DEVELOPMENT OF THE 2007 BASE YEAR AND TYPICAL YEAR FIRE EMISSION INVENTORY FOR THE SOUTHEASTERN STATES AIR RESOURCE MANAGERS, INC.

(FINAL REPORT)

FIRE METHODOLOGY

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1.0 OVERVIEW

Under contract with Southeastern States Air Resource Managers, Inc. (SESARM), AMEC was tasked to develop the 2007 base year inventory for the point, fire and on-road mobile source sectors. This document details the methods used to develop the fire component of the base year inventory.

Work to develop the fire component of the base year inventory was performed using a stepwise process. The steps in this process were:

1. Obtain data on wildfires, prescribed burns, agricultural burning and waste/land clearing burning activities from State and Federal fire officials. Data on acres burned, fuel loadings and emission factors were sought from these officials.
2. Evaluate the data received by the State and local agencies to determine whether or not the data were usable and what information was included with the submitted data. This included a quality assurance step performed to ensure that the submitted data contained all necessary information needed to develop 2007 emission estimates.
3. Quality assure the data submitted by fire officials for completeness and for location information.
4. Augment the data with any necessary default values for emission factors, fuel loadings/consumption values, location information, etc.
5. Develop fire emission estimates.
6. Provide initial fire estimates to State/Local/Federal fire officials for review and comment. Make any necessary changes based on these comments.
7. Provide files to the modeling contractor for use in the base year SMOKE air quality modeling for SESARM.
8. Develop and provide National Emission Inventory Input Files (NIF) for the SESARM States to include the calculated emissions data.

Version 1 of the inventory was then submitted to the States for review and comment. Changes were made to Version 1 of the inventory based on reviews of the inventory resulting in Version 2 of the inventory. This document details the methods used to estimate emissions for fires for the 2007 base year inventory.

2.0 2007 BASE YEAR FIRE EMISSION ESTIMATES DEVELOPMENT METHOD

Data Requested

In late September 2009, AMEC prepared a technical memorandum outlining the data requirements and approach specified in AMEC's proposed methodology, which was based on the request for proposals (RFP) initiated by SESARM. Under that approach, AMEC would obtain activity data for four different fire types: wildfires, prescribed burns, agricultural burning, and land clearing burns. In the technical memorandum, AMEC outlined the approach for estimating emissions.

The approach proposed for determining fire emissions for 2007 and the typical fire year was similar to that used in preparing the 2002 VISTAS base year inventory and in developing a typical fire year for the VISTAS projection estimates. The RFP had originally specified that the CONSUME model was to be used to calculate emissions from wildfires and prescribed burns. A conference call with the SESARM Fire Workgroup held shortly after the distribution of the technical memorandum to all SESARM Fire Workgroup participants indicated that few if any of the States and their forestry partners had the information necessary to utilize the CONSUME model to perform emission estimation for wildfires and prescribed burns without significant reliance on default values. As a consequence, AMEC was asked to modify the method to use a method similar to that used for the 2002 VISTAS fire inventory development effort. As a consequence, the approach used for all fires was similar to that used to calculate emissions for the 2002 VISTAS base year inventory.

Listed in Table 1 below are the minimum data elements required for each fire type in order to calculate fire emissions using the previous VISTAS 2002 base year/typical year approach:

TABLE 1.

MINIMUM FIRE DATA ELEMENTS NECESSARY TO CALCULATE EMISSIONS

Data	Note
Number of acres burned	per day if available
Date of fire	Actual days were preferred but time period of fire was acceptable (start and end dates). At a minimum the month that the fire occurred could be reported but the fire would then be reported either as starting on the first of the month or randomly assigned a date within that month
Type of material burned	e.g., short needle conifer, long needle conifer, logging slash debris, hardwood, palmetto, etc. or NFDRS or other fuel categorization code, crop type (for agricultural burning) or cleared material type (for land clearing burns)
Fuel consumption	tons/acre
Location of fire	Latitude/longitude information was preferred, but if not available, the minimum acceptable information was the county in which the fire was located. For fires that spanned counties, a breakdown of the acres per county was to be provided. If only a county was reported as the fire location it was assigned to the county centroid. Finally, latitude/longitude information in decimal degrees (rather than degrees/minutes/seconds) was preferred. Survey tract data was discouraged since it was not easy to convert to latitude/longitude. State and County FIPS codes were to be included with all entries.
Name of fire or fire control project	if available

While the majority of data was to be provided by State air regulatory and forestry agencies, AMEC also solicited data from Federal Land Managers (FLMs). Information from Federal agencies on fires on Federal lands was requested from the following Federal agencies:

- Forest Service;
- Fish and Wildlife Service;
- National Park Service;
- Bureau of Land Management; and
- Bureau of Indian Affairs.

All data submitted were to be for the year 2007 if possible. However, in order to determine "typical" year emissions and to keep the data solicitation to a minimum, AMEC requested that data for 2006-2008 (at a minimum) be submitted as part of the data request process. Those years represent the modeling period that SESARM was considering for the SIP submittals required by the States.

The information that follows describes the method used, the treatment and quality assurance of the data received and any modifications or adjustments to the data used to calculate emissions for each State in the SESARM region.

Data Supplied

The data provided by the States varied widely in both the quality and quantity of fire data provided. This obviously had a large effect on the final results. For example, Florida had exceptionally detailed data for all fire types. Georgia, by contrast had exceptionally detailed data for wildfires, but significantly less detailed information for prescribed burns. Similar statements could be made for other states

Data returned from the State air quality and forestry contacts and FLMs varied by State both in the types of fire information returned (e.g., wildfires, prescribed, agricultural or land clearing) and in the level of detail provided. Some respondents provided information on each fire by latitude and longitude while others provided only the county location. In other cases very detailed information was provided on the fire date (including reported date, control date and fire out date, for example) while others only provided the start date (in one case, Georgia, only the month and total acres burned was provided for prescribed, agricultural and land clearing fires – information on how these data were handled is presented later).

Some respondents provided fairly detailed information on the fuel type and loading while others provided no data at all on the fuel type (or loading). No States or FLMs provided estimates on the smoldering or flaming stages of the fire. All respondents provided information in electronic format.

FLM's provided data for wildfires and prescribed burns. Data for wildfires was provided by USFS, FWS, and NPS. Prescribed burning data were provided by these same three agencies. In addition, in a few counties in Georgia, the Department of Defense (DOD) provided data on prescribed burning since they were the major prescribed fire source in the county.

Tables 2 and 3 provide an overview of the data supplied by State and Federal agencies for fires for SESARM. Fire data for Mississippi was obtained from U.S. EPA's SMARTFIRE database. Prescribed fire data from DOD was only provided for a few counties in Georgia.

TABLE 2.

FIRES DATA PROVIDED BY STATE AGENCIES BY FIRE TYPE

State	Agriculture	Prescribed	Land Clearing	Wildfires
AL	✓	✓		✓
FL	✓	✓	✓	✓
GA	✓	✓	✓	✓
KY				✓
MS				
NC		✓		✓
SC	✓	✓		✓
TN				✓
VA		✓		✓
WV				✓

TABLE 3.

FIRES DATA PROVIDED BY FEDERAL AGENCIES BY FIRE TYPE

Agency	Agriculture	Prescribed	Land Clearing	Wildfires
USFS		✓		✓
FWS		✓		✓
NPS		✓		✓
DOD		✓		

Data Manipulation/Augmentation

Once all the data had been provided by the State and Federal agencies, AMEC compiled the data into a master database containing common pieces of information necessary to identify the fire location and date as well as the data necessary to calculate emissions. That database was used to calculate fires on a fire-by-fire basis for all data submitted at that resolution.

Prior to inserting data into the master database however, separate databases for each State and Federal submittal were developed. The first step in completing these databases was to ensure that sufficient and correct location information was available so that the fires could be compiled on a point source basis and so that emissions could eventually be summed at the county level for the NIF format annual inventory.

For those data submittals that provided only latitude and longitude, we imported the data into a geographic information system (GIS) program and used the GIS program to add information on the State and county where the fire was located. In many cases this involved converting the data on latitude and longitude. Data on latitude and longitude were submitted in both degrees:minutes:seconds format as well as decimal degrees. All data were converted to decimal degrees. For some of these records, the data either 1) fell outside of the State that the submittal was for or 2) fell in the ocean. Fires that fell outside of the State, in the ocean, or in the wrong State were flagged and those records were returned to the submitter for revision and updates prior to compilation of the Version 1 inventory.

For data submitted with only State and county information, we placed the fires at the county centroid location. For that work we used a file obtained from the EPA website that listed the location of the county centroid in decimal degrees. All records where the location information was the county centroid (as opposed to a fire specific location) were marked in the database using a field to indicate that the supplied data record was located in the county centroid.

Once the location information was completed for all data, we then proceeded to augment the fuel consumption information in the database if necessary. The general approach used for augmenting fuel consumption was as follows:

- Submitter-supplied data – if provided, these values were always used
- National Fire Danger Rating System (NFDRS) Model value assigned fuel consumption
- Fire Behavior Prediction System (FPBS) fuel model – the FBPS fuel model value was mapped to a NFDRS value and the fuel consumption was determined via the crosswalk between the two systems.
- Material burned type (a NFDRS value was assigned if the material burned could be easily matched to a NFDRS fuel model)
- Default values provided by State/Federal fire personnel – these values were only used where they were missing or where AMEC was specifically instructed to use them.
- Finally, for some fire types (e.g., agricultural burning or land clearing of debris), AP-42 fuel consumptions were utilized.

Values for fuel consumption were then assigned to each individual fire (either State or Federal) based on this priority scheme. If the State supplied a value for fuel consumption (even if the value was for the whole State) that value was used for all fires of that type (e.g., wildfires, prescribed fires, etc.). Similarly, if the Federal agency supplied fuel consumption data for the fire, it was always used. Where no State or Federal value was provided but a NFDRS fire model designation was provided, the default value for that fire model designation was used for the fuel consumption. If an FBPS value was provided, a crosswalk between FBPS classifications and NFDRS classifications was developed and used to look up a NFDRS value that corresponded to the FBPS value. Florida was the primary State that used FBPS values, however a few submittals from Federal agencies also contained FBPS values which we similarly cross-referenced to NFDRS categories to obtain the fuel consumption values. If the data included the type of material burned and it could be matched with a similar material described by the vegetation type of a NFDRS fire model category, then the fuel consumption for that NFDRS category was used. For example, if the material description indicated that the material type was grass burning, then it was assigned a NFDRS category of "C" and the default fuel consumption value for NFDRS category "C". Finally, for some fire types (e.g., agricultural burning or land clearing of debris), AP-42 fuel consumptions were utilized. For those fire types, AP-42 was the primary source of fuel consumption information unless information was provided by the State.

NFDRS classifies fuel models using an alphabetic system that describes the general type of material that is consumed in the fire. Table 4 shows the list of NFDRS fuel models and the vegetative types associated with each model.

TABLE 4.

NFDRS FUEL MODEL DESIGNATIONS AND VEGETATION TYPES

NFDRS Fuel Model	Vegetation
A	Annual grass and forbs
B	Mature chaparral
C	Open timber/grass
D	Southern rough
E	Hardwoods (winter)
F	Intermediate brush
G	Closed, short-needle conifer (heavy dead)
H	Closed, short-needle conifer (normal dead)
I	Heavy slash
J	Medium slash
K	Light slash
L	Perennial grass
N	Sawgrass
O	Pocosin
P	Southern plantation
Q	Alaskan black spruce
R	Hardwoods (summer)
S	Alaskan tundra
T	Sagebrush/grass
U	Western, long-needle conifer

Table 5 indicates the NFDRS/FBPS crosswalk values. FBPS values were assigned the corresponding NFDRS code and subsequently the NFDRS fuel consumption value.

TABLE 5.

FBPS to NFDRS Crosswalk

NFDRS Code	FBPS Number
A	1

NFDRS Code	FBPS Number
B	4
C	2
D	5
D	7
E	9
F	6
G	10
H	8
I	13
J	12
K	11
L	
M	
N	3
O	
P	
Q	
R	
S	
T	
U	

All fuel consumption values were based on evaluating the fuel loading values for each NFDRS fuel type using a scheme that estimated the weighted consumption values by percentage of fuel types in each category (e.g., the consumption portion of the fuel loading was applied to the base fuel loading value to obtain a fuel consumed value). The default values for the NFDRS fuel models were provided via an update of consumption weighted values originally developed for the 2002 VISTAS inventory by Bruce Bayle, USFS. The revised NFDRS consumption values used for this work were developed by Jim Brenner (FLDOF), Cindy Huber (USFS), Anthony Matthews (USFS), and Vince Carver (FWS). Discussion of the method used to derive the updated consumption values is detailed in Appendix A. These individuals reviewed the 2002 VISTAS values and proposed recommended changes to each NFDRS consumption weighted fuel loading value.

The original information provided by Bruce Bayle for the 2002 VISTAS inventory was in the form of consumption values developed by taking the average fuel loading by size class and weighting it to determine the percentage burned for each size class of fuel, for each NFDRS fuel model. Data on the fuel size class were provided for one hour, 10 hour, 100 hour, and 1000 hour fuels. The one hour fuel designation means that the fuel is of a size that will burn in the first hour of the fire. Similar meanings can be assigned to the other size class categories. In addition, information was provided on live woody and live herbaceous materials.

The consumption weighting scheme was developed by Bruce Bayle (USFS). For each respective southern fuel model, he used the following percentages to calculate a typical consumption per acre:

Include 100% of the 1 and 10 hour fuels (1h + 10h).
Include 50% of the 100 hour fuels (100h).
Include 10% of the 1,000 hour fuels (1,000h).
Include 40% of the "live woody" fuels.
Include 10% of the "live herbaceous" fuels.

The above percentages represented an average/typical wildfire and average/typical weather conditions/environmental factors in the southeast.

The fuel consumption for each size class (along with the live woody and herbaceous material) was calculated and then summed to provide the overall fuel consumption value for each NFDRS fuel model type.

The values calculated using this weighting scheme were then compared to the default State fuel consumption values from Table 4 of the report entitled "Data Needs and Availability for Wildland Fire Emission Inventories - Short-term Improvements to the Wildland Fire Component of the National Emissions Inventory" June 5, 2003, prepared under EPA Contract No. 68-D-02-064, Work Assignment No. I-08 for Tom Pace (known as the Pace Report). For the 2002 VISTAS inventory, a spreadsheet was prepared with the summarized fuel consumption values provided by Bruce Bayle along with those from the Pace Report. That spreadsheet was then reviewed by Bruce Bayle, Mark Clere (Fire Planning Specialist, National Forests in Florida, Tallahassee, FL), and Charlie Kerr (Fire Management Officer, Francis Marion & Sumter National Forests, Columbia, SC) to ensure that the data used were optimal for southeastern forests. Suggestions for modifying the values in the spreadsheet were made by the reviewers and implemented as the standard values for use with the different NFDRS fuel models.

For the current 2007 and typical year inventory work, revisions to the final version of the Bayle spreadsheet were made based upon review of that data by Jim Brenner (FLDOF), Cindy Huber (USFS), Anthony Matthews (USFS), and Vince Carver (FWS). They proposed recommended changes which were provided to the SESARM Fire Workgroup for review and comment. The revised values were developed following evaluation of values derived from the Fire Emission Production Simulator (FEPS) coupled with local knowledge of how the FEPS values (which are largely based on western fire values) would be different in the southeastern U.S. Following that review, the comments and changes were incorporated and a final version of the revised spreadsheet was provided for use in calculating emissions for fires for the 2007 base year inventory.

Appendix A contains a table with the initial values for each NFDRS fuel model calculated using the weighting scheme, the default EPA values from the Pace report and the final values used based on the review of both the initial calculated values and the Pace report defaults provided by Bayle. A second table details the modifications made for this work. Appendix A also contains more detailed information on the actual process used to modify the current consumption values for this work along with the input parameters used in the FEPS modeling to calculate the consumption values for each NFDRS type.

Once the fuel consumption had been assigned to each fire, the remaining information necessary to calculate emissions was emission factors. Each fire was assigned a “fire model” designation for the purposes of assigning an emission factor to the fire. In the cases where the fires had designated NFDRS fire models already, the “fire model” designation was identical to the NFDRS letter designation. There were other designations that were assigned to other fire types (agricultural burning fires, etc.). In some cases the material burned type was used to assign the “fire model” emission factor assignment. Emission factors were assigned for all fire types.

The basis for the emission factors for many of these fires was Table 2 of the Pace report. The emission factors used differ from Table 2 of the Pace report slightly for a few of the “fire models”. This is because per note 3 for Table 2 in the Pace report, emission factors for fuel models other than NFDRS types A, B, C, F, and L should be augmented by 17% and 8.5% for wildfires and prescribed fires respectively. We did augment the values by those percentages.

In addition, for this work, a comprehensive evaluation of all of the emission factors used in the VISTAS Base G inventory (which served as the starting point for this work) was performed to evaluate potential updates based on more recent research. That evaluation was conducted by Anthony Matthews (USFS). Modifications to several emission factors for both wildfires and prescribed burns were made based on his recommendations following that review. The emission factors that were updated are noted in Appendix B in the Source column of the table as "Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc". A copy of that document is also included in Appendix B.

In addition to the changes made during the review of the wildfire and prescribed burning emission factors, changes were made to the emission factors for other fire types. The emission factors for certain fire types were derived from AP-42. For example several of the emission factors for the agriculture fire types were derived from AP-42. In evaluating the emission factors for agricultural burning however, it was determined that the emission factors did not contain SO_2, NO_x, and NH_3 emission factors. In order to address this deficiency, AMEC researched available newer information on agricultural burning to determine if emission factors for those pollutants were available. The augmentation process for adding emission factors for these pollutants to the AP-42 emission factors is described in Section 3.

The emission factors for each emissions model are provided in Appendix B.
Once all of the data required to calculate emissions were acquired or assigned, we then put all of the State data into the master database. The master database contains the following data fields:

StateFIPS	State FIPS code
CountyFIPS	County FIPS code
SCC	Source Classification Code
Date	Date of Fire
Acres	Number of Acres burned
Latitude	Latitude in decimal degrees
Longitude	Longitude in decimal degrees
LatLongIsCountyCent	True/False field indicating whether the latitude and longitude value is the county centroid – value is "True" if it is
FireType	Type of fire - prescribed and silviculture burning were both assigned the prescribed burning SCC, waste burning and land clearing of debris burning were both assigned the waste burning SCC
Material	Type of material burned if known
Fuel Loading	Consumption weighted fuel loading value in tons/acre
Default Fuel Loading	True/false field indicating if the fuel loading value is a default value – "True" if it is
Default Material	True/false field indicating if the material field value is a default value – "True" if it is
Fuel Loading Source	Source for the fuel loading value
Emission Factor Code	Code used to look up emission factor values in the emission factor table - NFDRS fuel model if available
Pollutant	Pollutant for emissions
Emissions	Emissions value in tons
Emission Factor	Emission factor in lbs/ton of material burned
Agency	Agency that submitted data
DataSource	Who supplied the data (State or Federal or other)
StateFederal	One character indicator field that indicates if the record is a State (S) or federal (F) data record.

The master database file contains the raw fire-by-fire information used to estimate most (but not all) emissions in the SESARM fire inventory. Data in the master database includes information related to fires in 2007 but also in 2006 and 2008 (and other years for some States). In addition, a separate master database was prepared for data from Federal lands. Not all Federal data were used to calculate emissions. If a State had a permit program (predominantly for prescribed, agricultural or land clearing fires), that included issuance of permits for burns on Federal lands, then the data submitted by the Federal agencies were not included in preparing the estimates (except for a few instances) in order to avoid double counting of emissions. Thus if the State permit program included issuance of permits on Federal lands, then the Federal data for that State was not used to calculate emissions for the inventory.

3.0 STATES REQUIRING SPECIAL TREATMENT

In a few cases, data from certain States or agencies required special treatment. Those special cases are described below.

Mississippi Fires

Mississippi did not submit fire-by-fire data for use in calculating fire emissions. For Mississippi, the EPA SMARTFIRE data were used to develop the 2007 base year inventory. The SMARTFIRE data were divided between two source category codes, 2810001000 - Miscellaneous Area Sources, Other Combustion, Forest Wildfires, Wildfires – Unspecified and 2810090000, Miscellaneous Area Sources, Other Combustion, Open Fire, Not categorized. While the first category roughly corresponds to wildfires reported within other States, the second category may include prescribed fires, agricultural fires or land clearing fires as long as the fires were of sufficient size to illuminate a single pixel in the satellite images that SMARTFIRE is based on.

Georgia Prescribed Fires Data Augmentation

Data submitted by the Georgia Forestry Commission (via the Georgia Environmental Protection Division [GAEPD]) for prescribed fires contained only data on total acres burned per month by county. This created uncertainty in the time period when the fire occurred since no date (other than the month) was provided. Data had been supplied by both the USFS and the FWS for several counties in Georgia that provided individual burn days. Because the USFS/FWS data were available GAEPD personnel determined that the USFS/FWS data should be used to allocate individual fires to the database according to the following prioritized allocation system:

1. For those cases where the acreage provided by the USFS/FWS was greater than or equal to that provided for the month by the GFC, then the USFS/FWS prescribed fire records were used directly and replaced any information provided by the GFC for that county/month combination.
2. In those cases where the USFS/FWS acres were less than the GFC acreage, then the USFS/FWS acres were added directly as individual fires. The remaining acres from the GFC data were then allocated to dates from the U.S. EPA SMARTFIRE records for days that did NOT match any USFS/FWS fire days until all of the acreage was utilized.
3. If there were no SMARTFIRE days available to allocate residual GFC acres to, then a list of burn days (based on 2007 meteorology) was provided by GAEPD and the remaining acres were allocated equally to each available burn day until all acres were allocated.

In addition, for three counties, data on prescribed burns from the U.S. DOD were utilized in developing prescribed fire events. Burn records for Ft. Stewart (Liberty County), Ft. Benning (Chattahoochee County) and Ft. Gordon (Richmond County) were used exclusively for those counties to replace the GFC supplied data since those military facilities were the major burners in those counties.

Georgia Agricultural and Land Clearing Fires Data Augmentation

Data supplied by GFC for agricultural fires and land clearing fires was supplied at the same resolution as that for prescribed fires: monthly by county. In order to provide the resolution needed for modeling (fire-by-fire by date), the following scheme was used to allocate the acres to individual dates/times.

CASE 1 (GFC ~ SMARTFIRE): When records from GFC show similar burning as SMARTFIRE 2007, SMARTFIRE data (both temporal and spatial) were used directly.

CASE 2 (GFC < SMARTFIRE): When records from GFC show less burning than SMARTFIRE 2007, SMARTFIRE data were first scaled down to match GFC data, and then used to identify these fires (both temporal and spatial). If a specific county/month did not have any fires identified by GFC (but fires were identified by SMARTFIRE), then no fires were allocated to that county/month.

CASE 3 (GFC > SMARTFIRE): When records from GFC showed more burning than SMARTFIRE 2007, all SMARTFIRE data (both temporal and spatial) were used directly. The remaining fire acres that were not identified by SMARTFIRE were temporally allocated using fire danger rating days. If a specific county/month did not have any fires identified by SMARTFIRE (but fires were identified by GFC), then all the fires were temporally allocated using fire danger rating days equally.

Georgia EPD provided the list of days for each county/month that were used to allocate monthly emissions after analyzing fire danger rating data. The days identified by SMARTFIRE were excluded to avoid double counting. The remaining fires allocated via fire danger rating day data were not assigned a specific location (latitude/longitude), but were located in the county centroid.

Because SMARTFIRE 2007 provides only wildfire and all other fire SCCs, the acreages assigned to prescribed fires, agriculture burning and land clearing were allocated using the monthly ratios of these fires in each county based on the GFC burning permit records, since these fires cannot be differentiated by SMARTFIRE.

Second Level Latitude/Longitude QA

Despite the initial QA step used to verify that fire data were located in the correct State and county, some data still remained misplaced. This was discovered when the initial version of the inventory was provided to the SMOKE modelers. AMEC and Georgia EPD staff worked to develop a method for identifying and correcting these fires. In many cases these fires were identified during the initial QA step, had been returned from the State that was reviewing the data, but were not corrected because the States had no information with which to perform the correction. In a number of cases these fires were located just across the border from the county that they were actually located in. Georgia EPD staff developed an ArcGIS routine that used buffers around the county boundaries to determine which fires were located outside of the county they were attributed to in the original data. The buffers used were 6km. This step was taken to account for potential rounding errors that resulted from conversion of latitude/longitude data provided in degrees:minutes:seconds to decimal degrees. The fires that were located outside of the buffers were provided back to the States again for review and correction. If they were unable to correct the latitude/longitude value then the fire was placed at the county centroid.

Emission Estimates for States That Did Not Submit Fire-by-Fire Data

As seen in Table 2, several States did not provide fire-by-fire data necessary to calculate emissions for every fire type. For several of these States/fire types, emission estimates for the base year were provided by E.H. Pechan and Associates, Inc. at a county level in county area source NIF format. The Pechan provided estimates were developed for the following States/fire types:

State	**Fire Type**
AL	Land Clearing
KY	Land Clearing
NC	Agricultural Burning
SC	Land Clearing
TN	Land Clearing
VA	Land Clearing

If a State doesn’t show a fire type in the above list or in Table 2, then no fires of that type were found to occur in that State. NC DENR estimated the agricultural burning emissions that Pechan provided.

Augmentation of Emission Factors for Agricultural Burning

In processing the data for agricultural burning AMEC determined that there were no emission factors for NO_x, SO_2 and NH_3 for agricultural burning. This is because the AP-42 emission factors for agricultural burning sources do not have those pollutants. During the development of the 2002 VISTAS Base G inventory, the decision was made not to try and augment those pollutants in estimating emissions for that inventory. However, for the 2007 SEMAP base year inventory, the emission inventory workgroup decided that the pollutants should be included. In order to include them, AMEC augmented the emissions by determining emission factors for each agricultural activity for NO_x, SO_2 and NH_3. AMEC found two sources of emission factors for burning of agricultural crops. The two documents used to generate the ratios were the "2002 Fire Emission Inventory for the WRAP Region – Phase II" report prepared by Air Sciences (July, 2005) and a memorandum from Beverly Werner, Manager Regulatory Assistance Section Stationary Source Division, California Air Resources Board (CARB) to Dale Shimp, Manager, Emission Inventory Analysis Section, Planning and Technical Support Division (dated August 17, 2000) detailing agricultural emission factors for use by CARB in their inventory development efforts. The memorandum can be found at http://www.arb.ca.gov/smp/techtool/arbef.pdf. Table 24 of the WRAP report lists emission factors for a variety of crop types. Data from these two reports were combined to provide aggregate agricultural emission factors for the agricultural emission factor models that were developed for the 2002 VISTAS inventory. Each individual crop type was initially assigned to one of eight categories: Field Crop, Fruit, Nut, Vegetable, Grain, Hay, Sugarcane, and Other. Once these assignments were made the emission factor values were averaged (using a simple numeric averaging process) to produce an overall average value for each of the missing pollutants for that category along with an average CO emission factor.

The new emission factors were determined by developing ratios of emission factors reported in the two documents for each pollutant to CO, and then applying those ratios to the AP-42 emission CO emission factors. Thus the new emission factors were generated as follows:

New Pollutant EF = New Pollutant to CO ratio x AP-42 CO EF

From these eight categories, four of them were assigned to the corresponding emission model categories: Grain to AGGRAIN, Hay to AGHAY, Sugarcane to AGSC and Other to AGUNSP. These emission models (and the corresponding emission factors) were used to calculate the emissions from the fuel consumption and acreage for each fire.

For those states that did not provide fire-by-fire data, estimates at the county area source level were developed by TranSystems (Pechan). Those estimates did not contain NO_x, SO_2 or NH_3 emissions. For those states, emissions were calculated based on the ratio of the pollutant of interest to CO rather than directly with emission factors. That approach was necessary because the TranSystems data did not contain any activity data. Again the data from the two reports mentioned above were used to develop those ratios.

4.0 TYPICAL YEAR FIRE EMISSION ESTIMATES DEVELOPMENT METHOD

In addition to preparing the 2007 base year emission estimates, AMEC also developed a "typical" year fire inventory for use by air quality modelers. For the fire-by-fire data provided by the States and FLMs and used in the 2007 base year fire-by-fire portion of the inventory, a set of factors was developed and applied to the 2007 acreage which was then used to calculate a typical year emissions values.

The approach used for developing the typical year estimates was the same as that used for the 2002 VISTAS typical year inventory, which is summarized below.

Acreage values by fire type (wildfire, prescribed, agricultural and land clearing) were summed for the period 2006-2008 for each county in each State. Those values were then divided by three to obtain an "average" acreage value by county and fire type. That value was then divided by the 2007 actual acreage for each county and fire type to obtain a ratio used to modify the 2007 acreage value for a "typical" year in the 2006-2008 timeframe. The ratios were multiplied times the 2007 acreage value to produce the "typical" year acreage. Emissions were then calculated using the same consumption based fuel loadings and emission factors used for the 2007 base year inventory. Thus the only variable that changed was the acreage of the fire. Intrinsic to this approach were the following:

1. All fire fuel loading values were maintained
2. All fire locations were maintained
3. All fire occurrence times from 2007 were maintained

Emissions were calculated for all fire types for which data were provided in the fire-by-fire files. Exceptional event fires were excluded from the calculation of the ratios for the typical year emissions. The equation used for determining emissions was:

2007 Typical Emissions = 2007 Actual Emissions * (2006-2008 Average Acreage Burned/2007 Acreage Burned)

For those categories where no data were provided on a fire-by-fire basis, the 2007 values were maintained. Those fires were the county-level estimates produced by E.H. Pechan and Associates, Inc. in area source NIF format.

Mississippi typical fire data was calculated from the SMARTFIRE data. The SMARTFIRE data obtained from EPA contained data for the years 2006-2008 inclusive. Thus the average acreage values by fire type by county for MS were calculated and applied to the 2007 acreage to develop typical acreage similarly to how the values were calculated for other States that provided their own data.

Exceptional Event Fires

Several States identified fires classified as exceptional events for either the base year 2007 or in one of the years (e.g., 2006 or 2008) used to develop the "typical" year inventory. Any exceptional event must have been classified as such by the U.S. EPA. For those fires identified as exceptional event fires in the actual 2007 base year inventory, the fires identified by those States were included in the calculation of emissions for the 2007 base year inventory.

For exceptional event fires identified in 2007 and in years other than 2007, those fire acreages were removed from any calculation of acreage ratios used to adjust the base year acreage to typical year acreage values and thus from any subsequent emission calculations for the typical year.

Each State's exceptional events (for those States that submitted exceptional events) are described below.

Florida
In Florida, the only fire removed as an exceptional event was the Bugaboo fire, which was part of the Okefenokee area fire complex.

Georgia
The only exceptional event in Georgia during the 2006-2008 timeframe which was concurred by EPA was the Okefenokee area fire in 2007 (i.e., the Big Turnaround and Sweat Farm Road fires). These fires were removed from the inventory for emission calculation purposes and in determining the ratios used for typical year emission calculations. In addition, data provided by GAEPD and GFC in the form of ArcInfo shape files was used to determine the daily acreages for the fires in both Georgia and Florida (with agreement by Florida air quality and forestry personnel).

North Carolina
North Carolina provided data on five fires to consider for removal as exceptional events. These fires were:

Fire Location	**Fire Name**	**Fire Type**	**Date**	**Acreage**
Swain County	Prescribed Fire	Prescribed	3/22/2007	300
Robeson County	Georgia Fire (GA Roundabout Swamp Fire)	Wildfire	5/3/2007	5,956
McDowell County	Un-named	Wildfire	2/12/2008	?
New Hanover County	Edna Buck Road	Wildfire	3/31/2008	1,184
Hyde County	Evans Road	Wildfire	6/1/2008	41,060

Of these fires, the first and third fires were not found in the data submitted by NCDENR. The second one was a GA fire so it was not in the data submitted by NCDENR and did not need to be removed. The fourth fire was in the data provided by NCDENR and was removed for calculation of the typical year acreages. The fifth fire was a fire that had acreage on both State and Federal lands. Both the Federal and State acreage were removed for the typical year.

South Carolina
South Carolina air quality and forestry officials identified three potential fires for exclusion as exceptional events. These fires are described below.

Fire #1: February 20, 2008 with fire ID number N022008-1 was a local fire that impacted the Cowpens ozone monitor located in northern Cherokee County. The fire was a small NPS prescribed burn within the Cowpens National Battlefield. It was 74 acres, with 259 total tons burned.

Fire #2: March 29, 2007 with fire ID CFS_Number N032907-5 was a local fire that impacted the Congaree Bluff ozone monitor located in Richland County. This was also a NPS prescribed burn in Congaree National Park. The fire was 360 acres burned, with 1260 tons burned total.

Fire #3: March 13, 2007 SCDHEC identified this as a local fire that impacted the Trenton $PM_{2.5}$ monitor in Edgefield County. However no fire ID was available for this fire and several fires were identified for the March 12-14 timeframe. In addition, nothing that SCDHEC had provided in their data submittal identified if it was a prescribed or wildfire. As a consequence, SCDHEC personnel could not positively identify this fire and thus no fire was removed for this date range.

Tennessee

In Tennessee, the only fire removed from the inventory for emission calculation purposes and for development of the typical year ratio was the Signal Mountain fire at Edwards Point, which was a wildfire between 3/23/07-3/29/07 encompassing 515 acres.

Virginia

For Virginia, the only fire removed was the D7U0 South 1 Great Dismal Swamp fire which occurred in 2008. Thus it was not in the base year inventory and was removed in the calculation of the typical year ratio used to prepare the typical year inventory. It would not be included in any future year projections since we have confirmation that EPA is recognizing it as an exceptional event.

