

THE ECONOMIC IMPACTS OF SEA LEVEL RISE ON SOUTHERN CALIFORNIA BEACHES

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California Beaches Are Valuable

- 15 million people go to CA beaches annually *(NSRE 2000)*.
- Revenues
 - Out-of state visitors spend \$61 billion *(DBW, 2002)*.
 - Local residents \$4 billion *(Pendleton and Kildow, 2005)*.
- Non-market value
 - \$2billion + *(Pendleton and Kildow, 2005)*



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Climate change = Beach change

- **Increasing sea levels**
 - Inundation of beaches
 - Erosion of beaches
 - Change in wave climate
 - Change in erosion patterns
- **Effects of beach width change**
 - Visitation patterns
 - Expenditures
 - Non-market value



Linking 3 Models

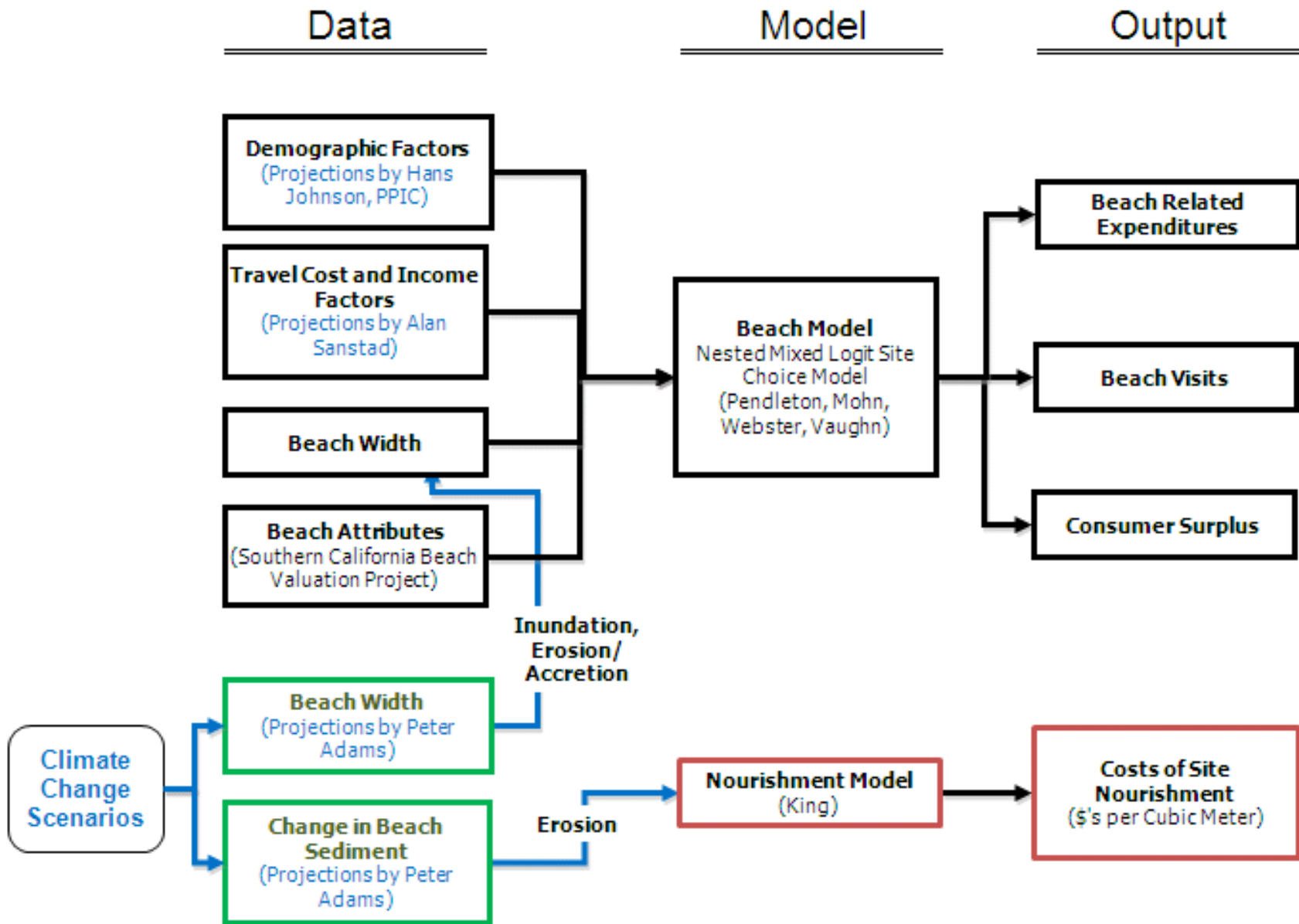
Beach Choice Model

Beach Sediment
Model

Beach Nourishment
Model

→ Visits
Expenditures
Consumer Surplus
Net Costs/Benefits of Nourishment

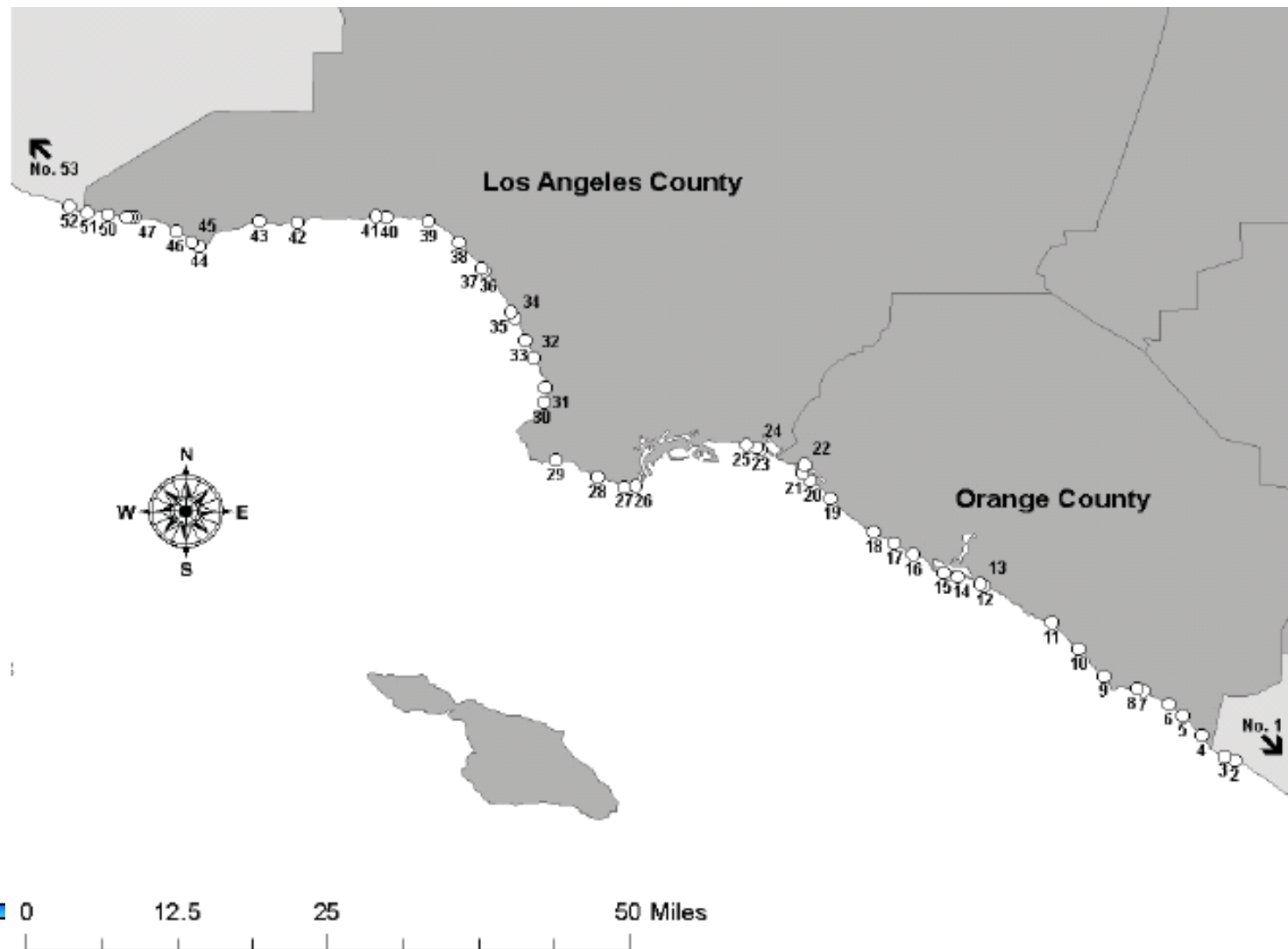




Beach Visitation Model



Study Area: LA and OC Public Beaches



Basic Inundation Scenarios

Beach sedimentation
over 100 years

1. Current sea level
(counterfactual)

2. +1 meter sea level
rise (climate change)

