



Resilience Planning – A State and National Perspective



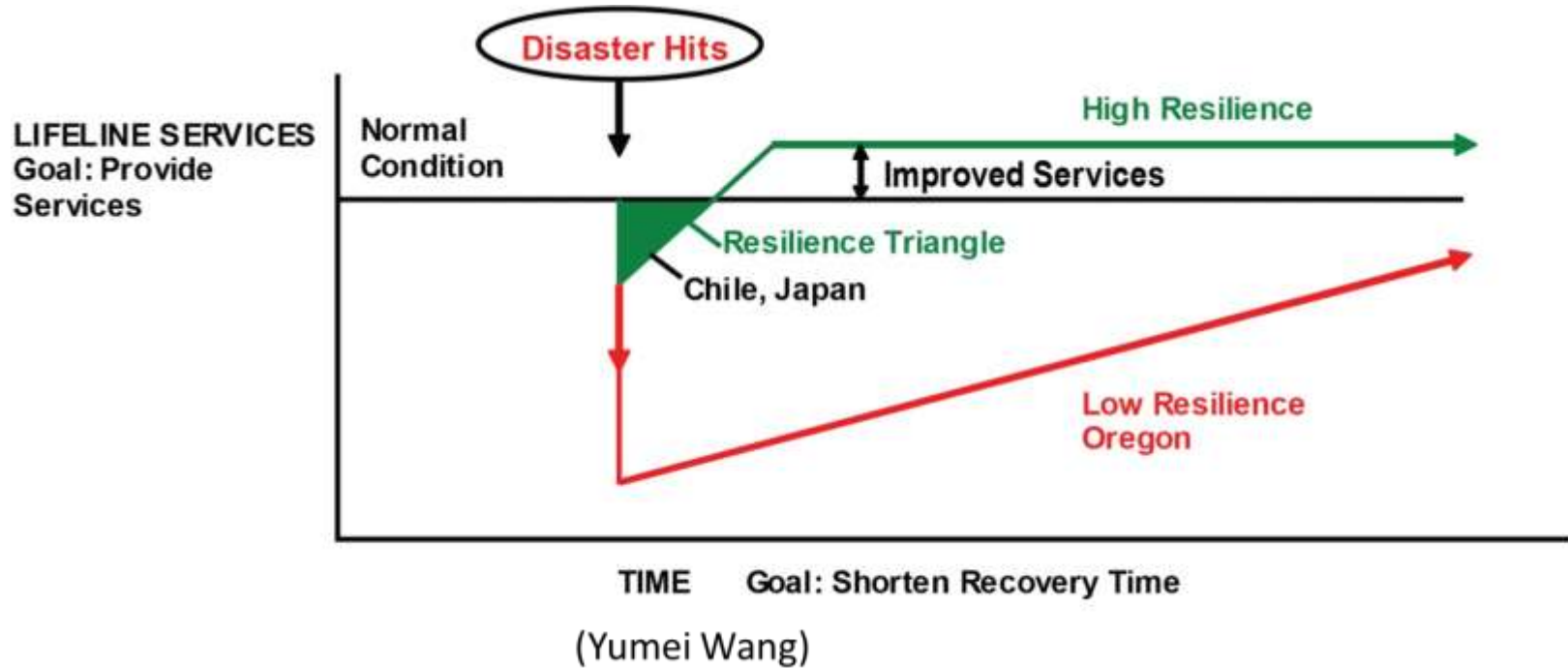
Kent Yu, PhD, PE, SE
Principal, SEFT Consulting Group
Beaverton, Oregon

Outline

- Definition of Resilience
- Oregon Resilience Plan
- OR-WA Regional Resilience Planning Workshop
- NIST Community Resilience Planning Guide for Buildings and Infrastructure Systems
- ASCE Infrastructure Resilience Division

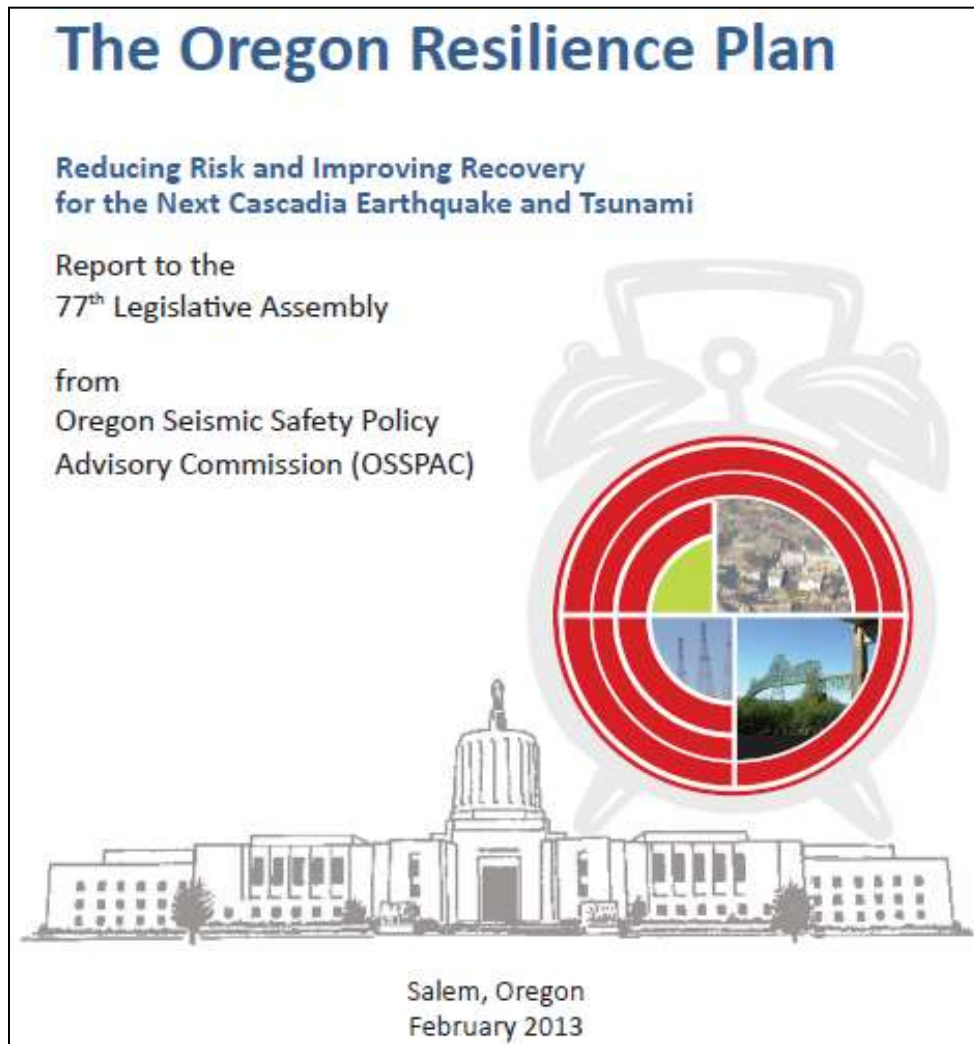


Definition of Resilience



- The ability to *prepare for* and *adapt to* changing conditions and *withstand* and *recover rapidly* from disruptions (from PPD-21)