5.0 RESULTS

Tables 6 through 38 and figures 1 through 33 provide an overview of the fire emissions estimates developed for SEMAP. Each of the tables presents the estimates by State for the 2002 VISTAS/SESARM Base G actual inventory, the actual 2007 base year inventory created under this contract and the "typical" year inventory created under this contract for each pollutant and fire type. The figures (7 through 39) provide data by State and pollutant for the 2007 actual base year inventory and the "typical" year inventory.

Tables 6 through 12 and Figures 1 through 7 provide data for wildfires in the southeastern U.S. Each of the tables shows that emissions for each pollutant were substantially higher in the 2007 actual base year inventory than in the 2002 VISTAS/SESARM Base G actual inventory or in the typical year inventory. This difference is the result of inclusion of the Okefenokee fire complex on the Florida/Georgia border. As indicated above, all fires were maintained in the actual 2007 base year inventory but exceptional event fires were removed from the typical year fires. Thus the differences are largely found in Florida and Georgia numbers. Typical year values for wildfires were roughly comparable to the actual values found in the 2002 VISTAS/SESARM Base G actual inventory. FL and GA dominate the emissions for the 2007 actual inventory, while AL, FL, KY, MS, and NC, are the main emitters for the typical inventory.

Tables 13 through 19 and Figures 8 through 14 provide similar information for prescribed burning. These tables and figures show that emissions from prescribed burning in the 2007 actual and typical inventories were roughly the same and generally at or slightly above the same values for the 2002 Base G Actual inventory. However it is important to note that the values in the tables for the 2007 actual and the typical inventory do NOT include estimates for MS. MS estimates are not included because MS used the EPA SMARTFIRE data which only differentiates between wildfires and all other fires. However, MS emissions in the 2002 Base G Actual inventory were generally less than 10% of the total emissions for each pollutant. Thus the values shown for 2007 actual and typical would like increase by less than 10 percent if data for MS were available. AL, FL, GA and SC dominate emissions for both the actual and typical prescribed fire inventories.

Agricultural fire emissions are shown in Tables 20 through 26 and Figures 15 through 21. Emissions from agricultural fires are only found in AL, FL, GA, NC and SC for the 2007 actual and typical inventory. In the 2002 Base G Actual inventory, MS also had agricultural fire emissions, but similarly to prescribed fire, MS's data was derived from EPA's SMARTFIRE inventory and agricultural fires cannot be separated out from the "other fire" category in that inventory. FL dominates emissions from agricultural burning representing between 60-90 percent of all pollutant emissions (depending upon the pollutant examined). Emissions for NO_x, SO_2 and NH_3 are missing for the 2002 Base G Actual inventory because the AP-42 emission factors did not contain values for those pollutants. They are included in the 2007 actual and typical due to the emission factor augmentation performed in this work.

Tables 27 through 31 and Figures 22 through 26 show emissions from land clearing fires. 2007 actual and typical values are generally similar but lower than the corresponding 2002 Base G Actual inventory. In addition, there are several other important differences. First, in the 2002 Base G Actual inventory, both NC and MS reported emissions where they are not reported for the 2007 actual and typical inventories (MS again because of the use of SMARTFIRE; NC because of lack of available data for 2007). Additionally, VA did not provide land clearing emissions for the 2002 Base G Actual inventory but did for the 2007 inventory effort. GA had the highest emissions from this category followed by TN, SC, AL and VA. Finally, SO_2 and NH_3 emissions are not reported for this category because those pollutants are not included in the AP-42 emission factors used to calculate the emissions.

Finally, in an effort to compare "other burning" emissions from MS with the combination of prescribed burning, agricultural burning, and land clearing from the other SESARM States, Tables 32 through 38 and Figures 27 through 33 show the combined totals for those three fire source categories compared to the "other burning" category for MS from EPA's SMARTFIRE database. For several of the pollutants (CO, SO_2, VOC, and NH_3) the emissions from other burning in MS are significantly higher than the sum of the three categories for any of the other SESARM States. For NO_x, and PM, the values are roughly the same as the highest values for the other SESARM States (typically FL and GA). 2007 actual emissions are generally slightly higher in MS than typical emissions for the other burning category.

TABLE 6.

WILDFIRE CO EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	15,849	21,341	16,547
FL	45,761	326,788	111,216
GA	99,715	673,802	18,974
KY	7,967	11,750	9,609
MS	30,429	5,563	18,108
NC	21,357	21,927	15,792
SC	51,183	5,841	2,107
TN	4,225	13,825	8,160
VA	15,625	4,525	5,470
WV	6,725	1,288	444
Total	**298,836**	**1,086,650**	**206,427**

FIGURE 1.

WILDFIRE CO EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

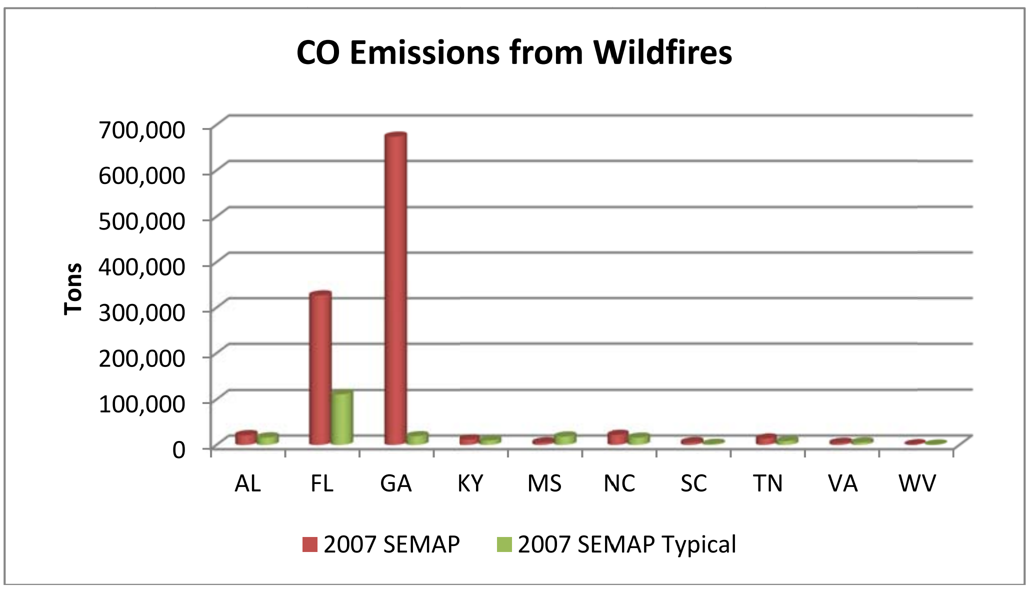


TABLE 7.

WILDFIRE NO_X EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	340	894	693
FL	982	13,740	4,667
GA	2,139	28,352	791
KY	171	494	404
MS	869	94	310
NC	458	919	661
SC	1,098	245	88
TN	91	581	343
VA	335	190	230
WV	144	54	19
Total	**6,627**	**45,563**	**8,206**

FIGURE 2.

WILDFIRE NO_X EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

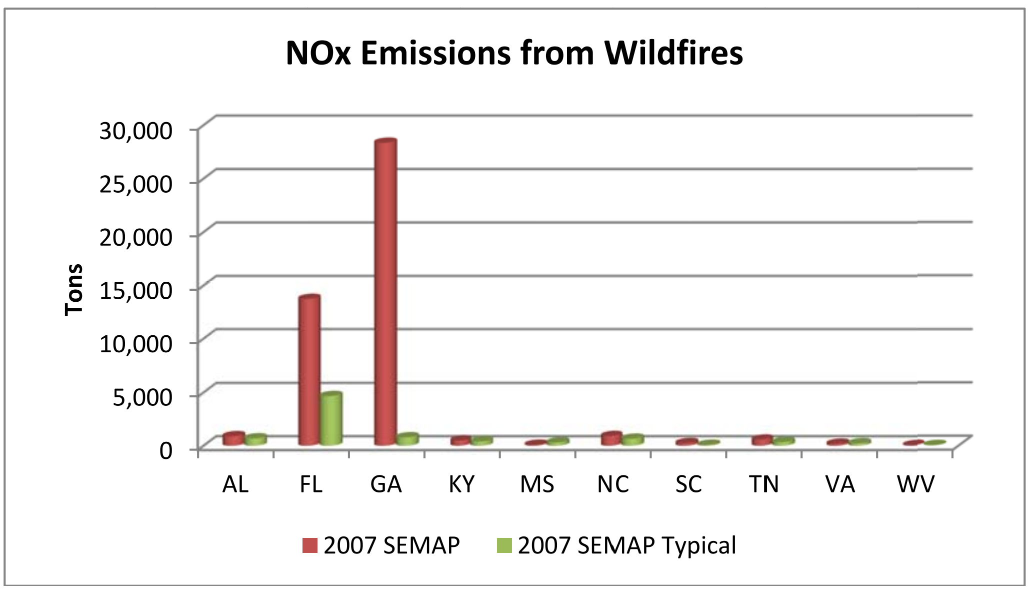


TABLE 8.

WILDFIRE SO_2 EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	93	244	189
FL	269	3,758	1,270
GA	587	7,774	217
KY	47	135	110
MS	33	47	155
NC	126	252	181
SC	301	66	24
TN	25	159	94
VA	92	52	63
WV	40	15	5
Total	**1613**	**12,502**	**2,308**

FIGURE 3.

WILDFIRE SO_2 EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

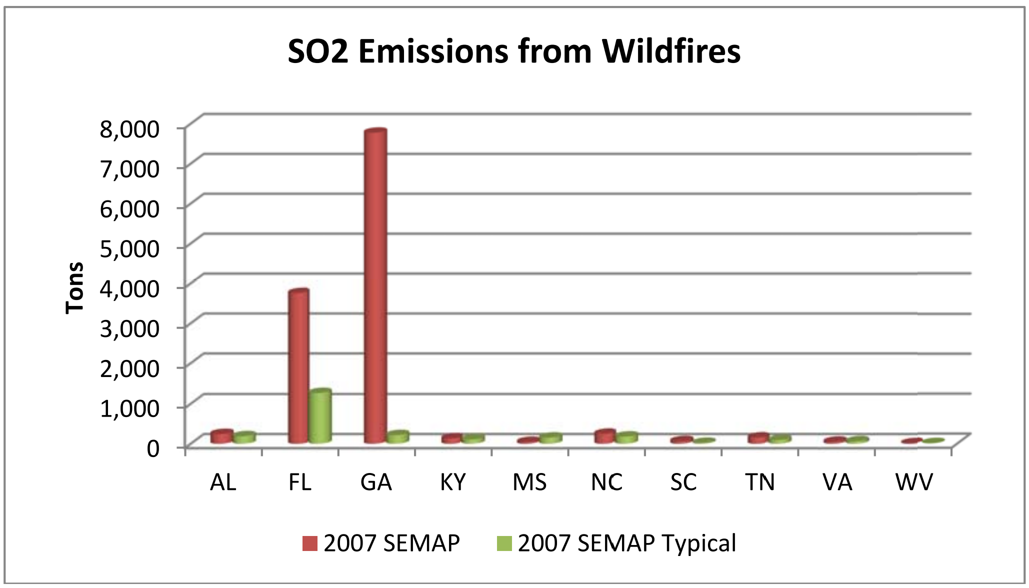


TABLE 9.

WILDFIRE VOC EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	746	1,719	1,333
FL	2,153	26,450	9,062
GA	4,692	54,348	1,507
KY	375	953	779
MS	4,173	1,317	4,290
NC	1,005	1,758	1,265
SC	2,409	485	175
TN	199	1,121	661
VA	735	367	444
WV	316	104	36
Total	**16,803**	**88,622**	**19,552**

FIGURE 4.

WILDFIRE VOC EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

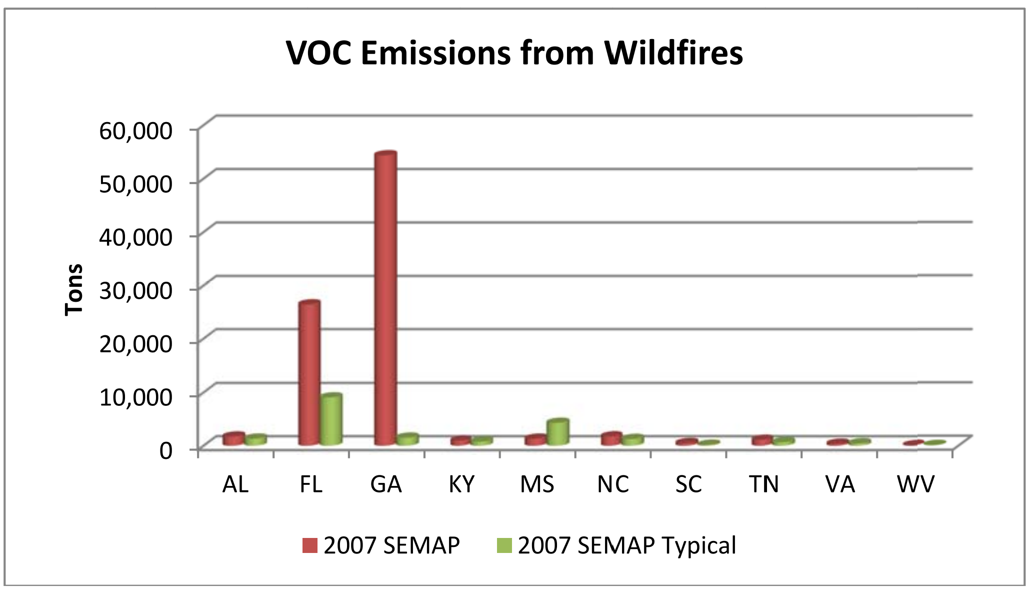


TABLE 10.

WILDFIRE PM_{10}-PRI EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	1,541	3,468	2,689
FL	4,449	53,272	18,127
GA	9,695	109,835	3,067
KY	775	1,916	1,567
MS	2,826	582	1,898
NC	2,077	3,563	2,564
SC	4,977	954	344
TN	411	2,255	1,331
VA	1,519	738	892
WV	654	210	72
Total	**28,924**	**176,793**	**32,551**

FIGURE 5.

WILDFIRE PM_{10}-PRI EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

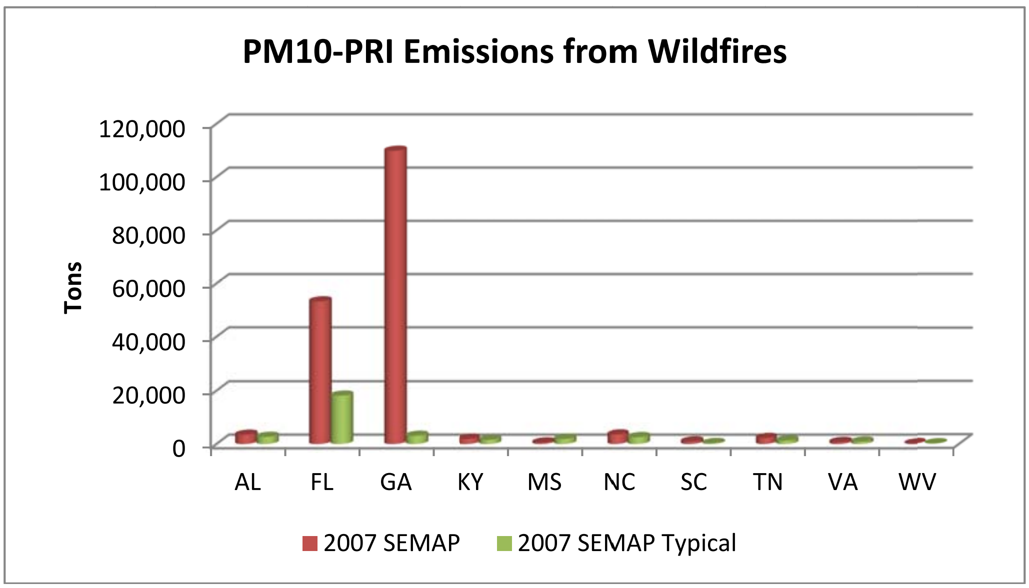


TABLE 11.

WILDFIRE $PM_{2.5}$-PRI EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	1,322	2,989	2,318
FL	3,816	45,913	15,648
GA	8,315	94,587	2,640
KY	664	1,652	1,351
MS	2,543	493	1,609
NC	1,781	3,067	2,208
SC	4,268	827	298
TN	352	1,944	1,147
VA	1,303	636	769
WV	561	181	62
Total	**24,925**	**152,289**	**28,050**

FIGURE 6.

WILDFIRE $PM_{2.5}$-PRI EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

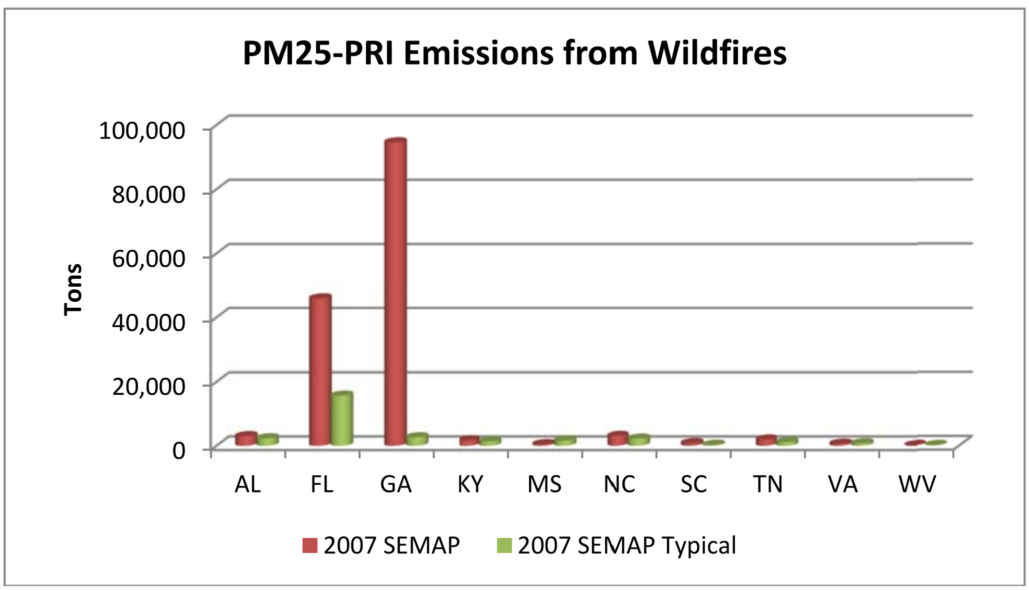


TABLE 12.

WILDFIRE NH_3 EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	71	189	146
FL	206	2,897	995
GA	449	5,945	166
KY	36	104	85
MS	126	92	298
NC	96	193	139
SC	230	54	19
TN	19	123	72
VA	70	40	49
WV	30	11	4
Total	**1333**	**9,648**	**1973**

FIGURE 7.

WILDFIRE NH_3 EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

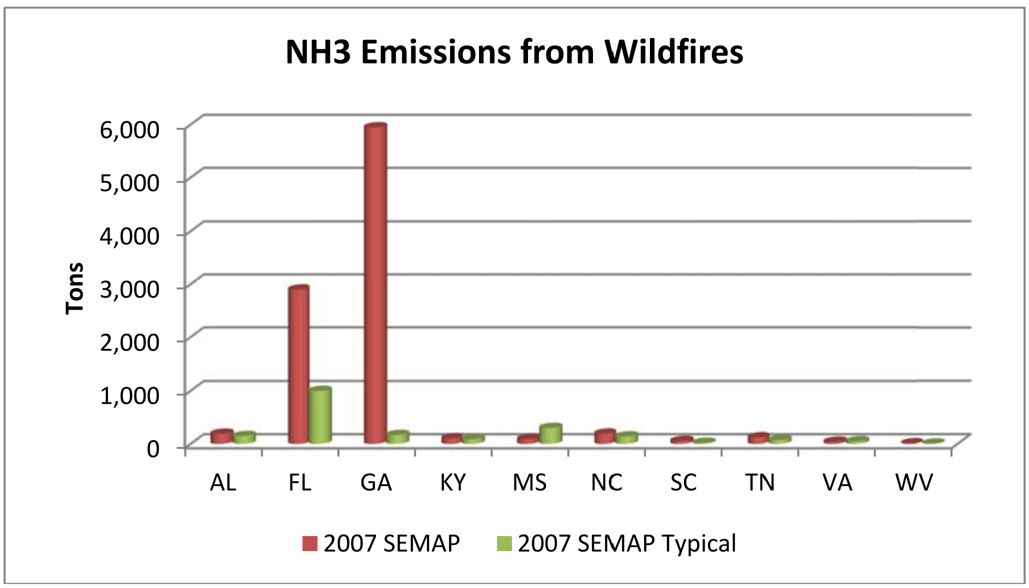


TABLE 13.

PRESCRIBED BURNING CO EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	359,596	199,974	208,060
FL	643,933	430,105	493,179
GA	473,461	348,655	402,157
KY	2,940	4,341	3,638
MS	11,350		
NC	13,158	21,951	7,329
SC	166,622	123,800	124,463
TN	580	9,246	6,072
VA	6,547	6,024	4,379
WV	30	219	130
Total	**1,678,217**	**1,144,315**	**1,249,407**

FIGURE 8.

PRESCRIBED BURNING CO EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

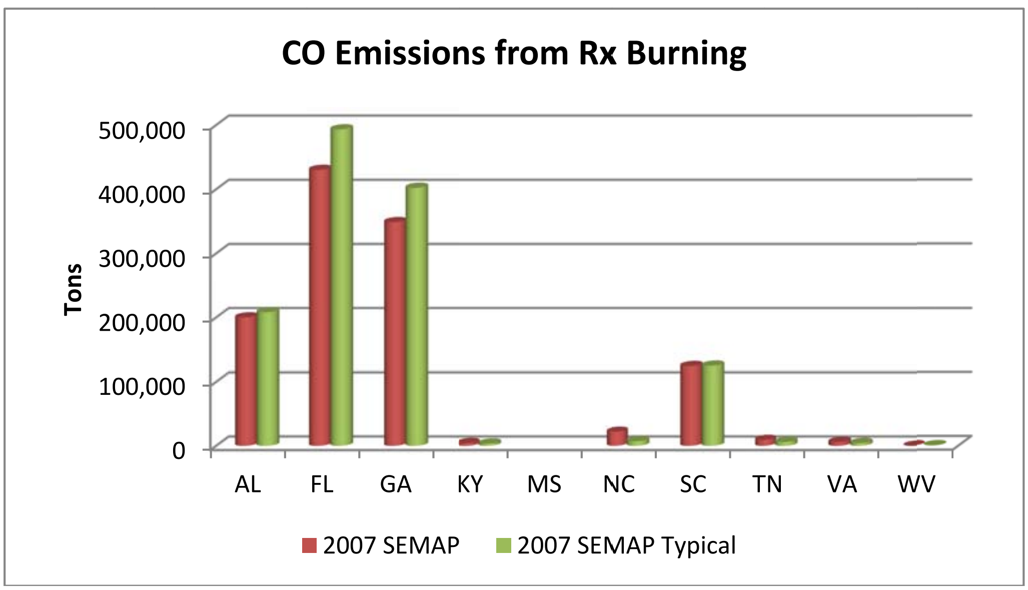


TABLE 14.

PRESCRIBED BURNING NO_X EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	7,715	6,830	7,106
FL	13,814	12,732	14,488
GA	10,157	13,841	15,294
KY	55	164	148
MS	244		
NC	282	943	315
SC	3,575	5,343	5,372
TN	11	209	136
VA	708	178	147
WV	1	7	4
Total	**36,562**	**40,247**	**43,010**

FIGURE 9.

PRESCRIBED BURNING NO_X EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

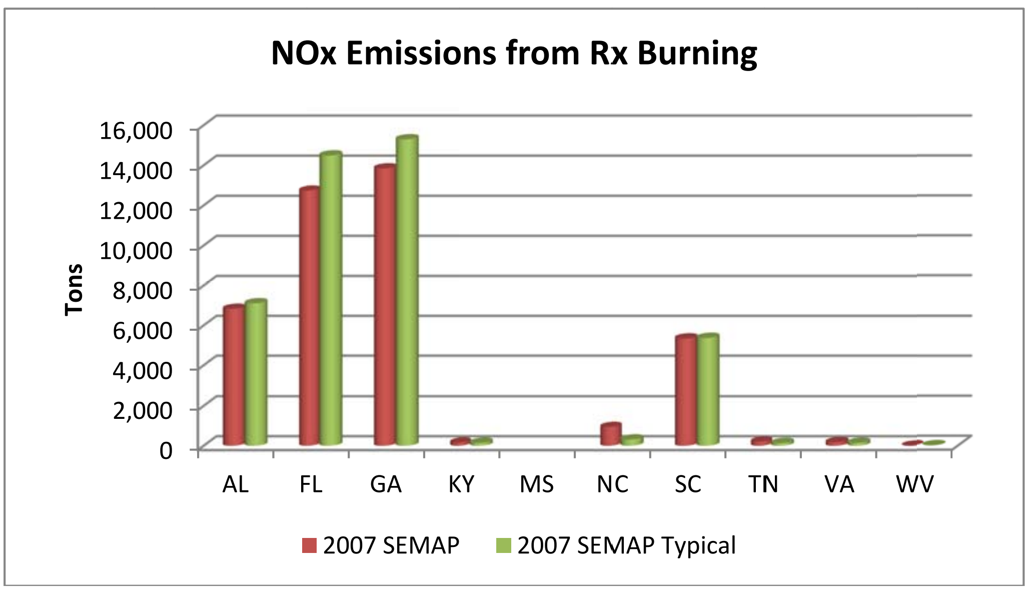


TABLE 15.

PRESCRIBED BURNING SO_2 EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	2,115	1,867	1,943
FL	3,788	3,481	3,963
GA	2,785	3,795	4,193
KY	2	45	41
MS	67		
NC	77	259	86
SC	980	1,465	1,473
TN	0	57	37
VA	25	49	40
WV	0	2	1
Total	**9,839**	**11,020**	**11,777**

FIGURE 10.

PRESCRIBED BURNING SO_2 EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

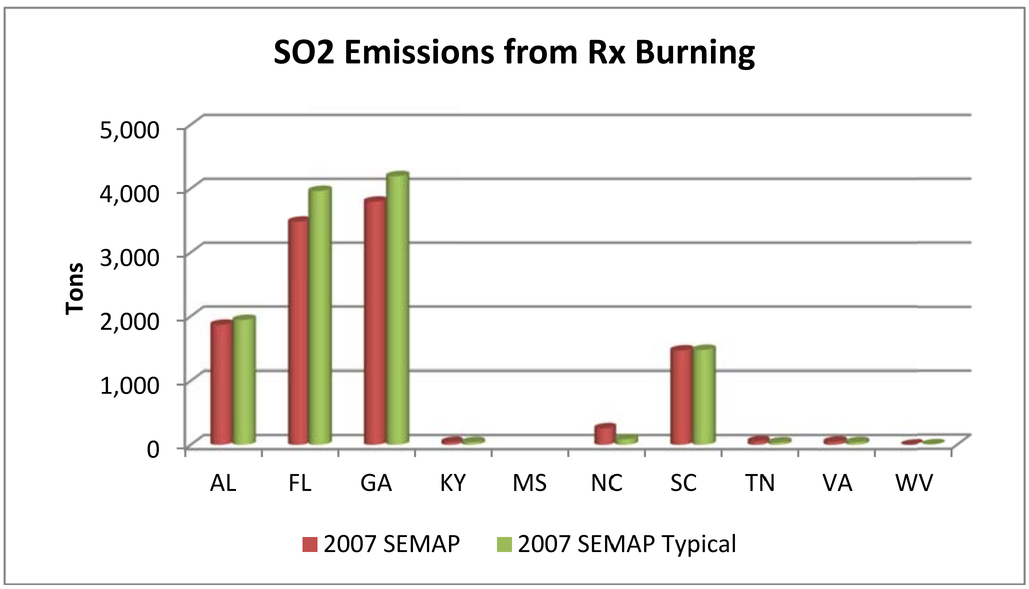


TABLE 16.

PRESCRIBED BURNING VOC EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	16,922	13,269	13,806
FL	30,303	25,988	29,609
GA	22,281	26,461	29,460
KY	140	319	285
MS	534		
NC	619	1,779	594
SC	7,841	10,073	10,127
TN	28	453	295
VA	319	373	298
WV	1	14	7
Total	**78,988**	**78,729**	**84,481**

FIGURE 11.

PRESCRIBED BURNING VOC EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

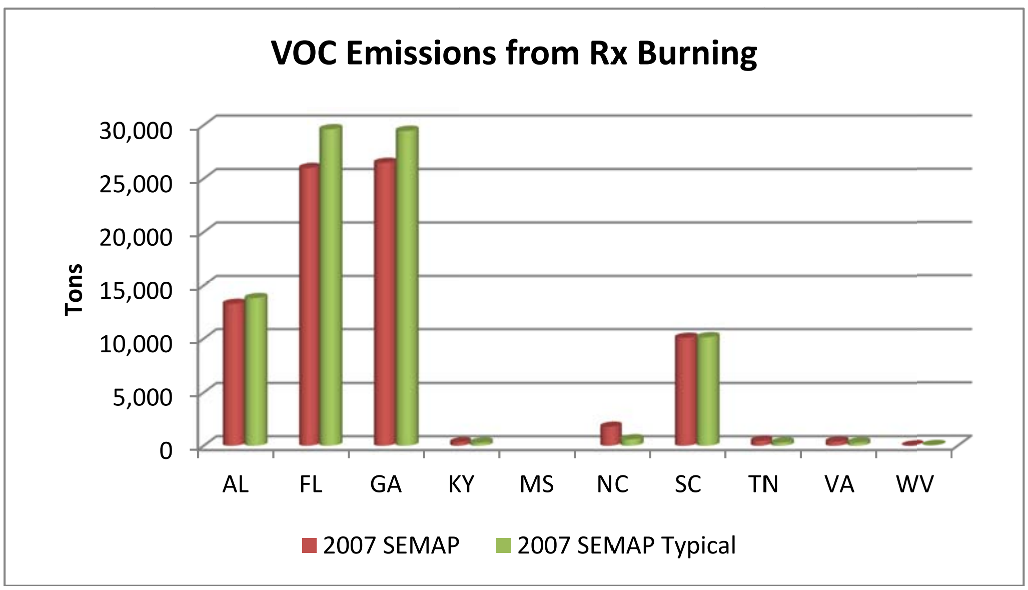


TABLE 17.

PRESCRIBED BURNING PM_{10}-PRI EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	34,964	26,991	28,082
FL	62,611	53,463	60,933
GA	46,035	54,537	60,729
KY	412	657	587
MS	1,104		
NC	1,279	3,666	1,224
SC	16,201	20,755	20,867
TN	81	936	609
VA	6,247	759	609
WV	3	29	15
Total	**168,937**	**161,793**	**173,655**

FIGURE 12.

PRESCRIBED BURNING PM_{10}-PRI EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

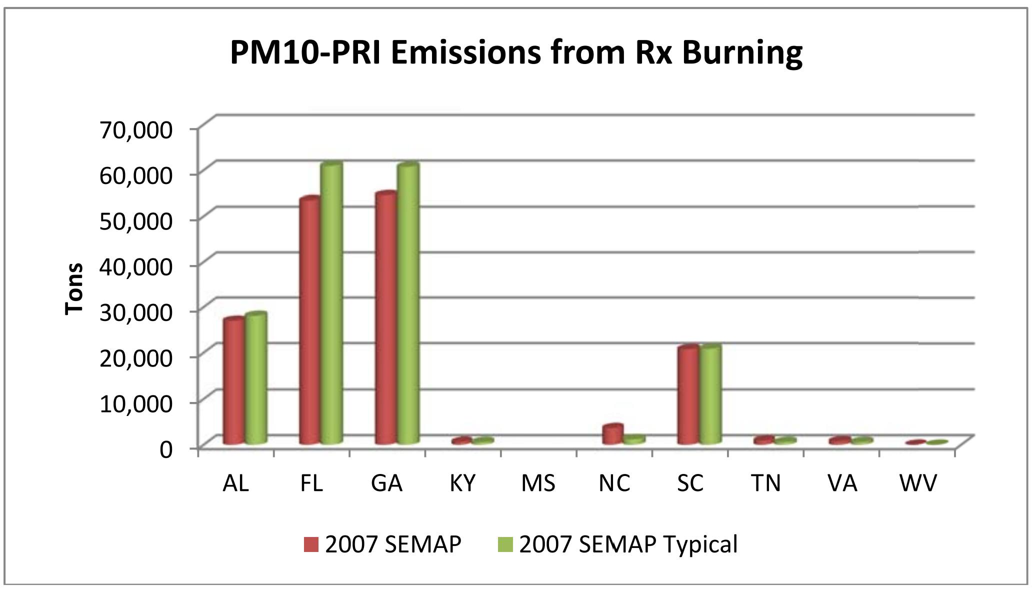


TABLE 18.

PRESCRIBED BURNING $PM_{2.5}$-PRI EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	29,987	23,662	24,619
FL	53,698	46,632	53,127
GA	39,482	48,501	53,894
KY	371	583	522
MS	947		
NC	1,097	3,273	1,093
SC	13,895	18,532	18,631
TN	73	805	524
VA	5,622	667	538
WV	3	26	13
Total	**145,175**	**142,681**	**152,961**

FIGURE 13.