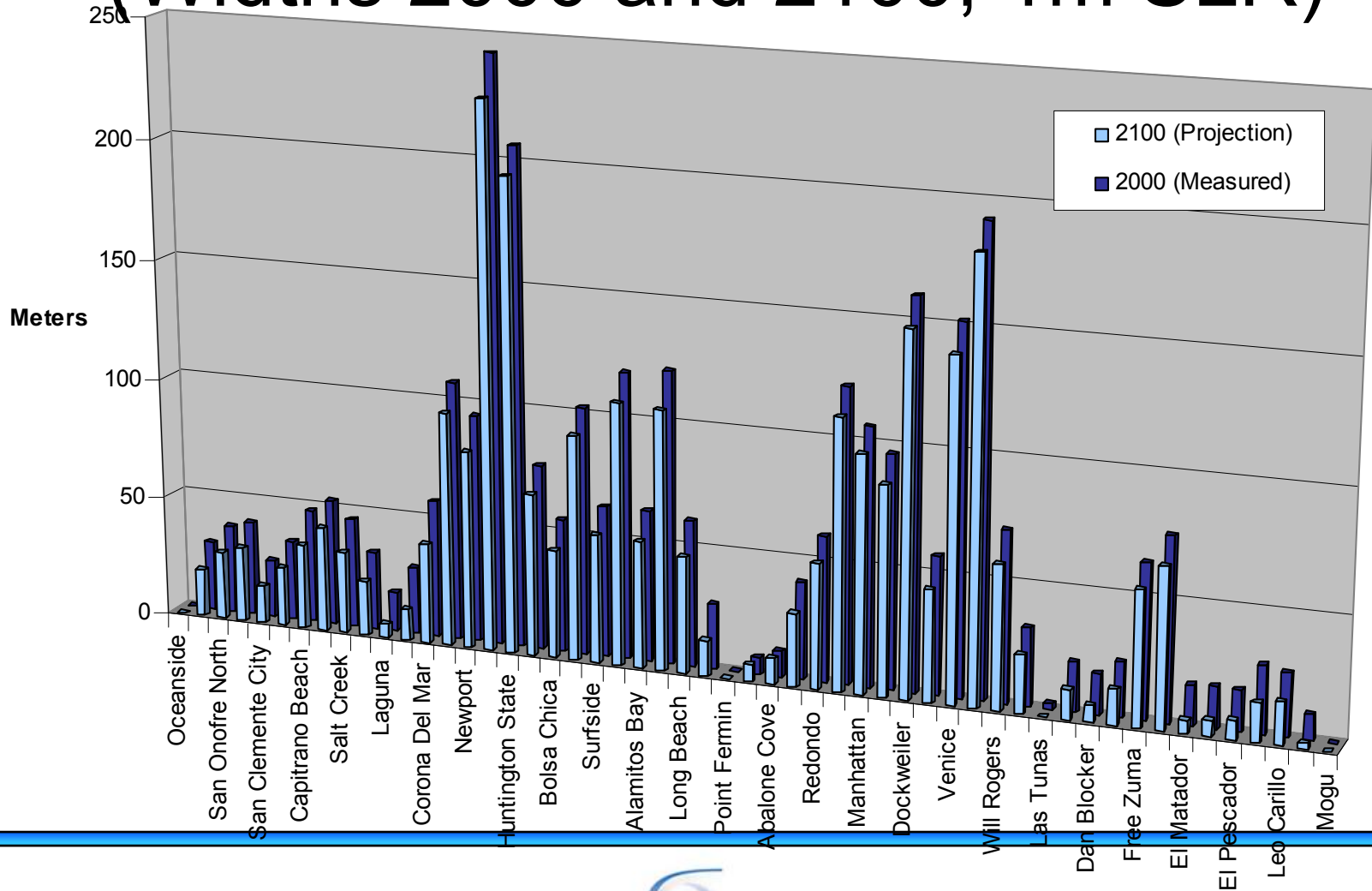
Demographic factors:
population, race, age
- Hans Johnson (medium)

Income and travel costs
- Current
- low (conservative)
expectations
- high expectations



