Is a richer-but-warmer world better than poorer-but-cooler worlds?

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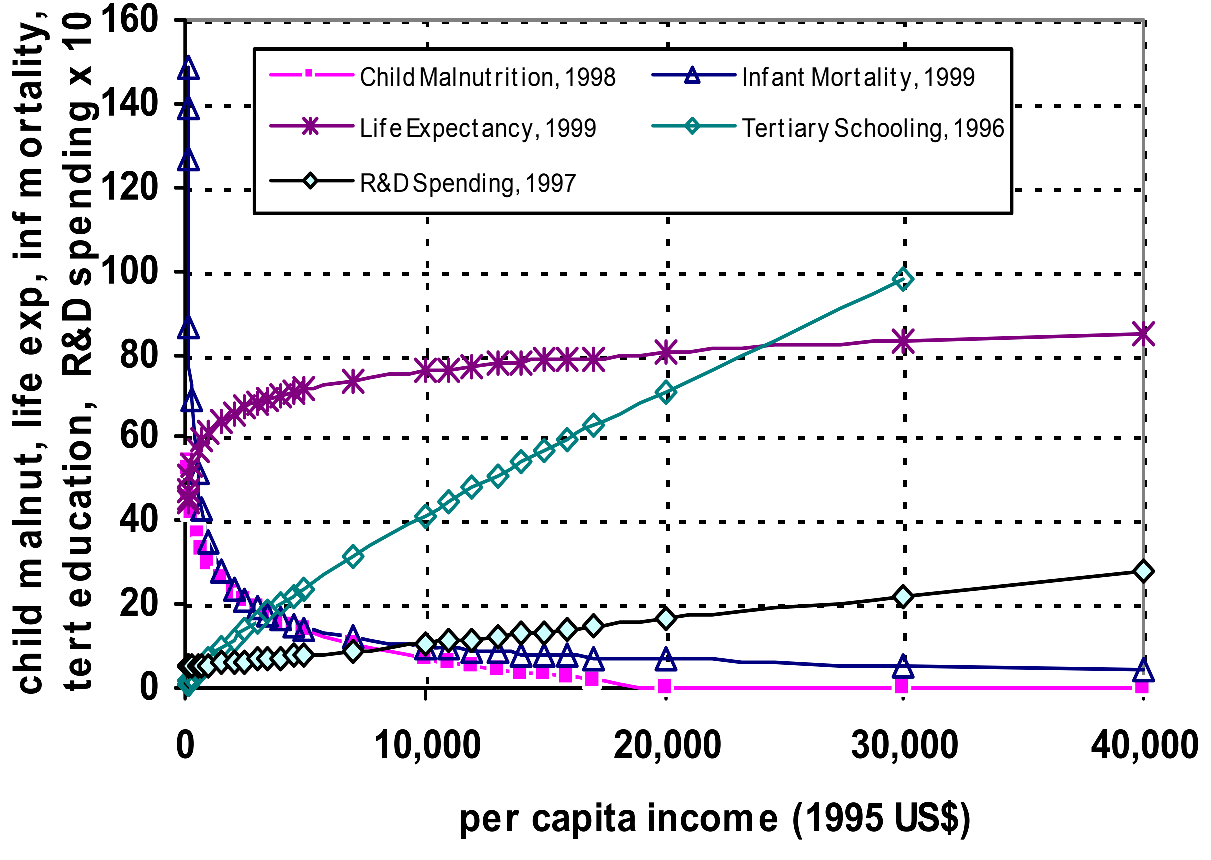
[1] Views expressed in this paper are the author's, and not necessarily those of any unit of the U.S. government.