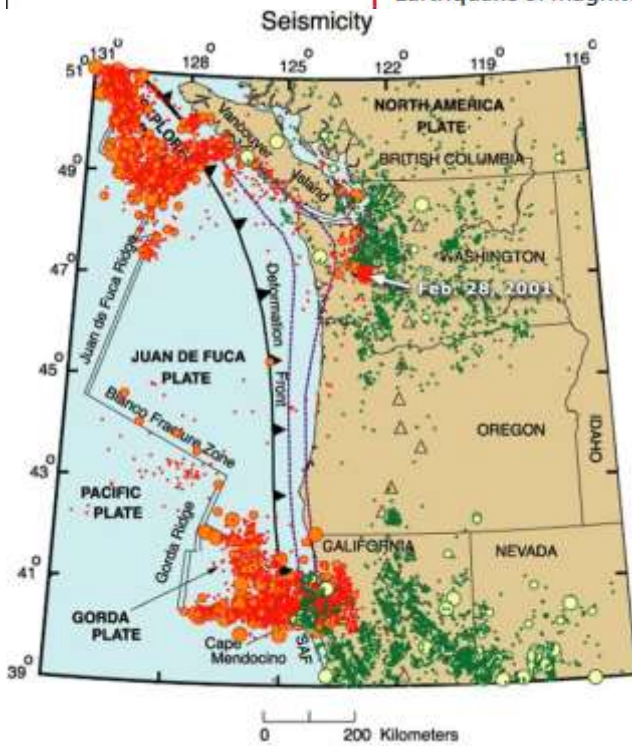
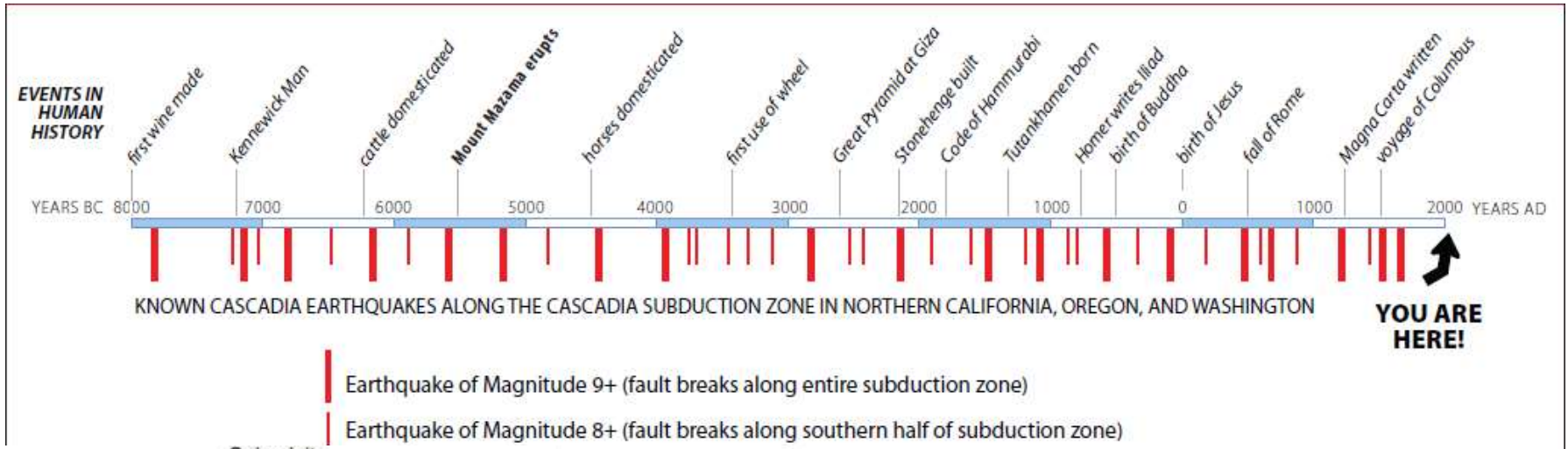
The Oregon Resilience Plan



(download it from

http://www.oregon.gov/OMD/OEM/osspace/docs/Oregon_Resilience_Plan_Final.pdf)

Cascadia Subduction Zone



modified from Weaver and Shedlock, 1996



House Resolution 3



76th OREGON LEGISLATIVE ASSEMBLY--2011 Regular Session

Enrolled

House Resolution 3

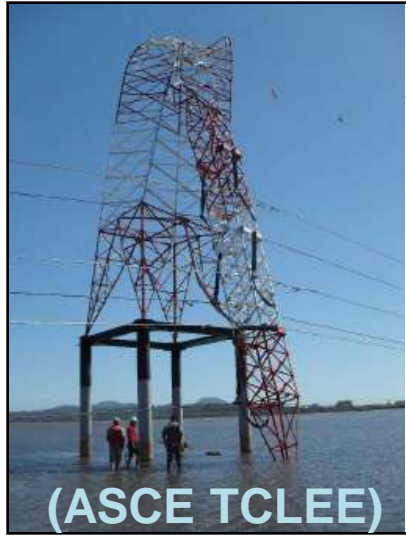
Sponsored by Representative BOONE; Representatives COWAN, KRIEGER, ROBLAN, WITT, Senators COURTNEY, JOHNSON, KRUSE, VERGER, WHITSETT

- Directs Oregon Seismic Safety Policy Advisory Commission (OSSPAC) to “lead and coordinate preparation of an Oregon Resilience Plan that . . . makes recommendations on policy direction to protect lives and keep commerce flowing during and after a Cascadia (megathrust) earthquake and tsunami.”
- Focuses on physical infrastructure

Lifeline Dependencies

Interdependencies will make disaster recovery much more difficult. The earthquake will damage all systems at the same time.

To restore electric service, you need to reopen roads



To restore water service, you need electricity



To restore fuel supplies you need electricity



To reopen roads, you need to restore fuel supplies



Lifeline Co-location



Aftermath of an earthquake in Japan, 2004
Photograph by Kimimasa Mayama/Reuters

Key Endorsement

NATIONAL SECURITY STAFF
WASHINGTON, D.C. 20504

December 7, 2011



Kent Yu, PhD
Chairman, Oregon Seismic Safety Policy Advisory Commission
P.O.Box 14370
Salem, OR
97309 5062

Dr. Yu:

On Tuesday, November 8, 2011 I had the pleasure of spending time with the working session of the National Earthquake Hazard Reduction Program (NEHRP) Advisory Committee. There, I was honored to meet Deborah Boone, Oregon State Representative and sponsor of Oregon House Resolution 3, which directs the creation of an Oregon Resilience Plan to prepare for the statewide impacts of a Cascadia earthquake and tsunami. I would like to wholeheartedly applaud Representative Boone, yourself, and the rest of the Oregon Seismic Safety Policy Advisory Commission on this initiative..

President Obama's top priority is the safety and security of the American people. I thank you for your leadership and your ongoing contribution to our Nation's resilience.

Sincerely,

Richard Reed
Special Assistant to the President for
National Security Affairs and
Senior Director for Resilience

From White House



JOHN A. KITZHABER, MD
GOVERNOR



January 4, 2012

Kent Yu, Ph.D, Chair
Oregon Seismic Safety Policy Advisory Commission
P.O. Box 14370
Salem, OR 97309

Dear Dr. Yu,

The Oregon Seismic Safety Policy Advisory Commission (OSSPAC) has a challenging mission to educate the public about our seismic risks and inform diverse policy decisions. Through OSSPAC's dedicated efforts, though, the State of Oregon and its citizens have become increasingly aware that we live in an earthquake-prone region.

This month will mark the 312th anniversary of the last major earthquake and resulting tsunami from the Cascadia Subduction Zone that sits off Oregon's coast. Throughout this year, OSSPAC will be drafting an Oregon Resilience Plan to help us better prepare for the next major earthquake and tsunami.

A focused resiliency effort can better prepare us for catastrophic disasters as well as help us weather our more common emergencies like storms, floods and fires. OSSPAC has had wide participation from state agencies, local governments, businesses and non-profits and I encourage their continued engagement on this critical effort.

