BUILDINGENERGY NYC

Counting the True Cost of Carbon to Make the Case for Deep Energy Retrofits

Michael Hindle (Passive to Positive)

Curated by Amalia Cuadra and Bianca Antonio

Northeast Sustainable Energy Association (NESEA) | October 24, 2024





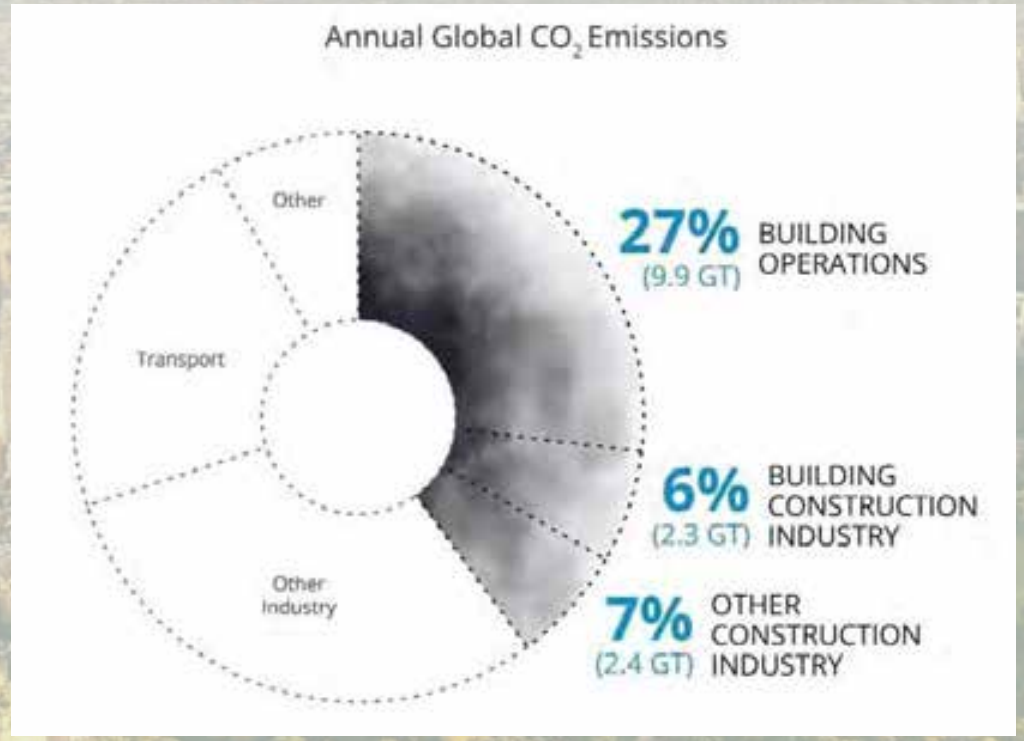


Passive to POSITIVE
PASSIVE HOUSE AND LOW IMPACT DESIGN

MICHAEL HINDLE, CPHC – Owner, Principal
michael@passivetopositive.com
240-431-1281

HIGH PERFORMANCE LOW CARBON **PASSIVE HOUSE** NET ZERO **NEW** RETROFIT

DEEP ENERGY RETROFITS ARE NOT OPTIONAL



In 2040, **2/3 of the global building stock** will be buildings that exist today. Without upgrades, they will still be emitting GHGs.

