ABOUT CHaRT

AN INTRODUCTION TO CHaRT

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Introduction

Negative impacts of climate change on health are increasingly apparent. Health hazards increased by climate change include heat, air pollution, wildfire smoke, wildfires, flooding, and high pollen concentrations. Vulnerability to these hazards is affected by demographic, medical, socioeconomic, and environmental factors. For effective adaptation to climate-driven health risks, decision makers, practitioners, and local communities need to understand not only where health risks are highest, but also the local, underlying drivers of that risk.

CHaRT is an interactive, web-based tool that exposes the level of health risk from a specific climate hazard and exposes the factors that drive that risk.

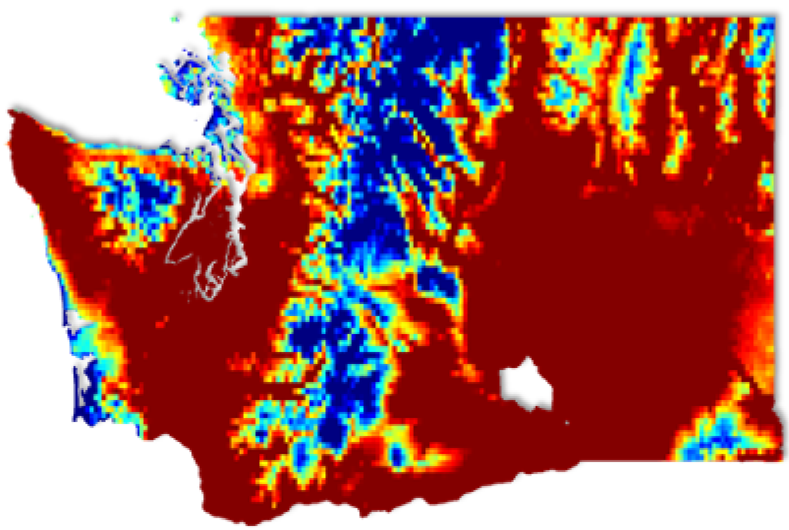
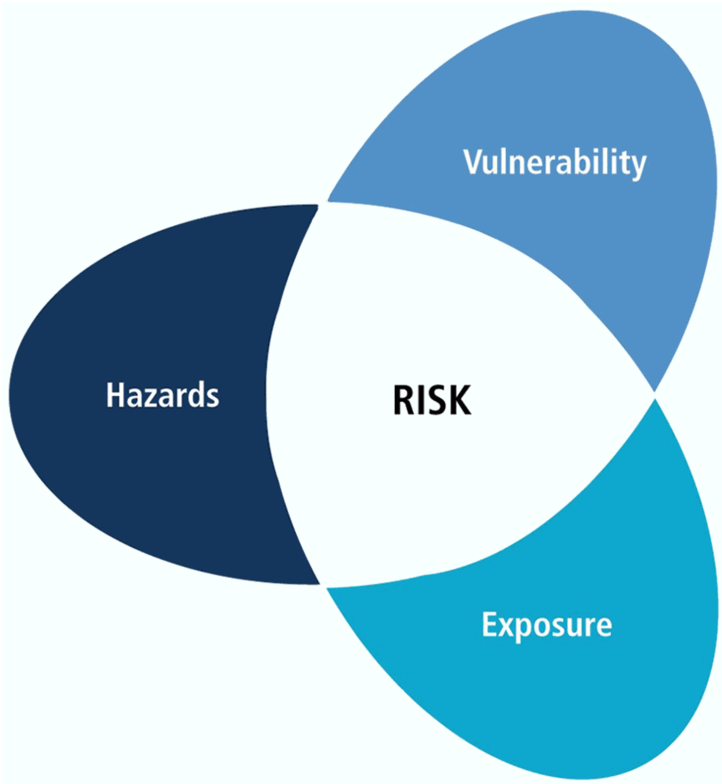


CHaRT Heat Health Risk from June 28, 2021, the hottest day of the heat dome climate event.

