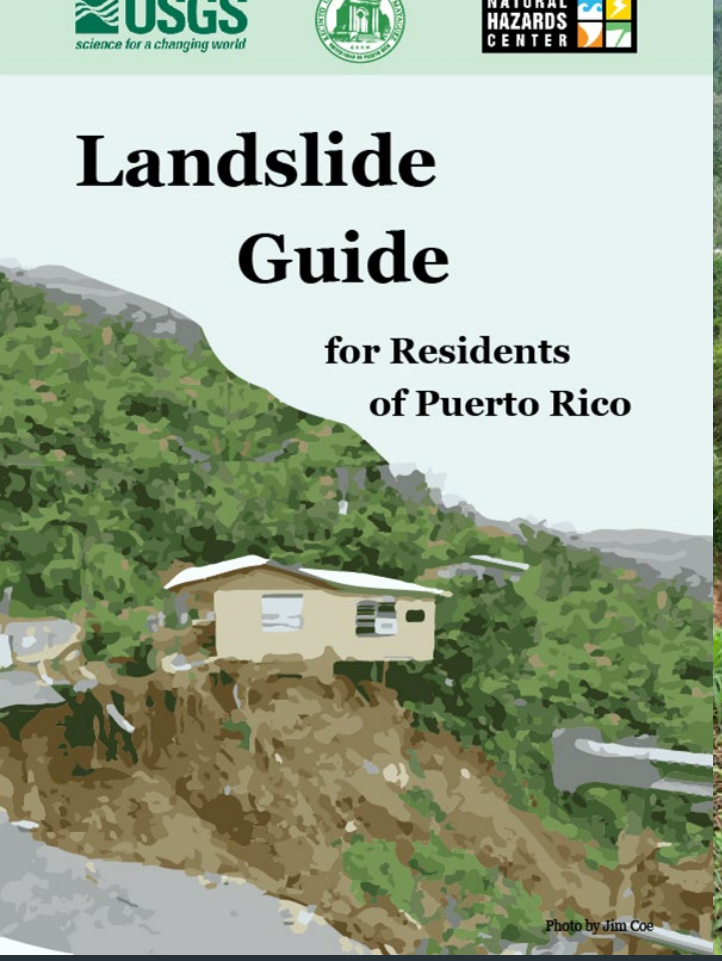
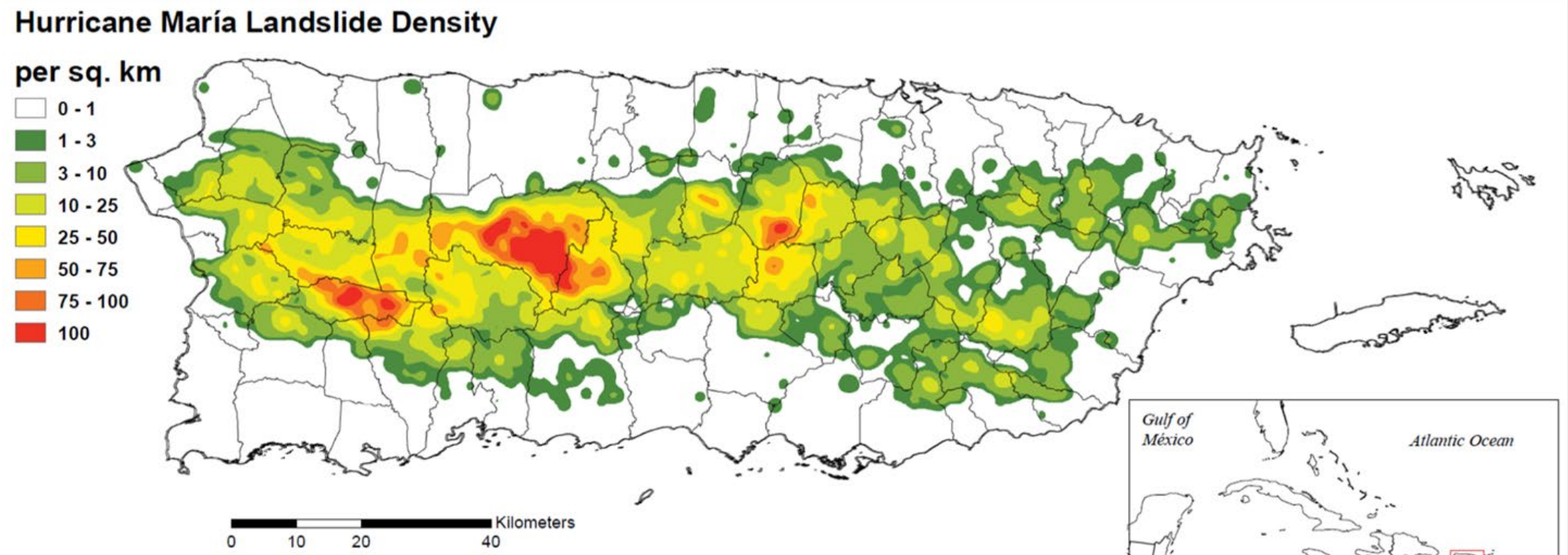