The Wealth Conundrum

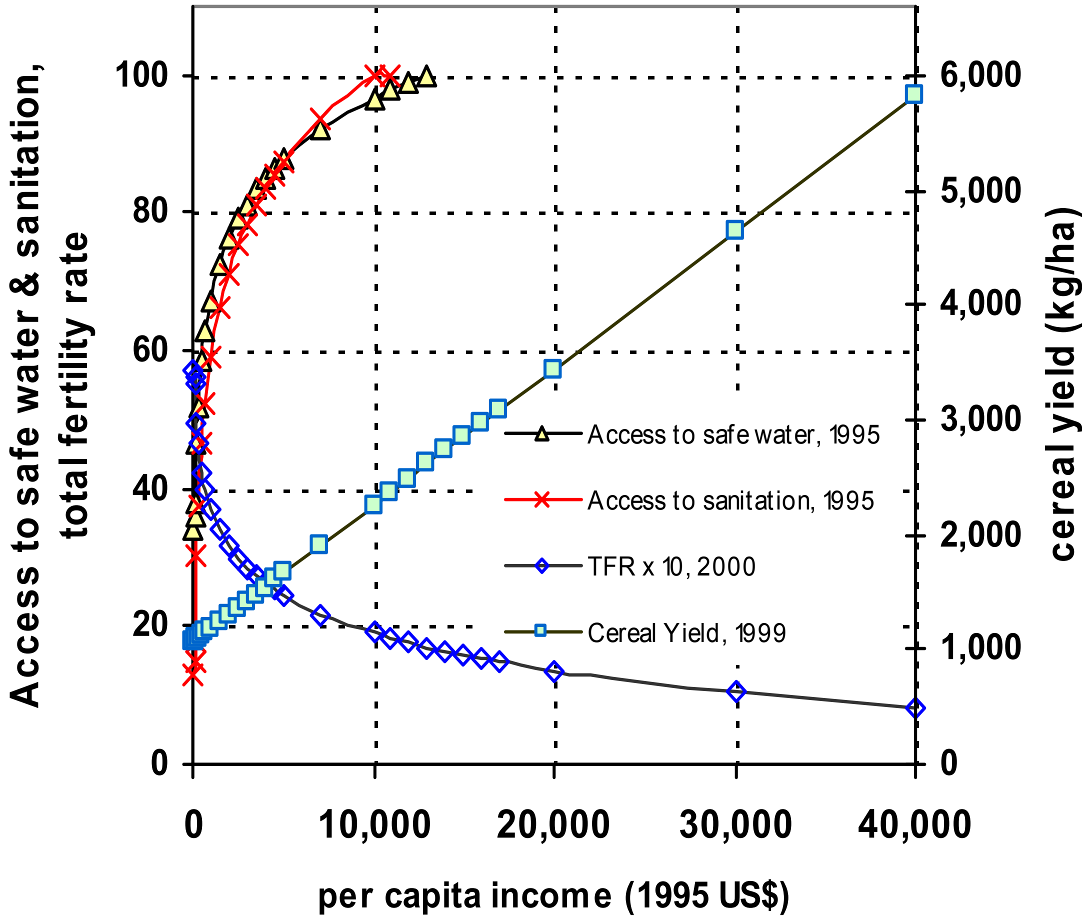
- Richer means greater energy use, greater GHG emissions, greater warming and, therefore, sooner or later, declining levels of well-being
- But richer also means higher levels of well-being and greater adaptive capacity to address not only climate change but other sources of adversity