Thank you for all of OSSPAC's efforts to date and for continuing to be a powerful voice for a more prepared and resilient Oregon.

Sincerely,

John A. Kitzhaber, M.D.
Governor

JKK/STP

From Governor of Oregon

The Oregon Resilience Plan

The Oregon Resilience Plan

Reducing Risk and Improving Recovery
for the Next Cascadia Earthquake and Tsunami

Report to the
77th Legislative Assembly

from
Oregon Seismic Safety Policy
Advisory Commission (OSSPAC)



Salem, Oregon
February 2013

50-year Comprehensive Plan

- Cascadia Earthquake Scenario
- Business/Workforce Continuity
- Coastal Communities
- Critical & Essential Buildings
- Transportation
- Energy
- Information and Communication
- Water & Wastewater

- Save Lives, protect our economy, and preserve our communities;
- 169 participants representing broad cross-section of stakeholders;
- \$ Millions in donation of professional services over a year

Eight Task Groups

Business and Work Force
Continuity

Coastal Communities



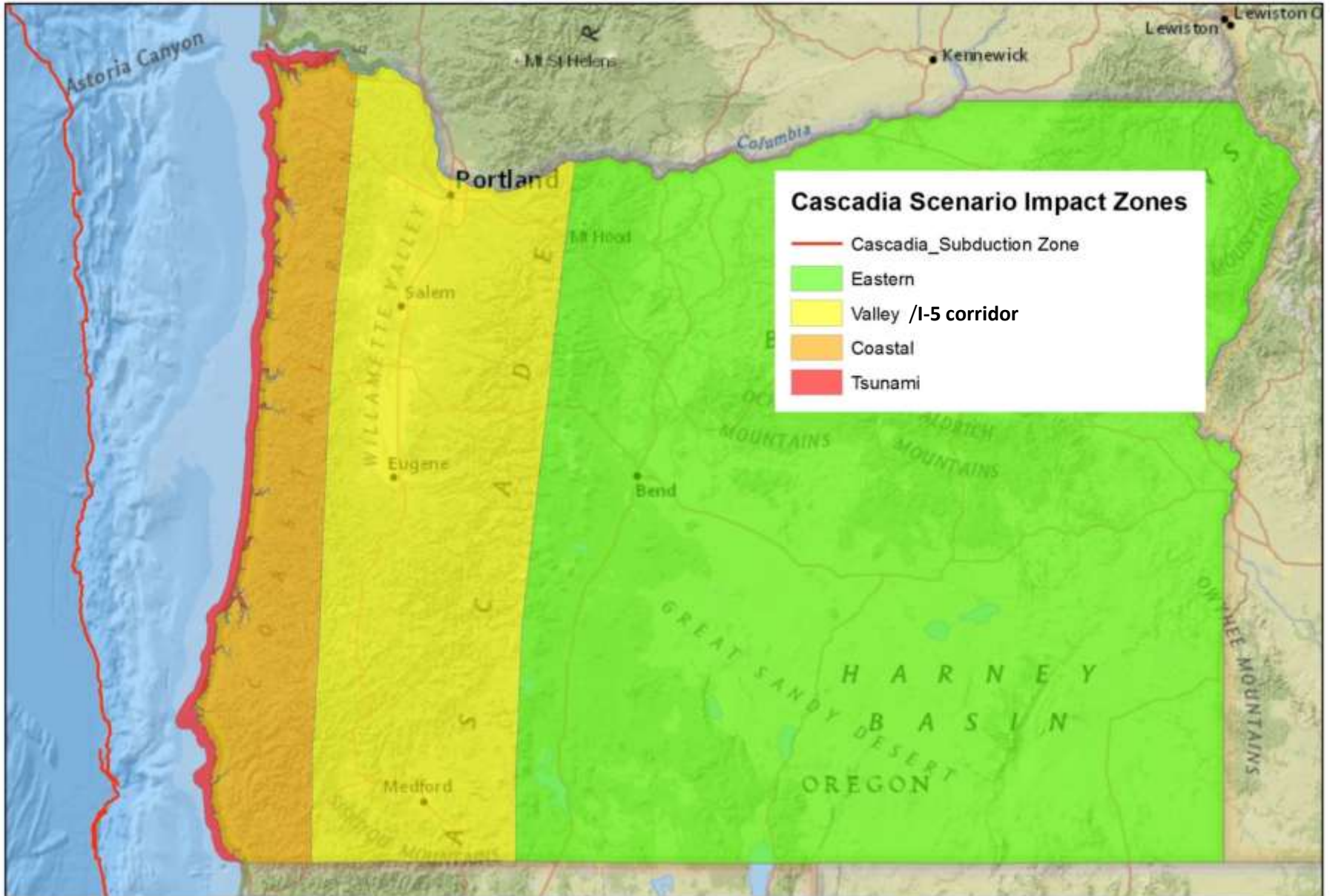
- Critical/Essential Buildings
- Energy
- Information and Communications
- Transportation
- Water and Waste Water

Interdependency
coordination



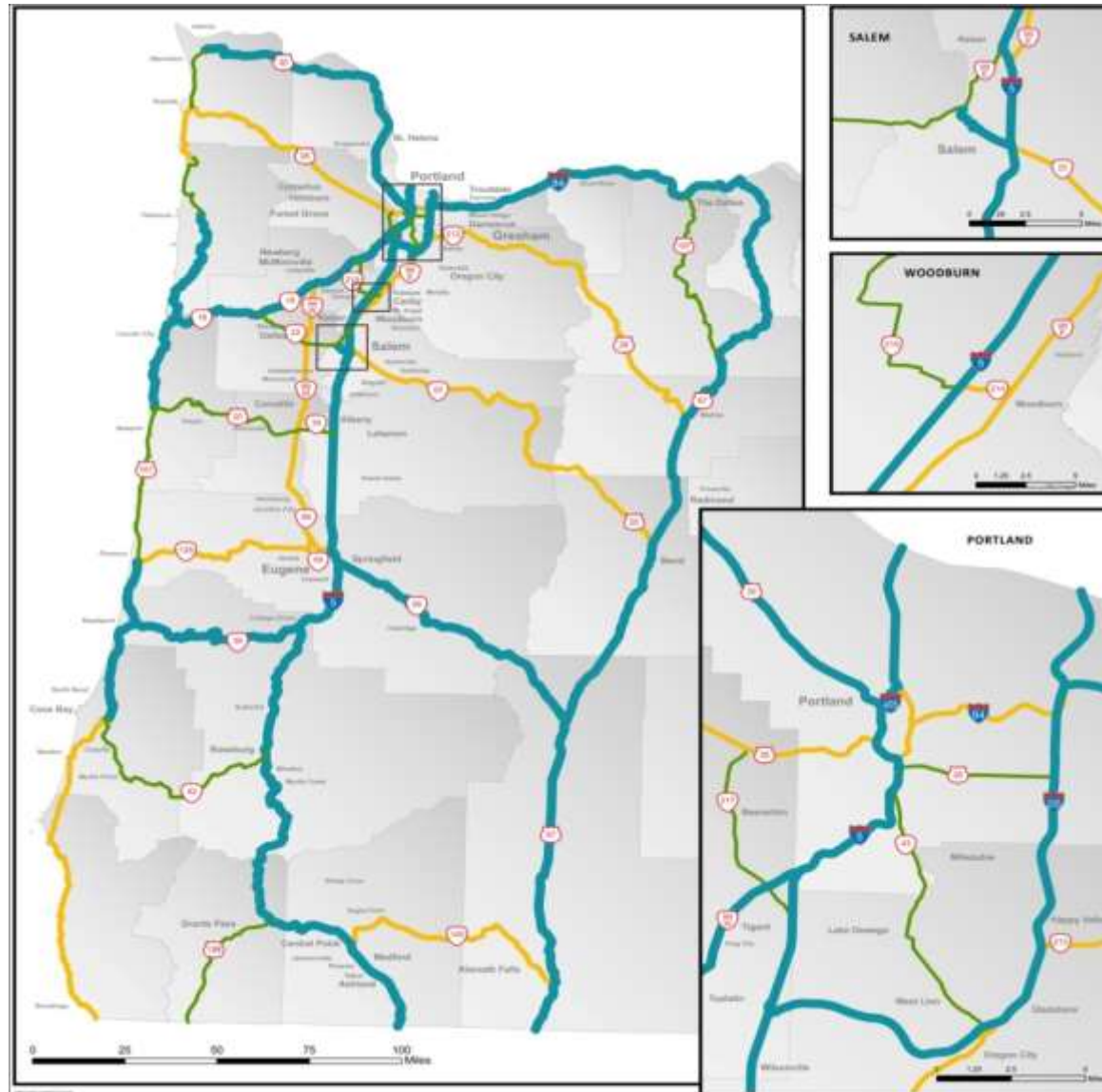
Magnitude 9.0
Earthquake/Tsunami Scenario

