The Costs of Policy Inaction on Climate Change

William R. Cline

Center for Global Development

INSTITUTE FOR INTERNATIONAL ECONOMICS

US Land Loss from 7.6 meters sea level rise, % (Schneider & Chen, 1980)

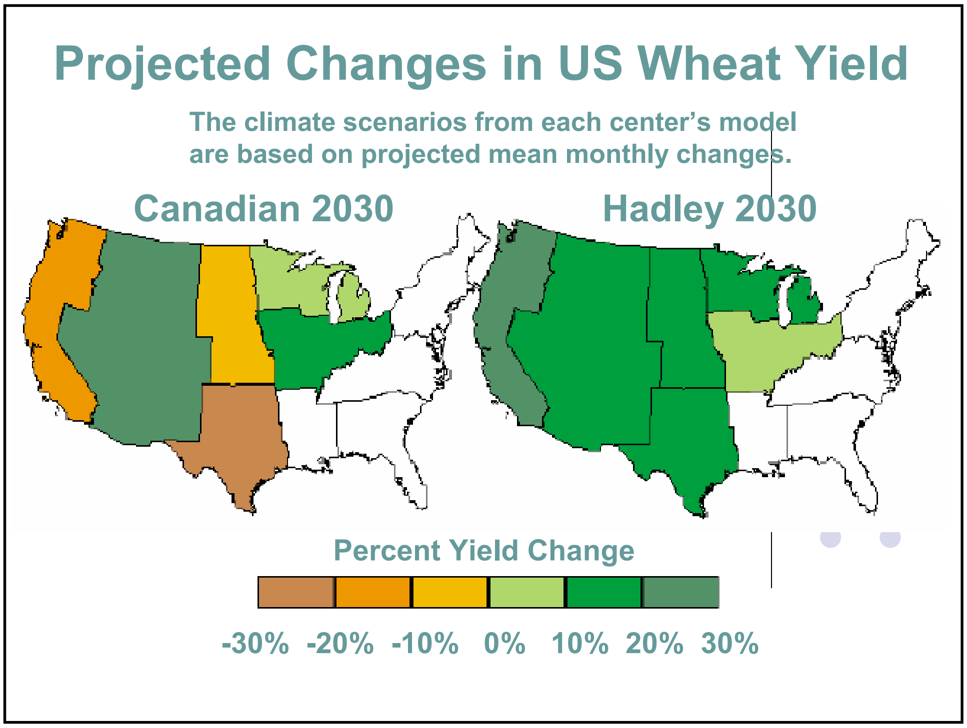
Florida	36
Louisiana	31
Delaware	25
Washington DC	20
Maryland	17
South Carolina	10
Continental US	2

Land Flooded by Sea Level Rise (%) (Source: SURVAS database)

Country	SLR in study (m)	Land loss
Bangladesh	2.0	24.5
Vietnam	1.0	12.3
Belize	1.0	8.0
Senegal	2.0	3.3
Netherlands	1.0	2.8
Nigeria	2.0	2.6
Malaysia	1.0	2.1
Indonesia	0.5	1.8
Venezuela	2.0	1.2

Drought, water, and impact on agriculture

- Contest between increased evapotranspiration (more drought) and increased precipitation (less drought)
- “Evapotranspiration increases most where the temperature is highest, at low- to mid-latitudes, while **precipitation increases most** where the air is coolest and easiest to saturate by the additional moisture, **at higher latitudes**.” Rind et al, 1990.



