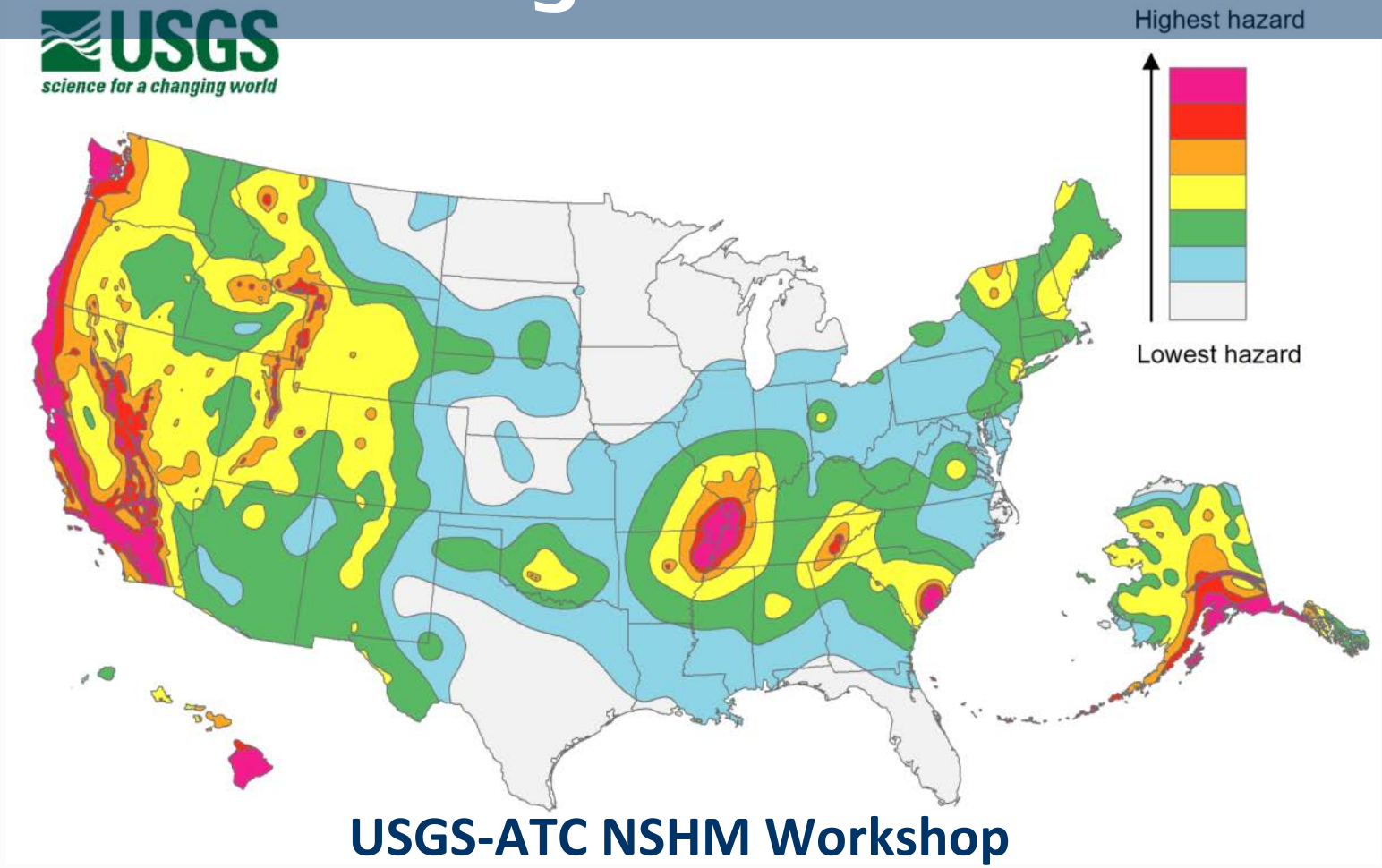
Applying Seismic Hazard Information in Local and Regional Urban Planning

