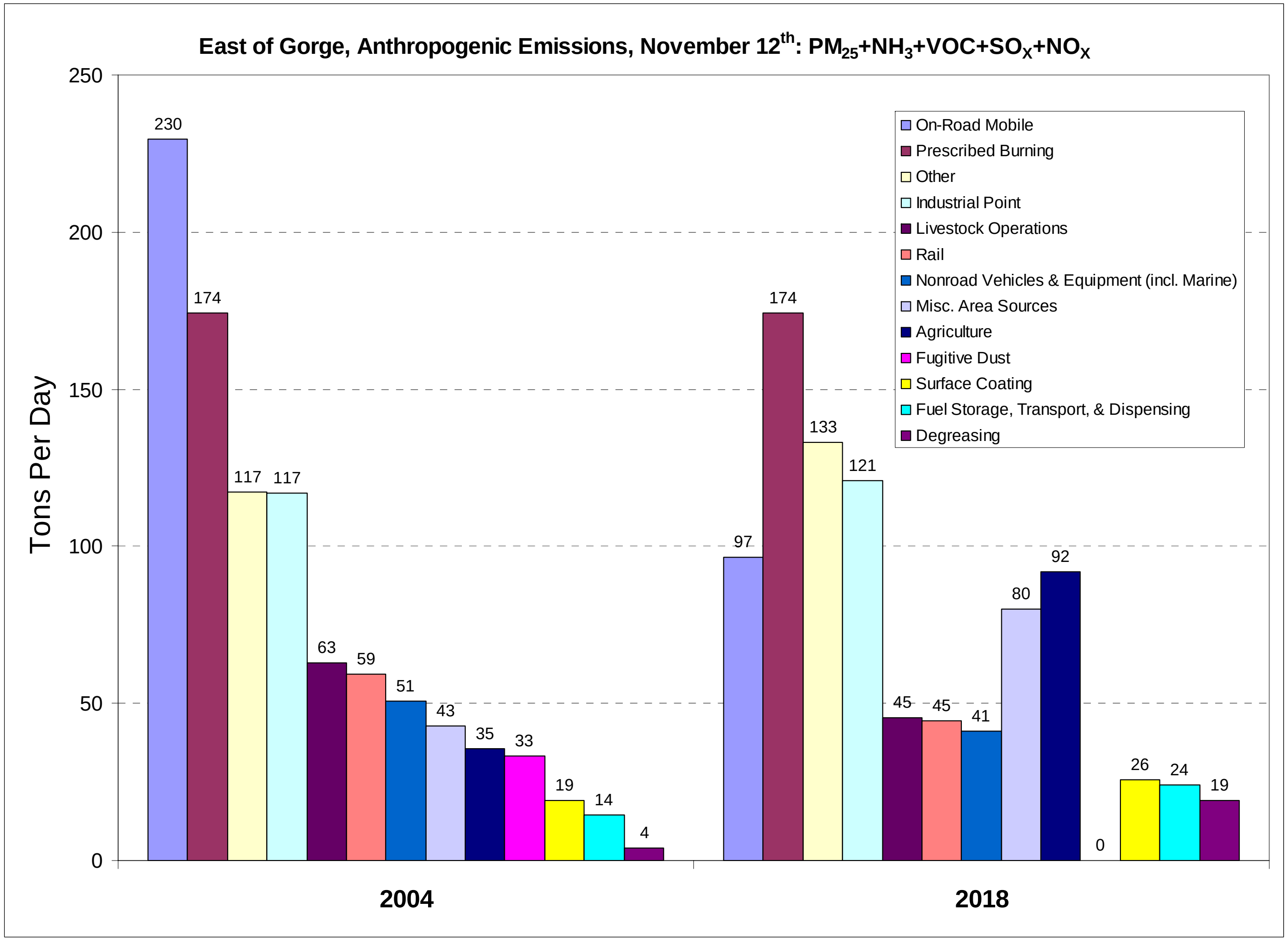
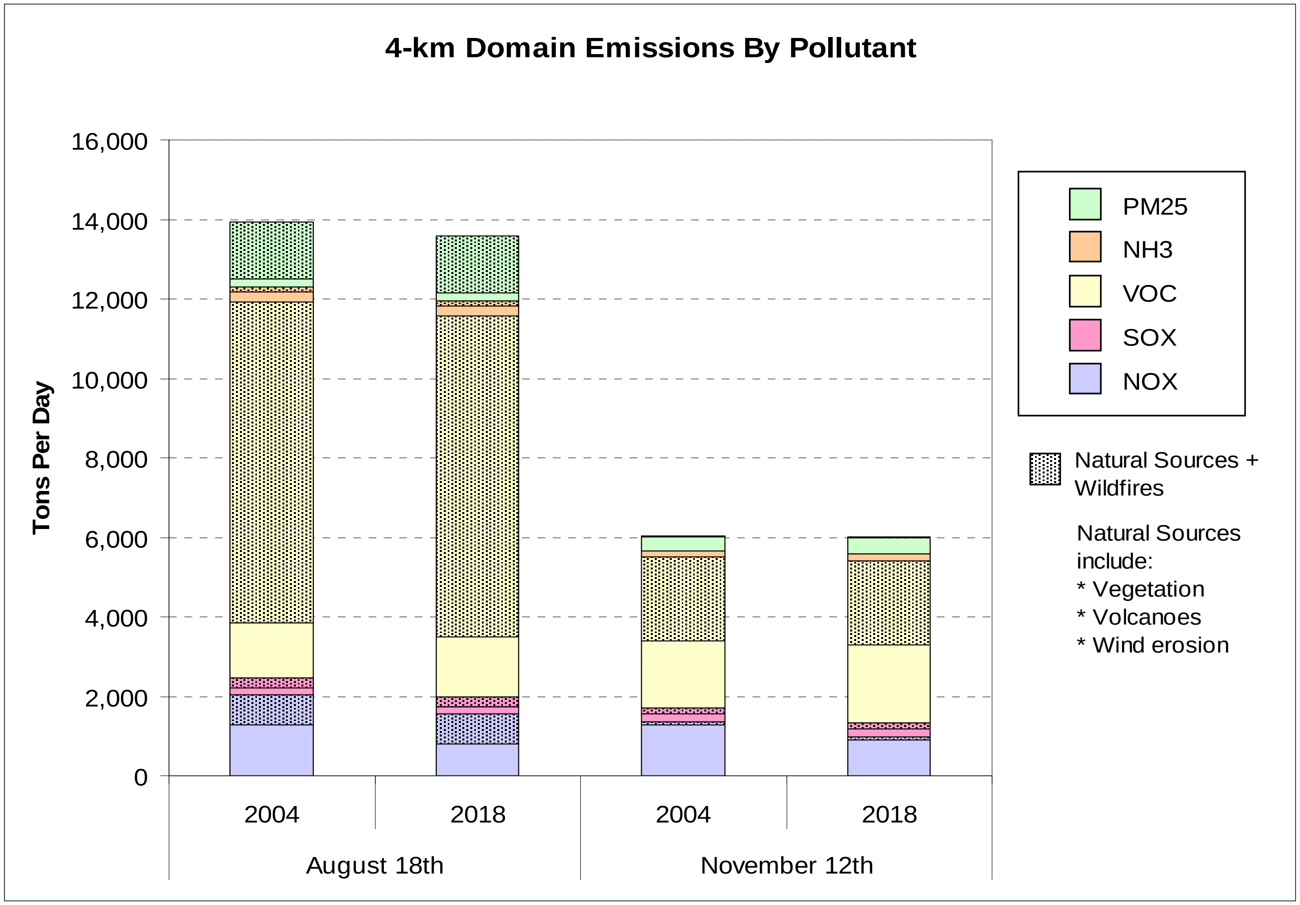


Figure x shows a comparison of source categories (man-made sources only) from November 12, 2004 to November 12, 2018. This is for East of Gorge sources only. On-road mobile emissions decrease by 58% (230 tons/day to 97 tons/day) due to EPA's ultra low sulfur fuel rules. Prescribed burning, industrial point emissions and residential wood combustion emissions remain constant. "Other" source category emissions increase, due to landfills and open burning. Fugitive dust emissions are nonexistent in 2018, potentially as a result of an EI error. Agriculture emissions increase as well, but it could be due to a temporal EI error. Miscellaneous area sources increase by 186% (43 tons/day to 80 tons/day) due to projected emissions calculated from EPA's EGAS model.



VII. Domain Emissions by Pollutant

Figure x provides an overall snapshot of pollutant emissions for the two specific episodes modeled. It shows the amount, in tons, per pollutant of what is being emitted over the modeling domain. The chart compares the August 2004 (base case) to August 2018 (future year) emissions and also shows the November base case and future year emissions. In the August and November episodes, VOC has the highest amount of emissions. For example, in August 2004, while VOC emissions are 4.5 times greater (9,460 tons/day VOC) than the next highest pollutant emissions (2,045 tons/day NOx), VOC does not have as much an effect on visibility conditions as other pollutants, such as NOx or SOx. PM2.5 and NH3 are similar to VOC, in that for visibility issues, NOx and SOx are more likely to cause visibility impairment. The graph also shows the comparison of natural sources vs. other sources for all the pollutants in the modeling domain. Natural sources include vegetation, volcanoes, and wind erosion. For example, the August 2004 episode shows 13,930 tons/day of emissions. Of that, 76% (10,651 tons/day) comes from natural sources and wildfires. The remaining 24% (3,279 tons/day) come from man-made sources. In August 2018, the contribution from natural sources increases, at 78% (10,651 tons/day) and with man-made sources contributing 12% (2,933 tons/day). For the November 2004 episode, it shows 6,047 tons/day of emissions. Natural emissions are 39% (2,347 tons/day) and man-made emissions are 61% (3,700 tons/day). In November 2018, the contributions from natural emissions 39% (2,347 tons/day) and man-made emissions 61% (3,659 tons/day) remain constant.


4-km Domain Emissions By Pollutant
Tons Per Day
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
2004
2018
2004
2018
August 18th
November 12th
PM25
NH3
VOC
SOX
NOX
Natural Sources + Wildfires
Natural Sources include:
* Vegetation
* Volcanoes
* Wind erosion

A. SOx

The following graphs show the distribution of SOx emissions over the modeling domain. For the August 18, 2004, Figure x shows the breakdown of natural vs. man made SOx sources for the whole domain. SOx is only 3% of the pollutant contribution for the domain, and of that natural sources are 59% of the SOx contribution and man-made sources comprise 41%. The charts are further distributed to show the composition of SOx natural sources and man-made sources. Wildfires are the sole contributor (100%) to the natural source component of SOx. For all the man-made sources, point sources contribute 24% of the total SOx emissions. Coal fired boilers are 38% of the man-made sources, but contribute only 16% of the total SOx emissions. Nonroad sources (26%) contribute to 11% of the total SOx emissions.

SOx Emissions (Domain)– August 18, 2004

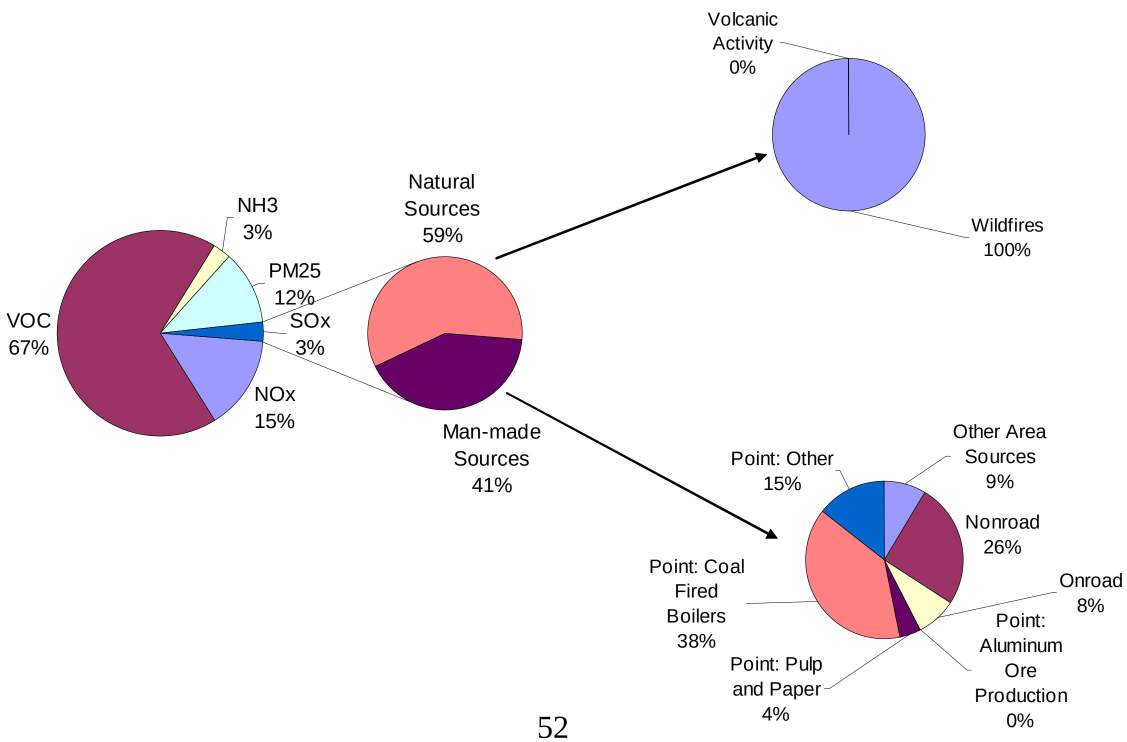
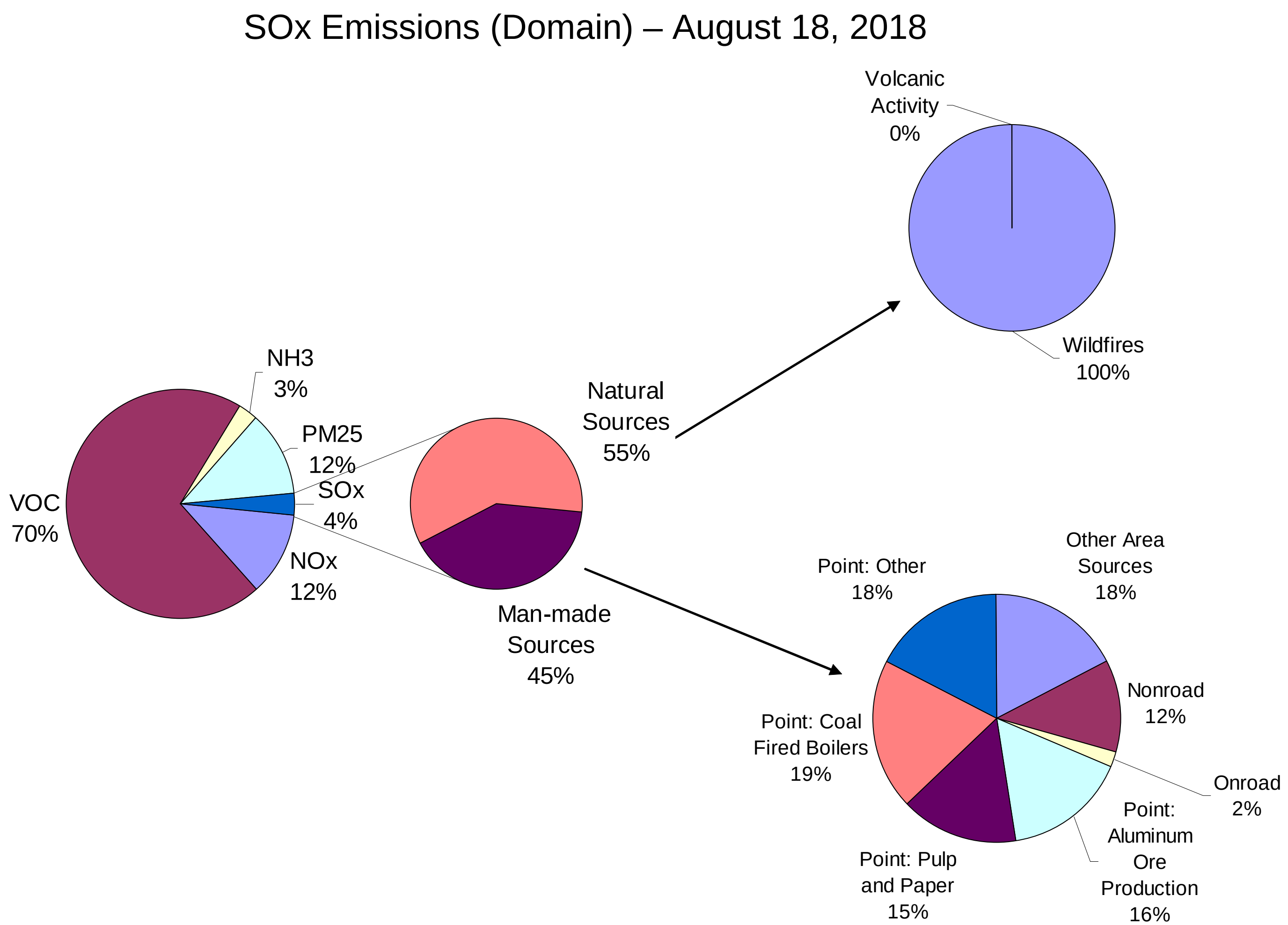


Figure x shows the breakdown of natural vs. man-made SOx sources for the August 18, **2018** episode. SOx emissions are 4% of the pollutant emissions for the whole domain, with natural sources comprising the majority of that contribution (55%) and man-made sources contributing 45%. Wildfires are the sole contributor (100%) to the natural source component of SOx. For all the man-made sources, all point sources contribute 68% of the total SOx emissions. Coal fired boilers contribute 9% of the total SOx emissions. Other area sources contribute 8% of the total SOx emissions.



For November 12, 2004, Figure x shows the breakdown of natural vs. man made SOx sources for the whole domain. SOx is only 8% of the pollutant contribution for the domain, and of that natural sources are 43% of the SOx contribution and man-made sources comprise 57%. The charts are further distributed to show the composition of SOx natural sources and man-made sources. Volcanic activity is the sole contributor (100%) to the natural source component of SOx. For all the man-made sources, all the point sources contribute 52% of the total SOx emissions. Coal fired boilers are 35% of the man-made source contribution, but are only 20% of the total SOx emissions. Other area sources (24%) contribute 14% of the total SOx emissions.

SOx Emissions (Domain) – November 12, 2004

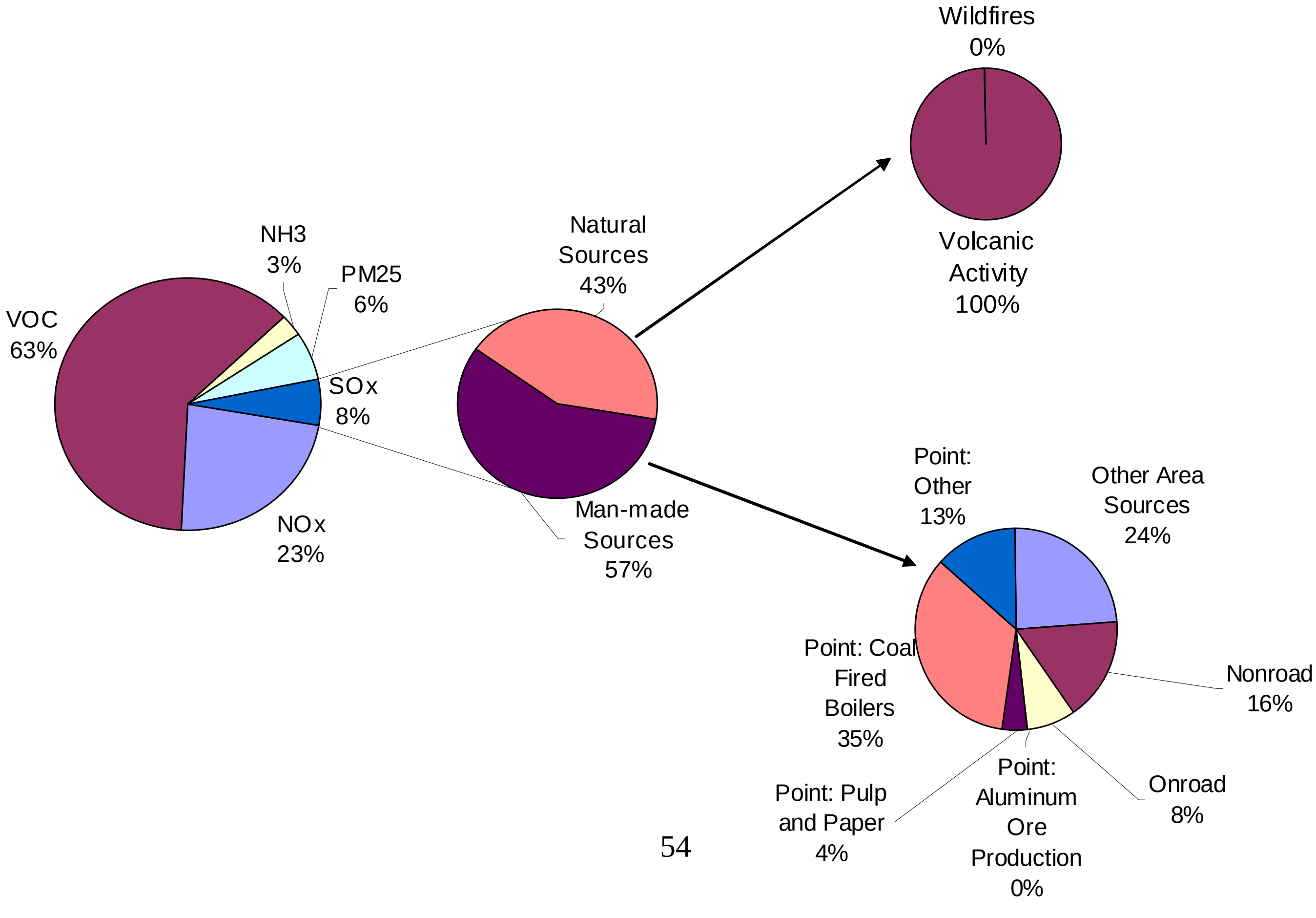
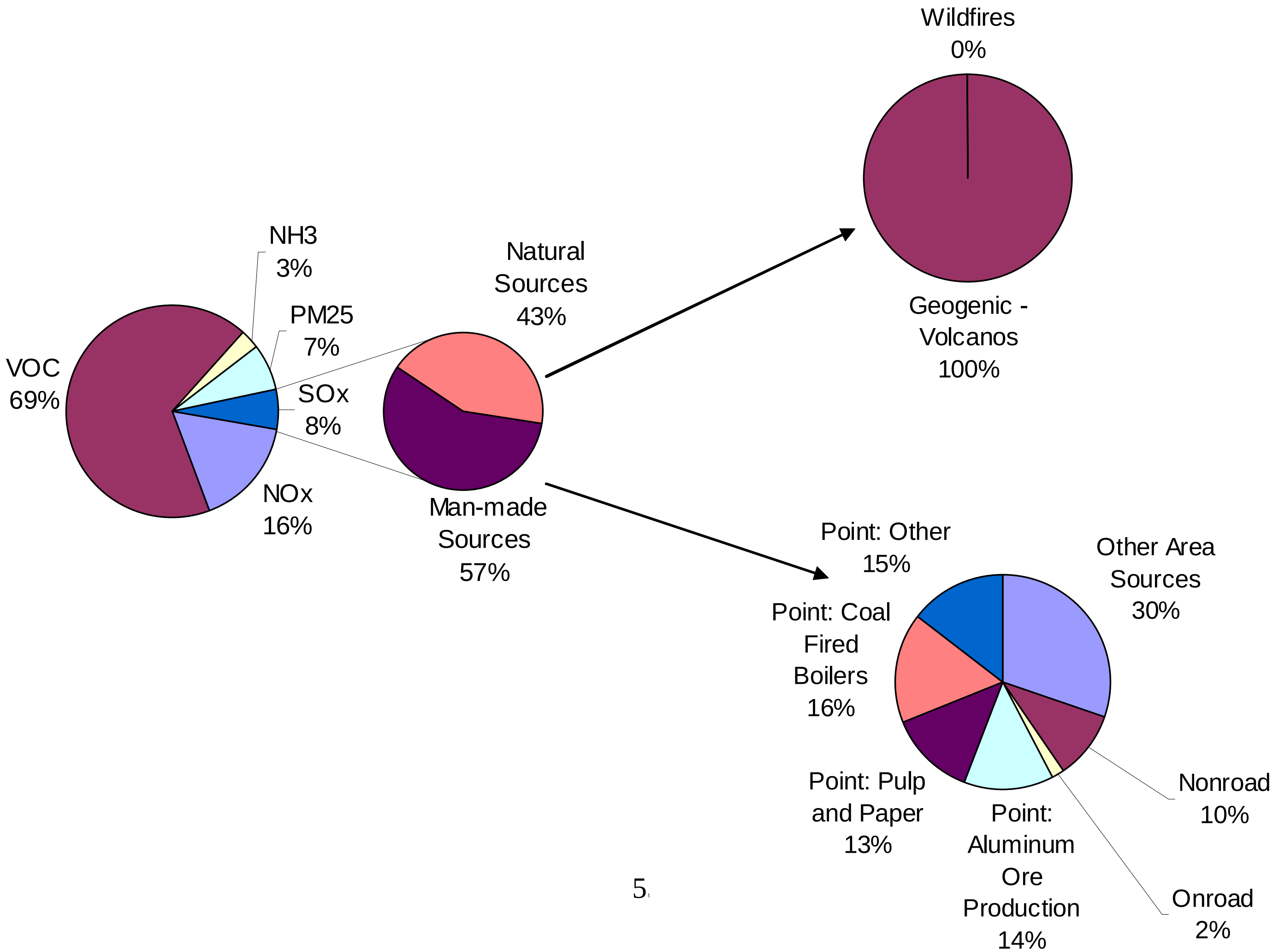


Figure x shows the breakdown of natural vs. man-made SOx sources for the November 12, **2018** episode. SOx emissions are 8% of the pollutant emissions for the whole domain, with man-made sources comprising the majority of that contribution (57%) and natural sources contributing 43%. Volcanic activity is the sole contributor (100%) to the natural source component of SOx. For all the man-made sources, all point sources contribute 58% of the total SOx emissions. Coal fired boilers contribute 9% of the total SOx emissions and other area sources contribute 17% of the total SOx emissions.

