



IMPACT OF EXTREME WEATHER EVENTS ON LOCAL COMMUNITIES AND POSSIBLE RESPONSE FROM THE LOCAL LEVEL

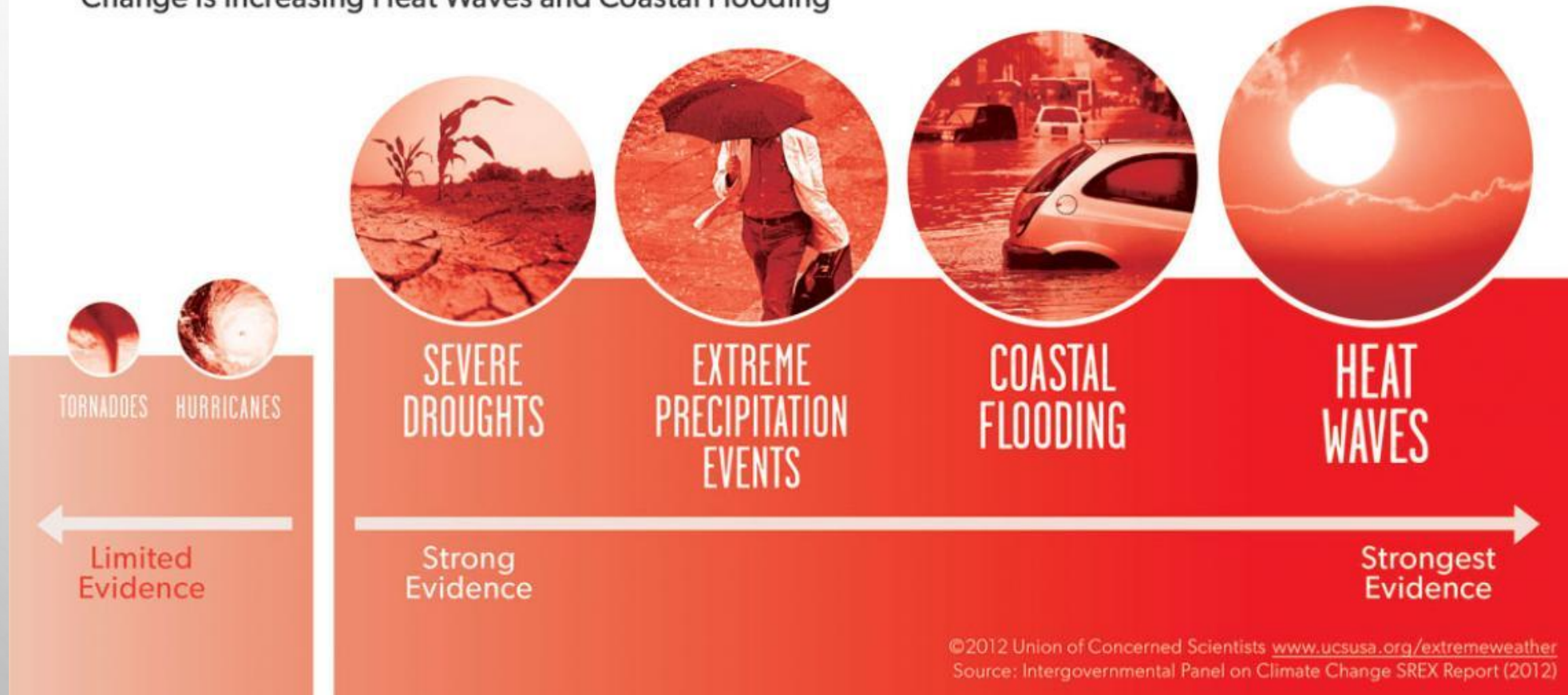
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SCIENCE
CONNECTIONS →

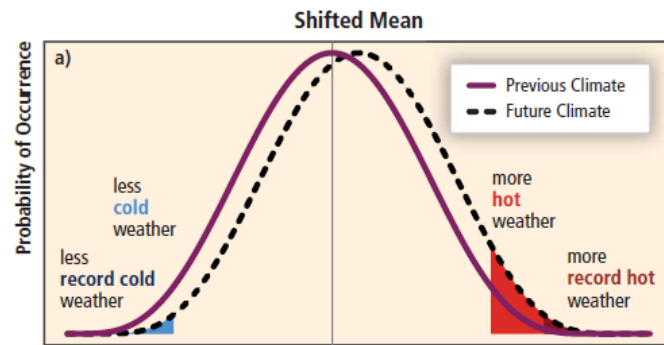
EXTREME WEATHER & CLIMATE CHANGE

→ Strongest Scientific Evidence Shows Human-Caused Climate Change Is Increasing Heat Waves and Coastal Flooding