USGS
science for a changing world

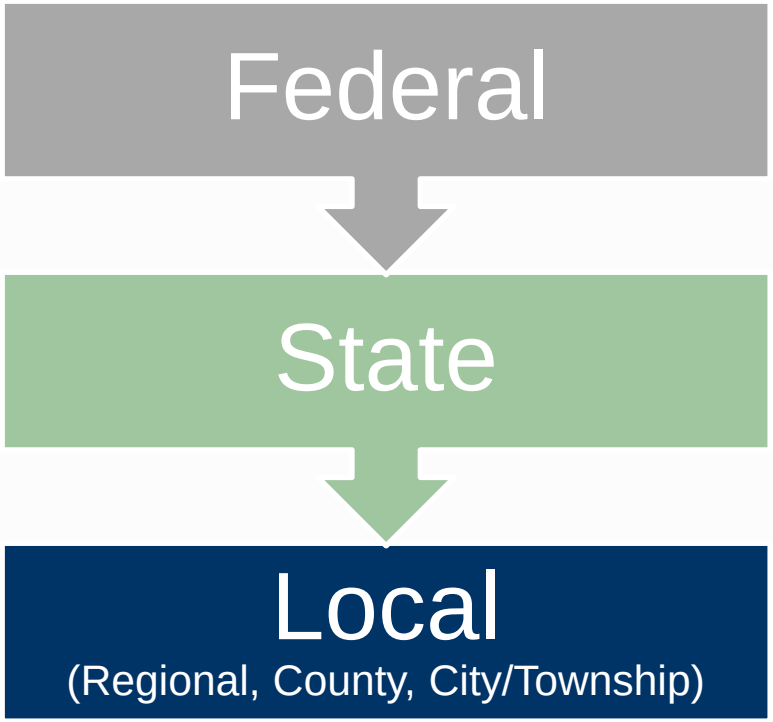


USGS-ATC NSHM Workshop
September 22, 2015

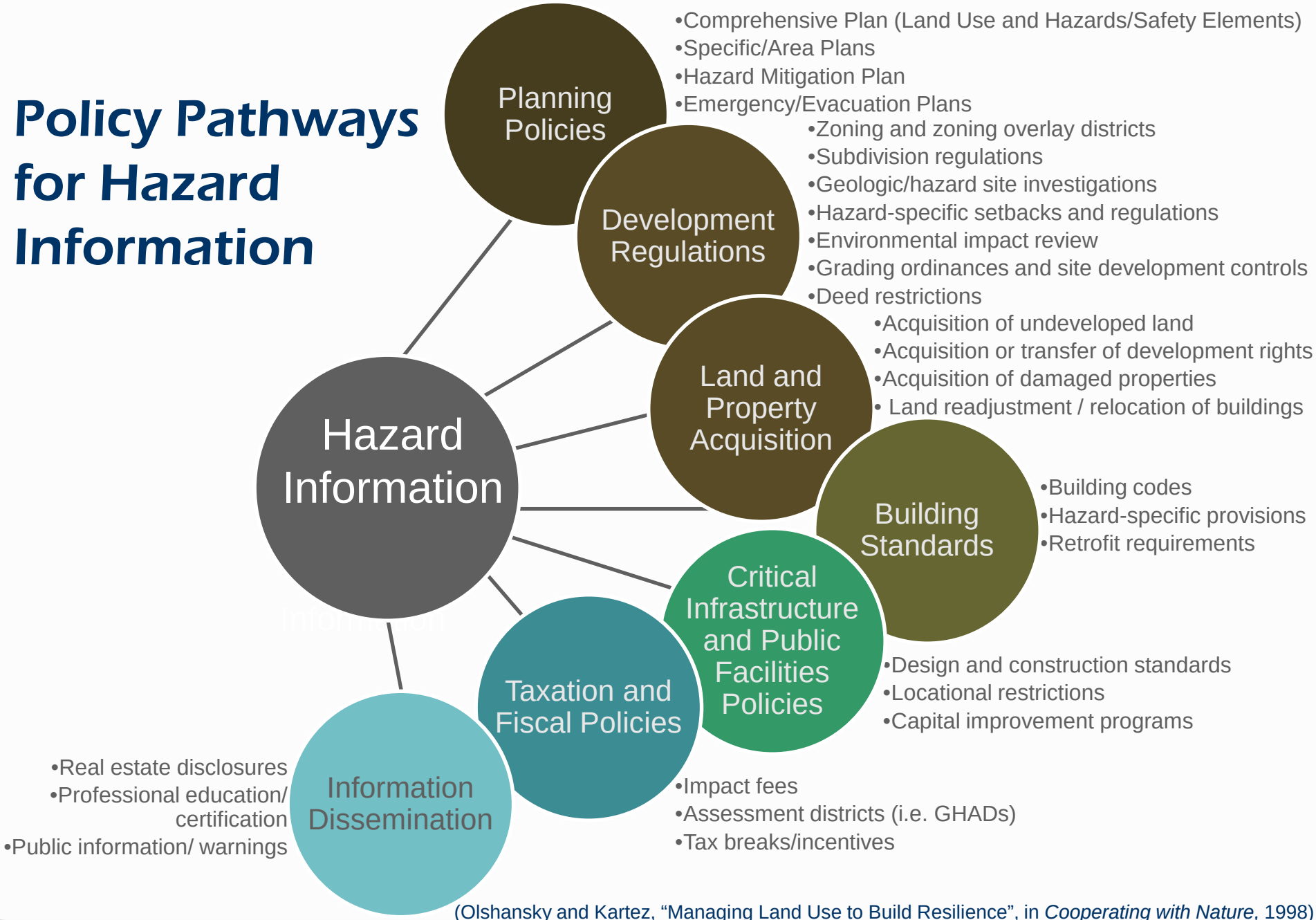
Laurie Johnson PhD AICP Consulting | Research

Governmental Authority for Planning in the U.S.

- Most power resides with States
  - States can plan and regulate land use, if they want to.
  - States have laws that enable cities to conduct their affairs, including planning.
  - So cities' planning laws depend on the state they are in.
- Federal government
  - Provides funding, policy guidance and technical assistance
  - Regulates air and water quality
  - Regulates the banking system (i.e. NFIP-flood hazard trigger in mortgage lending)



Policy Pathways for Hazard Information



(Olshansky and Kartez, "Managing Land Use to Build Resilience", in *Cooperating with Nature*, 1998)

Types of Local and Regional Planners

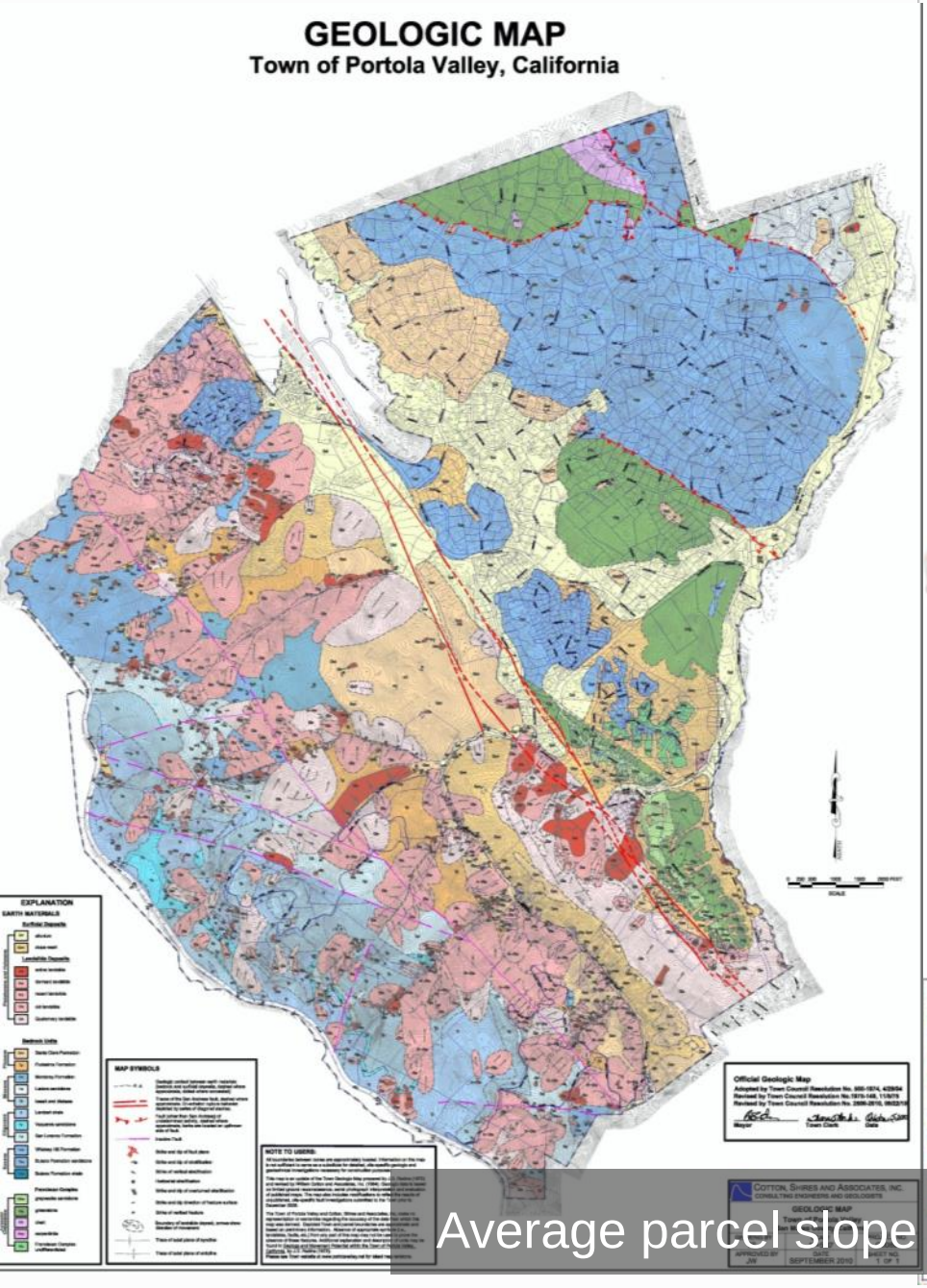
Urban / Land Use Planning	Capital Facilities/ Transportation Planning	Emergency Planning	Resiliency Planning
• General or comprehensive plans • Natural hazards/safety elements and plans • Housing plans • Land use zoning • Land/Development review • Redevelopment plans	• Capital improvement plans • Specific infrastructure/ transportation planning • Capital facilities and infrastructure siting/development	• Emergency response plans (earthquake annex) • Evacuation plans • Hazard mitigation plans	• Risk and hazard assessment • Resilience and vulnerability reduction strategy development