Beaches Shrink

(Widths 2000 and 2100, 1m SLR)



Beaches (South to North)

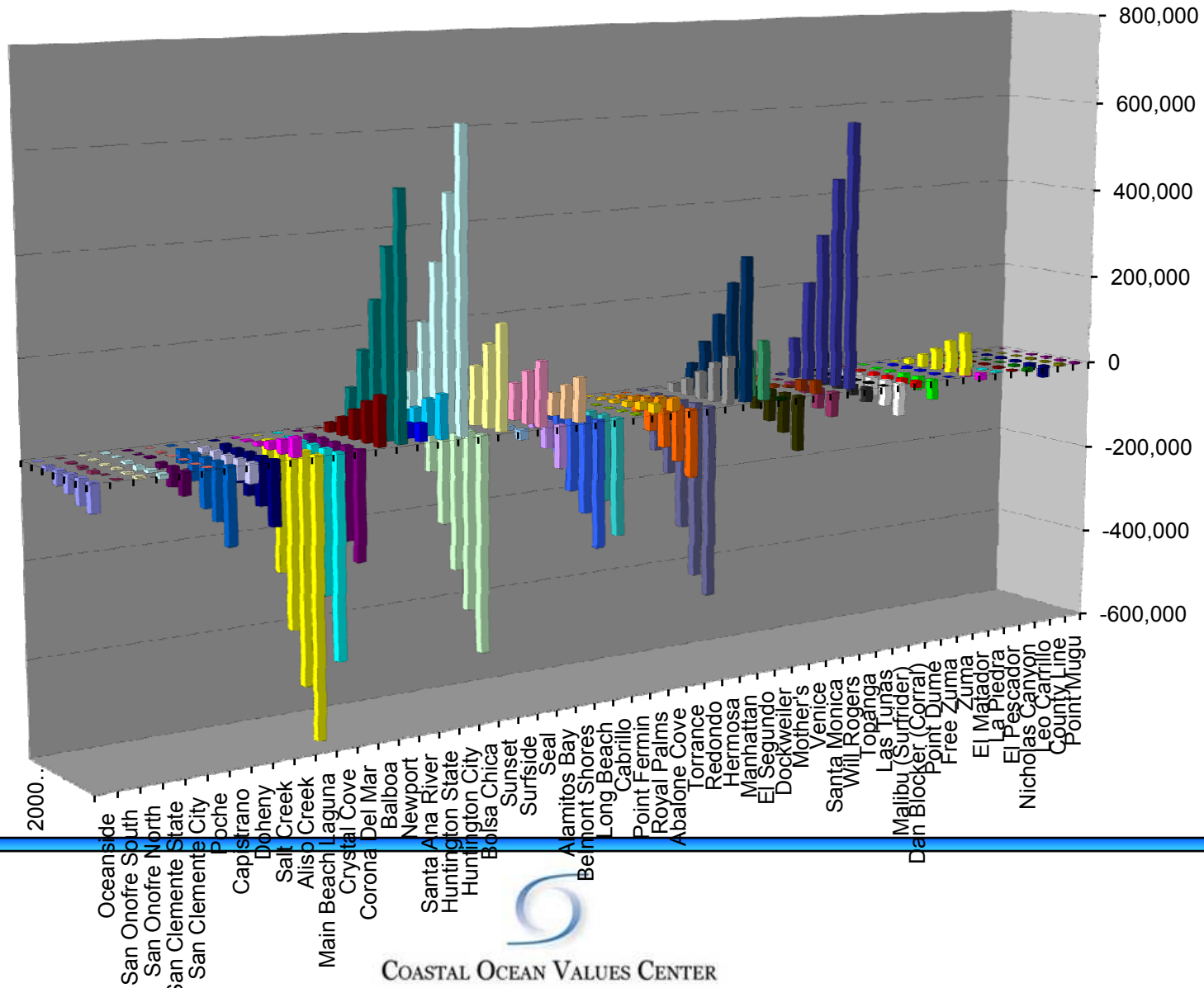
Uneven Loss of Beach

Inundation (1m SLR)

- Mean beach width Δ = -10 meters
 - Smallest change = -6 m, County Line
 - Largest change = -16 m, Santa Anna River
- Percentage change in beach width
 - Average Δ = - 26%
 - Minimum Δ = - 5%, Huntington State
 - Maximum Δ = - 100% Las Tunas



Uneven Difference In Trips (Current Pop)