Four Zones



State Response/Recover Strategy

1st tier
2nd tier
3rd tier



Business and Work Force Task Group

- Oregon is a small business state, 50% ~60% of our work force is employed by small businesses
- Business can only tolerate two to four weeks of disruption of essential services



The Oregon Resilience Plan

Water & Wastewater Task Force

- **Led by Mike Stuhr and Mark Knudson**
- **Participants representative of ~ 45% of state population**
 - Utilities, consultants, academia
- **Estimate of main line leaks & breaks**
 - “Seismic Fragility Formulations for Water Systems” American Lifeline Alliance, 2011
 - Based on empirical data from prior events
 - Input: Peak Ground Velocity, Permanent Ground Deformation, length of pipe, pipe material
- **Estimate of service line leaks & breaks**
 - Based on anecdotal data for similar events
 - About 7% failure (2% utility & 5% customer side)
- **Estimate of Reservoir and Pump Stations**
 - Based on age and Building code at the time of construction

Resiliency Goals (Valley)

TARGET STATES OF RECOVERY: WATER & WASTE WATER SECTOR											
	Event occurs	0-24 hours	1-3 days	3-7 days	1 week-2 weeks	2 weeks-1 month	1 month - 3 month	3 month - 6 month	6 month -1 year	1 year-3 years	3+ years
Domestic water supply											
Potable water available at supply source. (WTP, wells, impoundment)		R	Y		G	X					
Main transmission facilities, pipes, pump stations, and reservoirs ("backbone") operational		G	X								
Water supply to critical facilities available.		Y	G	X							
Water for fire suppression - at key supply points.		G	X								
Water for fire suppression - at fire hydrants.				R	Y	G	X				
Water available at community distribution centers/points			Y	G	X						
Distribution system operational			R	Y	G	X					
Wastewater systems											
Threats to public health & safety controlled.			R	Y		G			X		
Raw sewage contained & routed away from population		R		Y			G		X		
Treatment plants operational to meet regulatory requirements					R			Y	G		X
Major trunk lines and pump stations operational					R		Y	G			X
Collection system operational							R	Y	G	X	
	Event occurs	0-24 hours	1-3 days	3-7 days	1 week-2 weeks	2 weeks-1 month	1 month - 3 month	3 month - 6 month	6 month -1 year	1 year-3 years	3+ years

Water & Wastewater Systems

Findings & Conclusions

- Evaluate the need for seismic design standard of pipelines;
- All sectors develop seismic response plan & business continuity Plan and support employee preparedness;
- Require water systems to complete a seismic risk assessment and mitigation plan as part of the existing requirement for five-year updates to water system master plans ;
- Encourage firefighting agencies and water providers to establish joint standards for use in planning the firefighting response to a large seismic event;
- Require wastewater agencies to complete a seismic risk assessment and mitigation plan as part of periodic updates to facility plans.

Oregon Resilience Task Force

- Led by Prof. Scott Ashford and Dr. Jeff Rubin
- Report submitted to Legislature October 1, 2014
- Narrowed down over 140 recommendations from the ORP to the most important specific recommendations to take action on this upcoming biennium
- Specific Recommendations in 8 areas
 - A. Oversight
 - B. Transportation
 - C. Land Use
 - D. Energy
 - E. Research
 - F. Critical Facilities
 - G. Training and Education
 - H. Water and Wastewater

H. Water and Wastewater Recommendations

- Water providers complete a seismic risk assessment and mitigation plan as part of the existing requirement for periodic updates to water system master plans
- Wastewater agencies complete a seismic risk assessment and mitigation plan as part of periodic updates to facility plans
- Firefighting agencies, water providers, and emergency management agencies to establish joint standards for use in planning firefighting response to a large seismic event.

Cascadia Earthquake and Tsunami Readiness Workshop

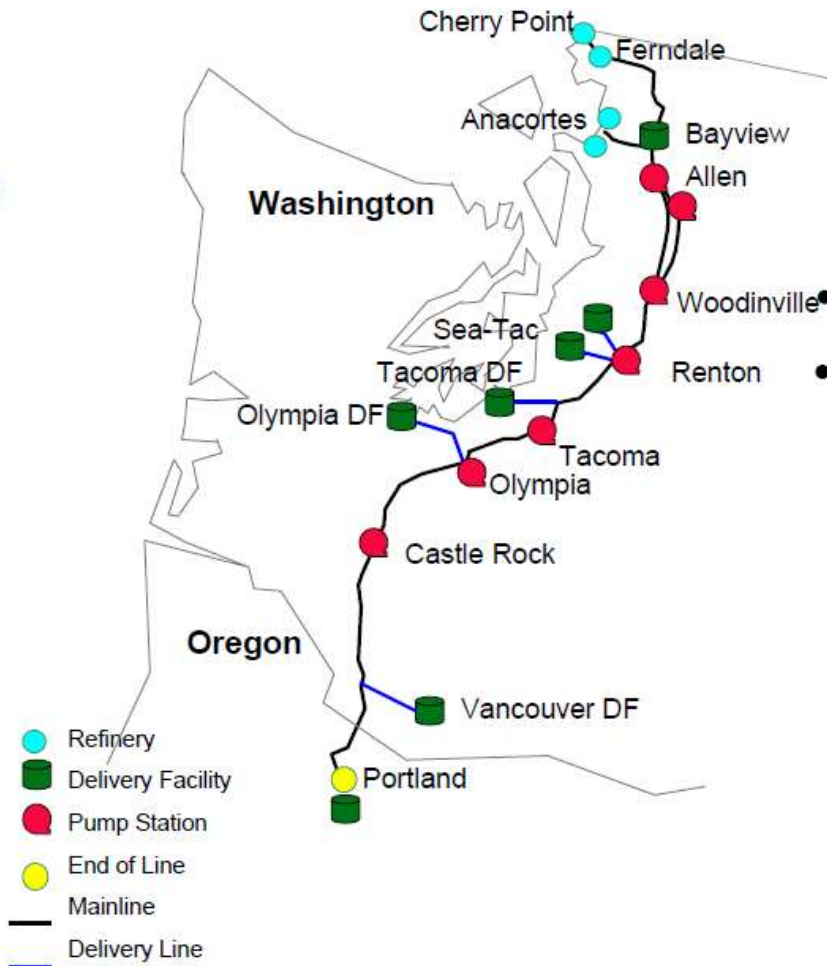
- **Regional workshop (June 2014)**



- SAME Portland Post
- SAME Seattle and Tacoma Posts
- Oregon DOGAMI
- Cascadia Region Earthquake Workgroup
- Centralia College
- FEMA Region X
- Oregon OEM
- Washington Emergency Management Division
- BPA