Human Well-Being & Wealth



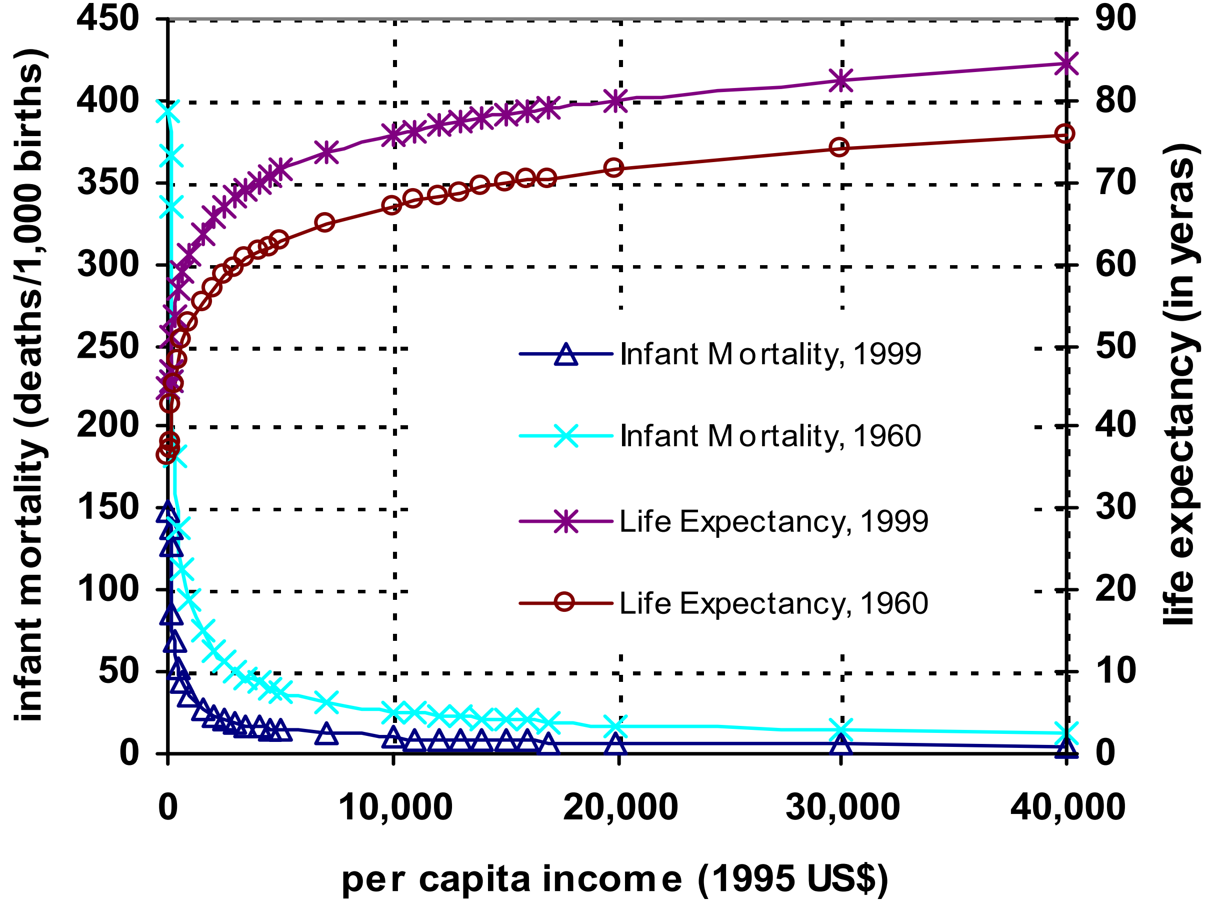
Sources: Goklany (2002a, 2005a)

Environmental Well-Being v Wealth



Sources: Goklany (2002a, 2005a)

Well-Being v Wealth & Technology (Time)



Sources: Goklany (2002a, 2005a)

Issue

- **Whether and, if so, for how long will a richer-but-warmer world be better for human and environmental well-being than poorer-but-cooler worlds?**

Approach

- Use results of studies of the global impacts of climate change sponsored by UK's Dept of Food, Environment & Rural Affairs (Defra)
  - ✓ available in the peer-reviewed literature; authors are in good standing with IPCC
  - ✓ use IPCC's SRES scenarios' assumptions for wealth, emissions and technological change between 1990-2100, to project climate change and its global impacts in the 2085-2100 period
  - ✗ tendency to overestimate impacts – don't fully allow for increase in adaptive capacity due to higher levels of future wealth and technological prowess

Estimates of Well-Being

- Well-being will be estimated one climate-sensitive hazard or threat at a time
- With respect to climate-sensitive hazards affecting humans (e.g., hunger, water shortage, coastal flooding and malaria), **human well-being** measured by the population at risk or suffering from that hazard (PAR)
- **Environmental well-being**, measured by the global carbon sink capacity, and global extent of cropland and coastal wetlands

Scenario Characteristics

	A1FI	A2	B2	B1
Pop, 2085 (billions)	7.9	14.2	10.2	7.9
GDP growth, 1990-2100	525-550	243	235	328
GDP/capita in 2100				
Industrial countries	*$107,300*	*$46,200*	*$54,400*	*$72,800*
Developing countries	*$66,500*	*$11,000*	*$18,000*	*$40,200*
Tech change	Rapid	Slow	Medium	Medium
Energy use	Very high	High	Medium	Low
Energy techs	fossil intensive	regionally diverse	"dynamics as usual"	high efficiency
Land use change	Low-medium	Medium-high	Medium	High
CO_2 conc, 2085, ppm	810	709	561	527
ΔGlobal temp, 2085	4.0 °C	3.3 °C	2.4 °C	2.1 °C

Sources: Arnell et al. (2004), Tables 1, 6, 7; Arnell (2004), Table 1

Hunger: Population at Risk in 2085 with & without climate change

(in millions)