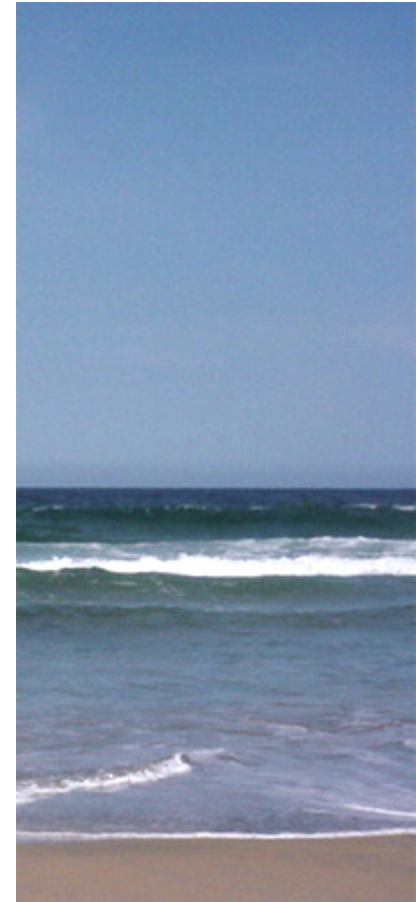
There are Winners and Losers

| Winners | Change in Expenditure (2100; 2000US\$) | Losers | Change in Expenditure (2100; 2000US\$) |
|-----------------|---|--------------|---|
| Huntington City | 16,000,000 | Laguna | -14,600,000 |
| Will Rogers | 15,000,000 | Bolsa Chica | -12,000,000 |
| Newport | 13,000,000 | Crystal Cove | -11,000,000 |
| Manhattan | 8,000,000 | Redondo | -10,000,000 |
| Sunset | 5,600,000 | Long Beach | -7,000,000 |