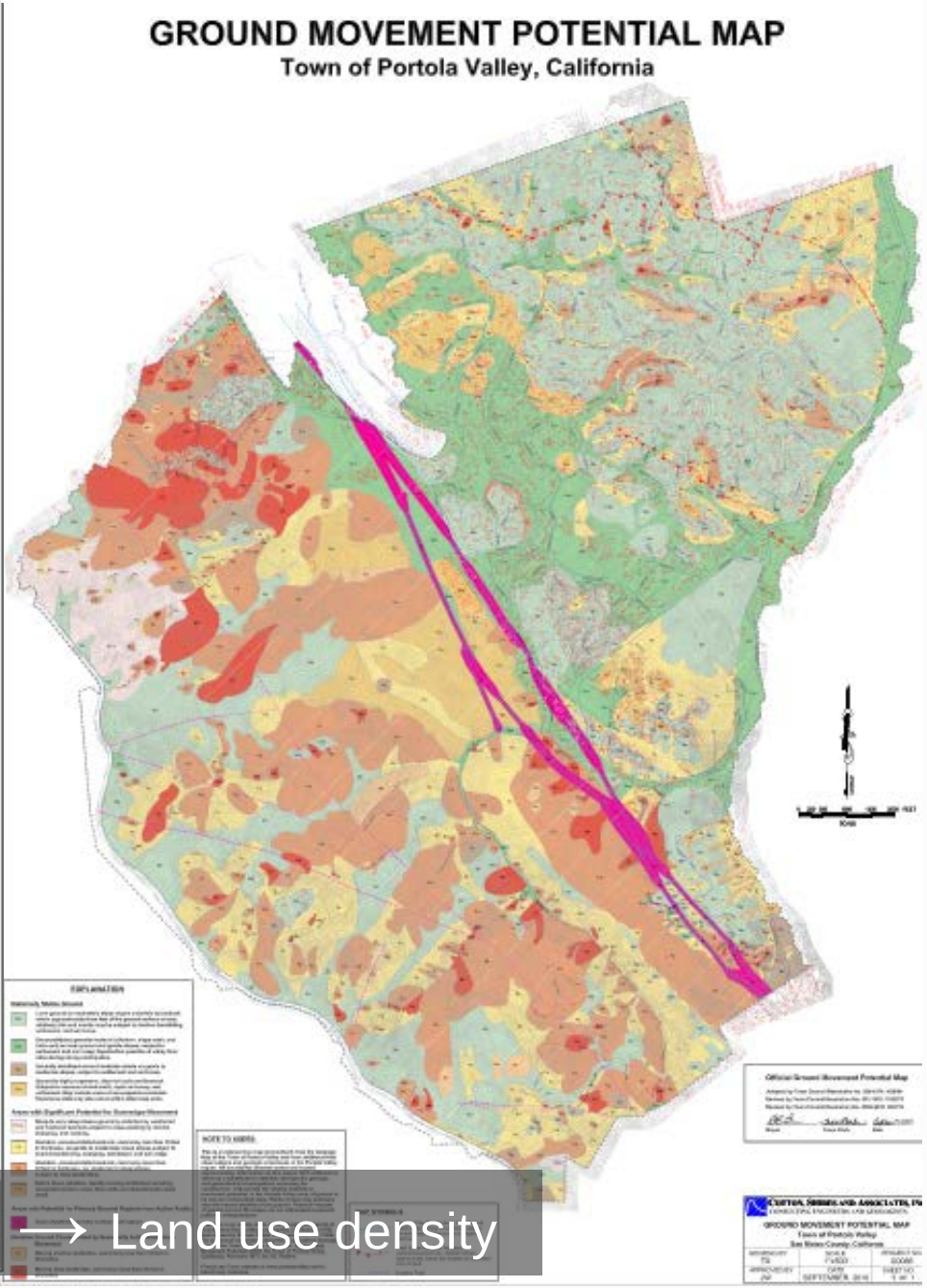
Town of Portola Valley, CA:

Example of robust and effective integration of "locally meaningful" seismic hazard information in public policy

Windy Hill Open Space Preserve
http://activerain.com/image_store/uploads/3/0/3/3/1/ar12702101313303.jpg

- Comprehensive planning
  (Land use and hazards elements)
- Zoning and zoning overlay districts
- Subdivision and development regulations
  - Geologic Safety Committee
  - Geologic/hazard site investigations
  - Environmental impact review
  - Hazard-specific setbacks and regulations
  - Grading and site development controls
- Acquisition or transfer of development rights
- Building standards (building codes, hazard-specific provisions)
- Critical infrastructure and public facilities (design and construction standards, locational restrictions, and capital improvement programs)
- Real estate transfer – hazard disclosure