	Baseline 1990	A1FI 2085	A2 2085	B2 2085	B1 2085
PAR, no climate change (CC)	**798-872**	**105**	**767**	**90**	**233**
ΔPAR, due to CC only	**NA**	**28**	**-28 to -9**	**-11 to +5**	**10**
Total PAR with climate change	***798 to 872***	***133***	***739 to 758***	***79 to 95***	***243***

Source: Parry et al. (2004)

Water Shortage: Population at Risk in 2085, with & without climate change

(in millions)

	Baseline 1990	A1FI 2085	A2 2085	B2 2085	B1 2085
PAR, no climate change	1,368	2,859	8,066	4,530	2,859
ΔPAR, due to CC only	NA	-1,192	- 2,100 to 0	- 937 to 104	-634
Total PAR with climate change	*NA*	*1,667*	*5,966-8,066*	*3,593-4,634*	*2,225*

PAR measured as the number of people inhabiting countries where available water supplies are less than 1,000 m^3 per person per year. Source: Arnell (2004).

Coastal Flooding: Population at Risk in 2085, with & without climate change

(in millions)

	Baseline 1990	A1FI 2085	A2 2085	B2 2085	B1 2085
PAR, no sea level rise (SLR)	10	1-3	30-74	5-35	2-5
ΔPAR, due to SLR alone	NA	10-42	50-277	27-66	3-34
TOTAL PAR	*10*	*11-45*	*80-351*	*32-101*	*5-39*

PAR is measured as the average number of people who experience flooding each year by storm surge. The low (high) end numbers are based on an assumption of low (high) subsidence. Source: Nicholls (2004).

C-Sink Capacity & Habitat Loss

(latter uses cropland as proxy)

		Baseline 1990	A1FI	A2	B2	B1
ΔT, in 2085	° C	*0*	4.0	3.3	2.4	2.1
Population, 2085	billions	*5.3*	7.9	14.2	10.2	7.9
GDP/capita, 2085	$/cap	*3.8*	52.6	13.0	20.0	36.6
CO_2 conc, 2100	ppm	*353*	970	856	621	549
Net Biome Productivity with climate change, 2100	Pg C/yr	*0.7*	5.8	5.9	3.1	2.4
Area of cropland with climate change (in 2100)	% of global area	*11.6%*	5.0%	NA	13.7%	7.8%

Sources: Arnell et al. (2004); Nicholls (2004); Levy et al. (2004)

Global Loss of Coastal Wetlands, 2085

		A1FI	A2	B2	B1
Losses due SLR alone	% of 1990 area	5 - 20%	3 - 14%	3 - 15%	4 - 16%
Losses due to other causes	% of 1990 area	32 - 62%	32 - 62%	11 - 32%	11 - 32%
Combined losses	% of 1990 area	35 - 70%	35 - 68%	14 - 42%	14 - 42%

Sources: Arnell et al. (2004); Nicholls (2004); Levy et al. (2004)

Ranking of scenarios per each indicator of future well-being, 2085-2100

Indicator	Without climate change				With climate change			
	A1FI	A2	B2	B1	A1FI	A2	B2	B1
Indicators of human well-being								
GDP/capita	1	4	3	2	1	4	3	2
Hunger, 2085	2	4	1	3	2	4	1	3
Water stress, 2085	1.5	4	3	1.5	1	4	3	2
Coastal flooding, 2085	1	4	3	2	2	4	3	1
Indicators of environmental quality								
Terrestrial carbon sink strength, 2100					1.5	1.5	3	4
Cropland area, 2100					1	NA	3	2
Coastal wetland area, 2085					3.5	3.5	1.5	1.5

Conclusions

- Richer-but-warmer world will likely be better for human well-being, at least through 2085
- Regarding environmental well-being, richer-but-warmer world:

  (a) would be better for C-sink capacity and habitat conservation through 2100, but not necessarily beyond

  (b) may or may not be better for coastal wetlands in 2085
- Assuming 50 years to replace the energy system, we have 30 years [=2085-50-2005] before hard decisions must be made on targets and timetables beyond “no-regrets”, provided we use the time wisely.