SOx Emissions (Domain) – November 12, 2018



B. NOx

The following graphs show the distribution of NOx emissions over the modeling domain. For the August 18, 2004, Figure x shows the breakdown of natural vs. man made NOx sources for the whole domain. NOx is 15% of the pollutant contribution for the domain, and of that man-made sources are 62% of the NOx contribution and natural sources comprise 38%. The charts are further distributed to show the composition of NOx natural sources and man-made sources. Wildfires contribute 73% and natural sources (as it is defined by its SCC classification) contribute 27% to the natural source component of NOx. For all the man-made sources, on-road emissions are 52% of the man-made source contribution and are 32% of the total NOx emissions. Nonroad sources (31%) contribute 19% of the total NOx emissions.

NOx Emissions (Domain) – August 18, 2004

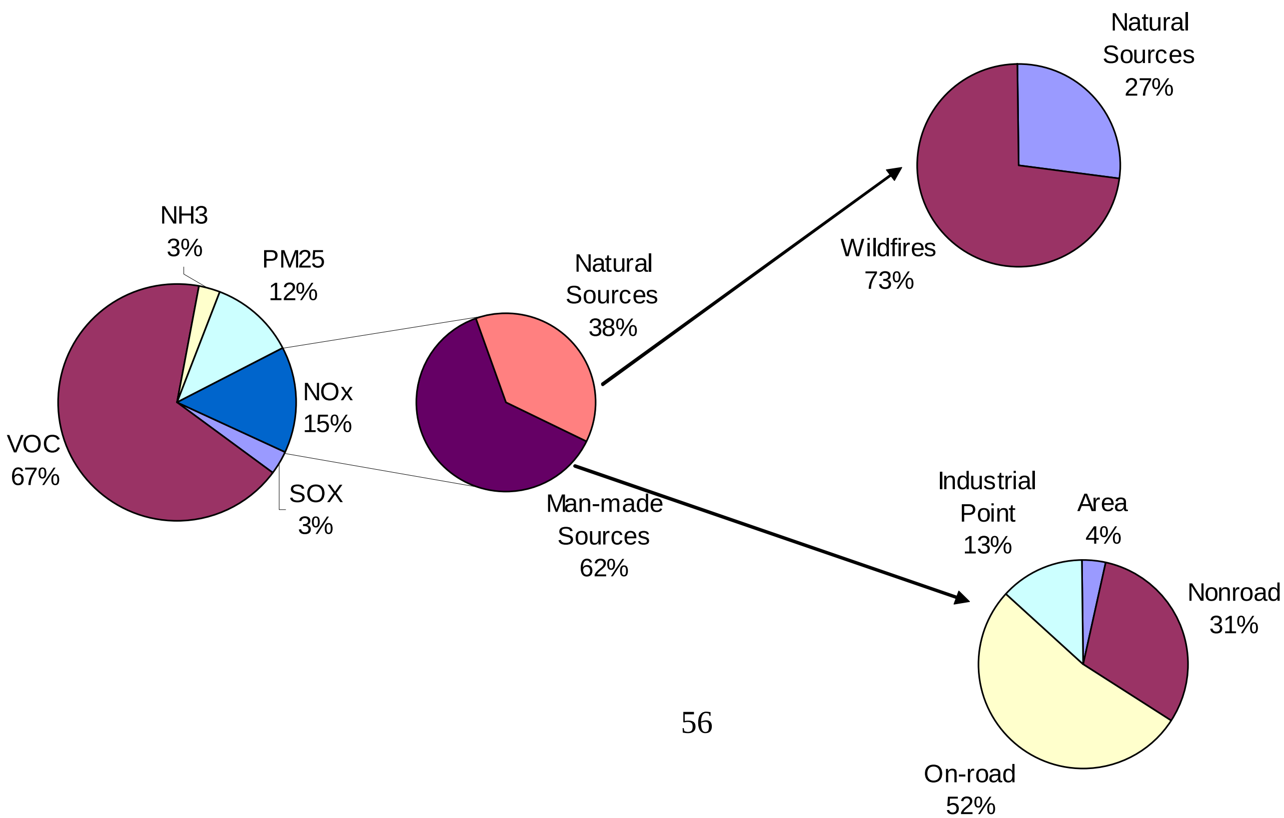
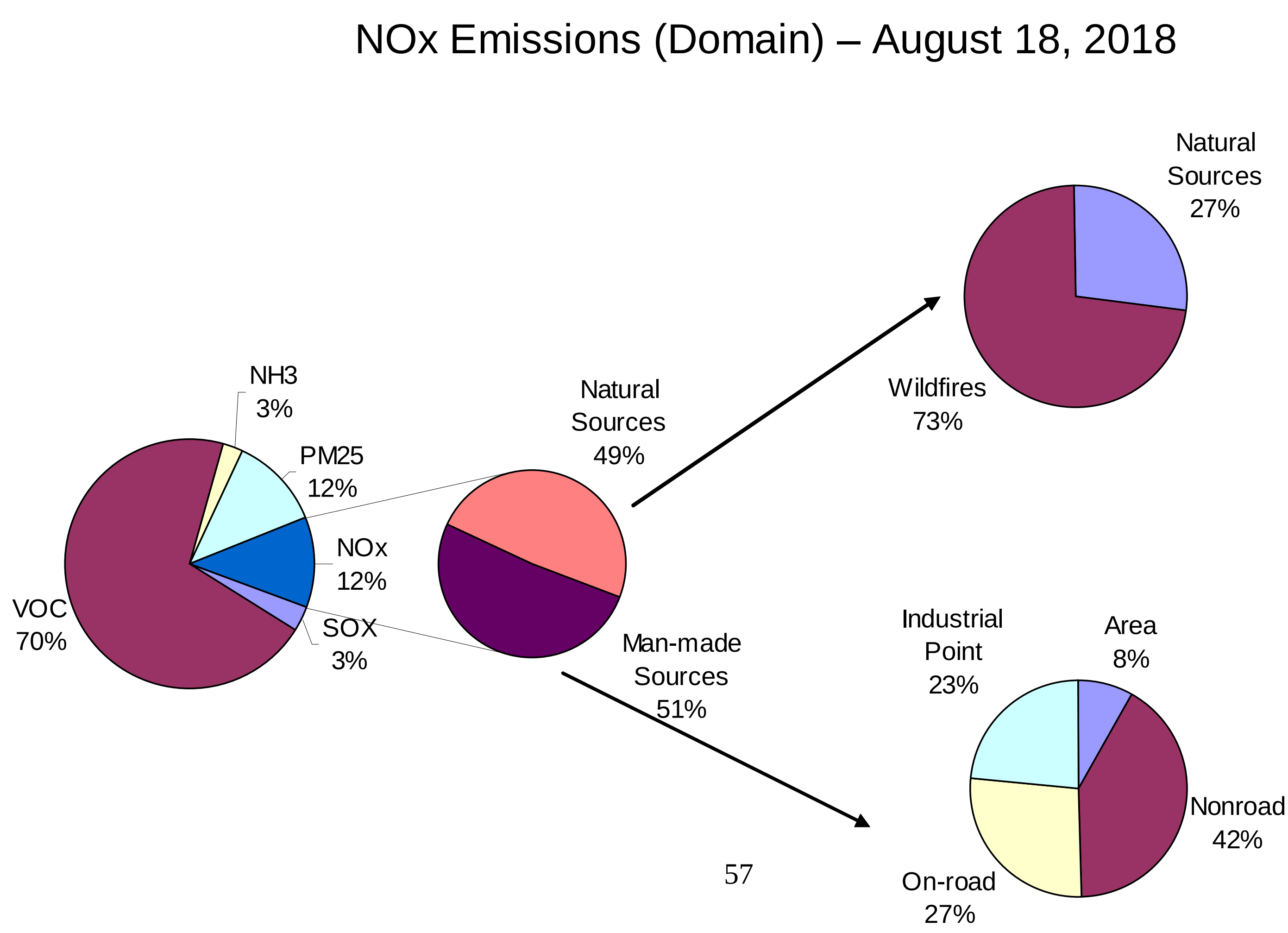


Figure x shows the breakdown of natural vs. man-made NOx sources for the August 18, **2018** episode. NOx emissions are 12% of the pollutant emissions for the whole domain, with man-made sources comprising the majority of that contribution (51%) and natural sources contributing 49%. Wildfires contribute 73% and natural sources (as it is defined by its SCC classification) contribute 27% to the natural source component of NOx. For all the man-made sources, nonroad emissions are 42% of the man-made source contribution and are 21% of the total NOx emissions. Onroad sources (27%) contribute 14% of the total NOx emissions.



For the November 12, 2004 episode, Figure x shows the breakdown of natural vs. man made NOx sources for the whole domain. NOx is 23% of the pollutant contribution for the domain, and of that man-made sources are 94% of the NOx contribution and natural sources comprise 6%. The charts are further distributed to show the composition of NOx natural sources and man-made sources. "Natural sources" are the sole contributor (100%) to the natural source component of NOx. For all the man-made sources, on-road emissions are 56% of the man-made source contribution and are 53% of the total NOx emissions. Nonroad sources (20%) contribute 19% of the total NOx emissions.

NOx Emissions (Domain) – November 12, 2004

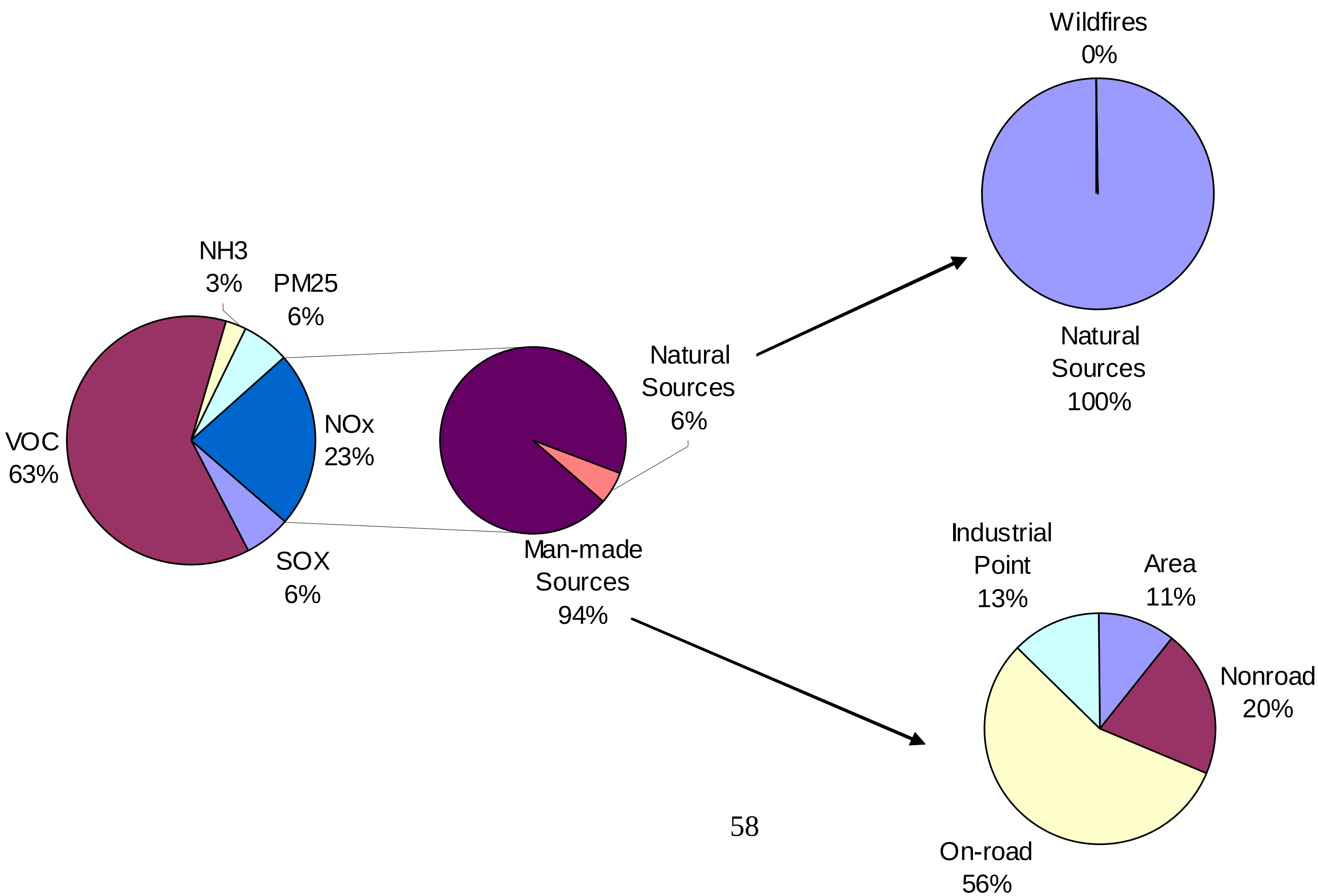
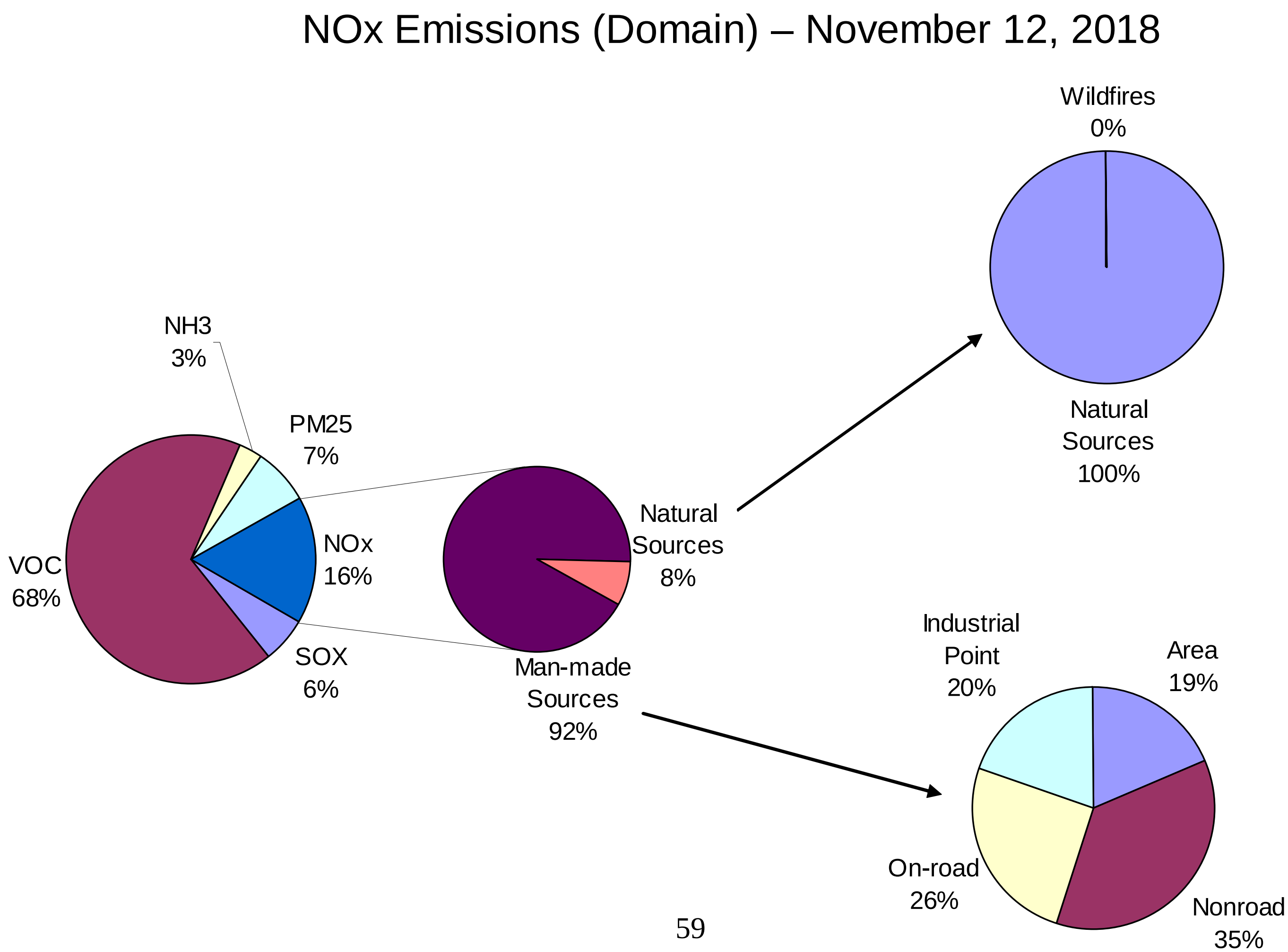


Figure x shows the breakdown of natural vs. man-made NOx sources for the November 12, **2018** episode. NOx emissions are 16% of the pollutant emissions for the whole domain, with man-made sources comprising the majority of that contribution (92%) and natural sources contributing 8%. "Natural sources" are the sole contributor (100%) to the natural source component of NOx. For all the man-made sources, nonroad emissions are 35% of the man-made source contribution and are 32% of the total NOx emissions. On-road sources (26%) contribute 24% of the total NOx emissions.



C. VOC

The following graphs show the distribution of VOC emissions over the modeling domain. For the August 18, 2004, Figure x shows the breakdown of natural vs. man made VOC sources for the whole domain. VOC is 67% of the pollutant contribution for the domain, and of that natural sources are 85% of the VOC contribution and man-made sources comprise 15%. The charts are further distributed to show the composition of VOC natural sources and man-made sources. "Natural sources" are the sole contributor (100%) to the natural source component of VOC. For all the man-made sources, area source emissions are 70% of the man-made source contribution and are 11% of the total VOC emissions. On-road sources (16%) contribute 2.4% of the total VOC emissions.

VOC Emissions (Domain) – August 18, 2004

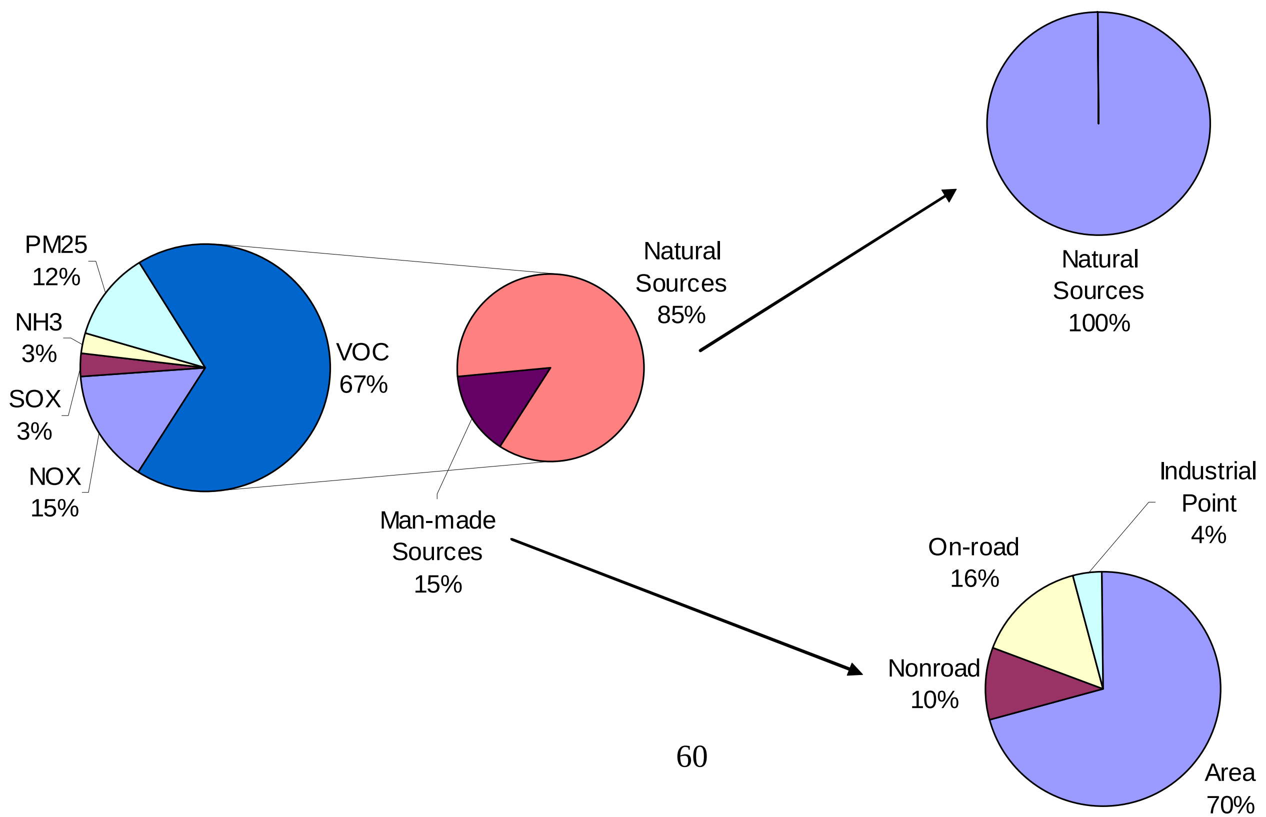
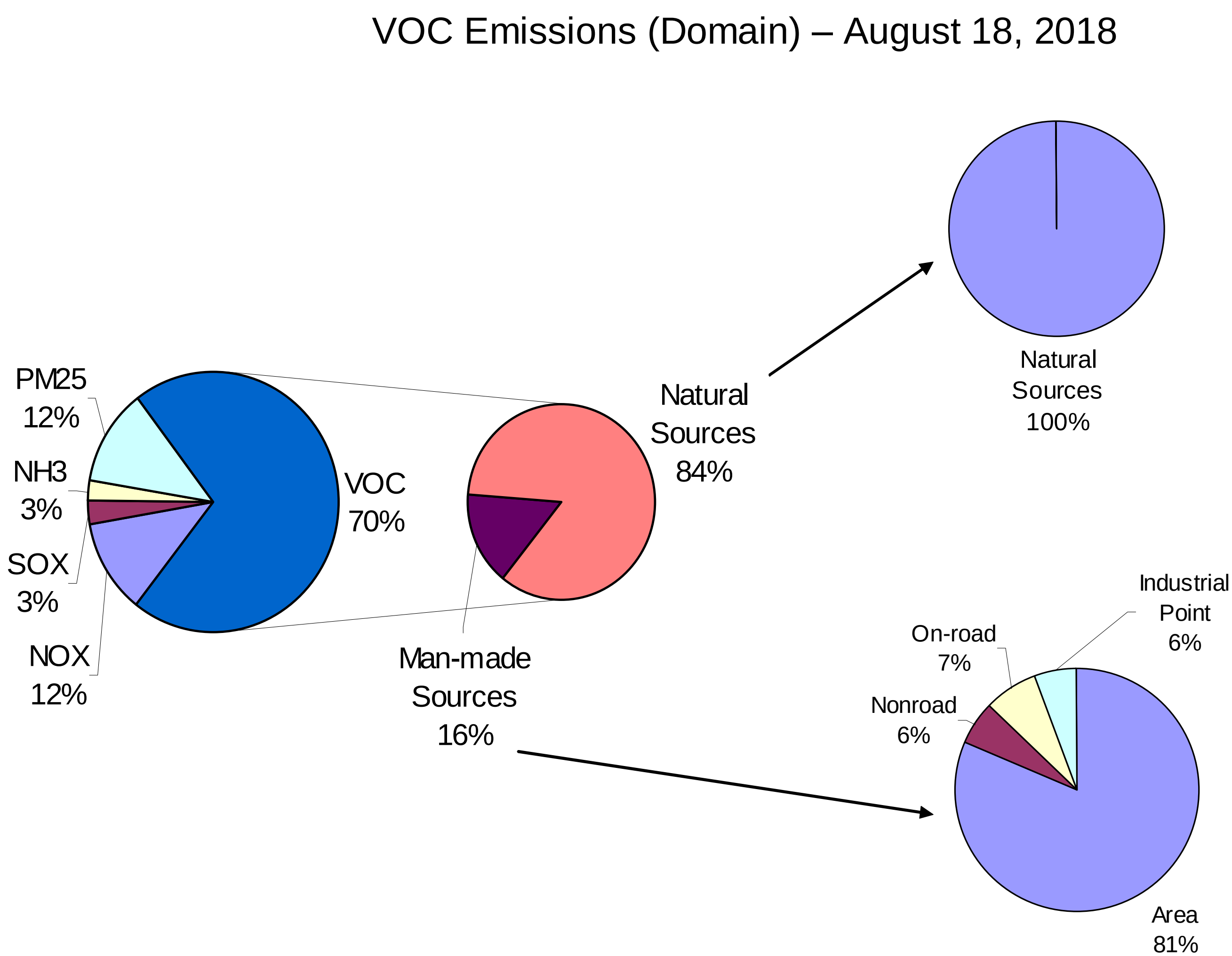


Figure x shows the breakdown of natural vs. man-made VOC sources for the August 18, **2018** episode. VOC emissions are 70% of the pollutant emissions for the whole domain, with natural sources comprising the majority of that contribution (84%) and man-made sources contributing 16%. "Natural sources" are the sole contributor (100%) to the natural source component of VOC. For all the man-made sources, area source emissions are 81% of the man-made source contribution and are 13% of the total VOC emissions. On-road sources (7%) contribute 1.1% of the total VOC emissions.