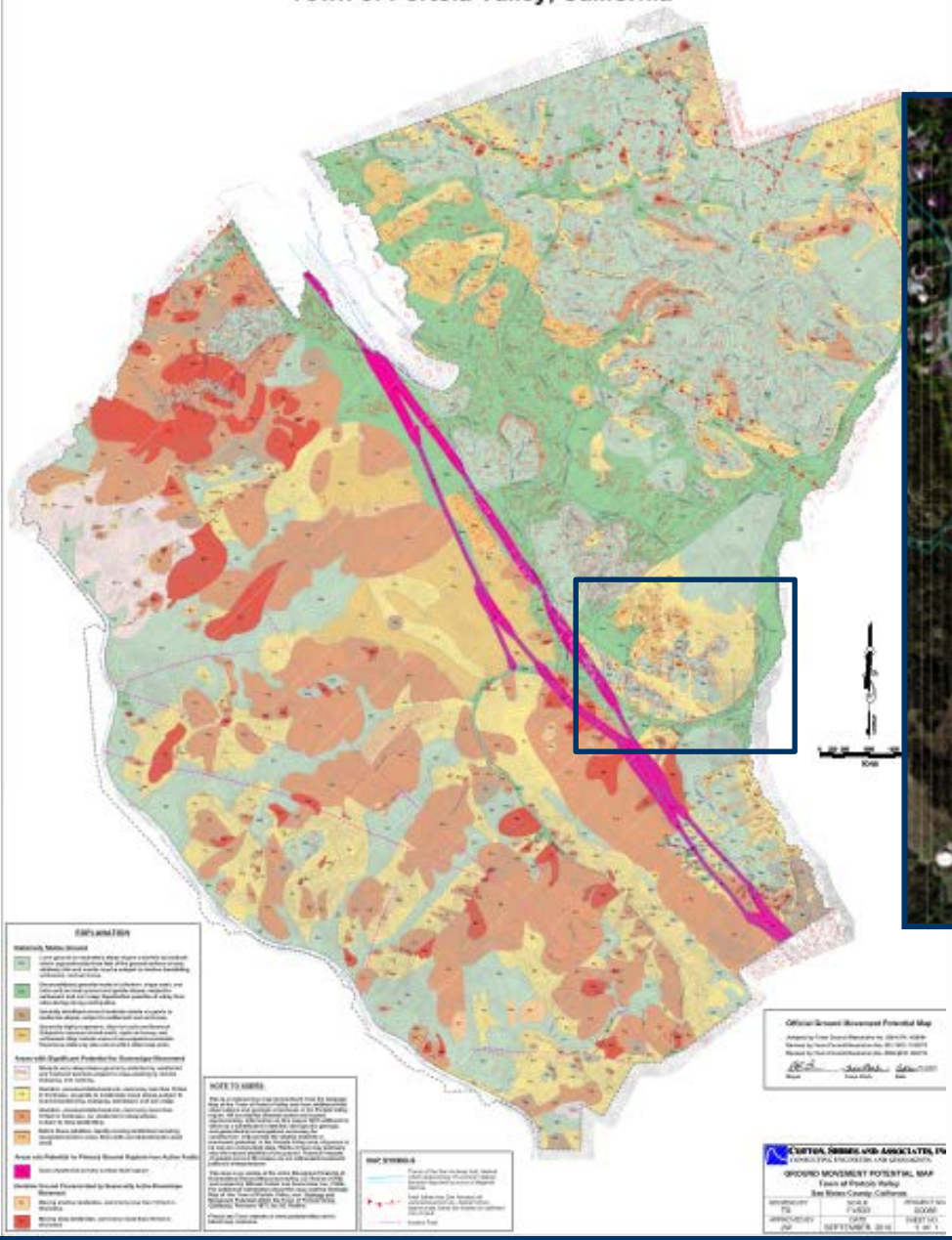




Average parcel slope ⟶ Land use density

GROUND MOVEMENT POTENTIAL MAP

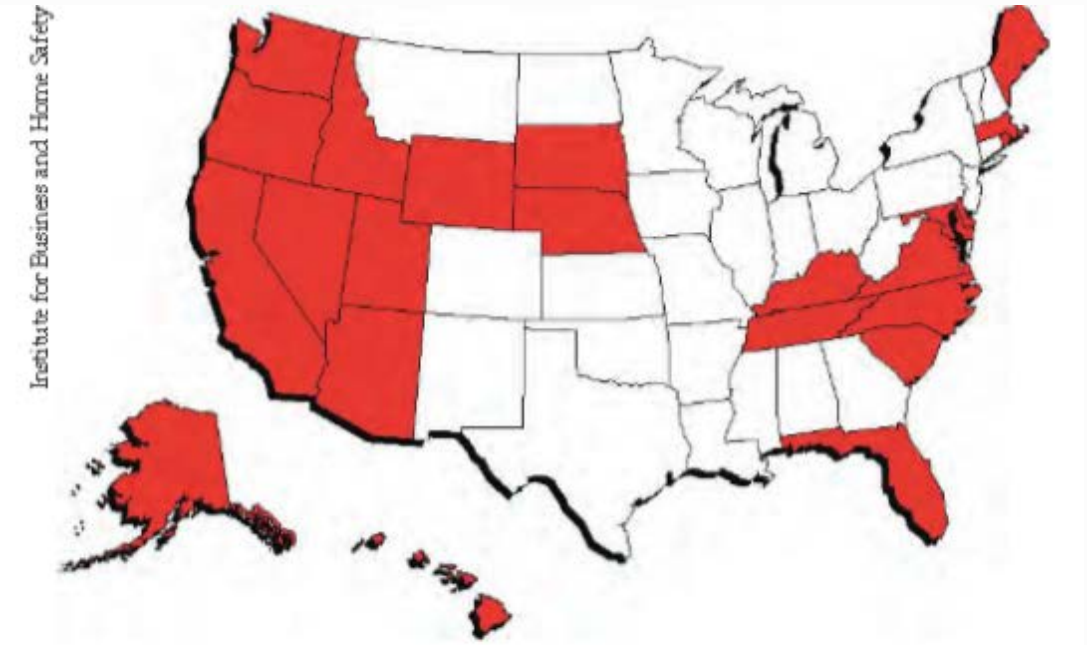
Town of Portola Valley, California



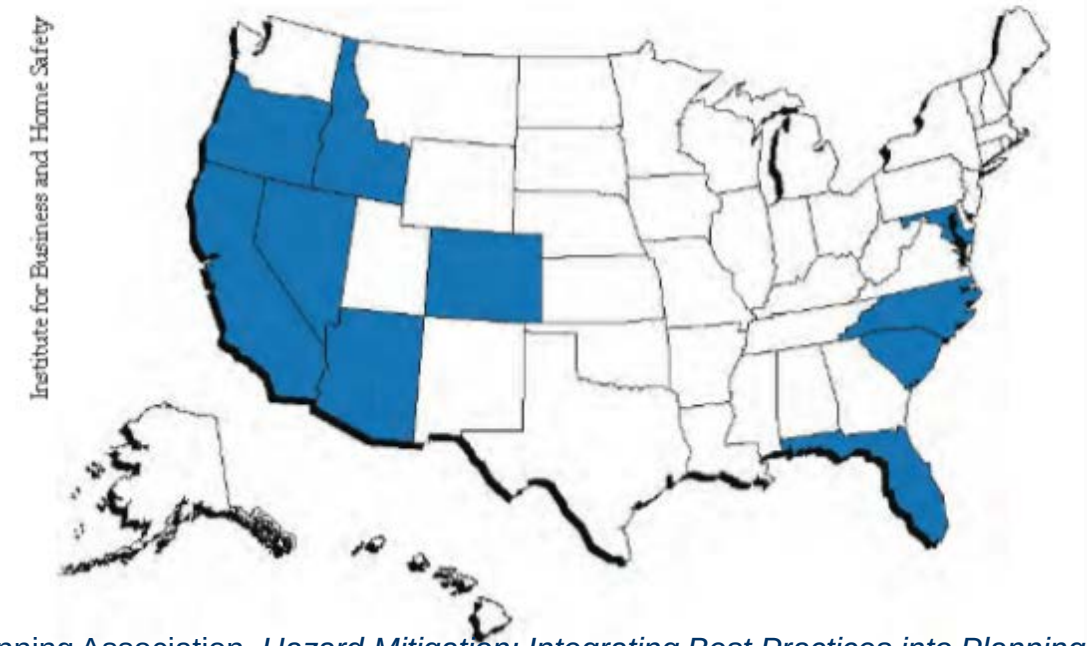
Midpeninsula Regional Open Space District

REGIONAL OPEN SPACE

States requiring local comprehensive plans (2009)



States requiring local comprehensive plans to address hazards (2009)



(American Planning Association, *Hazard Mitigation: Integrating Best Practices into Planning*, 2010)

Coastal State Building Code Effectiveness Rating

(Insurance Institute for Business & Home Safety (IBHS), August 2013)

