



36TH INTERNATIONAL CONFERENCE ON COASTAL ENGINEERING 2018

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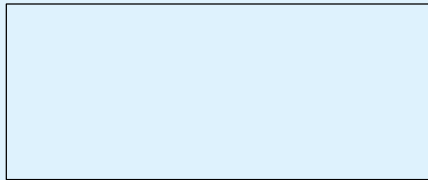
The State of the Art and Science of Coastal Engineering

Resilient Communities: A Vulnerability Assessment is Only Step One



Lesley Ewing, Ph.D., PE, M.ASCE

California Coastal Commission



Phyllis Grifman, Assistant Director

University of Southern California Sea Grant Program

Billy Edge, Ph.D., PE, F. ASCE

Professor Emeritus



Importance of Coastal Lands



California's Ocean Economy. 2012

Generated \$44.8 billion for the state economy (2.1% of State's GDP)

--- \$17.6 billion came from tourism & recreation

Generated over \$19 billion in wages & salaries

Provided 489,392 jobs

--- 367,952 jobs in tourism & recreation

Left: Santa Monica Beach, LA County
(courtesy of USC Sea Grant)
Right; Huntington Beach, Orange
County



Importance of Coastal Lands



Coast Also Poses Risks



1998 El Nino Waves – San Diego



Bolivar Island, TX After Hurricane Ike



1 March 2010: Deadly storms from La Rochelle to L'Aiguillon sur Mer Source: Associated Press



Tula After the 28 September 2009 Samoan Tsunami



Lessons from Coastal Disasters



Flood Wall scour, Kojirahama,
Japan May 2011



Foundation Scour, Sea
Bright, TX Oct 2008



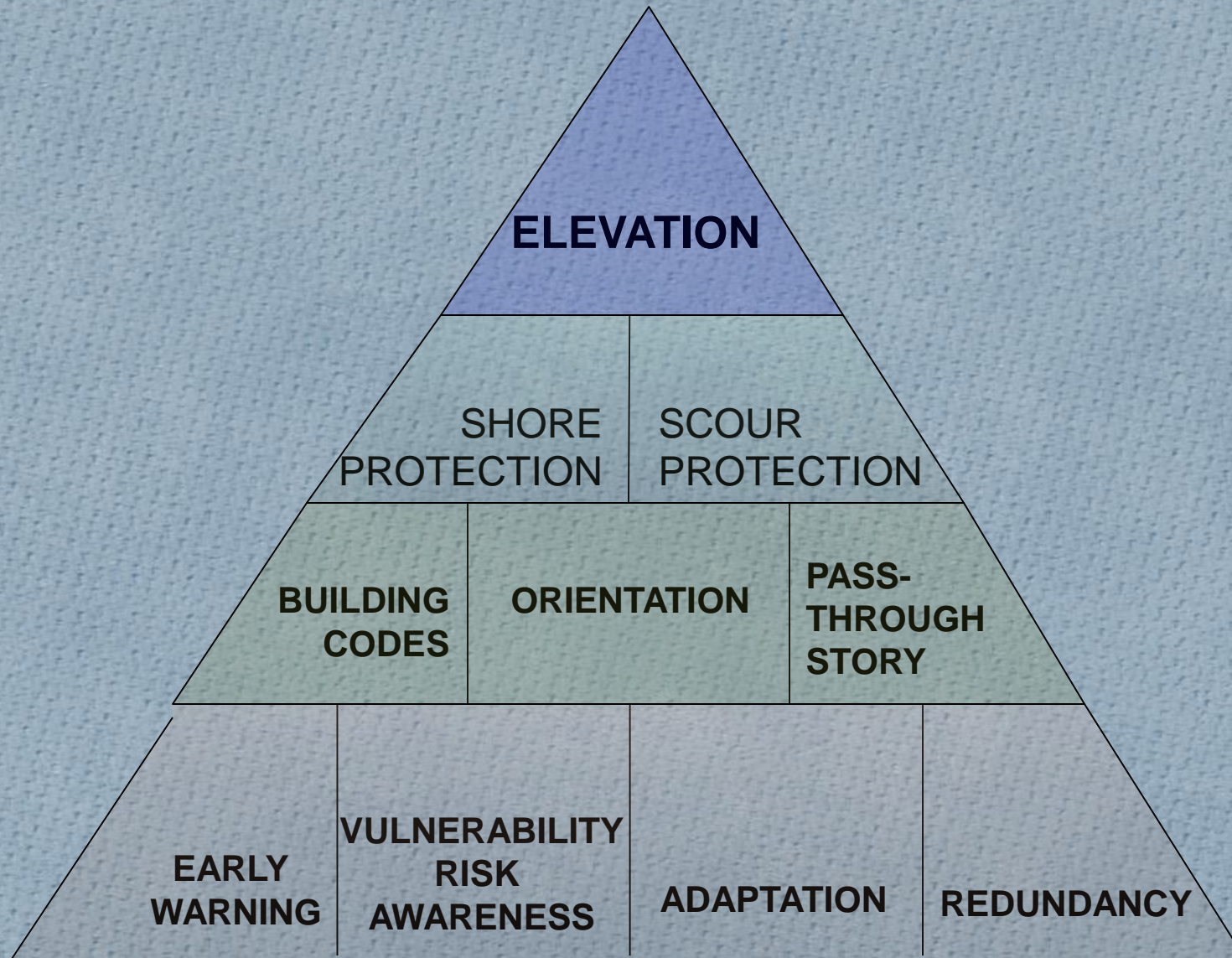
Geotube Scour, Galveston, TX Oct 2008



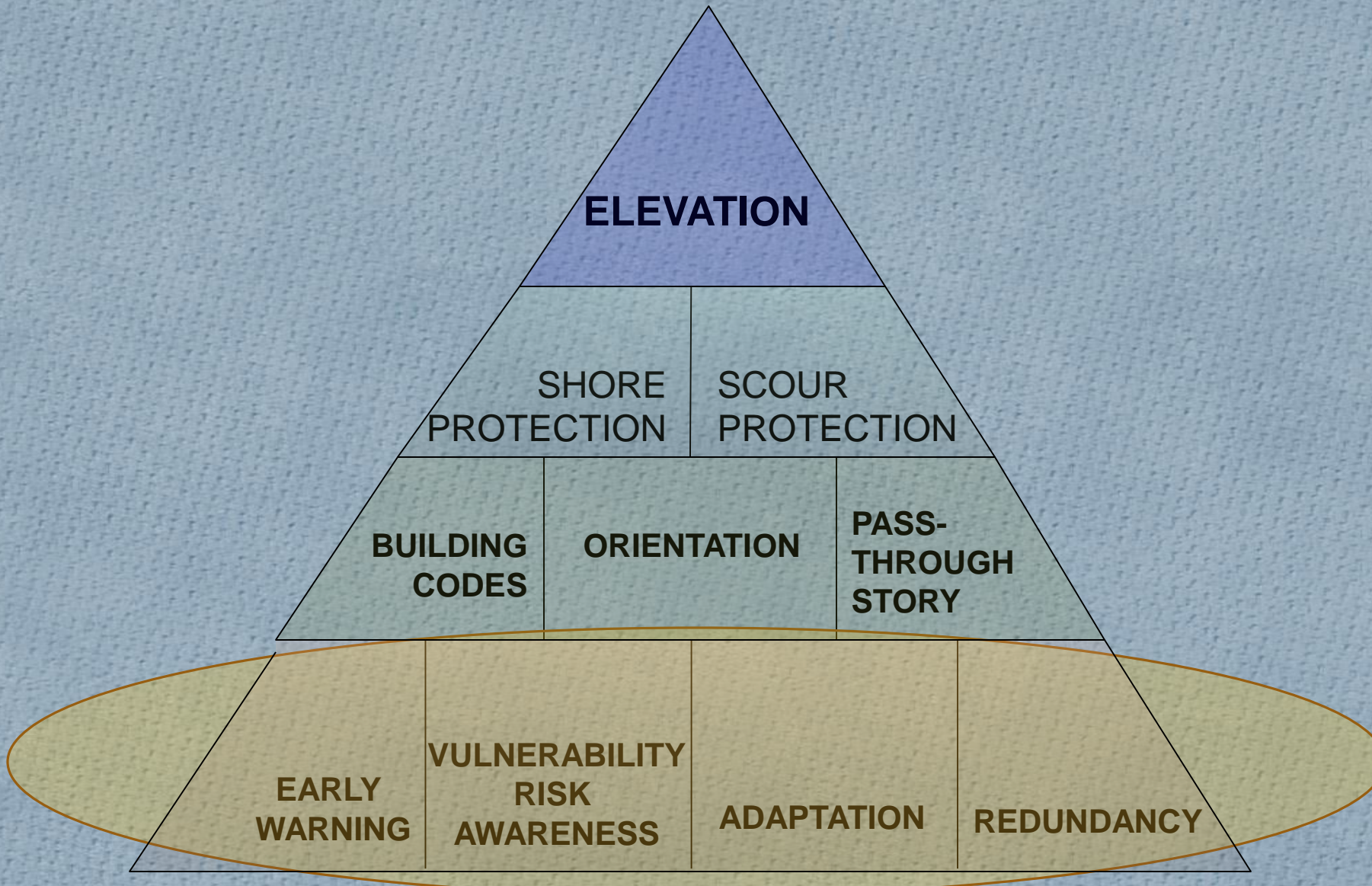
Wave Impacts, Poloa,
American Samoa Oct 2009