PRESCRIBED BURNING $PM_{2.5}$-PRI EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

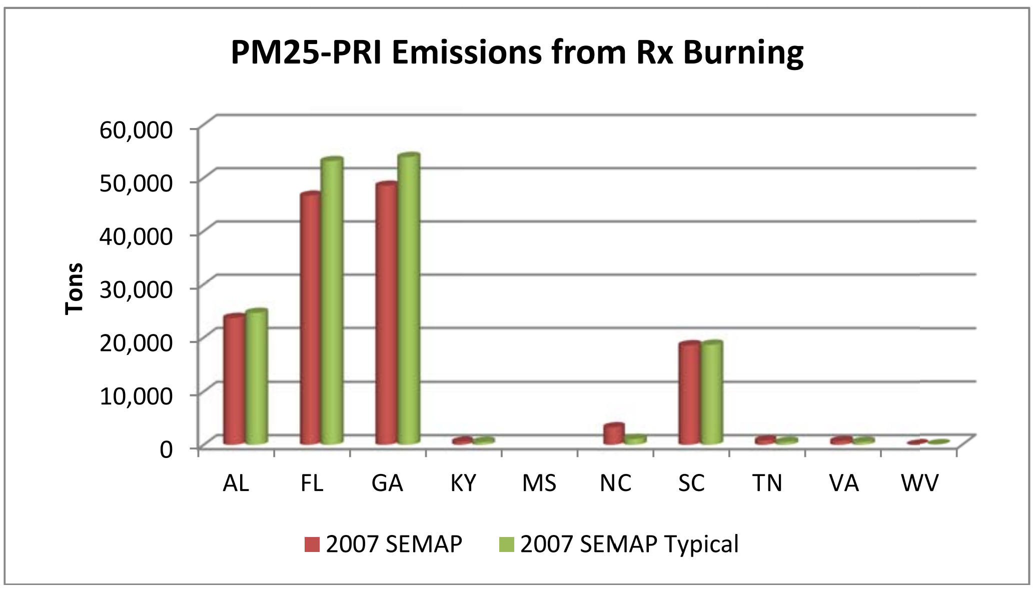


TABLE 19.

PRESCRIBED BURNING NH_3 EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	1,618	1,394	1,450
FL	2,897	2,685	3,054
GA	2,130	2,902	3,207
KY	8	34	31
MS	51		
NC	59	198	66
SC	750	1,120	1,126
TN	2	44	28
VA	103	37	31
WV	0	1	1
Total	**7,618**	**8,415**	**8,994**

FIGURE 14.

PRESCRIBED BURNING NH_3 EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

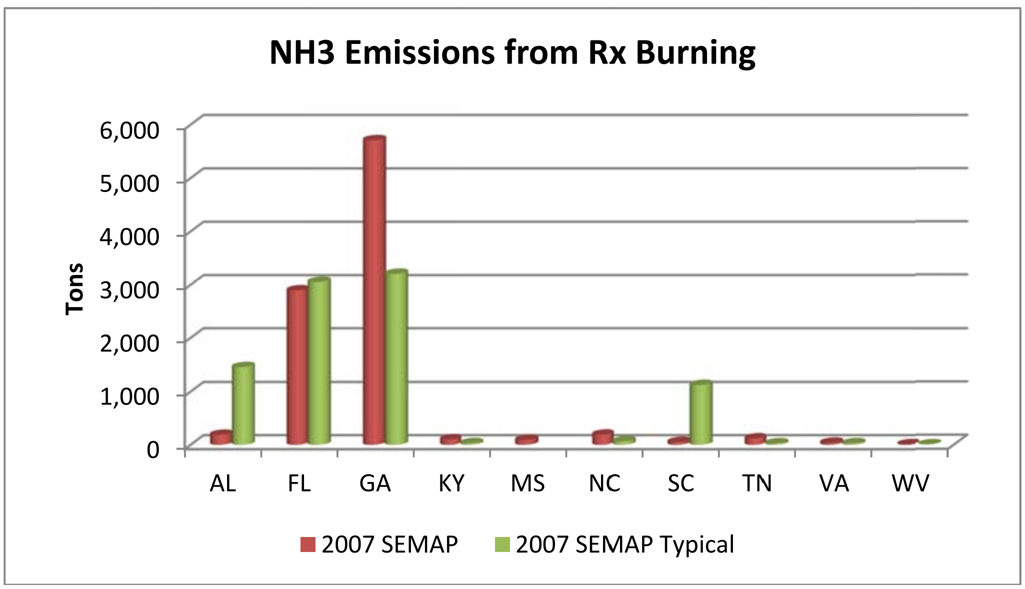


TABLE 20.

AGRICULTURAL BURNING CO EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	9,146	5,710	5,710
FL	62,191	98,966	114,340
GA	16,782	15,134	18,227
KY			
MS	42,319		
NC	12,051	17,423	17,423
SC	21,785	17,502	18,361
TN			
VA			
WV			
Total	**164,274**	**154,735**	**174,061**

FIGURE 15.

AGRICULTURAL BURNING CO EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

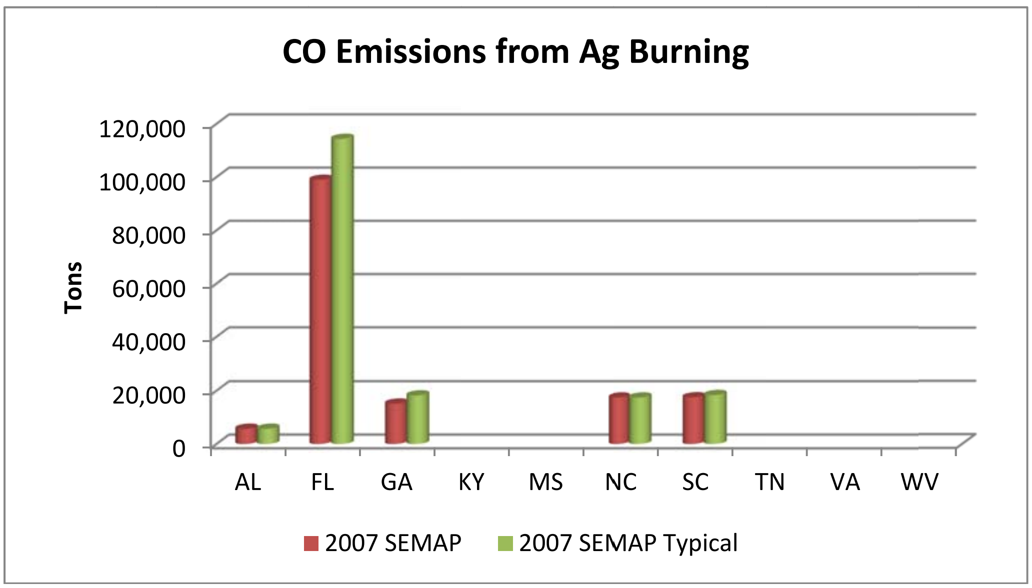


TABLE 21.

AGRICULTURAL BURNING NO_X EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL		222	222
FL		3,633	4,193
GA		588	709
KY			
MS	903		
NC		677	677
SC		588	617
TN			
VA			
WV			
Total	**903**	**5,708**	**6,418**

FIGURE 16.

AGRICULTURAL BURNING NO_X EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

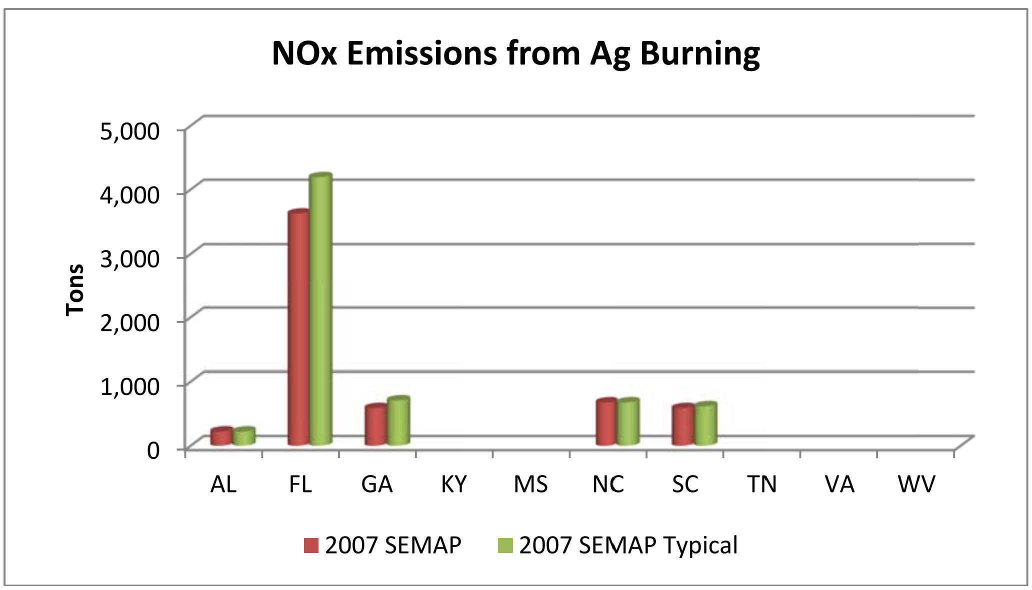


TABLE 22.

AGRICULTURAL BURNING SO_2 EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL		26	26
FL		684	773
GA		68	82
KY			
MS			
NC		78	78
SC		87	91
TN			
VA			
WV			
Total	**0**	**943**	**1050**

FIGURE 17.

AGRICULTURAL BURNING SO_2 EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

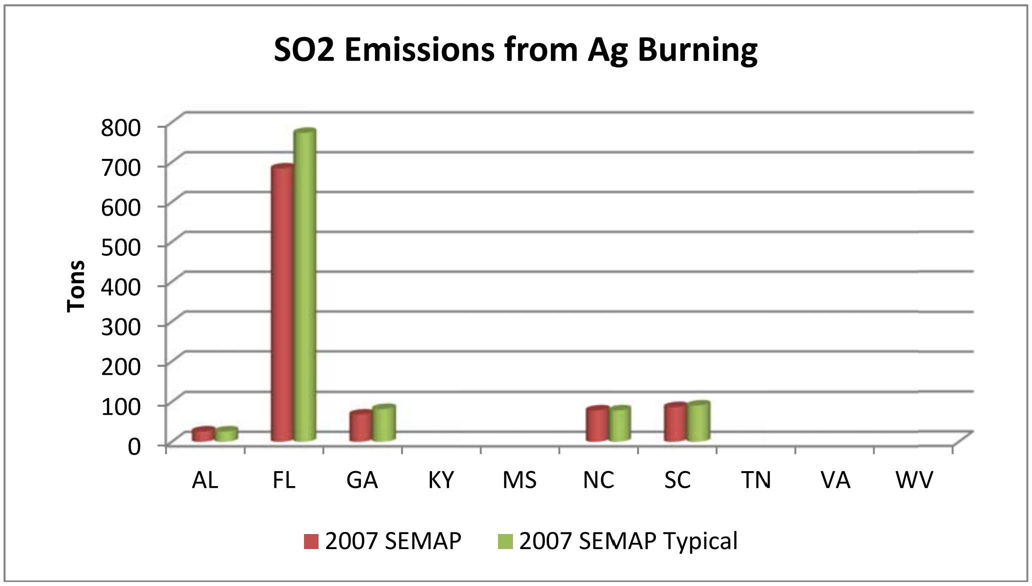


TABLE 23.

AGRICULTURAL BURNING VOC EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	1,407	878	878
FL	7,609	11,966	13,838
GA	2,582	2,328	2,804
KY			
MS	5,874		
NC	1,123	1,624	1,624
SC	3,352	2,243	2,353
TN			
VA			
WV			
Total	**21,947**	**19,039**	**21,497**

FIGURE 18.

AGRICULTURAL BURNING VOC EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

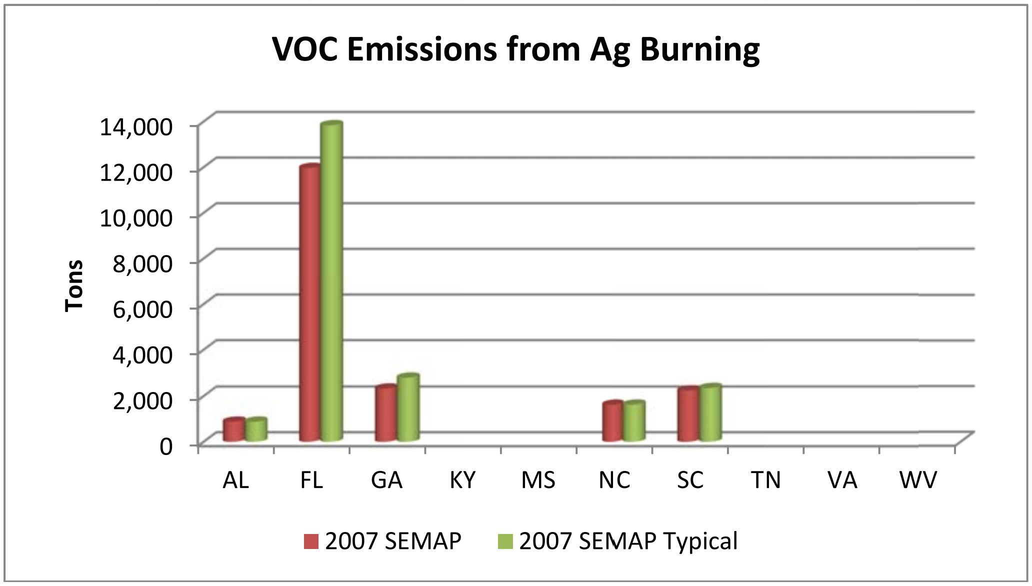


TABLE 24.

AGRICULTURAL BURNING PM_{10}-PRI EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	1,642	1,025	1,025
FL	14,306	20,696	24,080
GA	3,012	2,716	3,272
KY			
MS	6,301		
NC	1,787	2,584	2,584
SC	3,910	3,646	3,825
TN			
VA			
WV			
Total	**30,958**	**30,667**	**34,786**

FIGURE 19.

AGRICULTURAL BURNING PM_{10}-PRI EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

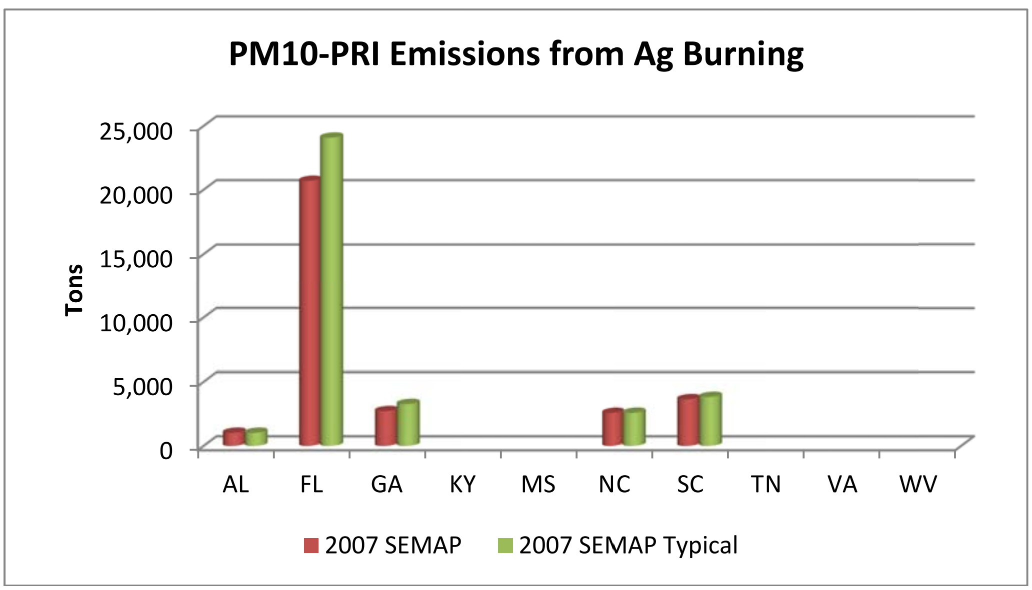


TABLE 25.

AGRICULTURAL BURNING $PM_{2.5}$-PRI EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	1,642	1,025	1,025
FL	14,306	20,696	24,080
GA	3,012	2,716	3,272
KY			
MS	5,728		
NC	1,787	2,584	2,584
SC	3,910	3,646	3,825
TN			
VA			
WV			
Total	**30,385**	**30,667**	**34,786**

FIGURE 20.

AGRICULTURAL BURNING $PM_{2.5}$-PRI EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

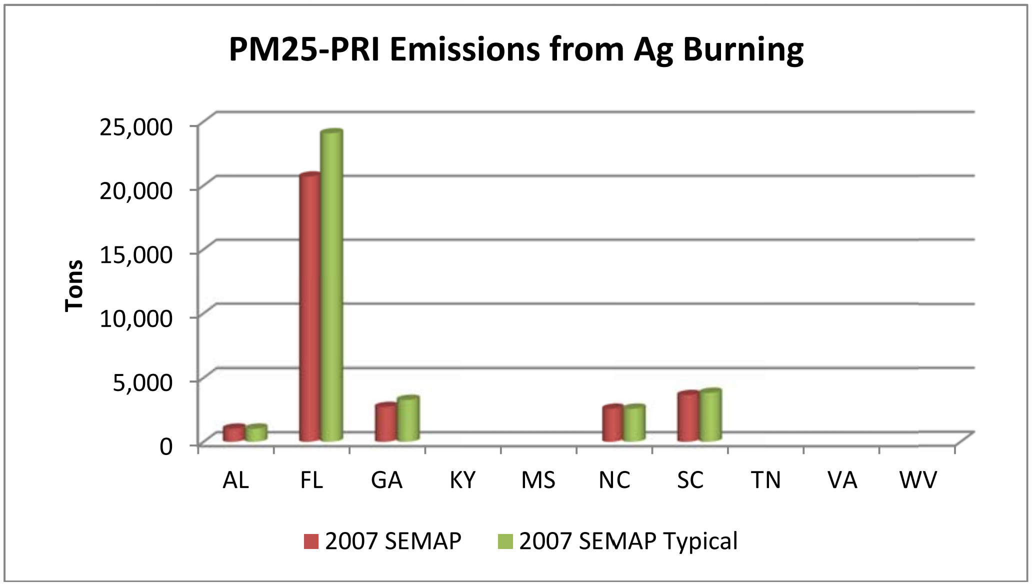


TABLE 26.

AGRICULTURAL BURNING NH_3 EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL		106	106
FL		1,818	2,107
GA		280	337
KY			
MS			
NC		322	322
SC		314	329
TN			
VA			
WV			
Total	**0**	**2,840**	**3,201**

FIGURE 21.

AGRICULTURAL BURNING NH_3 EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

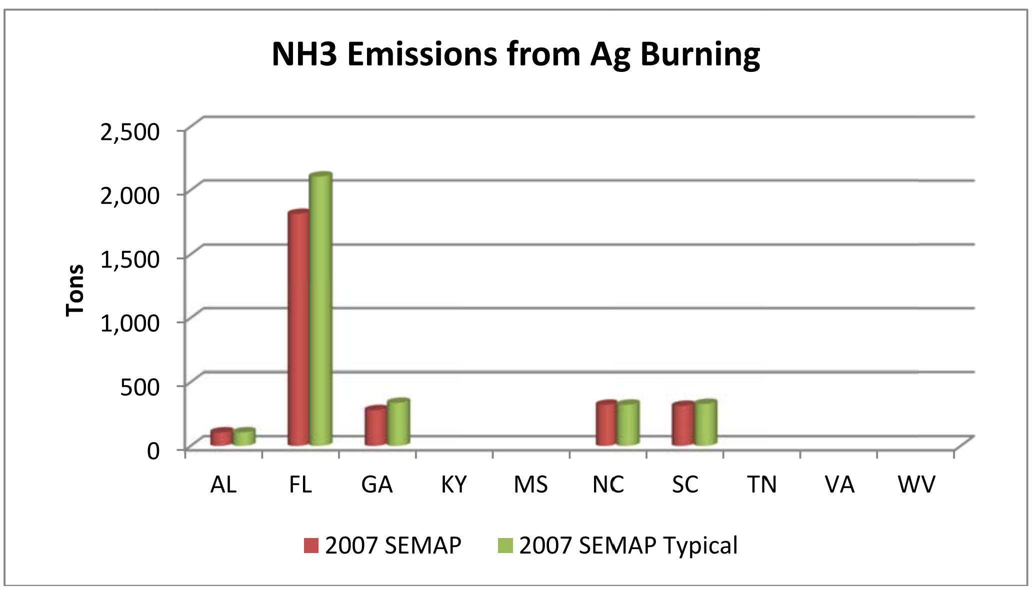


TABLE 27.

LAND CLEARING CO EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	90,368	42,147	42,147
FL	38,735	1,816	2,765
GA	64,454	85,833	89,077
KY	30,957	24,290	24,290
MS	44,295		
NC	116,975		
SC	8,752	53,636	53,636
TN	67,884	63,984	63,984
VA		43,980	43,980
WV	29,988		
Total	**492,408**	**315,686**	**319,879**

FIGURE 22.

LAND CLEARING CO EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

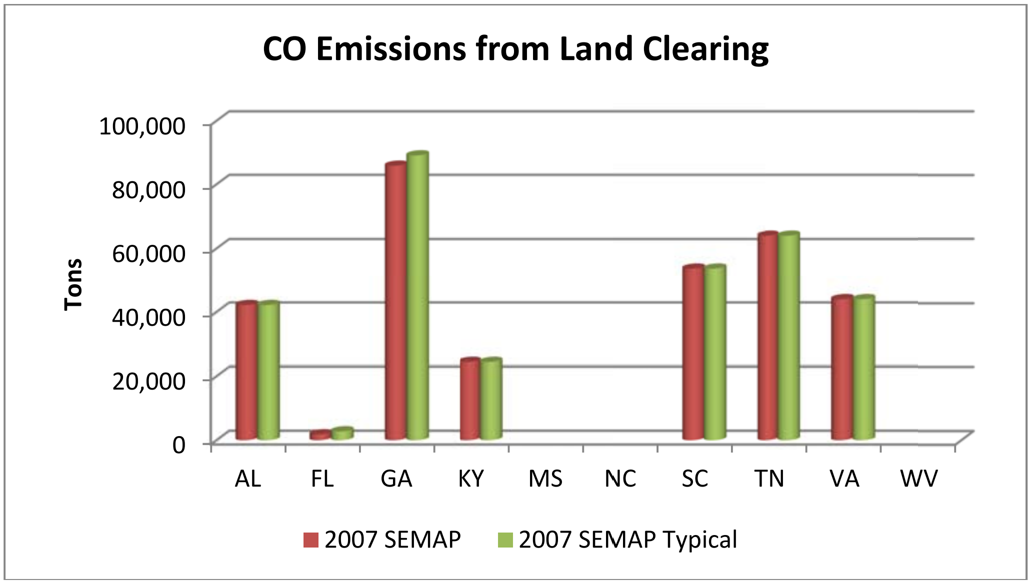


TABLE 28.

LAND CLEARING NO_X EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	2,674	1,247	1,247
FL	1,146	54	82
GA	1,907	2,539	2,635
KY	916	719	719
MS	1,311		
NC	3,461		
SC	259	1,587	1,587
TN	2,008	1,886	1,886
VA		1,301	1,301
WV	887		
Total	**14,569**	**9,333**	**9,457**

FIGURE 23.

LAND CLEARING NO_X EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

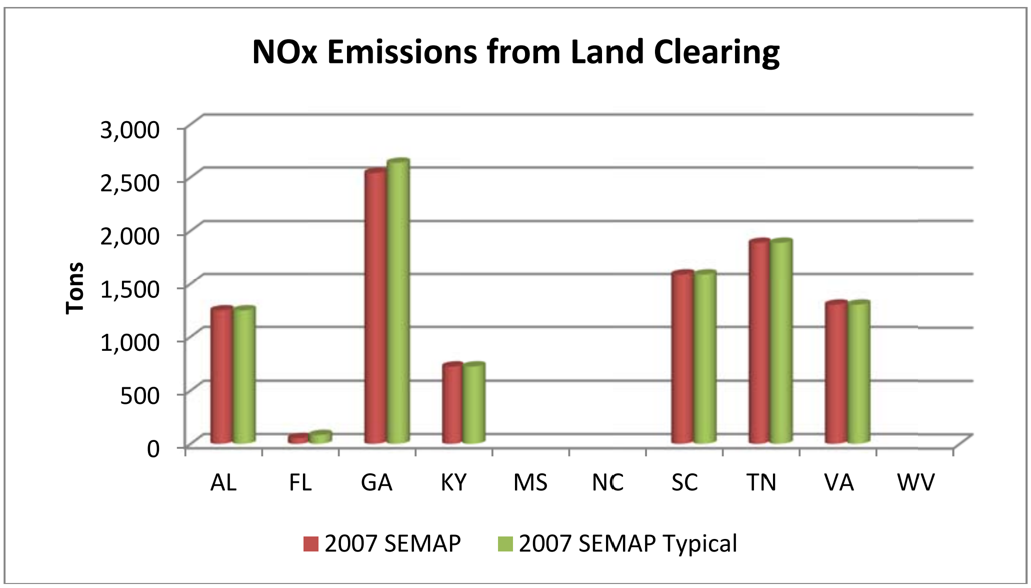


TABLE 29.

LAND CLEARING VOC EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	6,203	2,893	2,893
FL	2,659	125	190
GA	4,424	5,891	6,114
KY	2,125	1,667	1,667
MS	3,040		
NC	8,029		
SC	601	3,681	3,681
TN	4,659	4,876	4,876
VA		3,019	3,019
WV	2,058		
Total	**33,798**	**22,152**	**22,440**

FIGURE 24.

LAND CLEARING VOC EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

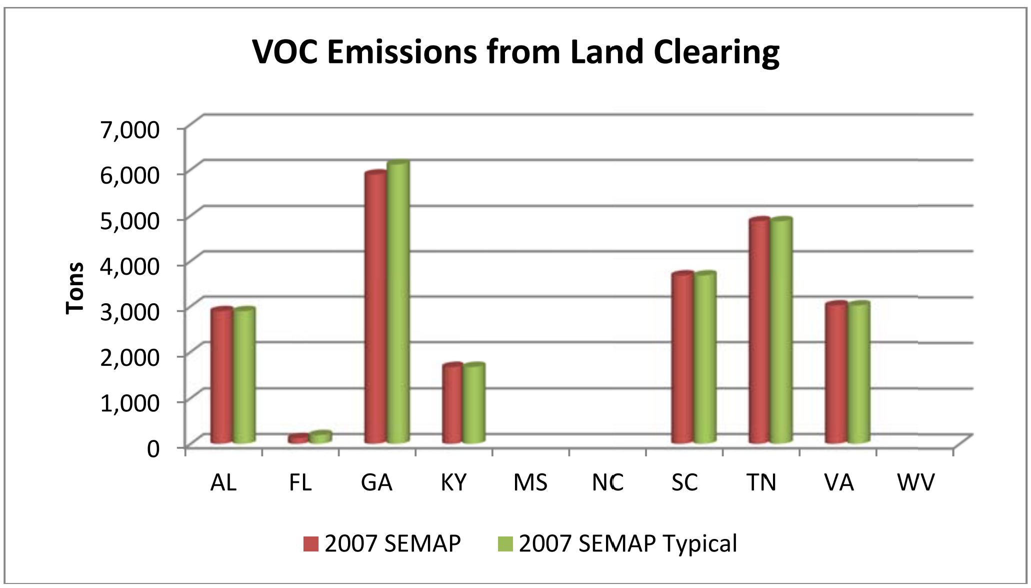


TABLE 30.

LAND CLEARING PM_{10}-PRI EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	9,090	4,240	4,240
FL	3,896	183	278
GA	6,484	8,634	8,960
KY	4,039	2,443	2,443
MS	4,456		
NC	11,767		
SC	880	5,395	5,395
TN	7,831	7,448	7,448
VA	10,687	4,424	4,424
WV	3,017	6,280	
Total	**62,147**	**39,047**	**33,188**

FIGURE 25.

LAND CLEARING PM_{10}-PRI EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

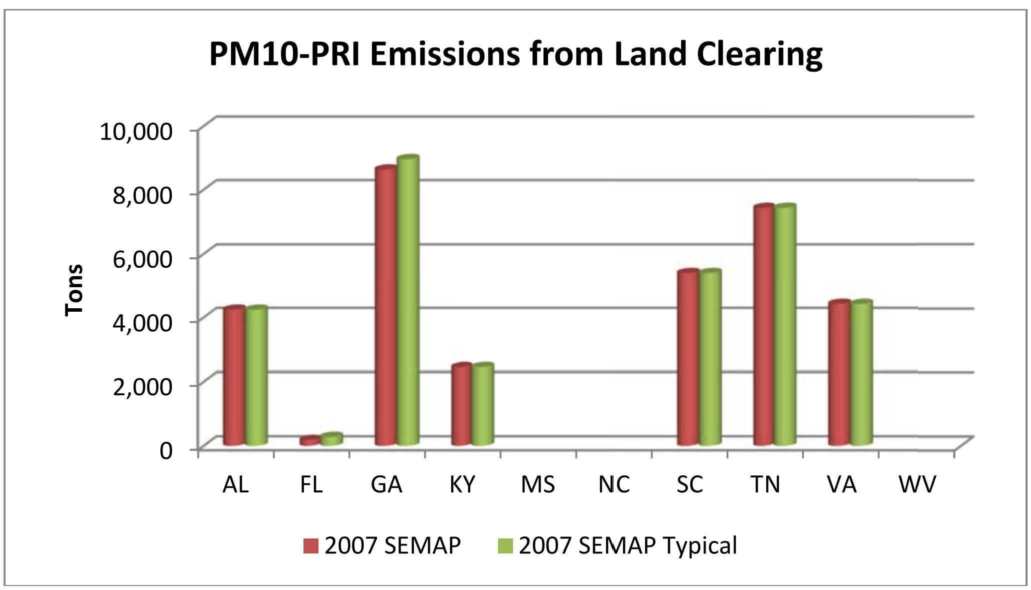


TABLE 31.

LAND CLEARING $PM_{2.5}$-PRI EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	9,090	4,240	4,240
FL	3,896	183	278
GA	6,484	8,634	8,960
KY	4,039	2,443	2,443
MS	4,456		
NC	11,767		
SC	880	5,395	5,395
TN	7,831	7,463	7,463
VA	10,687	4,424	4,424
WV	3,017		
Total	**62,147**	**32,782**	**33,203**

FIGURE 26.

LAND CLEARING $PM_{2.5}$-PRI EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

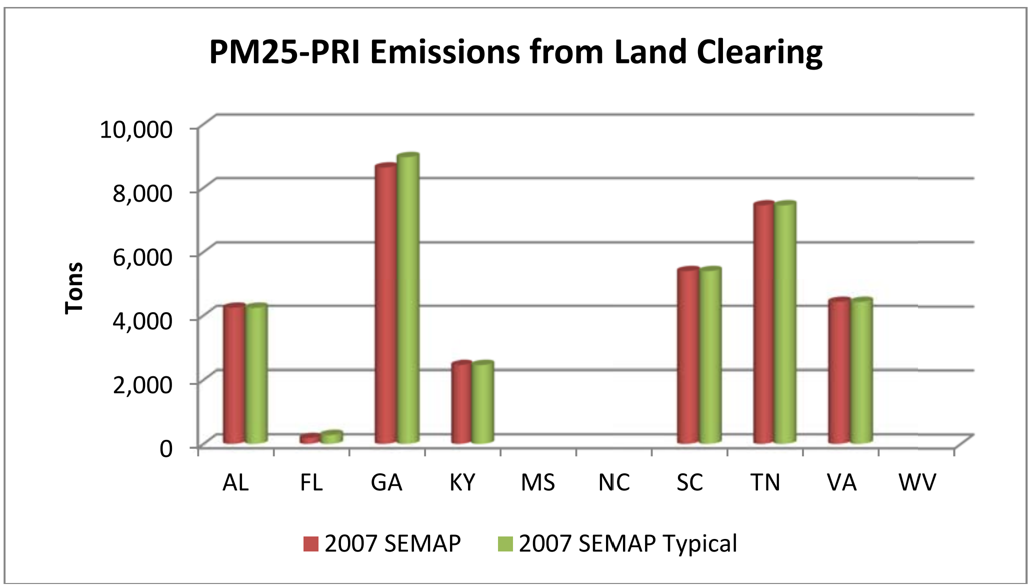


TABLE 32.

COMBINED NON-WILDFIRE BURNING CO EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	459,110	247,831	255,917
FL	744,859	530,887	610,283
GA	554,696	449,622	509,461
KY	33,897	28,631	27,928
MS	97,964	748,156	619,082
NC	142,184	39,375	24,752
SC	197,159	194,937	196,459
TN	68,464	73,230	70,056
VA	6,547	50,004	48,359
WV	30,017	219	130
Total	**2,334,897**	**2,362,892**	**2,362,427**

FIGURE 27.