Landslide Guide for Residents of Puerto Rico

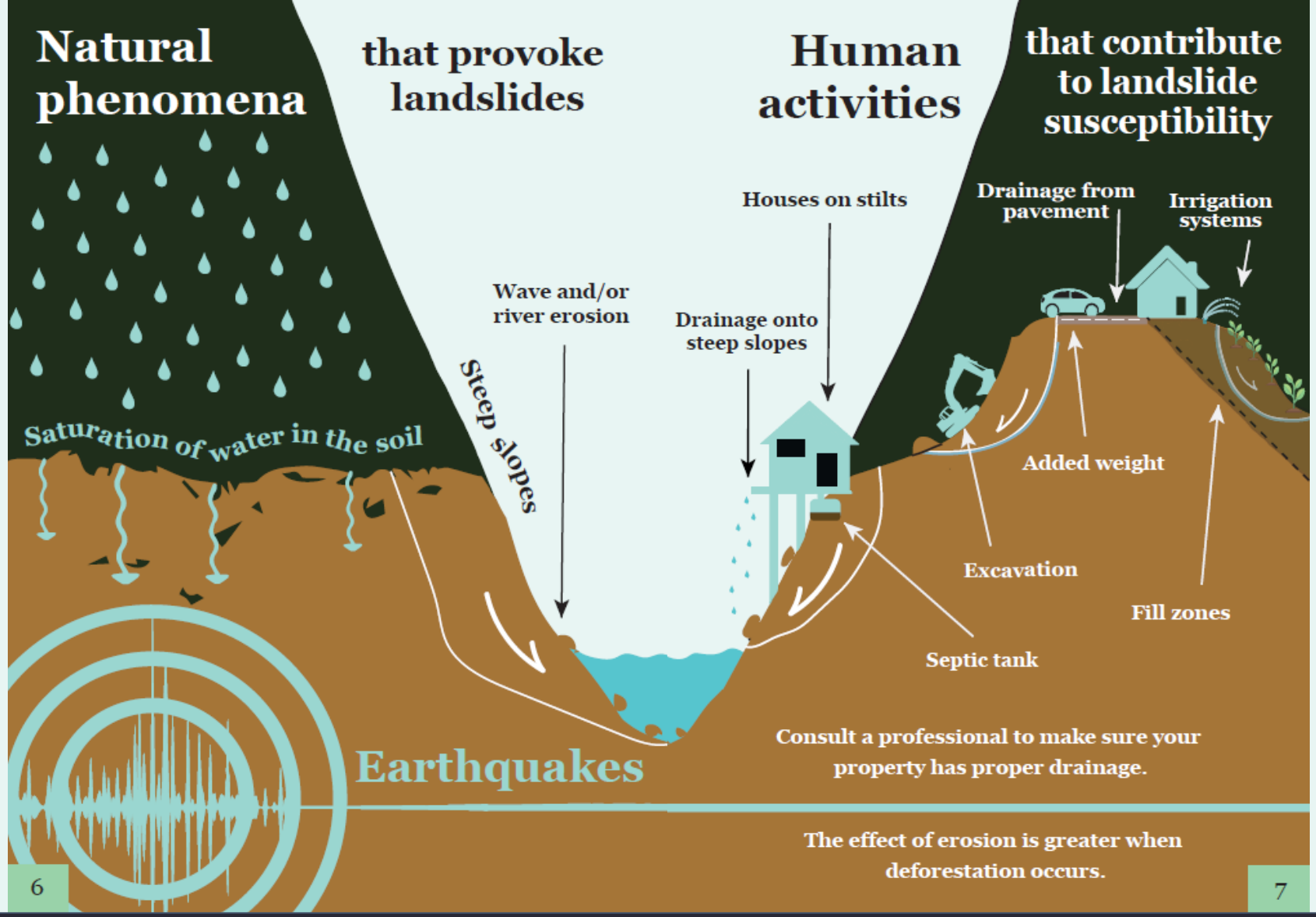
Download here:
hazards.colorado.edu/puertorico