For the November 12, 2004, Figure x shows the breakdown of natural vs. man made VOC sources for the whole domain. VOC is 61% of the pollutant contribution for the domain, and of that natural sources are 55% of the VOC contribution and man-made sources comprise 45%. The charts are further distributed to show the composition of VOC natural sources and man-made sources. “Natural sources” are the sole contributor (100%) to the natural source component of VOC. For all the man-made sources, area source emissions are 58% of the man-made source contribution and are 26% of the total VOC emissions. On-road sources (27%) contribute 12% of the total VOC emissions.

VOC Emissions (Domain) – November 12, 2004

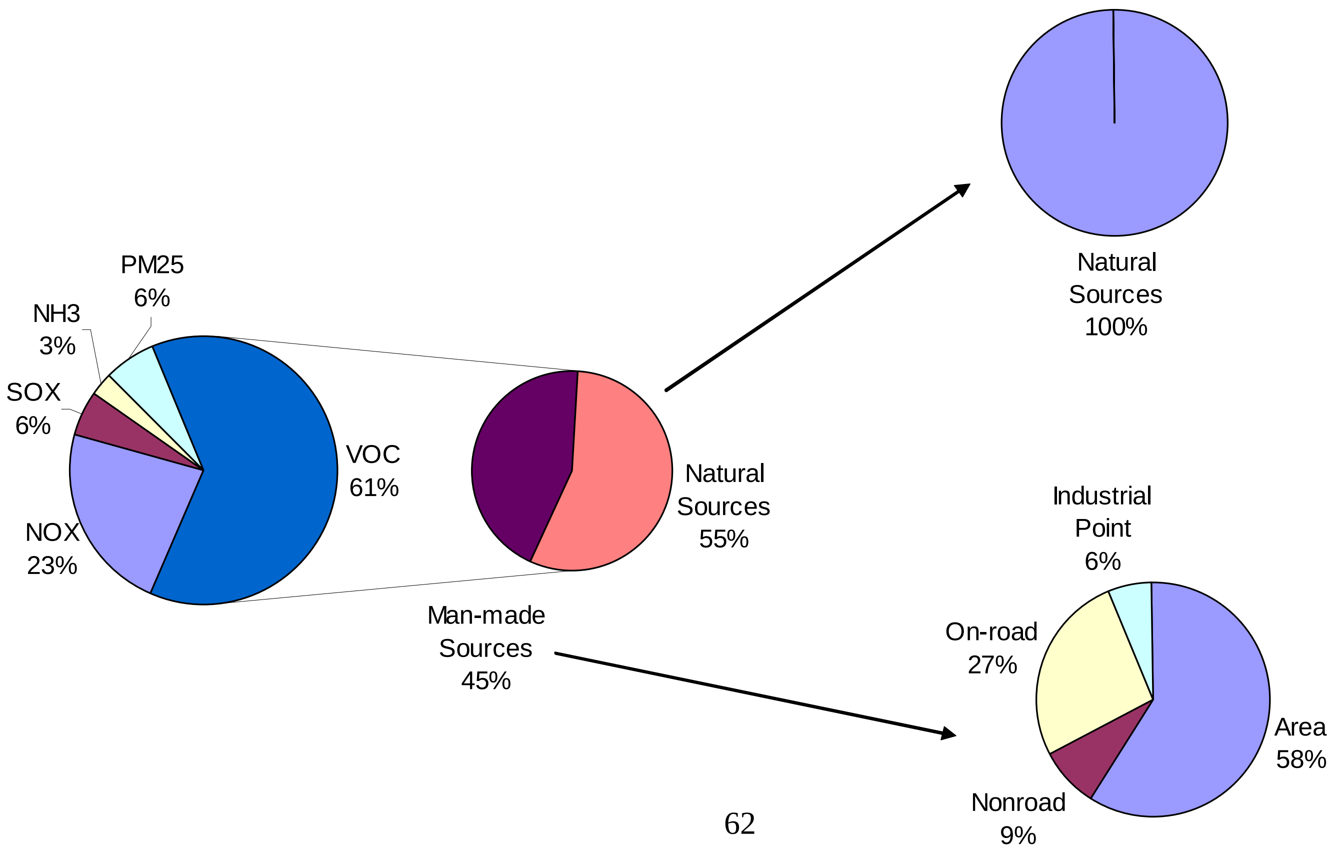
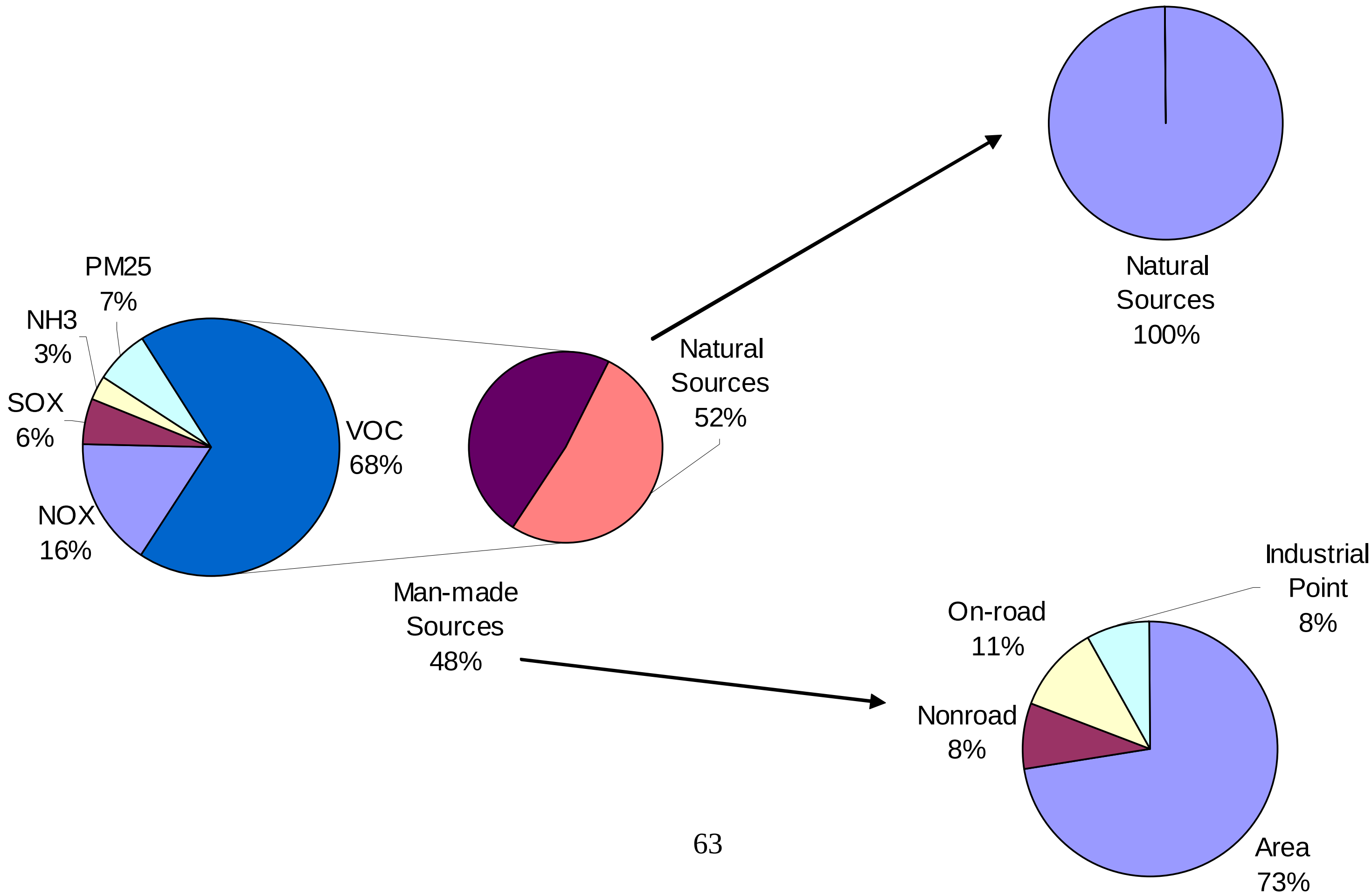


Figure x shows the breakdown of natural vs. man-made VOC sources for the November 12, **2018** episode. VOC emissions are 68% of the pollutant emissions for the whole domain, with natural sources comprising the majority of that contribution (52%) and man-made sources contributing 48%. "Natural sources" are the sole contributor (100%) to the natural source component of VOC. For all the man-made sources, area source emissions are 73% of the man-made source contribution and are 35% of the total VOC emissions. On-road sources (11%) contribute 5.2% of the total VOC emissions.

VOC Emissions (Domain) – November 12, 2018



D. NH3

The following graphs show the distribution of NH3 emissions over the modeling domain. For the August 18, 2004, Figure x shows the breakdown of natural vs. man made NH3 sources for the whole domain. NH3 is only 3% of the pollutant contribution for the domain, and of that man-made sources are 69% of the NH3 contribution and natural sources comprise 31%. The charts are further distributed to show the composition of NH3 natural sources and man-made sources. Wildfires are the sole contributor (100%) to the natural source component of NH3. For all the man-made sources, area source emissions are 91% of the man-made source contribution and are 63% of the total NH3 emissions. On-road sources (8%) contribute 6% of the total NH3 emissions.

NH3 Emissions (Domain) – August 18, 2004

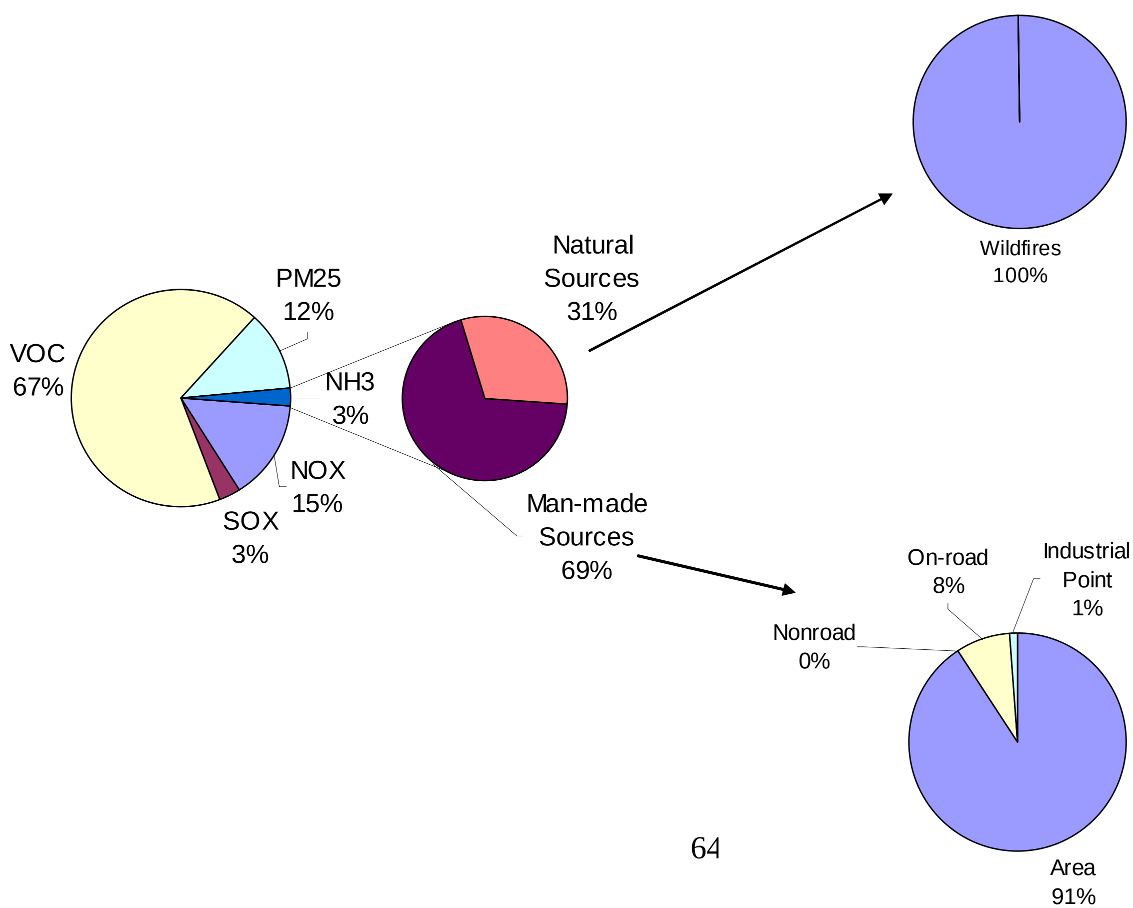
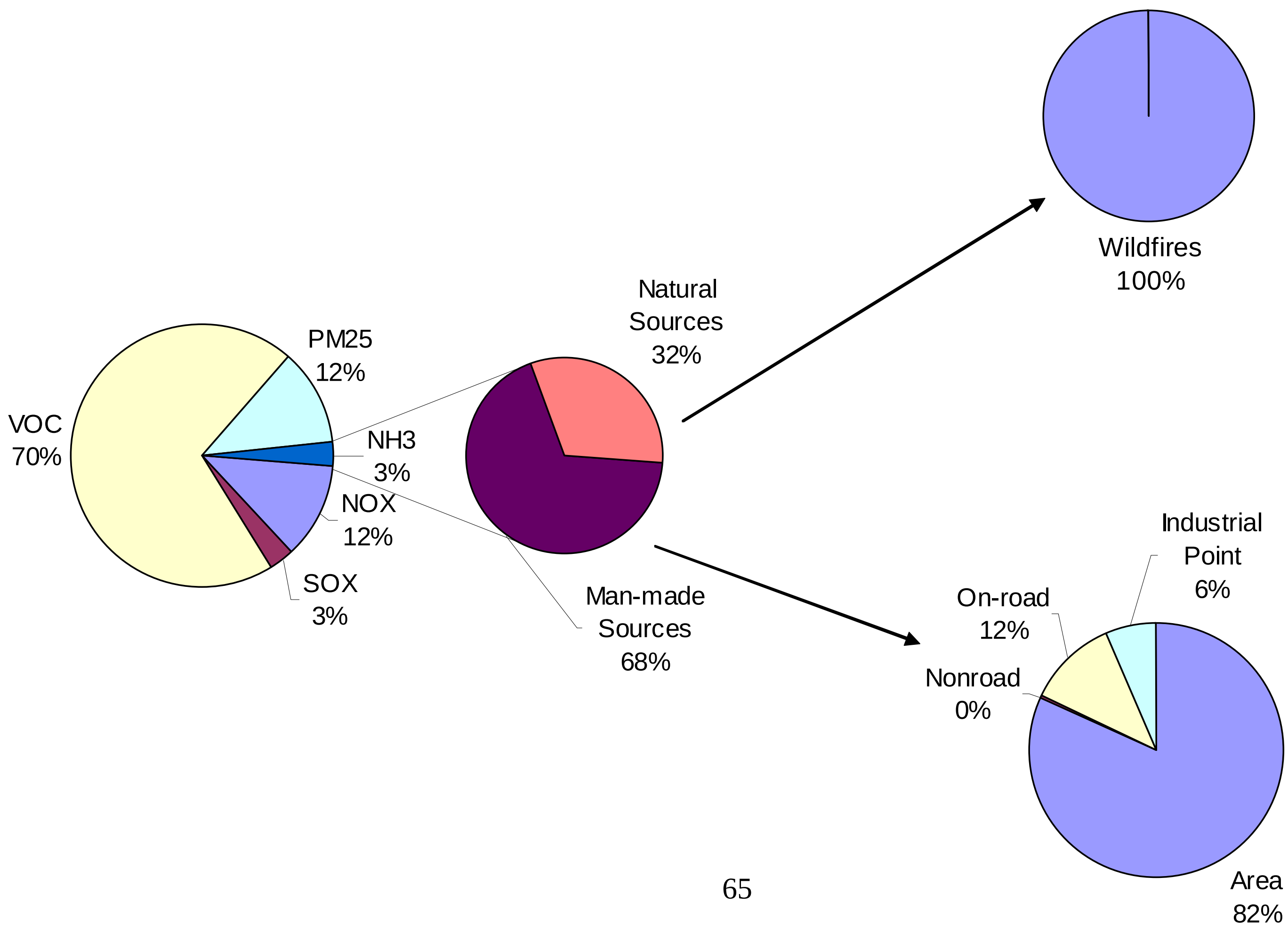


Figure x shows the breakdown of natural vs. man-made NH3 sources for the August 18, **2018** episode. NH3 emissions are 3% of the pollutant emissions for the whole domain, with man-made sources comprising the majority of that contribution (68%) and natural sources contributing 32%. Wildfires are the sole contributor (100%) to the natural source component of NH3. For all the man-made sources, area source emissions are 82% of the man-made source contribution and are 56% of the total NH3 emissions. On-road sources (12%) contribute 8% of the total NH3 emissions.

NH3 Emissions (Domain) – August 18, 2018



For the November 12, 2004, Figure x shows the breakdown of natural vs. man made NH3 sources for the whole domain. NH3 is only 3% of the pollutant contribution for the domain, and man-made sources is 100% of the NH3 contribution. The charts are further distributed to show the composition of NH3 man-made sources. For the man-made sources, area source emissions are 86% of the man-made source contribution. On-road sources contribute 12% of the total NH3 emissions.

NH3 Emissions (Domain) – November 12, 2004

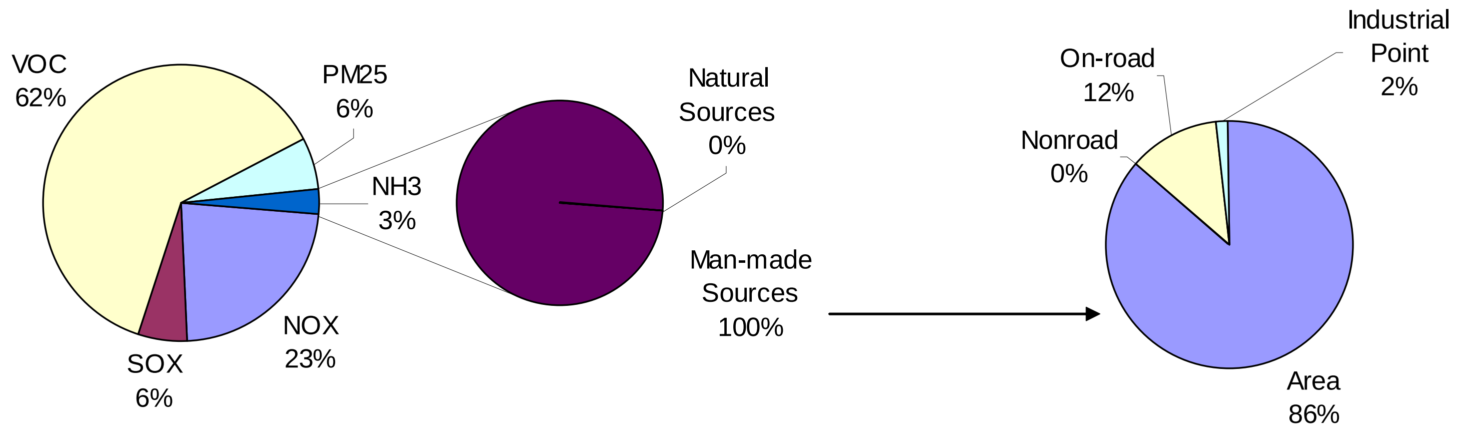
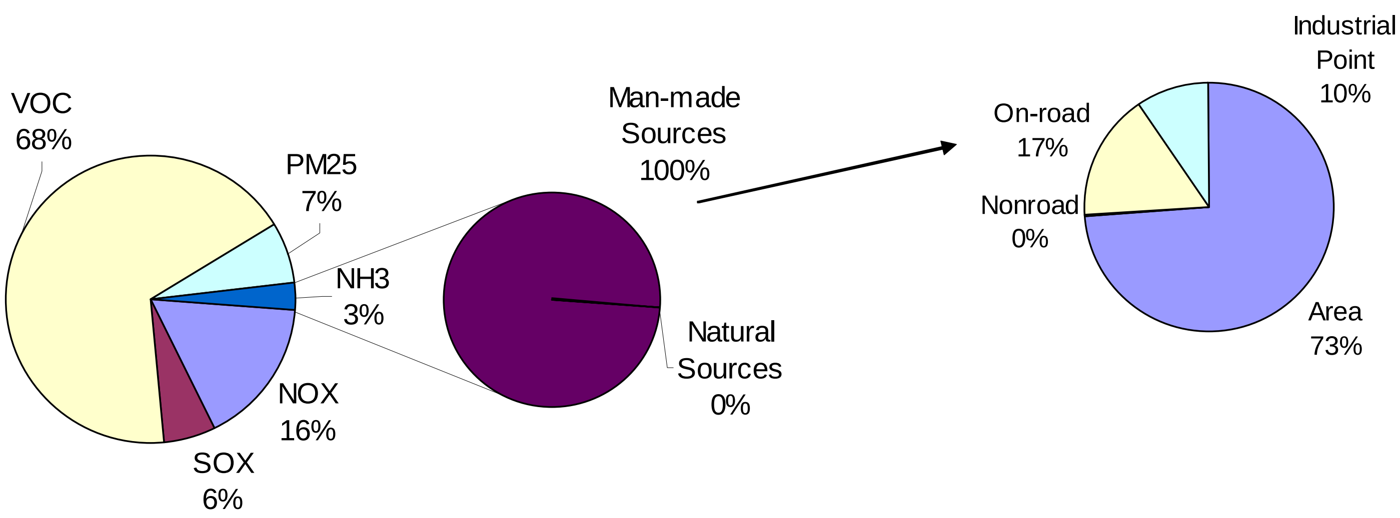


Figure x shows the breakdown of natural vs. man-made NH3 sources for the November 12, **2018** episode. NH3 is only 3% of the pollutant contribution for the domain, and man-made sources is 100% of the NH3 contribution. The charts are further distributed to show the composition of NH3 man-made sources. For the man-made sources, area source emissions are 73% of the man-made source contribution. On-road sources contribute 17% of the total NH3 emissions and industrial point sources contribute 10%.

NH3 Emissions (Domain) – November 12, 2018



E. PM2.5

The following graphs show the distribution of PM2.5 emissions over the modeling domain. For the August 18, 2004, Figure x shows the breakdown of natural vs. man made PM2.5 sources for the whole domain. PM2.5 is only 12% of the pollutant contribution for the domain, and of that natural sources are 88% of the PM2.5 contribution and man-made sources comprise 12%. The charts are further distributed to show the composition of PM2.5 natural sources and man-made sources. Wildfires contribute 96% to the natural source component of PM2.5 and natural sources contribute 4%. For all the man-made sources, area source emissions are 69% of the man-made source contribution and are 8% of the total PM2.5 emissions. Nonroad sources (17%) contribute 2% of the total PM2.5 emissions.