COMBINED NON-WILDFIRE BURNING CO EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

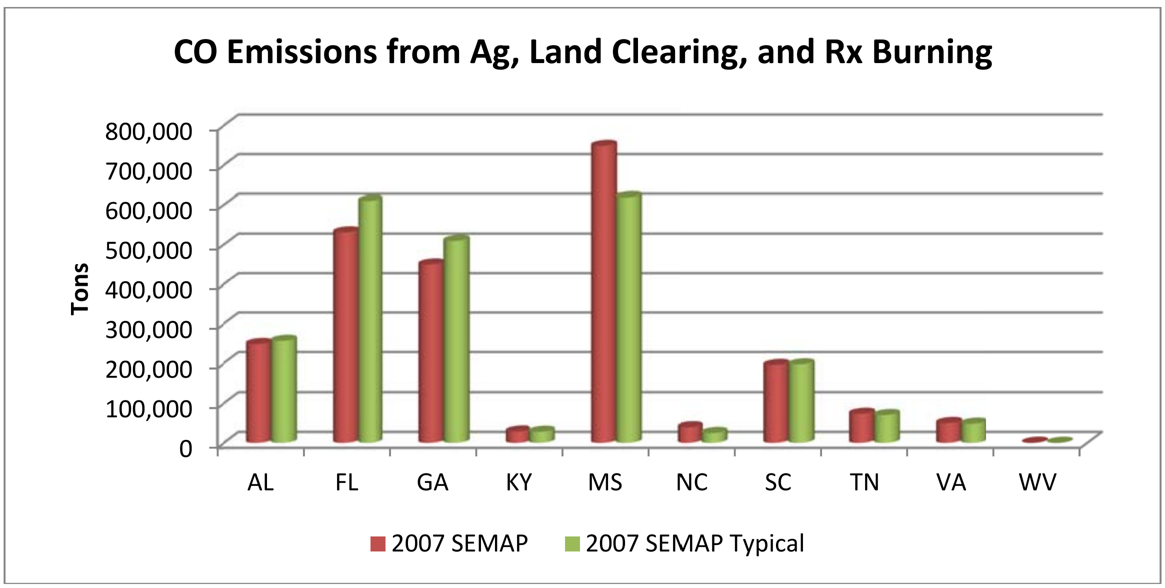


TABLE 33.

COMBINED NON-WILDFIRE BURNING NO_X EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	10,388	8,299	8,575
FL	14,960	16,418	18,762
GA	12,064	16,969	18,638
KY	971	882	867
MS	2,457	12,360	10,528
NC	3,743	1,620	992
SC	3,834	7,518	7,576
TN	2,019	2,095	2,022
VA	708	1,479	1,448
WV	888	7	4
Total	**52,032**	**67,647**	**69,412**

FIGURE 28.

COMBINED NON-WILDFIRE BURNING NO_X EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

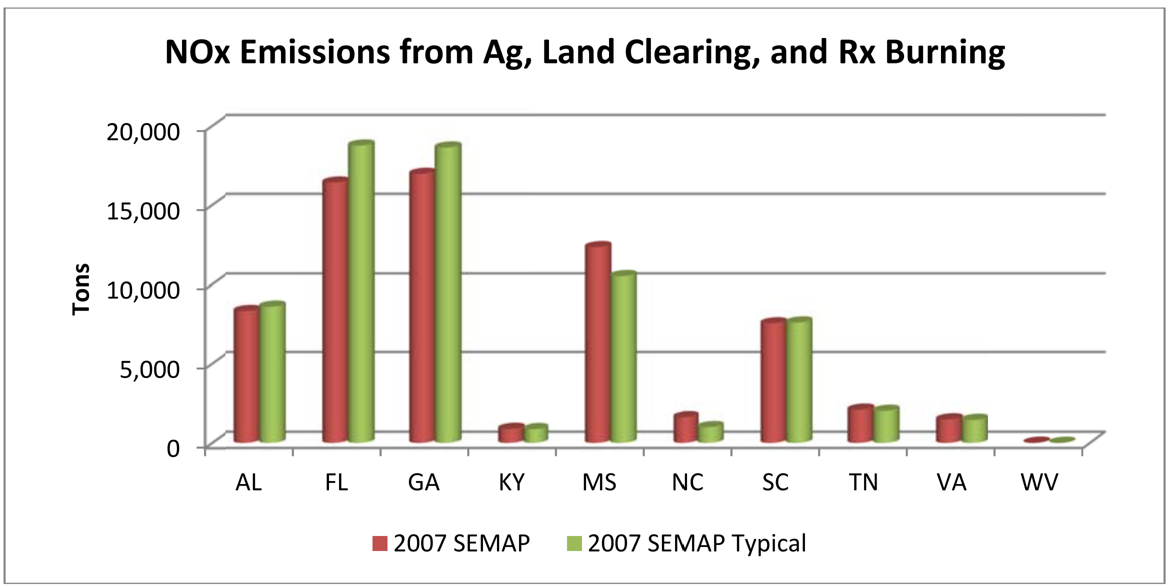


TABLE 34.

COMBINED NON-WILDFIRE BURNING SO_2 EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	2,115	1,893	1,968
FL	3,788	4,166	4,736
GA	2,785	3,863	4,275
KY	2	45	41
MS	67	6,280	5,289
NC	77	337	165
SC	980	1,552	1,564
TN	0	57	37
VA	25	49	40
WV	0	2	1
Total	**9,839**	**18,244**	**18,116**

FIGURE 29.

COMBINED NON-WILDFIRE BURNING SO_2 EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

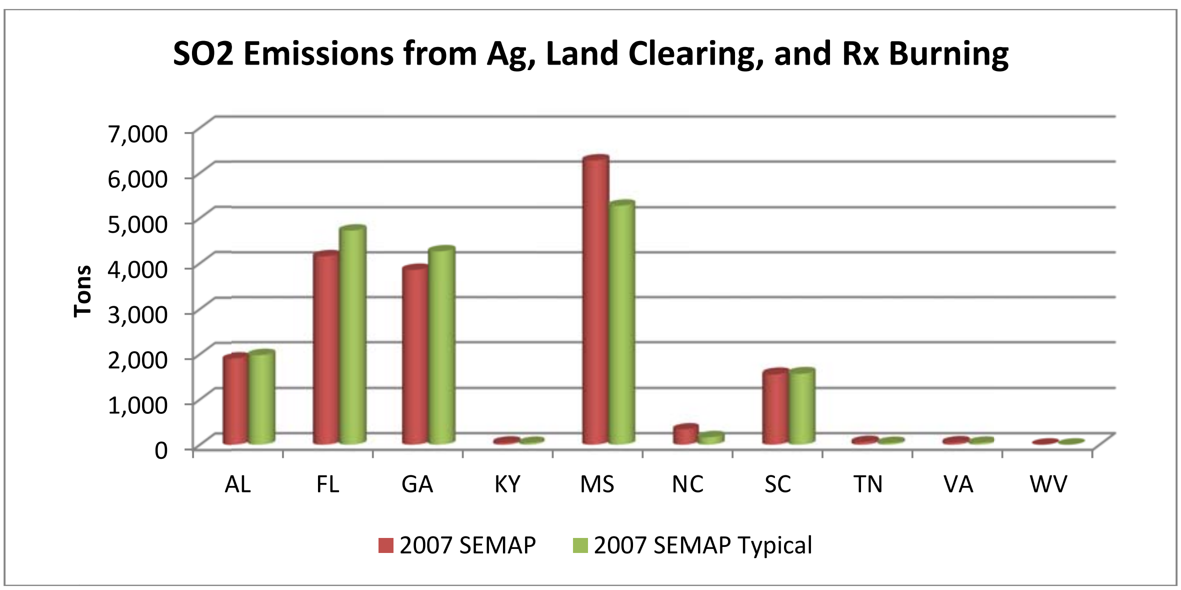


TABLE 35.

COMBINED NON-WILDFIRE BURNING VOC EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	24,532	17,040	17,577
FL	40,570	38,078	43,636
GA	29,286	34,681	38,379
KY	2,265	1,986	1,952
MS	9,448	177,114	146,642
NC	9,772	3,404	2,218
SC	11,793	15,997	16,162
TN	4,687	5,329	5,171
VA	319	3,392	3,317
WV	2,060	14	7
Total	**134,732**	**297,035**	**275,061**

FIGURE 30.

COMBINED NON-WILDFIRE BURNING VOC EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

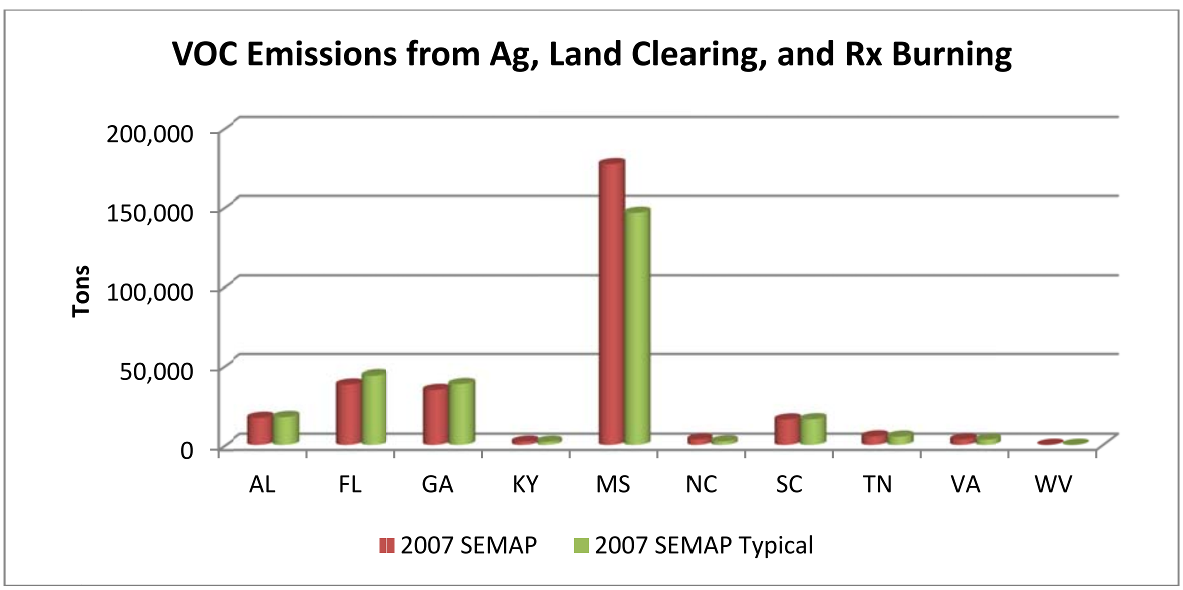


TABLE 36.

COMBINED NON-WILDFIRE BURNING PM_{10}-PRI EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	45,696	32,255	33,347
FL	80,813	74,342	85,291
GA	55,531	65,888	72,961
KY	4,451	3,100	3,030
MS	11,860	78,030	64,837
NC	14,833	6,250	3,808
SC	20,991	29,797	30,087
TN	7,912	8,384	8,057
VA	16,934	5,183	5,033
WV	3,019	6,309	15
Total	**262,040**	**309,538**	**306,466**

FIGURE 31.

COMBINED NON-WILDFIRE BURNING PM_{10}-PRI EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

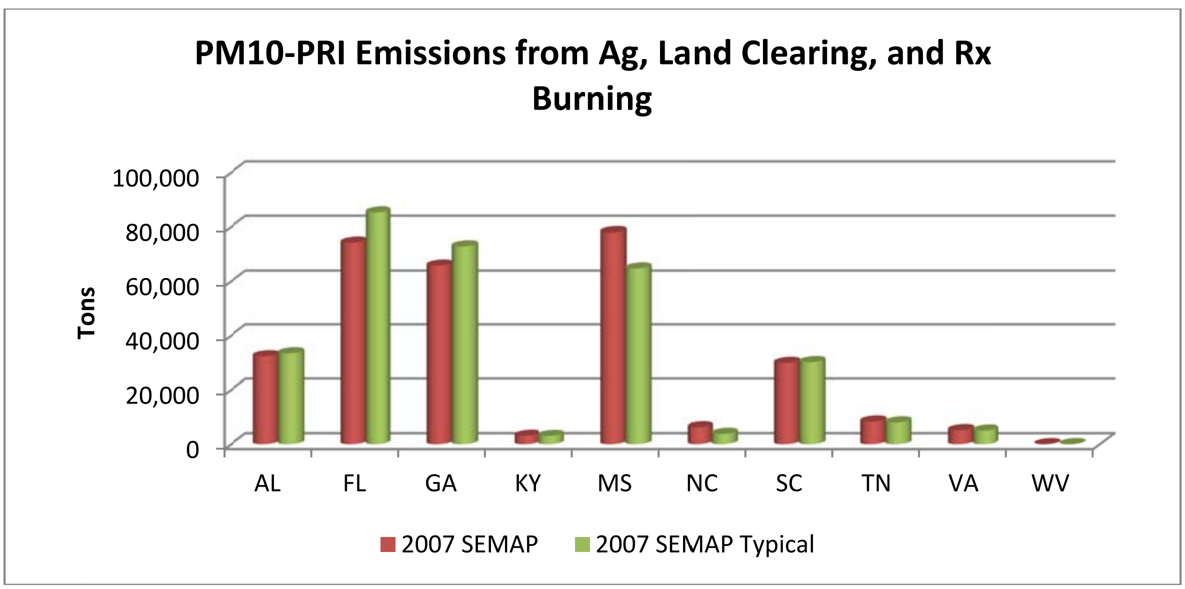


TABLE 37.

COMBINED NON-WILDFIRE BURNING $PM_{2.5}$-PRI EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	40,719	28,926	29,883
FL	71,901	67,511	77,485
GA	48,978	59,852	66,126
KY	4,410	3,026	2,966
MS	11,130	66,128	54,947
NC	14,651	5,857	3,677
SC	18,685	27,573	27,851
TN	7,904	8,268	7,987
VA	16,309	5,091	4,962
WV	3,019	26	13
Total	**237,706**	**272,258**	**275,897**

FIGURE 32.

COMBINED NON-WILDFIRE BURNING $PM_{2.5}$-PRI EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL

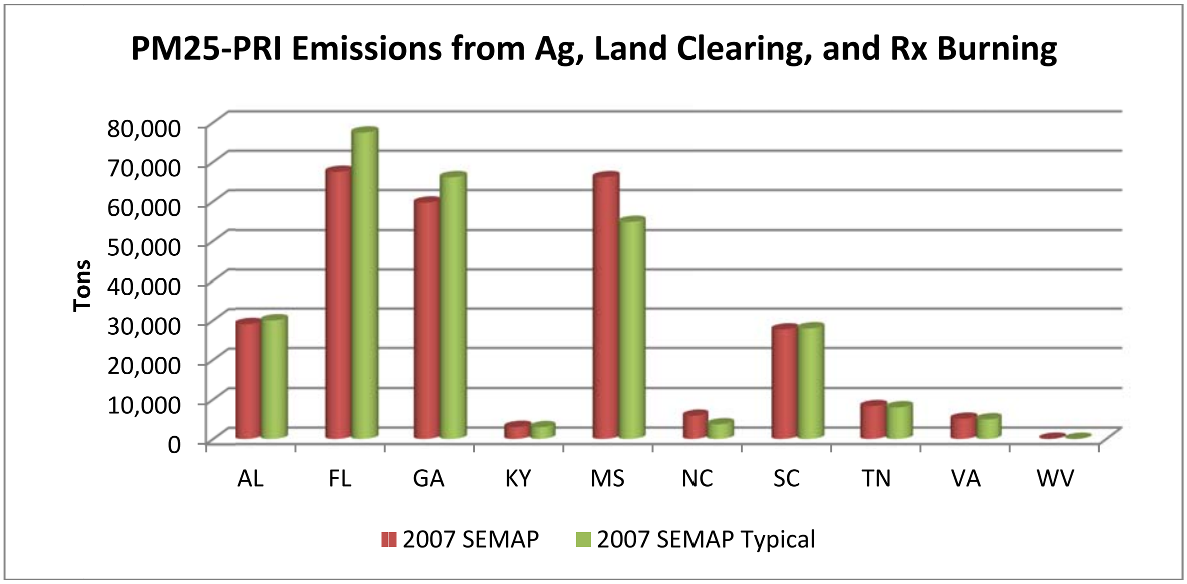


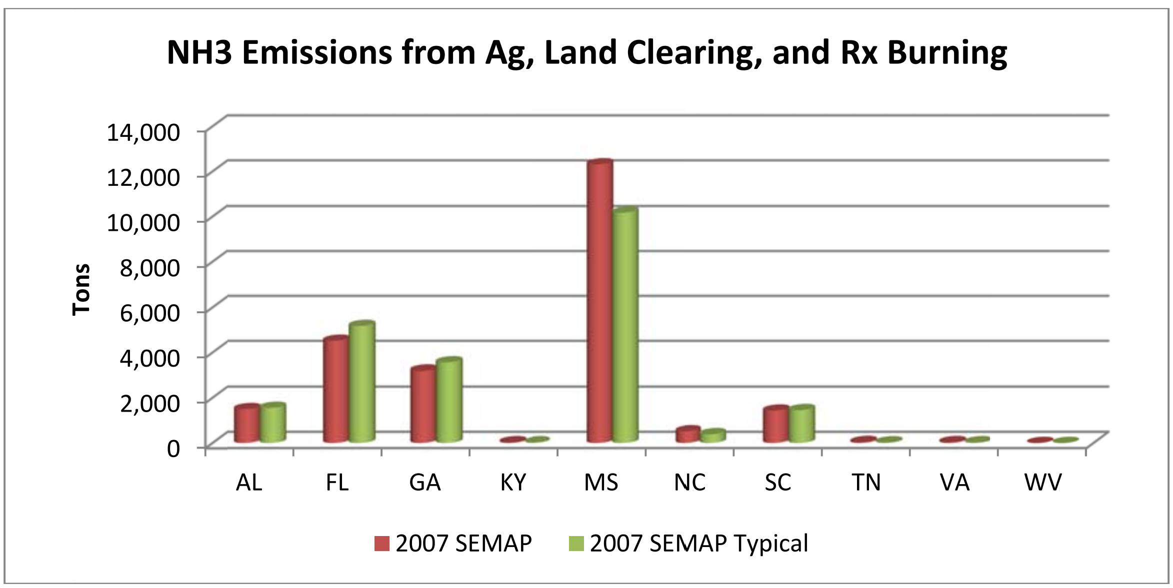
TABLE 38.

COMBINED NON-WILDFIRE BURNING NH_3 EMISSIONS (ALL VALUES IN TONS)

	VISTAS 2002 Base G Actual	SEMAP 2007 Actual	SEMAP 2007 Typical
AL	1,618	1,499	1,556
FL	2,897	4,503	5,161
GA	2,130	3,182	3,544
KY	8	34	31
MS	51	12,321	10,201
NC	59	520	388
SC	750	1,434	1,455
TN	2	44	28
VA	103	37	31
WV	0	1	1
Total	**7,618**	**23,575**	**22,396**

FIGURE 33.

COMBINED NON-WILDFIRE BURNING NH_3 EMISSIONS BY STATE FOR 2007 ACTUAL AND TYPICAL



Appendix A

Fire Fuel Consumption Values

TABLE A-1.

FUEL CONSUMPTION VALUES USED TO PRODUCE FIRE EMISSION FOR NFDRS CLASSIFIED FIRES

The table below provides the values used in the 2002 VISTAS Base G inventory

NFDRS Fuel Model	Vegetation	1h	10h	100h	1000h	live woody	live herb.	Average fuel loading	EPA wildfire fuel loading	EPA prescribed fuel loading	Bayle revised*
A	Annual grass and forbs	0.2					0.3	0.23	0.5	0.5	0.5
B	Mature chaparral	3.5	4	0.5		11.5		12.35	19.5	19.5	12.35
C	Open timber/grass	0.4	1			0.5	0.8	1.68	4.7	4.7	2
D	Southern rough	2	1			3	0.75	4.275	15.6	10.6	4.275
E	Hardwoods (winter)	1.5	0.5	0.25		0.5	0.5	2.375			2.375
F	Intermediate brush	2.5	2	1.5		9		8.85	3.8	3.8	8.85
G	Closed, short-needle conifer (heavy dead)	2.5	2	5	12	0.5	0.5	8.45	73.5	25.6	8.45
H	Closed, short-needle conifer (normal dead)	1.5	1	2	2	0.5	0.5	3.95	27.5	15	3.95
I	Heavy slash	12	12	10	12			30.2	55.1	49.1	30.2
J	Medium slash	7	7	6	5.5			17.55	34	31.2	12
K	Light slash	2.5	2.5	2	2.5			6.25	14.4	13.1	6.25
L	Perennial grass	0.25					0.5	0.3	0.8	0.8	0.3
N	Sawgrass	1.5	1.5			2		3.8	5	5	3.8
O	Pocosin	2	3	3	2	7		9.5	46.1	45.1	9.5
P	Southern plantation	1	1	0.5		0.5	0.5	2.5	16.4	10.2	2.5
Q	Alaskan black spruce	2	2.5	2	1	4	0.5	7.25	57.6	48.8	7.25
R	Hardwoods (summer)	0.5	0.5	0.5		0.5	0.5	1.5	3.1	3.1	2
S	Alaskan tundra	0.5	0.5	0.5	0.5	0.5	0.5	1.55			1.55
T	Sagebrush/grass	1	0.5			2.5	0.5	2.55	4.5	4.5	2.55
U	Western, long-needle conifer	1.5	1.5	1		0.5	0.5	3.75	19.1	10.3	3.75

* Bayle revised values were the values used to produce the emission inventory.

The values in this table are the revised values used for the 2007 actual and typical base year inventories. These values were based on consultation with fire experts from the southeastern U.S. after consideration of values predicted by FEPS.

NFDRS Fuel Model	Vegetation	VISTAS 2002	FEPS (A)	FEPS (B)	FEPS (C)	FEPS (D)	Initial Prescribed Fire	Initial Wildfire	RECOMMENDATION BASED ON 2/12/10 Conference Call Prescribed Fire	RECOMMENDATION BASED ON 2/12/10 Conference Call Wildfire
http://www.fs.fed.us/fire/planning/nist/nfdr.htm					**All values in tons/acre**					
A	Western annual grasses and forbs	**0.5**			0.4	0.5	**0.4**	**0.5**	**0.4**	**0.5**
B	Mature Brush (Mixed Chapparell)	**12.35**			14.8	15.8	**14.8**	**15.8**	**11.4**	**16.4**
C	Open Pine with Grass	**2**	2.6	2.2	1.8	2.5	**1.8**	**2.5**	**1.8**	**2.5**
D	Southern Rough (SE Coastal Plains Pine/Palmetto Gallberry)	**4.275**	6.9	6.1	5.3	6.5	**5.3**	**6.5**	**4.3**	**5.9**
E	Hardwood Litter (Fall)	**2.375**	2.8	2.7	2.6	2.9	**2.6**	**2.9**	**2.6**	**2.9**
F	Inter. Brush	**8.85**			11.3	12.1	**11.3**	**12.1**	**7.1**	**8.9**
G	Closed short needle conifer (heavy dead)	**8.45**	15.7	13.9	12.1	15.2	**12.1**	**15.2**	**12.1**	**15.2**
H	Closed short needle conifer (normal dead)	**3.95**	7.9	6.1	4.3	6.4	**4.3**	**6.4**	**4.3**	**6.4**
I	Heavy slash	**30.2**	42.5	40.7	38.9	43.7	**38.9**	**43.7**	**38.9**	**43.7**
J	Medium slash	**12**	25	23.3	21.6	25	**21.6**	**25**	**21.6**	**25**
K	Light, scattered slash	**6.25**	10	9	8	9.6	**8**	**9.6**	**8**	**9.6**
L	Western Perenial Grass	**0.3**			0.6	0.7	**0.6**	**0.7**	**0.6**	**0.7**
N	Sawgrass and other coarse grasses	**3.8**	3.8	3.8	3.8	4	**3.8**	**4**	**3.8**	**4**
O	Pocosin (dense shrubs over 6')	**9.5**	23	17.2	11.4	18.1	**11.4**	**18.1**	**8.1**	**18.6**
P	Southern Plantation	**2.5**	5.1	3.8	2.4	4	**2.4**	**4**	**2.4**	**4**
R	Hardwood (Summer version of E)	**2**	1.9	1.8	1.7	2	**1.7**	**2**	**1.7**	**2**

	Fuel Moisture Content (%) Profile						% Duff Consumed
	1 Hr	10 Hr	100 Hr	1000 Hr	Live Fuels	Duff	
FEPS (A)	8	9	11	15	100	100	20
FEPS (B)	8	9	11	15	120	200	10
FEPS C - Prescribed Fire	8	9	11	15	120	200	0
FEPS (D) - Wildfire	7	8	9	12	100	100	10

% Fuel Consumed					
Canopy	Shrub	Herbaceous	Dead Woody	Litter	Broadcast
63	80	63	47	100	79
80	86	89	53	100	95

Fire Sub-Work Group

FUEL CONSUMPTION VALUES

This paper documents the process used in finalizing fuel consumption values to be used in the 2010 fire emissions modeling for the southeastern modeling, analysis, and planning project (SEMAP).

Background

1. SEMAP agreed to use the same methodology that VISTAS used to estimate emissions from prescribed and wild fires. The fuel consumption data used in VISTAS was based on the National Fire Danger Rating System (NFDRS) fuel models (Attachment A). These same fuel models will be used by SEMAP in the 2010 work.

2. Discussion within the Fire Sub-Work Group centered on whether the fuel consumption values assigned in VISTAS were still acceptable. Concern was expressed over the data for wildfires as well as whether the original values accounted for consumption of duff and litter. The Fire Sub-Work Group took the lead in reviewing the fuel consumption values and determining whether adjustments were warranted.

3. The Fire Sub-Work Group decided that modeling consumption with the Fire Emissions Production Simulator (FEPS) and adjusting fuel moisture profiles and specific fuel component consumption rates would provide acceptable estimates of consumption.

Methodology

1. The FEPS model was used to estimate fuel consumption for NFDRS Fuel Models A,B,C,D,E,F,G,H,I,J,K,L,N,O,P,and R using 4 different fuel moisture content profiles. The results are displayed in Attachment B under FEPS(A), FEPS(B), FEPS(C), and FEPS(D). Based on discussions with prescribed fire managers and members of the Fire Sub-Work Group, the percent duff consumption default value was modified in FEPS to represent what is normally experienced by burners in the southeast. For prescribed fire scenarios, the percent duff consumed was set at zero; for wildfires, it was set at 10-percent.

2. Following the initial FEPS calculations, the Fire Sub-Work Group determined additional modeling was necessary to better represent how NFDRS Fuel Models B, D, F, and O burn in the southeast. Experience shows that models such as CONSUME and FEPS consume too much of the shrub layer in both Rx Fire and Wildfire for southeast fuel types. The defaults built into these models are based on western fuels (e.g., sagebrush) which tend to burn up more completely than brush types in the southeast. As such, percent consumption was modified as follows in the FEPS runs for these NFDRS models:

   a. FUEL MODEL B: For Prescribed Fire, the shrub component consumption percentage was changed to 50%; woody was at 47% and duff was set a zero. For wildfire, the fuel loading was changed to show 9 tons per acre of duff (default is zero) for pre-burn loading; then consumption percent set at 75% for shrubs, 75% for woody; 10% for duff

   b. FUEL MODEL D: For Prescribed Fire, the shrub component consumption percentage was set at 50% and woody set at 33% and duff set at Zero. For wildfire, shrubs set at 50%, woody at 100% and duff at 10%

   c. FUEL MODEL F: For Prescribed Fire, the shrub component consumption percentage was set at 33% and woody set at 47% and duff set at Zero. For wildfire, shrubs set at 40%, woody at 80% and duff at 10%

   d. FUEL MODEL O: For Prescribed Fire, the shrub component consumption percentage was set at 33% and woody set at 47% and duff set at Zero. For wildfire, shrubs set at 40%, woody at 100% and duff at 10%

Results

The fuel consumption values that the Fire Sub-Work Group and SEMAP agreed to use for the 2010 SEMAP modeling are shown in Table 1.

TABLE 1. Fuel Consumption in Pounds per Ton of Fuel Consumed by NFDRS Fuel Model.

NFDRS Fuel Model	Prescribed Fire	Wildfire
A - Western annual grasses and forbs	0.4	0.5
B - Mature Brush (Mixed Chapparell)	11.4	16.4
C - Open Pine with Grass	1.8	2.5
D - Southern Rough (SE Coastal Plains Pine/Palmetto Gallberry)	4.3	5.9
E - Hardwood Litter (Fall)	2.6	2.9
F - Intermediate. Brush	7.1	8.9
G - Closed short needle conifer (heavy dead)	12.1	15.2
H - Closed short needle conifer (normal dead)	4.3	6.4
I - Heavy slash	38.9	43.7
J - Medium slash	21.6	25
K - Light, scattered slash	8	9.6
L - Western Perenial Grass	0.6	0.7
N - Sawgrass and other coarse grasses	3.8	4
O - Pocosin (dense shrubs over 6')	8.1	18.6
P - Southern Plantation	2.4	4
R - Hardwood (Summer version of E)	1.7	2

ATTACHMENT A

NFDRS Fuel Model Descriptions

6.0 The National Fire Danger Rating System - 1978 7.0 Fuel Model Definitions	
Fuel Model A	This fuel model represents western grasslands vegetated by annual grasses and forbs. Brush or trees may be present but are very sparse, occupying less than a third of the area. Examples of types where Fuel Model A should be used are cheatgrass and medusahead. Open pinyon-juniper, sagebrush-grass, and desert shrub associations may appropriately be assigned this fuel model if the woody plants meet the density criteria. The quantity and continuity of the ground fuels vary greatly with rainfall from year to year.
Fuel Model B	Mature, dense fields of brush 6 feet or more in height are represented by this fuel model. One-fourth or more of the aerial fuel in such stands is dead. Foliage burns readily. Model B fuels are potentially very dangerous, fostering intense fast-spreading fires. This model is for California mixed chaparral generally 30 years or older. The F model is more appropriate for pure chamise stands. The B model may be used for the New Jersey pine barrens.
Fuel Model C	Open pine stands typify Model C fuels. Perennial grasses and forbs are the primary ground fuel but there is enough needle litter and branchwood present to contribute significantly to the fuel loading. Some brush and shrubs may be present but they are of little consequence. Situations covered by Fuel Model C are open, longleaf, slash, ponderosa, Jeffrey, and sugar pine stands. Some pinyon-juniper stands may qualify.
Fuel Model D	This fuel model is specifically for the palmetto-gallberry understory-pine overstory association of the southeast coastal plains. It can be also used for the so-called "low pocosins" where Fuel Model O might be too severe. This model should only be used in the Southeast because of a high moisture of extinction.
Fuel Model E	Use this model after leaf fall for hardwood and mixed hardwood-conifer types where the hardwoods dominate. The fuel is primarily hardwood leaf litter. The oak-hickory types are best represented by Fuel Model E, but E is an acceptable choice for northern hardwoods and mixed forests of the Southeast. In high winds, the fire danger may be underrated because rolling and blowing leaves are not accounted for. In the summer after the trees have leafed out, Fuel Model E should be replaced by fuel Model R.
Fuel Model F	Fuel Model F is the only one of the 1972 NFDRS Fuel Models whose application has changed. Model F now represents mature closed chamise stands and oakbrush fields of Arizona, Utah, and Colorado. It also applies to young, closed stands and mature, open stands of California mixed chaparral. Open stands of

	pinyon-juniper are represented; however, fire activity will be overrated at low windspeeds and where there is sparse ground fuels.
Fuel Model G	Fuel Model G is used for dense conifer stands where there is a heavy accumulation of litter and downed woody material. Such stands are typically overmature and may also be suffering insect, disease, wind, or ice damage -- natural events that create a very heavy buildup of dead material on the forest floor. The duff and litter are deep and much of the woody material is more than 3 inches in diameter. The undergrowth is variable, but shrubs are usually restricted to openings. Types meant to be represented by Fuel Model G are hemlock-Sitka spruce, Coast Douglas-fir, and windthrown or bug-killed stands of lodgepole pine and spruce.
Fuel Model H	The short-needled conifers (white pines, spruces, larches, and firs) are represented by Fuel Model H. In contrast to Model G fuels, Fuel Model H describes a healthy stand with sparse undergrowth and a thin layer of ground fuels. Fires in H fuels are typically slow spreading and are dangerous only in scattered areas where the downed woody material is concentrated.
Fuel Model I	Fuel Model I was designed for clear-cut conifer slash where the total loading of materials less than 6 inches in diameter exceeds 25 tons/acre. After settling and the fines (needles and twigs) fall from the branches, Fuel Model I will overrate the fire potential. For lighter loadings of clear-cut conifer slash, use Fuel Model J, and for light thinnings and partial cuts where the slash is scattered under a residual overstory, use Fuel Model K.
Fuel Model J	This model complements Fuel Model I. It is for clearcuts and heavily thinned conifer stands where the total loading of materials less than 6 inches in diameter is less than 25 tons/acre. Again, as the slash ages, the fire potential will be overrated.
Fuel Model K	Slash fuels from light thinnings and partial cuts in conifer stands are represented by Fuel Model K. Typically the slash is scattered about under an open overstory. This model applies to hardwood slash and to southern pine clearcuts where the loading of all fuels is less than 15 tons/acre.
Fuel Model L	This fuel model is meant to represent western grasslands vegetated by perennial grasses. The principal species are coarser and loadings heavier than those in Model A fuels. Otherwise the situations are very similar; shrubs and trees occupy less than one-third of the area. The quantity of fuel in these areas is more stable from year to year. In sagebrush areas Fuel Model T may be more appropriate.
Fuel Model N	This fuel model was constructed specifically for the sawgrass prairies of south Florida. It may be useful in other marsh situations where the fuel is coarse and reedlike. This model assumes that one-third of the aerial portion of the plants are dead. Fast-spreading, intense fires can occur even over standing water.
Fuel Model O	The O fuel model applies to dense, brushlike fuels of the Southeast. O fuels, except for the deep litter layer, are almost entirely living in contrast to B fuels.

