

# Mapping Wildfire Fuels, Behavior, and Hazard in a Managed Temperate Forest Using Airborne LiDAR and Sentinel-1 & -2



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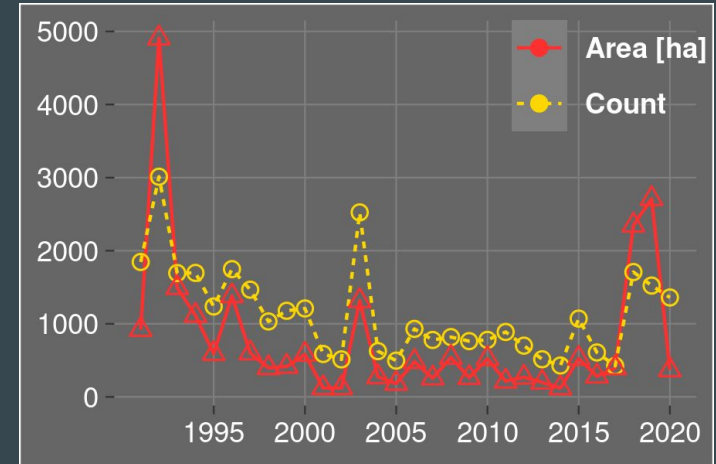
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# Wildfire in Central Europe

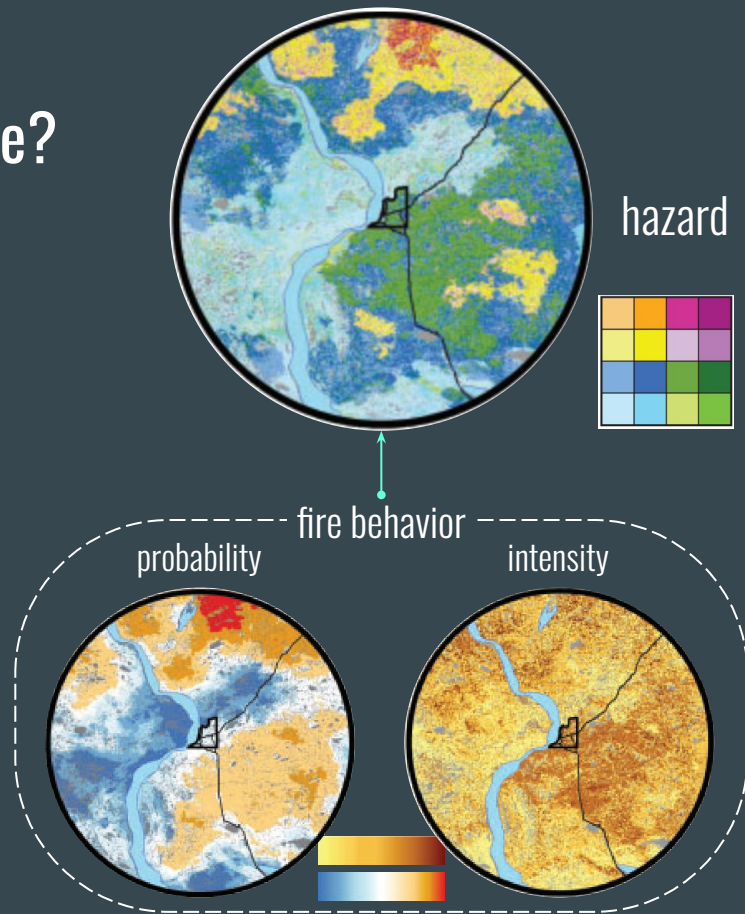
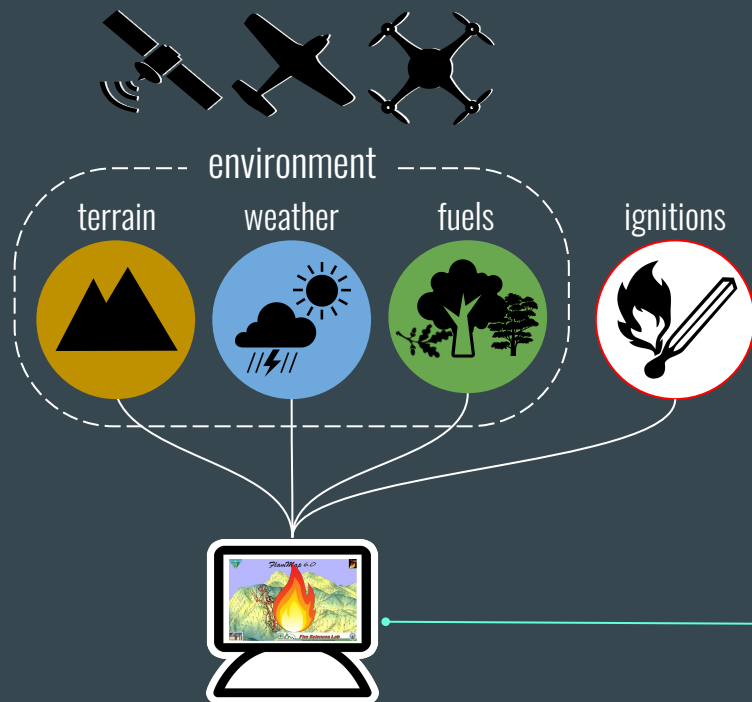
- Played a minor role historically
- Recent extreme summers put fire back on the agenda
- Climate projections indicate increase in number and size
- Both ecosystems and society are not adapted