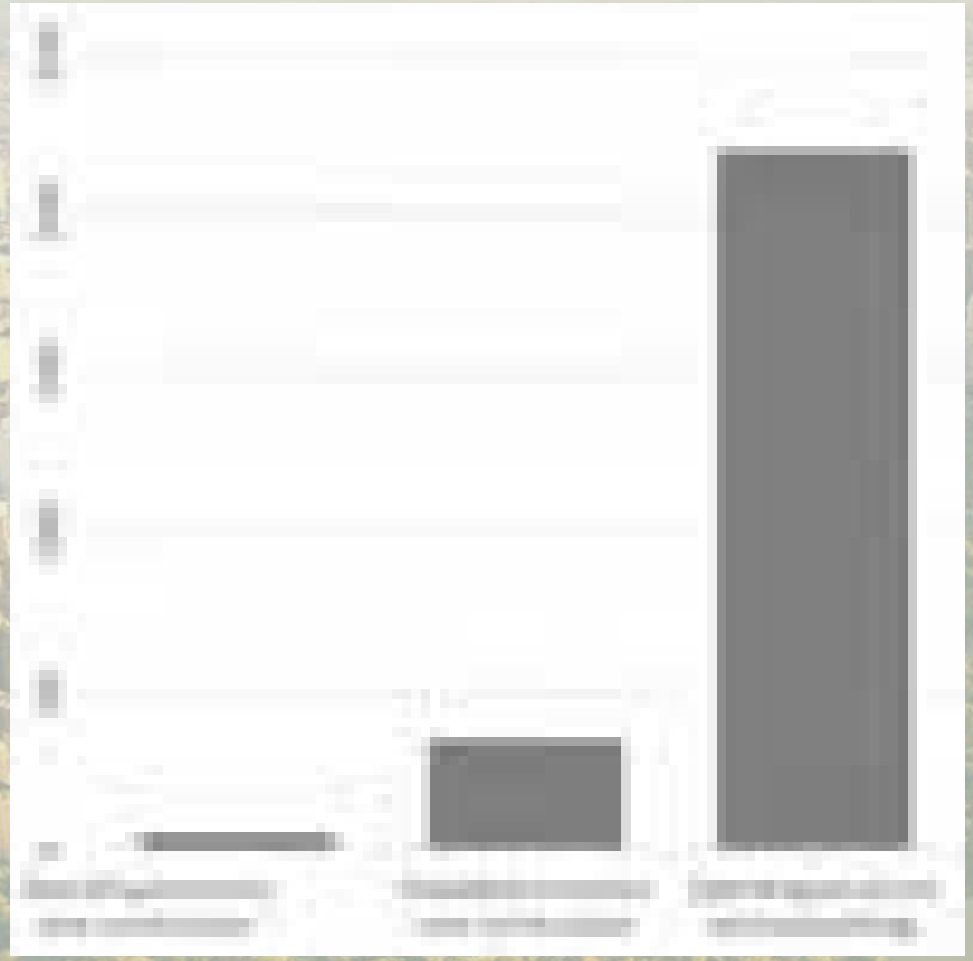
Data Source: IEA Energy Technology Perspectives 2020, February 2021 Revised Edition