IBHS Ratings by State: Highest to Lowest

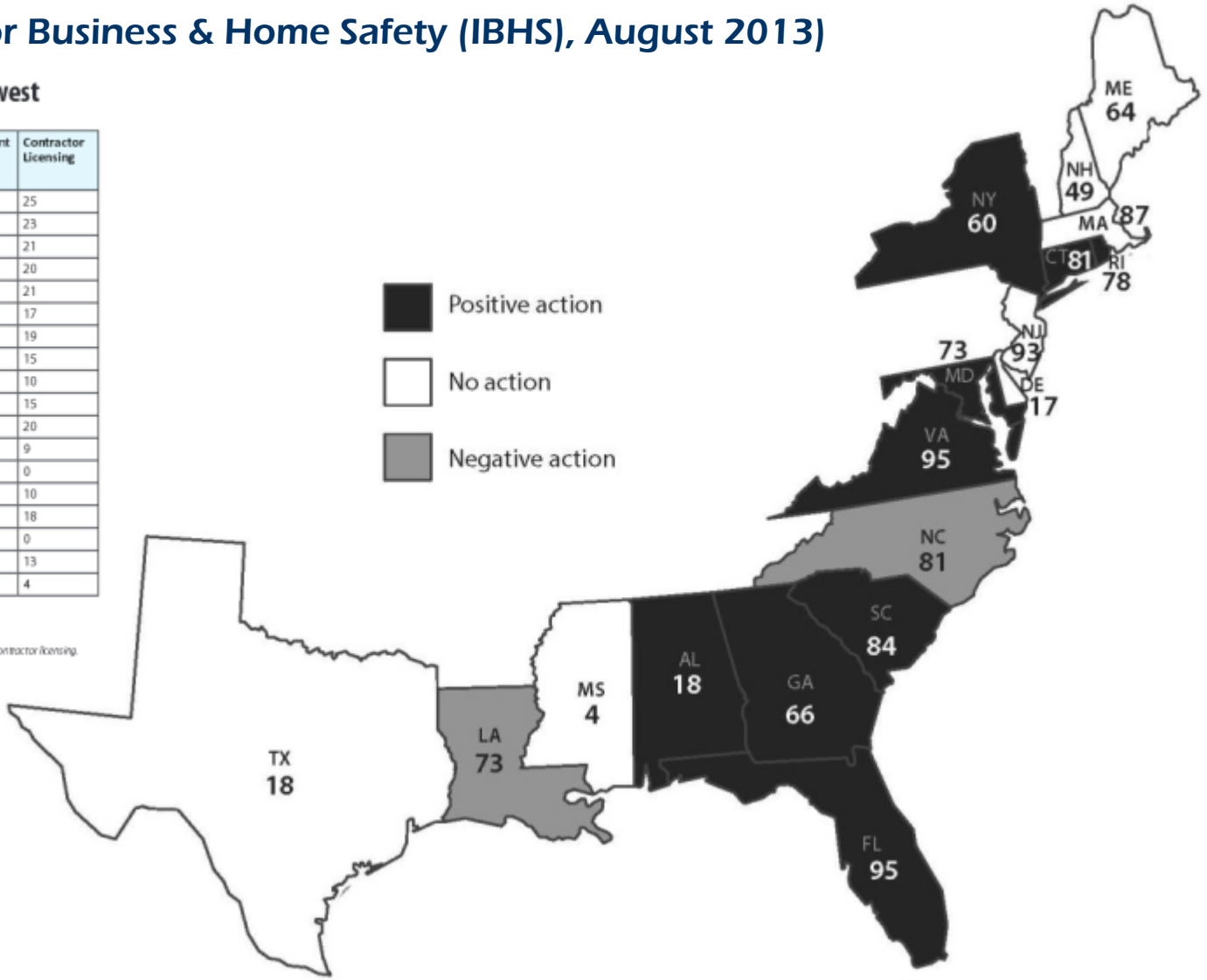
Scale 0-100*

State	Total	Adoption of code, universality, and weakening provisions	Enforcement Officials	Contractor Licensing
Florida	95	48	22	25
Virginia	95	48	24	23
New Jersey	93	49	23	21
Massachusetts	87	46	21	20
South Carolina	84	45	18	21
Connecticut	81	40	24	17
North Carolina	81	40	22	19
Rhode Island	78	44	19	15
Louisiana	73	48	15	10
Maryland	73	43	15	15
Georgia	66	31	15	20
Maine	64	33	22	9
New York	60	37	23	0
New Hampshire	49	39	0	10
Alabama	18	0	0	18
Texas	18	18	0	0
Delaware	17	4	0	13
Mississippi	4	0	0	4

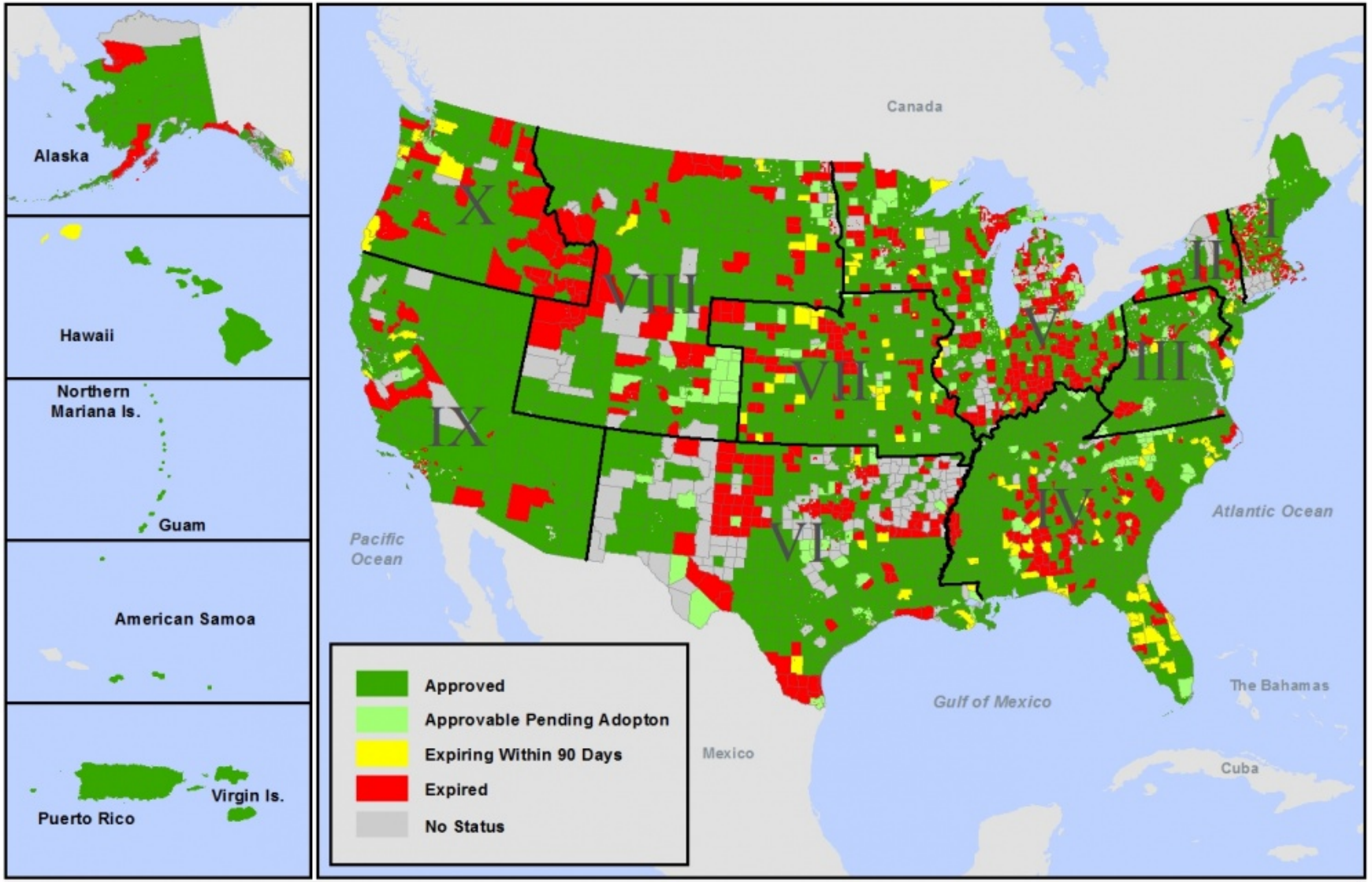
IBHS rankings were weighted based on the following variables:

- *50 percent for variables that relate to adoption and enforcement of building codes*
- *25 percent for variables that measure code official certification and training; and*
- *25 percent for variables that relate to on-site implementation, as measured by contractor and subcontractor licensing.*

**See Appendix B for a complete list of questions used to assign points in state ratings.*



Local Mitigation Plan Status as of June 30, 2015



FEMA

RiskMAP
Increasing Resilience Together

California Statewide Mandates for
Seismic, Wildfire, and Flood Hazard Identification

(My Hazard, California Office of Emergency Services)

California State Seismic Hazard Mapping Act

(Public Resources Code Section 2690-2699.6)

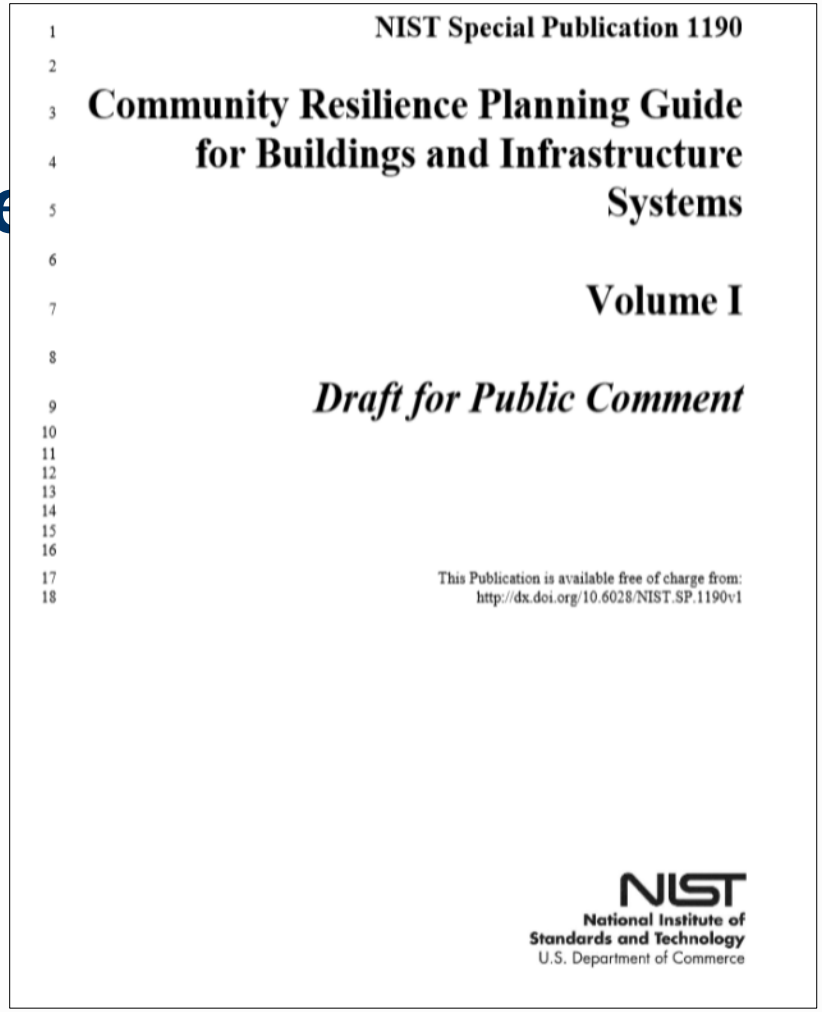
- ".. a statewide seismic hazard mapping and technical advisory program to assist cities and counties in fulfilling their responsibilities for protecting the public health and safety from the effects of strong ground shaking, liquefaction, landslides, or other ground failure and other seismic hazards caused by earthquakes."
- CGS established 4 technical advisory groups and their recommendations are contained in *CGS, Special Publication 118, Recommended Criteria for Delineating Seismic Hazard Zones in California (1992; revised 2004)*
  - "The purpose of the Seismic Hazard Mapping Act is to identify where special provisions, beyond those contained in the UBC, are necessary to ensure public safety. This need has not been recognized for the hazard of ground shaking. Design provisions contained in the UBC are believed to be representative of current knowledge and capability in earthquake-resistant design."
  - Further recommends investigating the development and utility for land-use planning purposes of informational maps that identify areas of soft-soil and/or basin structure or topography which may enhance ground shaking or where an aggregate of such adverse conditions within near-source zones might occur.

Considerable Variability in Hazard Mapping/Assessment Across the U.S.

- Hazard knowledge and ability to "map it" varies by peril: earthquake (faulting, liquefaction, landslide, strong shaking), flooding (riverine, dam/levee failure, storm surge, sea level rise), wildfire, landslides/debris flows, hurricane-force winds, tornadoes, hail, ice, subsidence, man-made, etc.
- Variations in mapping approach and accounting of uncertainty (inventory/identification, hazard/susceptibility, probabilistic, risk)
- Variations in mapping scales (regional to site-specific)
- Variations in legislative/policy controls: national, state, and local mandates requiring specific action versus informational or advisory only

NIST DRAFT Community Resilience Planning Guide

1. Form a collaborative planning team
2. Understand the situation (Social Dimensions and Built Environment)
3. Determine goals and objectives (Determine and characterize hazards (wind, earthquake, inundation, fire, snow, rain, human-caused or technological) for 3 hazard levels (routine, expected, extreme)
4. Plan development
5. Plan preparation, review, and approval
6. Plan implementation and maintenance