Landslide' scarps density map after Hurricane Maria, data from: Hughes et al., 2019

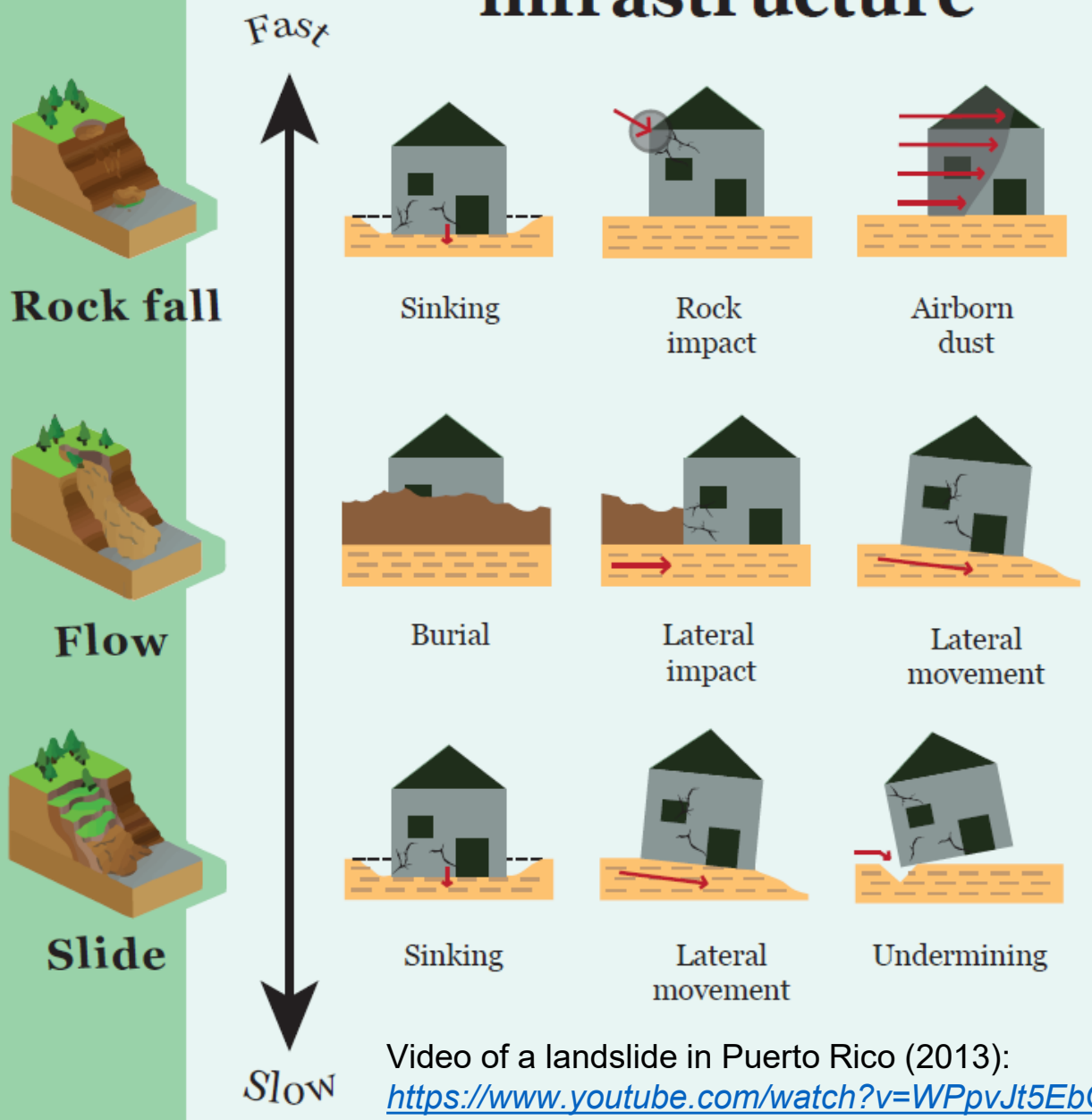
Landslides in Puerto Rico

- Landslide in Mameyes (Ponce) caused the death of hundreds of persons in 1985.
- After Hurricane Maria, there were more than 70,000 landslides.
- This map shows the density of landslides observed after Hurricane Maria.