Siegel & Strain Architects

WE *CAN NOT* BUILD OUR WAY TO LOW CARBON

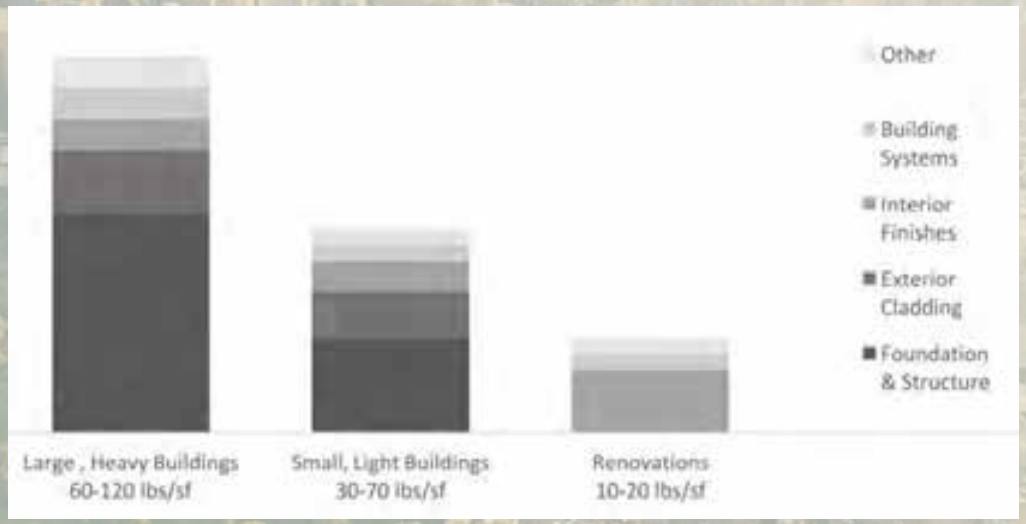
DEEP ENERGY RETROFITS ARE NOT OPTIONAL

OPERATIONAL EMISSIONS SOURCES – millions of tons



Siegel & Strain Architects

EMBODIED CO_2 EMISSIONS BY PROJECT TYPE



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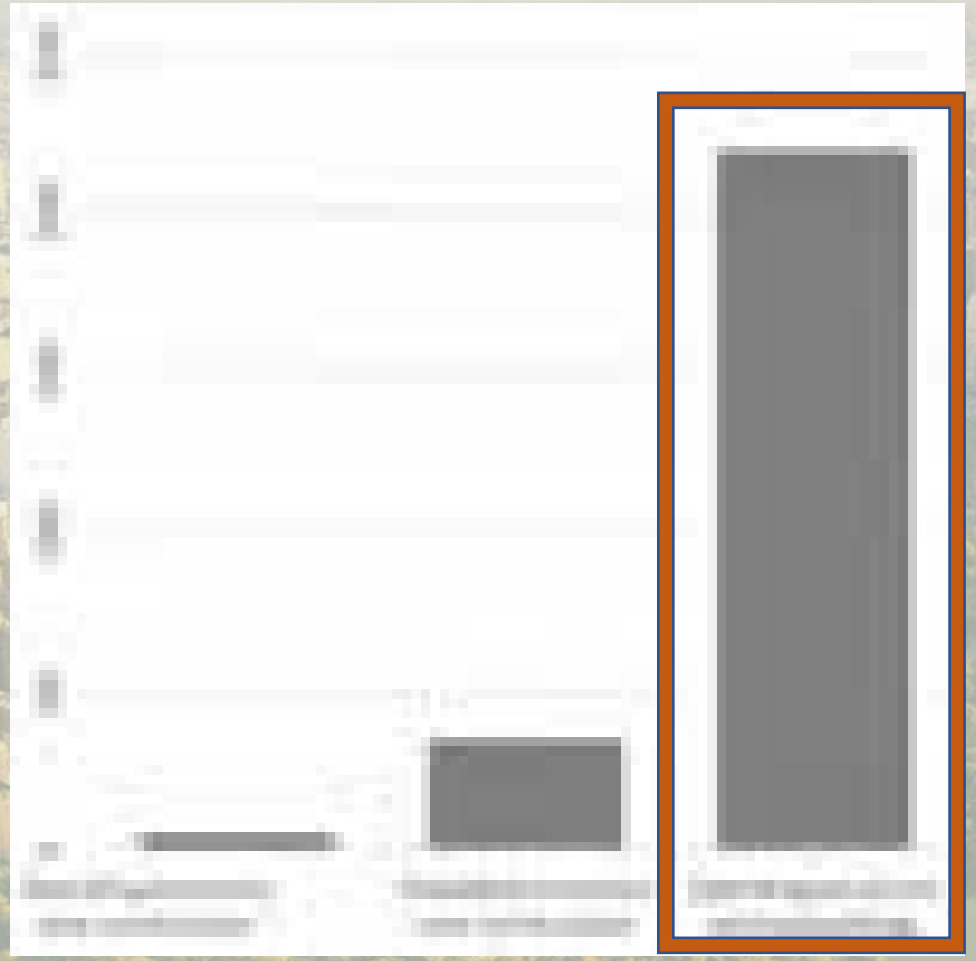
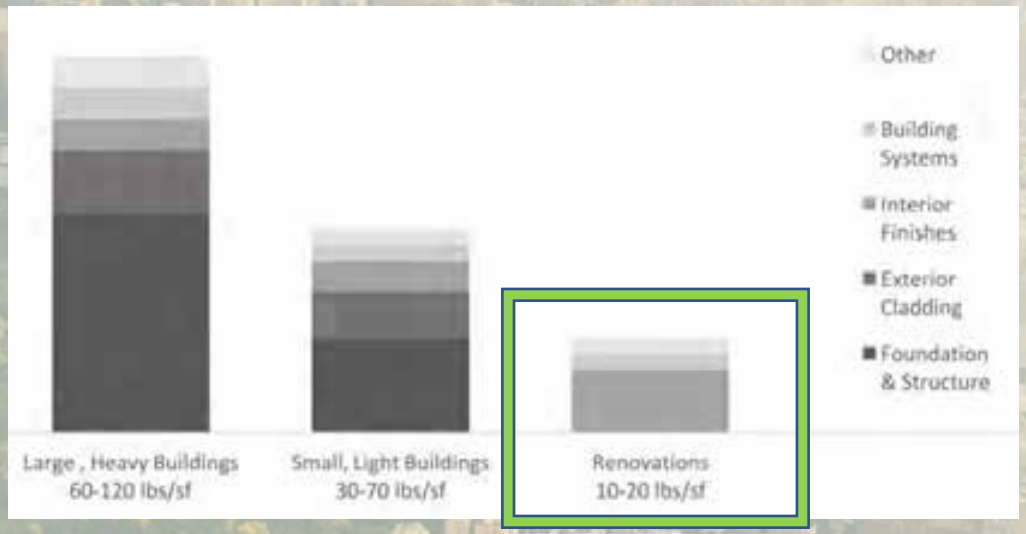