Projected Changes in US Wheat Yield

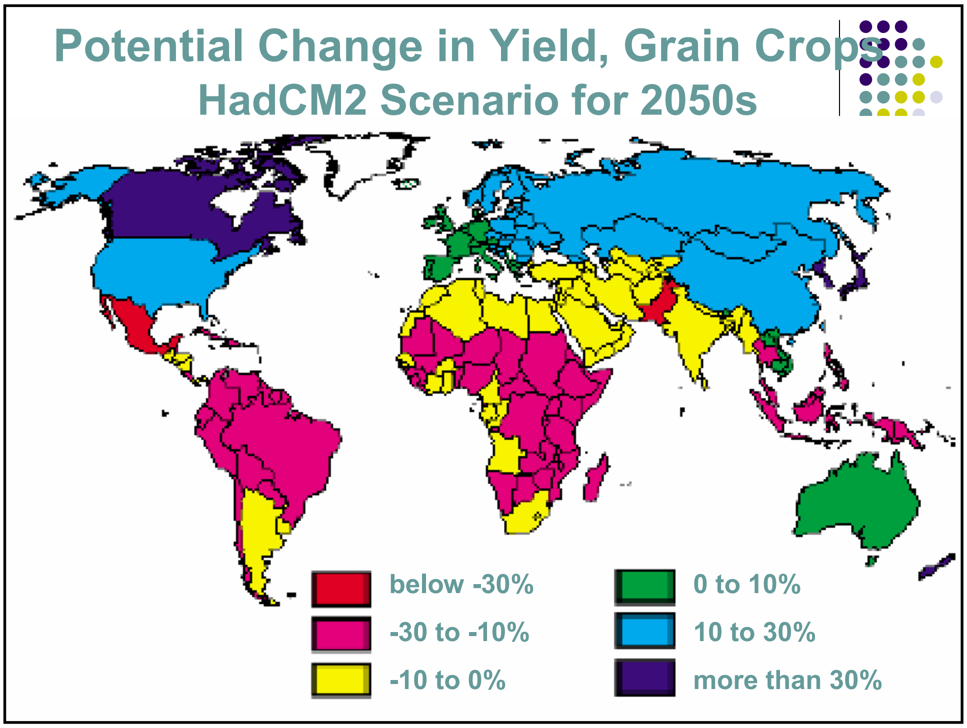
The climate scenarios from each center's model
are based on projected mean monthly changes.

Canadian 2030

Hadley 2030

Percent Yield Change

-30% -20% -10% 0% 10% 20% 30%



Potential Change in Yield, Grain Crops
HadCM2 Scenario for 2050s

🟥 below -30%

🟥 -30 to -10%

🟨 -10 to 0%

🟩 0 to 10%

🟦 10 to 30%

🟪 more than 30%

Present Value of $ 1 billion received 200 years in the future

Discount rate:

0.5%	$370 million
1.0%	$140 million
1.5%	$51 million
2.0%	$19 million
3.0%	$2.7 million
4.0%	$390 thousand
5.0%	$5.8 thousand

Social rate of time preference (SRTP)

SRTP = $\rho + g\theta$

ρ = pure time preference (impatience)

g = per capita growth

θ = (-) elasticity of marginal utility

Cline 1992

- 300 year horizon (deep ocean mixing)
- 2.5°C warming → 1%GWP damage; 10 °C →6% GWP damage.
- Agriculture sizable damage: 0.25%US GDP at 2.5°C; energy (cooling), water, sea level also prominent
- Abatement backstop at $250/tC
- With social cost-benefit discounting and some risk weight, benefits > costs for stabilizing global emissions at 4 GtC

Nordhaus-Boyer DICE 2000

- Smaller agricultural losses
- Lower emissions baseline
- Higher damage function incorporating willingness to pay to avoid catastrophe; 11% of GDP for Europe, India at 6°C.
- Optimal abatement small, as in earlier Nordhaus results. Cut emissions 5-11%, carbon tax $9/tC rising to $67 by 2100
- 4% discount rate main reason minimal action

Jorgensen et al 2004

- Both pessimistic and optimistic baselines based on literature
- Ag is key: Adams et al versus USNCCA
- At 2.4°C in 2100, damage as much as 3% GDP in pessimistic. In optimistic, *benefits* up to 1.9°C. Thereafter reduction

Hitz and Smith 2004

- Initial benefits for agriculture, land ecosysts.
- Strictly adverse: coastal resources, biodiversity, probably marine ecosysts.
- Initial effects unclear: water, health, energy
- All effects turn adverse beyond 3-4°C
- Long inertia damage (e.g. ocean) not included