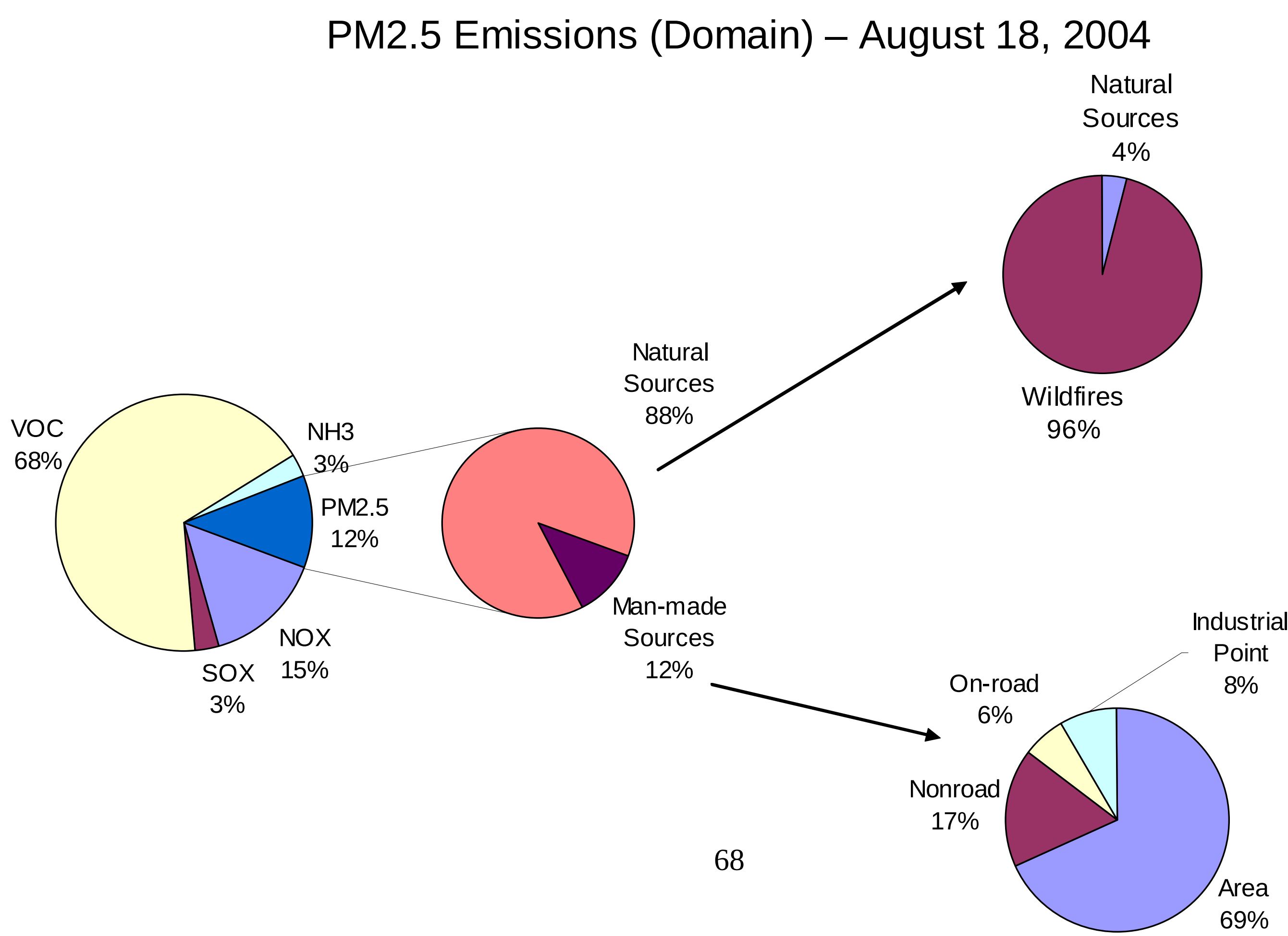
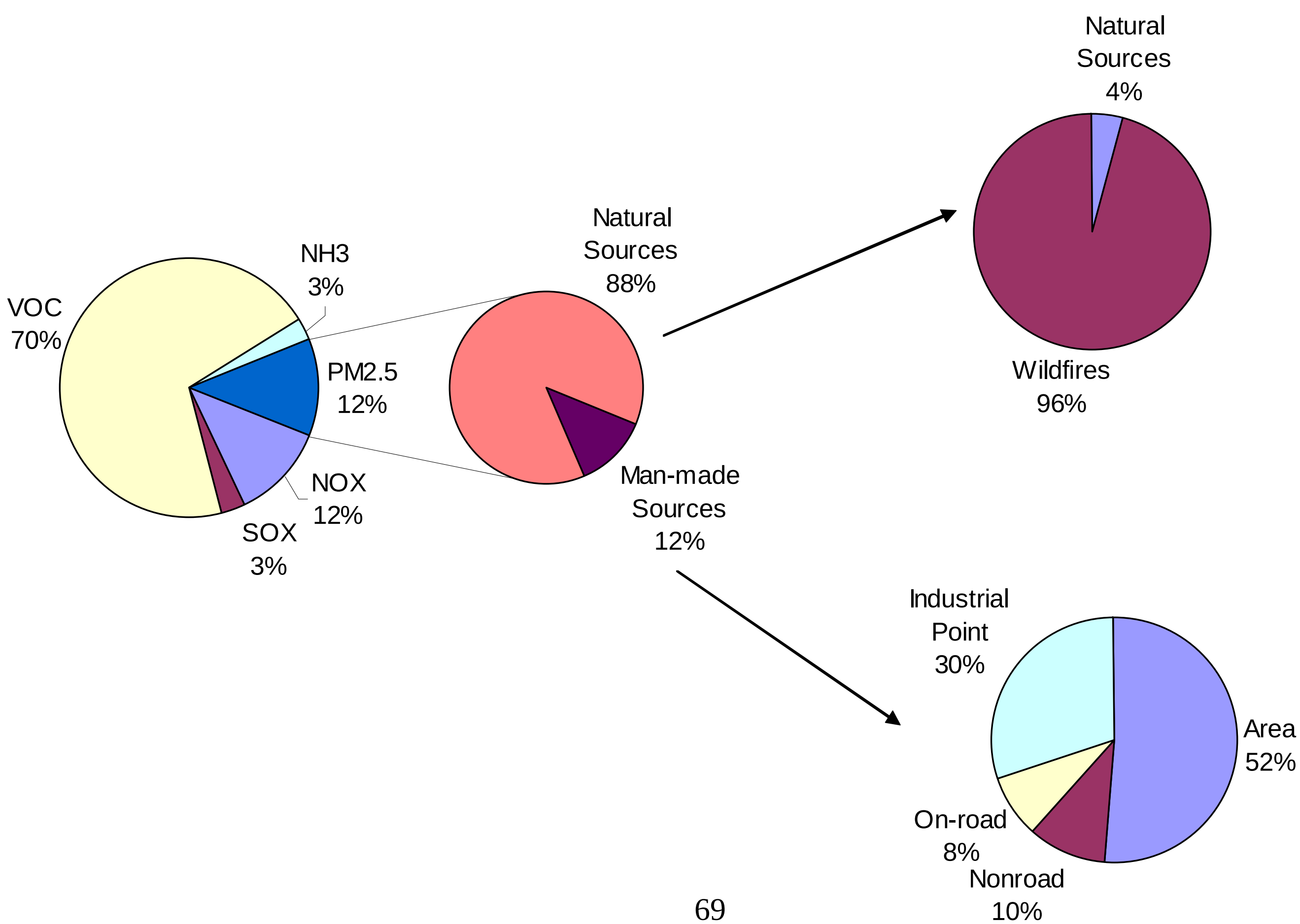


Figure x shows the breakdown of natural vs. man-made PM2.5 sources for the August 18, **2018** episode. PM2.5 emissions are 12% of the pollutant emissions for the whole domain, with natural sources comprising the majority of that contribution (88%) and man-made sources contributing 12%. Wildfires contribute 96% to the natural source component of PM2.5 and natural sources contribute 4%. For all the man-made sources, area source emissions are 52% of the man-made source contribution and are 6% of the total PM2.5 emissions. Industrial point sources (30%) contribute 3.6% of the total PM2.5 emissions.

PM2.5 Emissions (Domain) – August 18, 2018



For the November 12, 2004, Figure x shows the breakdown of natural vs. man made PM2.5 sources for the whole domain. PM2.5 is only 6% of the pollutant contribution for the domain, and of that man-made sources are 93% of the PM2.5 contribution and natural sources comprise 7%. The charts are further distributed to show the composition of PM2.5 natural sources and man-made sources. “Natural sources” are the sole contributor (100%) to the natural source component of PM2.5. For all the man-made sources, area source emissions are 88% of the man-made source contribution and are 82% of the total PM2.5 emissions. Nonroad sources (5%) contribute 5% of the total PM2.5 emissions.

PM2.5 Emissions (Domain) – November 12, 2004

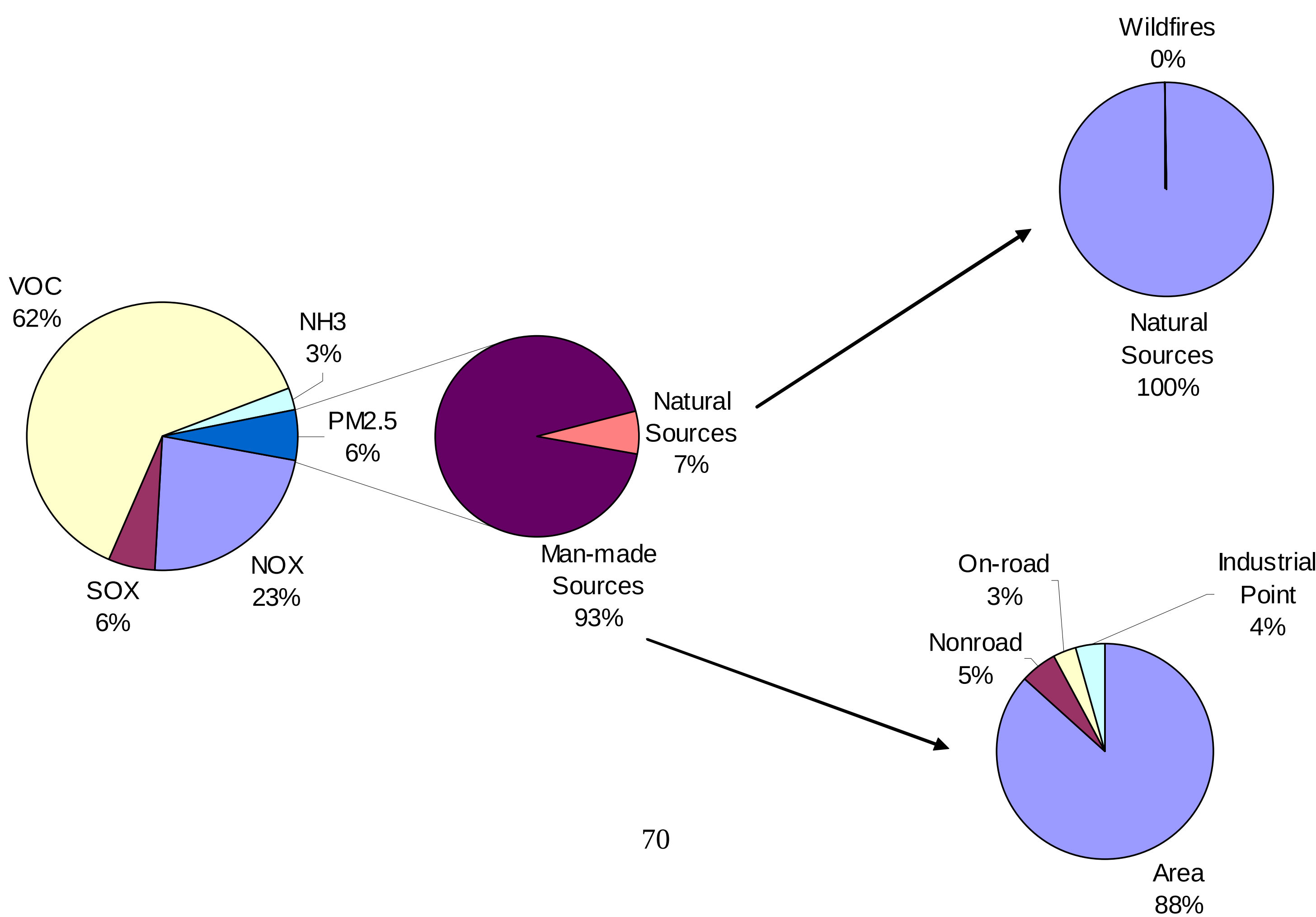
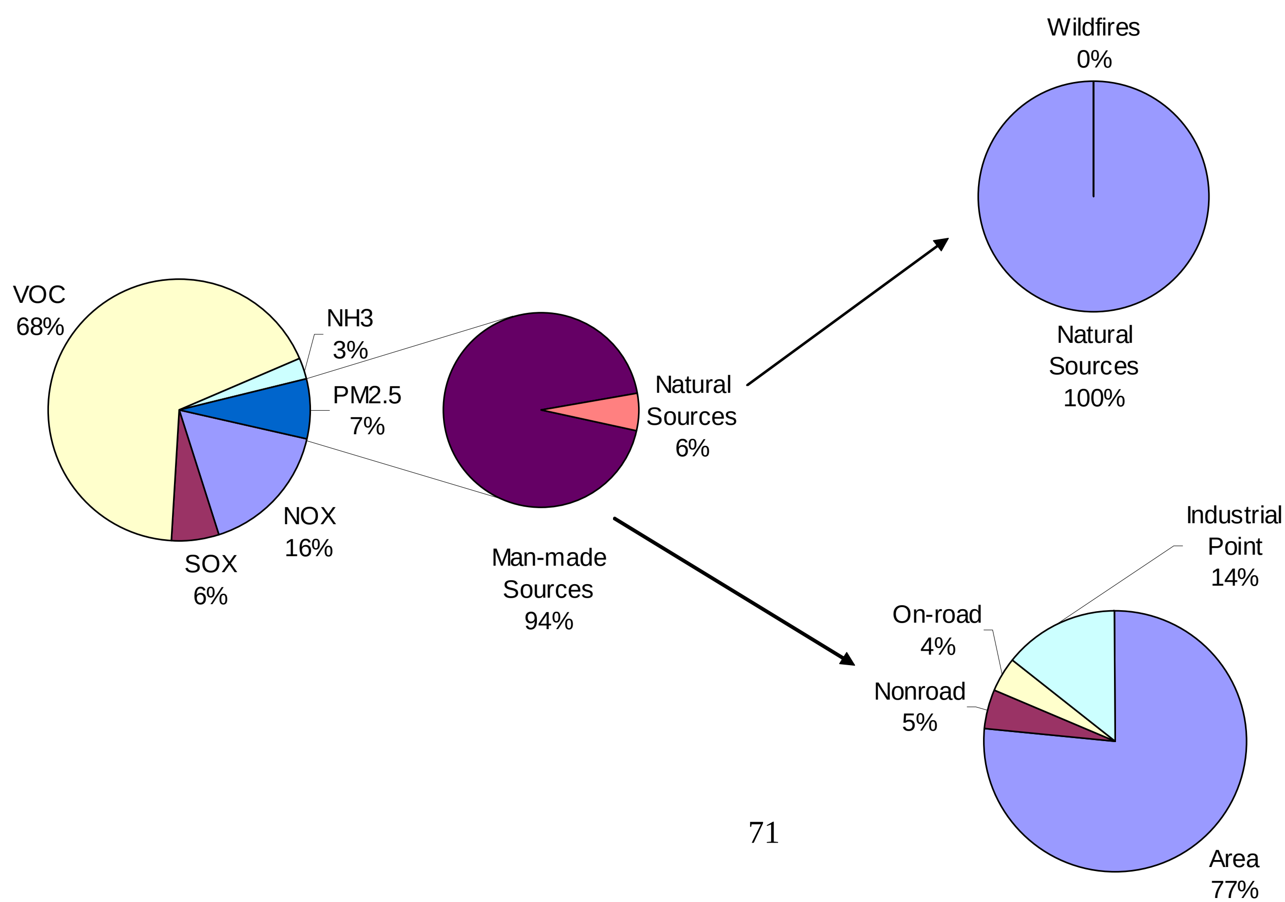


Figure x shows the breakdown of natural vs. man-made PM2.5 sources for the November 12, **2018** episode. PM2.5 emissions are 7% of the pollutant emissions for the whole domain, with man-made sources comprising the majority of that contribution (94%) and natural sources contributing 6%. “Natural sources” are the sole contributor (100%) to the natural source component of PM2.5. For all the man-made sources, area source emissions are 77% of the man-made source contribution and are 72% of the total PM2.5 emissions. Industrial point sources (14%) contribute 13% of the total PM2.5 emissions.

PM2.5 Emissions (Domain) – November 12, 2018



APPENDIX A

In-Gorge Anthropogenic Emissions: NH_3 + SO_X + PM_{25} + VOC + NO_X: Tons Per Day

		-- August 18th --	
Group	Category	2004	2018
Agriculture/Livestock	Fertilizer Application	0.92	0.92
Agriculture/Livestock	Livestock Operations	0.99	0.44
Agriculture/Livestock	Nonroad: Agricultural	1.21	1.43
Agriculture/Livestock	Open Burning: Agricultural	0.11	0.15
Agriculture/Livestock	Orchard Heaters	0.11	0.21
Commercial Marine (Barging-Towboats)	Nonroad: CMV	3.30	2.90
Industrial Point	Industrial Point	0.71	45.01
Nonroad Vehicles & Equipment	Nonroad: Aircraft & Aircraft Refueling	0.04	0.04
Nonroad Vehicles & Equipment	Nonroad: Airport GSE	0.00	0.00
Nonroad Vehicles & Equipment	Nonroad: Commercial	0.27	0.16
Nonroad Vehicles & Equipment	Nonroad: Construction & Mining	0.99	0.87
Nonroad Vehicles & Equipment	Nonroad: Diesel	0.01	--
Nonroad Vehicles & Equipment	Nonroad: Industrial	0.36	0.08
Nonroad Vehicles & Equipment	Nonroad: Lawn & Garden	1.62	0.92
Nonroad Vehicles & Equipment	Nonroad: Logging	0.06	0.01
Nonroad Vehicles & Equipment	Nonroad: Recreational	1.50	0.92
On-Road Mobile	On-Road Mobile	13.70	7.25
Open & Prescribed Burning	Open Burning: Land Clearing	--	0.32
Open & Prescribed Burning	Open Burning: Residential	0.46	0.75
Open & Prescribed Burning	Prescribed Burning	0.06	0.06
Other	Area: Misc. Industrial	0.25	0.36
Other	Commercial Food Preparation	0.07	0.07
Other	Degreasing	0.37	1.21
Other	Drycleaning	0.01	0.05
Other	Fuel Storage & Transport	0.62	0.82
Other	Fugitive Dust	0.43	0.00
Other	Graphic Arts	0.51	0.79
Other	Incineration	0.09	0.00
Other	Misc. Area Sources	0.33	0.41
Other	Misc. Non-Industrial Solvent Utilization	1.63	3.14
Other	Municipal (non-TV) Landfills	0.22	0.32
Other	POTWs	0.06	0.09
Other	Stationary Source Fuel Combustion	0.27	0.41
Other	TSDFs	0.00	0.00
Rail	Nonroad: Rail	12.27	8.93
Recreational Marine	Nonroad: Recreational Marine	1.46	0.40
Residential Wood Combustion	Residential Wood Combustion	0.65	0.68
Surface Coating	Surface Coating	1.57	2.43
Total		**47.2**	**82.6**

In-Gorge Anthropogenic Emissions: NH_3 + SO_X + PM_{25} + VOC + NO_X: Tons Per Day

Group	Category	-- November 12th -- 2004	2018
Agriculture/Livestock	Fertilizer Application	0.33	0.33
Agriculture/Livestock	Livestock Operations	0.62	0.34
Agriculture/Livestock	Nonroad: Agricultural	0.15	1.43
Agriculture/Livestock	Open Burning: Agricultural	0.52	0.65
Agriculture/Livestock	Orchard Heaters	0.35	0.72
Commercial Marine (Barging-Towboats)	Nonroad: CMV	3.30	2.90
Industrial Point	Industrial Point	0.70	42.00
Nonorad Vehicles & Equipment	Nonroad: Aircraft & Aircraft Refueling	0.04	0.04
Nonorad Vehicles & Equipment	Nonroad: Airport GSE	0.00	0.00
Nonorad Vehicles & Equipment	Nonroad: Commercial	0.27	0.16
Nonorad Vehicles & Equipment	Nonroad: Construction & Mining	0.68	0.87
Nonorad Vehicles & Equipment	Nonroad: Diesel	0.01	--
Nonorad Vehicles & Equipment	Nonroad: Industrial	0.25	0.08
Nonorad Vehicles & Equipment	Nonroad: Lawn & Garden	0.33	0.92
Nonorad Vehicles & Equipment	Nonroad: Logging	0.06	0.01
Nonorad Vehicles & Equipment	Nonroad: Recreational	1.92	0.92
On-Road Mobile	On-Road Mobile	15.57	7.88
Other	Area: Misc. Industrial	0.25	0.36
Other	Commercial Food Preparation	0.07	0.07
Other	Degreasing	0.38	1.23
Other	Drycleaning	0.01	0.05
Other	Fuel Storage & Transport	0.62	0.82
Other	Fugitive Dust	0.33	0.00
Other	Graphic Arts	0.51	0.79
Other	Incineration	0.09	0.00
Other	Misc. Area Sources	0.33	0.41
Other	Misc. Non-Industrial Solvent Utilization	1.65	3.18
Other	Municipal (non-TV) Landfills	0.22	0.32
Other	Open Burning: Land Clearing	--	0.36
Other	Open Burning: Residential	0.47	0.76
Other	POTWs	0.06	0.09
Other	Stationary Source Fuel Combustion	0.56	0.73
Other	TSDFs	0.00	0.00
Prescribed Burning	Prescribed Burning	15.91	15.91
Rail	Nonroad: Rail	12.27	8.93
Recreational Marine	Nonroad: Recreational Marine	1.16	0.40
Residential Wood Combustion	Residential Wood Combustion	6.63	6.89
Surface Coating	Surface Coating	1.56	2.43
		68.2	**103.0**

Portland Anthropogenic Emissions: NH_3 + SO_X + PM_{25} + VOC + NO_X: Tons Per Day

		-- August 18th --	
Group	Category	2004	2018
Agriculture/Livestock	Fertilizer Application	1.76	1.76
Agriculture/Livestock	Livestock Operations	13.58	11.67
Agriculture/Livestock	Nonroad: Agricultural	3.28	3.97
Agriculture/Livestock	Open Burning: Agricultural	0.04	0.04
Agriculture/Livestock	Orchard Heaters	0.17	0.19
Commercial Marine Vessels	Nonroad: CMV	4.64	4.49
Degreasing	Degreasing	13.26	54.21
Graphic Arts	Graphic Arts	8.21	35.02
Industrial Point	Industrial Point	20.57	33.22
Misc. Area Sources	Area: Misc. Industrial	12.83	15.49
Misc. Area Sources	Misc. Area Sources	3.87	4.46
Misc. Area Sources	Misc. Non-Industrial Solvent Utilization	20.22	27.70
Nonroad Vehicles & Equipment	Nonroad: Aircraft & Aircraft Refueling	3.21	3.68
Nonroad Vehicles & Equipment	Nonroad: Airport GSE	0.00	0.11
Nonroad Vehicles & Equipment	Nonroad: Commercial	11.45	6.57
Nonroad Vehicles & Equipment	Nonroad: Construction & Mining	35.13	17.92
Nonroad Vehicles & Equipment	Nonroad: Diesel	0.87	--
Nonroad Vehicles & Equipment	Nonroad: Industrial	13.71	2.60
Nonroad Vehicles & Equipment	Nonroad: Logging	0.30	0.34
Nonroad Vehicles & Equipment	Nonroad: Recreational	5.24	3.08
Nonroad: Lawn & Garden	Nonroad: Lawn & Garden	47.54	25.38
On-Road Mobile	On-Road Mobile	171.64	74.97
Other	Commercial Food Preparation	0.41	11.51
Other	Drycleaning	0.21	4.75
Other	Fuel Storage & Transport	3.08	4.66
Other	Fugitive Dust	2.62	0.00
Other	Incineration	1.34	0.48
Other	Municipal (non-TV) Landfills	0.37	0.53
Other	Open Burning: Land Clearing	--	4.96
Other	Open Burning: Residential	1.83	3.76
Other	POTWs	0.89	1.32
Other	Prescribed Burning	0.33	0.33
Other	Residential Wood Combustion	7.21	7.50
Other	TSDFs	0.30	0.43
Rail	Nonroad: Rail	9.02	6.02
Recreational Marine	Nonroad: Recreational Marine	7.27	2.14
Stationary Source Fuel Combustion	Stationary Source Fuel Combustion	13.18	16.33
Surface Coating	Surface Coating	59.81	102.69
Total		**499.4**	**494.3**

Portland Anthropogenic Emissions: NH_3 + SO_X + PM_{25} + VOC + NO_X: Tons Per Day

