National Aeronautics and Space Administration

NASAfacts

NASA RRED: Rapid Response Erosion Database

Challenge

Soil erosion by water is a critically important global hydrological problem impacting both agricultural productivity and natural resources. Flooding and erosion that can occur after a wildfire poses a significant threat to life, property and natural resources such as municipal water supplies. To respond to this threat, interdisciplinary Burned Area Emergency Response (BAER) teams are formed to assess potential erosion and flood risks. BAER teams must quickly determine if expensive remediation treatments are needed and prioritize their spatial application. NASA Earth Observations of burn severity provide critical information for assessing risk. Slope, soils, land cover and climate are also important factors, but the spatially explicit process based models needed to account for these parameters are both difficult to set up and require properly formatted spatial inputs.

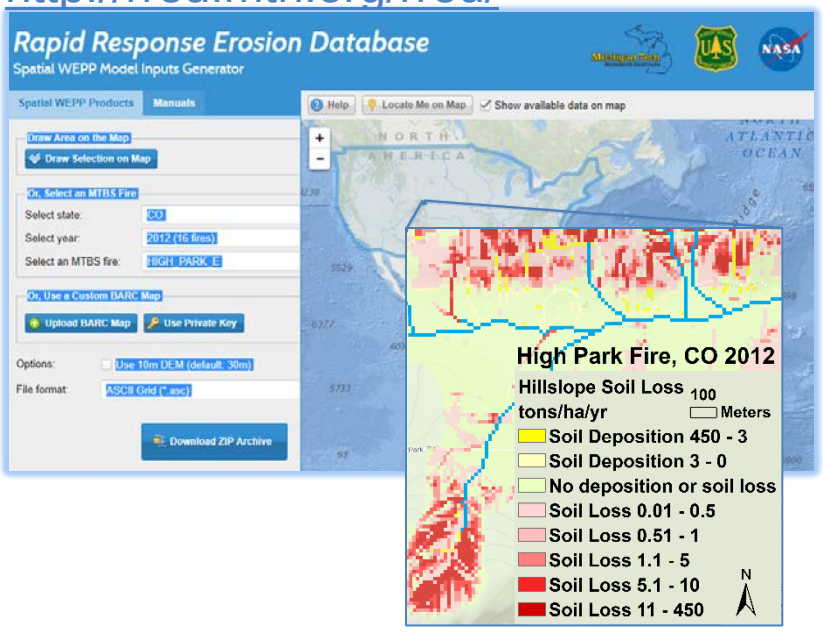
Sediment from the 2002 Hayman Fire, CO.

Solution

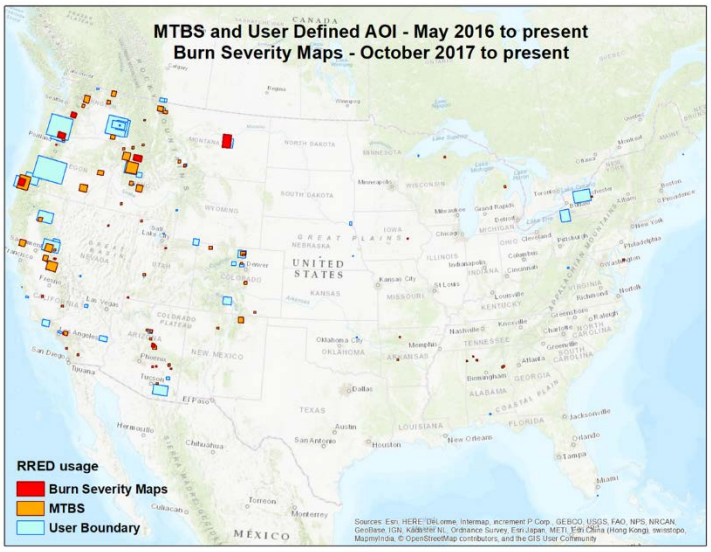
A joint partnership between NASA, Michigan Tech Research Institute, and the USDA Forest Service has led to the creation of an interactive online spatial database to support post-fire remediation through hydrological modeling. The NASA RRED database automatically creates spatial model inputs derived from Earth Observations so that modeling can be carried out rapidly and the results used to support decision-making activities such as post-fire risk assessment and rehabilitation. The new website delivers spatial model inputs in mere seconds; previously, assembling and formatting this type of data would have taken multiple days. Data are provided in both burned and not burned formats providing flexibility for other applications such as agriculture and fuel planning projects from a watershed perspective.