NIST Special Publication 1190

Community Resilience Planning Guide for Buildings and Infrastructure Systems

Volume I

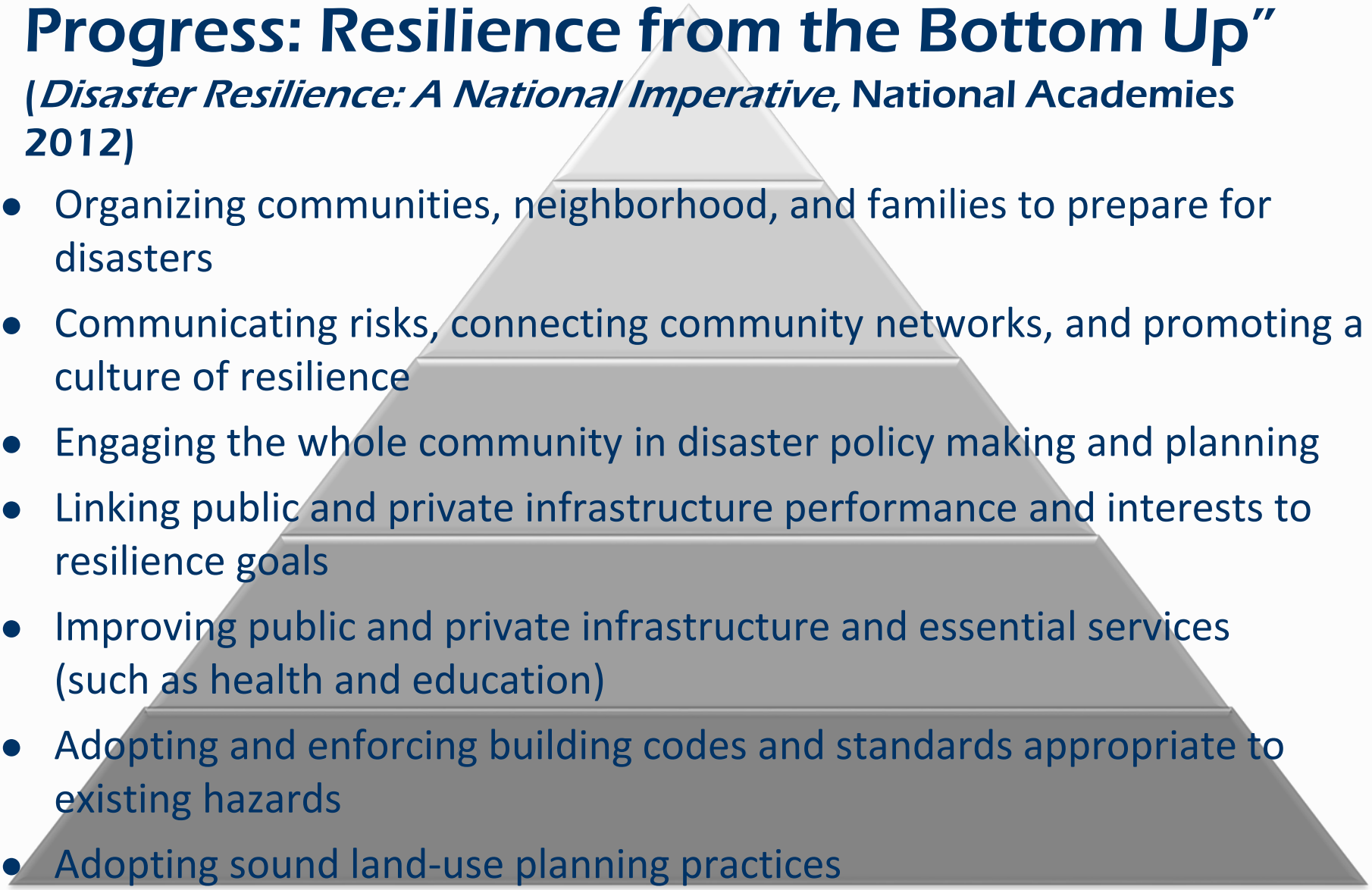
Draft for Public Comment

This Publication is available free of charge from:
http://dx.doi.org/10.6028/NIST.SP.1190v1

NIST
National Institute of Standards and Technology
U.S. Department of Commerce

"Building Local Capacity and Accelerating Progress: Resilience from the Bottom Up"

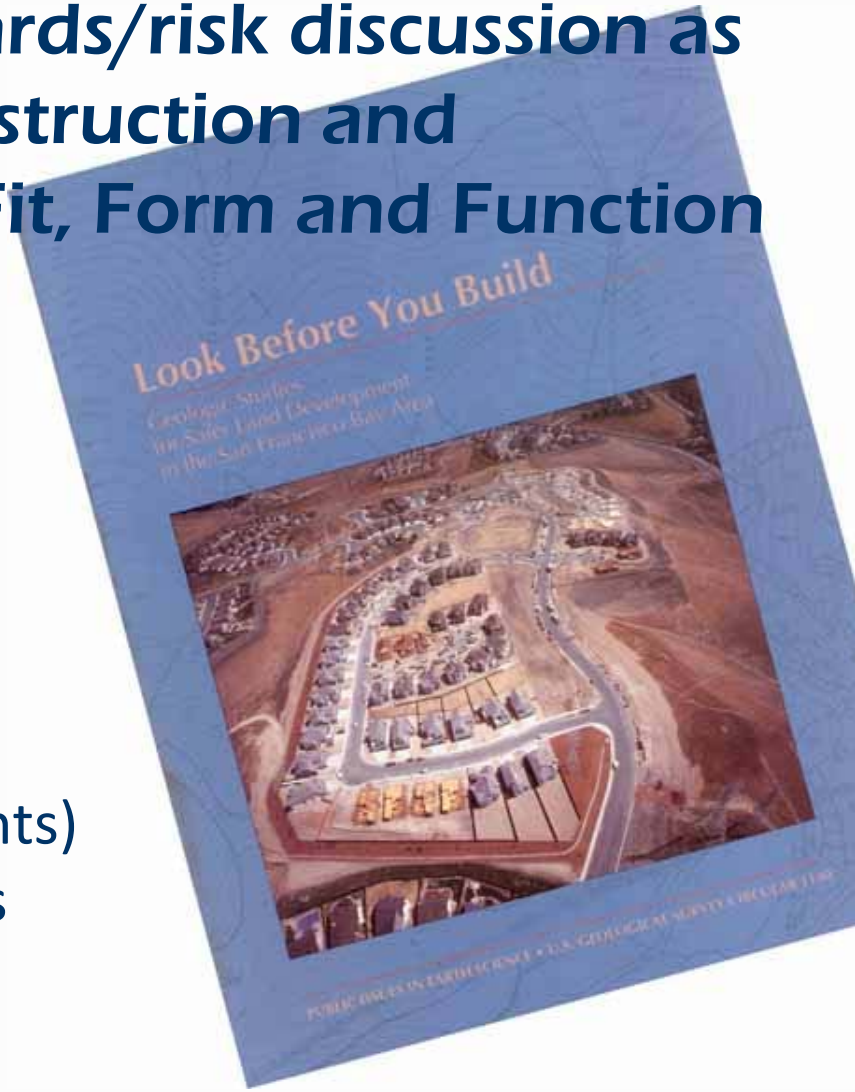
(*Disaster Resilience: A National Imperative*, National Academies 2012)



- Organizing communities, neighborhood, and families to prepare for disasters
- Communicating risks, connecting community networks, and promoting a culture of resilience
- Engaging the whole community in disaster policy making and planning
- Linking public and private infrastructure performance and interests to resilience goals
- Improving public and private infrastructure and essential services (such as health and education)
- Adopting and enforcing building codes and standards appropriate to existing hazards
- Adopting sound land-use planning practices

