

Predicting the spread of wildfires through computer simulations

August 12 2021



Destructive wildfires are increasingly common due to climate change and rising global temperatures. Understanding wildfire behavior using advanced computer models may help us understand how forest fires develop and spread. Credit: KAUST.

Computer simulations can predict the spread of wildfires through sections of a real forest using a realistic yet computationally efficient new method to model the combustion of individual trees. The model, which accurately captures wildfire behavior at forest scale, was created by KAUST researchers and their international collaborators.

"Our work can help to make real [forest](#) fires more predictable by simulating potential [fire](#) scenarios with real forestry data," says Torsten Hädrich, a Ph.D. student in Dominik Michels' group. "We are also able to simulate how firebreaks in forests can be used to contain fire spread," he adds.

Climate change simulations have long predicted a global rise in the prevalence and intensity of wildfires. "We titled our research paper 'Fire in Paradise' in reference to the northern Californian town of Paradise that was devastated by a [wildfire](#) in November 2018, resulting in more than 80 fatalities," says Michels, who led the research.

Accurate computational simulations could improve our understanding and management of wildfire behavior. "The main challenge is to capture the complex dynamics involved," Hädrich explains. The simulation must include a model for tree combustion and a fluid dynamics component for the simulation of fire while accounting for environmental variations, such as tree density, terrain and wind.

Previous forest-scale fire simulations have represented trees as simple cones or cylinders, but this extreme simplification of forest structure reduces the accuracy of the simulation. Hädrich, Michels and their collaborators developed a method to model [trees](#) as collections of branch-like modules. "Our module-based representation provides a way to control the level of detail for the simulation," Hädrich says.

Depending on the scenario being simulated, each tree can be represented either by many detailed modules to generate highly realistic branching structures or by fewer coarser modules for efficient computation. "Our approach is capable of realistically simulating the propagation of fire through entire ecosystems with varying forest cover," Hädrich says.

Further improvements of the predictive accuracy of the simulation

include modeling the cloud formation and rainfall that can result as water vapor is released from burning vegetation. Additional refinements to the simulation are planned, notes Michels. "We would like to include the [simulation](#) of sparks flying through the air and address fire spread on the ground facilitated by grass, branch litter and undergrowth vegetation," he says. "We also plan to further validate our approach using satellite images of real wildfires," Michels adds.

More information: Torsten Hädrich et al, Fire in paradise, *ACM Transactions on Graphics* (2021). [DOI: 10.1145/3450626.3459954](https://doi.org/10.1145/3450626.3459954)

Provided by King Abdullah University of Science and Technology

Citation: Predicting the spread of wildfires through computer simulations (2021, August 12) retrieved 29 April 2024 from <https://phys.org/news/2021-08-wildfires-simulations.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.