

Global Expansion of Wildland-Urban Interface (WUI) and WUI fires

Wenfu Tang¹, Cenlin He², Louisa K. Emmons¹, and Junzhe Zhang³

¹Atmospheric Chemistry Observations & Modeling Laboratory (ACOM), National Center for Atmospheric Research, Boulder, CO, USA; ²Research Applications Laboratory (RAL), National Center for Atmospheric Research, Boulder, CO, USA; ³Department of Geography, University of California, Los Angeles, CA 90095, USA



wenfut@ucar.edu

What is WUI?



The wildland-urban interface (WUI) is the geographic area where anthropogenic urban land use and wildland vegetation come into contact.

What is WUI?

Even though the term “wildland-urban interface (WUI)” is self-explanatory, the technical definition can vary according to the purpose.

USA Federal Register definition (USDA and USDI, 2001) is a widely used WUI definition.

WUI Definition

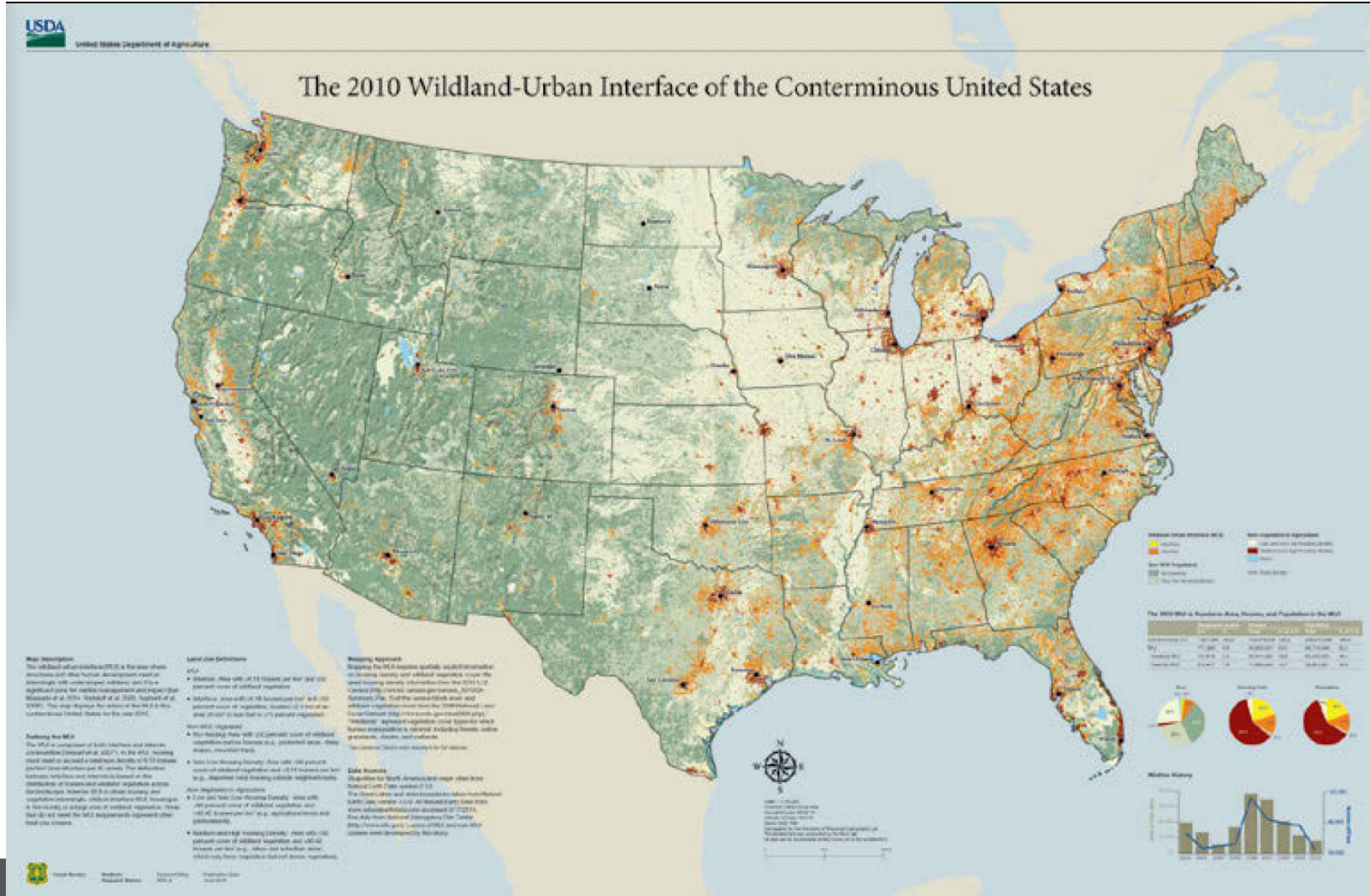
Intermix	Areas with ≥ 6.18 houses per km^2 and ≥ 50 percent cover of wildland vegetation
Interface	Areas with ≥ 6.18 houses per km^2 and < 50 percent cover of vegetation located < 2.4 km of an area ≥ 5 km^2 in size that is ≥ 75 percent vegetated

