NARA Supply Chain Emissions: Impacts on Air Quality in the Pacific Northwest
Current Status and Future Work

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Introduction
As a forest management practice, and to reduce potential catastrophic forest fires, the residue from harvesting activities is conventionally burned for removal. Under the NARA program, this residue will be harvested for use as a feedstock which will reduce the need for biomass burning and the resulting air pollutant emissions. At the same time, emissions from the supply chain and, specifically, the bioenergy, will result in new air pollutant sources. Progress on the assessment of the air quality impacts of the NARA supply chain are presented. First, the impacts of the prescribed fires on PM<sub>2.5</sub> and ozone are presented. We also show the improvements in model performance when prescribed fire emissions are included. The regional air quality modeling system, called ARAPPT-4 (based on WRF, SMOKE, CAMQ4), is used for this analysis. Second, initial compilation of the emissions from a bioenergy are described and an approach for future analyses is presented.

Objectives
To assess the environmental benefits associated with biomass harvesting (i.e., prevention of biomass burning) for biofuel feedstock
Assessing model performance improvement when prescribed fire emissions are included
Quantifying estimated emissions from the NARA bioenergy

Methods
Prescribed fires for the model domain were extracted from the National Fire Emission Inventory (NFEI) 2011 available from the US EPA.
An analysis of the fire emission data shows that emissions peak during the months of October and November (Figure 1).
Model simulations were completed for the period 10 October – 15 November 2011 for three different emission scenarios:
100% Fire (with fire) Case: includes all the fire emissions as per NFEI 2011
30% Fire Case: includes all the fire sources as per NFEI 2011, but all the fire emissions (a heat flux) uniformly reduced by 70%
No Fire Case: none of the fires from NFEI 2011 were included
Performance metrics including the Mean Fractional Bias (MBF) and Mean Fractional Error (MFE) along with Mean Bias (MB) and Mean Error (ME) are used for evaluation of the model performance.

Conclusions
Most prescribed fire emissions occur during October and November, with Oregon emitting the most among all the PNW states (within the ARAPPT-4 domain).
Model performance is within EPA criteria for elemental carbon, nitrate, sulfate, and ammonium aerosols for all sites. Significant improvement in model performance is seen for total PM<sub>2.5</sub> and organic carbon when compared against observation data from IMPROVE sites.
ARAPPT-4 simulations show that the impact on PM<sub>2.5</sub> is negligible for the period of simulation, with some large prescribed fires contributing 0.5ppb - 1ppb.
Under a scenario of 70% decrease in fire emissions (for biomass harvesting for biofuels), we could see significant decrease in 37 averaged PM<sub>2.5</sub> concentration. This decrease is mostly for areas in Oregon, where most fire emissions take place. This is an indication of potential benefits of biomass harvesting for a biofuel industry.

Planned work
Emissions from various NARA processes have been developed and as a next step we will undertake the simulation of the entire supply chain under different scenarios as described above for an extended period of time and analyzing different scenarios to assess the impact of NARA supply chain on the air quality.

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References