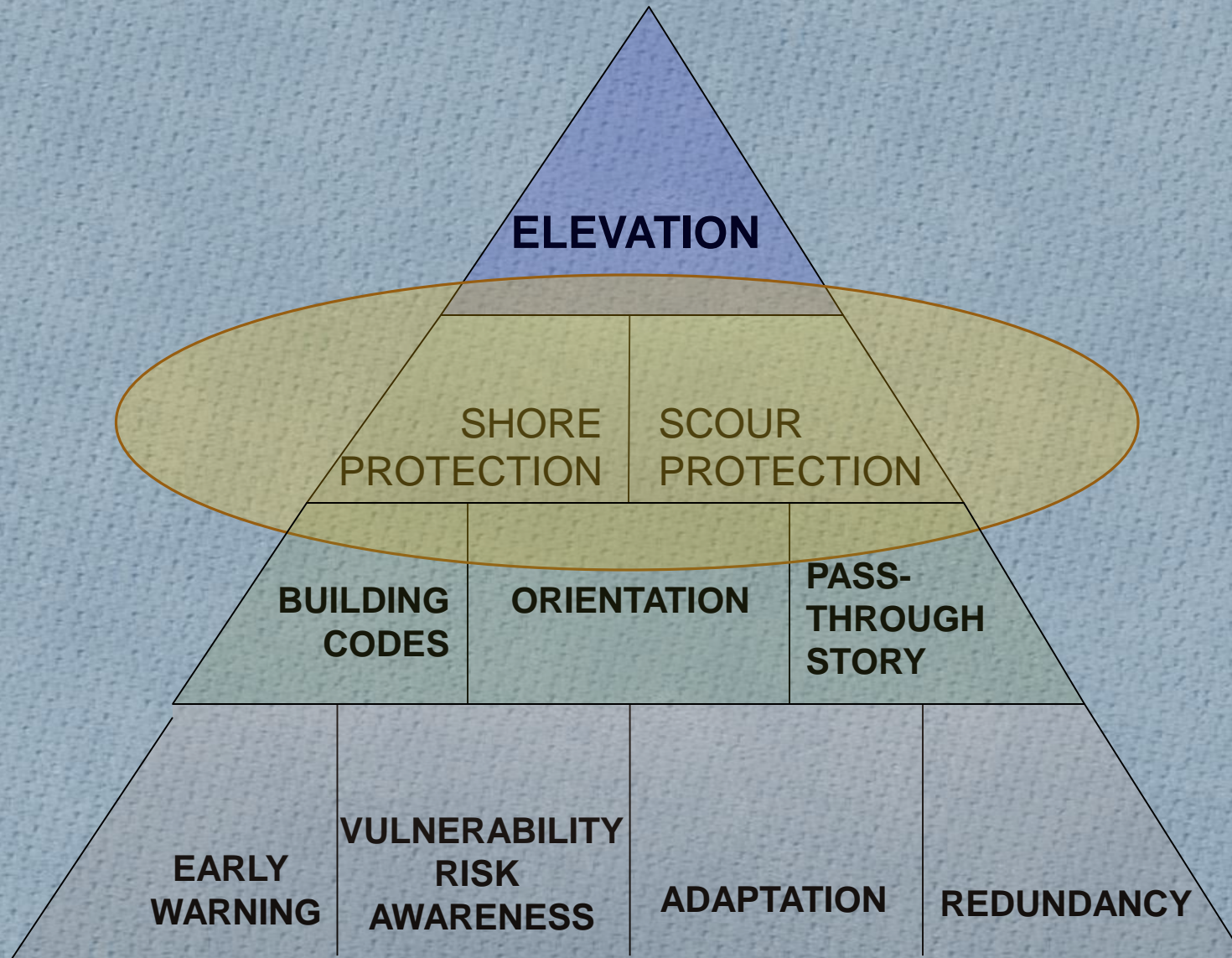
Resilience Pyramid – Community Options



Resilience Pyramid – Community Options



Resilience Pyramid – Community Options



CCHPR Index

	Direct Benefit from protection	Secondary Benefit to what is protected
Economic Value	Improve Navigation Tourism Tax base Revenues Fisheries	Commercial & Fishing Harbors Tourist Facilities Roads and Rail Corridors Electricity, Communications, Utilities Business Continuity Jobs
Environmental Value	Ecosystem habitat Air Quality Water Quality	Upland Habitat or fresh water lake Chemical & Industrial Plants Wastewater Treatment Plants
Social/Cultural Value	Coastal Access/Open Space Recreation Quality of life	Recreational Boating and Fishing Houses Heritage Sites Parks Trails and Access Schools Hospitals