What is WUI?

USA Federal Register definition (USDA and USDI, 2001) is a widely used WUI definition.

Wildland-Urban Interface (WUI)

- Interface
- Intermix



Fires in WUI

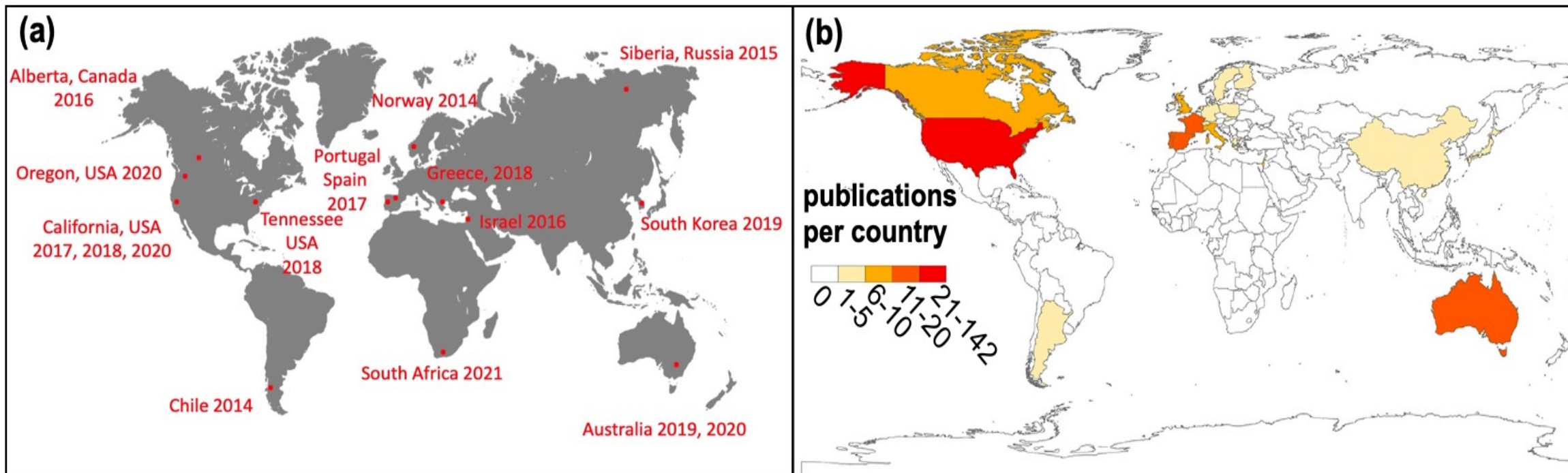
Fires in WUI are an important issue and require more research and better understanding.

- **In WUI, fire risk is relatively high** due to human ignitions;
- **WUI fires are closer to humans and properties** and can cause significant destruction and economic losses. As an example, the 2003 Cedar Fire in California destroyed more than 3,000 homes;
- **Fire emissions from WUI fires can be more harmful** compared to wildland fires when structure and waste burning are involved;
- **WUI fires will become even more important in the future.** For instance, previous studies indicated WUI is expanding in some countries or regions.



WUI is a understudied issue globally

Fires in the wildland-urban interface (WUI) are an important issue globally. However, WUI fire research has been focusing on a few regions.