CHaRT Conceptual Framework

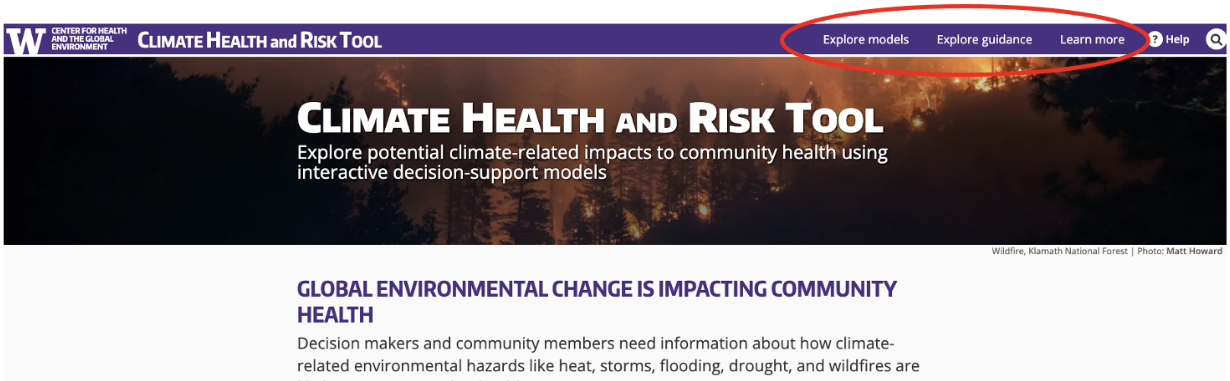
CHaRT uses the IPPC risk framework in which risk is defined as the combination of vulnerability, hazard, and exposure. Within this framework, vulnerability consists of those factors which make the effects of a hazard more or less damaging. These may be social, economic, environmental, or biophysical. Hazard is the factor that does damage, for example heat or flooding. Exposure consists of the assets at risk from the hazard, for example lives, infrastructure, or natural resources.



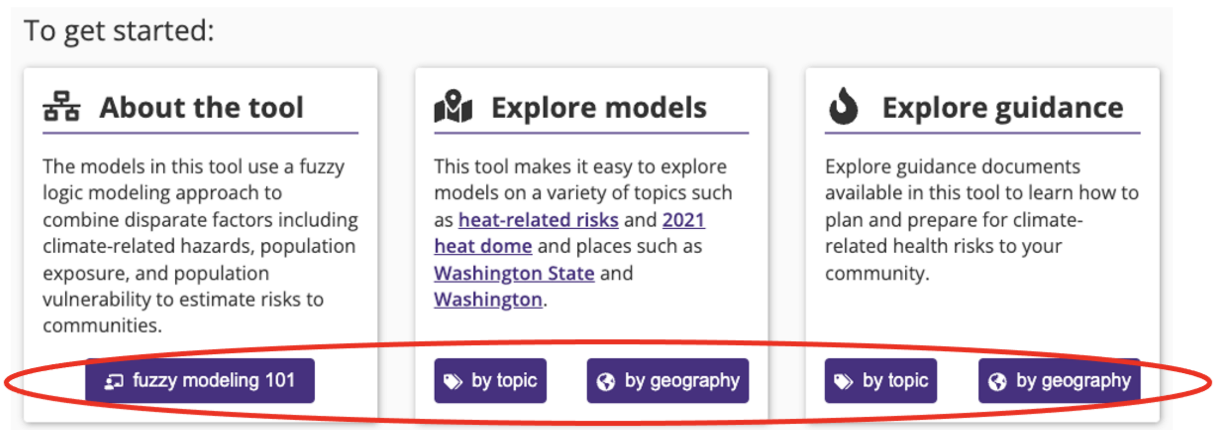
The IPCC risk framework combines Vulnerability, Exposure, and Hazards to define Risk.