Challenge: Expand the hazards/risk discussion as part of building design, construction and (re)development; consider Fit, Form and Function

- Where (more precisely) to build ?
- What to build?
- How to build?
- Also, think about who ultimately owns the (retained) risk (multiple successions of owners and occupants) and how to ensure their awareness and preparedness



Property Rights Valuation ≠ Hazard-Risk Ownership/Retention

Challenge: Account for uncertainty and risk of "delusional precision" in hazards characterization and risk management

Research Investigations

Probabilistic Hazard Assessment

Consensus-based, periodic synthesis

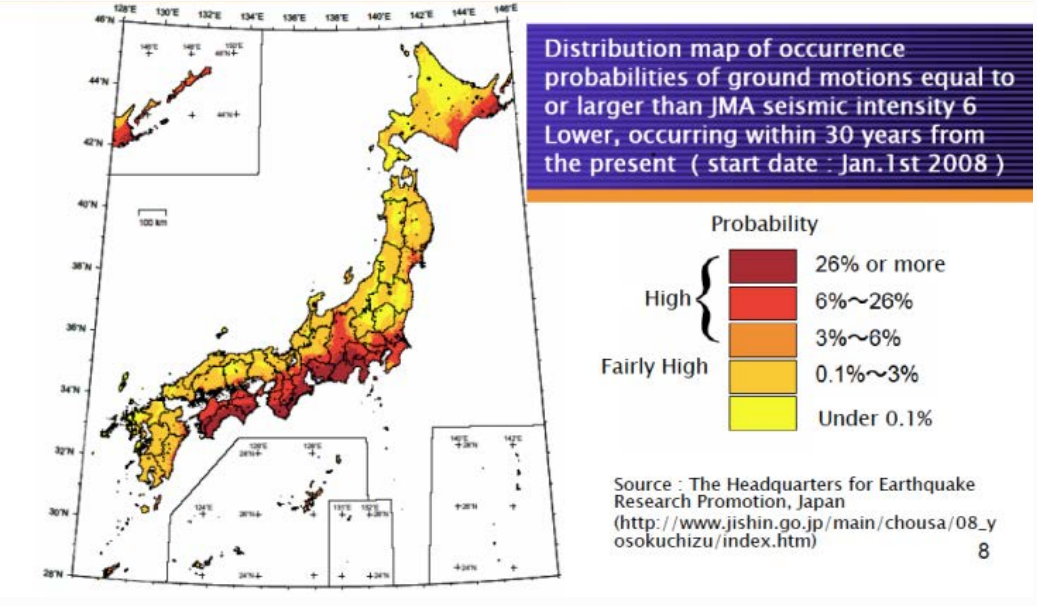
Catastrophe Risk Models
Building Codes
Infrastructure Design
Land Use Planning
Evacuation Maps
Response Exercises
Warnings/Forecasts

Derivative Products (updated periodically)

Comprehensive Risk Management

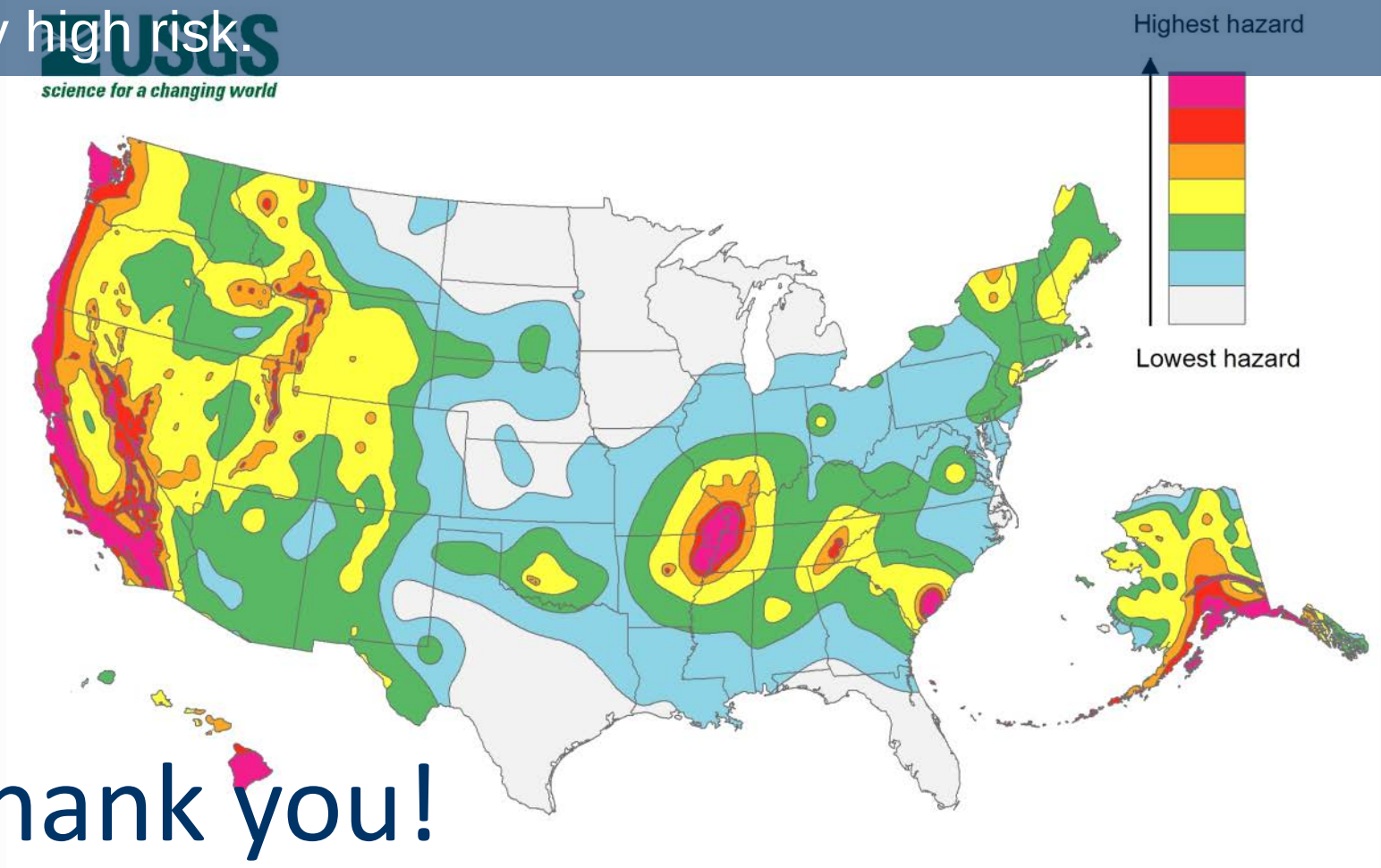
?

Correlated Uncertainty



Challenge: Enable "locally meaningful" characterizations of seismic hazards information in an increasingly multi-hazards policy environment

Almost half of the U.S. population—150 million people—reside in portions of 42 states at risk of experiencing a damaging earthquake within the next 50 years. Sixteen of those states are at very high risk.



Thank you!

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