	The foliage burns readily except during the active growing season. The plants are typically over 6 feet tall and are often found under an open stand of pine. The pocosins of the Virginia, North and South Carolina coasts are the ideal of Fuel Model O. If the plants do not meet the 6-foot criteria in those areas, Fuel Model D should be used.
Fuel Model P	Closed, thrifty stands of long-needled southern pines are characteristic of P fuels. A 2- to 4-inch layer of lightly compacted needle litter is the primary fuel. Some small diameter branchwood is present but the density of the canopy precludes more than a scattering of shrubs and grass. Fuel Model P has the high moisture of extinction characteristic of the Southeast. The corresponding model for other long-needled pines is U.
Fuel Model Q	Upland Alaskan black spruce is represented by Fuel Model Q. The stands are dense but have frequent openings filled with usually inflammable shrub species. The forest floor is a deep layer of moss and lichens, but there is some needle litter and small-diameter branchwood. The branches are persistent on the trees, and ground fires easily reach into the tree crowns. This fuel model may be useful for jack pine stands in the Lake States. Ground fires are typically slow spreading, but a dangerous crowning potential exists. Users should be alert to such events and note those levels of SC and BI when crowning occurs.
Fuel Model R	This fuel model represents the hardwood areas after the canopies leaf out in the spring. It is provided as the off-season substitute for E. It should be used during the summer in all hardwood and mixed conifer-hardwood stands where more than half of the overstory is deciduous.
Fuel Model S	Alaskan or alpine tundra on relatively well-drained sites is the S fuel. Grass and low shrubs are often present, but the principal fuel is a deep layer of lichens and moss. Fires in these fuels are not fast spreading or intense, but are difficult to extinguish.
Fuel Model T	The bothersome sagebrush-grass types of the Great Basin and the Intermountain West are characteristic of T fuels. The shrubs burn easily and are not dense enough to shade out grass and other herbaceous plants. the shrubs must occupy at lease one-third of the site or the A or L fuel models should be used. Fuel Model T might be used for immature scrub oak and desert shrub associations in the West, and the scrub oak-wire grass type in the Southeast.
Fuel Model U	Closed stands of western long-needled pines are covered by this model. The ground fuels are primarily litter and small branchwood. Grass and shrubs are precluded by the dense canopy but occur in the occasional natural opening. Fuel Model U should be used for ponderosa, Jeffrey, sugar pine, and red pine stands of the Lake States. Fuel Model P is the corresponding model for southern pine plantations.

ATTACHMENT B

SEMAP 2010: DEVELOPMENT OF FUEL CONSUMPTION VALUES for the NFDRS Fuel Models

FEPS A, B, and C represent decreasing duff consumption

FEPS D represents lower fuel moistures (dry vs moist)

Changing live fuel and duff moisture content does not change consumption

	These did not include litter or duff consumption					INITIAL RECOMMENDATION		FINAL RECOMMENDATION	
NFDRS Fuel Model	**VISTAS 2002**	**FEPS (A)**	**FEPS (B)**	**FEPS (C)**	**FEPS (D)**	**Prescribed Fire**	**Wildfire**	**Prescribed Fire**	**Wildfire**
	TONS/ACRE								
A - Western annual grasses and forbs	**0.5**			0.4	0.5	**0.4**	**0.5**	**0.4**	**0.5**
B - Mature Brush (Mixed Chapparell)	**12.35**			14.8	15.8	**14.8**	**15.8**	**11.4**	**16.4**
C - Open Pine with Grass	**2**	2.6	2.2	1.8	2.5	**1.8**	**2.5**	**1.8**	**2.5**
D - Southern Rough (SE Coastal Plains Pine/Palmetto Gallberry)	**4.275**	6.9	6.1	5.3	6.5	**5.3**	**6.5**	**4.3**	**5.9**
E - Hardwood Litter (Fall)	**2.375**	2.8	2.7	2.6	2.9	**2.6**	**2.9**	**2.6**	**2.9**
F - Inter. Brush	**8.85**			11.3	12.1	**11.3**	**12.1**	**7.1**	**8.9**
G - Closed short needle conifer (heavy dead)	**8.45**	15.7	13.9	12.1	15.2	**12.1**	**15.2**	**12.1**	**15.2**
H - Closed short needle conifer (normal dead)	**3.95**	7.9	6.1	4.3	6.4	**4.3**	**6.4**	**4.3**	**6.4**
I - Heavy slash	**30.2**	42.5	40.7	38.9	43.7	**38.9**	**43.7**	**38.9**	**43.7**
J - Medium slash	**12**	25	23.3	21.6	25	**21.6**	**25**	**21.6**	**25**
K - Light, scattered slash	**6.25**	10	9	8	9.6	**8**	**9.6**	**8**	**9.6**
L - Western Perenial Grass	**0.3**			0.6	0.7	**0.6**	**0.7**	**0.6**	**0.7**

N - Sawgrass and other coarse grasses	**3.8**	3.8	3.8	3.8	4	**3.8**	**4**	**3.8**	**4**
O - Pocosin (dense shrubs over 6')	**9.5**	23	17.2	11.4	18.1	**11.4**	**18.1**	**8.1**	**18.6**
P - Southern Plantation	**2.5**	5.1	3.8	2.4	4	**2.4**	**4**	**2.4**	**4**
R - Hardwood (Summer version of E)	**2**	1.9	1.8	1.7	2	**1.7**	**2**	**1.7**	**2**

	Fuel Moisure Content (%) Profile						**% Duff Consumed**
	1 Hr	**10 Hr**	**100 Hr**	**1000 Hr**	**Live Fuels**	**Duff**	
FEPS (A)	8	9	11	15	100	100	20
FEPS (B)	8	9	11	15	120	200	10
FEPS C - Prescribed Fire	8	9	11	15	120	200	0
FEPS (D) - Wildfire	7	8	9	12	100	100	10

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<tr><th></th><th>Canopy</th><th>Shrub</th><th>Herbaceous</th><th>Dead Woody</th><th>Litter</th><th>Broadcasat</th><th></th></tr>
<tr><td>FEPS (A)</td><td rowspan="3">63</td><td rowspan="3">80</td><td rowspan="3">63</td><td rowspan="3">47</td><td rowspan="3">100</td><td rowspan="3">79</td><td></td></tr>
<tr><td>FEPS (B)</td><td></td></tr>
<tr><td>FEPS C - Prescribed Fire</td><td></td></tr>
<tr><td>FEPS (D) - Wildfire</td><td>80</td><td>86</td><td>89</td><td>53</td><td>100</td><td>95</td><td></td></tr>
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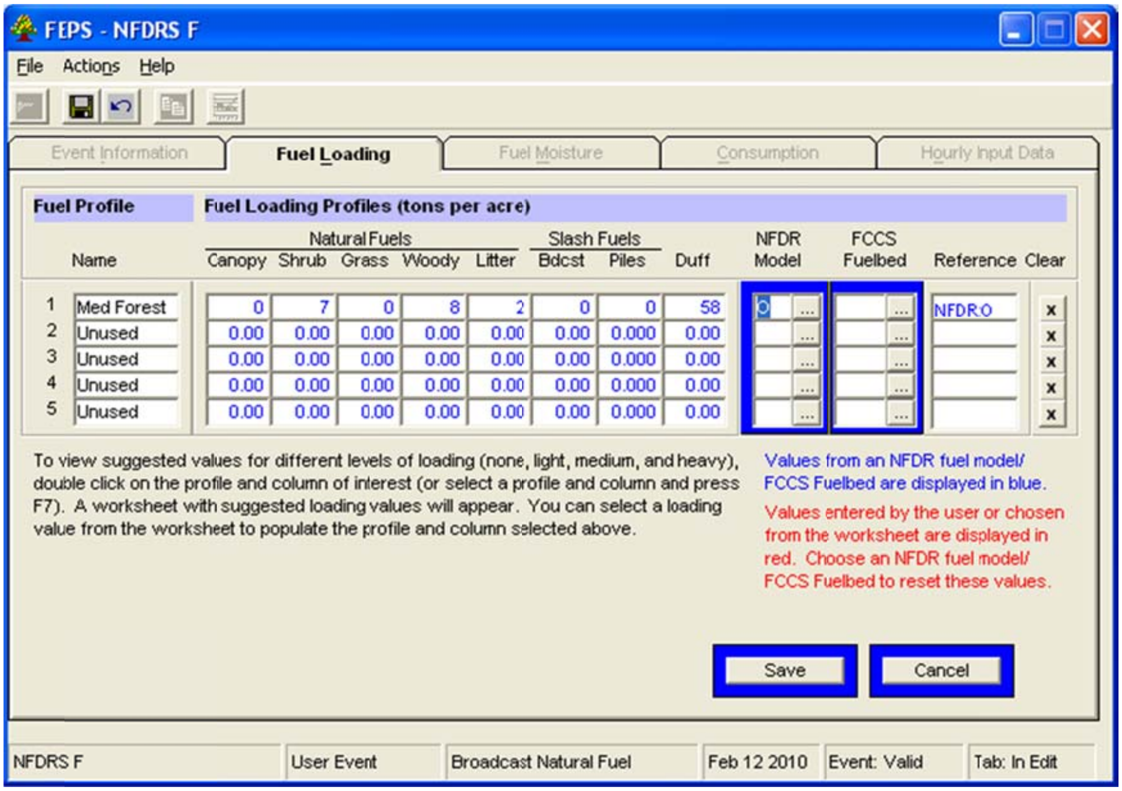
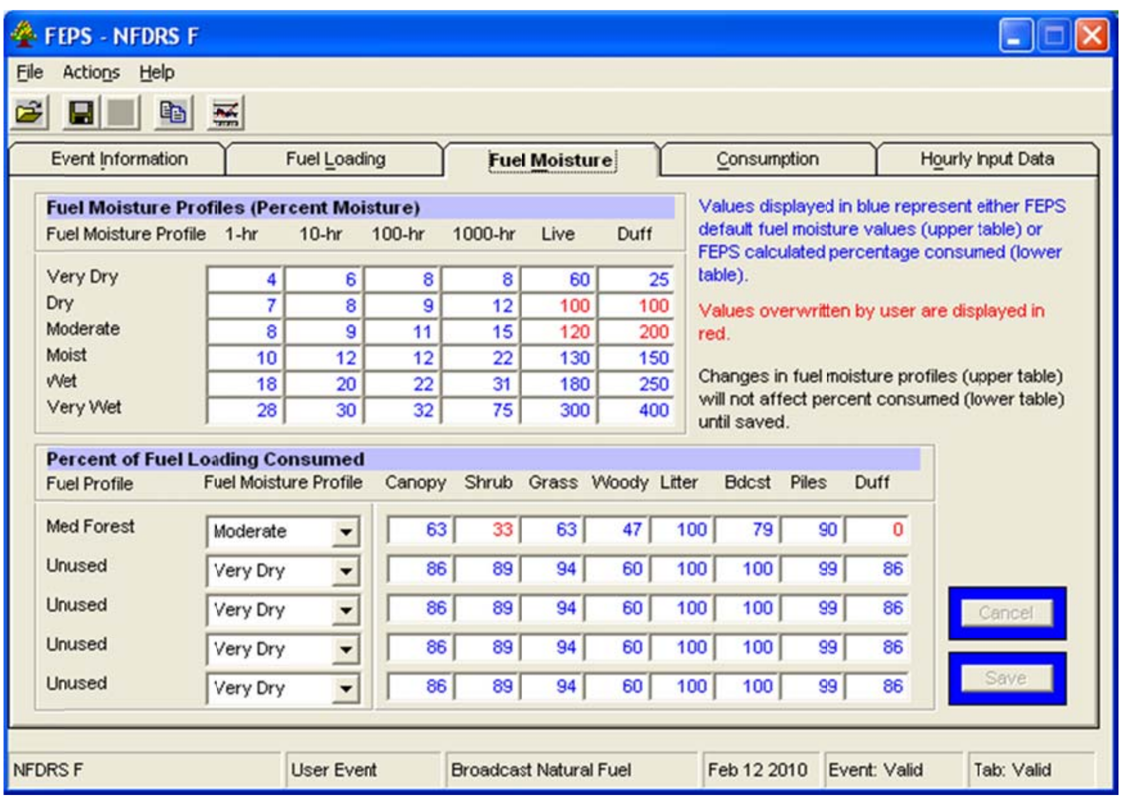
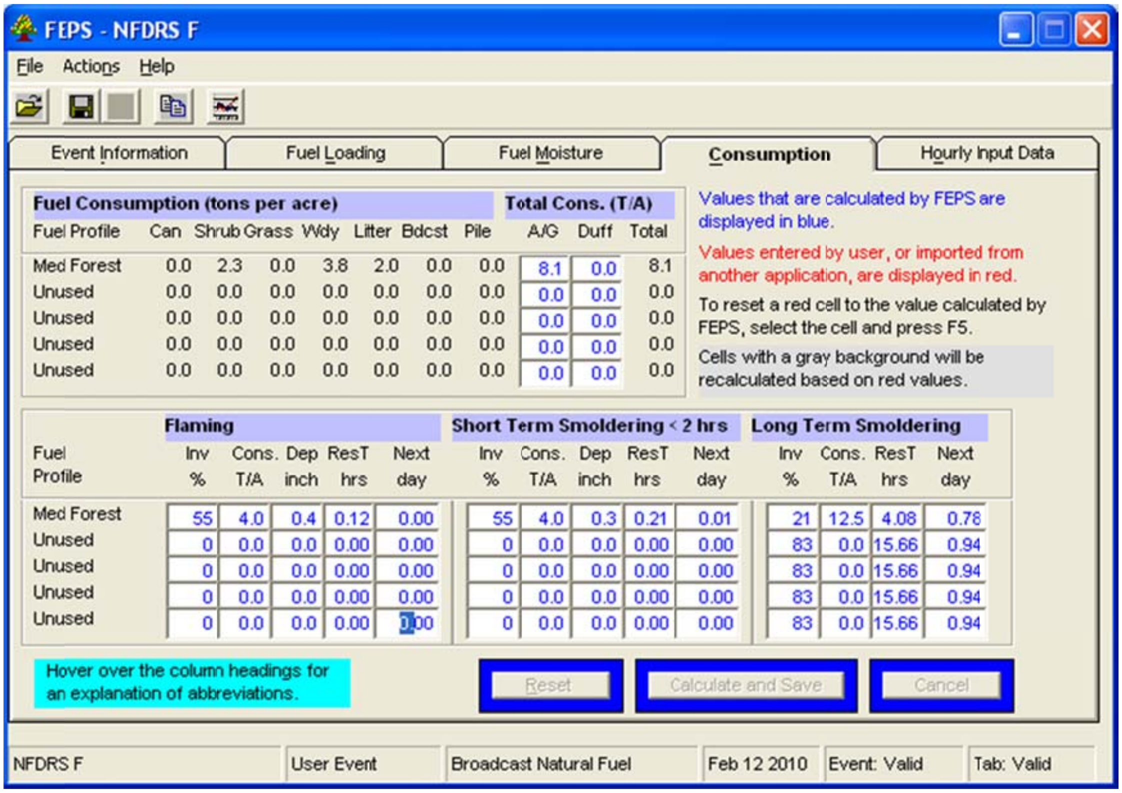
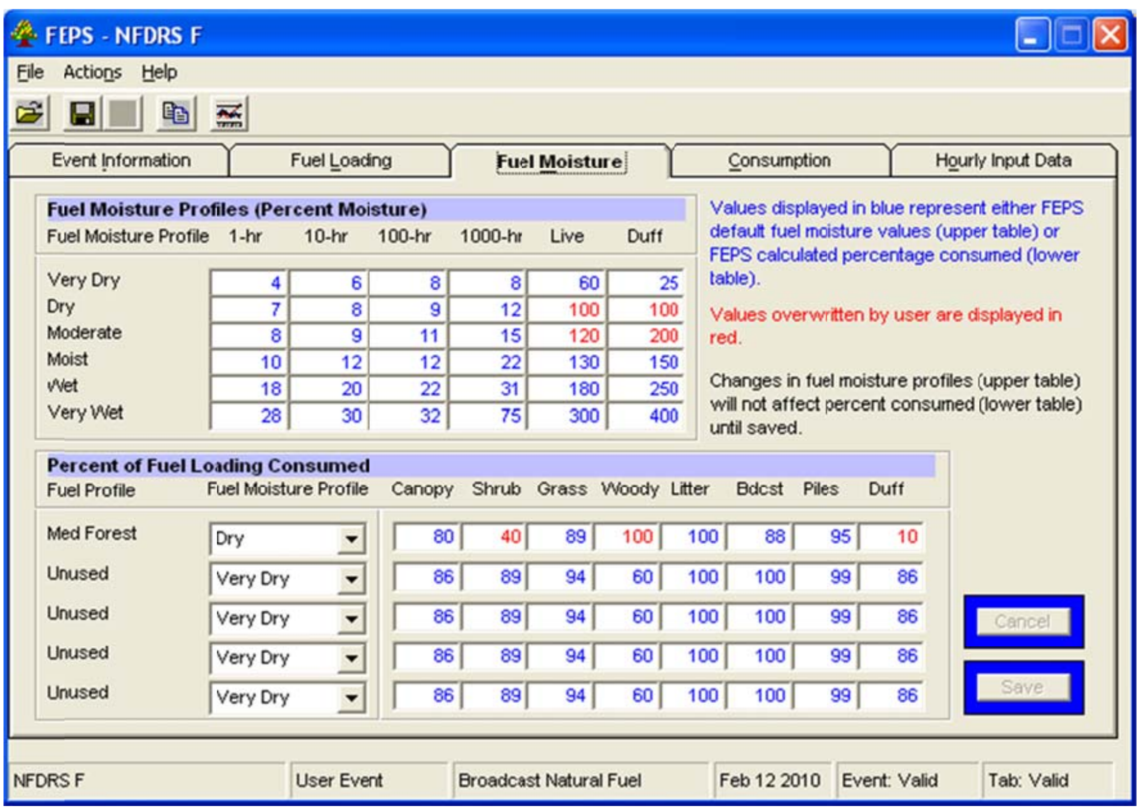
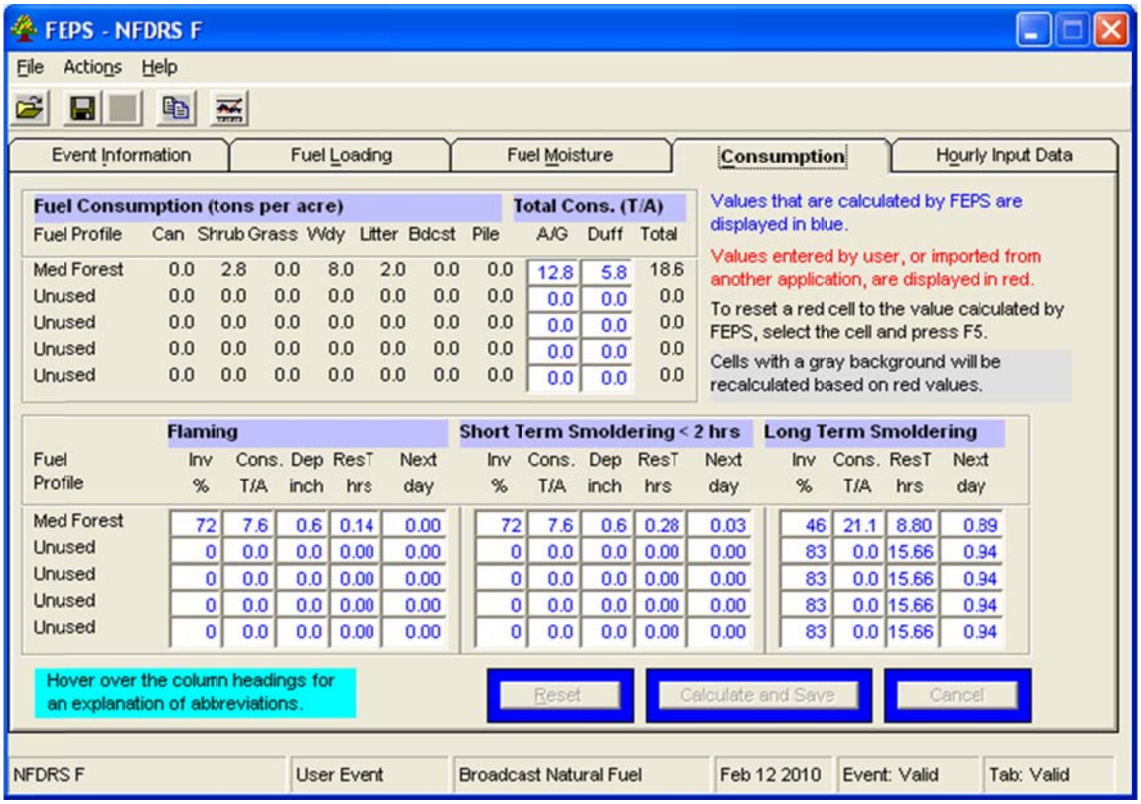






MODEL O:Wildfire





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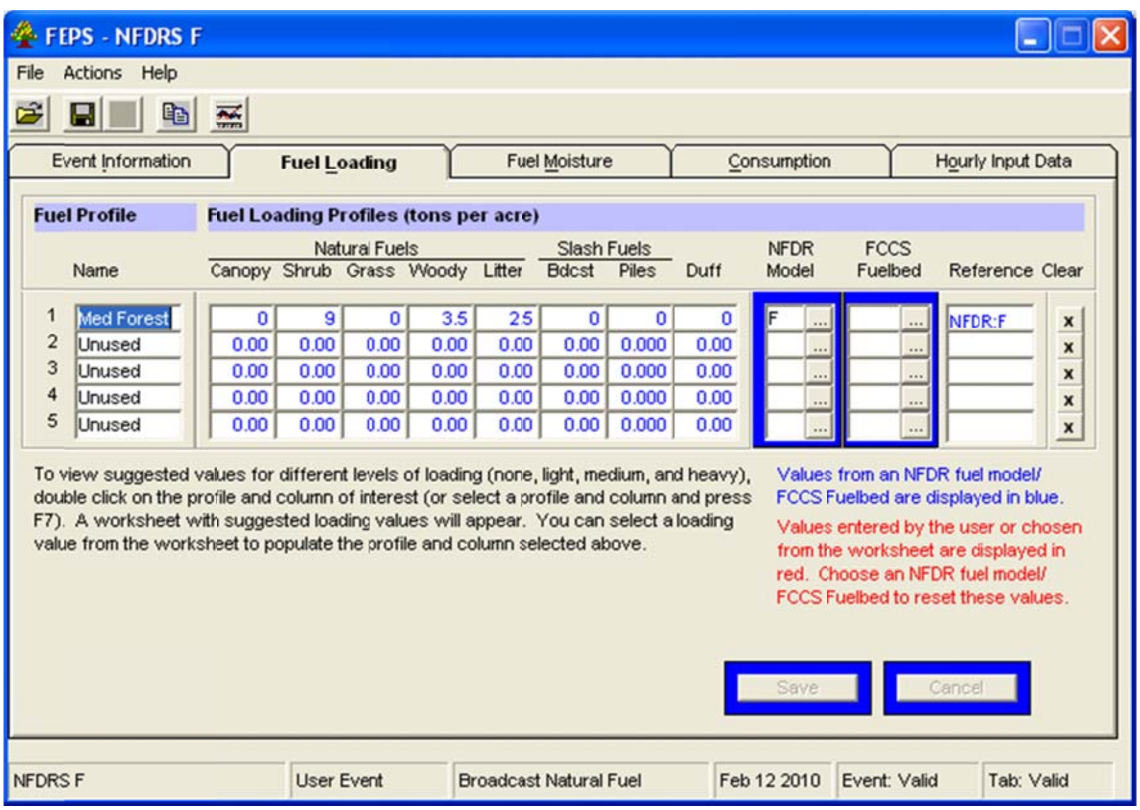
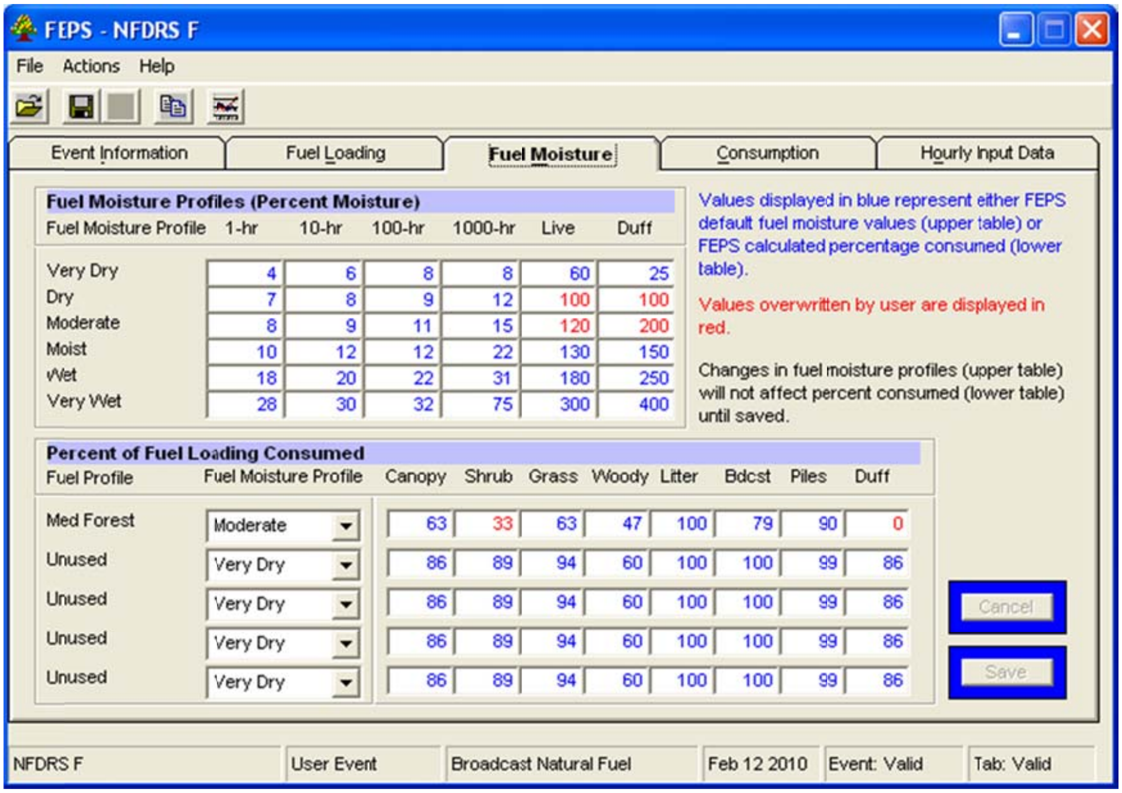
Fuel Model F – Rx Fire




FEPS - NFDRS F
File Actions Help
Event Information
Fuel Loading
Fuel Moisture
Consumption
Hourly Input Data
Fuel Moisture Profiles (Percent Moisture)
Fuel Moisture Profile 1-hr 10-hr 100-hr 1000-hr Live Duff
Very Dry 4 6 8 8 60 25
Dry 7 8 9 12 100 100
Moderate 8 9 11 15 120 200
Moist 10 12 12 22 130 150
Wet 18 20 22 31 180 250
Very Wet 28 30 32 75 300 400
Values displayed in blue represent either FEPS default fuel moisture values (upper table) or FEPS calculated percentage consumed (lower table).
Values overwritten by user are displayed in red.
Changes in fuel moisture profiles (upper table) will not affect percent consumed (lower table) until saved.
Percent of Fuel Loading Consumed
Fuel Profile Fuel Moisture Profile Canopy Shrub Grass Woody Litter Bdcst Piles Duff
Med Forest Moderate 63 33 63 47 100 79 90 0
Unused Very Dry 86 89 94 60 100 100 99 86
Unused Very Dry 86 89 94 60 100 100 99 86
Unused Very Dry 86 89 94 60 100 100 99 86
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Feb 12 2010
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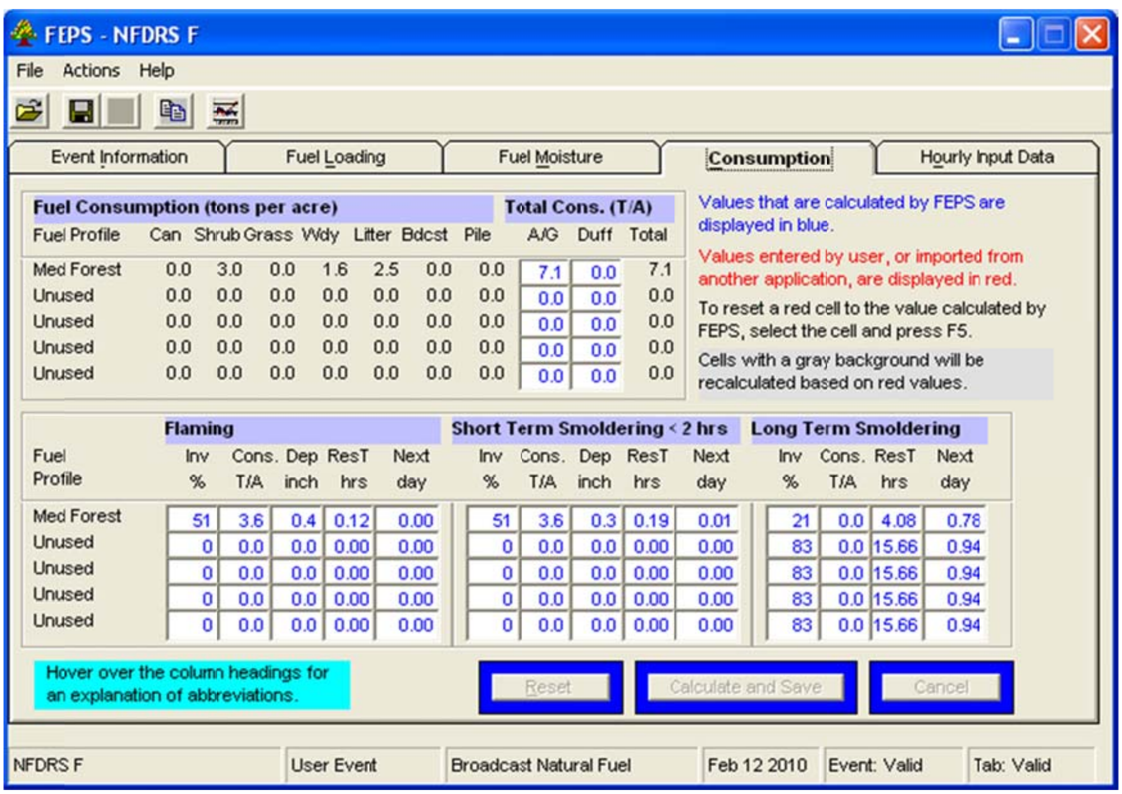
FEPS - NFDRS F
File Actions Help
Event Information
Fuel Loading
Fuel Moisture
Consumption
Hourly Input Data
Fuel Consumption (tons per acre)
Total Cons. (T/A)
Fuel Profile Can Shrub Grass Wdy Litter Bdcst Pile A/G Duff Total
Med Forest 0.0 3.0 0.0 1.6 2.5 0.0 0.0 7.1 0.0 7.1
Unused 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
Unused 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
Unused 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
Unused 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
Values that are calculated by FEPS are displayed in blue.
Values entered by user, or imported from another application, are displayed in red.
To reset a red cell to the value calculated by FEPS, select the cell and press F5.
Cells with a gray background will be recalculated based on red values.
Flaming
Short Term Smoldering < 2 hrs
Long Term Smoldering
Fuel Profile Inv % Cons. T/A Dep inch ResT hrs Next day Inv % Cons. T/A Dep inch ResT hrs Next day Inv % Cons. T/A ResT hrs Next day
Med Forest 51 3.6 0.4 0.12 0.00 51 3.6 0.3 0.19 0.01 21 0.0 4.08 0.78
Unused 0 0.0 0.0 0.00 0.00 0 0.0 0.0 0.00 0.00 83 0.0 15.66 0.94
Unused 0 0.0 0.0 0.00 0.00 0 0.0 0.0 0.00 0.00 83 0.0 15.66 0.94
Unused 0 0.0 0.0 0.00 0.00 0 0.0 0.0 0.00 0.00 83 0.0 15.66 0.94
Unused 0 0.0 0.0 0.00 0.00 0 0.0 0.0 0.00 0.00 83 0.0 15.66 0.94
Hover over the column headings for an explanation of abbreviations.
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Feb 12 2010
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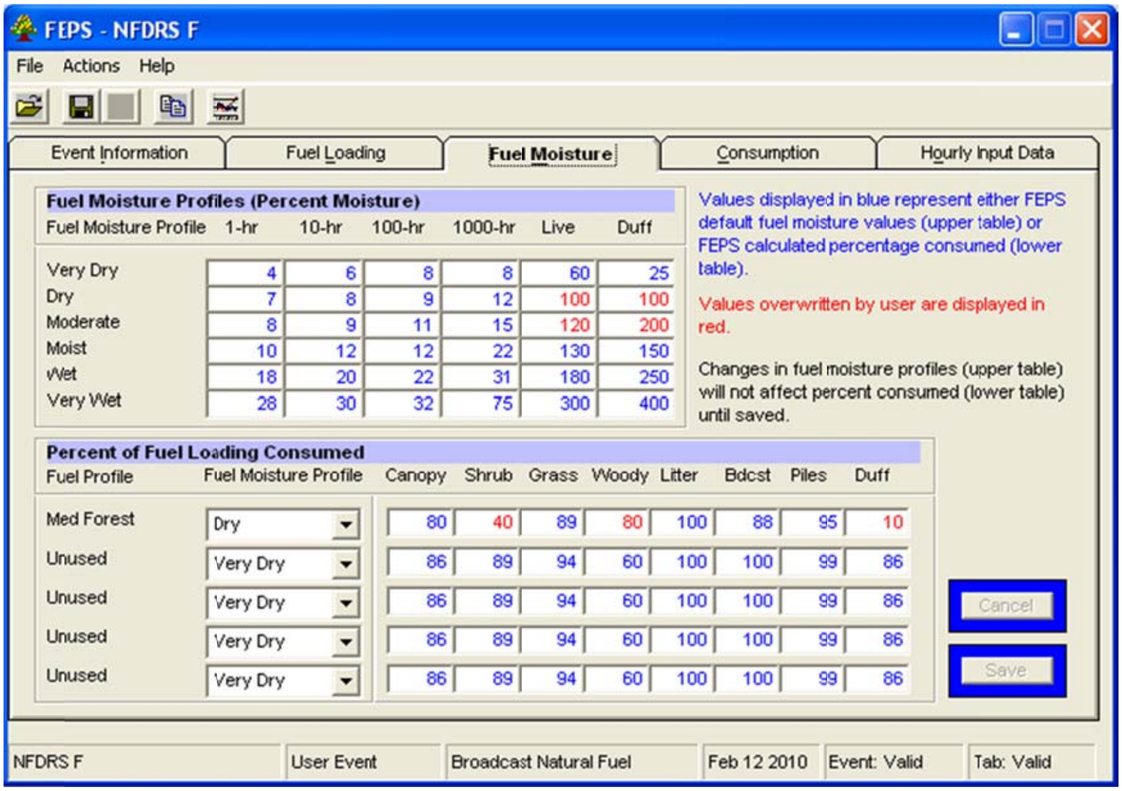
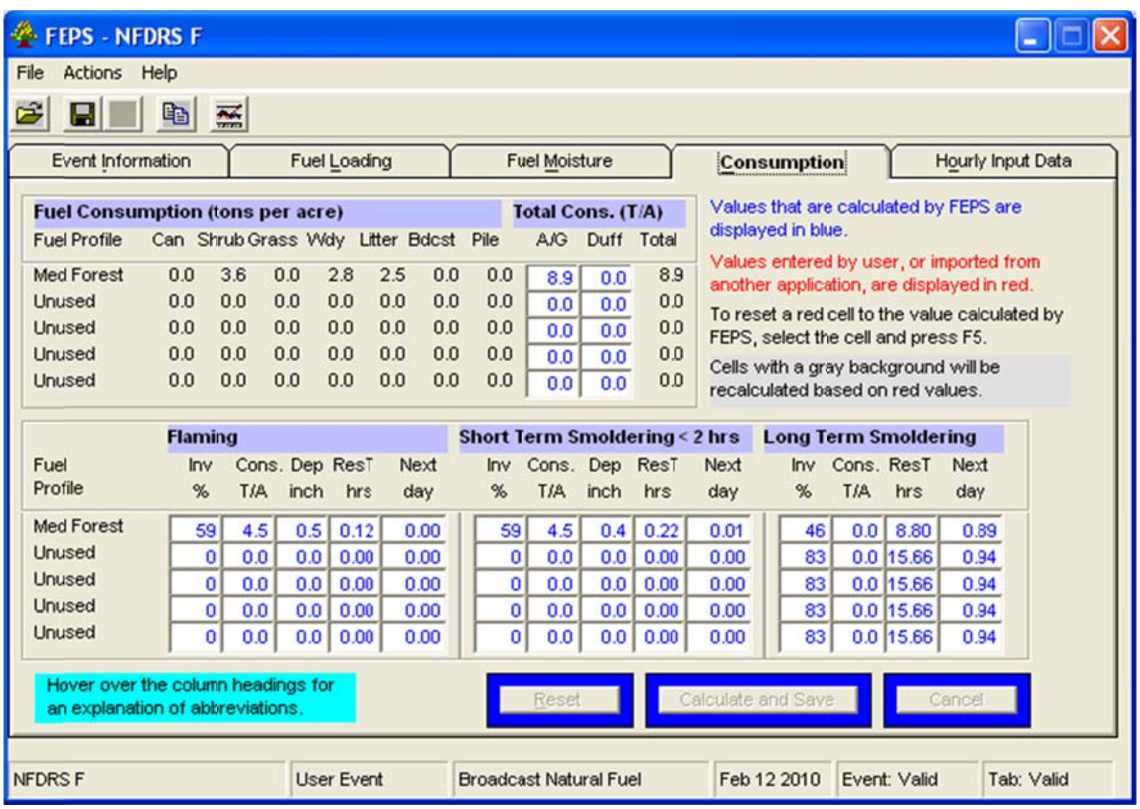
FUEL MODEL F;   Wildfire