What causes landslides?

Possible effects on infrastructure



Video of a landslide in Puerto Rico (2013):
https://www.youtube.com/watch?v=WPpvJt5EbQ4

Landslides can occur in just seconds, or can develop over the course of years.

Photo by Javier Colón Dávila

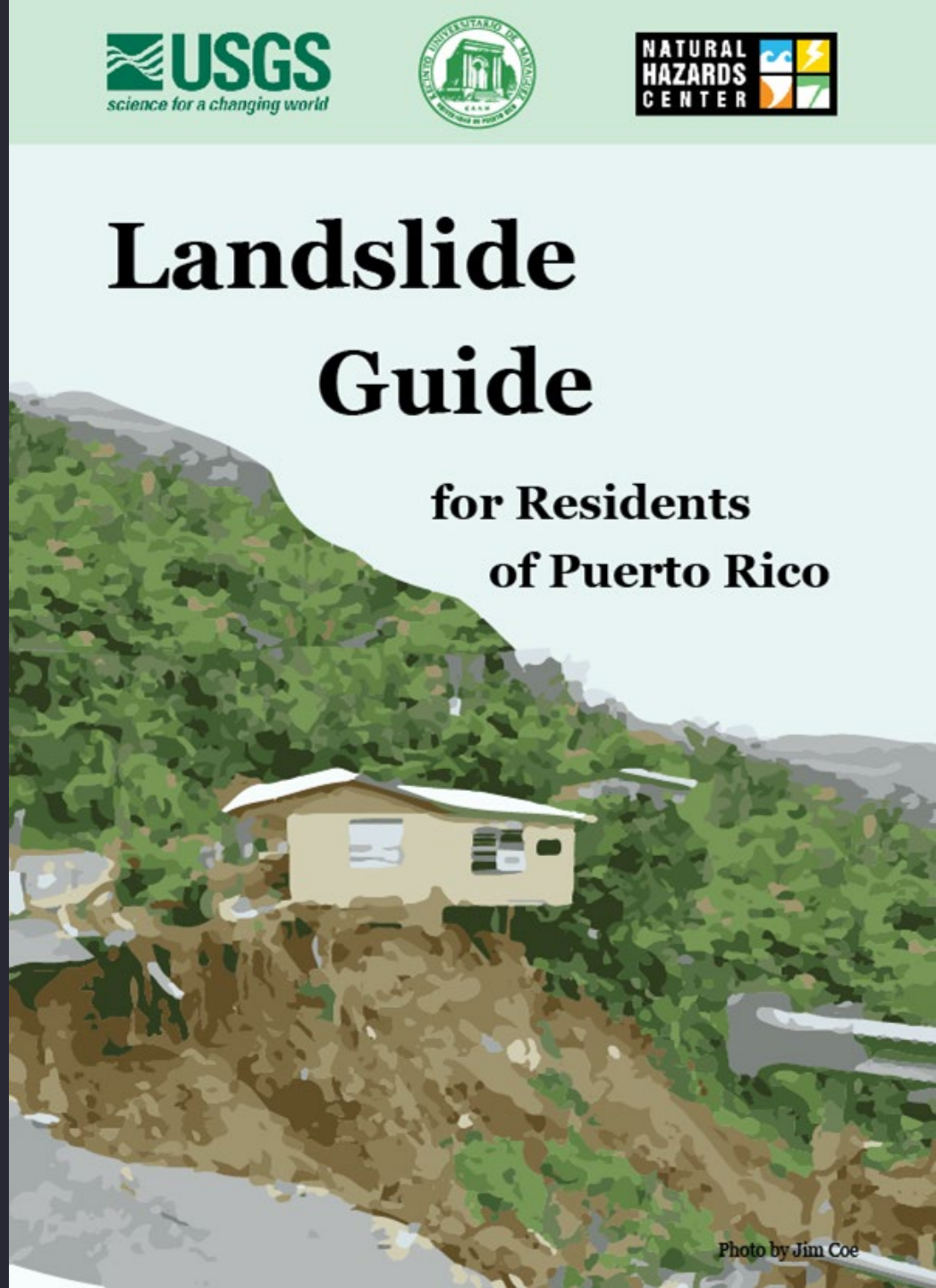
Examples of landslides in specific municipalities in Puerto Rico