Siegel & Strain Architects

EMBODIED CO_2 EMISSIONS BY PROJECT TYPE



Siegel & Strain Architects

WE *CAN NOT* BUILD OUR WAY TO LOW CARBON


NORTH
NEGLEY
RESIDENCES
REGEN
PITTSBURGH
Innovation

A RATIONAL ANALYSIS

Fine Homebuilding

Subscribe MAIN MENU

GUIDE
Energy Retrofit

CHAPTER
Deep Energy Retrofits

- Deep Energy Retrofits 101
- Featured Deep Energy Retrofits
  - Deep-Energy Retrofit of an Old Timber Frame
  - A Retrofit for the Future
  - Flood-Ready Passive House
  - The BS* + Beer Show: Two Deep-Energy Retrofits
  - Deep-Energy Retrofit for an Adaptive-Reuse Project
  - Simple Shapes Make Sense for Passive House Performance
  - Tackling an Energy Remodel in New Hampshire
  - Texas Deep-Energy Retrofit

BUILDING MATTERS

The End of Deep Energy Retrofits?

Learn why one design-build remodeling firm stopped doing these types of renovations in favor of other efficiency improvements and upgrades.

By Rachel White | Issue 314 - April/May 2023

NESEA

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Wednesday Keynote — Why We Stopped Doing Deep Energy Retrofits