Global distributions of (a) examples of WUI fires and (b) publications per country (1975–2018). Fig. 1a is modified from Manzello [2021], presentation at 2021 the chemistry of urban wildfires workshop (<https://www.nationalacademies.org/event/06-08-2021/the-chemistry-of-urban-wildfires-a-virtual-information-gathering-workshop>). Fig. 1b is modified from Bento-Gonçalves & Vieira. [2020], Source: <http://www.webofknowledge.com>.

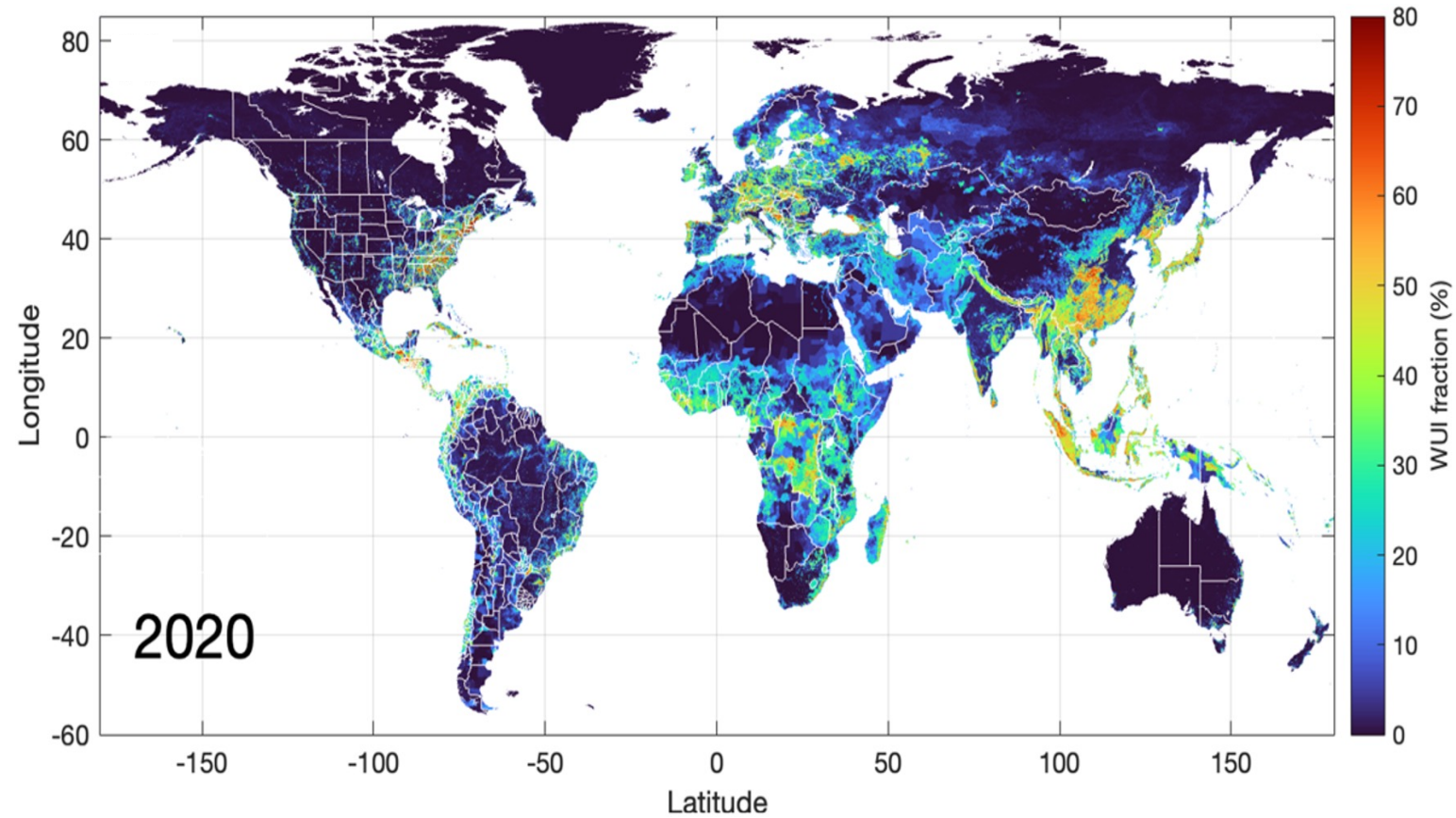
Worldwide Unified Wildland-Urban Interface (WUWUI)

We use the CONUS WUI map to train a random forest model to predict WUI globally for 2010 and 2020. The outcome database is called Worldwide Unified Wildland-Urban Interface (WUWUI) database.