NASA Rapid Response Erosion Database:

http://rred.mtri.org/rred/

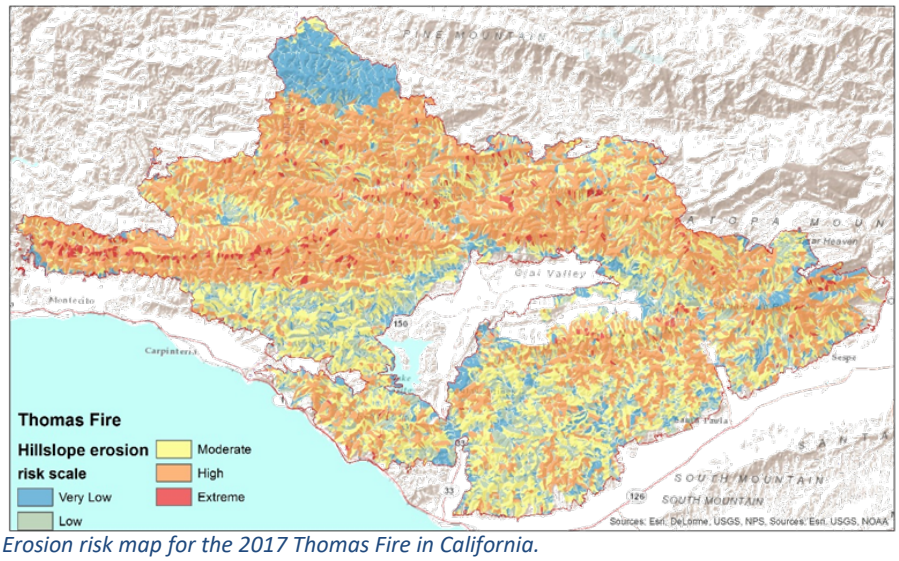


RRED in action



RRED has been used by multiple BAER teams and fuel planning projects. Users can either upload a new soil burn severity map, select a burn severity map from the Monitoring Trends in Burn Severity project (MTBS), or delineate an area and within minutes begin modeling runoff and erosion. Small fires such as the French (5,600 ha) and Silverado (390 ha) fires can be modeled in a few hours, while larger fires such as the Valley (30,800ha) and Happy Camp (54,200 ha) fires may take a day. Modeling work on the 2015 King fire was used to justify and target more than $1 million in mulching treatments, which the Sacramento Municipal Utility District was willing to pay for in order to protect a valuable water reservoir. Hillslope scale predictions save money by allowing for the spatial prioritization of costly post-fire remediation treatments.

- WEPP is a complex process based hydrology model underutilized outside of research.
- To make WEPP accessible for operational use we have built an easy to use open source modeling database and interface.
- We have developed tools to model large areas rapidly.
  - Thomas fire (1,140 km^2) was modeled within QWEPP as an example of our capabilities with two computers in ~12 hours.



Erosion risk map for the 2017 Thomas Fire in California.

RRED Applications

- Post-fire remediation
- Road culverts at risk
- Fuels Planning from a watershed perspective
- Watershed management – ex. roads, logging, fuel treatments
- Contaminated sediment transport
- Academic / student projects
- EPA Total Maximum Daily Loading
- Agriculture

Publications

Miller, M. E., Elliot, W. J., Billmire, M., Robichaud, P. R., & Endsley, K. A. (2016). Rapid-response tools and datasets for post-fire remediation: linking remote sensing and process-based hydrological models. International Journal of Wildland Fire, 25(10), 1061-1073.

Elliot, W. J., Miller, M. E., & Enstice, N. (2016). Targeting forest management through fire and erosion modelling. *International Journal of Wildland Fire*, *25*(8), 876-887.

Future vision

Our goal is to make the latest technology and satellite data easily accessible to the land managers tasked with protecting lives, property and natural resources.

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Wildfires program area

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