Interim Actions

- Advance economic growth, human capital and the propensity for technological change – advance human well-being, adaptive capacity and mitigative capacity
- Reduce vulnerability to today's urgent problems that might be exacerbated by climate change
- Expand range of no-regret options through R&D
- Allow the market to run its course in implementing no-regret options as their range expands, e.g., reduce subsidies that might increase GHG emissions
- Develop more robust understanding of CC science, impacts and policies related to climate change
- Monitor impacts of climate change to spot "dangerous" impacts before they become imminent

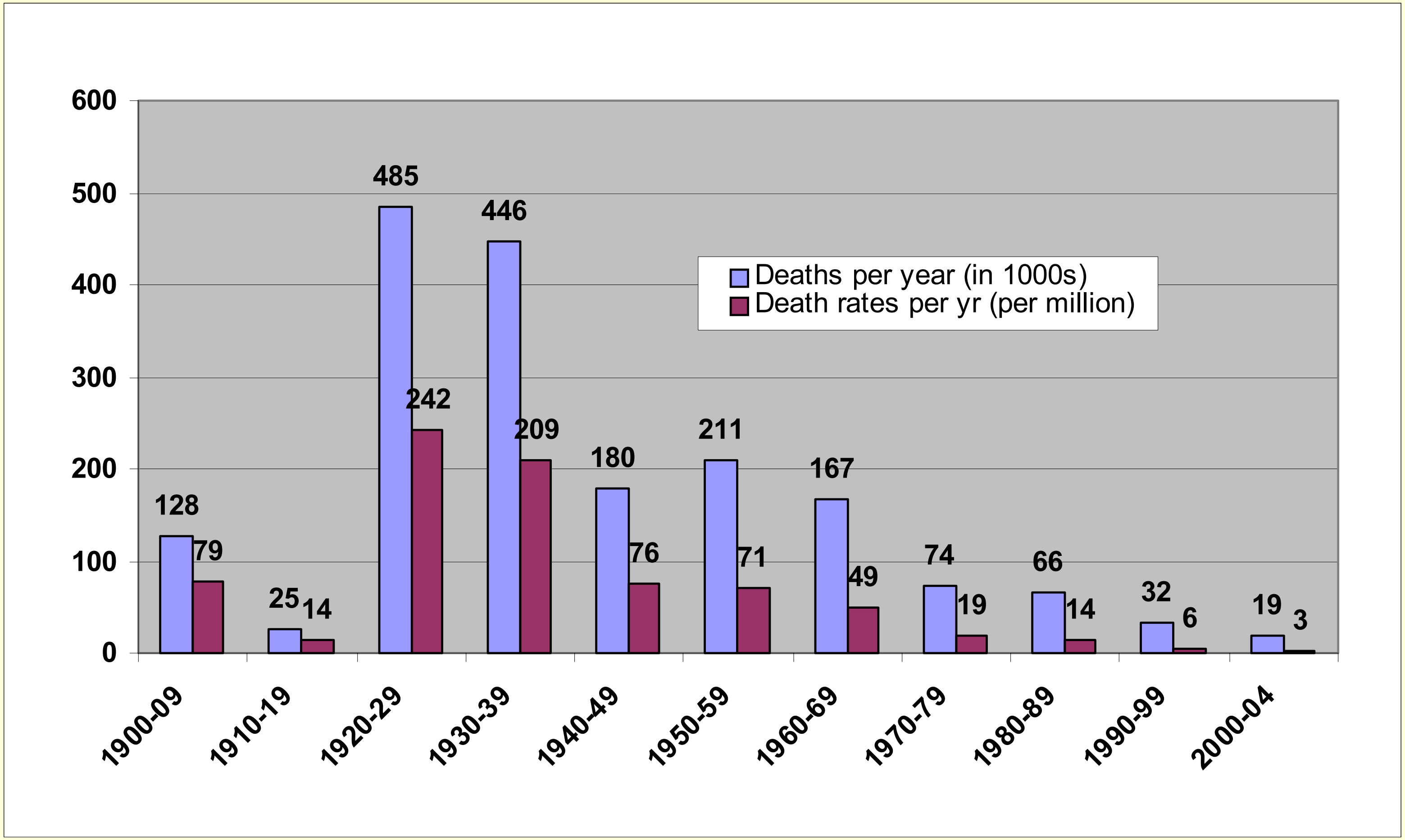
Increasing Adaptive Capacity

- Will increase society’s resilience to all manner of adversity, and not just climate change, thereby broadly advancing human well-being, and sustainable (economic) development.
- Will enhance mitigative capacity.
- Could raise the level at which GHG concentrations might become “dangerous” and/or allow mitigation to be postponed.
- It is generally consistent with UNFCC’s Article 2.