Fuel Moisture Profile	1-hr	10-hr	100-hr	1000-hr	Live	Duff
Very Dry	4	6	8	8	60	25
Dry	7	8	9	12	100	100
Moderate	8	9	11	15	120	200
Moist	10	12	12	22	130	150
Wet	18	20	22	31	180	250
Very Wet	28	30	32	75	300	400

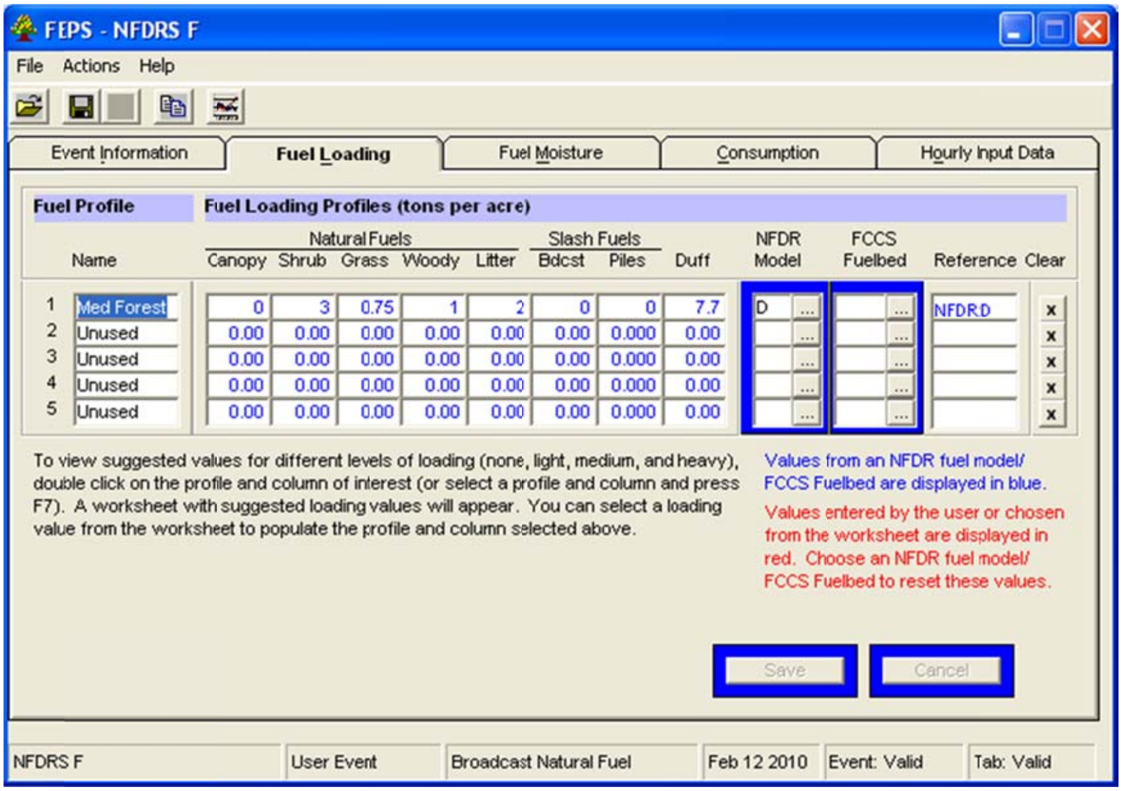
Fuel Profile	Fuel Moisture Profile	Canopy	Shrub	Grass	Woody	Litter	Bdcst	Piles	Duff
Med Forest	Dry	80	40	89	80	100	88	95	10
Unused	Very Dry	86	89	94	60	100	100	99	86
Unused	Very Dry	86	89	94	60	100	100	99	86
Unused	Very Dry	86	89	94	60	100	100	99	86
Unused	Very Dry	86	89	94	60	100	100	99	86

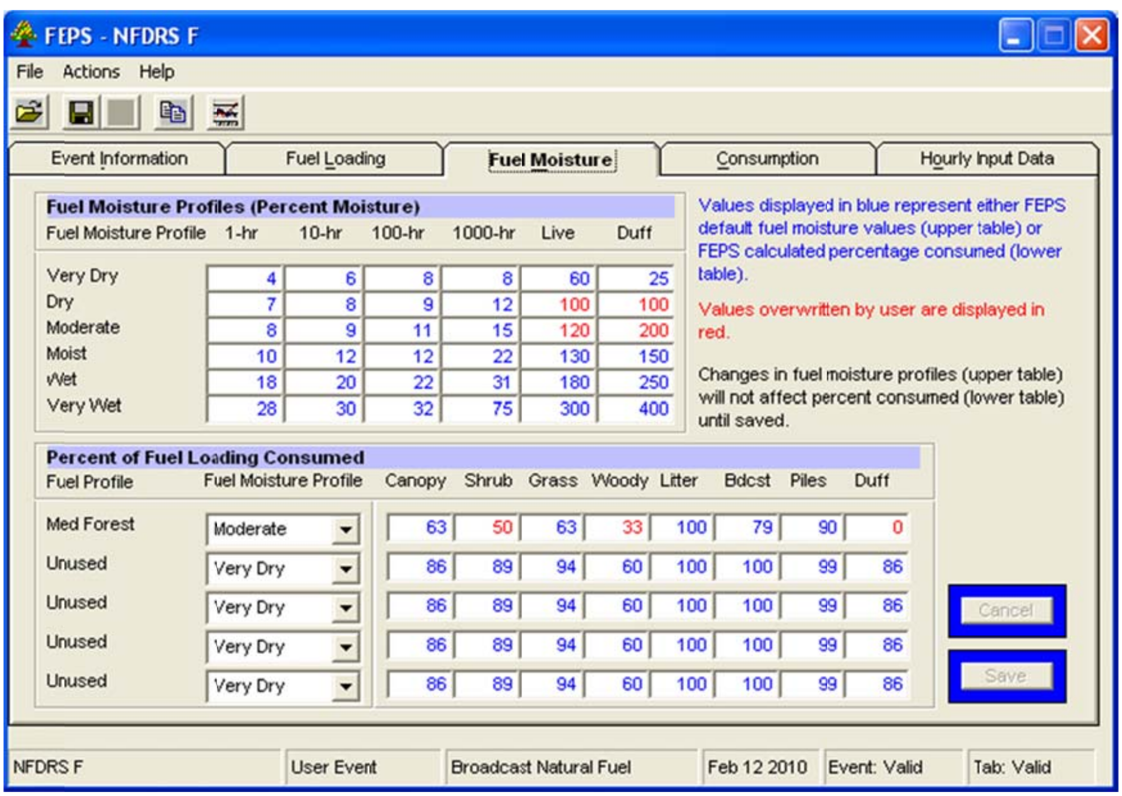


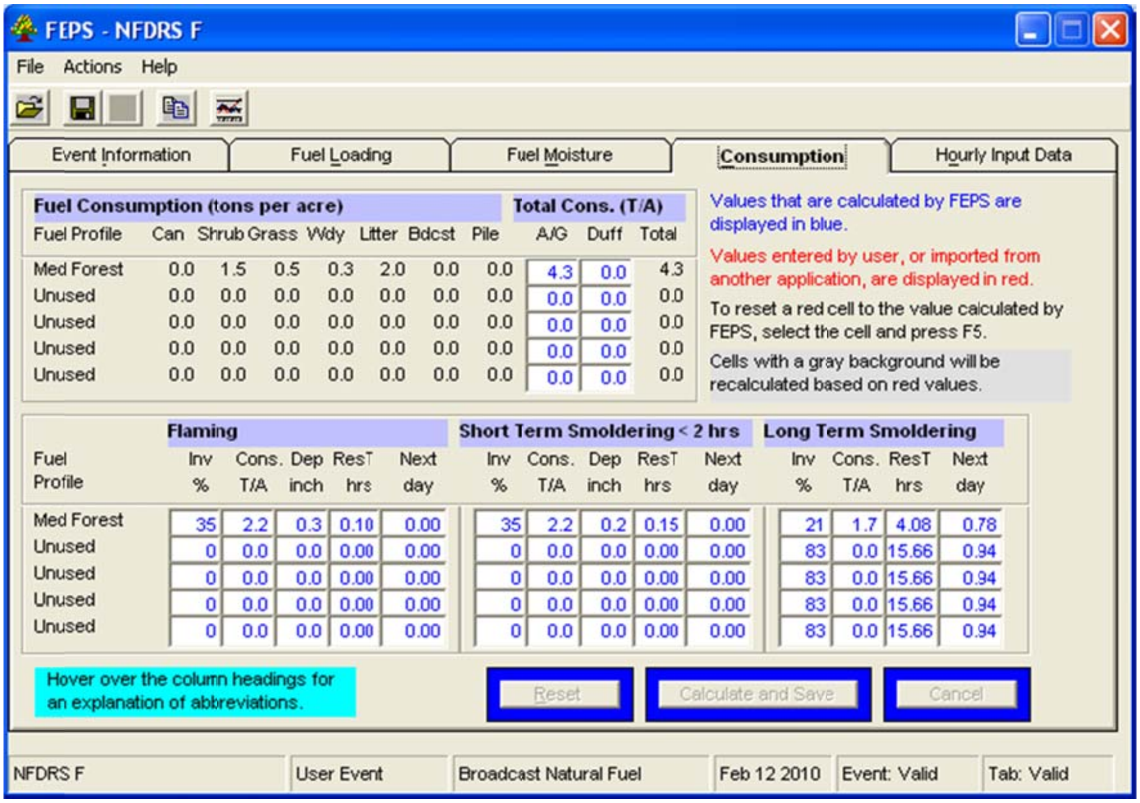
Fuel Profile	Can	Shrub	Grass	Wdy	Litter	Bdcst	Pile	A/G	Duff	Total
Med Forest	0.0	3.6	0.0	2.8	2.5	0.0	0.0	8.9	0.0	8.9
Unused	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unused	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unused	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unused	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Fuel Profile	Flaming Inv %	Cons. T/A	Dep inch	ResT hrs	Next day	Short Term Smoldering < 2 hrs Inv %	Cons. T/A	Dep inch	ResT hrs	Next day	Long Term Smoldering Inv %	Cons. T/A	ResT hrs	Next day
Med Forest	59	4.5	0.5	0.12	0.00	59	4.5	0.4	0.22	0.01	46	0.0	8.80	0.89
Unused	0	0.0	0.0	0.00	0.00	0	0.0	0.0	0.00	0.00	83	0.0	15.66	0.94
Unused	0	0.0	0.0	0.00	0.00	0	0.0	0.0	0.00	0.00	83	0.0	15.66	0.94
Unused	0	0.0	0.0	0.00	0.00	0	0.0	0.0	0.00	0.00	83	0.0	15.66	0.94
Unused	0	0.0	0.0	0.00	0.00	0	0.0	0.0	0.00	0.00	83	0.0	15.66	0.94