- Three Breakout Sessions: Ports and Waterways, Critical Energy Infrastructure, Emergency Management

Liquid Fuel Refinery and Distribution



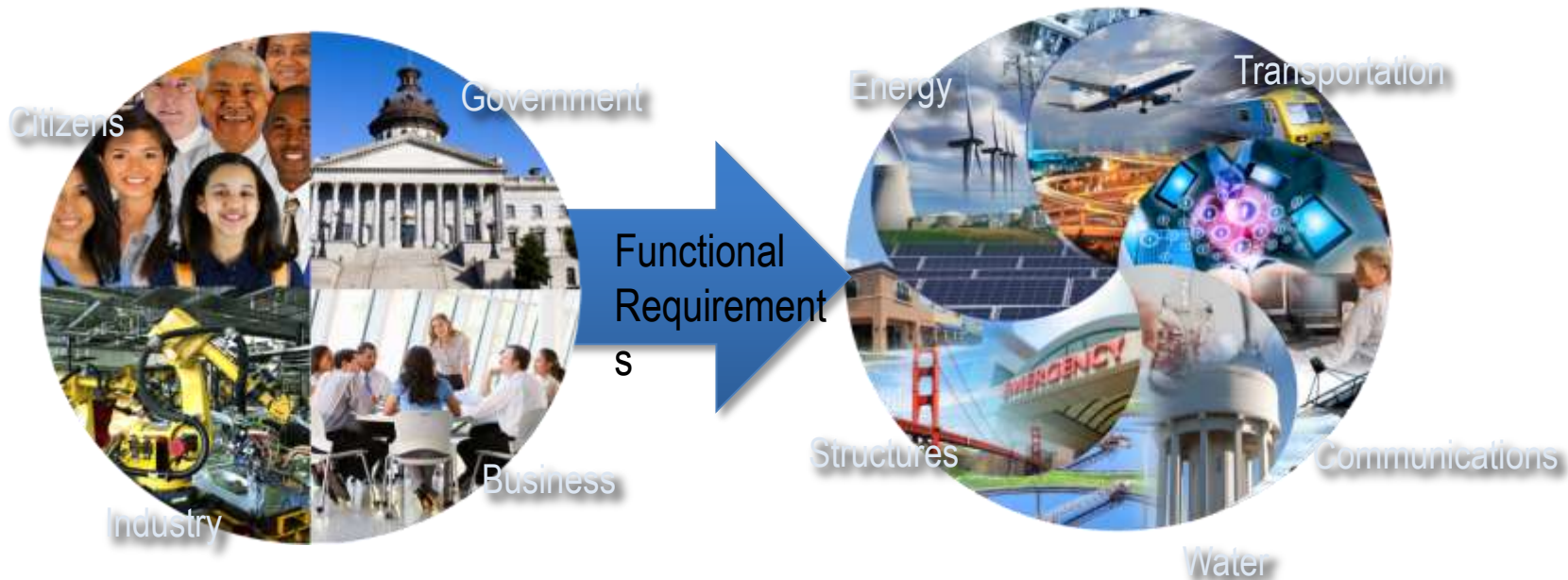
(Source: Yumei Wang, Steven F. Bartlett & Scott Miles, 2012)

Source: <http://www.bppipelines.com/cartoon-maps/olympic.pdf>

Columbia River Ports and Bridges



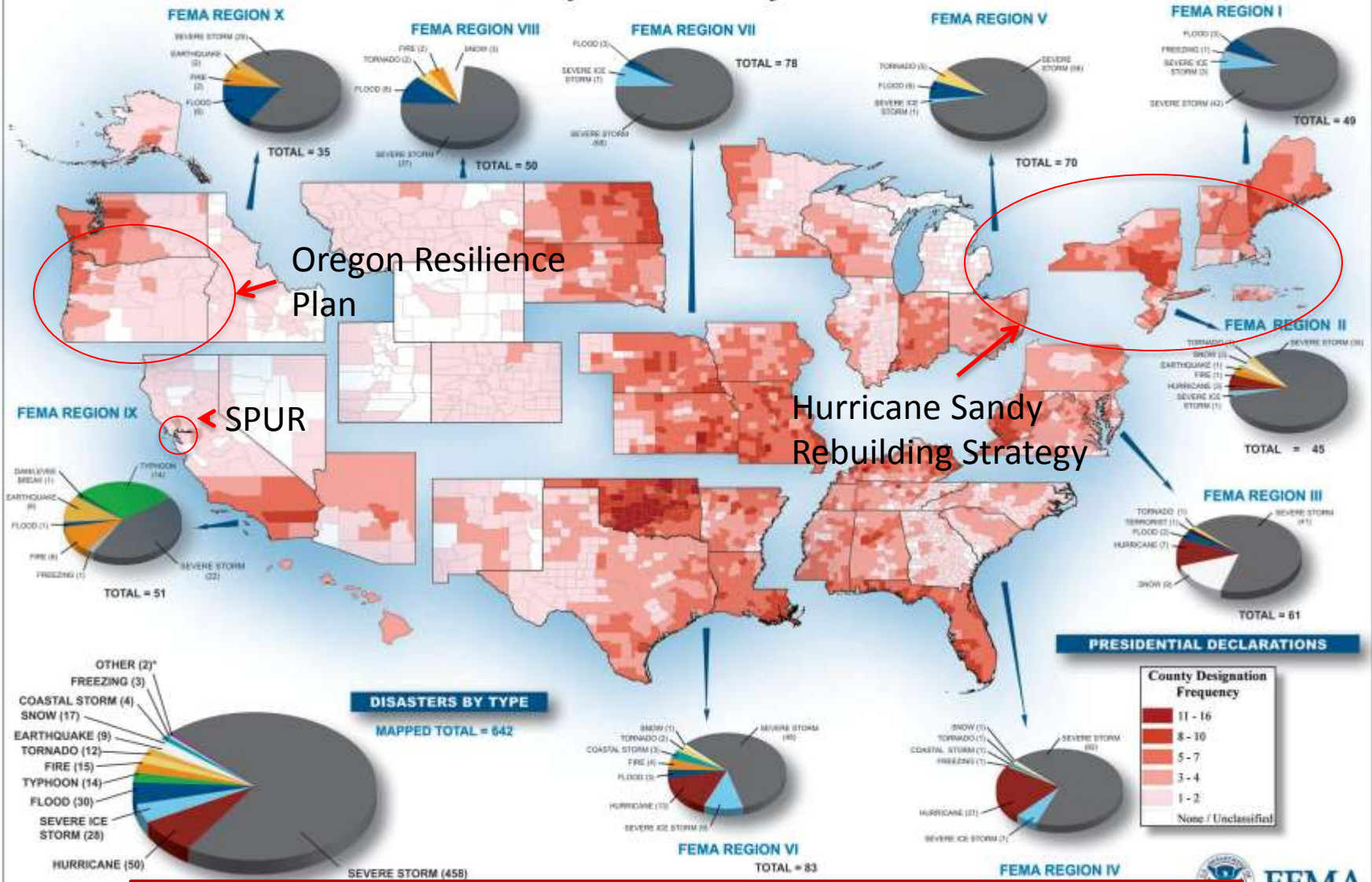
NIST Community Resilience Planning Guide for Buildings and Infrastructure Systems



(Note: 1. CRPG is a two-volume document, and available for public comment. Go to http://www.nist.gov/el/building_materials/resilience/guide.cfm to download
2. Disaster Resilience Standards Panel solicitation will come out in May 2015)

