

TECHNICAL MEMORANDUM

APPROACH FOR CATEGORIZING NATURAL AND ANTHROPOGENIC FOR WRAP PHASE I FIRE EMISSION INVENTORY

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This memo presents a method to categorize each wildfire, prescribed burn, and agricultural burn in the Western Regional Air Partnership (WRAP) Phase I emission inventory for fire as “natural” or “anthropogenic” in origin. The following approaches are based on the WRAP Fire Emissions Joint Forum’s (FEJF) *2001 WRAP Policy for Categorizing Fire Emissions and Guidance for Classifying Natural Versus Anthropogenic Fire Emissions* (under development). Further approaches for categorizing natural and anthropogenic fires may be developed by the FEJF for subsequent phase II, III, and IV emission inventories.

The FEJF database for Phase I wildfire and prescribed burning will be amended with a field to flag each fire event as natural or anthropogenic. Also, the Source Classification Code (SCC) assignment performed in the database will be refined to assign custom SCCs which accommodate specific fire types discussed in this document. Each SCC present in the refined Phase I emission inventory will represent either natural or anthropogenic origin. The SCC will stay with the fire event once exported to SMOKE model-ready files and delivered to the WRAP Regional Modeling Center (RMC). The RMC will also receive a lookup table defining each SCC as natural or anthropogenic so the RMC pre-processing software can reconstruct the natural/anthropogenic flag (Table 1).

Table 1: SCCs and their Fire Type and Natural/Anthropogenic Classification.

SCC	Fire Type	Natural or Anthropogenic
2810001000	Wildfire	Natural
2810001001	WFU	Natural
2801500000	Agricultural	Anthropogenic
2801500001	Agricultural (Native American)	Natural
2810015000	Prescribed	Anthropogenic
2810015001	Prescribed	Natural

Wildfire

All wildfire will be categorized as natural. The SCC for wildfire (2810001000) will be considered exclusively natural.

Wildland Fire Use

All Wildland Fire Use (WFU) incidents identified in the Phase I inventory will be categorized as natural. A custom SCC of 2810001001 will be used to identify WFU and be defined as natural. It is helpful to note that by definition WFU is a distinct fire source from both wildfire and prescribed burning. That is, a WFU incident cannot also be considered wildfire or prescribed burning.

Year 2002 was a high wildfire year with preparedness levels thereby elevated for many weeks. The FEJF believes wildland fire use was rarely employed by land managers that year and that out of operational necessity, WFU would have only occurred in fuels that were closer to natural conditions and in more fire sustainable systems. Based on this rationale, all WFU identifiable in the Phase I inventory will be classified as natural.

WFU incidents coming from the federal activity databases will be identified and reclassified as WFU in the Phase I wildfire and prescribed burning emission inventory. Activity data originating from state activity databases does not have obvious identifiers and will not be reclassified

Agricultural Fire

All agricultural burning in the Phase I emission inventory will be categorized as anthropogenic and given the standard SCC of 2801500000.

The 2001 WRAP Policy for Categorizing Fire Emissions states that “vegetative burning conducted by Native Americans for traditional, religious and ceremonial purposes” is considered natural and all other vegetative burning conducted by Native Americans is classified as “prescribed”, with agricultural burning fitting the definition of prescribed fire. Some agricultural fire events in the Phase I emission inventory fall within the exterior boundaries of Tribal lands, but the Phase I inventory lacks an indication of “traditional, religious, or ceremonial” purpose. Therefore agricultural events falling on tribal lands will still be categorized as anthropogenic. A custom SCC of 2801500001 will be used in the future to classify agricultural burning determined to be of a natural origin.

Prescribed Fire

Prescribed fire will be categorized as either natural or anthropogenic. The standard SCC of 2810015000 will represent anthropogenic prescribed burns and a custom SCC of 2810015001 will represent natural burns.

Categorization of prescribed fire as natural or anthropogenic will be based on the National Fire Danger Rating System (NFDRS) fuel model for each incident (Table 2). An NFDRS fuel model exists for each wildfire and prescribed burn in the Phase I emission inventory. Each incident in the Phase I emission inventory has only one NFDRS assignment based on the observed fuel model reported in the activity database (preferred) or is assigned by overlaying the fire location on the national NFDRS fuel model map using GIS (see the WRAP 1996 Fire Emission Inventory documentation). The NFDRS categorizations as natural or anthropogenic are based on examining the text descriptions of the fuel models (Appendix A) and identifying the buildup of “above normal” fuel loadings (for example, the short needle conifer models G and H as anthropogenic and natural, respectively).

Regardless of NFDRS fuel model, all piled prescribed burns will be categorized as anthropogenic.

Table 2: NFDRS Fuel Model Categorization as Natural or Anthropogenic

NFDRS		
Fuel Model	Categorization	Short Vegetation Description
A	Natural	Western Annual Grasslands
B	Anthropogenic	Tall dense older brush
C	Natural	Open pine with grass understory
D	Non-applicable	Southeast Fuel Types
E	Natural	Hardwood after leaf fall
F	Natural	Mature closed Chamise with Oakbrush
G	Anthropogenic	Dense Conifer with heavy downed duff
H	Natural	Short Needled Conifer with thin litter
I	Anthropogenic	Clearcut Conifer Slash <6"
J	Anthropogenic	Clearcut heavily thinned Conifer Slash <6"
K	Anthropogenic	Light conifer slash partial cuts
L	Natural	Western Perennial Grasslands
N	Non-applicable	Southeast Fuel Types
O	Non-applicable	Southeast Fuel Types
P	Non-applicable	Southeast Fuel Types
Q	Natural	Upland Alaska Black Spruce
R	Natural	Hardwoods after leafout
S	Natural	Apline Tundra and Grass
T	Natural	Sagebrush and Grasslands
U	Anthropogenic	Closed Western Long-Needled Pine
<i>Piles</i>	<i>Anthropogenic</i>	<i>Piled activity fuels</i>

APPENDIX A

National Fire Danger Rating System Fuel Model Descriptions

Text descriptions taken from *The National Fire Danger Rating System*, 1978, Deeming et al., USDA, Forest Service GTR INT-39.

FUEL MODEL A – Natural

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 one 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 – Anthropogenic

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 also be used for the New Jersey pine barrens.

FUEL MODEL C – Natural

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 – Non-applicable

This fuel model is specifically for the palmetto-gallberry understory-pine association of the southeast coastal plains. It can also be 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 the high moisture of extinction associated with it.

FUEL MODEL E – Natural

Use this model after Autumn 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 – Natural

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 – Anthropogenic

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 – Natural

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 – Anthropogenic

Fuel Model I was designed for clearcut 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 clearcut 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 – Anthropogenic

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 – Anthropogenic

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 – Natural

This fuel model is meant to represent western grasslands vegetated by perennial grasses. The principal species are coarser and the 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 – Non-applicable

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 is dead fast-spreading, intense fires can occur even over standing water.

FUEL MODEL O – Non-applicable

The O fuel model applies to dense, brushlike fuels of the Southeast. O fuels, except for a 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 high 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 – Non-applicable

Closed, thrifty stands of long-needled southern pines are characteristic of P fuel: 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 – Natural

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 Spread Component (SC) and BI when crowning occurs.

FUEL MODEL R – Natural

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 – Natural

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 – Natural

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 least 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 – Anthropogenic

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.