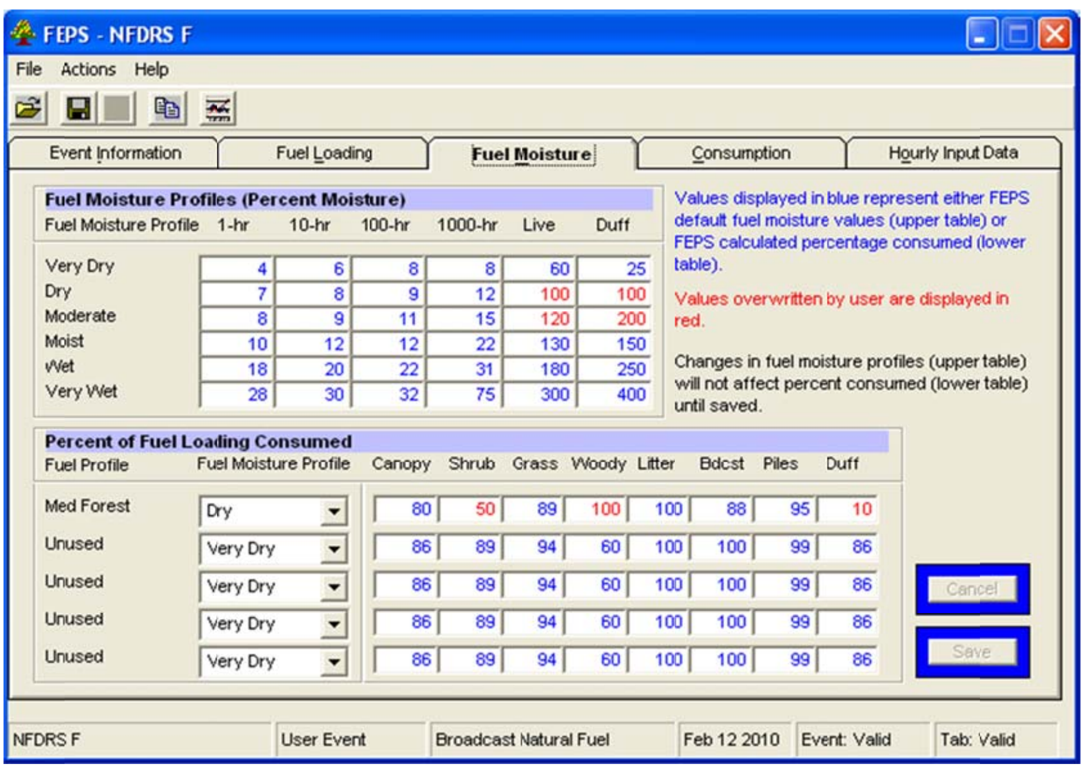
FUEL MODEL D: Rx Fire

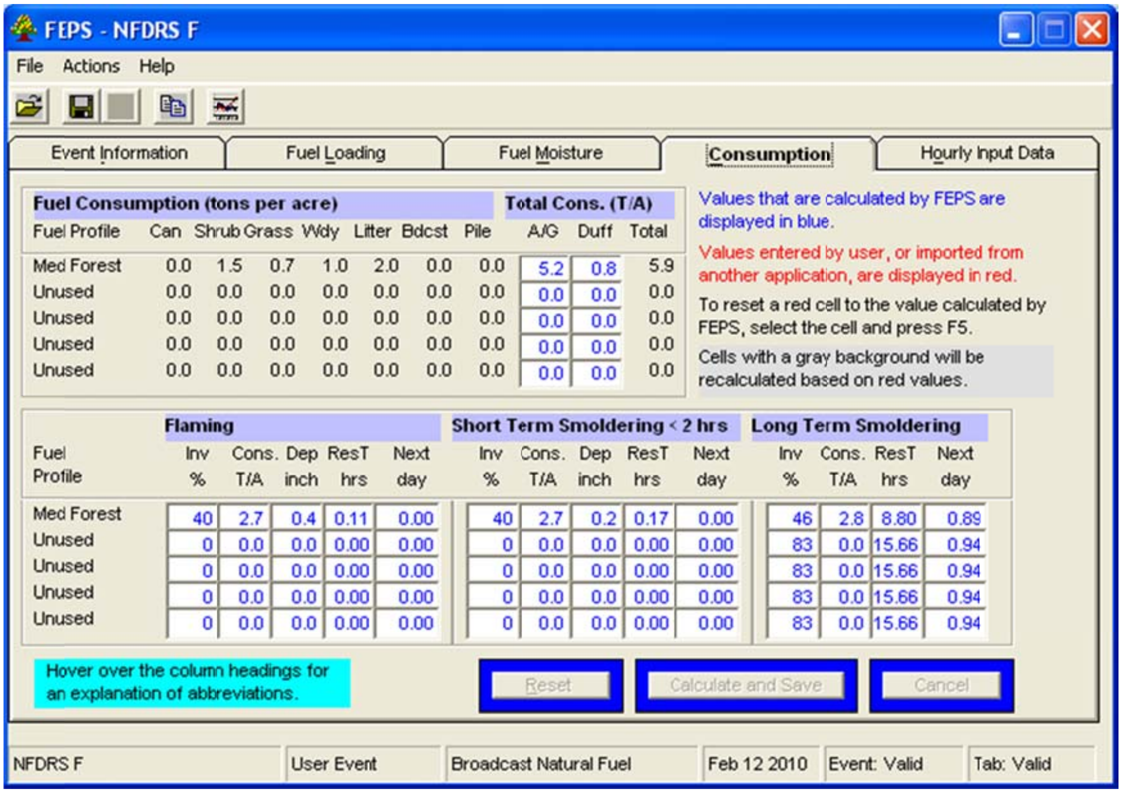




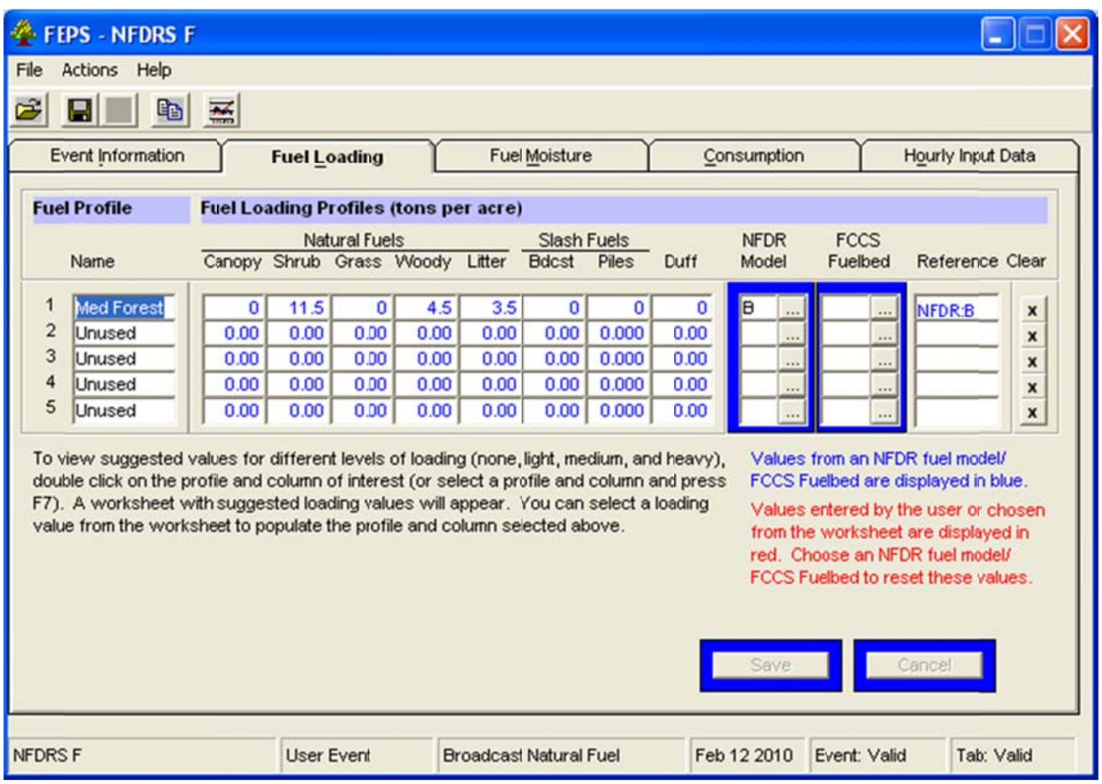


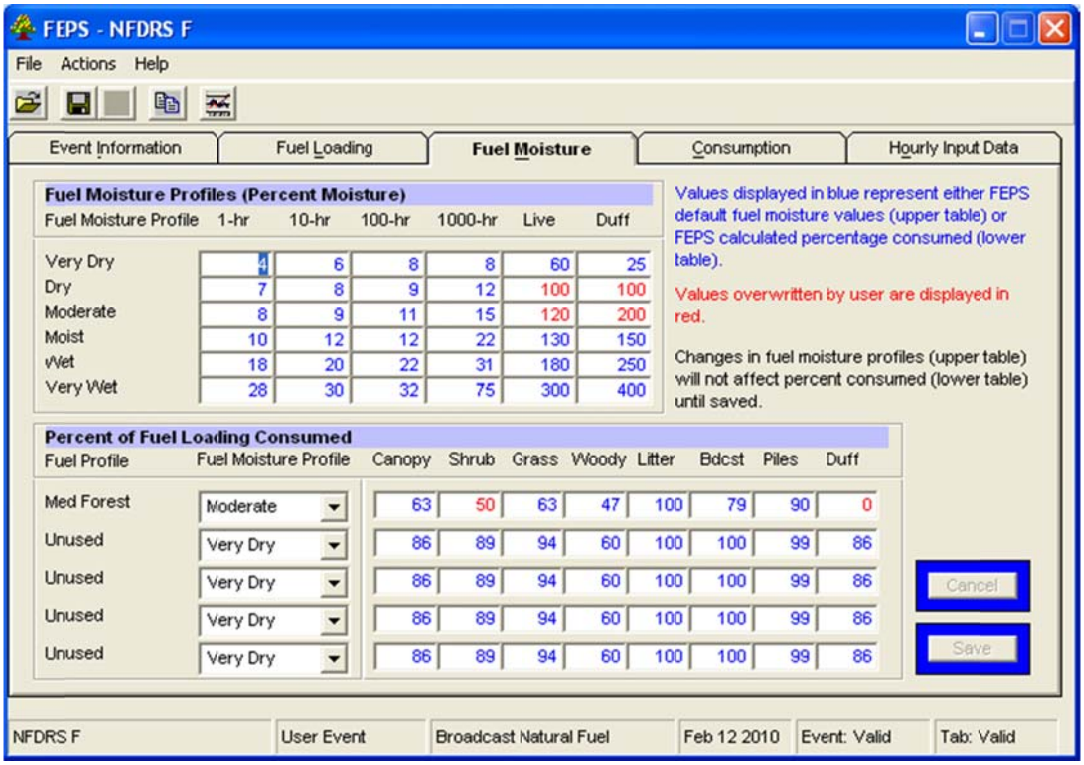
Fuel Model d: Wildfire

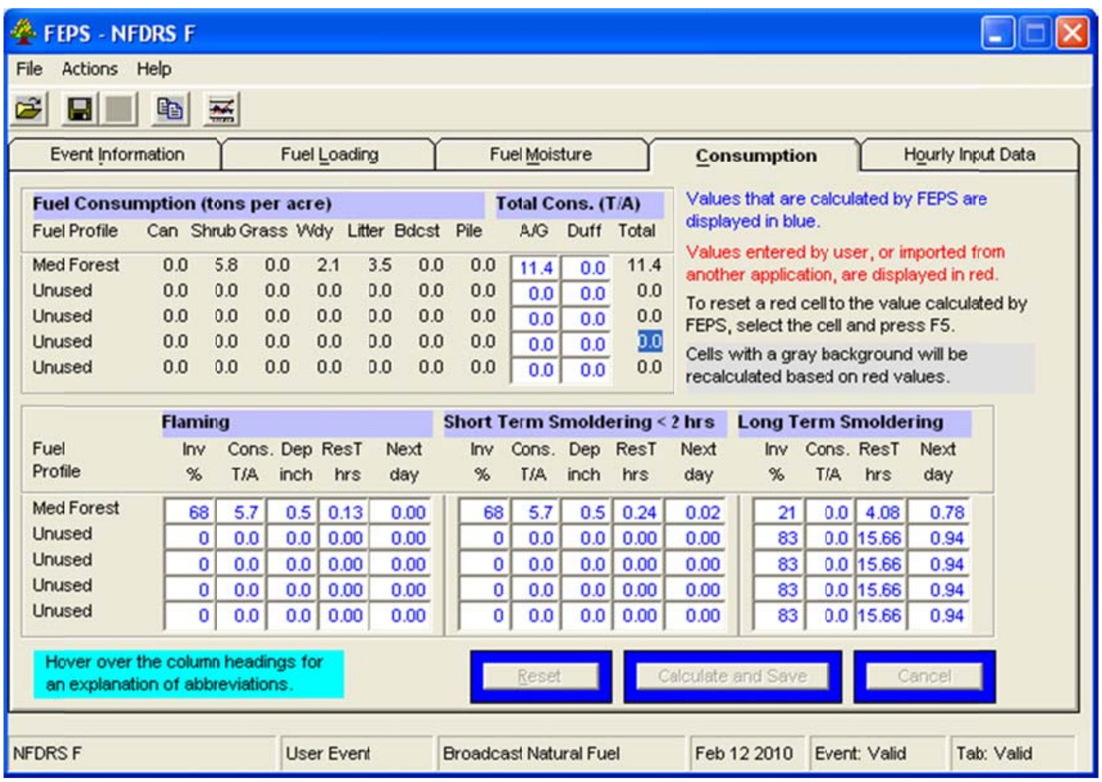




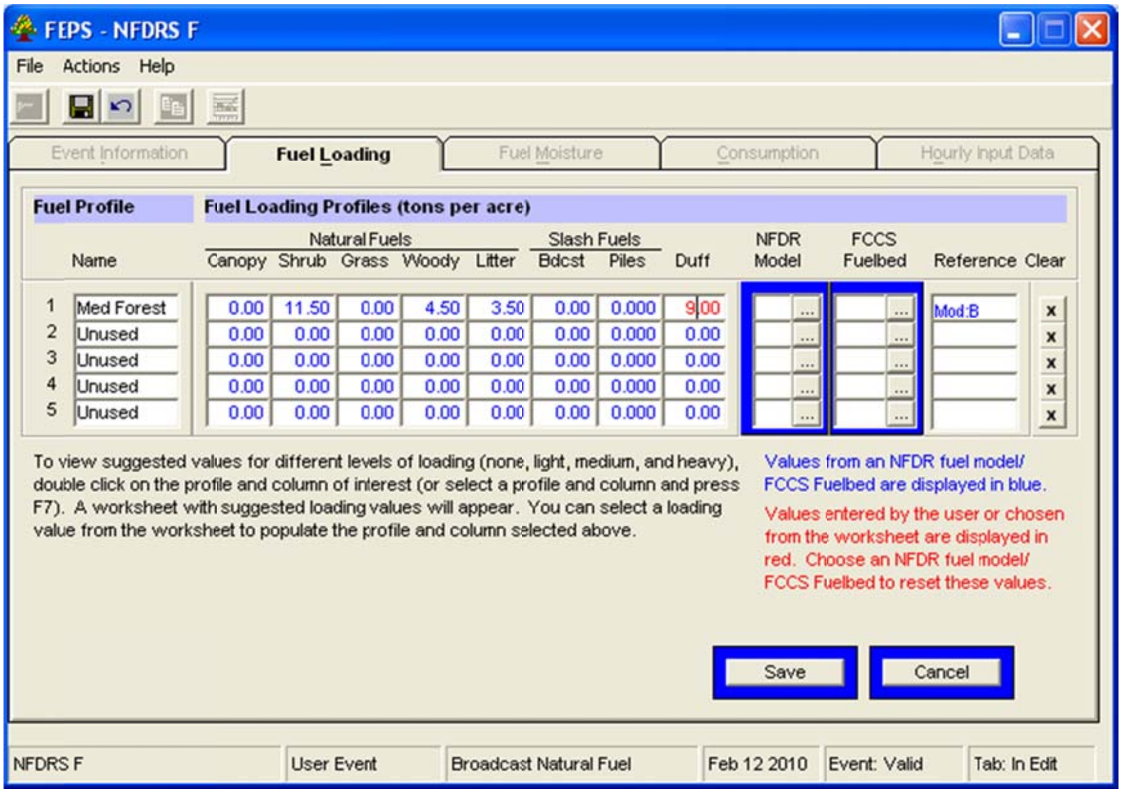
FUEL MODEL B: Rx Fire

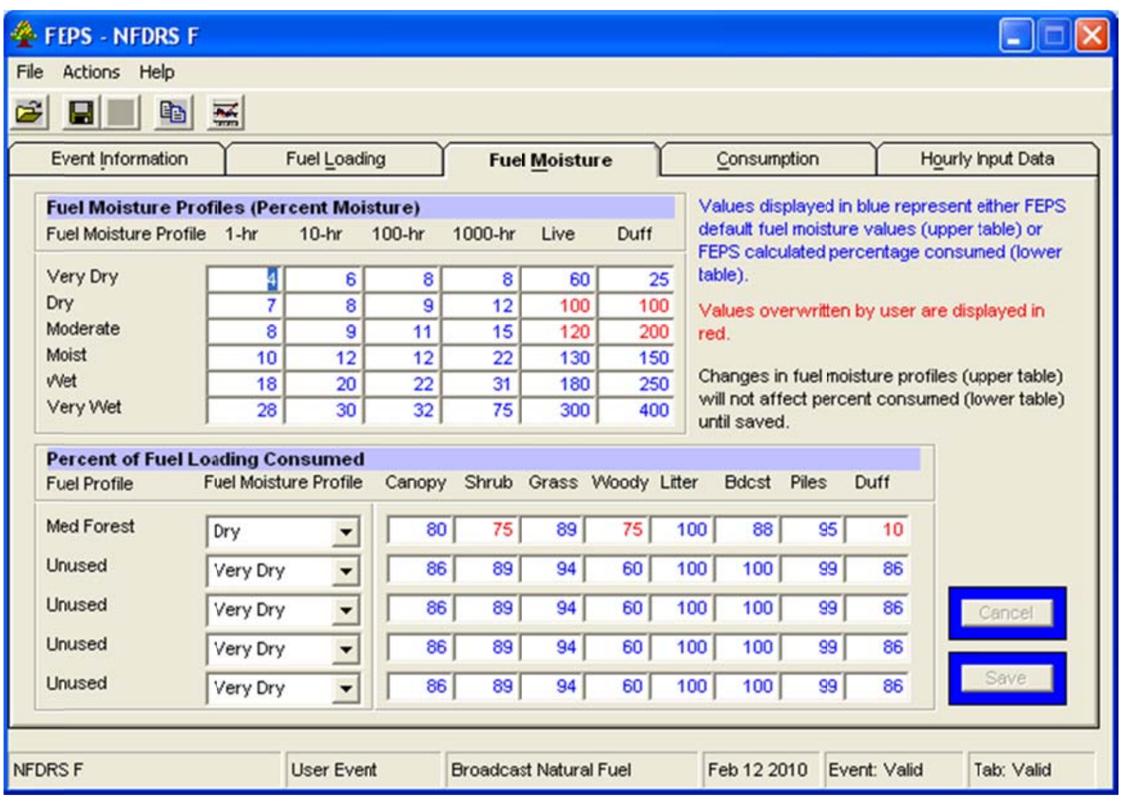


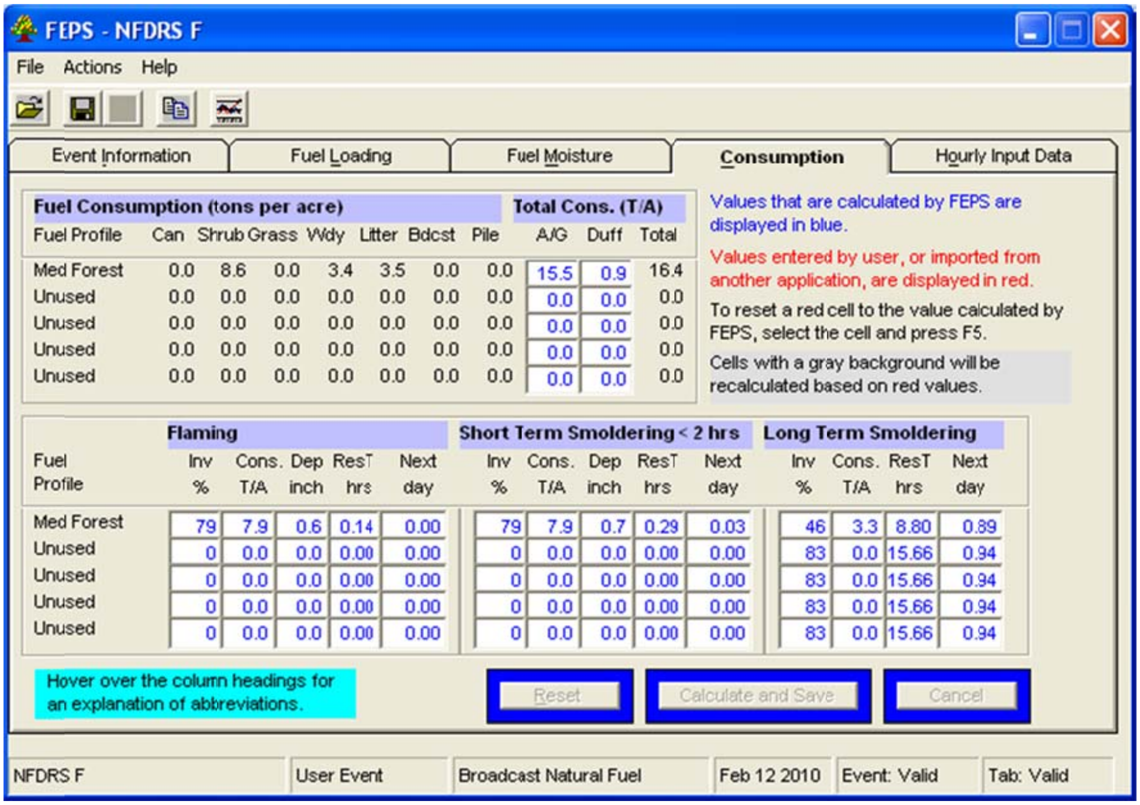

FEPS - NFDRS F
File Actions Help
Event Information
Fuel Loading
Fuel Moisture
Consumption
Hourly Input Data
Fuel Moisture Profiles (Percent Moisture)
Fuel Moisture Profile 1-hr 10-hr 100-hr 1000-hr Live Duff
Very Dry 4 6 8 8 60 25
Dry 7 8 9 12 100 100
Moderate 8 9 11 15 120 200
Moist 10 12 12 22 130 150
Wet 18 20 22 31 180 250
Very Wet 28 30 32 75 300 400
Values displayed in blue represent either FEPS default fuel moisture values (upper table) or FEPS calculated percentage consumed (lower table).
Values overwritten by user are displayed in red.
Changes in fuel moisture profiles (upper table) will not affect percent consumed (lower table) until saved.
Percent of Fuel Loading Consumed
Fuel Profile Fuel Moisture Profile Canopy Shrub Grass Woody Litter Bdcst Piles Duff
Med Forest Moderate 63 50 63 47 100 79 90 0
Unused Very Dry 86 89 94 60 100 100 99 86
Unused Very Dry 86 89 94 60 100 100 99 86
Unused Very Dry 86 89 94 60 100 100 99 86
Unused Very Dry 86 89 94 60 100 100 99 86
Cancel
Save
NFDRS F
User Event
Broadcast Natural Fuel
Feb 12 2010
Event: Valid
Tab: Valid


FEPS - NFDRS F
File Actions Help
Event Information
Fuel Loading
Fuel Moisture
Consumption
Hourly Input Data
Fuel Consumption (tons per acre)
Total Cons. (T/A)
Fuel Profile Can Shrub Grass Wdy Litter Bdcst Pile A/G Duff Total
Med Forest 0.0 5.8 0.0 2.1 3.5 0.0 0.0 11.4 0.0 11.4
Unused 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
Unused 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
Unused 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
Unused 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
Values that are calculated by FEPS are displayed in blue.
Values entered by user, or imported from another application, are displayed in red.
To reset a red cell to the value calculated by FEPS, select the cell and press F5.
Cells with a gray background will be recalculated based on red values.
Flaming
Short Term Smoldering < 2 hrs
Long Term Smoldering
Fuel Profile Inv % Cons. T/A Dep inch ResT hrs Next day Inv % Cons. T/A Dep inch ResT hrs Next day Inv % Cons. T/A ResT hrs Next day
Med Forest 68 5.7 0.5 0.13 0.00 68 5.7 0.5 0.24 0.02 21 0.0 4.08 0.78
Unused 0 0.0 0.0 0.00 0.00 0 0.0 0.0 0.00 0.00 83 0.0 15.66 0.94
Unused 0 0.0 0.0 0.00 0.00 0 0.0 0.0 0.00 0.00 83 0.0 15.66 0.94
Unused 0 0.0 0.0 0.00 0.00 0 0.0 0.0 0.00 0.00 83 0.0 15.66 0.94
Unused 0 0.0 0.0 0.00 0.00 0 0.0 0.0 0.00 0.00 83 0.0 15.66 0.94
Hover over the column headings for an explanation of abbreviations.
Reset
Calculate and Save
Cancel
NFDRS F
User Event
Broadcast Natural Fuel
Feb 12 2010
Event: Valid
Tab: Valid

FUEL MODEL B: WIDLFIRE






FEPS - NFDRS F
File Actions Help
Event Information
Fuel Loading
Fuel Moisture
Consumption
Hourly Input Data
Fuel Consumption (tons per acre)
Total Cons. (T/A)
Fuel Profile Can Shrub Grass Wdy Litter Bdcst Pile A/G Duff Total
Med Forest 0.0 8.6 0.0 3.4 3.5 0.0 0.0 15.5 0.9 16.4
Unused 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
Unused 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
Unused 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
Unused 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
Values that are calculated by FEPS are displayed in blue.
Values entered by user, or imported from another application, are displayed in red.
To reset a red cell to the value calculated by FEPS, select the cell and press F5.
Cells with a gray background will be recalculated based on red values.
Flaming
Short Term Smoldering < 2 hrs
Long Term Smoldering
Fuel Profile Inv % Cons. T/A Dep inch ResT hrs Next day Inv % Cons. T/A Dep inch ResT hrs Next day Inv % Cons. T/A ResT hrs Next day
Med Forest 79 7.9 0.6 0.14 0.00 79 7.9 0.7 0.29 0.03 46 3.3 8.80 0.89
Unused 0 0.0 0.0 0.00 0.00 0 0.0 0.0 0.00 0.00 83 0.0 15.66 0.94
Unused 0 0.0 0.0 0.00 0.00 0 0.0 0.0 0.00 0.00 83 0.0 15.66 0.94
Unused 0 0.0 0.0 0.00 0.00 0 0.0 0.0 0.00 0.00 83 0.0 15.66 0.94
Unused 0 0.0 0.0 0.00 0.00 0 0.0 0.0 0.00 0.00 83 0.0 15.66 0.94
Hover over the column headings for an explanation of abbreviations.
Reset
Calculate and Save
Cancel
NFDRS F
User Event
Broadcast Natural Fuel
Feb 12 2010
Event: Valid
Tab: Valid

Appendix B

Emission Factors Used for Fire Emission Calculations

TABLE B-1.

FIRE EMISSION FACTORS (LB/TON OF FUEL CONSUMED)

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
A	Annual grass and forbs	CH4	5.07	7.7	13.6	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
A	Annual grass and forbs	CO	152.67	74.3	289	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
A	Annual grass and forbs	EC	1.5	0.6	1.5	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	NH3	1.3	0.5	1.3	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	NOX	6.2	6.2	6.2	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	OC	11.6	4.3	11.6	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	PM10	24.1	8	28.1	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
A	Annual grass and forbs	PM25	20.7	8	24.1	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
A	Annual grass and forbs	SO2	1.7	1.7	1.7	Table 2 Data Needs and Availability - Pace Report
A	Annual grass and forbs	TSP	29.2	12	34.1	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
A	Annual grass and forbs	VOC	11.6	6.3	13.6	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
AGGRAIN	Agriculture-Grain	CH4	5.43	5.43	5.43	AP-42 Table 2.5-5 Avg of Oat/Barley/Wheat
AGGRAIN	Agriculture-Grain	CO	140.66	140.66	140.66	AP-42 Table 2.5-5 Avg of Oat/Barley/Wheat
AGGRAIN	Agriculture-Grain	NH3	2.51941176470588	2.51941176470588	2.51941176470588	Avg from WRAP/CARB tables
AGGRAIN	Agriculture-Grain	NOX	4.7196	4.7196	4.7196	Avg from WRAP/CARB tables
AGGRAIN	Agriculture-Grain	PM10	29.33	29.33	29.33	AP-42 Table 2.5-5 Avg of Oat/Barley/Wheat
AGGRAIN	Agriculture-Grain	PM25	29.33	29.33	29.33	AP-42 Table 2.5-5 Avg of Oat/Barley/Wheat
AGGRAIN	Agriculture-Grain	SO2	0.6968	0.6968	0.6968	Avg from WRAP/CARB tables
AGGRAIN	Agriculture-Grain	VOC	18	18	18	AP-42 Table 2.5-5 Avg of Oat/Barley/Wheat
AGHAY	Agriculture-Hay (pasture/range)	CH4	5	5	5	AP-42 Table 2.5-5 Hay
AGHAY	Agriculture-Hay (pasture/range)	CO	139	139	139	AP-42 Table 2.5-5 Hay
AGHAY	Agriculture-Hay (pasture/range)	NH3	2.66	2.66	2.66	Avg from WRAP/CARB tables
AGHAY	Agriculture-Hay (pasture/range)	NOX	5.02	5.02	5.02	Avg from WRAP/CARB tables
AGHAY	Agriculture-Hay (pasture/range)	PM10	32	32	32	AP-42 Table 2.5-5 Hay
AGHAY	Agriculture-Hay (pasture/range)	PM25	32	32	32	AP-42 Table 2.5-5 Hay

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
AGHAY	Agriculture-Hay (pasture/range)	SO2	0.67	0.67	0.67	Avg from WRAP/CARB tables
AGHAY	Agriculture-Hay (pasture/range)	VOC	17	17	17	AP-42 Table 2.5-5 Hay
AGSC	Agriculture-Sugar Cane	CH4	2.5	2.5	2.5	AP-42 Table 2.5-5 Sugar Cane
AGSC	Agriculture-Sugar Cane	CO	70.5	70.5	70.5	AP-42 Table 2.5-5 Sugar Cane
AGSC	Agriculture-Sugar Cane	NH3	1.02	1.02	1.02	Avg from WRAP/CARB tables
AGSC	Agriculture-Sugar Cane	NOX	2.8	2.8	2.8	Avg from WRAP/CARB tables
AGSC	Agriculture-Sugar Cane	PM10	7.2	7.2	7.2	AP-42 Table 2.5-5 Sugar Cane
AGSC	Agriculture-Sugar Cane	PM25	7.2	7.2	7.2	AP-42 Table 2.5-5 Sugar Cane
AGSC	Agriculture-Sugar Cane	SO2	1.24	1.24	1.24	Avg from WRAP/CARB tables
AGSC	Agriculture-Sugar Cane	VOC	8	8	8	AP-42 Table 2.5-5 Sugar Cane
AGUNSP	Agriculture-Unspecified	CH4	5.4	5.4	5.4	AP-42 Table 2.5-5 Unspecified
AGUNSP	Agriculture-Unspecified	CO	117	117	117	AP-42 Table 2.5-5 Unspecified
AGUNSP	Agriculture-Unspecified	NH3	2.16444444444444	2.16444444444444	2.16444444444444	Avg from WRAP/CARB tables
AGUNSP	Agriculture-Unspecified	NOX	4.54842105263158	4.54842105263158	4.54842105263158	Avg from WRAP/CARB tables
AGUNSP	Agriculture-Unspecified	PM10	21	21	21	AP-42 Table 2.5-5 Unspecified
AGUNSP	Agriculture-Unspecified	PM25	21	21	21	AP-42 Table 2.5-5 Unspecified
AGUNSP	Agriculture-Unspecified	SO2	0.526842105263158	0.526842105263158	0.526842105263158	Avg from WRAP/CARB tables
AGUNSP	Agriculture-Unspecified	VOC	18	18	18	AP-42 Table 2.5-5 Unspecified
B	Mature chaparral	CH4	5.07	7.7	13.6	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
B	Mature chaparral	CO	152.67	74.3	289	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
B	Mature chaparral	EC	1.5	0.6	1.5	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	NH3	1.3	0.5	1.3	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	NOX	6.2	6.2	6.2	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	OC	11.6	4.3	11.6	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	PM10	24.1	8	28.1	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
B	Mature chaparral	PM25	20.7	8	24.1	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
B	Mature chaparral	SO2	1.7	1.7	1.7	Table 2 Data Needs and Availability - Pace Report
B	Mature chaparral	TSP	29.2	12	34.1	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
B	Mature chaparral	VOC	11.6	6.3	13.6	Anthony Matthews

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
						Draft_2010_EmissionFactors_SEMAP.doc
C	Open timber/grass	CH4	5.07	7.7	4.59	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
C	Open timber/grass	CO	152.67	74.3	145.71	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
C	Open timber/grass	EC	1.5	0.6	1.5	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	NH3	1.3	0.5	1.3	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	NOX	6.2	6.2	6.2	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	OC	11.6	4.3	11.6	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	PM10	24.1	8	24.1	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
C	Open timber/grass	PM25	20.7	8	20.7	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
C	Open timber/grass	SO2	1.7	1.7	1.7	Table 2 Data Needs and Availability - Pace Report
C	Open timber/grass	TSP	29.2	12	29.2	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
C	Open timber/grass	VOC	11.6	6.3	11.6	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
D	Southern rough	CH4	7.91	8.3545	3.86	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
D	Southern rough	CO	172.3	80.6155	150.31	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
D	Southern rough	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	PM10	28.1	8.68	26.3	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
D	Southern rough	PM25	24.2	8.68	23.5	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
D	Southern rough	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
D	Southern rough	TSP	34.2	13.02	31.9	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
D	Southern rough	VOC	13.91	6.8355	12.76	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
DE	Southern Rough/Hardwood (winter)	CH4	7.91	8.3545	3.86	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
DE	Southern Rough/Hardwood (winter)	CO	172.3	80.6155	150.31	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
DE	Southern Rough/Hardwood (winter)	EC	1.755	0.651	1.6275	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	NH3	1.521	0.5425	1.4105	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	NOX	7.254	6.727	6.727	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	OC	13.572	4.6655	12.586	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	PM10	28.1	8.68	26.3	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
DE	Southern Rough/Hardwood (winter)	PM25	24.2	8.68	23.5	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
DE	Southern Rough/Hardwood (winter)	SO2	1.989	1.8445	1.8445	Same as Emission Factors for D and E
DE	Southern Rough/Hardwood (winter)	TSP	34.2	13.02	31.9	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
DE	Southern Rough/Hardwood (winter)	VOC	13.91	6.8355	12.76	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
E	Hardwoods (winter)	CH4	7.91	8.3545	3.86	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
E	Hardwoods (winter)	CO	172.3	80.6155	150.31	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
E	Hardwoods (winter)	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	PM10	28.1	8.68	26.3	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
E	Hardwoods (winter)	PM25	24.2	8.68	23.5	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
E	Hardwoods (winter)	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
E	Hardwoods (winter)	TSP	34.2	13.02	31.9	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
E	Hardwoods (winter)	VOC	13.91	6.8355	12.76	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
F	Intermediate brush	CH4	5.07	7.7	13.6	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
F	Intermediate brush	CO	152.67	74.3	289	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
F	Intermediate brush	EC	1.5	0.6	1.5	Table 2 Data Needs and Availability - Pace Report

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
F	Intermediate brush	NH3	1.3	0.5	1.3	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	NOX	6.2	6.2	6.2	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	OC	11.6	4.3	11.6	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	PM10	24.1	8	28.1	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
F	Intermediate brush	PM25	20.7	8	24.1	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
F	Intermediate brush	SO2	1.7	1.7	1.7	Table 2 Data Needs and Availability - Pace Report
F	Intermediate brush	TSP	29.2	12	34.1	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
F	Intermediate brush	VOC	11.6	6.3	13.6	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
G	Closed, short-needle conifer (heavy dead)	CH4	7.91	8.3545	14.756	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
G	Closed, short-needle conifer (heavy dead)	CO	172.3	80.6155	313.565	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
G	Closed, short-needle conifer (heavy dead)	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	PM10	28.1	8.68	30.4885	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
G	Closed, short-needle conifer (heavy dead)	PM25	24.2	8.68	26.1485	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
G	Closed, short-needle conifer (heavy dead)	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
G	Closed, short-needle conifer (heavy dead)	TSP	34.2	13.02	36.9985	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
G	Closed, short-needle conifer (heavy dead)	VOC	13.91	6.8355	14.756	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
H	Closed, short-needle conifer (normal dead)	CH4	7.91	8.3545	14.756	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
H	Closed, short-needle conifer (normal dead)	CO	172.3	80.6155	313.565	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
H	Closed, short-needle conifer (normal dead)	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
H	Closed, short-needle conifer (normal dead)	PM10	28.1	8.68	30.4885	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
H	Closed, short-needle conifer (normal dead)	PM25	24.2	8.68	26.1485	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
H	Closed, short-needle conifer (normal dead)	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
H	Closed, short-needle conifer (normal dead)	TSP	34.2	13.02	36.9985	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
H	Closed, short-needle conifer (normal dead)	VOC	13.91	6.8355	14.756	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
I	Heavy slash	CH4	7.91	8.3545	14.756	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
I	Heavy slash	CO	172.3	80.6155	313.565	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
I	Heavy slash	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	PM10	28.1	8.68	30.4885	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
I	Heavy slash	PM25	24.2	8.68	26.1485	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
I	Heavy slash	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
I	Heavy slash	TSP	34.2	13.02	36.9985	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
I	Heavy slash	VOC	13.91	6.8355	14.756	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
J	Medium slash	CH4	7.91	8.3545	3.86	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
J	Medium slash	CO	172.3	80.6155	150.31	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
J	Medium slash	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	PM10	28.1	8.68	26.3	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
J	Medium slash	PM25	24.2	8.68	23.5	Anthony Matthews

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
						Draft_2010_EmissionFactors_SEMAP.doc
J	Medium slash	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
J	Medium slash	TSP	34.2	13.02	31.9	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
J	Medium slash	VOC	13.91	6.8355	12.76	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
K	Light slash	CH4	7.91	8.3545	14.756	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
K	Light slash	CO	172.3	80.6155	313.565	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
K	Light slash	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
K	Light slash	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
K	Light slash	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
K	Light slash	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
K	Light slash	PM10	28.1	8.68	30.4885	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
K	Light slash	PM25	24.2	8.68	26.1485	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
K	Light slash	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
K	Light slash	TSP	34.2	13.02	36.9985	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
K	Light slash	VOC	13.91	6.8355	14.756	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
L	Perennial grass	CH4	5.07	7.7	13.6	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
L	Perennial grass	CO	152.67	74.3	289	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
L	Perennial grass	EC	1.5	0.6	1.5	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	NH3	1.3	0.5	1.3	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	NOX	6.2	6.2	6.2	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	OC	11.6	4.3	11.6	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	PM10	24.1	8	28.1	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
L	Perennial grass	PM25	20.7	8	24.1	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
L	Perennial grass	SO2	1.7	1.7	1.7	Table 2 Data Needs and Availability - Pace Report
L	Perennial grass	TSP	29.2	12	34.1	Anthony Matthews

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
						Draft_2010_EmissionFactors_SEMAP.doc
L	Perennial grass	VOC	11.6	6.3	13.6	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
LC	Land Clearing - All types	CO	169	169	169	Table 2 Data Needs and Availability - Pace Report
LC	Land Clearing - All types	NOX	5	5	5	Table 2 Data Needs and Availability - Pace Report
LC	Land Clearing - All types	PM10	17	17	17	Table 2 Data Needs and Availability - Pace Report
LC	Land Clearing - All types	PM25	17	17	17	Table 2 Data Needs and Availability - Pace Report
LC	Land Clearing - All types	VOC	11.6	11.6	11.6	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	CH4	7.91	8.3545	14.756	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
N	Sawgrass	CO	172.3	80.6155	313.565	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
N	Sawgrass	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	PM10	28.1	8.68	30.4885	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
N	Sawgrass	PM25	24.2	8.68	26.1485	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
N	Sawgrass	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
N	Sawgrass	TSP	34.2	13.02	36.9985	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
N	Sawgrass	VOC	13.91	6.8355	14.756	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
O	Pocosin	CH4	7.91	8.3545	14.756	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
O	Pocosin	CO	172.3	80.6155	313.565	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
O	Pocosin	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	PM10	28.1	8.68	30.4885	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
O	Pocosin	PM25	24.2	8.68	26.1485	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
O	Pocosin	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
O	Pocosin	TSP	34.2	13.02	36.9985	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
O	Pocosin	VOC	13.91	6.8355	14.756	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
P	Southern plantation	CH4	7.91	8.3545	14.756	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
P	Southern plantation	CO	172.3	80.6155	313.565	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
P	Southern plantation	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	PM10	28.1	8.68	30.4885	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
P	Southern plantation	PM25	24.2	8.68	26.1485	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
P	Southern plantation	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
P	Southern plantation	TSP	34.2	13.02	36.9985	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
P	Southern plantation	VOC	13.91	6.8355	14.756	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
PREHARD	Prescribed - Hardwoods	CH4	15.912	8.3545	3.86	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
PREHARD	Prescribed - Hardwoods	CO	338.13	80.6155	150.31	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
PREHARD	Prescribed - Hardwoods	EC	1.755	0.651	1.6275	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	NH3	1.521	0.5425	1.4105	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	NOX	7.254	6.727	6.727	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	OC	13.572	4.6655	12.586	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	PM10	32.877	8.68	26.3	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
PREHARD	Prescribed - Hardwoods	PM25	28.197	8.68	23.5	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
PREHARD	Prescribed - Hardwoods	SO2	1.989	1.8445	1.8445	Hardwood fuel model values
PREHARD	Prescribed - Hardwoods	TSP	39.897	13.02	31.9	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
PREHARD	Prescribed - Hardwoods	VOC	15.912	6.8355	12.76	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
PREMISC	Prescribed - Miscellaneous types	CH4	3.86	3.86	3.86	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
PREMISC	Prescribed - Miscellaneous types	CO	150.31	150.31	150.31	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
PREMISC	Prescribed - Miscellaneous types	EC	1.56954545454545	1.56954545454545	1.56954545454545	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	NH3	1.36027272727273	1.36027272727273	1.36027272727273	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	NOX	6.48745454545455	6.48745454545455	6.48745454545455	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	OC	12.1378181818182	12.1378181818182	12.1378181818182	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	PM10	25.2	25.2	25.2	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
PREMISC	Prescribed - Miscellaneous types	PM25	22.5	22.5	22.5	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
PREMISC	Prescribed - Miscellaneous types	SO2	1.77881818181818	1.77881818181818	1.77881818181818	Average of all used fuel models
PREMISC	Prescribed - Miscellaneous types	TSP	31.9	31.9	31.9	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
PREMISC	Prescribed - Miscellaneous types	VOC	12.23	12.23	12.23	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
Q	Alaskan black spruce	CH4	7.91	8.3545	14.756	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
Q	Alaskan black spruce	CO	172.3	80.6155	313.565	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
Q	Alaskan black spruce	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	PM10	28.1	8.68	30.4885	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
Q	Alaskan black spruce	PM25	24.2	8.68	26.1485	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
Q	Alaskan black spruce	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
Q	Alaskan black spruce	TSP	34.2	13.02	36.9985	Anthony Matthews

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
						Draft_2010_EmissionFactors_SEMAP.doc
Q	Alaskan black spruce	VOC	13.91	6.8355	14.756	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
R	Hardwoods (summer)	CH4	7.91	8.3545	14.756	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
R	Hardwoods (summer)	CO	172.3	80.6155	313.565	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
R	Hardwoods (summer)	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	PM10	28.1	8.68	30.4885	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
R	Hardwoods (summer)	PM25	24.2	8.68	26.1485	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
R	Hardwoods (summer)	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
R	Hardwoods (summer)	TSP	34.2	13.02	36.9985	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
R	Hardwoods (summer)	VOC	13.91	6.8355	14.756	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
S	Alaskan tundra	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
S	Alaskan tundra	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
SILVI	Silviculture-All types	CH4	3.86	3.86	3.86	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
SILVI	Silviculture-All types	CO	150.31	150.31	150.31	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
SILVI	Silviculture-All types	EC	1.56954545454545	1.56954545454545	1.56954545454545	Average of all used fuel models

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
SILVI	Silviculture-All types	NH3	1.36027272727273	1.36027272727273	1.36027272727273	Average of all used fuel models
SILVI	Silviculture-All types	NOX	6.48745454545455	6.48745454545455	6.48745454545455	Average of all used fuel models
SILVI	Silviculture-All types	OC	12.1378181818182	12.1378181818182	12.1378181818182	Average of all used fuel models
SILVI	Silviculture-All types	PM10	25.2	25.2	25.2	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
SILVI	Silviculture-All types	PM25	22.5	22.5	22.5	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
SILVI	Silviculture-All types	SO2	1.77881818181818	1.77881818181818	1.77881818181818	Average of all used fuel models
SILVI	Silviculture-All types	TSP	31.9	31.9	31.9	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
SILVI	Silviculture-All types	VOC	12.23	12.23	12.23	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
T	Sagebrush/grass	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report
T	Sagebrush/grass	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	CH4	15.912	8.3545	14.756	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	CO	338.13	80.6155	313.565	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	EC	1.755	0.651	1.6275	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	NH3	1.521	0.5425	1.4105	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	NOX	7.254	6.727	6.727	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	OC	13.572	4.6655	12.586	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	PM10	32.877	8.68	30.4885	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	PM25	28.197	8.68	26.1485	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	SO2	1.989	1.8445	1.8445	Table 2 Data Needs and Availability - Pace Report
U	Western, long-needle conifer	TSP	39.897	13.02	36.9985	Table 2 Data Needs and Availability - Pace Report

Fuel Model[1]	Vegetation	Pollutant	Wildfires[2]	Prescribed - piled fuel	Prescribed - nonpiled	Source
U	Western, long-needle conifer	VOC	15.912	6.8355	14.756	Table 2 Data Needs and Availability - Pace Report
WASTE	Waste Burning (all categories)	CH4	13	13	13	NEI values
WASTE	Waste Burning (all categories)	CO	85	85	85	NEI values
WASTE	Waste Burning (all categories)	NOX	6	6	6	NEI values
WASTE	Waste Burning (all categories)	PM10	38	38	38	NEI values
WASTE	Waste Burning (all categories)	PM25	34.8	34.8	34.8	NEI values
WASTE	Waste Burning (all categories)	VOC	30	30	30	NEI values
WILDLEAF	Wildfire-Leaf and needle mix	CH4	7.91	15.912	15.912	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
WILDLEAF	Wildfire-Leaf and needle mix	CO	172.3	338.13	338.13	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
WILDLEAF	Wildfire-Leaf and needle mix	EC	1.755	1.755	1.755	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	NH3	1.521	1.521	1.521	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	NOX	7.254	7.254	7.254	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	OC	13.572	13.572	13.572	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	PM10	28.1	32.877	32.877	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
WILDLEAF	Wildfire-Leaf and needle mix	PM25	24.2	28.197	28.197	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
WILDLEAF	Wildfire-Leaf and needle mix	SO2	1.989	1.989	1.989	Average of fuel models E & H
WILDLEAF	Wildfire-Leaf and needle mix	TSP	34.2	39.897	39.897	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
WILDLEAF	Wildfire-Leaf and needle mix	VOC	13.91	15.912	15.912	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
WILDUNSP	Wildfire-Unspecified	CH4	3.86	3.86	3.86	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
WILDUNSP	Wildfire-Unspecified	CO	150.31	150.31	150.31	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
WILDUNSP	Wildfire-Unspecified	EC	1.63909090909091	1.63909090909091	1.63909090909091	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	NH3	1.42054545454546	1.42054545454546	1.42054545454546	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	NOX	6.77490909090909	6.77490909090909	6.77490909090909	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	OC	12.6756363636364	12.6756363636364	12.6756363636364	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	PM10	26.3	26.3	26.3	Anthony Matthews

Fuel Model[1]	**Vegetation**	**Pollutant**	**Wildfires**[2]	**Prescribed - piled fuel**	**Prescribed - nonpiled**	**Source**
						Draft_2010_EmissionFactors_SEMAP.doc
WILDUNSP	Wildfire-Unspecified	PM25	23.5	23.5	23.5	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
WILDUNSP	Wildfire-Unspecified	SO2	1.85763636363636	1.85763636363636	1.85763636363636	Average of all used fuel models
WILDUNSP	Wildfire-Unspecified	TSP	31.9	31.9	31.9	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc
WILDUNSP	Wildfire-Unspecified	VOC	12.76	12.76	12.76	Anthony Matthews Draft_2010_EmissionFactors_SEMAP.doc

[1] Single Character Fuel Models correspond to the same value NFDRS models
[2] Emission factors listed in the wildfire and prescribed emission factor columns for other fire types are all identical. They do not truly represent wildfire or prescribed emission factors but rather the emission factors for that type of fire.

SEMAP EMISSION FACTORS

January 2010

This paper documents the process used in finalizing emission factors (EF) to be used in the 2010 fire emissions modeling for the southeastern modeling, analysis, and planning project (SEMAP).

BACKGROUND

1. The EFs listed in the "VISTAS 2002[i]" project served as the base data for EFs in this process. The final EFs were developed by modifying the 2002 EFs based on EFs published in recent research papers[ii] as well as AP-42.[iii]
    a. Modifications to the VISTAS 2002 EFs were made if data was available in these papers to support a change.
    b. Consistent with VISTAS 2002, all EFs are displayed as "pounds/ton of fuel consumed." EFs from the various research papers referred to here have been converted from the "grams per kilogram" or "kilograms per megagram" units to the "lbs/ton" units.
2. In VISTAS 2002, there were 11 pollutants assigned EFs for 32 fuels models (including 20 NFDRS Fuel Models). This resulted in a database of 1161 lines of data (refer to the Excel Workbook "Emission Factor Comparison.xlsx, worksheet "VISTAS per Bill B"). Many of the pollutant/fuel model combinations shared an identical EF.
    a. By filtering the data to reflect only the unique EFs, the data reduced to 72 unique EF/fuel model records (refer to worksheet "Minus Duplicates" in the same Excel Workbook).
    b. The 11 pollutants with EFs are: CO (carbon monoxide), CH4 (methane), EC (elemental carbon), NH3 (ammonia), NOX (nitrous oxides), OC (organic carbon), PM10 (particulate matter ≤ 10 microns), PM2.5 (particulate matter ≤ 2.5 microns), SO2 (sulfur dioxide), TSP (total suspended particulates), and VOC (volatile organic compounds).
        i. In the research, NMHC (non-methane hydrocarbons) are usually considered the equivalent of VOC (volatile organic compounds).
    c. Per a conference call by the SEMAP Fire Sub-Work Group, the pollutants that are critical to the modeling project are NOX, PM10, PM2.5, and SO2.
3. The research referenced in this paper (see "ii" in endnotes) did not break out EFs for wildfires and prescribed fires separately. Urbanski, et.al. 2009 (4.4.2) notes that numerous laboratory and field studies (both ground-based and airborne) have shown EFs for a wide range of compounds are linearly correlated with MCE [modified combustion efficiency], particularly within vegetation types. Therefore, the similar MCE of wildfires (ranged from 0.89 – 0.94) and prescribed fires (averaged 0.92) suggests the aggregation of emissions data from these fire events is appropriate for estimating EFs for use in global to continental scale modeling.
    a. The MCEs reported by the AP-42 document showed the average for wildfire at 0.924 and prescribed fire at 0.929.