PRESIDENTIAL DISASTER DECLARATIONS

January 10, 2000 to January 28, 2011



Oregon Resilience Plan

SPUR

Hurricane Sandy Rebuilding Strategy

45 to 81 Presidential Disaster Declarations are made every year



Understanding the Social Environment

Framework
focus is here

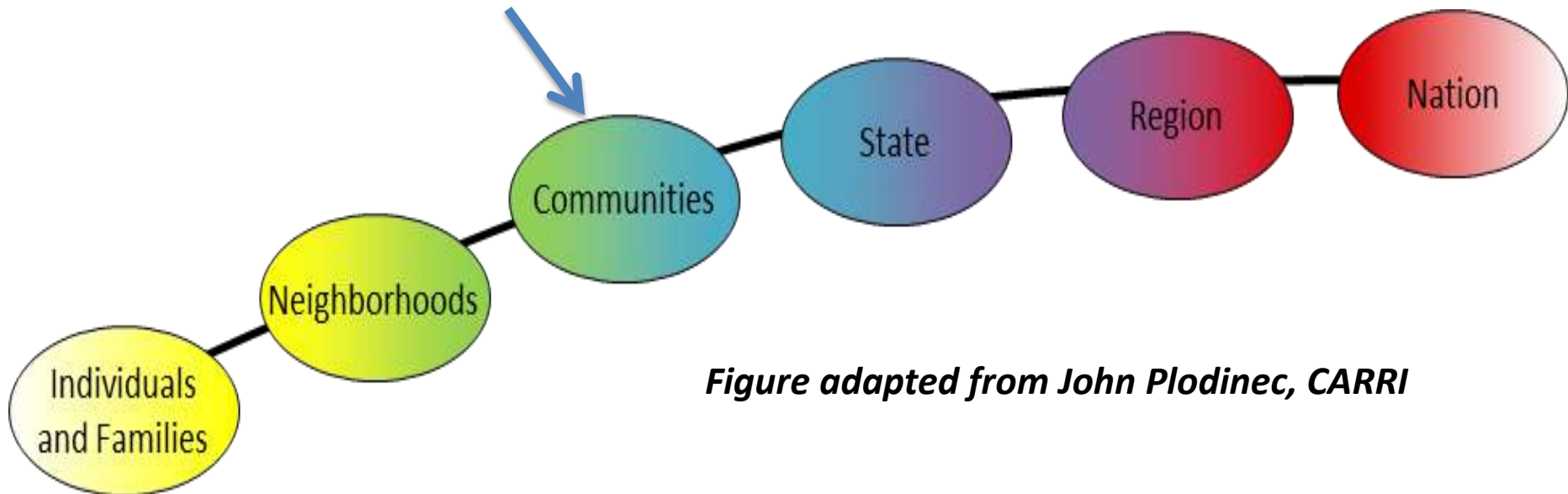


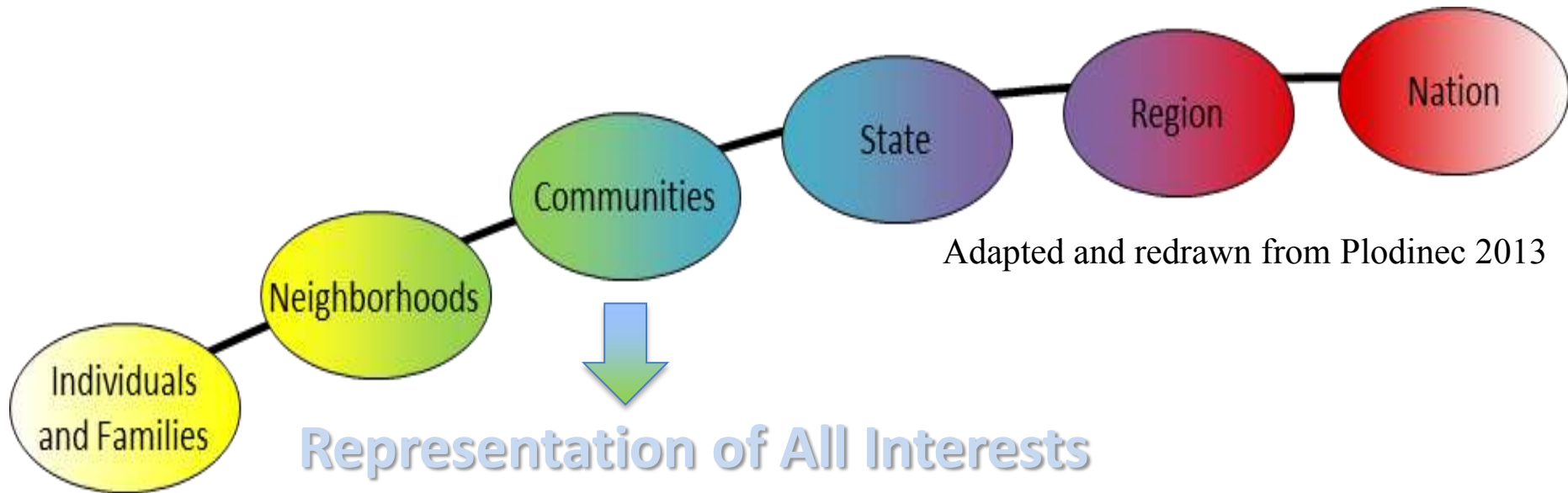
Figure adapted from John Plodinec, CARRI

Six Planning Steps for Community Resilience

1. Form a collaborative planning team
2. Understand the situation
 - Social Dimensions
 - Built Environment
3. Determine goals and objectives
4. Plan development
5. Plan preparation, review, and approval
6. Plan implementation and maintenance



1. Form a Collaborative Planning Team



Public

- Elected Officials
 - Mayor, City Council
- Local Government
 - Planning & Building Dept, Public Works, Education, Human Services
- Community Members