REGISTER

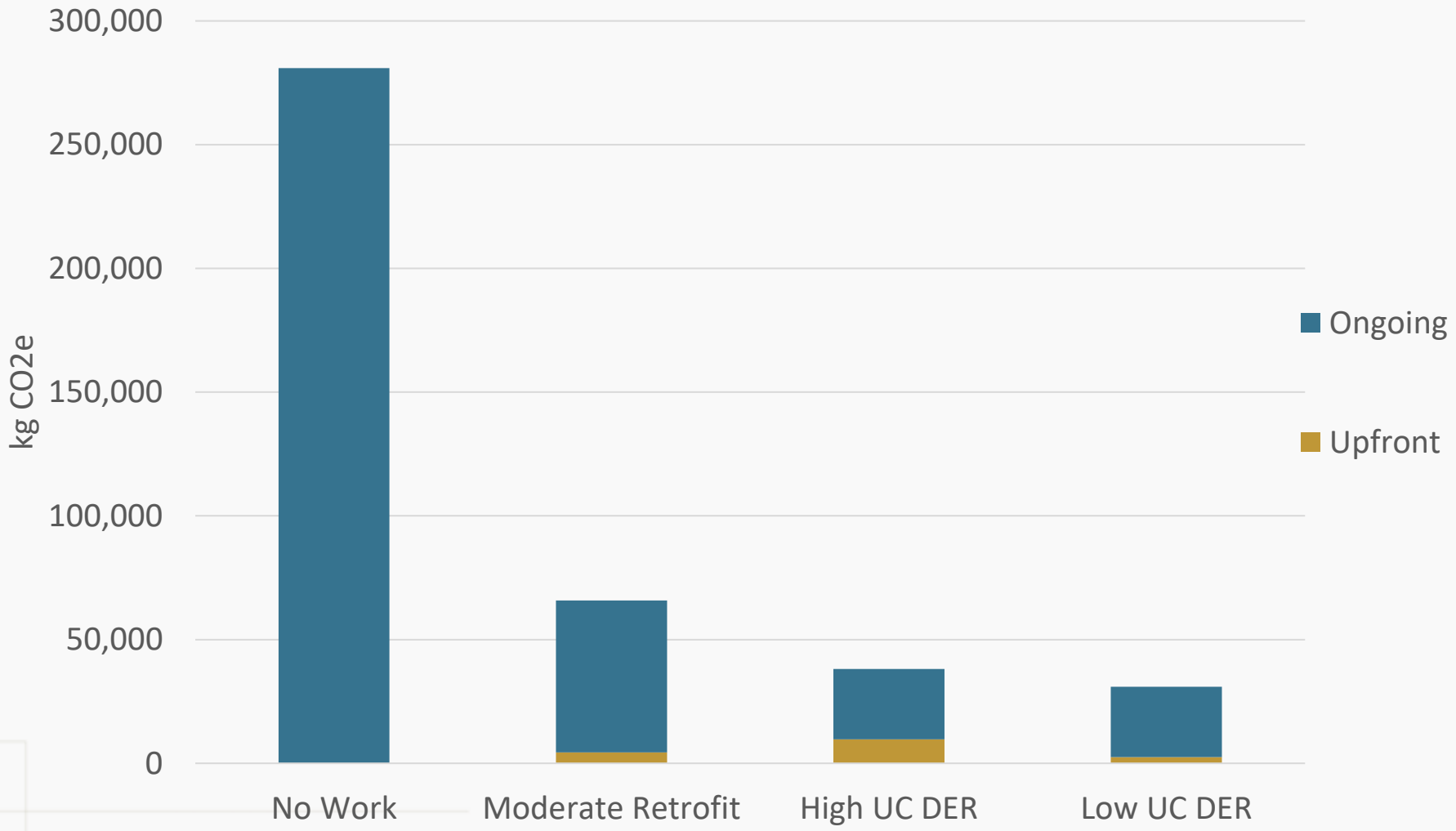
Past Conferences

CEO
Rachel White

PROJECT MANAGER & PERFORMANCE MANAGER
Brendan Kavanagh

BYGG MEISTER
DESIGN | BUILD

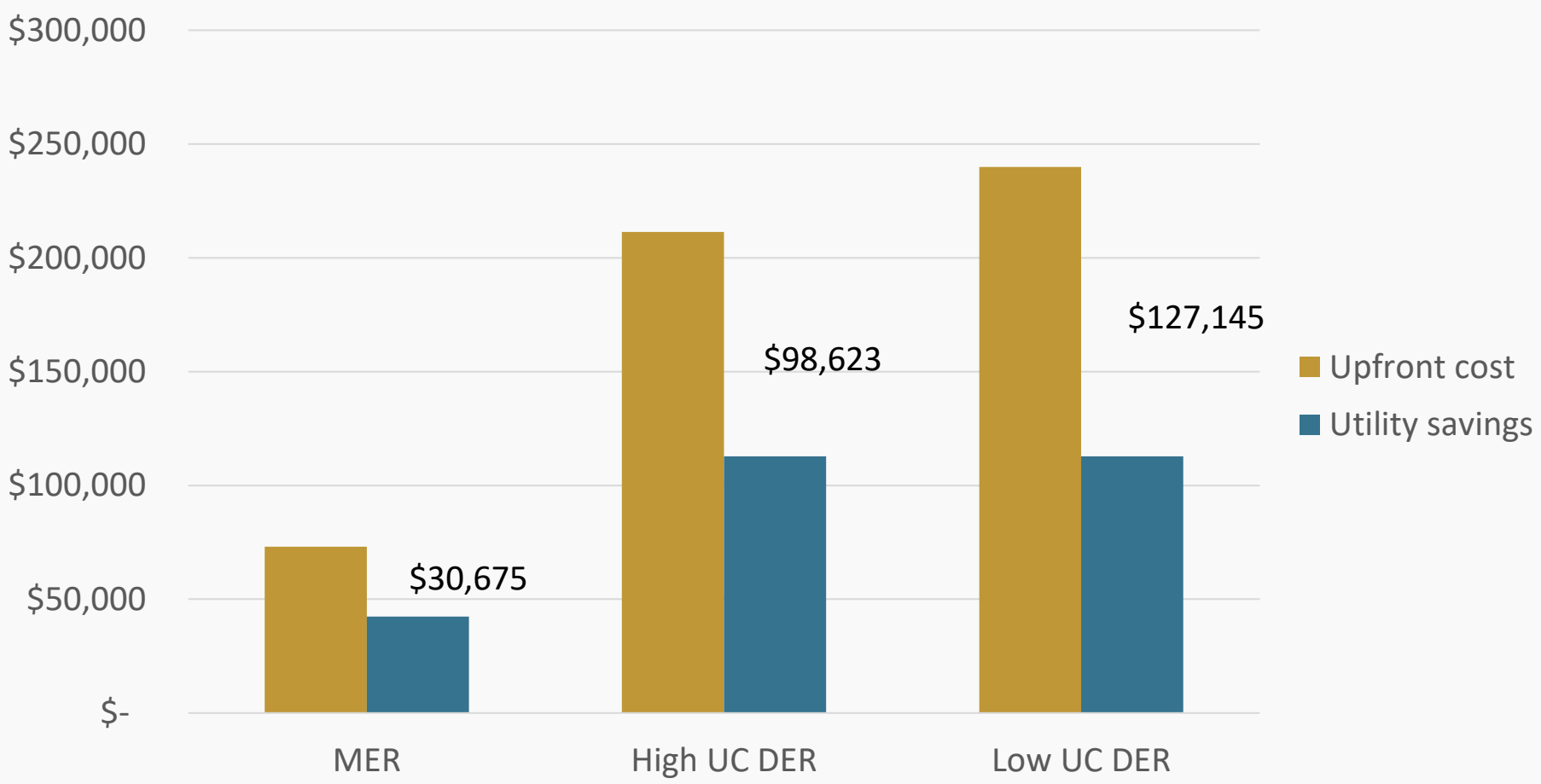
Carbon Emissions 2020-2050*



**DER operating emissions updated*

BYGG MEISTER
DESIGN | BUILD

Net Costs 2020-2050



Deep energy retrofits are not (currently) a cost-effective decarbonization strategy for single-family homes. For now, we think all-electric moderate retrofits are where Byggmeister can have the most impact, but if experience or data indicate otherwise, we stand ready to pivot.