Number of Wildfires and Burned Area in Germany  
1991-2020

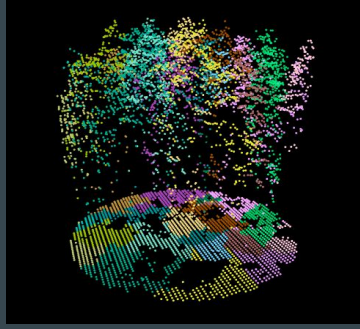


Wildfire Report for Germany (BLE, 2021)

# Which locations are most exposed to wildfire?

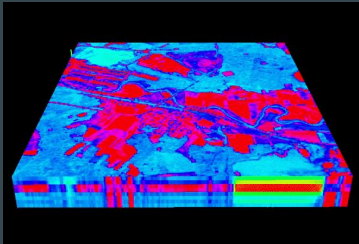


ALS



vertical structure metrics  
 $n = 73$

Sentinel-1 & 2



percentiles 10, 50, and 90 of  
annual cloud-free composites  
 $n = 36$

# Fuels mapping

**Ridge Regression**

RMSE = 0.069;  $R^2 = 0.73$

**Random Forest  
Classification**

OA = 0.97; Kappa = 0.96

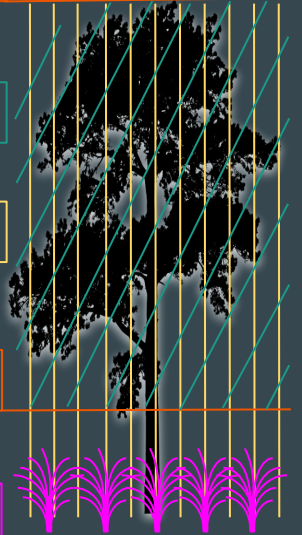
Canopy Height

Crown Bulk Density

Canopy Cover

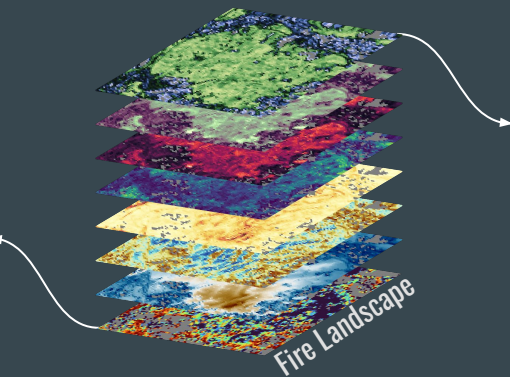
Crown Base Height

Surface Fuel Type

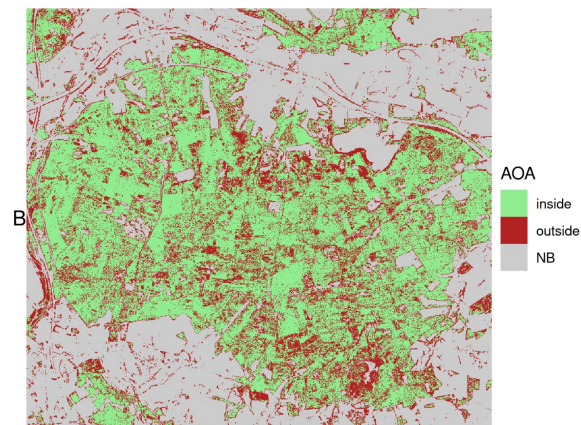
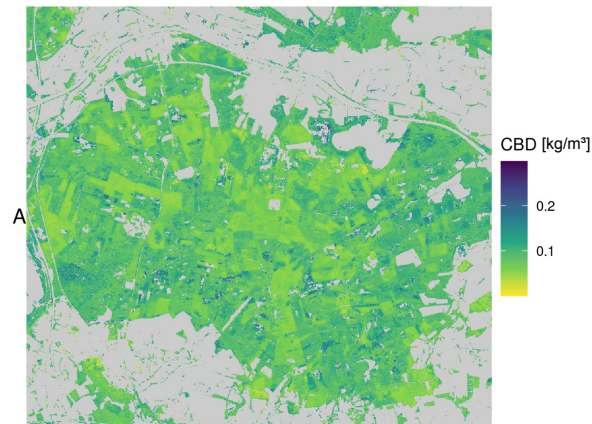


# Results: Fuels

## Crown Bulk Density



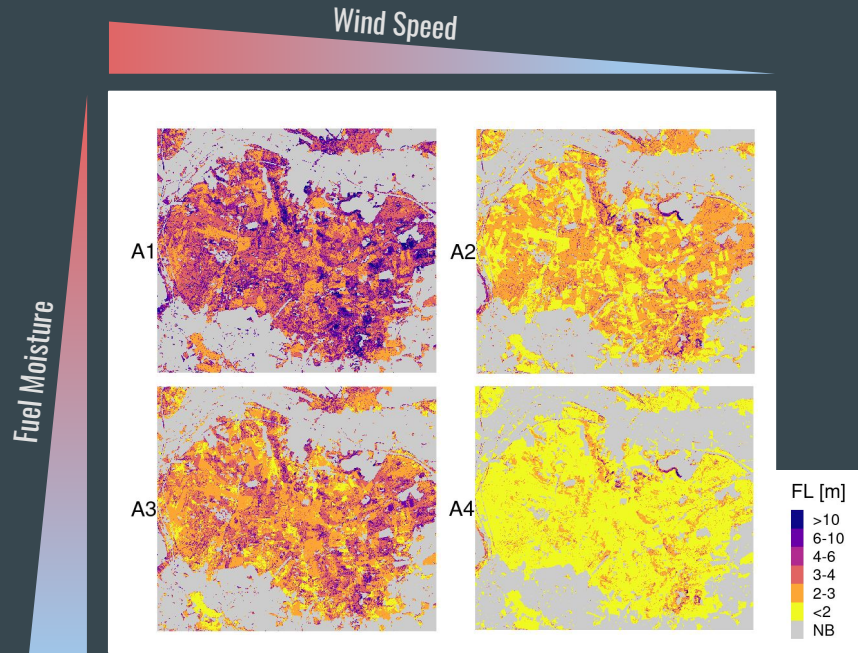
## Tree Species / Fuel Model Classification