Data name	Dataset name
MODIS/Terra+Aqua Land Cover Type Yearly	MCD12Q1 v6.1
MODIS/Terra+Aqua Albedo Daily	MCD43A3 v6.1
MODIS/Terra Vegetation Indices 16-Day	MOD13Q1 v6.1
MODIS/Terra Vegetation Continuous Fields Yearly	MOD44B v6.1
Population density	gpw_v4_population_density

Worldwide Unified Wildland-Urban Interface (WUWUI)

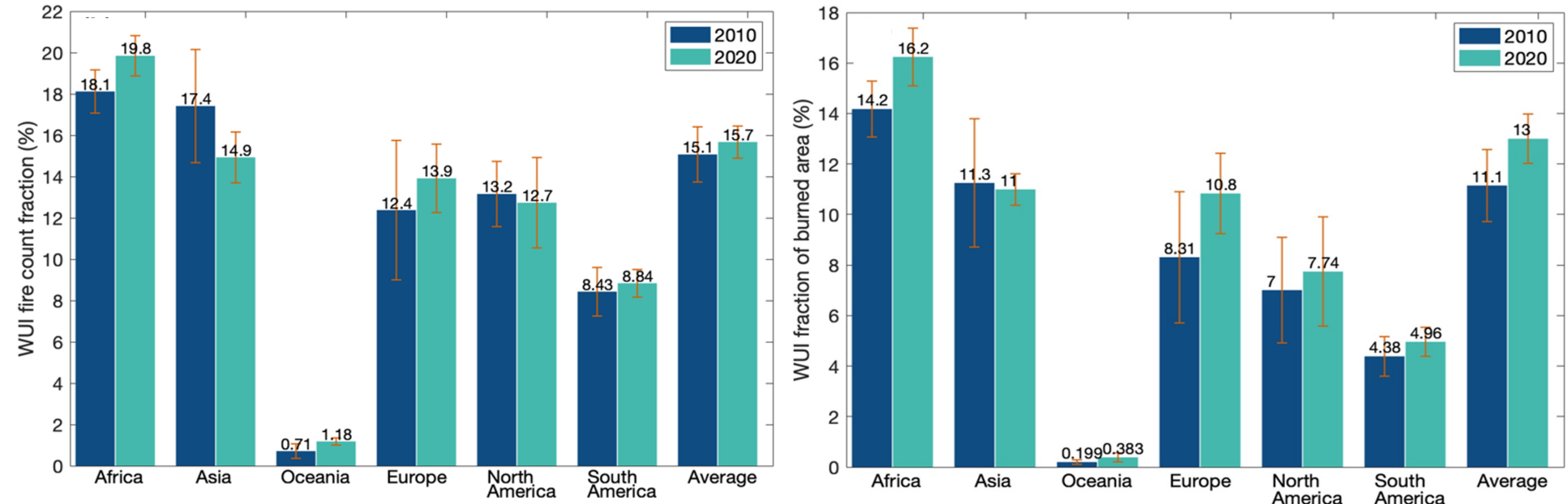
Global WUI fraction in 2020



Worldwide Unified Wildland-Urban Interface (WUWUI)

Global total fire counts and burned area (from MODIS) decreased from 2010 to 2020 whereas the WUI fraction of fire counts and burned area from 2010 to 2020 increases.

In all six continents, the WUI fractions of fire counts are higher than the WUI fractions of burned area, implying that WUI fires tend to have smaller sizes than wildland fires.



Recently another global WUI map was developed for 2020 using remote sensing-derived datasets of building area and wildland vegetation.