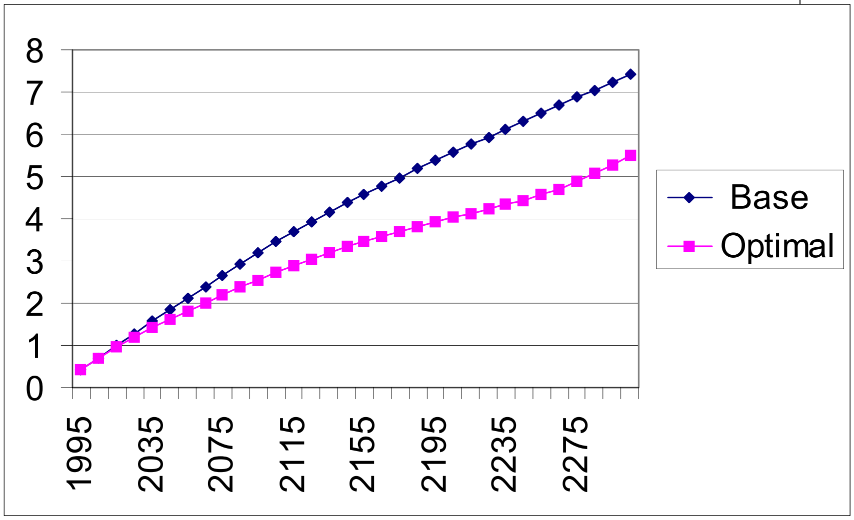
Tol et al 2004; CBO 2004

- Initial mild warming (1°C) +2.3% GWP weighting by income, -2.7% weighting by population
- Poor countries closer to climatic limits, economies more exposed to weather, less able to adapt
- CBO: Uncertainty means should use price (eg carbon tax) rather than rigid quota limits

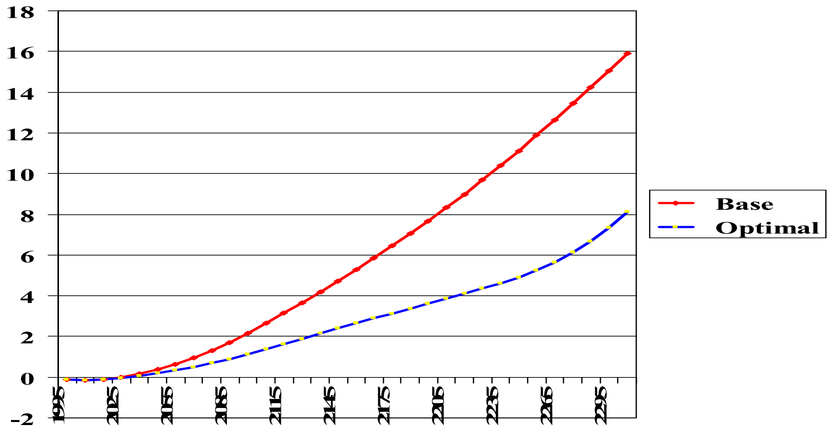
Nonlinearities

- Schneider-Lane 2000: Ocean conveyer-belt shutdown at 1350 ppm; at 750 ppm if faster
- Would reduce North Atlantic region temp. 8°C below present even with global mean +3.6°C
- Andronova-Schlesinger (2001): Higher probability climate sensitivity (CS) parameter (2xCO2 warming) is above IPCC's range (1.5°C-4.5°C) than that it is below
- 95% confidence threshold only at CS=9.3°C

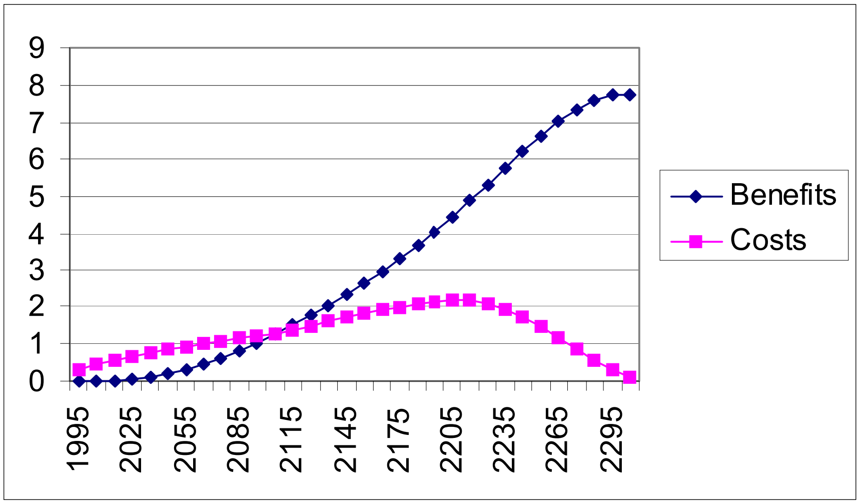
Baseline and Optimal Warming (° C)