Private

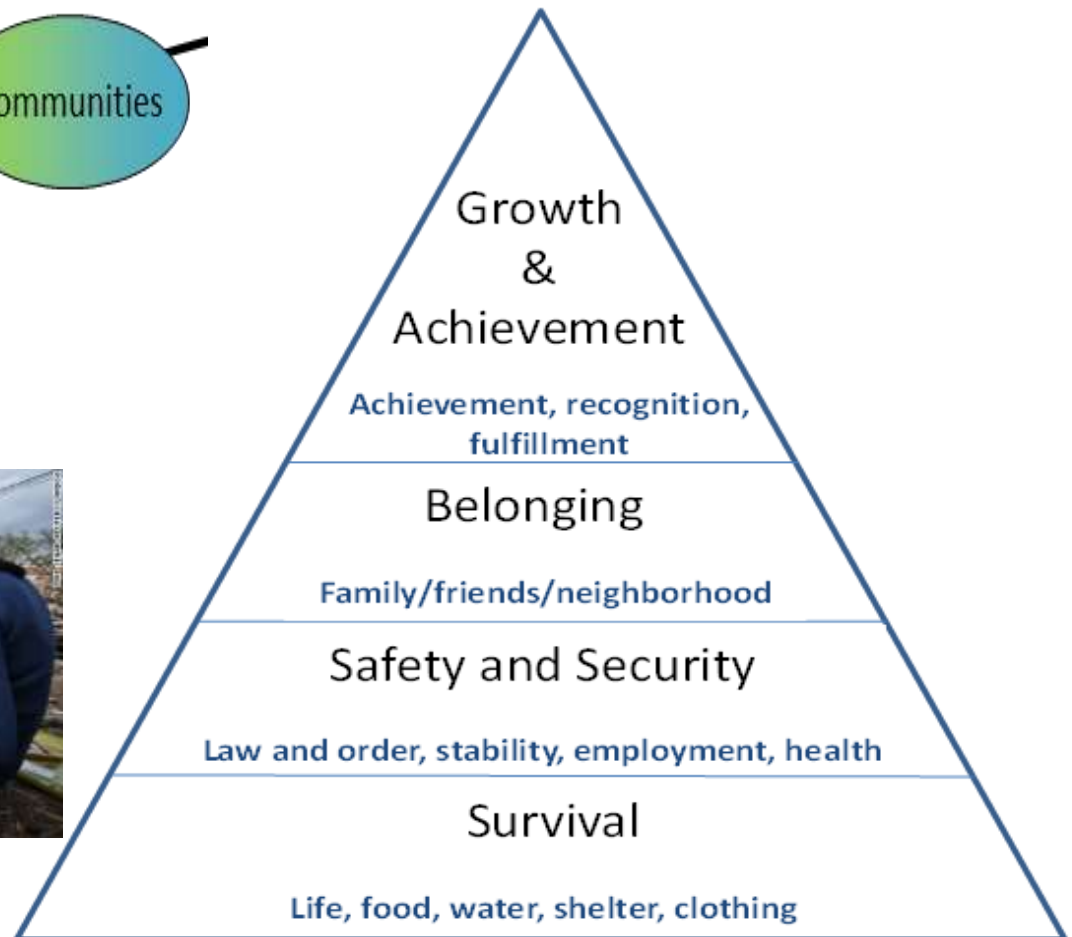
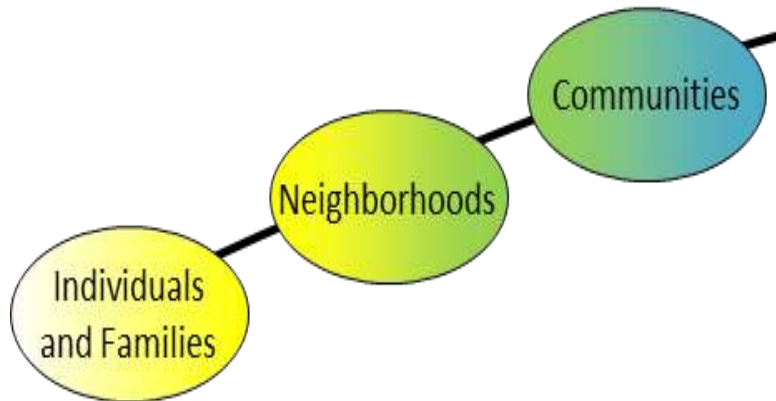
- Business and Services
 - Banking, Utility providers, Health care, Media
- Organizations
 - Non-Governmental, Voluntary Org. Active in Disasters, Community Service

2. Understand the Situation

Social Dimensions

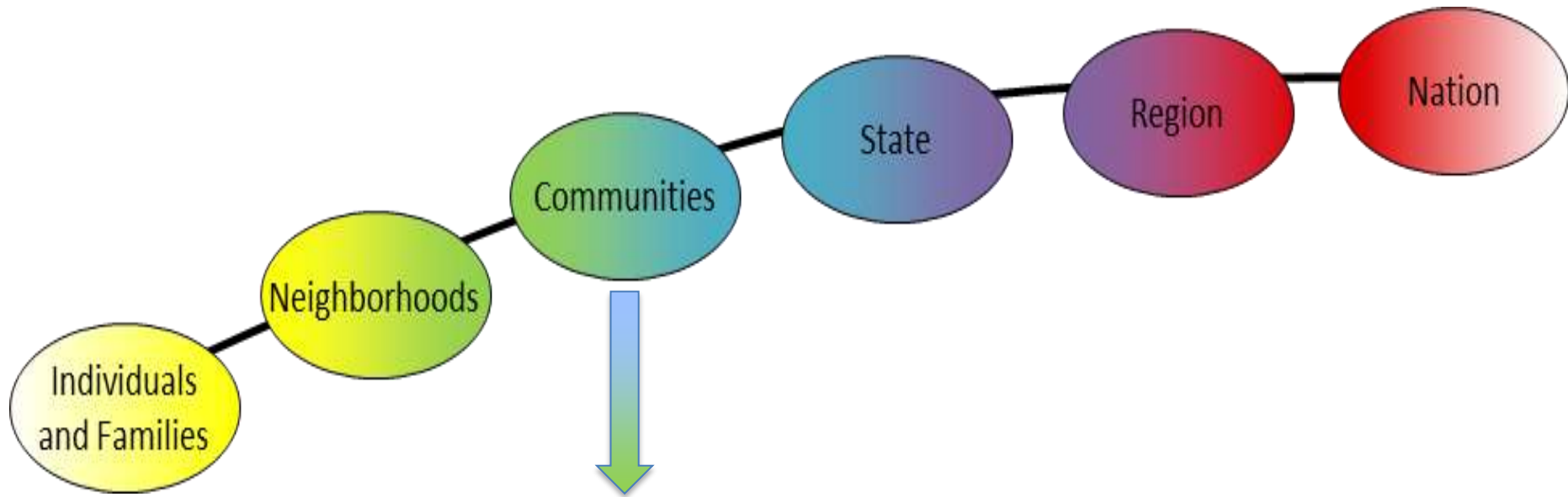
- Identify and Characterize the Social Dimensions
 - Community Members
 - Present and future needs
 - Demographics
 - Economic Indicators
 - Social Vulnerabilities
 - Social Institutions, their functions, any gaps in capacity
 - Social Institution's dependencies

Community Member Needs



Adapted from Maslow 1943

Social Institutions that Meet Needs



Family and Kinship

Government

Education

Religious and others

Economic

Health

Community Service

Media

2. Understand the Situation

Link Social Dimensions and Built Environment



2. Understand the Situation

The Built Environment

Buildings

Individual structures including the equipment and contents that house people and support social institutions



Building Clusters

A set of Buildings that serve a common function such as housing, healthcare, retail, etc.



Infrastructure Systems

Physical networks and structures that support social institutions including transportation, energy, communications, water and waste water systems.



Dependencies

Internal vs External, Time, Space, Source

Characterize

Location, number, construction, demands and use, etc.

2. Understand the Situation

Link Social Dimensions and Built Environment

Some rely more on the built environment



Emergency Rooms



Industrial Plants

- Identify how services are supported
 - Services provided to meet needs
 - Dependency on other services and systems
 - Dependency on built environment
 - Consequences of loss

Some functions change

Schools → Shelters



3. Determine Goals and Objectives

- Establish Long-Term Community Goals
- Establish Desired Performance Goals for the Built Environment
 - Recovery phases
 - Performance levels for buildings
 - Functional levels for building clusters and infrastructure systems
- Community Hazards and Levels
 - Prevailing Hazards
 - Hazard Levels (3)
 - Hazard Impact
- Anticipated Performance of Existing Built Environment
 - Anticipated Recovery of Function
- Summarize the Results

Establish Long Term Community Goals

Long Term goals that improve the community can guide the prioritization and implementation process.

- Improve reliability of infrastructure systems
- Enhance community functions
- Reduce travel time impacts to residents and businesses.
- Revitalize an existing blighted area

Establish Desired Recovery Performance Goals for the Built Environment

- Define in terms of extent of damage and time needed to restore functionality.
- Based on the needs of the social institutions and local economy and their dependencies.
- Should also consider the role of a facility or system outside of the community.
- Suggests criteria for new and retrofit of existing construction.

Recovery of the Built Environment

Organize around restoring functionality over time



When is each cluster and system needed for recovery?