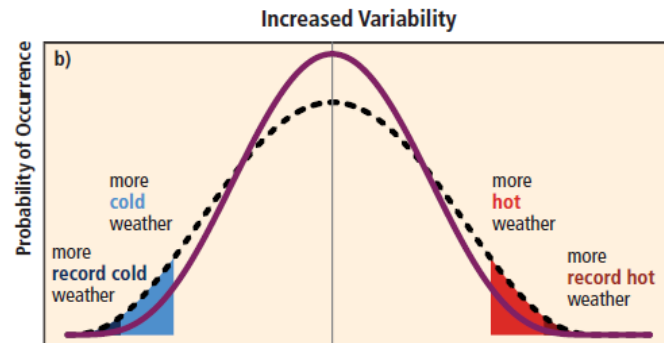


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Source: Intergovernmental Panel on Climate Change SREX Report (2012)

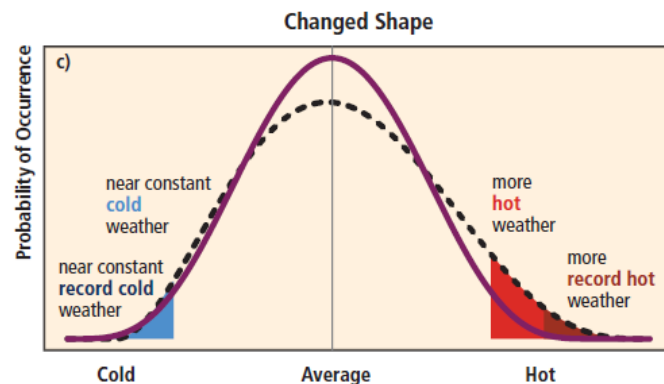




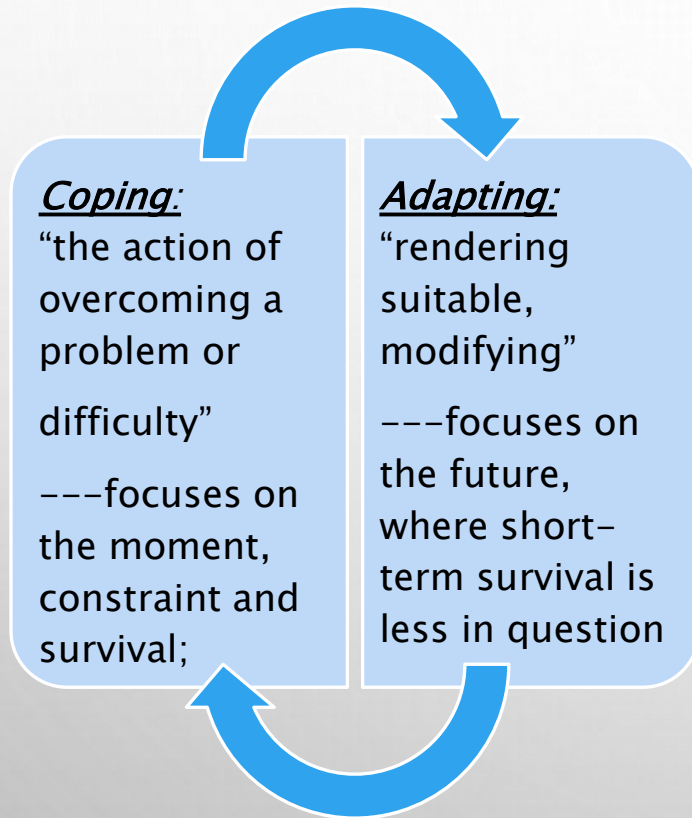
Changes in natural
physical environment



Changes in
ecosystems



Adverse effects on
human conditions



Dimension	Coping	Adapting
Exigency	Survival in the face of immediate, unusually significant stress, when resources, which may have been minimal to start with, are taxed (Wisner et al., 2004).	Reorientation in response to recent past or anticipated future change, often without specific reference to resource limitations.
Constraint	Survival is foremost and tactics are constrained by available knowledge, experience, and assets; reinvention is a secondary concern (Bankoff, 2004).	Adjustment is the focus and strategy is constrained less by current limits than by assumptions regarding future resource availability and trends.
Reactivity	Decisions are primarily tactical and made with the goal of protecting basic welfare and providing for basic human security after an event has occurred (Adger, 2000).	Decisions are strategic and focused on anticipating change and addressing this proactively (Füssel, 2007), even if spurred by recent events seen as harbingers of further change.
Orientation	Focus is on past events that shape current conditions and limitations; by extension, the focus is also on previously successful tactics (Bankoff, 2004).	Focus on future conditions and strategies; past tactics are relevant to the extent they might facilitate adjustment, though some experts believe past and future orientation can overlap and blend (Chen, 1991).