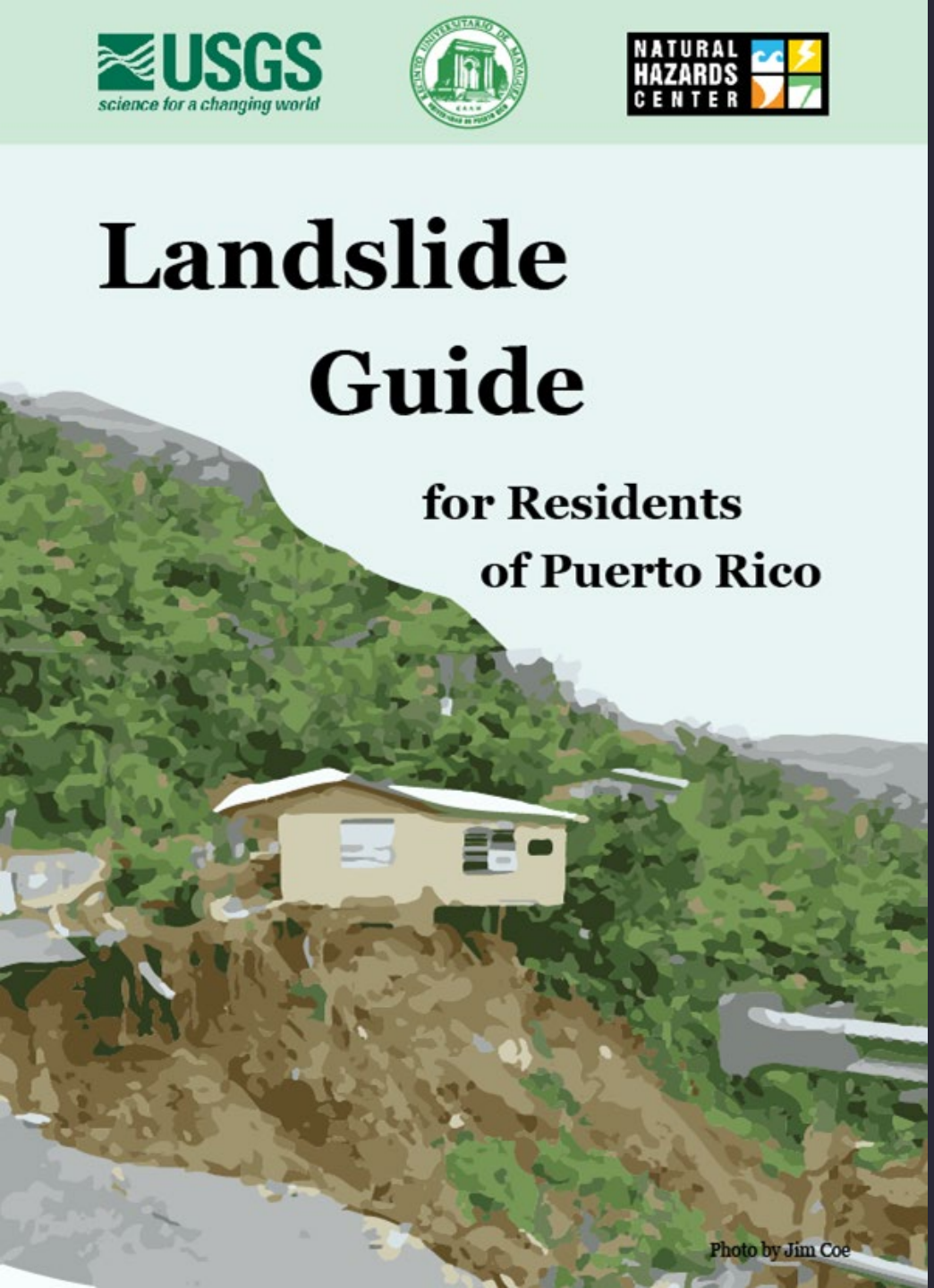
The type of landslide—debris flow or rockfall—depends on various factors:

- Saturation of the soil with water
- Type of rock and soil
- Angle of the slope

Why was the guide created?

- To engage, inform, and raise awareness about landslide risks in communities in Puerto Rico.
- To serve as a foundation for various modes modes of risk communication including multimedia, workshops, and presentations.
- To support the risk reduction objectives of residents and professionals in Puerto Rico.





What is the goal?

- To encourage residents to take necessary precautions
- To help people respond in a timely manner
- To educate people about what to do in case a landslide occurs
- Download here: hazards.colorado.edu/puertorico

Avoid making cuts in steep slopes.

Use drains and culverts to direct water away from slopes and areas prone to landslides.

Avoid deforestation and increase the planting of trees on slopes.

Do not build in areas prone to landslides and consult with a professional.

The guide highlights recommended mitigation measures

For more information: www.listo.gov/es

The guide also highlights recommended preparedness actions

Response and Recovery

Stay alert to any change in noise. Moving landslides can make the ground shake.

Move away from windows or areas where sediment could enter.

Help the people that have been affected.

Stay informed and consult emergency management offices.

If you are not able to evacuate the area in time, move away from any area of the structure that is more vulnerable.

Stay calm and evacuate the affected structure immediately.

Report damage to houses and property as soon as possible.

If you have lost your home, go to a temporary shelter with your family.

Replant terrain that has been affected to avoid additional erosion.

Stay away from active landslide areas in case more landslides occur.

In nature

Tilted trees are evidence that a slow movement of land is occurring.

Photo by K. Stephen Hughes

Springs develop in new places at the surface, or streams stop flowing suddenly due to landslides obstructing the passage of water.

Cracks in terrain facilitate the infiltration of water.

Possible signs of landslides

- It's important to always be alert to these signs and not wait to identify them all in order to take action.
- Remember to monitor any type of change in your home or surroundings

Distortion of structures;
broken, displaced, or dislocated pipes.

Cracks that extend in the streets or
in the walls or floors of houses and around
windows or doors.

Floors, posts, or walls that are **tilted**.