Climate damage as % of GWP, Baseline and Optimal



Benefits and Costs of Optimal Abatement (% GWP)



DiceCL Optimal Carbon Tax ($/t) and Abatement (% cut)

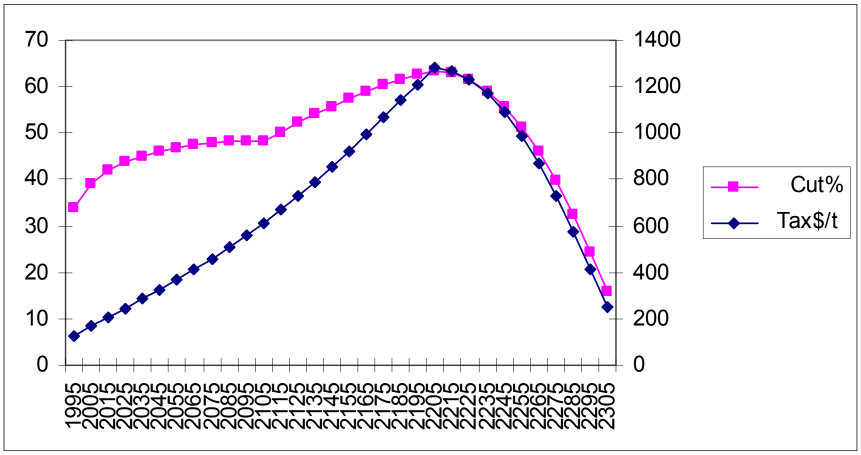
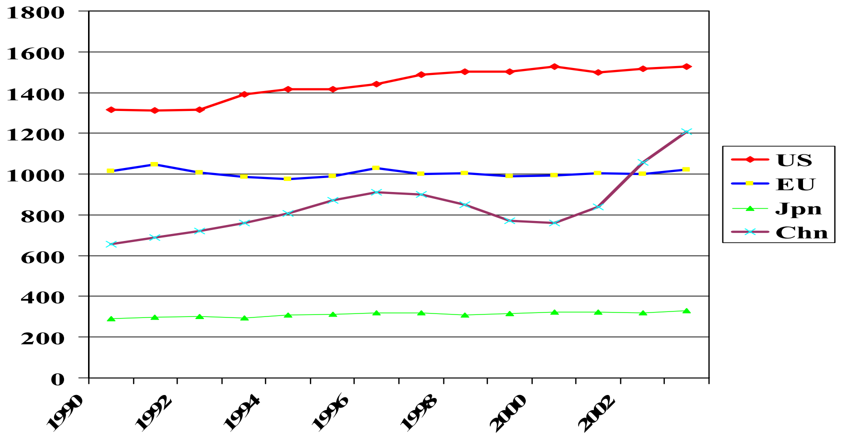


Table 1
Annual costs and benefits of optimal carbon abatement, 2005-2025

	2005	2015	2025
Baseline emissions, industrial (GtC)	7.61	9.21	10.75
Optimal emissions, industrial (GtC)	4.64	5.34	6.03
Percent cut from baseline (%)	39.0	42.0	44.9
Shadow price of carbon ($/tC)	171	208	242
Optimal abatement (GtC)	2.97	3.97	4.72
Benefit value of abatement ($ billions)	508.2	806.1	1154.0
World output ($ trillion, 1990 prices)	48.3	61.1	74.5
Abatement cost as % of world output	0.49	0.61	0.72
Abatement cost ($ billion)	236.5	372.6	536.6
Net abatement benefit ($ billion)	271.7	433.5	617.4
Net abatement benefit, present value	271.7	354.6	424.8

Source: Cline (2004a) and unpublished model results.

Fossil fuel carbon emissions, million mt



Fossil fuel carbon emissions per $1000 ppp GDP (mt)