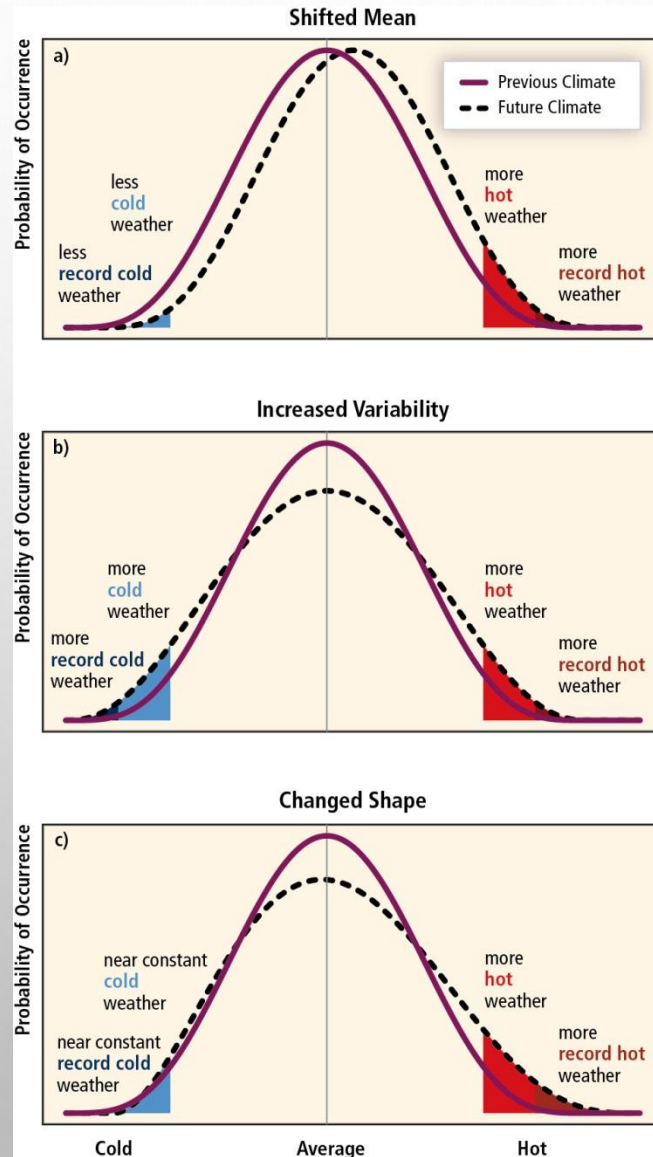
EXTREME CLIMATE AND WEATHER EVENTS

- CHANGING CLIMATE LEADS TO CHANGES IN THE FREQUENCY AND INTENSITY OF WEATHER AND CLIMATE EXTREMES
 - COULD LEAD TO EXTREME IMPACTS AND DISASTERS
 - ACCUMULATION OF NON-EXTREME EVENTS (FLOODS, DROUGHTS)
- EVENTS ARE GROUPED AS 'CLIMATE EXTREMES'
 - "OCCURRENCE OF A WEATHER OR CLIMATE VARIABLE ABOVE (OR BELOW) A THRESHOLD NEAR THE UPPER (OR LOWER) ENDS OF THE RANGE OF OBSERVED VALUES OF THE VARIABLE."
- QUANTITATIVE DEFINITIONS FOR CLIMATE EXTREMES:
 - 1) RELATED TO THEIR PROBABILITY OF OCCURRENCE
 - PERCENTILES OF DISTRIBUTION FUNCTIONS OR RETURN FREQUENCIES
 - 2) RELATED TO A SPECIFIC (POSSIBLY IMPACT RELATED) THRESHOLD
 - EX: TEMPERATURE RANGE CAUSING HEAT STRESS IN A POPULATION

CLIMATE EXTREMES

- CHANGES IN EXTREMES CAN BE LINKED TO CHANGES IN THE MEAN, VARIANCE, OR SHAPE OF PROBABILITY DISTRIBUTIONS, OR ALL OF THESE
- CHANGES IN VARIABILITY AND SHAPE OF PROBABILITY DISTRIBUTIONS MUST BE CONSIDERED IN ADDITION TO CHANGES IN THE MEAN TO PROJECT FUTURE CHANGES IN EXTREMES
- MANY EXTREME WEATHER AND CLIMATE EVENTS CONTINUE TO RESULT FROM NATURAL CLIMATE VARIABILITY
 - NATURAL VARIABILITY SHAPES FUTURE EXTREMES IN ADDITION TO ANTHROPOGENIC CLIMATE CHANGE

EXAMPLE: TEMPERATURE



- POTENTIAL CHANGES IN TEMPERATURE DISTRIBUTIONS BETWEEN A PRESENT AND FUTURE CLIMATE WILL AFFECT THE EXTREME VALUES OF THE DISTRIBUTIONS:
- (A) EFFECTS OF A SHIFT TOWARD A WARMER CLIMATE
- (B) EFFECTS OF AN INCREASE IN VARIABILITY WITH NO SHIFT IN THE MEAN