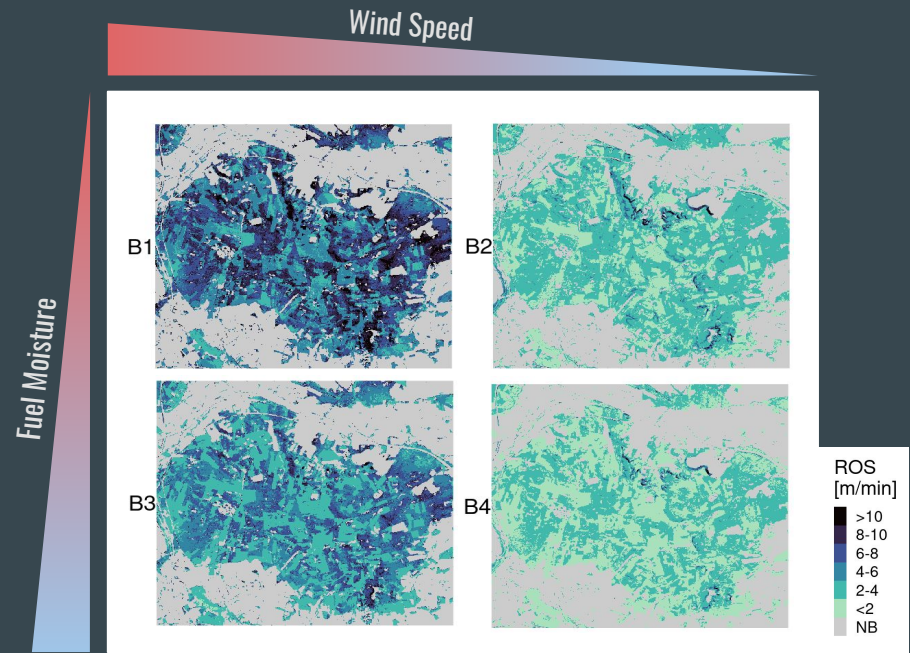


# Results: Fire Behavior

## Flame Length

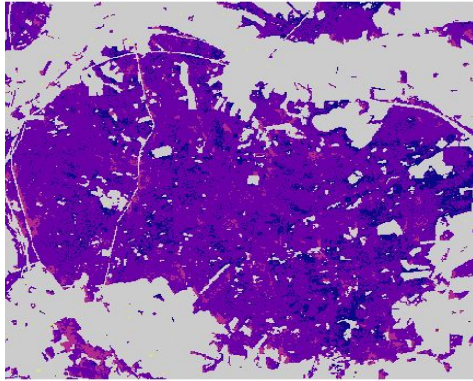


## Rate of Spread

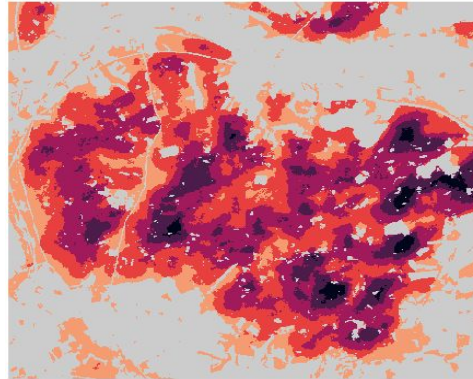


# Results: Fire Hazard

Conditional  
Flame Length



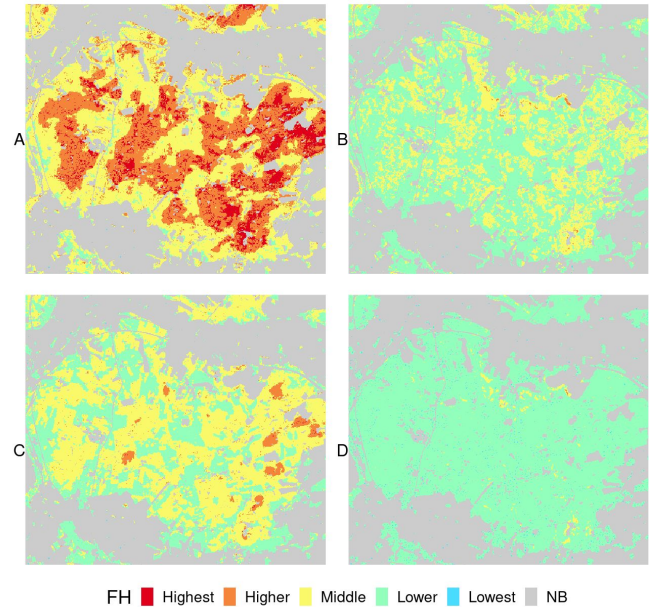
Conditional  
Burn Probability



Burn Probability Classes					
	Lowest 0-20% of max	Lower 20-40% of max	Middle 40-60% of max	Higher 60-80% of max	Highest 80-100% of max
Cond. Flame Length Classes					
> 12 ft					
> 8 - 12 ft					
> 6 - 8 ft					
> 4 - 6 ft					
> 2 - 4 ft					
> 0 - 2 ft					
	Lowest Hazard	Lower Hazard	Middle Hazard	Higher Hazard	Highest Hazard

Fuel Moisture

Wind Speed

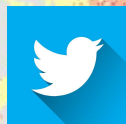


Interagency Fuels Treatment Decision Support System (IFTDSS), 2021

Abstract:



# Thanks for your attention!



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Heisig, Olson & Pebesma (2022)  
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Forest Using Airborne LiDAR and Sentinel-1 & -2