BE23 KEYNOTE CONCLUSION

A SYSTEMIC CRITIQUE

RESPONSE TO THE NESEA BE BOSTON 2023 WEDNESDAY KEYNOTE, "WHY WE STOPPED DOING DEEP ENERGY RETROFITS"

Michael Hindle

WE ARE TOLD WE CANNOT AFFORD TO DO THIS

AND YET THIS COST EFFECTIVE

A ONE-WAY TRIP

IT'S COST EFFECTIVENESS TO DO THIS

EXTRACTIVE, LINEAR ECONOMICS - A ONE-WAY TRIP

AND WHAT ABOUT THE COST EFFECTIVENESS OF THIS

ABANDONED POPULATIONS, SINKING IN WASTE

Child Waste picker in Malaysia:JP Getty Images

The west and rich populations export all negative externalities

OBSCENE, SPECULATIVE, ECONOMICS FOR BILLIONAIRES IS COST EFFECTIVE

OPULENCE ONLY FOR A FEW

AND OF COURSE , OUR FAVORITE - MILITARISM

IRAQ WAR COST $ 1.3 TRILLION TO THE US ALONE

Image credit: Oregon Public Broadcasting

"It is just not cost-effective"

Energy is cheap, construction is dear.

In a system predicated on

cheap fossil fuels . . .

and that intentionally externalizes impacts,

any cost effectiveness evaluation that attempts to internalize externalities is a forgone conclusion.

Image credit: Oregon Public Broadcasting

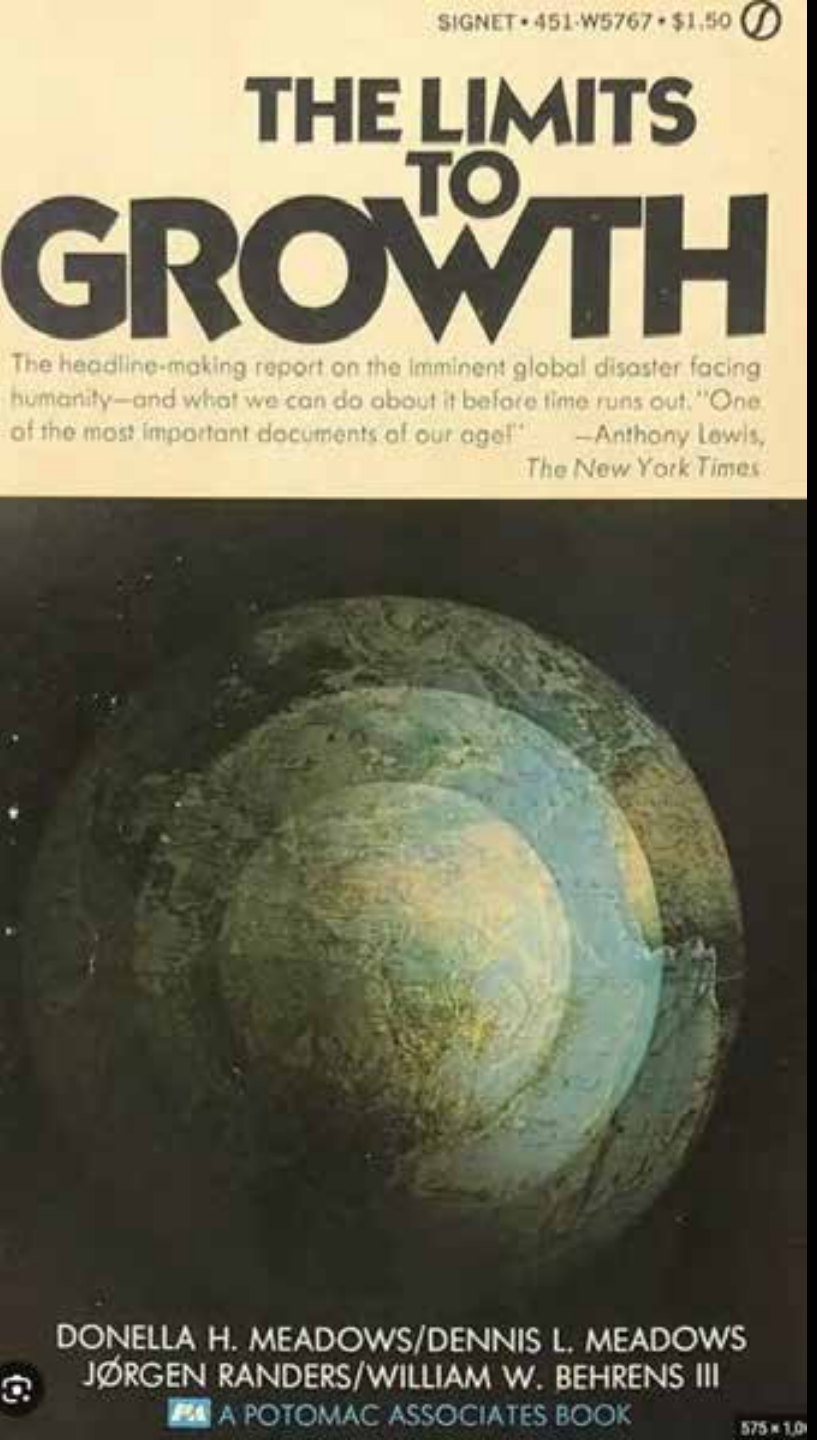
Image credit: Oregon Public Broadcasting