TEMPERATURE EXTREMES

- GLOBAL SCALE INCREASE IN WARM DAYS AND NIGHTS AND DECREASE IN COLD DAYS AND NIGHTS IS VERY LIKELY
- WARM SPELLS AND HEAT WAVES ARE LIKELY TO INCREASE OVER MOST LAND AREAS
- INCREASED DROUGHT FREQUENCY AND SEVERITY FOR SOME REGIONS IN CONJUNCTION WITH RAINFALL VARIABILITY CHANGES
- CHANGES HAVE GREAT IMPACT ON NATURAL PHYSICAL ENVIRONMENT AND ON HUMAN SYSTEMS AND ECOSYSTEMS
- HIGH CONFIDENCE IN PROJECTIONS GLOBALLY

PRECIPITATION EXTREMES

- FREQUENCY OR PROPORTION OF TOTAL RAINFALL FROM HEAVY RAIN EVENTS WILL LIKELY INCREASE FOR MANY AREAS
 - PARTICULARLY IN HIGH LAT. AND TROPICAL REGIONS
- REGIONS OF REDUCED PRECIPITATION MAY STILL SEE AN INCREASE IN HEAVY RAINFALL EVENTS
- CAVEAT: STRONG REGIONAL AND SUBREGIONAL TRENDS
- MEDIUM CONFIDENCE IN PROJECTIONS GLOBALLY

DROUGHT AND FLOODS

- DROUGHT INTENSIFICATION
 - CHANGES WELL PROJECTED FOR SOME SEASONS AND AREAS ONLY
 - PORTIONS OF EUROPE, N/C AMERICA, NE BRAZIL, AND S. AFRICA MOST AT RISK
 - MEDIUM CONFIDENCE IN DROUGHT INTENSIFICATION WITH MANY CAVEATS
- FLOODING
 - LOW CONFIDENCE IN FLUVIAL (RIVER) FLOOD CHANGES
 - LIMITED EVIDENCE AND COMPLEX REGIONAL CHANGES
 - MEDIUM CONFIDENCE IN PLUVIAL (RUNOFF) FLOODING
 - RAINFALL INCREASES IN SOME AREAS WILL RESULT IN LOCAL RUNOFF ISSUES

CLIMATE EXTREMES IMPACTS

- CLIMATE IMPACTS ON HUMANS DETERMINED BY EXPOSURE AND VULNERABILITY
 - EXPOSURE
 - ASSETS AND ACTIVITIES IN AREAS AFFECTED BY CLIMATE EXTREMES
 - MORE SUBJECT TO HAZARDS
 - VULNERABILITY
 - SUSCEPTIBILITY OF WHAT IS EXPOSED TO HARM
 - CAPACITY FOR RECOVERY
- CLIMATE IMPACTS TO ECOSYSTEMS
 - CAN DETERMINE SPECIES MORTALITY AND WHICH SPECIES SURVIVE IN AN ECOSYSTEM

“TOWARD A SUSTAINABLE AND RESILIENT FUTURE”

- DISASTER RISK – REMINDER THAT THIS COMMUNITY INCLUDES ALL HAZARDS WITH CLIMATE/WEATHER AS A SUBSET, TSUNAMIS, EARTHQUAKES, VOLCANOES ARE ALSO WITHIN ITS SCOPE
- CLIMATE ADAPTATION – DISASTER IS NOT JUST CYCLONE, FLOOD AND DROUGHT BUT ALSO “CREEPING” LONG TERM SHIFTS IN TEMPERATURE, PRECIPITATION OR CRYOSPHERE
- COMMON GROUND – FLOODS, DROUGHTS, HEAT WAVES
- THE UNDERLYING THEME IS REDUCE RISKS AND UNDERSTAND THE POTENTIAL FOR THRESHOLDS AND TIPPING POINTS.

EXTREME VALUE THEORY

- AN APPROACH TO ESTIMATE EXTREME VALUE PROBABILITIES FROM THE TAIL OF A PROBABILITY DISTRIBUTION.
- ESTIMATION OF PROBABILITIES OUTSIDE OBSERVABLE DATA RANGES

CONCLUSIONS

- NEED GREATER AMOUNT OF USEFUL INFORMATION ON RISKS BEFORE EVENTS OCCUR INCLUDING EARLY WARNINGS.
- RISK TRANSFER PROVIDES INCENTIVES FOR REDUCTION OF VULNERABILITY AND EXPOSURE.
- RESEARCH THAT INTEGRATES NATURAL, SOCIAL, HEALTH AND ENGINEERING SCIENCES PROVIDES THE JUSTIFICATION FOR RISK REDUCTION.