CCHPR Index

Protective Element		Economic Value		Environmental Value		Social/Cultural Value	
Type	Shore Length	Direct		Direct		Direct	
Beaches		2.6		2.0		3.0	
Sand Back-pass		0.3		-1.0		2.0	
Beach Berm		1.0		-1.0		2.0	
Groin		1.0		-1.0		0.0	
Jetty		3.0		-0.8		1.5	
Perched Beach		0.0		0.5		1.3	
Breakwater		3.0		2.0		2.0	
Floating Breakwater		1.5		-1.5		0.0	
Enhanced Delta		1.0		0.8		0.0	
Headlands		1.0		0.8		0.0	
Dewatering		0.8		-0.1		0.0	
Wetlands		1.0		3.0		1.0	
Dunes		1.8		2.0		3.0	
Reefs		1.0		3.0		2.0	
Habitat Buffers		-2.0		2.0		2.0	
Living Shores		1.0		2.0		2.0	
Levee		0.3		-1.1		0.0	
Horizontal Levee		0.3		1.4		0.0	
Revetment		0.3		-1.3		-1.9	
Dynamic Revetment		0.0		-0.5		-1.1	
Seawalls		0.3		-0.8		-1.1	
Sand Bags		-0.3		-1.4		-1.9	
Surge Barrier		0.3		0.0		0.0	
Building Protection		1.5		0.3		0.6	
Land Acquisition		-2.0		2.5		1.6	
Insurance		0.0		-0.3		0.5	
Warning System		0.6		0.3		0.3	



CCHPR Index – San Francisco

CCHPR Index Normalized Values for Ocean Beach, SF, CA

	Economic Values	Environmental Values	Social/ Cultural Values
Direct Value	3.6	2.2	3.3
Secondary Value	2.7	3.6	0.2



CCHPR Index – Hermosa Beach

CCHPR Index Normalized Values for Hermosa Beach, CA			
	Economic Values	Environmental Values	Social/ Cultural Values
Direct Value	2.9	1.1	2.0
Secondary Value	4	-1.1	3.6

Hermosa Study courtesy of Patrick Cousineau, Juliette Hart and Phyllis Grifman, University of Southern California, USC Sea Grant



CCHPR Index Comparison

CCHPR Index Normalized Values for Ocean Beach, SF, CA

	Economic Values	Environmental Values	Social/ Cultural Values
Direct Value	3.6	2.2	3.3
Secondary Value	2.7	3.6	0.2

CCHPR Index Normalized Values for Hermosa Beach, CA

	Economic Values	Environmental Values	Social/ Cultural Values
Direct Value	2.9	1.1	2.0
Secondary Value	4	-1.1	3.6



Where we are now



Metrics for Resilience and Coastal Protection

Protection Characteristics

- Technical details

- Initial costs and costs and frequency of maintenance

- Failure Modes

Protection Values

- Economic (resources, tax base, revenues)

- Environmental (air, water quality, ecosystems)

- Social/Community (recreation, quality of life)



Evaluation Metrics

Protection Characteristics

Technical details

- Protection from waves & storms

- Protection from flooding

- Protection from erosion

Initial costs

Costs & frequency of maintenance

Failure modes



Noda, Japan May 2011
Connections for a Tsunami Wall



Evaluation Metrics

Protection Characteristics

Technical details – Check performance for an array of actual conditions

- Protection from waves & storms

- Protection from flooding

- Protection from erosion

Initial costs – Compare to Actual Costs

Costs & frequency of maintenance – What are the long-term costs for the protection

Failure modes – What are the consequences if it does not perform as expected

MONITOR – DOES PROTECTION DO WHAT WAS INTENDED



Monitoring All Aspects of the Protection

Protection Values

Economic (resources, tax base, revenues)

Has the structure increased revenue or improved taxes over time?

Environmental (air, water quality, ecosystems)

Are there quantifiable benefits to water quality?

Has there been enhanced ecosystem value, compared to a pre-project level or a control?

Do benefits continue, improve or diminish with time?

Social/Community (recreation, quality of life)

Do people use the area? How many?

Does the Community use the area frequently?

Is it a safe area for families or tourists?



Thank you for your attention

- Thought for the Day -

Two of the greatest
assets to have in life are
patience and wisdom.