Based on this information, it could be reasonable to assign one EF for wildfire and prescribed fire under each fuel model. However, since we are using the 2002 model as the basis, EFs for both wildfire and prescribed fire will be used.

4. In Wiedinmeyer, et.al. 2006, emission factors (EF) were estimated based on published literature (EPA AP-42 document, 1995; Guild, 2004; Reddy and Venkataraman, 2002; Battye and Battye, 2002; Andreae and Merlet, 2001; Hoelzemann et al., 2004; Liu, 2004). When more than one emission factor was available in the literature, the average of relevant emission factors for each gaseous or particulate species was applied. Emission factors for croplands (GLC2000 Codes 18 and 19) were assigned based on values reported by Dennis et al. (2002), Andreae and Merlet (2001), Jenkins (1996) and the EPA AP-42 document (1995). The EFs were applied to vegetation types defined in the GLC-2000 (Global Land Cover Project 2000). The EFs assigned to specific GLC2000 classifications by the authors are shown in the Excel Workbook "Emission Factor Comparison.xlsx."
5. The EFs (which appear appropriate at large scales) in the research papers were compared to the VISTAS 2002 EFs to determine whether adjustments may be warranted. Given that the Urbanski (2009) paper included specific measurements for prescribed fires throughout the southeast (Table A-1 of the Urbanski paper), more weight is given to those EFs in the comparisons.
6. Comparison of emission factors (EF) in the 2003 "Draft Report: Development of the Draft 2002 VISTAS Emissions Inventory for Regional Haze Modeling," the NFDRS Fuel Models shows that the NFDRS Fuel Models had identical EFs for the VISTAS 2002 work in the following vegetation grouping

GRASSES, SHRUBS, OPEN TIMBER/GRASS	**TIMBERED**
A – Annual Grass and Forbs	D: Southern Rough
B – Mature Chaparral	E – Hardwoods (winter)
C – Open Timber / Grass	G – Closed, Short-Needle Conifer (heavy dead)
F – Intermediate Brush	H – Closed, Short-Needle Conifer (normal dead)
L – Perennial Grass	I – Heavy Slash
	J – Medium Slash
	K – Light Slash
	N – Sawgrass
	O – Picosin
	P – Southern Plantation
	Q – Alaskan Black Spruce
	R – Hardwoods (summer)
	S – Alaskan Tundra
	T – Sagebrush / Grass
	U – Western, Long-Needle Conifer

RECOMMENDATIONS

1. For fuel models **AGSC, AGHAY, AGUNSP, AGGRAIN, WASTE, and LC**, no data was available to evaluate whether adjustments to the EFs were warranted. Therefore, the EFs listed in VISTAS 2002 for these models should be used in the 2010 modeling effort.
2. For **all wildfire and prescribed fire fuel models**, the EFs for elemental carbon (**EC**), and organic carbon (**OC**), should remain at the VISTAS 2002 levels given no data was found to warrant an adjustment.

3. For **all wildfire and prescribed fire fuel models**, the EFs for ammonia (**NH3**), nitrous oxides (**NOX**), and sulfur dioxide (**SO2**) should remain unchanged from the 2002 VISTAS; the average 2002 EFs were very close to the averages in the research.
4. For **all wildfire and prescribed fire fuel models**, the EF for volatile organic compounds (**VOC**) should be revised downward by 2 points per EF/fuel model. This is based on comparison of the values in research for the NMHC.

Fire Type	Fuel Model	Recommended VOC
Wildfire	A,B,C,F,L	11.60
	D,E,G,H,I,J,K, N,O,P,Q,R, Leaf & Needle Mix	13.91
Prescribed	C (Open Timber & Grass)	11.60
	PREMISC, SILVI	12.23
	D,E,J, PREHARD, WILDUNSP	12.76

5. The EFs for carbon monoxide (**CO**) and methane (**CH4**) should be reduced based on the data from the research. Comparison of the VISTAS 2002 EFs with the recent research shows VISTAS 2002 EFs to be too high. Reasonable EFs for CO range from 140 to 212 lbs/ton in the research; CH4 ranges from 3.76 to 13.6 lbs/ton.
   a. Recommended EFs for CO and CH4 by fuel model are:

Fire Type	Fuel Model	CO	CH4
Wildfire	A,B,C,F,L	152.67	5.07
	D,E,G,H,I,J,K, N,O,P,Q,R, Leaf & Needle Mix	172.30	7.91
Prescribed	C (Open Timber & Grass)	145.71	4.59
	PREMISC, SILVI	150.31	3.86
	D,E,J, PREHARD, WILDUNSP	150.31	3.86

6. EFs for PM in the 2002 VISTAS were calculated as described on page 7 of the 2002 VISTAS report:
   a. "The basis for the emission factors for many of these fires was Table 2 of the EPA 2003 report. For a few of the "fire models", the emission factors used differ slightly from Table 2 of that report. This is consistent with note 3 for Table 2 in the EPA 2003 report, which indicates emission factors for fuel models other than NFDRS types A, B, C, F, and L should be augmented by 17% and 8.5% for wildfires and prescribed fires respectively. Accordingly, the values for those fuel models were augmented by those percentages."
   b. Comparing the 2002 VISTAS **PM2.5** to EFs in the research papers results shows that the average EF for grasses and shrubs in Urbanski is 20.7 lbs/ton and Wiedinmyer is 20.7 lbs/ton (using grassland and wetlands EFs from Wiedinmeyer. (Note that Wiedinmeyer, et.al. estimates include the AP-42 data.) Using the same augmentation factor for fuel models other than A, B, C, F, and L (as above in "a") and percentage increases similar to the VISTAS 2002 EFs, then the $PM_{2.5}$ EFs would be:
      i. Recommended EFs for $PM_{2.5}$ by fuel model are:

Fire Type	Fuel Model	$PM_{2.5}$
Wildfire	A,B,C,F,L	20.7
	D,E,G,H,I,J,K, N,O,P,Q,R, Leaf & Needle Mix	24.2

Prescribed	C (Open Timber & Grass)	20.7
	PREMISC, SILVI	22.5
	D,E,J, PREHARD, WILDUNSP	23.5

7. Based on changes to the $PM_{2.5}$ EFs, the recommended EFs for PM 10 and TSP (based on percentages from VISTAS 2002 data) would be:

Fire Type	Fuel Model	PM_{10}	TSP
Wildfire	A,B,C,F,L	24.1	29.2
	D,E,G,H,I,J,K, N,O,P,Q,R, Leaf & Needle Mix	28.1	34.2
Prescribed	C (Open Timber & Grass)	24.1	29.2
	PREMISC, SILVI	25.2	30.6
	D,E,J, PREHARD, WILDUNSP	26.3	31.9

8. BELOW is a table with the recommended updates to the emission factors:

FIRE TYPE	FUEL MODEL	CH4	CO	EC	NH3	NOX	OC	PM10	PM25	SO2	TSP	VOC
Agriculture	AGSC	2.50	70.50	-	-	-	-	7.20	7.20	-	-	8.00
	AGHAY	5.00	139.00	-	-	-	-	32.00	32.00	-	-	17.00
	AGUNSP	5.40	117.00	-	-	-	-	21.00	21.00	-	-	18.00
	AGGRAIN	5.43	140.66	-	-	-	-	29.33	29.33	-	-	18.00
Waste Burning	WASTE	13.00	85.00	-	-	6.00	-	38.00	34.80	-	-	30.00
Land Clearing	LC	-	169.00	-	-	5.00	-	17.00	17.00	-	-	11.60
Wildfire	A, B, C, F, L	5.07	152.67	1.50	1.30	6.20	11.60	24.1	20.7	1.70	29.2	11.60
	D, E, G, H, I, J, K, N, O, P, Q, R, and LEAF& NEEDLE MIX	7.91	172.30	1.76	1.52	7.25	13.57	28.1	24.2	1.99	34.2	13.91
Prescribed Fire	C (open timber/grass)	4.59	145.71	1.50	1.30	6.20	11.60	24.1	20.7	1.70	29.2	11.60
	PREMISC, SILVI	3.86	150.31	1.57	1.36	6.49	12.14	25.2	22.5	1.78	30.6	12.23
	D, E, J, PREHARD	3.86	150.31	1.63	1.41	6.73	12.59	26.3	23.5	1.84	31.9	12.76
	WILDUNSP	3.86	150.31	1.64	1.42	6.77	12.68	26.3	23.5	1.86	31.9	12.76

[i] -2003. Barnard, William R. Draft Report - Development of the Draft 2002 VISTAS Emission Inventory for Regional Haze Modeling Fire Emission Methodology. MACTEC Engineering and Consulting, Inc. Newberry, FL.

[ii] -2004. Liu, Y. Variability of Wildland Fire Emissions Across the Contiguous United States. USDA Forest Service Foresty Sciences Laboratory. Publ. by ELSEVIER ltd., Atmospheric Environment 38:3489-3499. E

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-2007. Randerson, J.T., van der Werf, L. Giglio, G.J. Collatz, and P.S. Kasibhatla. Global Fire Emissions Database, Version 2 (GFEDv2.1). Data Set. Available on-line [http://daac.ornl.gov/] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A

-2009. Urbanski, S.P., Wei Min Hao, and Steve Baker. Chemical Composition of Wildland Fire Emissions. In Wildland Fires and Air Pollution. Editors Andrzej Bytnerowicz, Michael Arbaugh, Allen Riebau, and Christian Andersen. Published by Elsevier. Amsterdam. 638 pp.

[iii] AP-42 Documents:

-2002. Battye, W. and Battye, R. Development of Emissions Inventory Methods for Wildland Fire. Prepared for T.G. Pace, D205-01. US EPA. Research Triangle Park ,N.C. 82 pp.

-1996. Chapter 13.1 Wildfires and Prescribed Burning. October 1996. Currently listed on EPA's AP-42 website as Chapter 13.1 of AP-42.

Appendix C

Fuel Model, Fuel Loading Source, and Emission Factor by State, Providing Agency and Fire Type

TABLE C-1.

Fuel Model, Fuel Loading Source, and Emission Factor by State, Providing Agency and Fire Type

StateFIPS	SCC	Agency	Fuel Model	Fuel Loading Source	Emission Factor Code
01	2801500000	ADEM		AP-42 Table 2.5-5 Unspecified field crops	AGUNSP
01	2810001000	ADEM	C	NFDRS Map	C
01	2810001000	ADEM	D	NFDRS Map	D
01	2810001000	ADEM	D	Tracy Anderson email 10/8/2010	D
01	2810001000	ADEM	L	NFDRS Map	L
01	2810001000	ADEM	M	AP-42 Table 2.5-5 Unspecified field crops	AGUNSP
01	2810001000	ADEM	P	NFDRS Map	P
01	2810001000	ADEM	R	NFDRS Map	R
01	2810001000	USFS	C	NFDRS Map	C
01	2810001000	USFS	D	NFDRS Map	D
01	2810001000	USFS	L	NFDRS Map	L
01	2810001000	USFS	P	NFDRS Map	P
01	2810001000	USFS	R	NFDRS Map	R
01	2810015000	ADEM	C	NFDRS Map	C
01	2810015000	ADEM	D	NFDRS Map	D
01	2810015000	ADEM	D	Tracy Anderson email 10/8/2010	D
01	2810015000	ADEM	L	NFDRS Map	L
01	2810015000	ADEM	M	NFDRS Map	AGUNSP
01	2810015000	ADEM	P	NFDRS Map	P
01	2810015000	ADEM	R	NFDRS Map	R
37	2810001000	ADEM	C	NFDRS Map	C
12	2610000500	FLDOF	10	FL FBPS Map	LC
12	2610000500	FLDOF	2	FL FBPS Map	LC
12	2610000500	FLDOF	3	FL FBPS Map	LC
12	2610000500	FLDOF	4	FL FBPS Map	LC
12	2610000500	FLDOF	5	FL FBPS Map	LC
12	2610000500	FLDOF	6	FL FBPS Map	LC
12	2610000500	FLDOF	7	FL FBPS Map	LC
12	2610000500	FLDOF	8	FL FBPS Map	LC
12	2610000500	FLDOF	9	FL FBPS Map	LC
12	2610000500	FLDOF	C	NFDRS Map	LC

StateFIPS	SCC	Agency	Fuel Model	Fuel Loading Source	Emission Factor Code
12	2610000500	FLDOF	D	NFDRS Map	LC
12	2610000500	FLDOF	L	NFDRS Map	LC
12	2610000500	FLDOF	M	NFDRS Map	LC
12	2610000500	FLDOF	N	NFDRS Map	LC
12	2610000500	FLDOF	O	NFDRS Map	LC
12	2610000500	FLDOF	P	NFDRS Map	LC
12	2610000500	FLDOF	R	NFDRS Map	LC
12	2801500000	FLDEP	2	Jim Brenner Phone conversation 7/2/10	AGHAY
12	2801500000	FLDEP	2	Jim Brenner Phone conversation 7/2/10	AGSC
12	2801500000	FLDEP	2	Jim Brenner Phone conversation 7/2/10	AGUNSP
12	2801500000	FLDEP	3	Jim Brenner Phone conversation 7/2/10	AGHAY
12	2801500000	FLDEP	3	Jim Brenner Phone conversation 7/2/10	AGSC
12	2801500000	FLDEP	4	Jim Brenner Phone conversation 7/2/10	AGHAY
12	2801500000	FLDEP	4	Jim Brenner Phone conversation 7/2/10	AGSC
12	2801500000	FLDEP	5	Jim Brenner Phone conversation 7/2/10	AGHAY
12	2801500000	FLDEP	7	Jim Brenner Phone conversation 7/2/10	AGHAY
12	2801500000	FLDEP	7	Jim Brenner Phone conversation 7/2/10	AGSC
12	2801500000	FLDEP	8	Jim Brenner Phone conversation 7/2/10	AGHAY
12	2801500000	FLDEP	8	Jim Brenner Phone conversation 7/2/10	AGSC
12	2801500000	FLDEP	9	Jim Brenner Phone conversation 7/2/10	AGHAY
12	2801500000	FLDEP	9	Jim Brenner Phone conversation 7/2/10	AGSC
12	2801500000	FLDEP	C	NFDRS Map	AGHAY
12	2801500000	FLDEP	D	NFDRS Map	AGHAY
12	2801500000	FLDEP	D	NFDRS Map	AGSC
12	2801500000	FLDEP	D	NFDRS Map	AGUNSP
12	2801500000	FLDEP	L	NFDRS Map	AGHAY
12	2801500000	FLDEP	L	NFDRS Map	AGSC
12	2801500000	FLDEP	M	NFDRS Map	AGHAY
12	2801500000	FLDEP	M	NFDRS Map	AGSC
12	2801500000	FLDEP	M	NFDRS Map	AGUNSP
12	2801500000	FLDEP	N	NFDRS Map	AGHAY
12	2801500000	FLDEP	N	NFDRS Map	AGSC
12	2801500000	FLDEP	O	NFDRS Map	AGHAY
12	2801500000	FLDEP	O	NFDRS Map	AGSC
12	2801500000	FLDEP	P	NFDRS Map	AGHAY
12	2801500000	FLDEP	P	NFDRS Map	AGSC

StateFIPS	SCC	Agency	Fuel Model	Fuel Loading Source	Emission Factor Code
12	2801500000	FLDEP	R	NFDRS Map	AGHAY
12	2801500000	FLDEP	R	NFDRS Map	AGSC
12	2801500000	FLDOF	K	NFDRS Map	AGHAY
12	2801500000	FLDOF	K	NFDRS Map	AGSC
12	2801500000	FLDOF	K	NFDRS Map	AGUNSP
12	2810001000	FLDOF	2	FL FBPS Map	C
12	2810001000	FLDOF	3	FL FBPS Map	N
12	2810001000	FLDOF	4	FL FBPS Map	B
12	2810001000	FLDOF	5	FL FBPS Map	D
12	2810001000	FLDOF	7	FL FBPS Map	D
12	2810001000	FLDOF	8	FL FBPS Map	H
12	2810001000	FLDOF	9	FL FBPS Map	E
12	2810001000	FLDOF	C	NFDRS Map	C
12	2810001000	FLDOF	D	NFDRS Map	D
12	2810001000	FLDOF	L	NFDRS Map	L
12	2810001000	FLDOF	M	NFDRS Map	AGUNSP
12	2810001000	FLDOF	N	NFDRS Map	N
12	2810001000	FLDOF	O	NFDRS Map	O
12	2810001000	FLDOF	P	NFDRS Map	P
12	2810001000	FLDOF	R	NFDRS Map	R
12	2810001000	FWS	D	NFDRS Map	D
12	2810001000	FWS	L	NFDRS Map	L
12	2810001000	FWS	M	NFDRS Map	AGUNSP
12	2810001000	FWS	N	NFDRS Map	N
12	2810001000	FWS	O	NFDRS Map	O
12	2810001000	FWS	P	NFDRS Map	P
12	2810001000	GAEPD	D	NFDRS Map	D
12	2810001000	GAEPD	O	NFDRS Map	O
12	2810001000	NPS	1	Aids to Determining Fuel Models for Estimating Fire Behavior	A
12	2810001000	NPS	2	Aids to Determining Fuel Models for Estimating Fire Behavior	C
12	2810001000	NPS	3	Aids to Determining Fuel Models for Estimating Fire Behavior	N
12	2810001000	NPS	7	Aids to Determining Fuel Models for Estimating Fire Behavior	D
12	2810001000	NPS	8	Aids to Determining Fuel Models for Estimating Fire Behavior	H
12	2810001000	NPS	M	NFDRS Map	AGUNSP
12	2810001000	NPS	N	NFDRS Map	N
12	2810001000	NPS	P	NFDRS Map	P

StateFIPS	SCC	Agency	Fuel Model	Fuel Loading Source	Emission Factor Code
12	2810001000	USFS	2	NFDRS Fuel Consumption via Huber	C
12	2810001000	USFS	3	NFDRS Fuel Consumption via Huber	N
12	2810001000	USFS	4	NFDRS Fuel Consumption via Huber	B
12	2810001000	USFS	5	NFDRS Fuel Consumption via Huber	D
12	2810001000	USFS	7	NFDRS Fuel Consumption via Huber	D
12	2810001000	USFS	8	NFDRS Fuel Consumption via Huber	H
12	2810001000	USFS	9	NFDRS Fuel Consumption via Huber	E
12	2810001000	USFS	99	Per Cindy Huber 20100914 email	F
12	2810015000	FLDOF	1	FLDOF FBPS Map to NFDRS	A
12	2810015000	FLDOF	2	FLDOF FBPS Map to NFDRS	C
12	2810015000	FLDOF	3	FLDOF FBPS Map to NFDRS	N
12	2810015000	FLDOF	4	FLDOF FBPS Map to NFDRS	B
12	2810015000	FLDOF	5	FLDOF FBPS Map to NFDRS	D
12	2810015000	FLDOF	7	FLDOF FBPS Map to NFDRS	D
12	2810015000	FLDOF	8	FLDOF FBPS Map to NFDRS	H
12	2810015000	FLDOF	9	FLDOF FBPS Map to NFDRS	E
12	2810015000	FLDOF	C	NFDRS Map	C
12	2810015000	FLDOF	D	NFDRS Map	D
12	2810015000	FLDOF	K	Jim Brenner Email 7/8/10	K
12	2810015000	FLDOF	L	NFDRS Map	L
12	2810015000	FLDOF	M	NFDRS Map	AGUNSP
12	2810015000	FLDOF	N	NFDRS Map	N
12	2810015000	FLDOF	O	NFDRS Map	O
12	2810015000	FLDOF	P	NFDRS Map	P
12	2810015000	FLDOF	R	NFDRS Map	R
13	2610000500	GAEPD	LC	May 5 memo - VISTAS 2002	LC
13	2801500000	GAEPD	AGUNSP	May 5 memo - VISTAS 2002	AGUNSP
13	2810001000	FWS	C	NFDRS Map	C
13	2810001000	FWS	N	NFDRS Map	N
13	2810001000	FWS	O	NFDRS Map	O
13	2810001000	FWS	P	NFDRS Map	P
13	2810001000	GAEPD	D	NFDRS Map	D
13	2810001000	GAEPD	O	NFDRS Map	O
13	2810001000	GAEPD	P	NFDRS Map	P
13	2810001000	GFC	C	May 5 memo - VISTAS 2002 w/Huber values	C
13	2810001000	GFC	E	May 5 memo - VISTAS 2002 w/Huber values	E

StateFIPS	SCC	Agency	Fuel Model	Fuel Loading Source	Emission Factor Code
13	2810001000	GFC	F	May 5 memo - VISTAS 2002 w/Huber values	F
13	2810001000	GFC	H	May 5 memo - VISTAS 2002 w/Huber values	H
13	2810001000	GFC	J	May 5 memo - VISTAS 2002 w/Huber values	J
13	2810001000	GFC	L	May 5 memo - VISTAS 2002 w/Huber values	L
13	2810001000	GFC	WILDLEAF	May 5 memo - VISTAS 2002	WILDLEAF
13	2810001000	USFS	2	NFDRS Fuel Consumption via Huber	C
13	2810001000	USFS	5	NFDRS Fuel Consumption via Huber	D
13	2810001000	USFS	8	NFDRS Fuel Consumption via Huber	H
13	2810001000	USFS	9	NFDRS Fuel Consumption via Huber	E
13	2810001000	USFS	96	Per Cindy Huber 20100914 email	F
13	2810001000	USFS	98	Per Cindy Huber 20100914 email	F
13	2810015000	DOD	N	NFDRS Map	N
13	2810015000	DOD	R	NFDRS Map	R
13	2810015000	FWS	M	NFDRS Map	AGUNSP
13	2810015000	FWS	N	NFDRS Map	N
13	2810015000	FWS	P	NFDRS Map	P
13	2810015000	GAEPD	SILVI	May 5 memo - VISTAS 2002	SILVI
13	2810015000	USFS	C	NFDRS Map	C
13	2810015000	USFS	D	NFDRS Map	D
13	2810015000	USFS	P	NFDRS Map	P
13	2810015000	USFS	R	NFDRS Map	R
21	2810001000	NPS	10	Aids to Determining Fuel Models for Estimating Fire Behavior	G
21	2810001000	NPS	8	Aids to Determining Fuel Models for Estimating Fire Behavior	H
21	2810001000	NPS	9	Aids to Determining Fuel Models for Estimating Fire Behavior	E
21	2810001000	State DOF	C	NFDRS Map	C
21	2810001000	State DOF	L	NFDRS Map	L
21	2810001000	State DOF	M	NFDRS Map	AGUNSP
21	2810001000	State DOF	P	NFDRS Map	P
21	2810001000	State DOF	R	NFDRS Map	R
21	2810001000	USFS	2	NFDRS Fuel Consumption via Huber	C
21	2810001000	USFS	3	NFDRS Fuel Consumption via Huber	N
21	2810001000	USFS	8	NFDRS Fuel Consumption via Huber	H
21	2810001000	USFS	9	NFDRS Fuel Consumption via Huber	E
21	2810001000	USFS	98	Per Cindy Huber 20100914 email	F
21	2810015000	NPS	3	Aids to Determining Fuel Models for Estimating Fire Behavior	N
21	2810015000	NPS	9	Aids to Determining Fuel Models for Estimating Fire Behavior	E

StateFIPS	SCC	Agency	Fuel Model	Fuel Loading Source	Emission Factor Code
21	2810015000	USFS	E	FS/FOFEM	E
21	2810015000	USFS	N	FS/FOFEM	N
21	2810015000	USFS	R	NFDRS Map	R
37	2810001000	FWS	B	NFDRS Map	B
37	2810001000	FWS	C	NFDRS Map	C
37	2810001000	FWS	D	NFDRS Map	D
37	2810001000	FWS	N	NFDRS Map	N
37	2810001000	FWS	R	NFDRS Map	R
37	2810001000	NCDENR	1	State Supplied FBPS	A
37	2810001000	NCDENR	10	State Supplied FBPS	G
37	2810001000	NCDENR	11	State Supplied FBPS	K
37	2810001000	NCDENR	12	State Supplied FBPS	J
37	2810001000	NCDENR	13	State Supplied FBPS	I
37	2810001000	NCDENR	2	State Supplied FBPS	C
37	2810001000	NCDENR	3	State Supplied FBPS	N
37	2810001000	NCDENR	4	State Supplied FBPS	B
37	2810001000	NCDENR	5	State Supplied FBPS	D
37	2810001000	NCDENR	6	State Supplied FBPS	F
37	2810001000	NCDENR	7	State Supplied FBPS	D
37	2810001000	NCDENR	8	State Supplied FBPS	H
37	2810001000	NCDENR	9	State Supplied FBPS	E
37	2810001000	NCDENR	B	NFDRS Map	B
37	2810001000	NCDENR	C	NFDRS Map	C
37	2810001000	NCDENR	D	NFDRS Map	D
37	2810001000	NCDENR	L	NFDRS Map	L
37	2810001000	NCDENR	M	NFDRS Map	AGUNSP
37	2810001000	NCDENR	N	NFDRS Map	N
37	2810001000	NCDENR	P	NFDRS Map	P
37	2810001000	NCDENR	R	NFDRS Map	R
37	2810001000	NPS	1	Aids to Determining Fuel Models for Estimating Fire Behavior	A
37	2810001000	NPS	10	Aids to Determining Fuel Models for Estimating Fire Behavior	G
37	2810001000	NPS	15	Aids to Determining Fuel Models for Estimating Fire Behavior	I
37	2810001000	NPS	2	Aids to Determining Fuel Models for Estimating Fire Behavior	C
37	2810001000	NPS	3	Aids to Determining Fuel Models for Estimating Fire Behavior	N
37	2810001000	NPS	9	Aids to Determining Fuel Models for Estimating Fire Behavior	E
37	2810001000	NPS	P	NFDRS Map	P

StateFIPS	SCC	Agency	Fuel Model	Fuel Loading Source	Emission Factor Code
37	2810001000	NPS	R	NFDRS Map	R
37	2810001000	USFS	2	NFDRS Fuel Consumption via Huber	C
37	2810001000	USFS	4	NFDRS Fuel Consumption via Huber	B
37	2810001000	USFS	5	NFDRS Fuel Consumption via Huber	D
37	2810001000	USFS	6	NFDRS Fuel Consumption via Huber	F
37	2810001000	USFS	7	NFDRS Fuel Consumption via Huber	D
37	2810001000	USFS	8	NFDRS Fuel Consumption via Huber	H
37	2810001000	USFS	9	NFDRS Fuel Consumption via Huber	E
37	2810001000	USFS	96	Per Cindy Huber 20100914 email	F
37	2810001000	USFS	98	Per Cindy Huber 20100914 email	F
37	2810015000	NCDENR		State Supp	PREMISC
37	2810015000	NCDENR	D	NFDRS Map	D
37	2810015000	NCDENR	M	NFDRS Map	AGUNSP
37	2810015000	NCDENR	P	NFDRS Map	P
37	2810015000	NCDENR	R	NFDRS Map	R
45	2801500000	SCDHEQ		State Supp	AGGRAIN
45	2801500000	SCDHEQ		State Supp	AGUNSP
45	2810001000	FWS	D	NFDRS Map	D
45	2810001000	FWS	N	NFDRS Map	N
45	2810001000	FWS	R	NFDRS Map	R
45	2810001000	SCDHEQ	B	NFDRS Map	B
45	2810001000	SCDHEQ	C	NFDRS Map	C
45	2810001000	SCDHEQ	D	NFDRS Map	D
45	2810001000	SCDHEQ	L	NFDRS Map	L
45	2810001000	SCDHEQ	M	NFDRS Map	AGUNSP
45	2810001000	SCDHEQ	N	NFDRS Map	N
45	2810001000	SCDHEQ	P	NFDRS Map	P
45	2810001000	SCDHEQ	R	NFDRS Map	R
45	2810001000	USFS	2	NFDRS Fuel Consumption via Huber	C
45	2810001000	USFS	3	NFDRS Fuel Consumption via Huber	N
45	2810001000	USFS	4	NFDRS Fuel Consumption via Huber	B
45	2810001000	USFS	5	NFDRS Fuel Consumption via Huber	D
45	2810001000	USFS	6	NFDRS Fuel Consumption via Huber	F
45	2810001000	USFS	8	NFDRS Fuel Consumption via Huber	H
45	2810001000	USFS	9	NFDRS Fuel Consumption via Huber	E
45	2810001000	USFS	97	Per Cindy Huber 20100914 email	F

StateFIPS	SCC	Agency	Fuel Model	Fuel Loading Source	Emission Factor Code
45	2810001000	USFS	98	Per Cindy Huber 20100914 email	F
45	2810015000	SCDHEQ		State Supp	PREMISC
47	2810001000	FWS	M	NFDRS Map	AGUNSP
47	2810001000	NPS	1	Aids to Determining Fuel Models for Estimating Fire Behavior	A
47	2810001000	NPS	10	Aids to Determining Fuel Models for Estimating Fire Behavior	G
47	2810001000	NPS	2	Aids to Determining Fuel Models for Estimating Fire Behavior	C
47	2810001000	NPS	8	Aids to Determining Fuel Models for Estimating Fire Behavior	H
47	2810001000	NPS	9	Aids to Determining Fuel Models for Estimating Fire Behavior	E
47	2810001000	NPS	P	NFDRS Map	P
47	2810001000	NPS	R	NFDRS Map	R
47	2810001000	TNAPCD	C	NFDRS Map	C
47	2810001000	TNAPCD	D	NFDRS Map	D
47	2810001000	TNAPCD	L	NFDRS Map	L
47	2810001000	TNAPCD	M	NFDRS Map	AGUNSP
47	2810001000	TNAPCD	P	NFDRS Map	P
47	2810001000	TNAPCD	R	NFDRS Map	R
47	2810001000	USFS	10	NFDRS Fuel Consumption via Huber	G
47	2810001000	USFS	2	NFDRS Fuel Consumption via Huber	C
47	2810001000	USFS	8	NFDRS Fuel Consumption via Huber	H
47	2810001000	USFS	9	NFDRS Fuel Consumption via Huber	E
47	2810001000	USFS	97	Per Cindy Huber 20100914 email	F
47	2810015000	NPS	1	Aids to Determining Fuel Models for Estimating Fire Behavior	A
47	2810015000	NPS	10	Aids to Determining Fuel Models for Estimating Fire Behavior	G
47	2810015000	NPS	8	Aids to Determining Fuel Models for Estimating Fire Behavior	H
47	2810015000	NPS	9	Aids to Determining Fuel Models for Estimating Fire Behavior	PREHARD
47	2810015000	NPS	P	NFDRS Map	P
47	2810015000	NPS	R	NFDRS Map	R
47	2810015000	USFS	L	NFDRS Map	L
47	2810015000	USFS	P	NFDRS Map	P
47	2810015000	USFS	R	NFDRS Map	R
51	2810001000	FWS	D	NFDRS Map	D
51	2810001000	FWS	L	NFDRS Map	L
51	2810001000	FWS	M	NFDRS Map	AGUNSP
51	2810001000	FWS	P	NFDRS Map	P
51	2810001000	FWS	R	NFDRS Map	R
51	2810001000	NPS	1	Aids to Determining Fuel Models for Estimating Fire Behavior	A

StateFIPS	SCC	Agency	Fuel Model	Fuel Loading Source	Emission Factor Code
51	2810001000	NPS	10	Aids to Determining Fuel Models for Estimating Fire Behavior	G
51	2810001000	NPS	8	Aids to Determining Fuel Models for Estimating Fire Behavior	H
51	2810001000	NPS	9	Aids to Determining Fuel Models for Estimating Fire Behavior	E
51	2810001000	NPS	R	NFDRS Map	R
51	2810001000	USFS	9	Aids to Determining Fuel Models for Estimating Fire Behavior	E
51	2810001000	VADEQ	B	NFDRS Map	B
51	2810001000	VADEQ	L	NFDRS Map	L
51	2810001000	VADEQ	M	NFDRS Map	AGUNSP
51	2810001000	VADEQ	N	NFDRS Map	N
51	2810001000	VADEQ	P	NFDRS Map	P
51	2810001000	VADEQ	R	NFDRS Map	R
51	2810015000	FWS	D	NFDRS Map	D
51	2810015000	FWS	M	NFDRS Map	AGUNSP
51	2810015000	FWS	N	NFDRS Map	N
51	2810015000	FWS	P	NFDRS Map	P
51	2810015000	FWS	R	NFDRS Map	R
51	2810015000	NPS	1	Aids to Determining Fuel Models for Estimating Fire Behavior	A
51	2810015000	NPS	10	Aids to Determining Fuel Models for Estimating Fire Behavior	G
51	2810015000	NPS	8	Aids to Determining Fuel Models for Estimating Fire Behavior	H
51	2810015000	USFS	9	Aids to Determining Fuel Models for Estimating Fire Behavior	PREHARD
51	2810015000	VADEQ	M	NFDRS Map	AGUNSP
51	2810015000	VADEQ	P	NFDRS Map	P
51	2810015000	VADEQ	R	NFDRS Map	R
54	2810001000	NPS	14	Aids to Determining Fuel Models for Estimating Fire Behavior	I
54	2810001000	NPS	9	Aids to Determining Fuel Models for Estimating Fire Behavior	E
54	2810001000	NPS	R	NFDRS Map	R
54	2810001000	USFS	R	NFDRS Map	R
54	2810001000	WVDOF	M	NFDRS Map	AGUNSP
54	2810001000	WVDOF	P	NFDRS Map	P
54	2810001000	WVDOF	R	NFDRS Map	R
54	2810015000	NPS	3	Aids to Determining Fuel Models for Estimating Fire Behavior	N
54	2810015000	USFS	9	Aids to Determining Fuel Models for Estimating Fire Behavior	PREHARD
54	2810015000	USFS	R	NFDRS Map	R