Windows or doors that suddenly begin
to **stick.**

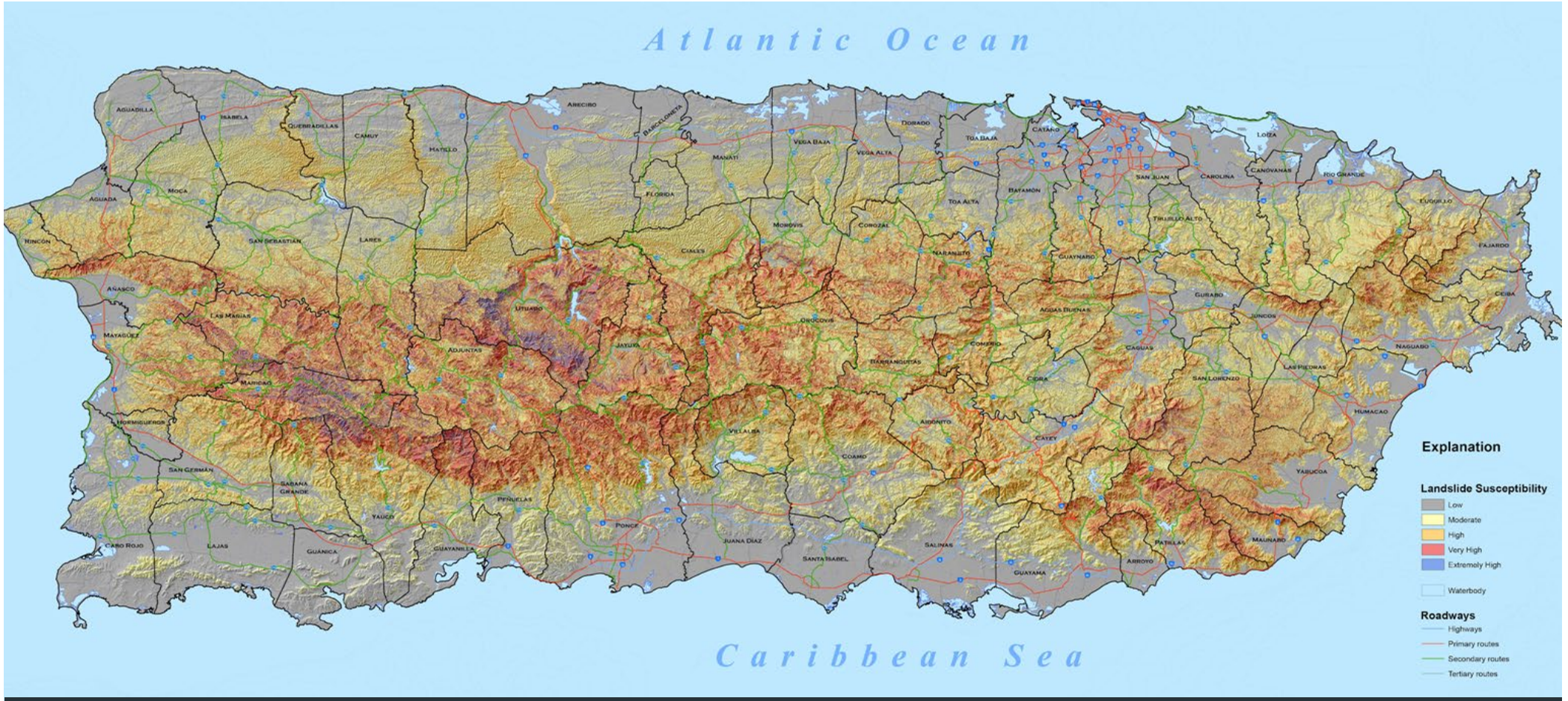
In infrastructure

Photos by K. Stephen Hughes

Possible signs of landslides in infrastructure

- This shows some, but not all, of the signs that indicate landslide risk.
- Consult with a professional if you notice all or some of these signs.

Landslide Susceptibility Map



For more information: https://pubs.er.usgs.gov/publication/ofr20201022

An interactive map intended to illustrate landslide hazards, showing the likelihood of occurrence in different parts of the

For more information:

- USGS Landslides Hazards Program: www.landslides.usgs.gov
- SLIDES-PR: www.facebook.com/SlidesPR
- EcoExploratorio: www.ecoexploratorio.org
- Floods and Landslides in Puerto Rico: Damage Mitigation Guide (CIAPR, AEMEAD, FEMA)
- Geology Division: www.drna.pr.gov/oficinas/division-de-geologia/
- Puerto Rico Seismic Network: http://redsismica.uprm.edu/Spanish/

Collaborators:

Lori Peek y Jocelyn West
Natural Hazards Center, University of Colorado Boulder

K. Stephen Hughes y James Joyce
University of Puerto Rico, Mayagüez

Lindsay Davis, Jonathan Godt y Bill Schulz
U.S. Geological Survey

Darysabel Pérez Martínez
Puerto Rico Highway and Transportation Authority

Gisela Báez Sánchez y Glorymar Gómez Pérez
Puerto Rico Seismic Network

Made by:
Raquel Lugo Bendezú y Yahaira D. Álvarez Gandía
University of Puerto Rico, Mayagüez

Christa von Hillebrandt y Carolina Hincapié Cárdenas
Caribbean Tsunami Warning Program

Lorna Jaramillo Nieves y Jenniffer Santos Hernández
University of Puerto Rico, Río Piedras

NOAA National Weather Service, San Juan Weather Forecasting Office

San Juan Puerto Rico Science, Technology & Research Trust

Puerto Rico Planning Board

Contacts:
K. Stephen Hughes:
kenneth.hughes@upr.edu
Lindsay Davis: ldavis@usgs.gov