Title: Contributions of Nitrite-Nitrogen, Nitrate-Nitrogen, and Orthophosphate Levels in Surface Water Runoff from Wildfire Severity Classes from the Las Conchas Fire in the Jemez Mountains, New Mexico, 2012, Poster, Individual Permit for Storm Water, NPDES Permit No. NM0030759

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Intended for: Public

Purpose: This poster was prepared for the 13th Annual Student Symposium at Los Alamos National Laboratory (LANL) held in July 2013. The symposium is a showcase for the work of students at the Laboratory. The poster was prepared by a student who provides support to the Individual Permit (IP) project. It will be available on LANL’s IP public website.
Introduction
As one of the most arid areas in the USA, the southwest faces significant challenges to increased wildfire potential and severity due to climatic variation. Warming temperatures can be highly correlated with increased wildfire risk and severity, which may change the frequency of fire danger (Standish-Lee, 2008). In June of 2011 the Las Conchas fire in the Jemez Mountains of New Mexico exemplified conditions representative to the changing wildfire severity classes from the Las Conchas fire in the Jemez Mountains of New Mexico, 2012. To complete this task, NO2− and OP concentrations will be determined from surface water runoff and soils originating from qualified high, moderate, low, mixed, and control (unburned site) fire severity types. Fire severity classification was determined using geospatial applications and ground measurements in a concurrent study. We hypothesize that our results from the high severity burn area will have the least contribution of NO2−: NO− 3: and OP control will have the highest.

Methodology
Study Sites
The study conducted in the Valles Caldera west of Los Alamos, New Mexico. On the Camp del Medio, northern slopes within the Caldera, four burned site were selected based on their urban visual representation of fire severity class. Surface water was collected in low, moderate, high, and mixed severity burned basins. Soils were collected at randomly selected points within the low, moderate, high and severity areas. Due to the saddle shapes of the burned area, a control site (unburned area) was chosen nearly one-kilometer north-west from the burned study area and is located on the northeastern section of the Ruidoso mountain region where surface water and soils were also collected.

Surface Water and Soil Collection
Surface water was collected at catchment basins of each severity site using 3700 Solinst model 600 portasampers equipped with 24 one-liter polypropylene bottles and a one-liter simple stage sample bottle. Following an April 10 snowmelt event, April 24, May 15, July 12, July 25, August 6, August 15, September 13, and October 17 precipitation events, water samples were collected (as indicated by Valles Caldera Climate Stations). Soil was collected at five random locations within each severity site nearly every two weeks beginning in May and ending in October. Surface water and soil samples were transferred to the lab for analysis.

Laboratory Analysis
NO2−, NO− 3: and OP concentrations were determined using an FS 3100 C Analytical Auto Analyzer according to USEPA Method 303.2 and USEPA Method 365.1 and Standard Method 4500-PG (OP). All calibrants, standards, reagents, and field blanks were prepared using 18.2 water from a Barnstead Easy Pure HI UV/UF water purification system. Continuous calibration verifications (CCV) were utilized at 0.1, 0.15, 0.25, 0.5, 1.5, and 10 mg/L, following every fifth sample during analysis to verify accuracy of instrument measurement.

Discussion
It is important to know that with a climate change-induced increase in the probability of mega-fires, the nitrogen and phosphorus levels from these fires may be equivalent to and representative of other mega-fires in the future. Excessive amounts of nitrogen and phosphorus can produce nutrient imbalances and fire-reacting impacts on public health, the environment and the economy. This research has shown that mega-fire conditions, such as the Las Conchas fire, have produce unfavorable effects to terrestrial and aquatic ecosystems. We hope this study will allow scientists, land managers, and the public to recognize the impact of potential effects of large wildfires, thereby encouraging managers to implement best management practices to decrease the probability of mega-fires in Southwestern forests.

Conclusion
Results have shown that NO2− concentrations in surface water are greatest in the mixed severity and lowest in the unburned site. Conversely, OP concentrations are greatest in the unburned site and lowest in the mixed severity area. Soil nutrient concentrations for both NO2− and OP show a general decrease in concentration as severity class increases. NO2− levels have minimum detection for surface water and soil.

We have shown that NO2− exhibits significant importance due to its vast abundance in our measured parameters. During a July 12, 2013 precipitation event NO2− concentrations reached an average of 8.83 mg/L, which borders EPA’s 10 mg/L water quality standard. A summary of the literature compiled by Tiedemann et al. (1979) revealed that soil NO2− levels were higher at 1500-1000 ft elevation than at 150-2500 ft elevation. However, the differences were not statistically significant. Our results may be due to a climate change impact on fire severity and the historical fire suppression activities that increased tree densities, nutrient rich understory vegetation and fuels since the 1960 to 1970 studies.

Surface water ANOVA tests reveal a significant difference for NO2− (F(4, 316) = 5.53, p < .05) and OP (F(4, 316) = 5.22, p < .05) between severity sites. Post hoc analysis confirm that NO2− concentrations in CON (M = 3.05, SD = 0.5), HI (M = 4.27, SD = 0.68) and MIX (M = 4.27, SD = 0.68) are significantly different than HI (M = 7.91, SD = 7.42) and MIX (M = 6.8, SD = 7.63). HI and MIX are not significantly different from each other. NO2− concentrations in CON (M = 0.04, SD = 0.13) and MIX (M = 0.04, SD = 0.68) were the highest. For OP, as severity class increases, nutrient richness decreases. Therefore, CON (M = 0.33, SD = 0.20) had the highest concentrations and MIX (M = 0.15, SD = 0.4) had the lowest.

Surface water nutrients per severity through time

Surface water ANOVA tests reveal a significant difference for NO2− (F(4, 316) = 5.53, p < .05) and OP (F(4, 316) = 5.22, p < .05) between severity sites. Post hoc analysis confirm that NO2− concentrations in CON (M = 3.05, SD = 0.5), HI (M = 4.27, SD = 0.68), and MIX (M = 4.27, SD = 0.68) are significantly different than HI (M = 7.91, SD = 7.42) and MIX (M = 6.8, SD = 7.63). HI and MIX are not significantly different from each other. NO2− concentrations in CON (M = 0.04, SD = 0.13) and MIX (M = 0.04, SD = 0.68) were the highest. For OP, as severity class increases, nutrient richness decreases. Therefore, CON (M = 0.33, SD = 0.20) had the highest concentrations and MIX (M = 0.15, SD = 0.4) had the lowest.

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