Article

The global wildland–urban interface

<https://doi.org/10.1038/s41586-023-06320-0>

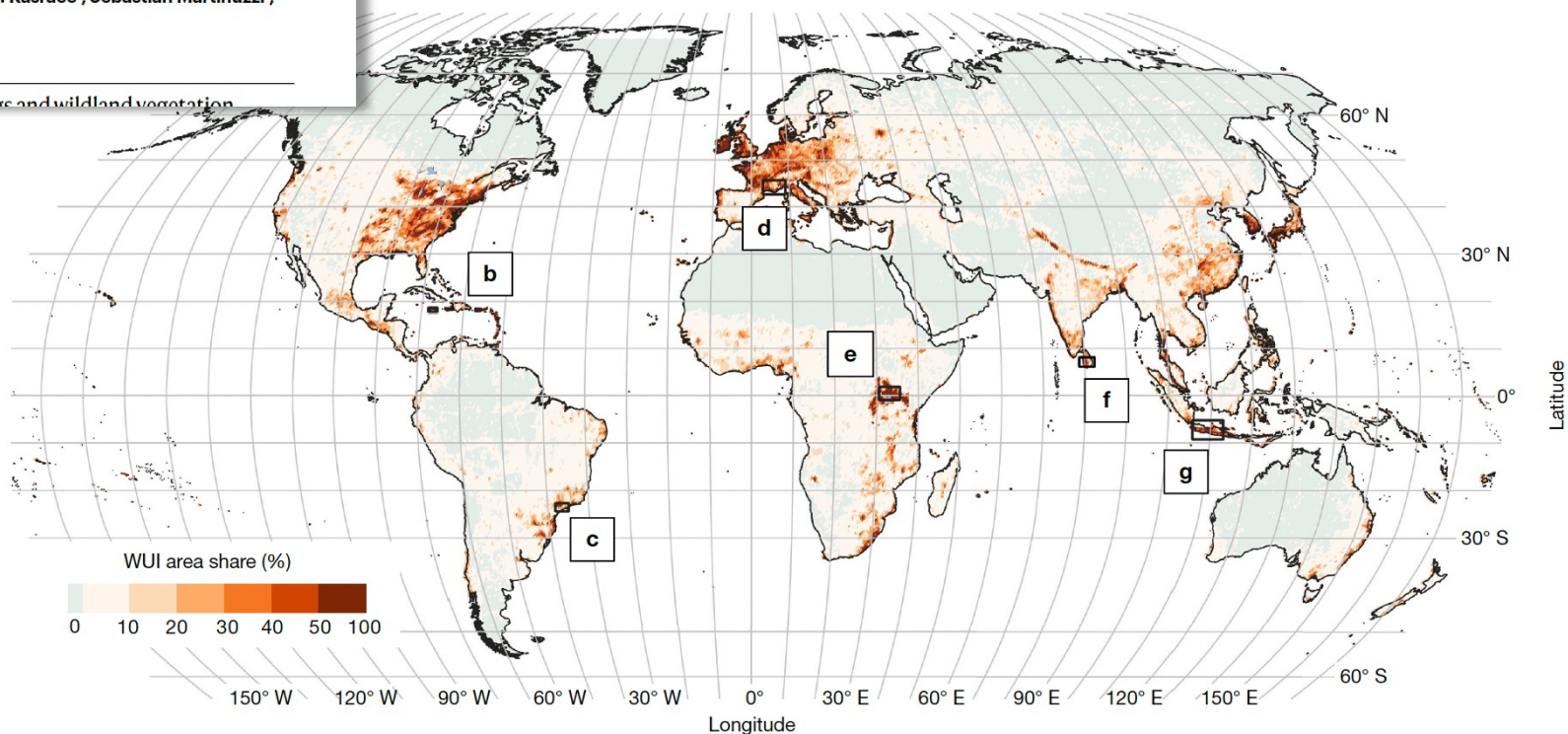
Received: 12 May 2023

Accepted: 14 June 2023

Published online: 19 July 2023

Franz Schug¹✉, Avi Bar-Massada², Amanda R. Carlson³, Heather Cox¹, Todd J. Hawbaker³, David Helmers¹, Patrick Hostert^{4,5}, Dominik Kaim⁶, Neda K. Kasraee¹, Sebastián Martinuzzi¹, Miranda H. Mockrin⁷, Kira A. Pfoch¹ & Volker C. Radeloff¹

The wildland–urban interface (WUI) is where buildings and wildland vegetation





Given the global expansion of WUI areas and the increasing importance of WUI fires, understanding WUI fires is becoming more and more crucial to fully understand fires in the Earth system, interactions between fires and human activities, changing impacts of fires in the future, and fire impacts on air quality and health.

We are developing WUWUI version 2 for the past 20 years. The new dataset will be available in a open repository.

This project is supported by NOAA Atmospheric Chemistry, Carbon Cycle and Climate (AC4) Program (Award Number: NA22OAR4310204).



Thank you!

wenfut@ucar.edu