		-- November 12th --	
Group	Category	2004	2018
Agriculture/Livestock	Fertilizer Application	0.69	0.69
Agriculture/Livestock	Livestock Operations	9.71	8.75
Agriculture/Livestock	Nonroad: Agricultural	0.40	3.97
Agriculture/Livestock	Open Burning: Agricultural	0.56	0.58
Agriculture/Livestock	Orchard Heaters	0.58	0.65
Commercial Marine Vessels	Nonroad: CMV	4.64	4.49
Graphic Arts	Graphic Arts	8.21	35.02
Industrial Point	Industrial Point	22.31	32.84
Misc. Area Sources	Area: Misc. Industrial	12.82	15.49
Misc. Area Sources	Degreasing	13.42	54.85
Misc. Area Sources	Misc. Area Sources	3.87	4.46
Misc. Area Sources	Misc. Non-Industrial Solvent Utilization	20.43	27.95
Nonroad Vehicles & Equipment	Nonroad: Aircraft & Aircraft Refueling	3.21	3.68
Nonroad Vehicles & Equipment	Nonroad: Airport GSE	0.00	0.11
Nonroad Vehicles & Equipment	Nonroad: Commercial	11.50	6.57
Nonroad Vehicles & Equipment	Nonroad: Diesel	0.87	--
Nonroad Vehicles & Equipment	Nonroad: Industrial	9.42	2.60
Nonroad Vehicles & Equipment	Nonroad: Lawn & Garden	11.46	25.38
Nonroad Vehicles & Equipment	Nonroad: Logging	0.31	0.34
Nonroad Vehicles & Equipment	Nonroad: Recreational	1.55	3.08
Nonroad: Construction & Mining	Nonroad: Construction & Mining	23.64	17.92
On-Road Mobile	On-Road Mobile	195.18	83.92
Other	Commercial Food Preparation	0.41	11.51
Other	Drycleaning	0.21	4.75
Other	Fuel Storage & Transport	3.08	4.66
Other	Fugitive Dust	2.46	0.00
Other	Incineration	1.34	0.48
Other	Municipal (non-TV) Landfills	0.37	0.53
Other	Open Burning: Land Clearing	--	5.65
Other	Open Burning: Residential	1.89	3.84
Other	POTWs	0.89	1.32
Other	Prescribed Burning	1.13	1.13
Other	TSDFs	0.30	0.43
Rail	Nonroad: Rail	9.02	6.02
Recreational Marine	Nonroad: Recreational Marine	6.90	2.14
Residential Wood Combustion	Residential Wood Combustion	73.99	76.95
Stationary Source Fuel Combustion	Stationary Source Fuel Combustion	21.58	26.15
Surface Coating	Surface Coating	59.73	102.78
		538.1	**581.7**

Northwest of Gorge Anthropogenic Emissions: NH_3 + SO_X + PM_{25} + VOC + NO_X: Ton

Group	Category	-- August 18th -- 2004	2018
Agriculture/Livestock	Fertilizer Application	0.87	0.87
Agriculture/Livestock	Livestock Operations	3.03	1.34
Agriculture/Livestock	Nonroad: Agricultural	0.64	0.66
Agriculture/Livestock	Open Burning: Agricultural	0.00	0.00
Agriculture/Livestock	Orchard Heaters	0.00	0.00
Commercial Marine Vessels	Nonroad: CMV	18.87	19.66
Industrial Point	Industrial Point	127.91	70.71
Misc. Area Sources	Area: Misc. Industrial	2.12	2.92
Misc. Area Sources	Misc. Area Sources	0.83	0.74
Misc. Area Sources	Misc. Non-Industrial Solvent Utilization	2.00	3.21
Nonroad Vehicles & Equipment	Nonroad: Aircraft & Aircraft Refueling	0.13	0.16
Nonroad Vehicles & Equipment	Nonroad: Airport GSE	0.00	0.00
Nonroad Vehicles & Equipment	Nonroad: Commercial	0.48	0.33
Nonroad Vehicles & Equipment	Nonroad: Construction & Mining	2.15	1.44
Nonroad Vehicles & Equipment	Nonroad: Diesel	0.00	--
Nonroad Vehicles & Equipment	Nonroad: Industrial	1.70	0.30
Nonroad Vehicles & Equipment	Nonroad: Lawn & Garden	2.03	1.42
Nonroad Vehicles & Equipment	Nonroad: Logging	1.69	1.53
Nonroad Vehicles & Equipment	Nonroad: Recreational	3.65	1.90
On-Road Mobile	On-Road Mobile	31.44	15.85
Other	Commercial Food Preparation	0.17	0.28
Other	Degreasing	0.74	1.93
Other	Drycleaning	0.04	0.10
Other	Fuel Storage & Transport	2.08	4.55
Other	Fugitive Dust	0.32	0.00
Other	Graphic Arts	0.35	0.71
Other	Incineration	0.46	0.01
Other	Municipal (non-TV) Landfills	0.00	0.00
Other	Open Burning: Land Clearing	--	1.37
Other	Open Burning: Residential	0.94	1.71
Other	POTWs	0.24	0.35
Other	Prescribed Burning	0.55	0.55
Other	Residential Wood Combustion	1.80	1.87
Other	Stationary Source Fuel Combustion	1.06	1.34
Other	TSDFs	0.00	0.00
Rail	Nonroad: Rail	2.63	2.86
Recreational Marine	Nonroad: Recreational Marine	4.04	3.01
Surface Coating	Surface Coating	4.59	6.31
Total		**219.6**	**150.0**

Northwest of Gorge Anthropogenic Emissions: NH_3 + SO_X + PM_{25} + VOC + NO_X: Ton

		-- November 12th --	
Group	Category	2004	2018
Commercial Marine Vessels	Nonroad: CMV	18.87	19.66
Fuel Storage, Transport, & Dispensing	Fuel Storage & Transport	2.08	4.55
Industrial Point	Industrial Point	121.84	69.74
Misc. Area Sources	Area: Misc. Industrial	2.12	2.92
Misc. Area Sources	Misc. Area Sources	0.83	0.74
Misc. Area Sources	Misc. Non-Industrial Solvent Utilization	2.02	3.23
Nonroad Vehicles & Equipment	Nonroad: Aircraft & Aircraft Refueling	0.13	0.16
Nonroad Vehicles & Equipment	Nonroad: Airport GSE	0.00	0.00
Nonroad Vehicles & Equipment	Nonroad: Commercial	0.49	0.33
Nonroad Vehicles & Equipment	Nonroad: Construction & Mining	1.47	1.44
Nonroad Vehicles & Equipment	Nonroad: Diesel	0.00	--
Nonroad Vehicles & Equipment	Nonroad: Industrial	1.17	0.30
Nonroad Vehicles & Equipment	Nonroad: Lawn & Garden	0.38	1.42
Nonroad Vehicles & Equipment	Nonroad: Logging	1.73	1.53
Nonroad Vehicles & Equipment	Nonroad: Recreational	1.04	1.90
On-Road Mobile	On-Road Mobile	34.15	17.10
Open Burning: Land Clearing	Open Burning: Land Clearing	--	1.57
Open Burning: Residential	Open Burning: Residential	0.96	1.73
Other	Commercial Food Preparation	0.17	0.28
Other	Degreasing	0.75	1.95
Other	Drycleaning	0.04	0.10
Other	Fertilizer Application	0.15	0.15
Other	Fugitive Dust	0.28	0.00
Other	Graphic Arts	0.35	0.71
Other	Incineration	0.46	0.01
Other	Livestock Operations	2.05	1.20
Other	Municipal (non-TV) Landfills	0.00	0.00
Other	Nonroad: Agricultural	0.08	0.66
Other	Open Burning: Agricultural	0.00	0.00
Other	Orchard Heaters	0.00	0.00
Other	POTWs	0.24	0.35
Other	Stationary Source Fuel Combustion	1.63	1.97
Other	TSDFs	0.00	0.00
Prescribed Burning	Prescribed Burning	7.24	7.24
Rail	Nonroad: Rail	2.63	2.86
Recreational Marine	Nonroad: Recreational Marine	3.04	3.01
Residential Wood Combustion	Residential Wood Combustion	17.85	18.56
Surface Coating	Surface Coating	4.61	6.30
		230.9	**173.7**

West of Gorge Anthropogenic Emissions: NH_3 + SO_X + PM_{25} + VOC + NO_X: Tons Per

		-- August 18th --	
Group	Category	2004	2018
Agriculture	Fertilizer Application	7.88	7.88
Agriculture	Nonroad: Agricultural	16.15	18.77
Agriculture	Open Burning: Agricultural	0.13	0.15
Agriculture	Orchard Heaters	0.46	0.47
Commercial Marine Vessels	Nonroad: CMV	0.41	48.80
Fuel Storage, Transport, & Dispensing	Fuel Storage & Transport	27.09	78.44
Industrial Point	Industrial Point	129.76	267.78
Livestock Operations	Livestock Operations	49.30	35.86
Misc. Area Sources	Area: Misc. Industrial	23.07	35.17
Misc. Area Sources	Degreasing	16.67	63.03
Misc. Area Sources	Graphic Arts	14.37	32.53
Misc. Area Sources	Misc. Area Sources	16.23	13.00
Misc. Area Sources	Misc. Non-Industrial Solvent Utilization	52.60	46.67
Nonroad Vehicles & Equipment	Nonroad: Aircraft & Aircraft Refueling	0.72	7.98
Nonroad Vehicles & Equipment	Nonroad: Airport GSE	0.68	0.34
Nonroad Vehicles & Equipment	Nonroad: Commercial	22.48	14.25
Nonroad Vehicles & Equipment	Nonroad: Construction & Mining	86.03	38.72
Nonroad Vehicles & Equipment	Nonroad: Diesel	0.02	--
Nonroad Vehicles & Equipment	Nonroad: Industrial	38.43	6.61
Nonroad Vehicles & Equipment	Nonroad: Logging	6.79	6.47
Nonroad Vehicles & Equipment	Nonroad: Recreational	18.68	12.99
Nonroad: Lawn & Garden	Nonroad: Lawn & Garden	88.60	51.21
On-Road Mobile	On-Road Mobile	708.94	282.64
Other	Commercial Food Preparation	7.77	10.49
Other	Drycleaning	7.61	11.31
Other	Fugitive Dust	5.27	0.00
Other	Incineration	11.20	0.20
Other	Municipal (non-TV) Landfills	1.32	1.86
Other	Open Burning: Land Clearing	0.09	28.50
Other	Open Burning: Residential	7.79	38.14
Other	Placeholder	0.22	--
Other	POTWs	7.54	11.20
Other	Prescribed Burning	4.35	4.78
Other	Residential Wood Combustion	37.30	38.79
Other	TSDFs	0.14	0.21
Rail	Nonroad: Rail	28.19	18.51
Recreational Marine	Nonroad: Recreational Marine	21.58	27.71
Stationary Source Fuel Combustion	Stationary Source Fuel Combustion	21.03	43.94
Surface Coating	Surface Coating	89.78	146.69
Total		**1,576.7**	**1,452.1**

West of Gorge Anthropogenic Emissions: NH_3 + SO_X + PM_{25} + VOC + NO_X: Tons Per

		-- November 12th --	
Group	Category	2004	2018
Agriculture	Fertilizer Application	1.95	1.95
Agriculture	Nonroad: Agricultural	2.52	18.77
Agriculture	Open Burning: Agricultural	12.13	12.17
Agriculture	Orchard Heaters	1.55	1.57
Commercial Marine Vessels	Nonroad: CMV	0.41	48.80
Degreasing	Degreasing	16.87	63.78
Fuel Storage, Transport, & Dispensing	Fuel Storage & Transport	27.09	78.44
Graphic Arts	Graphic Arts	14.37	32.53
Industrial Point	Industrial Point	127.37	259.81
Livestock Operations	Livestock Operations	38.65	31.88
Misc. Area Sources	Area: Misc. Industrial	23.07	35.17
Misc. Area Sources	Misc. Area Sources	16.23	13.00
Misc. Area Sources	Misc. Non-Industrial Solvent Utilization	53.15	47.04
Nonroad Vehicles & Equipment	Nonroad: Aircraft & Aircraft Refueling	0.71	7.98
Nonroad Vehicles & Equipment	Nonroad: Airport GSE	0.69	0.34
Nonroad Vehicles & Equipment	Nonroad: Commercial	23.53	14.25
Nonroad Vehicles & Equipment	Nonroad: Construction & Mining	58.96	38.72
Nonroad Vehicles & Equipment	Nonroad: Diesel	0.02	--
Nonroad Vehicles & Equipment	Nonroad: Industrial	26.57	6.61
Nonroad Vehicles & Equipment	Nonroad: Logging	6.93	6.47
Nonroad Vehicles & Equipment	Nonroad: Recreational	9.82	12.99
Nonroad: Lawn & Garden	Nonroad: Lawn & Garden	30.64	51.21
On-Road Mobile	On-Road Mobile	746.65	298.57
Open Burning: Residential & Land Clearing	Open Burning: Land Clearing	0.10	32.48
Open Burning: Residential & Land Clearing	Open Burning: Residential	8.13	38.35
Other	Commercial Food Preparation	7.77	10.49
Other	Drycleaning	7.61	11.31
Other	Fugitive Dust	4.85	0.00
Other	Incineration	11.20	0.20
Other	Municipal (non-TV) Landfills	1.32	1.86
Other	Placeholder	0.22	--
Other	POTWs	7.54	11.20
Other	TSDFs	0.14	0.21
Prescribed Burning	Prescribed Burning	71.01	72.49
Rail	Nonroad: Rail	28.19	18.51
Recreational Marine	Nonroad: Recreational Marine	10.57	27.71
Residential Wood Combustion	Residential Wood Combustion	366.00	380.64
Stationary Source Fuel Combustion	Stationary Source Fuel Combustion	47.98	70.60
Surface Coating	Surface Coating	89.84	146.72
		1,902.3	**1,904.8**

East of Gorge Anthropogenic Emissions: NH_3 + SO_X + PM_{25} + VOC + NO_X: Tons Per Day

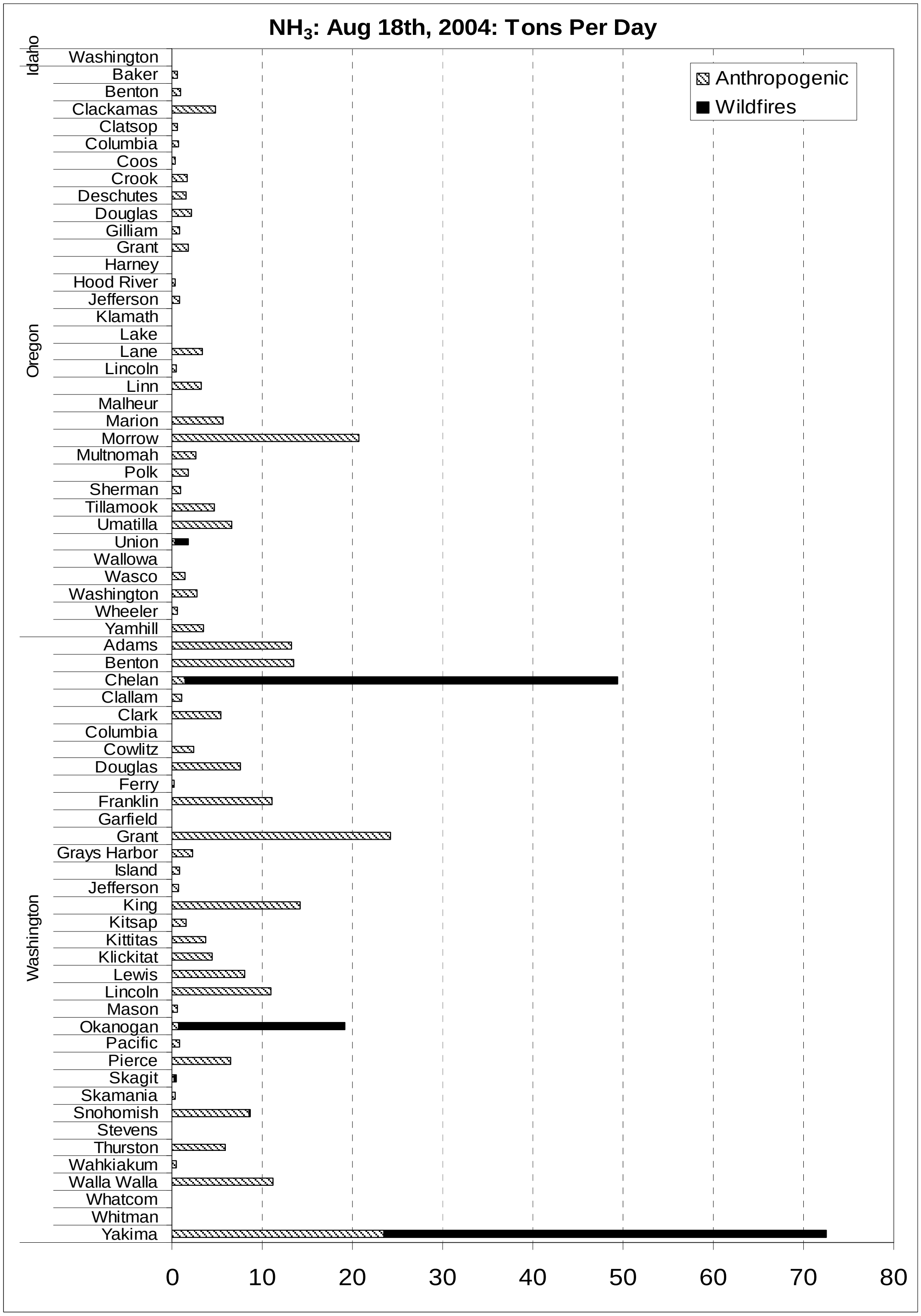
		-- August 18th --	
Group	Category	2004	2018
Agriculture	Fertilizer Application	79.52	79.52
Agriculture	Nonroad: Agricultural	79.49	71.15
Agriculture	Open Burning: Agricultural	62.36	62.35
Agriculture	Orchard Heaters	0.20	0.10
Degreasing	Degreasing	3.86	18.74
Fuel Storage, Transport, & Dispensing	Fuel Storage & Transport	14.46	23.90
Fugitive Dust	Fugitive Dust	54.12	0.00
Industrial Point	Industrial Point	112.44	121.04
Livestock Operations	Livestock Operations	82.85	47.60
Misc. Area Sources	Area: Misc. Industrial	10.10	14.59
Misc. Area Sources	Graphic Arts	2.60	3.44
Misc. Area Sources	Misc. Area Sources	7.92	7.37
Misc. Area Sources	Misc. Non-Industrial Solvent Utilization	21.83	54.26
Nonroad Vehicles & Equip (includes marine)	Nonroad: Aircraft & Aircraft Refueling	0.75	0.82
Nonroad Vehicles & Equip (includes marine)	Nonroad: Airport GSE	0.02	0.01
Nonroad Vehicles & Equip (includes marine)	Nonroad: CMV	4.93	4.85
Nonroad Vehicles & Equip (includes marine)	Nonroad: Commercial	3.82	2.63
Nonroad Vehicles & Equip (includes marine)	Nonroad: Construction & Mining	18.91	10.37
Nonroad Vehicles & Equip (includes marine)	Nonroad: Diesel	0.00	--
Nonroad Vehicles & Equip (includes marine)	Nonroad: Industrial	5.67	1.08
Nonroad Vehicles & Equip (includes marine)	Nonroad: Lawn & Garden	10.66	6.84
Nonroad Vehicles & Equip (includes marine)	Nonroad: Logging	1.54	0.39
Nonroad Vehicles & Equip (includes marine)	Nonroad: Recreational	16.42	7.61
Nonroad Vehicles & Equip (includes marine)	Nonroad: Recreational Marine	9.90	6.55
On-Road Mobile	On-Road Mobile	220.39	92.70
Other	Commercial Food Preparation	1.10	1.56
Other	Drycleaning	0.93	1.54
Other	Incineration	1.51	0.37
Other	Municipal (non-TV) Landfills	7.80	11.19
Other	Open Burning: Land Clearing	0.21	4.73
Other	Open Burning: Residential	3.83	6.66
Other	Placeholder	0.01	--
Other	POTWs	1.49	2.21
Other	Prescribed Burning	2.41	2.41
Other	Residential Wood Combustion	9.15	9.52
Other	Stationary Source Fuel Combustion	4.95	5.99
Other	TSDFs	0.00	0.00
Rail	Nonroad: Rail	59.36	44.54
Surface Coating	Surface Coating	19.08	25.64
Total		**936.6**	**754.3**

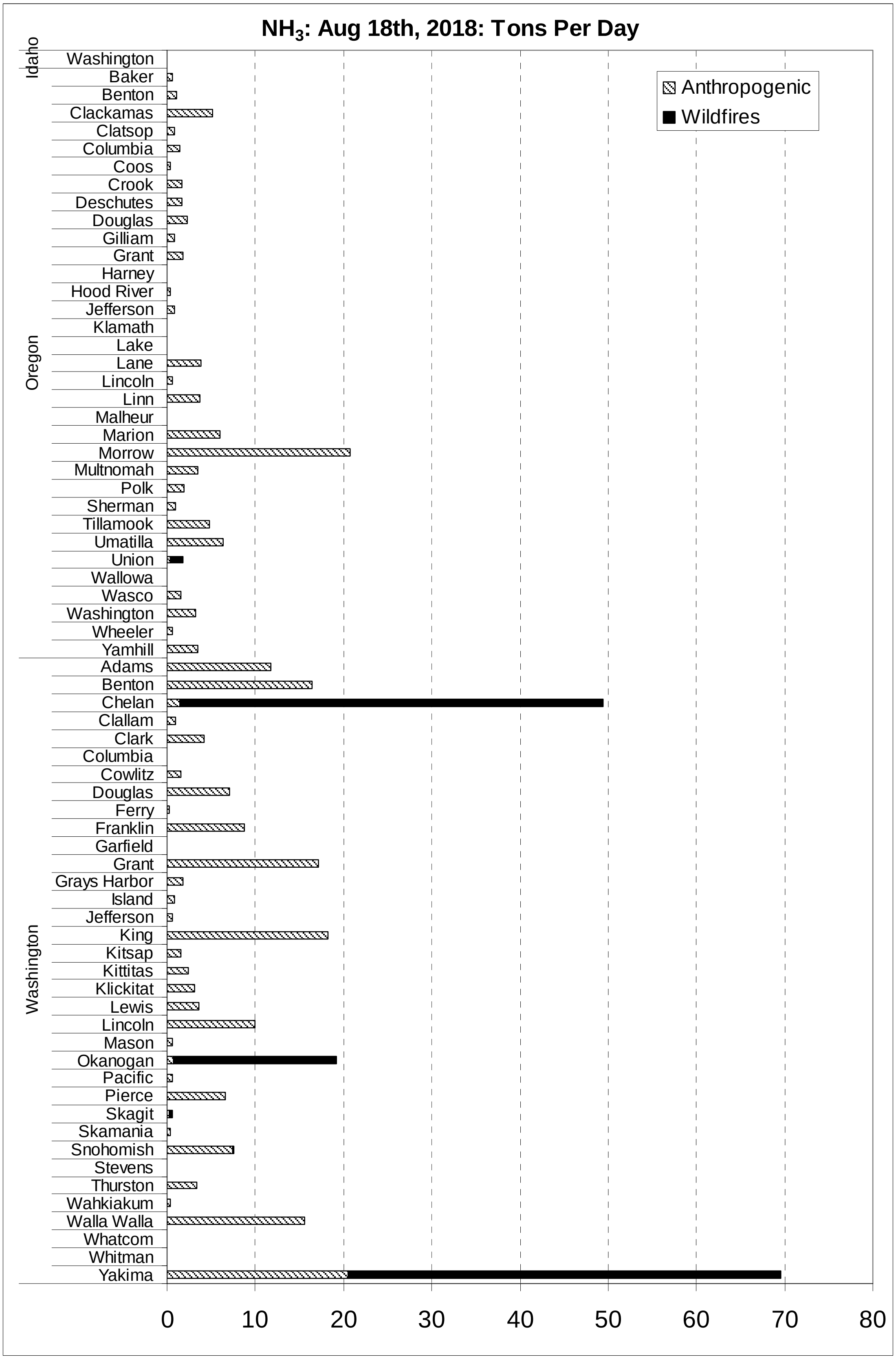
East of Gorge Anthropogenic Emissions: NH_3 + SO_X + PM_{25} + VOC + NO_X: Tons Per Day