Source: National Disaster Recovery Framework

Functionality Needs For Recovery

- **Short-Term:** Secure, Rescue, Stabilize, Clear Routes
 - Clusters: Critical Facilities, Emergency Housing
Related Infrastructure Systems
- **Intermediate:** Restore Neighborhoods, meet social needs
 - Clusters: Housing, healthcare, main street, schools, Churches
 - Related Infrastructure Systems
- **Long-Term:** Community Social and Economic Recovery
 - Clusters: Commercial and Industrial Businesses
 - Related Infrastructure Systems



Determine and characterize Hazards

- **Prevalent Hazards**

- Wind, Earthquake, Inundation,
- Fire, Snow, Rain,
- Human caused

- **Hazard Level:**

- Routine level that is expected to occur frequently
- Expected level equal to the design level used for buildings
- Extreme level that is the maximum considered possible

- **Hazard Intensity:**

- Area affected defined as “local, community, or regional”
- Disruption Level defined as “minor, moderate, or severe”

Example Summary Resilience Matrix

Example: Expected, Community, Moderate

Functional Category: Cluster	Overall Recovery Time for Hazard and Level Listed								
	Expected Hazard Level								
	Phase 1 - Short-Term			Phase 1 - Short-Term			Phase 1 - Short-Term		
	Days	Days	Days	Wks	Wks	Wks	Mos	Mos	Mos
0	1	1-3	1-4	4-8	8-12	4	4-24	24+	
Critical Facilities									
Buildings	90%							X	
Transportation		90%	X						
Energy		90%	X						
Water			90%		X				
Waste Water				90%				X	
Communication		90%		X					
Emergency Housing									
Buildings				90%					X
Transportation			90%	X					
Energy			90%	X					
Water			90%		X				
Waste Water				90%				X	
Communication				90%	X				
Housing/Neighborhoods									
Buildings						90%			X
Transportation			90%	X					
Energy			90%	X					
Water				90%				X	
Waste Water					90%			X	
Communication				90%			X		
Community Recovery									
Buildings								90%	X
Transportation				90%	X				
Energy			90%	X					
Water				90%				X	
Waste Water							90%	X	
Communication				90%			X		



Sandy

4. Plan Development

- Evaluate Gaps between Desired and Anticipated Performance
- Identify Solutions to Address Gaps
 - Administrative Solutions
 - Construction Solutions (New Construction, Existing Construction)
- Prioritize Solutions and Develop Implementation Plan

Future Directions

Disaster Resilience Standards Panel

(DRSP)

- Independent organization
- Engage all stakeholders for community resilience issues
- Activities
 - Support of continued development and implementation of Guide
 - Support development of Implementation Guidelines
 - Identify and promote need for improved codes and standards, best practices, and tools
- Applications for membership will be available online in May 2015
- First Meeting: Aug 12-13, 2015, in DC area



Infrastructure Resilience Division

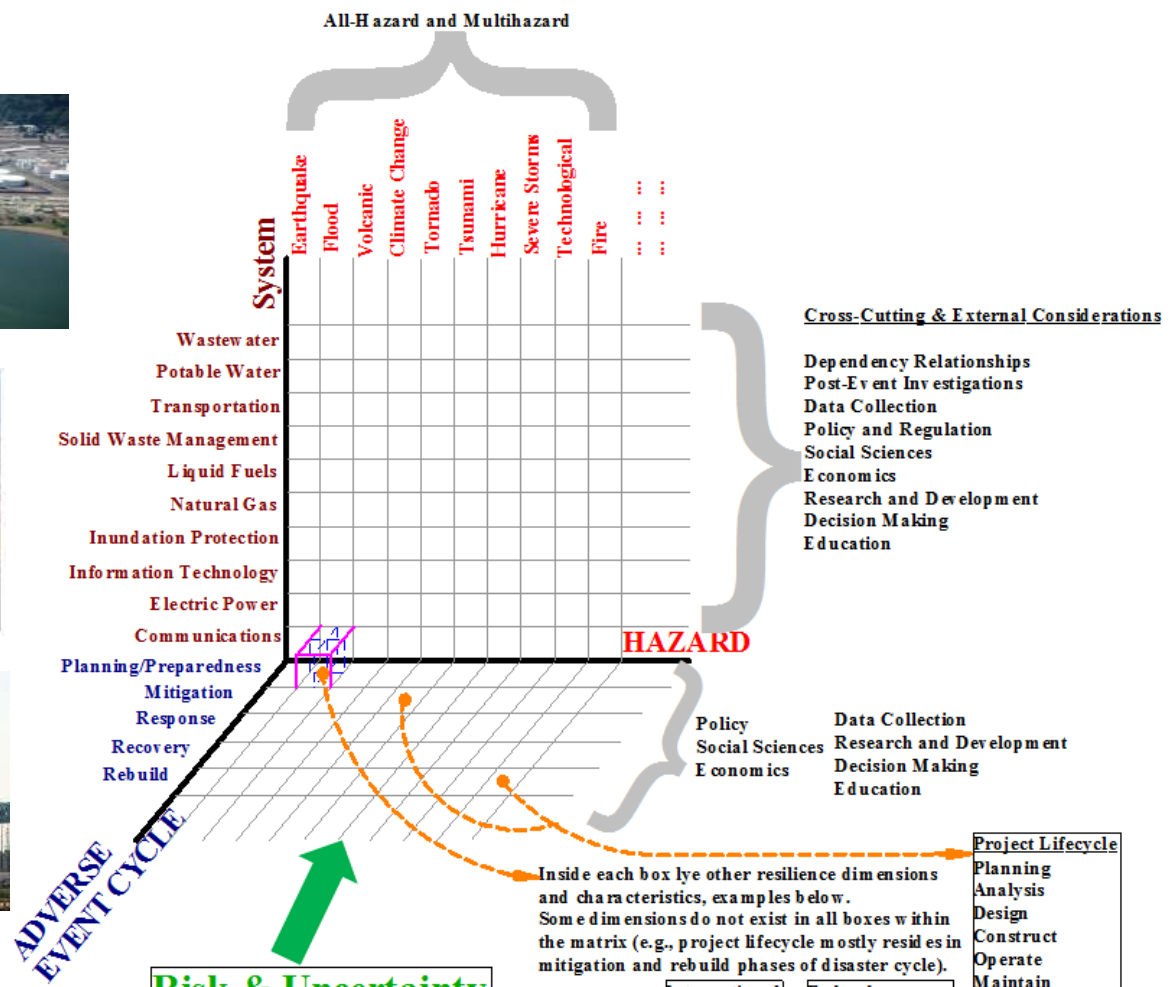


ASCE Infrastructure Resilience Division

- Merged TCLEE, CCI, and CDRM in October 2014
- **MISSION:** Serve the civil engineering profession in advancing civil infrastructure and lifeline systems for local, regional, and national resilience against all hazards. All hazards and resilience are defined in ASCE Policy Statement 518
- Executive Committee, Administrative Committee, and Five Technical Committees



Infrastructure Resilience Model



Each box has a geographic location of impact/use

ASCE IRD Technical Committees

- Civil Infrastructure and Lifeline Systems Committee
- Risk and Resilience Measurements Committee
- Disaster Response and Recovery Committee
- Social Science, Policy, Economics, Education, and Decision (SPEED) for Community Resilience Committee
- Emerging Technologies Committee

Check <http://www.asce.org/infrastructure-resilience/infrastructure-resilience-division/>

Final Remarks

- Start from Social Needs (to define performance goal)
- Consider Dependencies (no more silo approach!)
- Oregon-Washington Regional Resilience Plan
- Participate in NIST Community Disaster Resilience Program – Disaster Resilience Standards Panel
- Start to use NIST Community Resilience Planning Guides for Buildings and Infrastructure Systems
- Join ASCE Infrastructure Resilience Division