Accessing CHaRT, CHaRT Models, and CHaRT Guidance.

CHaRT available online at https://climatesmarthealth.org/. The landing page has links to introductory materials, models, and guidance in the menu bar and in the body of the landing page.



Links on the CHaRT menu bar.



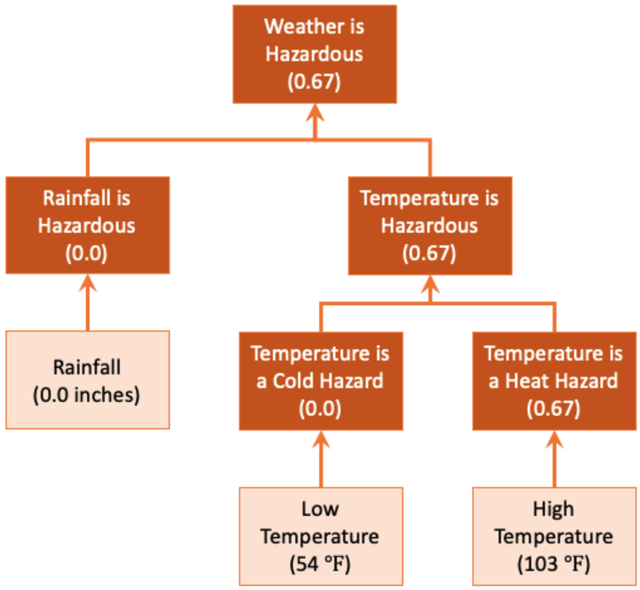
Links on the CHaRT landing page.

For details on how to use the CHaRT model explorer, click on the Help button in the top menu bar.

Causal Pathways and Fuzzy Logic Modeling

The underlying contributors to vulnerability, exposure, and hazard vary geographically. CHaRT uses fuzzy logic modeling to expose local causal pathways (i.e specific drivers).

Fuzzy logic models are hierarchical bottom-up logic models. In the first step of a fuzzy logic model, data for contributing factors (termed "raw data") are read into the model. Data for each factor are then converted to a 0 to 1 scale representing how strongly they represent a factor's effect. This effect is expressed in terms of a statement, such as "Heat is Hazardous." Values in the 0 to 1 scale are called fuzzy values, and the 0 to 1 value range is called fuzzy space. In subsequent steps of a fuzzy logic model, factors in fuzzy space are combined using fuzzy logic operators. Generally, similar factors are combined with one another. Fuzzy logic operators allow for appropriate weighting and selection factors in the model. The example below illustrates a fuzzy logic model and how it exposes the causal pathway.



Representation of a simple fuzzy logic model for hazardous weather. Each box in the model (referred to as a node) represents a layer of spatial data and corresponds to a map. Light colored nodes represent the raw data the model starts with, dark colored nodes represent fuzzy data. The raw data is converted into fuzzy space (with values from 0 to 1). Moving up the model related fuzzy nodes are combined producing higher level nodes, also in fuzzy space. The values in parentheses are associated with a single map location. In this example, it is easy to see that for the selected map location, that High Temperature is driving the value for Hazardous weather.

In the prototype CHaRT Explorer, the fuzzy logic model is displayed side by side with a map. A user selects a node in the model to display the associated map. By zooming in on a location in the map and clicking through the model nodes, a user can determine the location's causal pathway. In the first production version of CHaRT, a user will be able to select a location on the map and see the associated node values. The causal pathway will be immediately apparent.

The prototype CHaRT Explorer. Clicking on a model node in the left pane brings up the node's map in the right pane.

Conclusions

ABOUT CHaRT

CHaRT is already proving to be a valuable tool for displaying and understanding the drivers of Heat Health Risk in Washington State, both currently and in the future. As we move forward with CHaRT, we will be creating additional models, expanding geographies, and adding content about specific risk drivers, adaptation, and mitigation. CHaRT is and will continue to be an evolving tool dedicated to exposing and reducing climate-driven health risks.