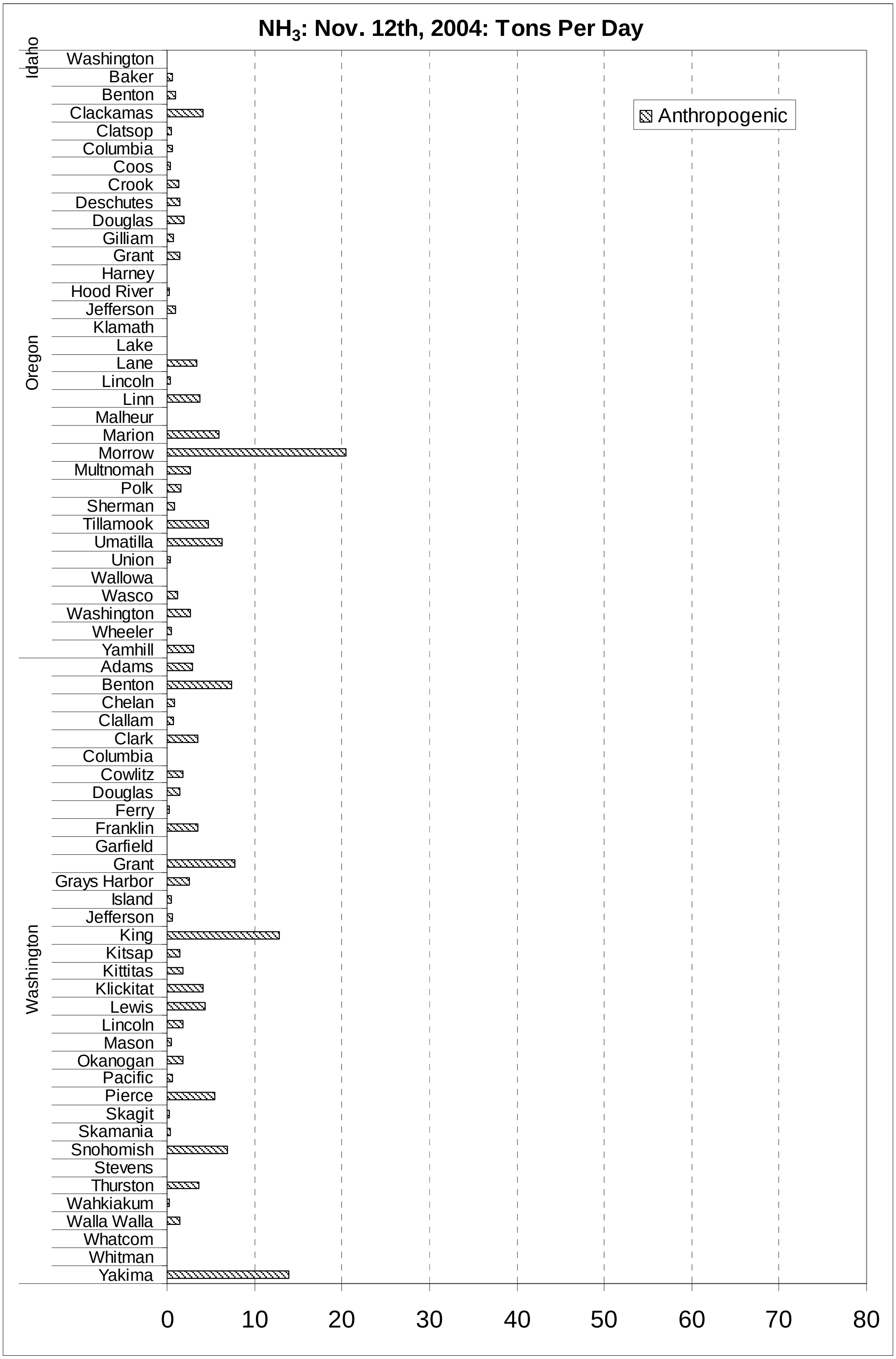
		-- November 12th --	
Group	Category	2004	2018
Agriculture	Fertilizer Application	13.78	13.78
Agriculture	Nonroad: Agricultural	14.33	71.15
Agriculture	Open Burning: Agricultural	6.71	6.67
Agriculture	Orchard Heaters	0.67	0.34
Degreasing	Degreasing	3.90	18.96
Fuel Storage, Transport, & Dispensing	Fuel Storage & Transport	14.46	23.90
Fugitive Dust	Fugitive Dust	33.24	0.00
Industrial Point	Industrial Point	117.01	120.90
Livestock Operations	Livestock Operations	63.02	45.35
Misc. Area Sources	Area: Misc. Industrial	10.10	14.59
Misc. Area Sources	Graphic Arts	2.60	3.44
Misc. Area Sources	Misc. Area Sources	7.92	7.37
Misc. Area Sources	Misc. Non-Industrial Solvent Utilization	22.07	54.79
Nonroad Vehicles & Equipment (incl. Marine)	Nonroad: Aircraft & Aircraft Refueling	0.74	0.82
Nonroad Vehicles & Equipment (incl. Marine)	Nonroad: Airport GSE	0.02	0.01
Nonroad Vehicles & Equipment (incl. Marine)	Nonroad: CMV	4.93	4.85
Nonroad Vehicles & Equipment (incl. Marine)	Nonroad: Commercial	3.99	2.63
Nonroad Vehicles & Equipment (incl. Marine)	Nonroad: Construction & Mining	12.70	10.37
Nonroad Vehicles & Equipment (incl. Marine)	Nonroad: Diesel	0.00	--
Nonroad Vehicles & Equipment (incl. Marine)	Nonroad: Industrial	3.97	1.08
Nonroad Vehicles & Equipment (incl. Marine)	Nonroad: Lawn & Garden	3.66	6.84
Nonroad Vehicles & Equipment (incl. Marine)	Nonroad: Logging	1.57	0.39
Nonroad Vehicles & Equipment (incl. Marine)	Nonroad: Recreational	15.18	7.61
Nonroad Vehicles & Equipment (incl. Marine)	Nonroad: Recreational Marine	4.03	6.55
On-Road Mobile	On-Road Mobile	229.61	96.60
Other	Commercial Food Preparation	1.10	1.56
Other	Drycleaning	0.93	1.54
Other	Incineration	1.51	0.37
Other	Municipal (non-TV) Landfills	7.80	11.19
Other	Open Burning: Land Clearing	0.23	5.39
Other	Open Burning: Residential	3.90	6.75
Other	Placeholder	0.01	--
Other	POTWs	1.49	2.21
Other	Residential Wood Combustion	90.48	94.20
Other	Stationary Source Fuel Combustion	9.83	9.76
Other	TSDFs	0.00	0.00
Prescribed Burning	Prescribed Burning	174.24	174.24
Rail	Nonroad: Rail	59.37	44.54
Surface Coating	Surface Coating	19.06	25.63
		960.2	**896.4**

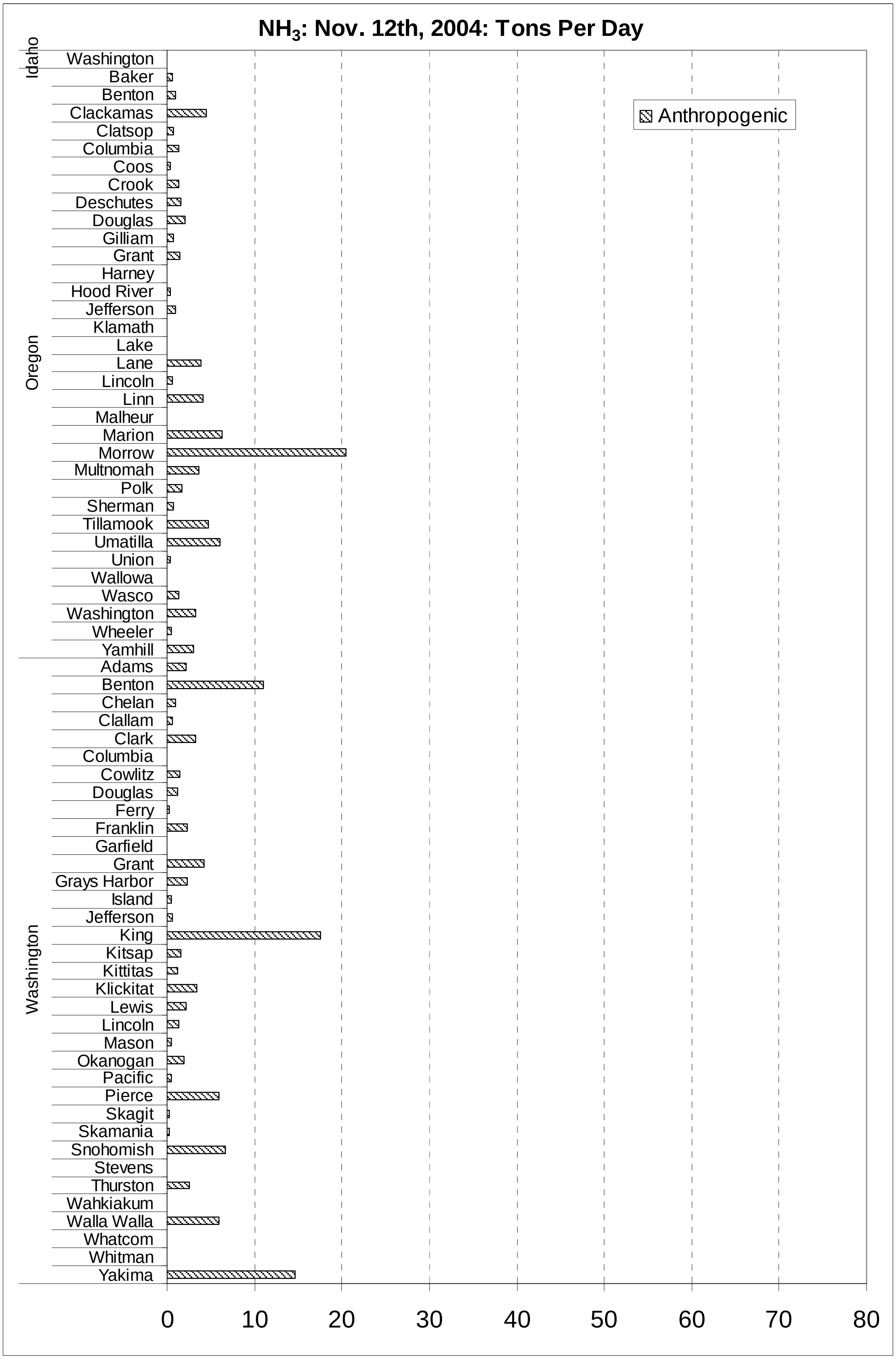
APPENDIX B

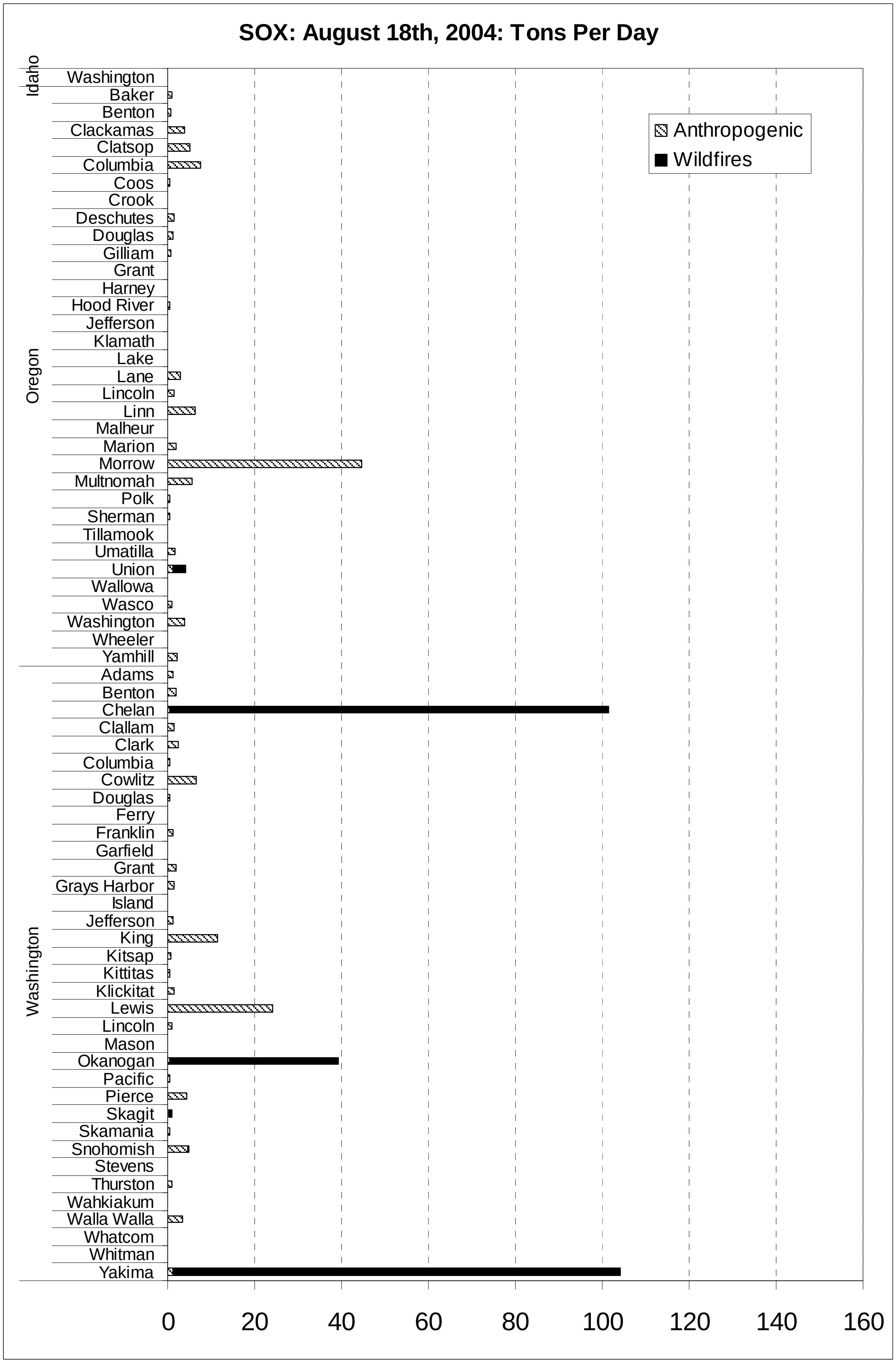
County Charts of Emissions




NH3: Aug 18th, 2018: Tons Per Day
Anthropogenic
Wildfires
Idaho
Oregon
Washington
Washington
Baker
Benton
Clackamas
Clatsop
Columbia
Coos
Crook
Deschutes
Douglas
Gilliam
Grant
Harney
Hood River
Jefferson
Klamath
Lake
Lane
Lincoln
Linn
Malheur
Marion
Morrow
Multnomah
Polk
Sherman
Tillamook
Umatilla
Union
Wallowa
Wasco
Washington
Wheeler
Yamhill
Adams
Benton
Chelan
Clallam
Clark
Columbia
Cowlitz
Douglas
Ferry
Franklin
Garfield
Grant
Grays Harbor
Island
Jefferson
King
Kitsap
Kittitas
Klickitat
Lewis
Lincoln
Mason
Okanogan
Pacific
Pierce
Skagit
Skamania
Snohomish
Stevens
Thurston
Wahkiakum
Walla Walla
Whatcom
Whitman
Yakima
0
10
20
30
40
50
60
70
80


NH3: Nov. 12th, 2004: Tons Per Day
Anthropogenic
Idaho
Washington
Oregon
Baker
Benton
Clackamas
Clatsop
Columbia
Coos
Crook
Deschutes
Douglas
Gilliam
Grant
Harney
Hood River
Jefferson
Klamath
Lake
Lane
Lincoln
Linn
Malheur
Marion
Morrow
Multnomah
Polk
Sherman
Tillamook
Umatilla
Union
Wallowa
Wasco
Washington
Wheeler
Yamhill
Washington
Adams
Benton
Chelan
Clallam
Clark
Columbia
Cowlitz
Douglas
Ferry
Franklin
Garfield
Grant
Grays Harbor
Island
Jefferson
King
Kitsap
Kittitas
Klickitat
Lewis
Lincoln
Mason
Okanogan
Pacific
Pierce
Skagit
Skamania
Snohomish
Stevens
Thurston
Wahkiakum
Walla Walla
Whatcom
Whitman
Yakima
0
10
20
30
40
50
60
70
80


NH3: Nov. 12th, 2004: Tons Per Day
Anthropogenic
Idaho
Washington
Oregon
Baker
Benton
Clackamas
Clatsop
Columbia
Coos
Crook
Deschutes
Douglas
Gilliam
Grant
Harney
Hood River
Jefferson
Klamath
Lake
Lane
Lincoln
Linn
Malheur
Marion
Morrow
Multnomah
Polk
Sherman
Tillamook
Umatilla
Union
Wallowa
Wasco
Washington
Wheeler
Yamhill
Washington
Adams
Benton
Chelan
Clallam
Clark
Columbia
Cowlitz
Douglas
Ferry
Franklin
Garfield
Grant
Grays Harbor
Island
Jefferson
King
Kitsap
Kittitas
Klickitat
Lewis
Lincoln
Mason
Okanogan
Pacific
Pierce
Skagit
Skamania
Snohomish
Stevens
Thurston
Wahkiakum
Walla Walla
Whatcom
Whitman
Yakima
0
10
20
30
40
50
60
70
80