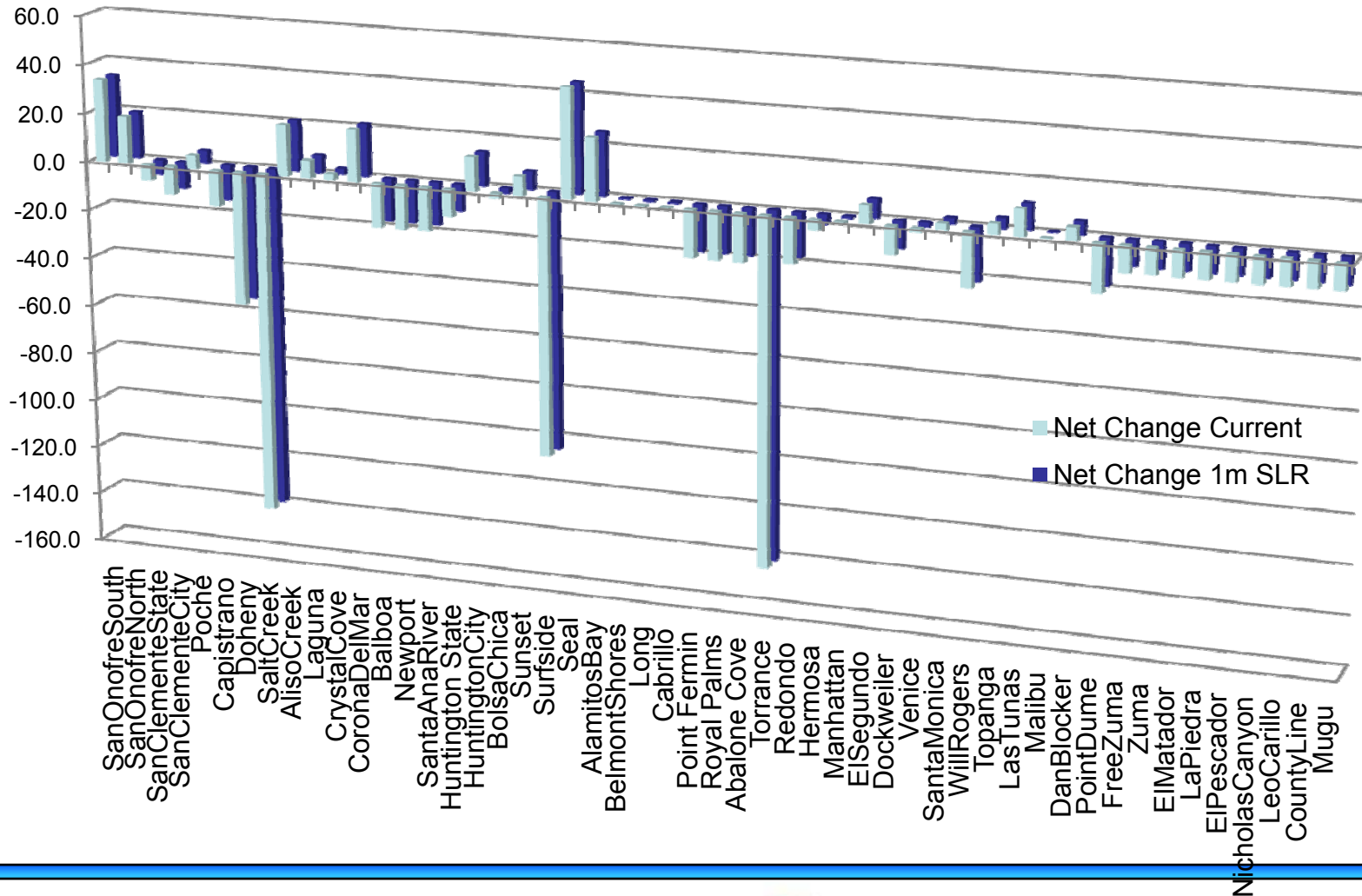


+ Net Benefits of Mitigation

- Lost Consumer Surplus by
2100 = \$63 million/yr
- Lost Expenditures by
2100 = \$12 million/yr
- Cost of nourishment =
\$4 million/year



Extreme Erosion Has Uneven Effects on Beaches (preliminary)



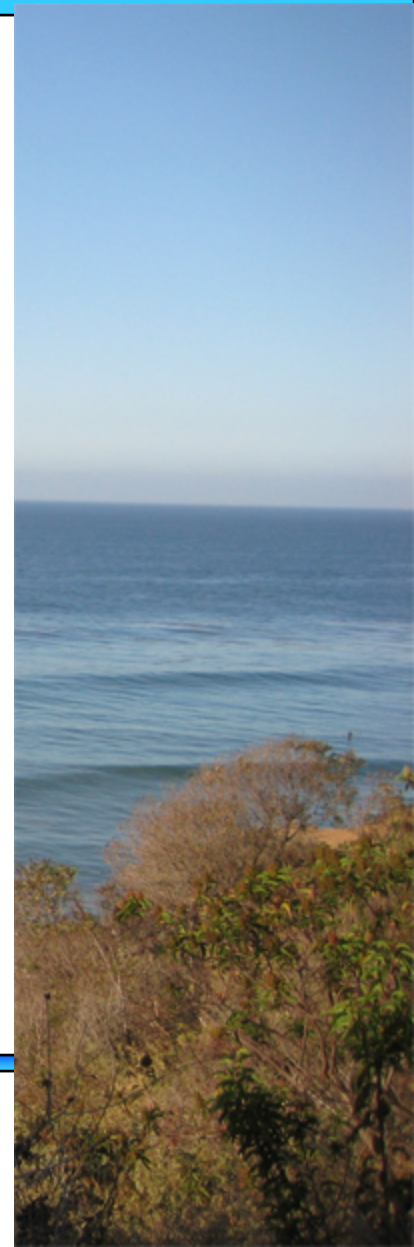
Extreme Events (preliminary)

- 1) Re-nourishment costs: current sea level
= \$317 million (undiscounted)
- 2) Re-nourishment cost **+1 m sea level rise**
= \$715 million (undiscounted)
- 3) Overall Consumer Surplus Difference
= \$37 million
- 4) Lost expenditures – top 5 beaches lose
>\$120million (winners gain \$112 million)



Conclusion

- Slow rise in sea level a problem
- Storms and wave-generated erosion accretion much more important
 - Impacts additional to inundation
 - Economic impacts of extreme event > inundation
- Need to understand uneven impacts across region.





Extreme Erosion Events (current vs. +1 m SLR)

- Width Change
 - Mean Δ = -1.1 meters
 - Minimum Δ = -37.5 m, Salt Creek
 - Maximum Δ = +4.0 m, Surfside
- Volume Change
 - Mean Δ = -30,000 m³
 - Minimum Δ = -788,000 m³, Salt Creek
 - Maximum Δ = 131,000 m³, Crystal Cove

