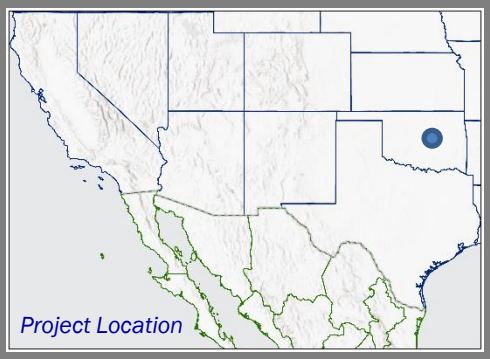
Fire Management

Using Regional Soil Moisture to Map Wildfire Probability in the Rio Grande and Red River Watersheds

Prescribed Burn/ Tyson Ochsner

Soil moisture (SM) is an important indicator of wildfire probability, which is also driven by climate, fuel, ignition, and topography. Existing wildfire danger indices do not incorporate measured soil moisture data despite research indicating that SM data could improve wildfire danger assessment. As a result, researchers at Oklahoma State University and the University of Georgia are improving the soil moisture modeling capabilities of the Newhall Simulation Model (rNewhall) to improve the prediction of wildfire probability in the Red River and Rio Grande Basins.



KEY ISSUES ADDRESSED

Wildfire danger indices do not include measured soil moisture data in predicting wildfire probability. With more in-situ soil moisture measurements available, there is an opportunity to enhance these indices' accuracy. Traditional wildfire danger indices often lack the ability to predict soil moisture changes at the relevant time scales needed by resource managers. Wildfire conditions can change daily, which makes it is crucial for managers to access accurate soil moisture information.

Greater dialogue is needed to understand how land managers can utilize soil moisture information in wildfire risk assessment, planning, and decision-support tools.

PROJECT GOALS

- Modify Newhall Soil Moisture model to predict daily changes in soil moisture conditions
- Use rNewhall to model daily changes in soil moisture conditions at multiple depths across the Red River and Rio Grande Basins
- Using in situ soil moisture data to validate the wildfire probability of the rNewhall model.
- Understand how soil moisture information can be incorporated into wildfire modeling, risk assessment, planning, and decision-support tools

THE OKLAHOMA MESONET

The approximately 120 soil moisture monitoring stations are one of the densest in situ soil moisture monitoring networks globally, key for validating the modeled output of rNewhall.

Marena, Oklahoma Mesonet Site / The Oklahoma Mesonet

PROJECT HIGHLIGHTS

Improved Soil Moisture Modeling: During a model evaluation, rNewhall had the greatest skill in modeling soil moisture in the first 100 cm of the soil depth. This result can be attributed to accounting various physical features in the model.

A Daily Timescale: rNewhall introduces an expanded capability to model soil moisture dynamics on a daily time scale, which ensures resource managers can assess wildfire danger with the latest data available.

Soil Moisture as a Measure for Predicting Wildfire Size: rNewhall quantified the relationship between soil moisture and wildfire occurrence in the 2016-2018 non-growing season (winter months). Researchers found the inclusion of soil moisture information allowed rNewhall to be relatively accurate in modeling wildfire size within the Red River Watershed.

Researchers and Land Managers in Dialogue: Thirty-four researchers and land managers participated in a one-day workshop held in April 2019 at the 6th International Fire Behavior and Fuels Conference. Participants discussed current trends in wildfire occurrence and opportunities to incorporate soil moisture in wildfire danger assessment.

LESSONS LEARNED

Most regions lack a dense network of in-situ soil moisture data, limiting rNewhall's validation outside the Rio Grande and Red River Basins and requiring further investigation in other areas.

In Oklahoma, soil moisture data supports model validation. Elsewhere, a central repository for these datasets would enhance rNewhall's accessibility and usability.

Soil moisture information enables live and dead fuel moisture modeling, crucial for predicting wildfire severity.

Collaborations using rNewhall would benefit from consistent programming languages, streamlining development.

Resource managers and stakeholders need access to more high-quality soil moisture data to effectively integrate it into existing wildfire danger rating systems, where it plays a key role in wildfire prediction.

NEXT STEPS

- Determine the rNewhall's physical limitations
- Overcome the logistical challenges of utilizing soil moisture metrics in improving wildfire danger assessments
- Develop standardized soil moisture indices.
- Determine the accuracy of wildfire systems with and without soil moisture information
- Incorporate measured soil moisture into existing wildfire danger rating systems
- Improve the accessibility of soil moisture data

Collaborators

- U.S. Department of Agriculture Natural Resources Conservation Service
- U.S. Geological Survey
- University of Georgia
- Oklahoma State University

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