SOX: August 18th, 2004: Tons Per Day
Anthropogenic
Wildfires
Idaho
Washington
Oregon
Baker
Benton
Clackamas
Clatsop
Columbia
Coos
Crook
Deschutes
Douglas
Gilliam
Grant
Harney
Hood River
Jefferson
Klamath
Lake
Lane
Lincoln
Linn
Malheur
Marion
Morrow
Multnomah
Polk
Sherman
Tillamook
Umatilla
Union
Wallowa
Wasco
Washington
Wheeler
Yamhill
Washington
Adams
Benton
Chelan
Clallam
Clark
Columbia
Cowlitz
Douglas
Ferry
Franklin
Garfield
Grant
Grays Harbor
Island
Jefferson
King
Kitsap
Kittitas
Klickitat
Lewis
Lincoln
Mason
Okanogan
Pacific
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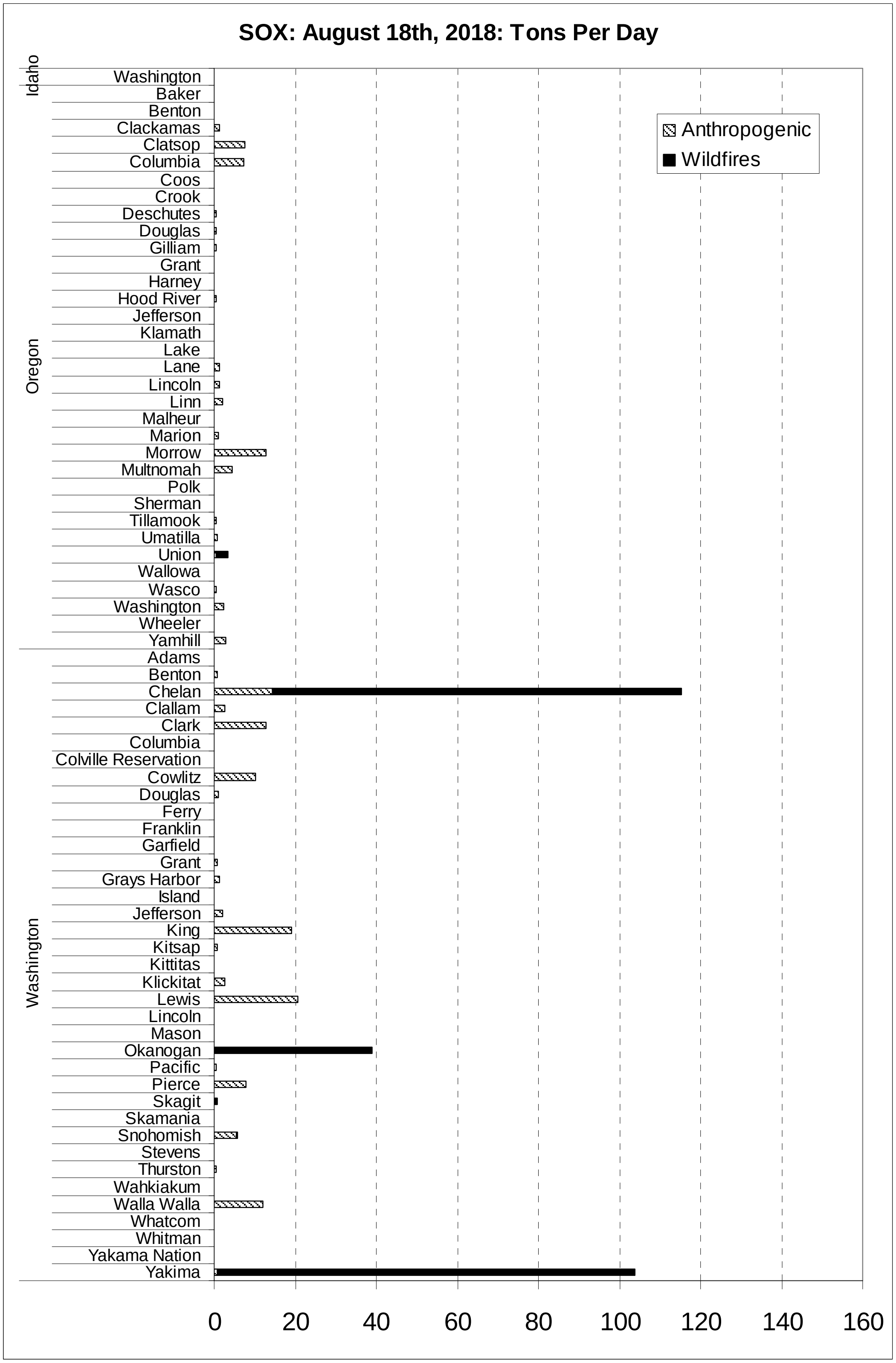
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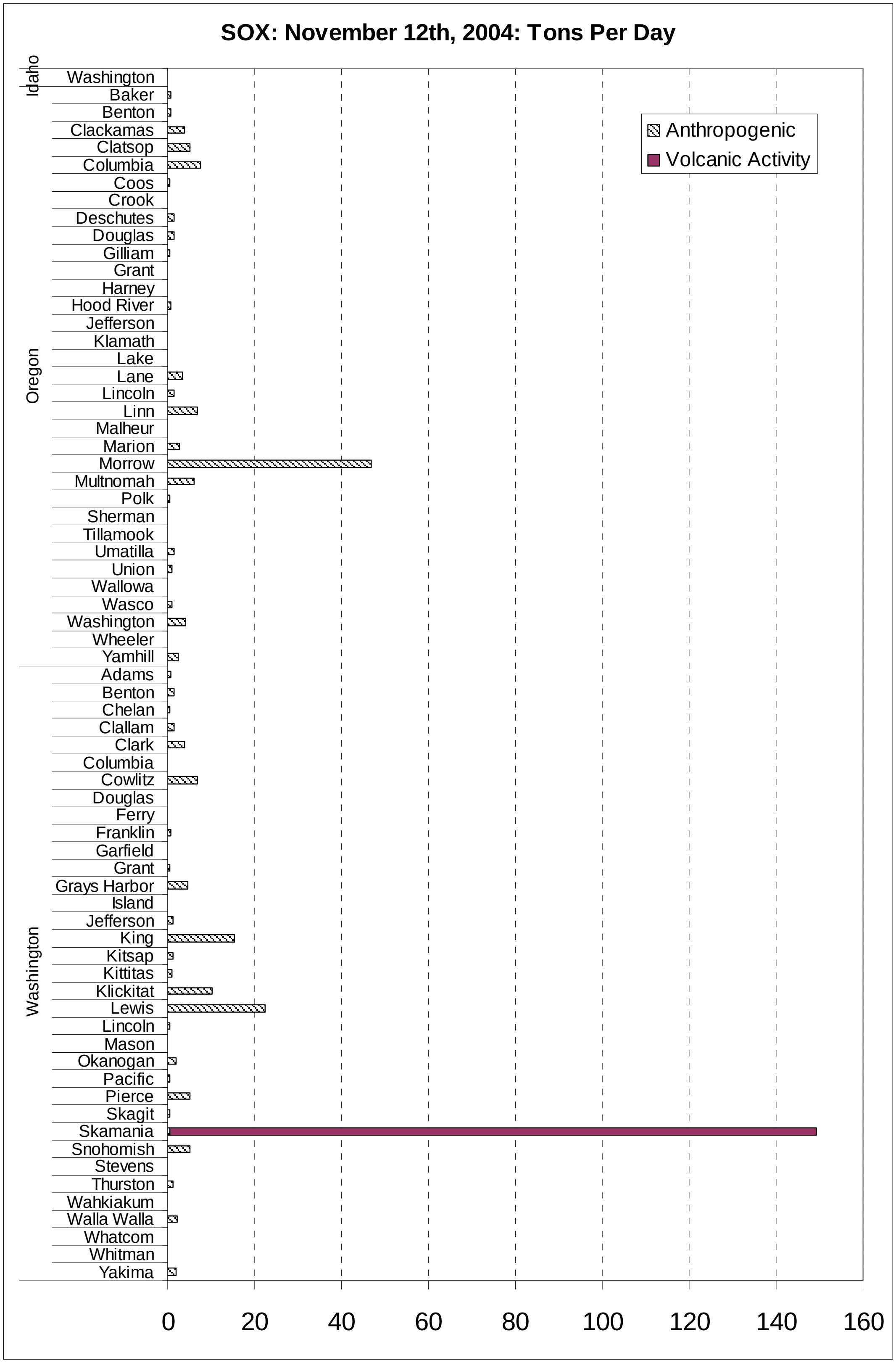
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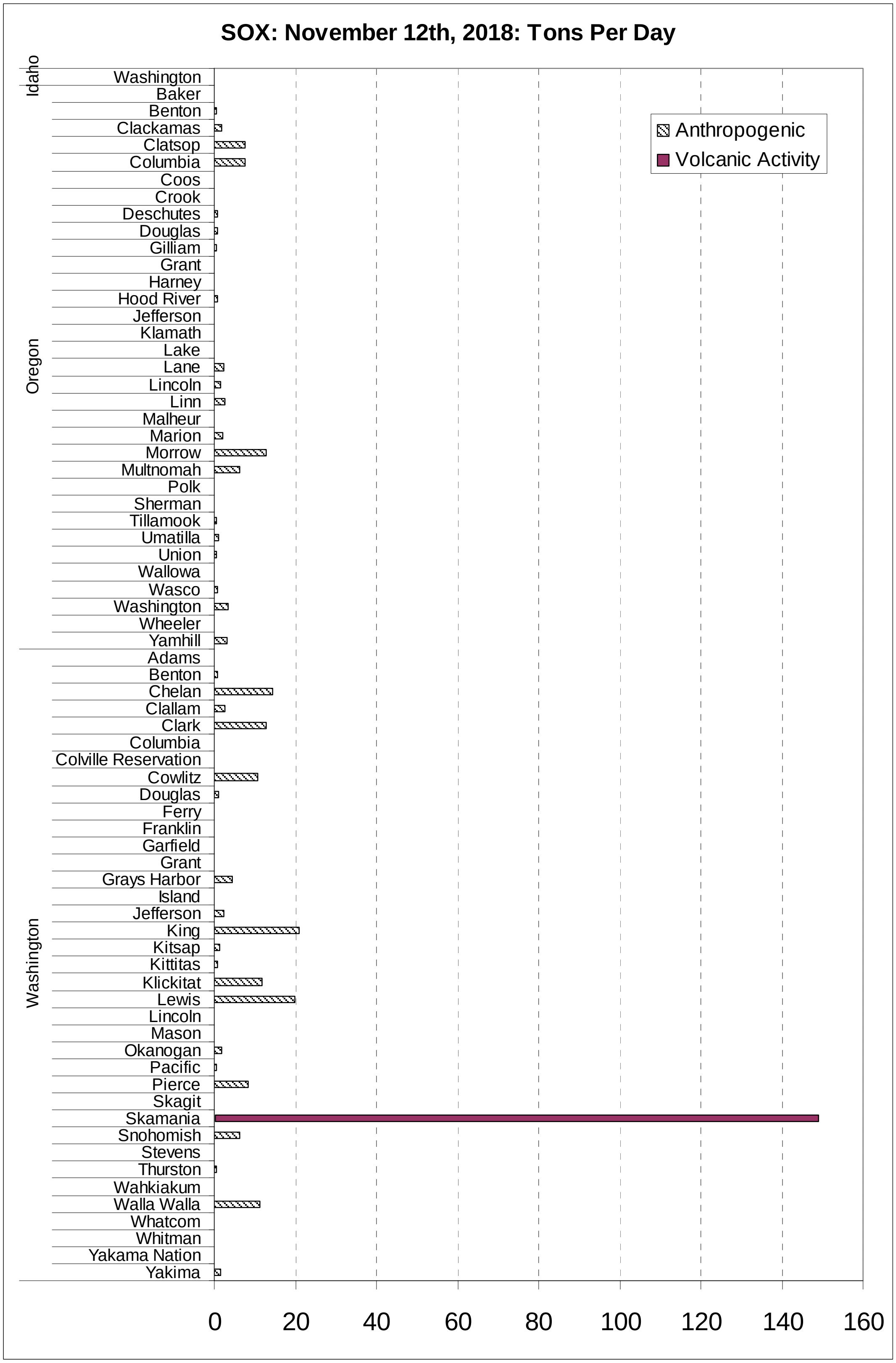
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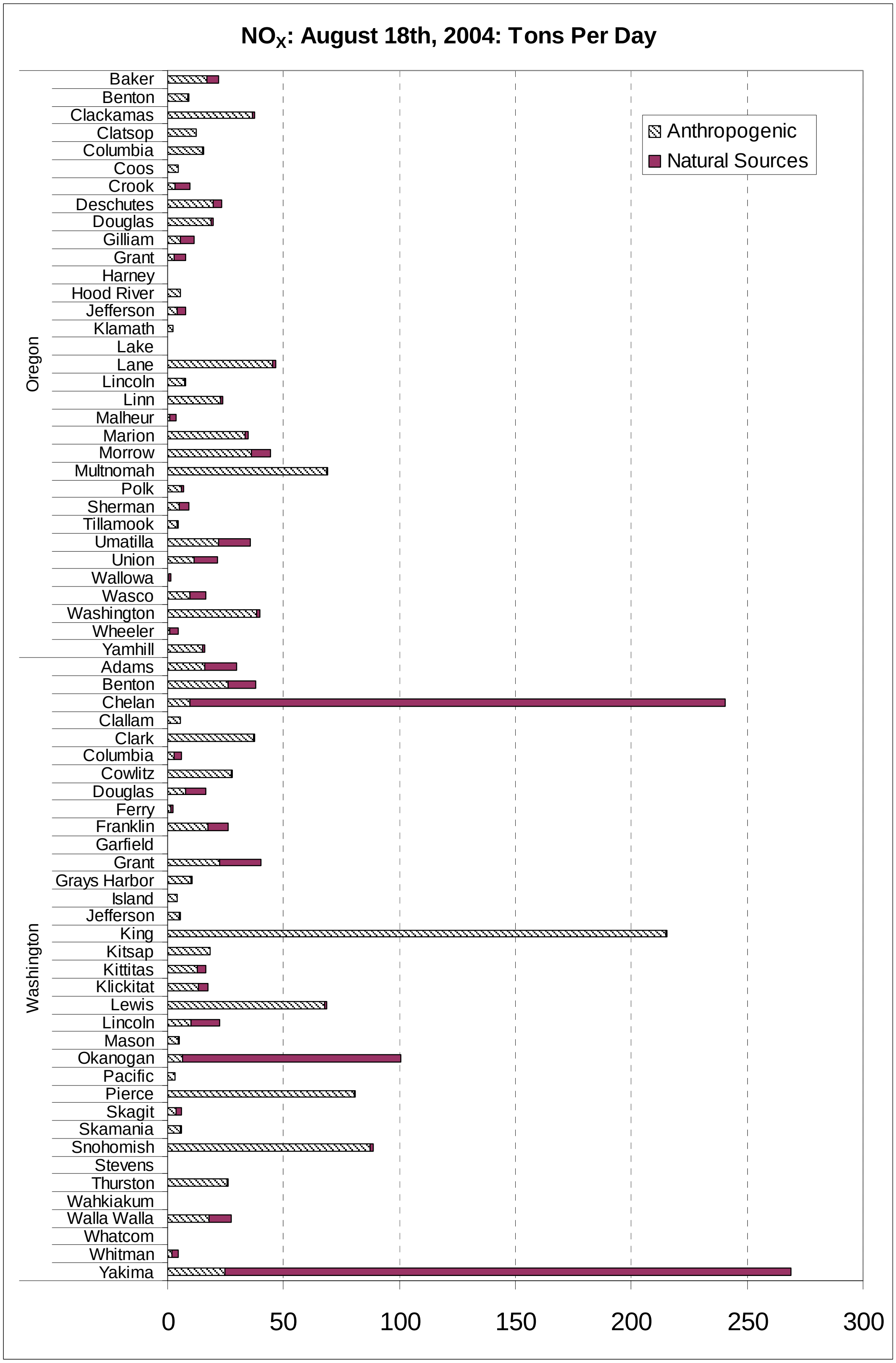
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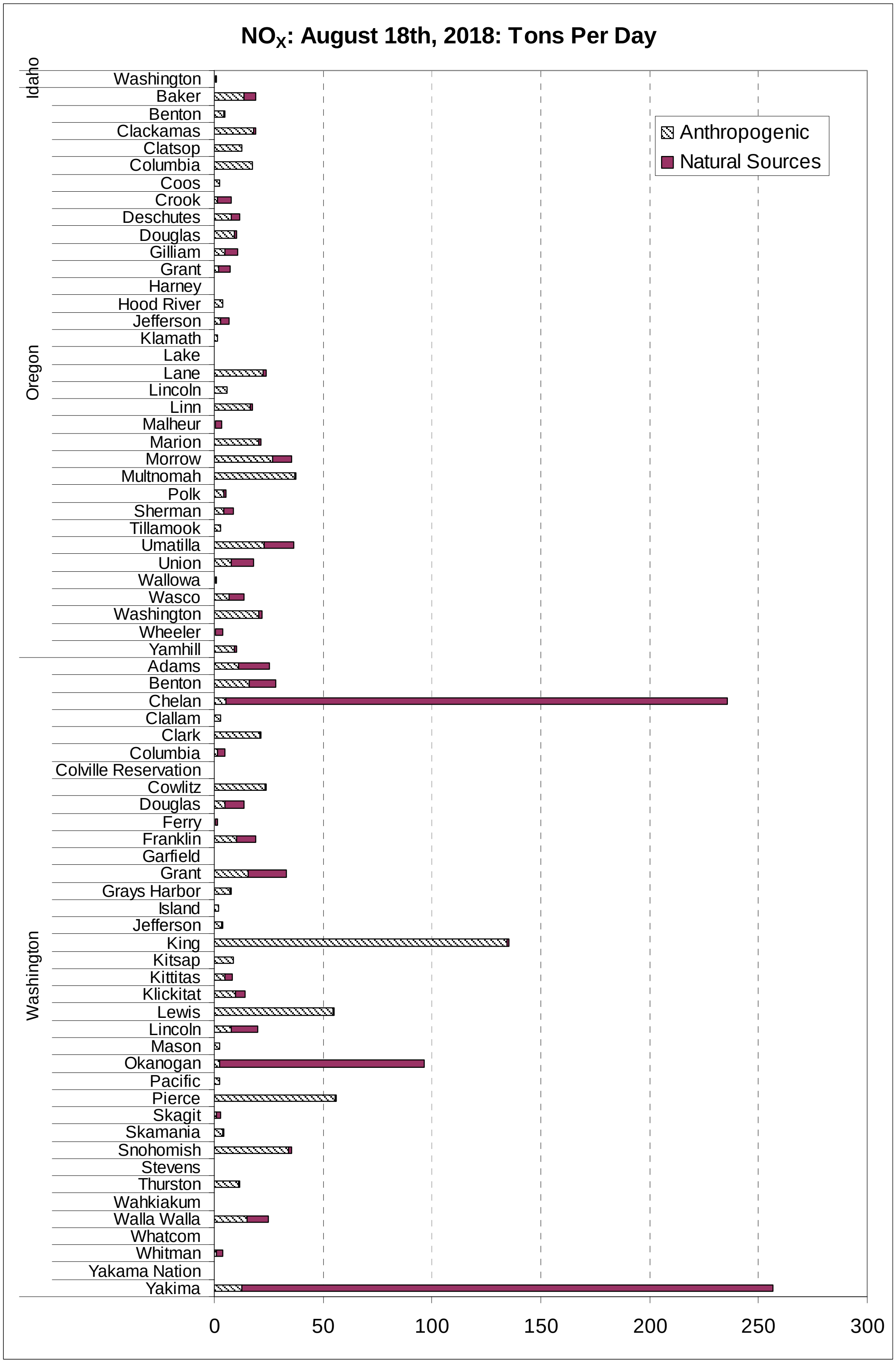
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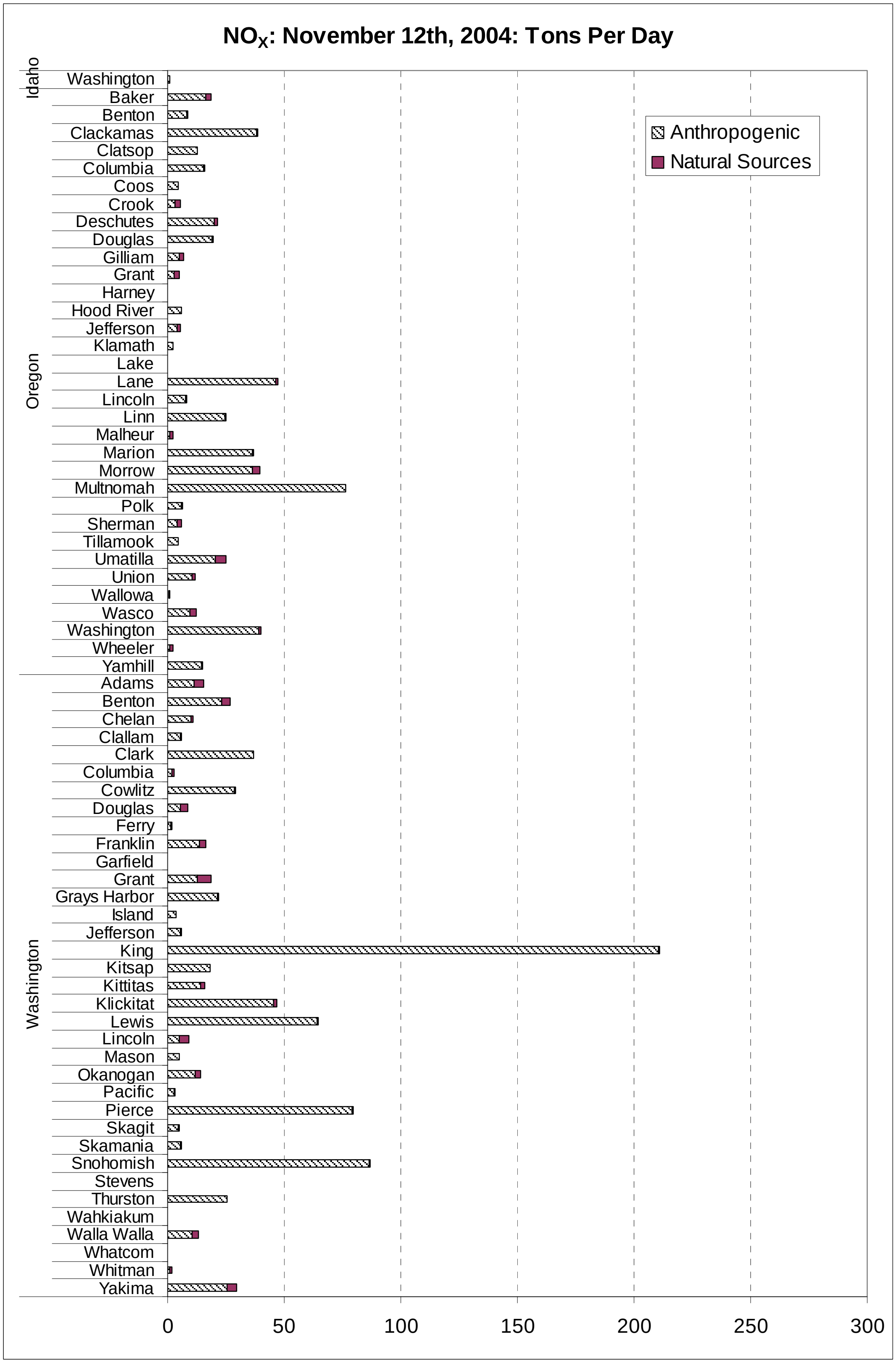
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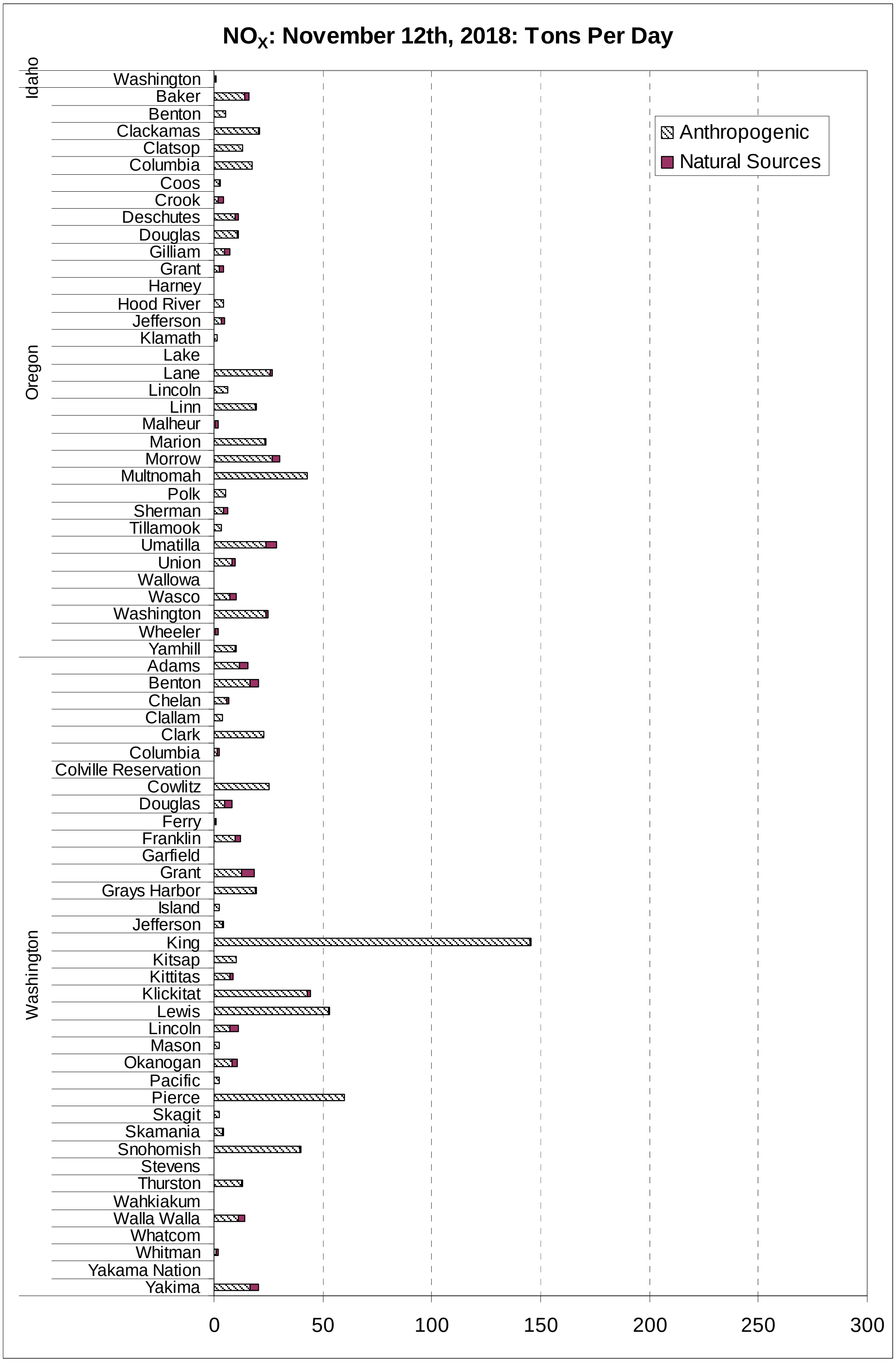
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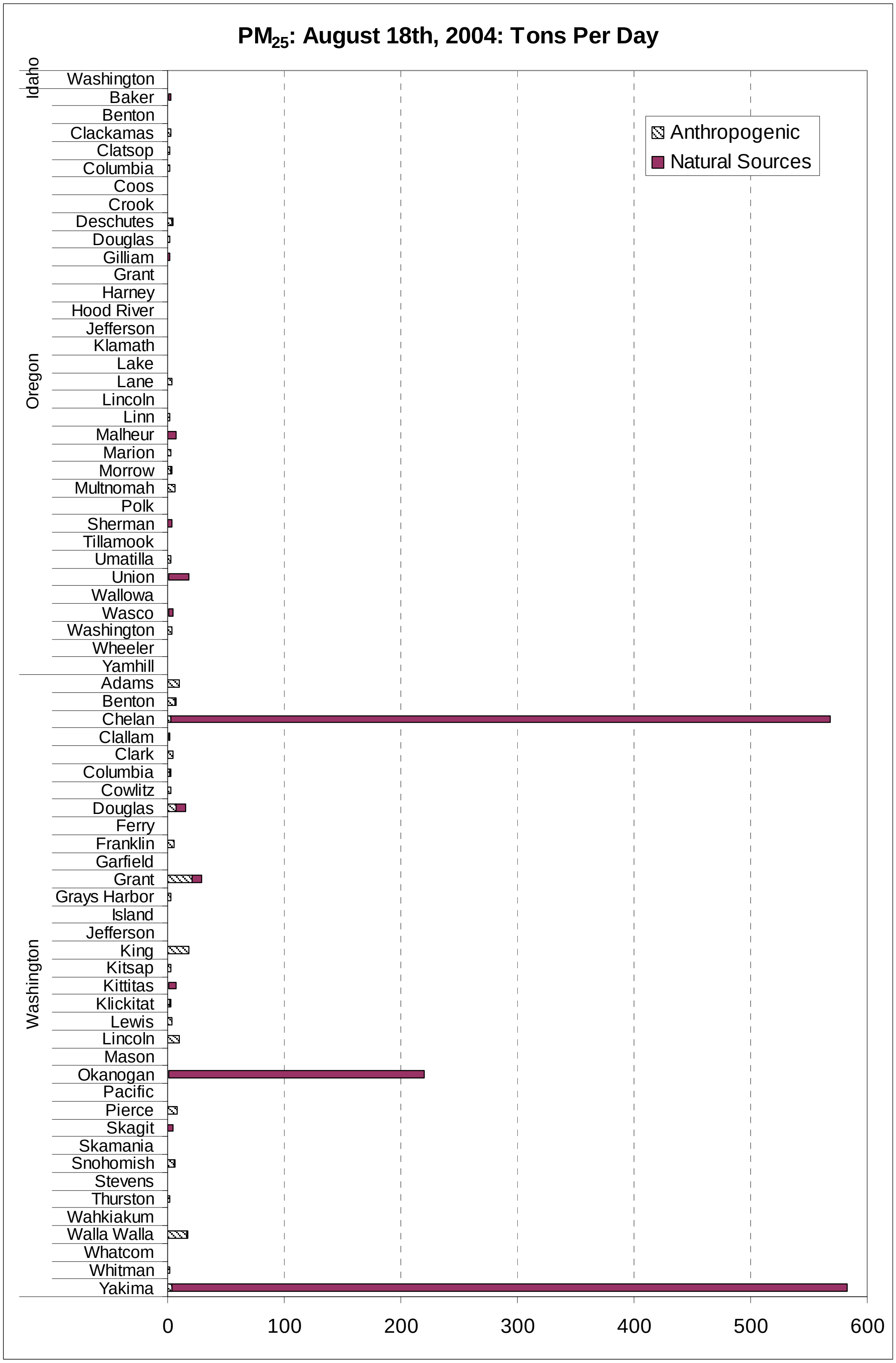