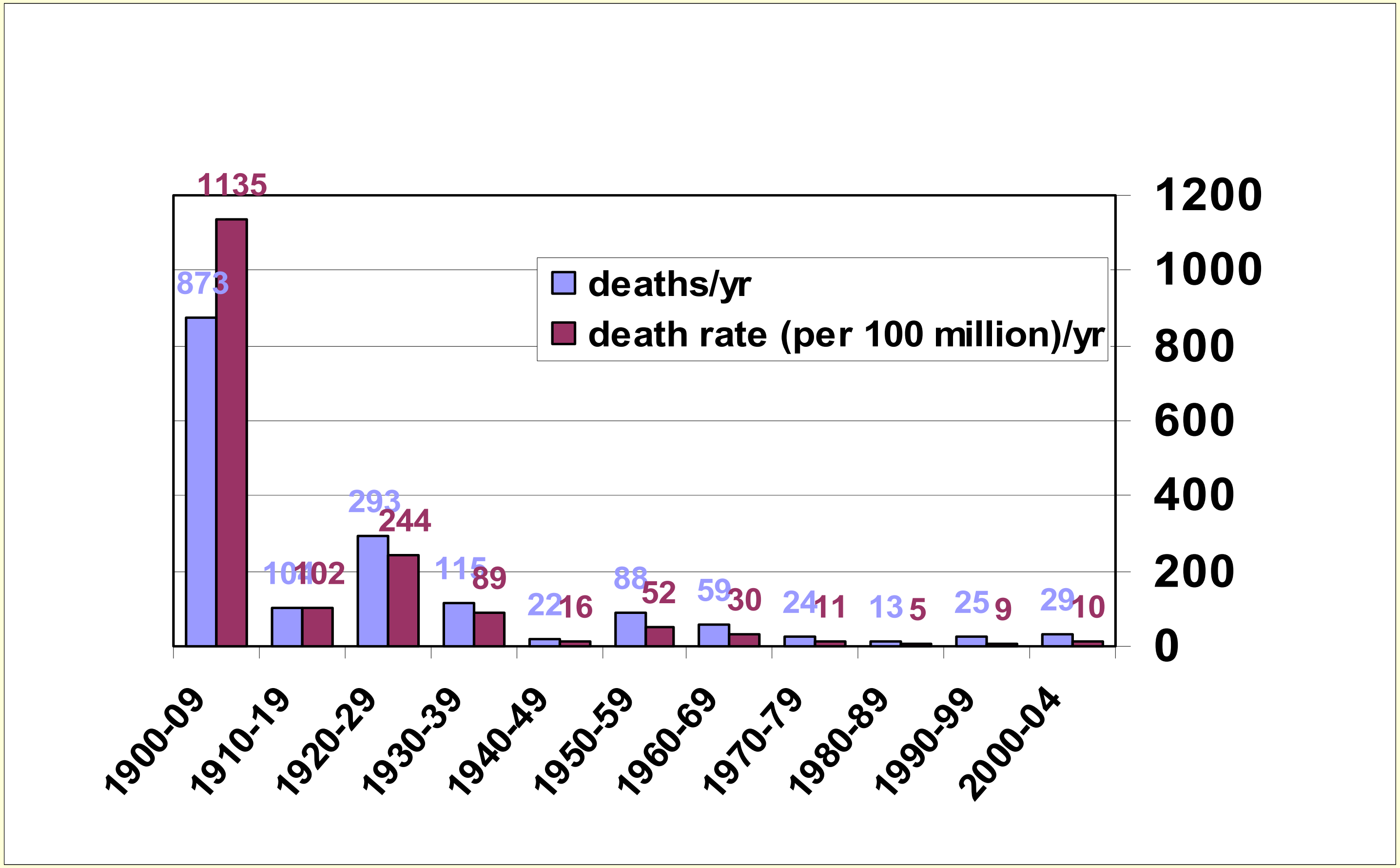
END

Supplementary slides follow

Global deaths & death rates from extreme weather events, 1900-2004



Deaths & Death Rates , Hurricanes, U.S., 1900-2004



Property Losses, Hurricanes, U.S., 1929-2004 (in $ per $1,000 of weighted income per year)