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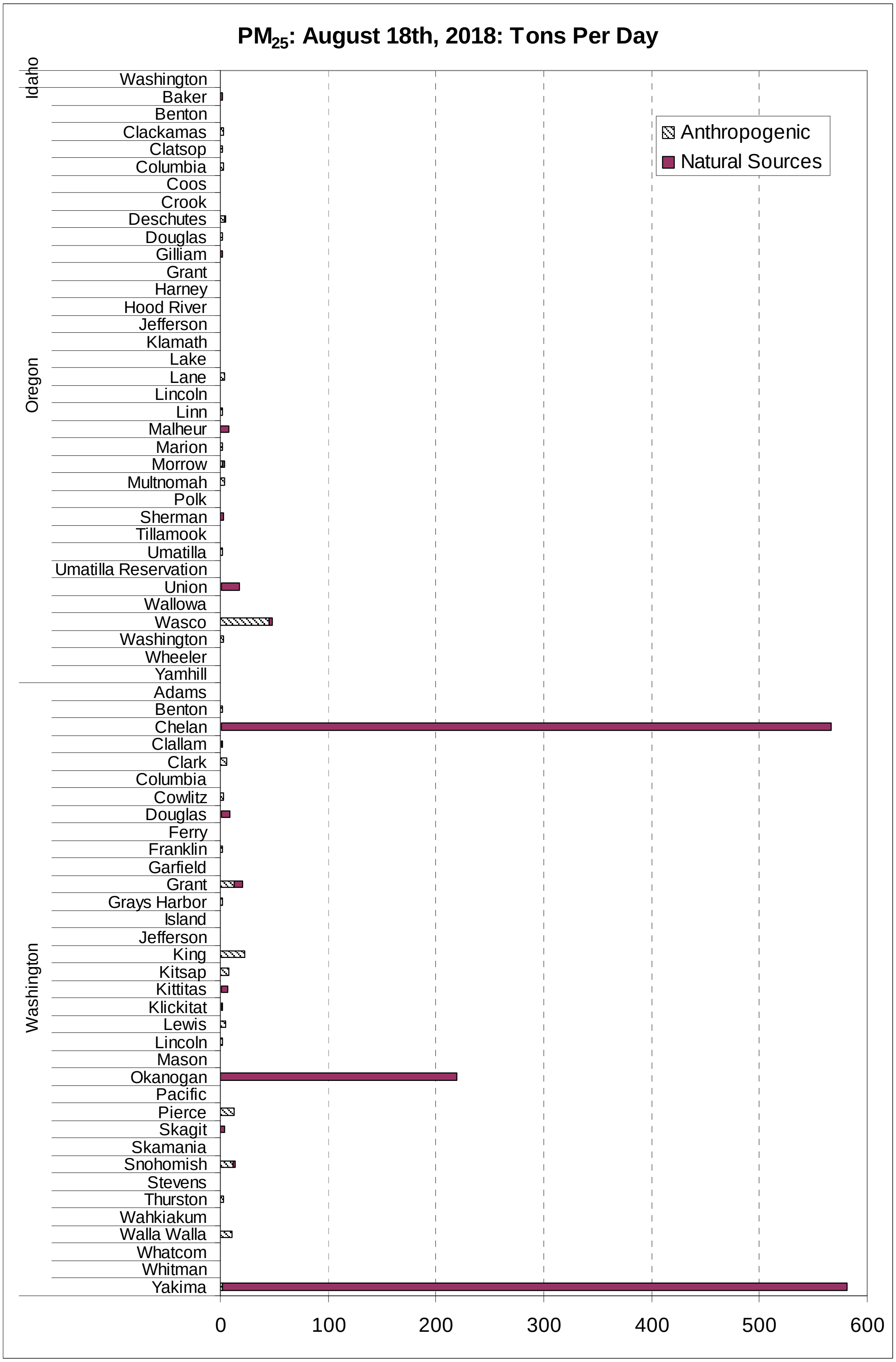
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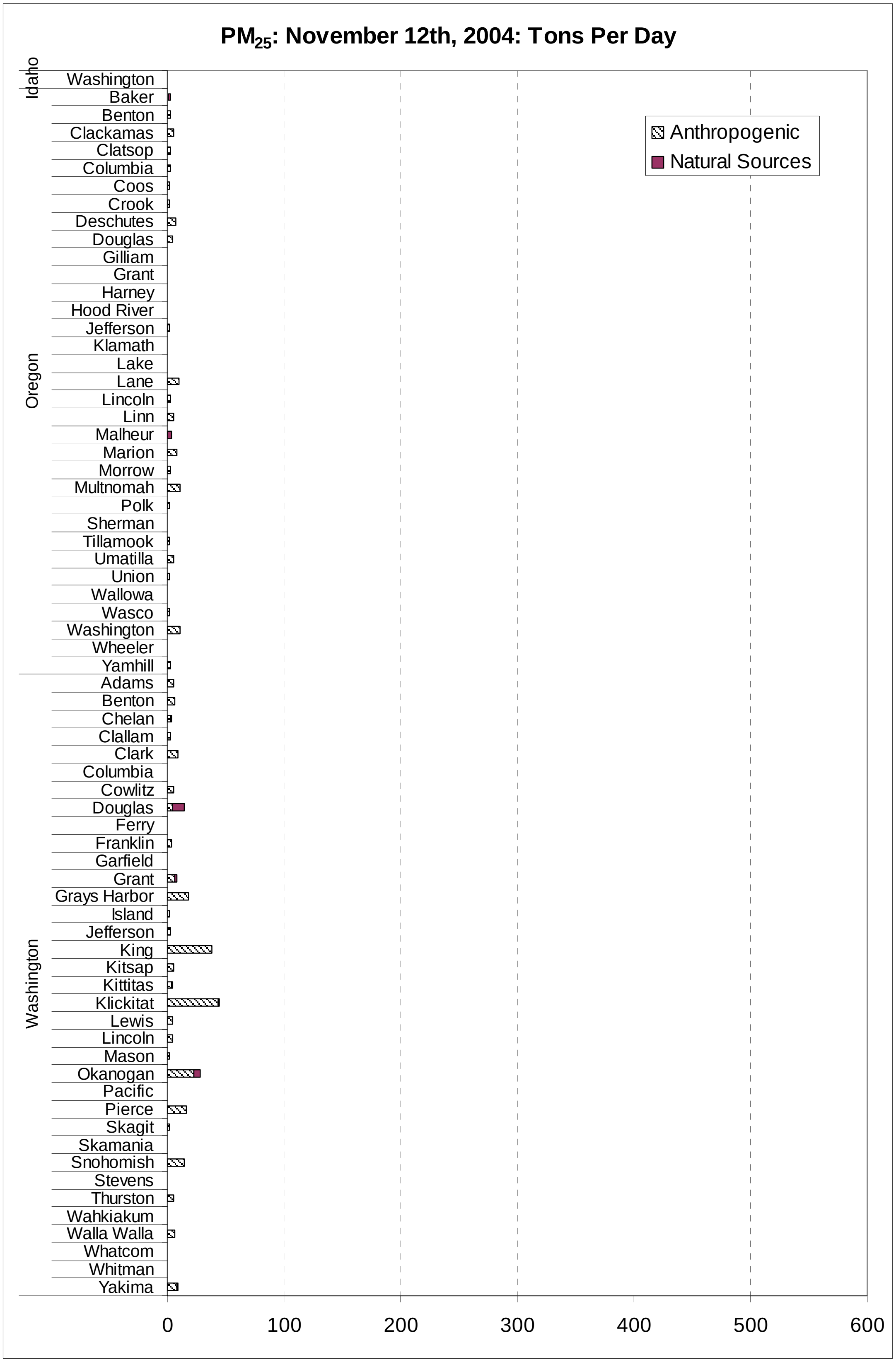
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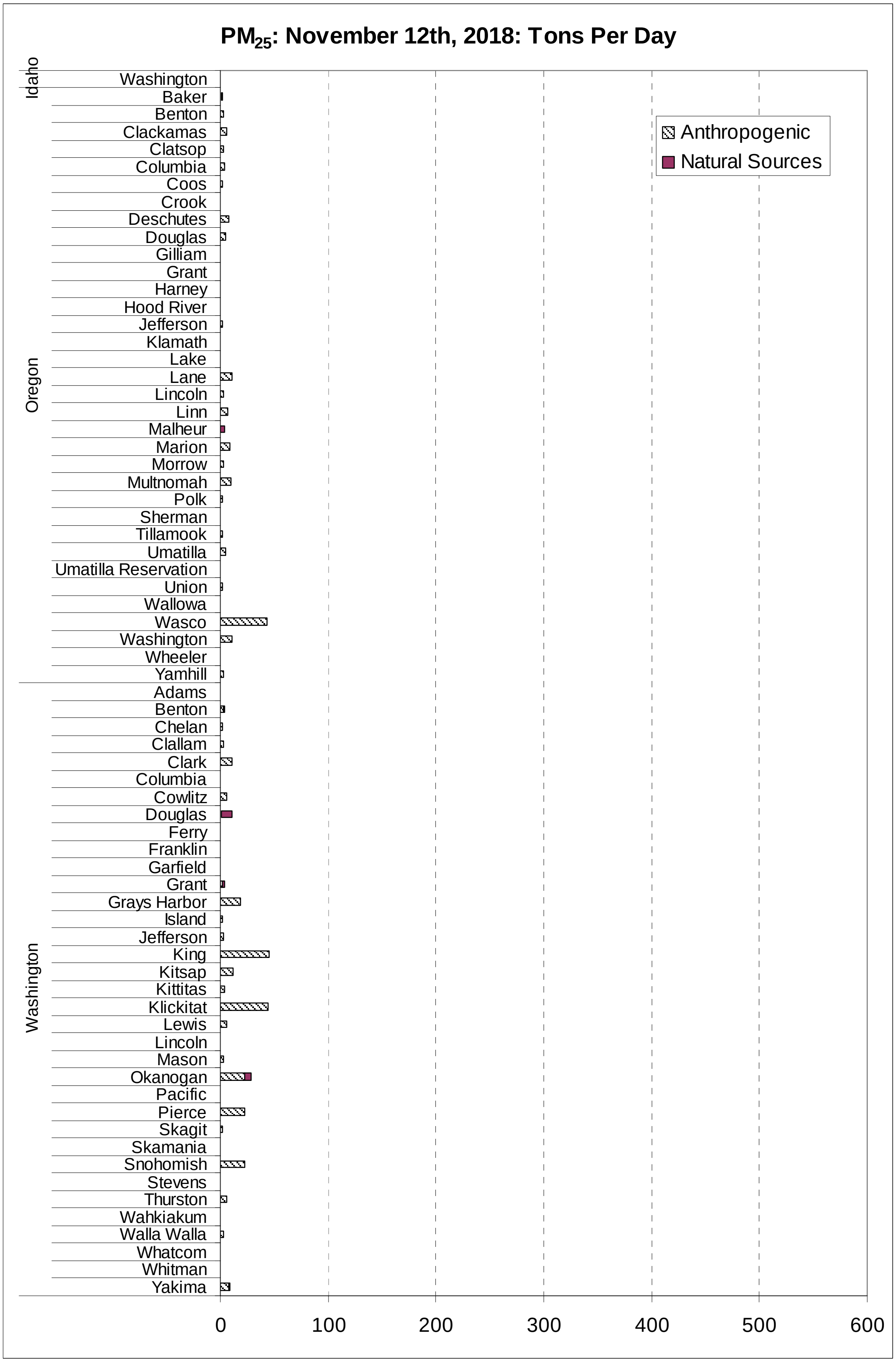
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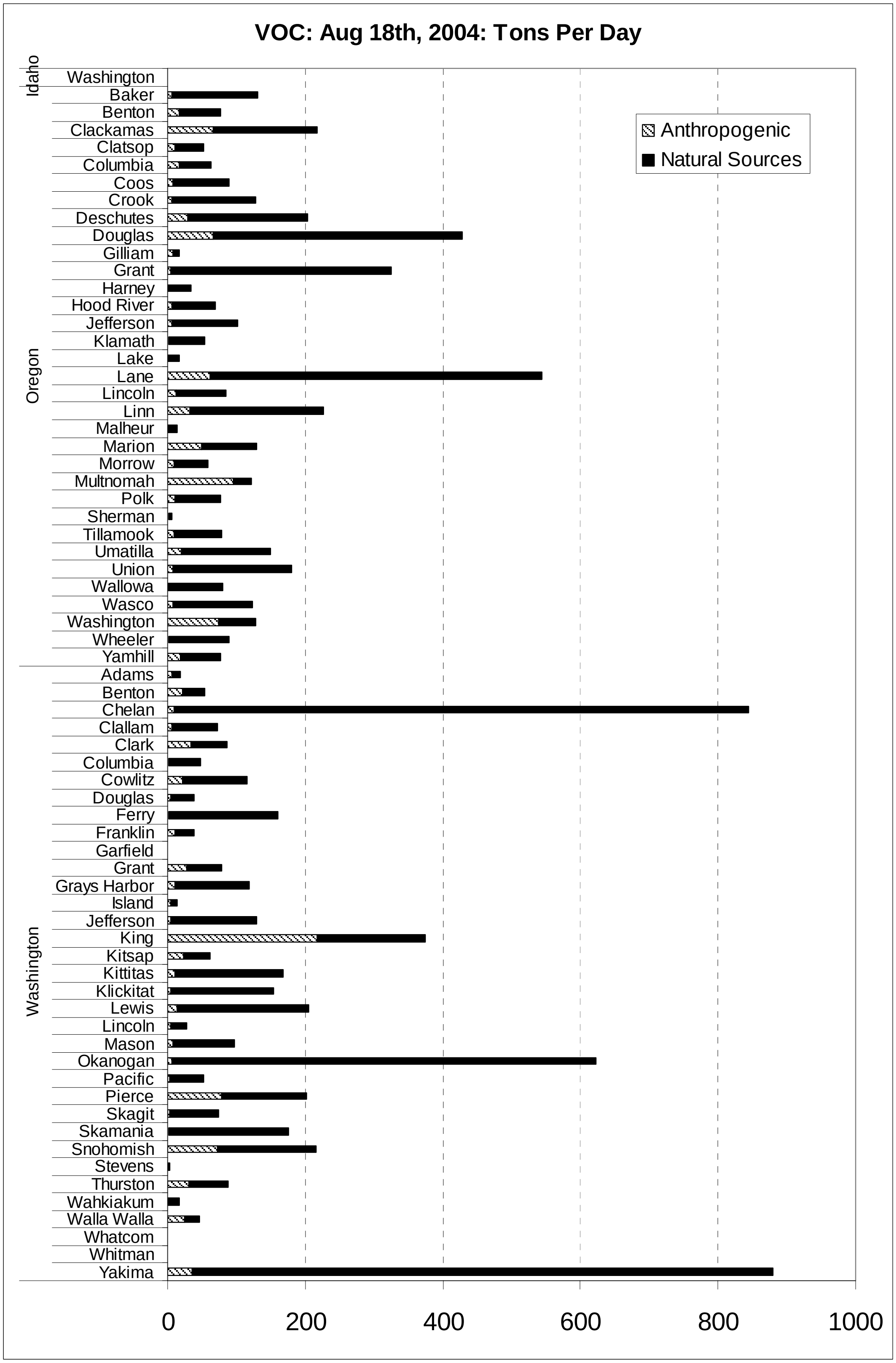
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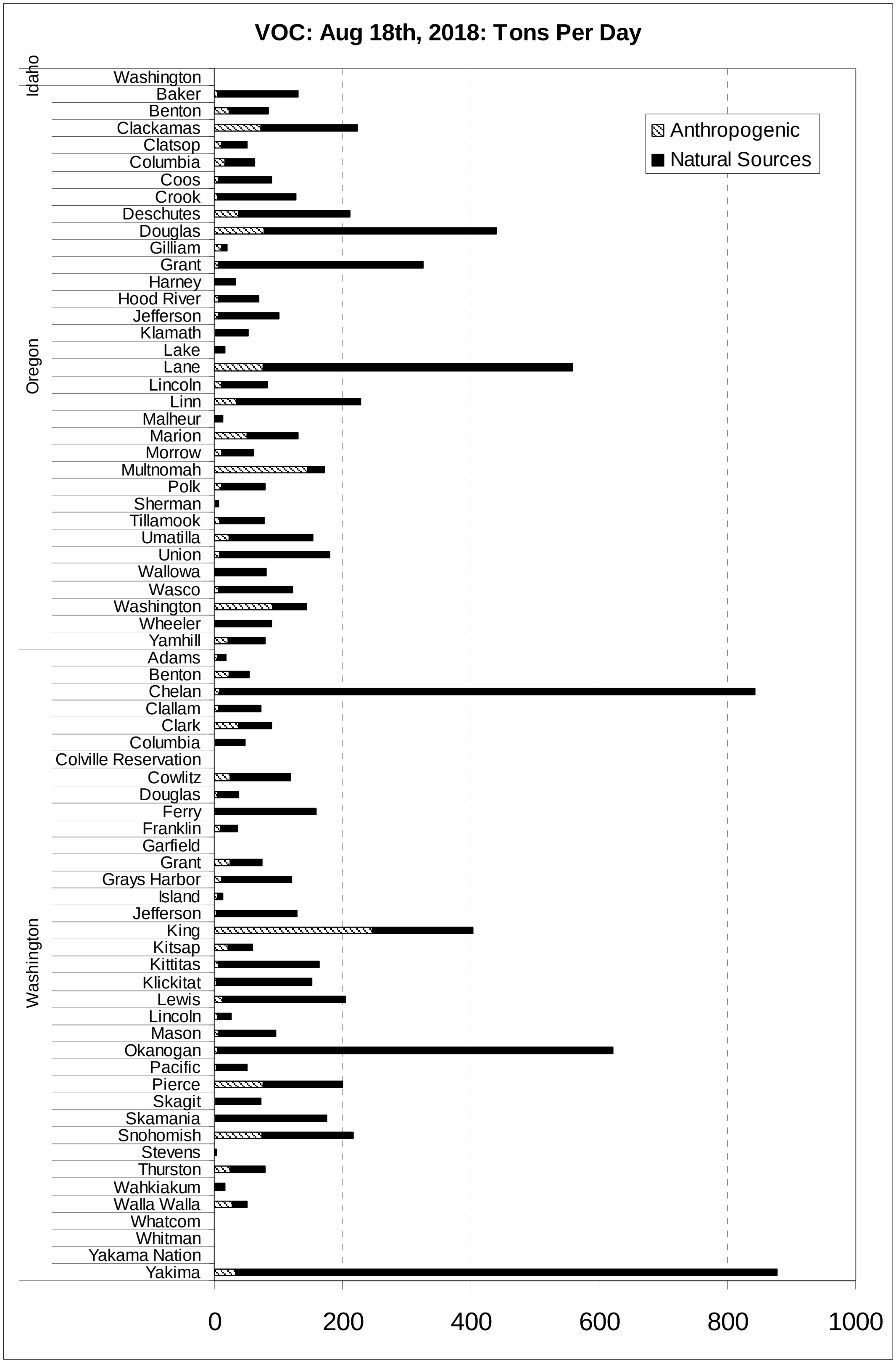

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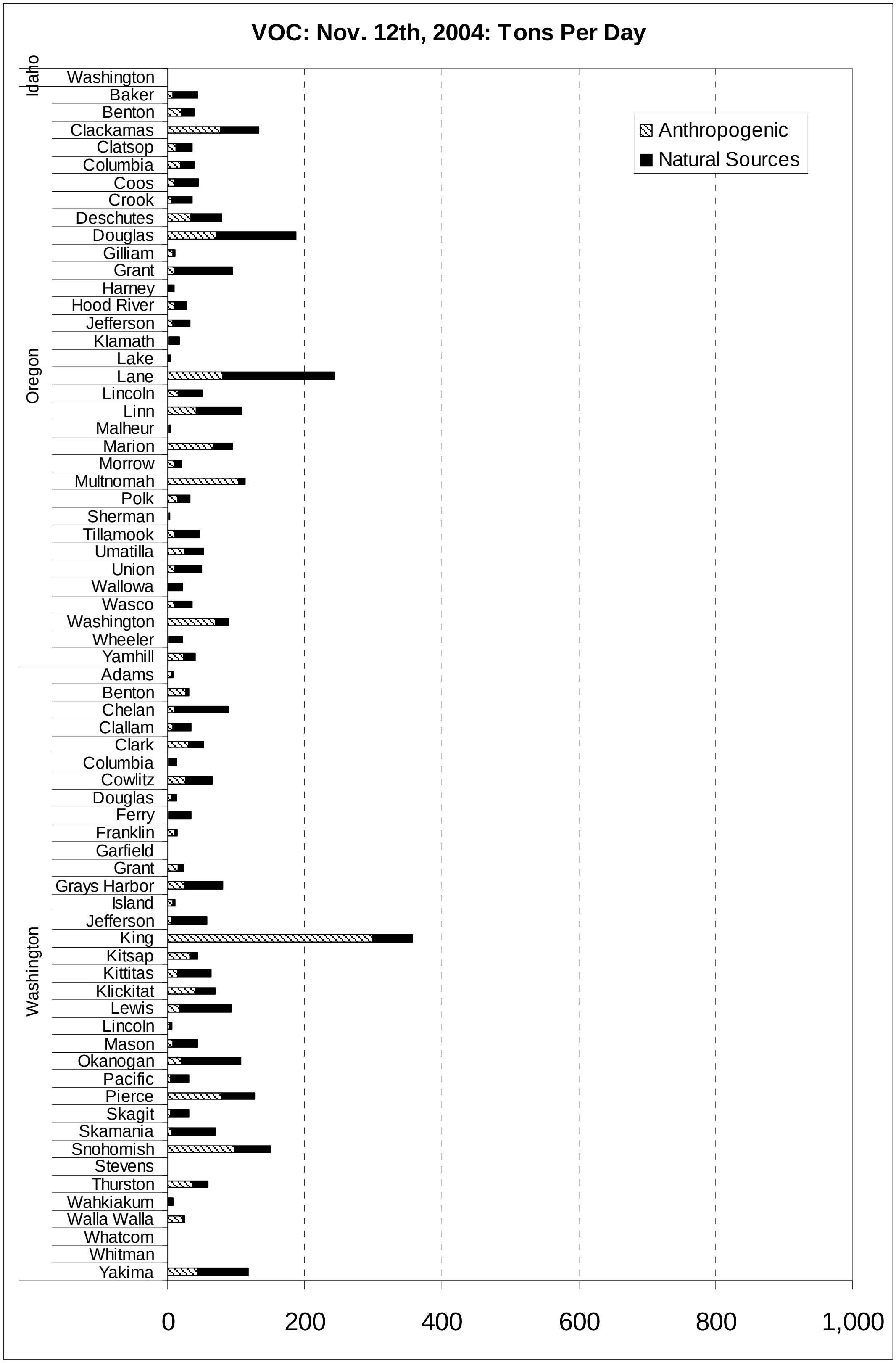

VOC: Nov. 12th, 2004: Tons Per Day
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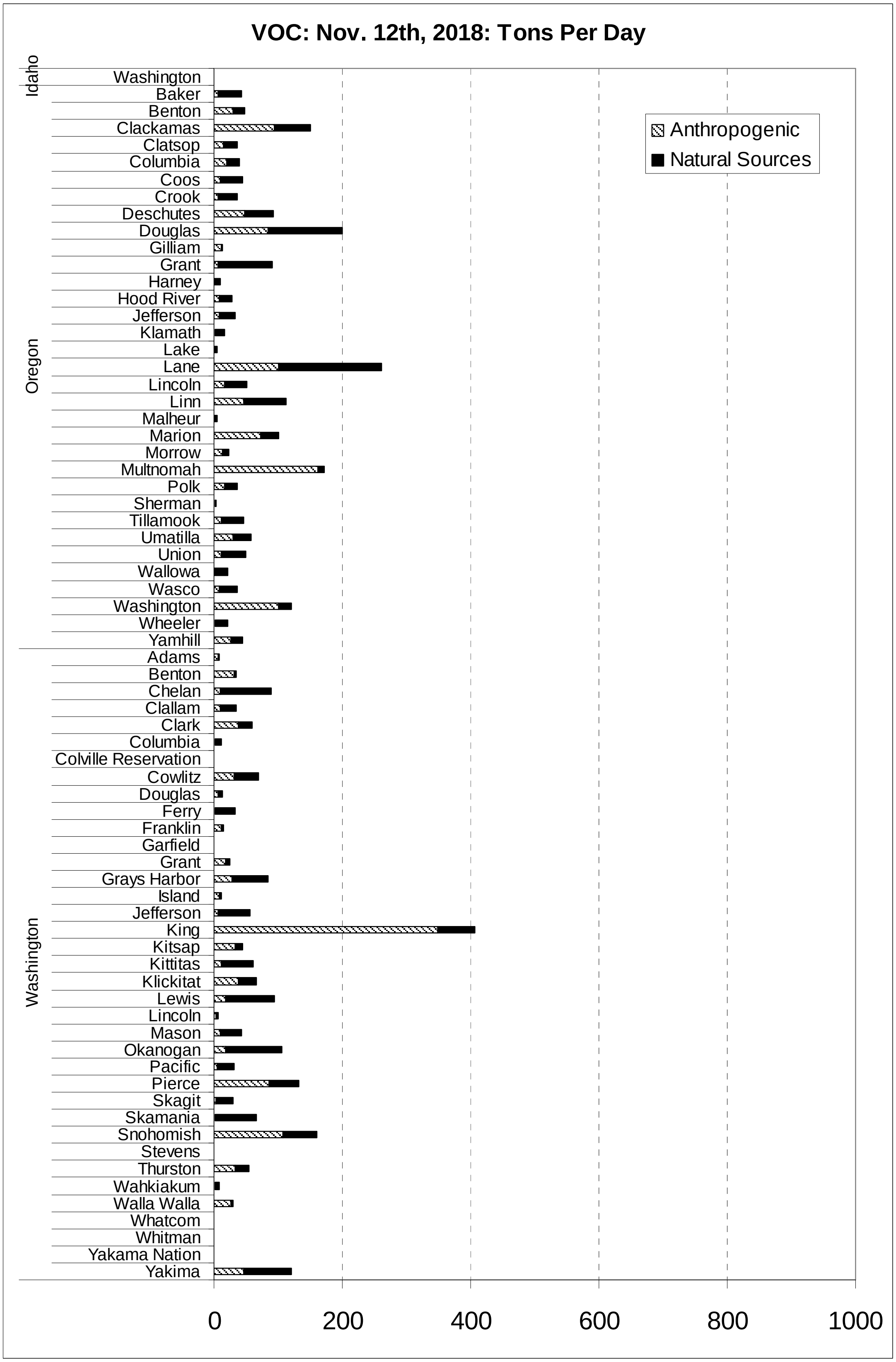

VOC: Nov. 12th, 2018: Tons Per Day
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