Image credit: Oregon Public Broadcasting

BUT I AM NOT SEING IT

WHY?

DAMAGE FROM KATRINA - MICHAEL APPLTON, NY DAILY NEWS ARCHIVE, GETTY IMAGES



SYSTEMS THINKING

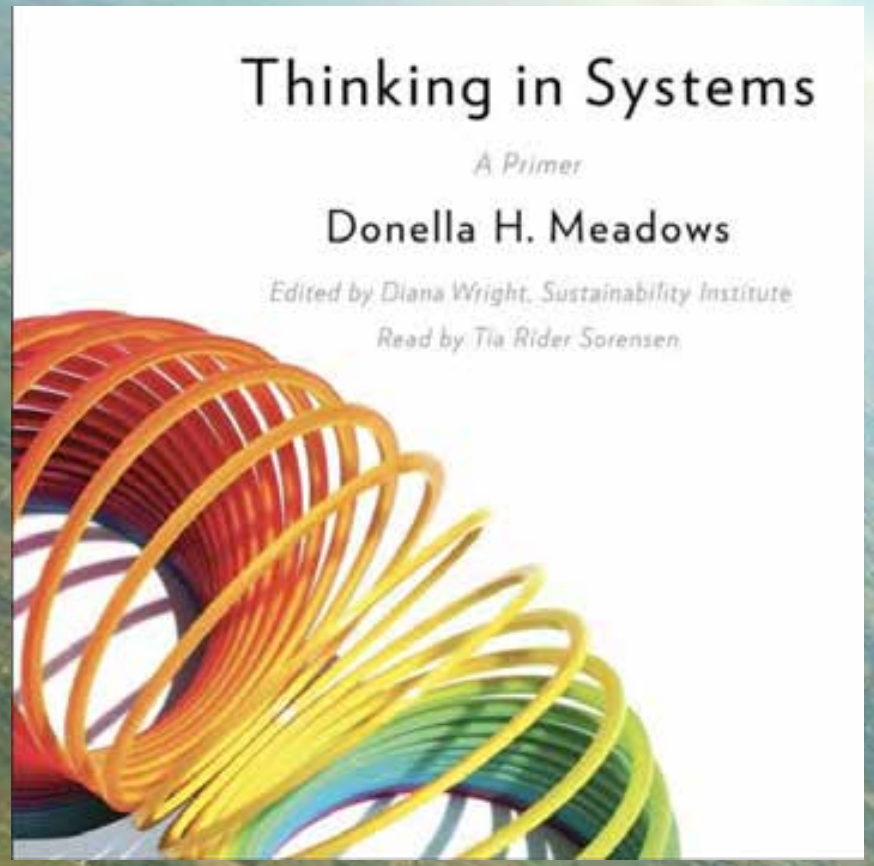
WHAT DYNAMICS MAKE SYSTEMS RESISTANT ?

Image credit Wall Street Journal

SYSTEMIC INERTIA

THE SYSTEM SETS THE RULES . . .
THE SYSTEM DECIDES WHAT HAS VALUE

SYSTEMS THINKING



FEEDBACK LOOPS

REINFORCING

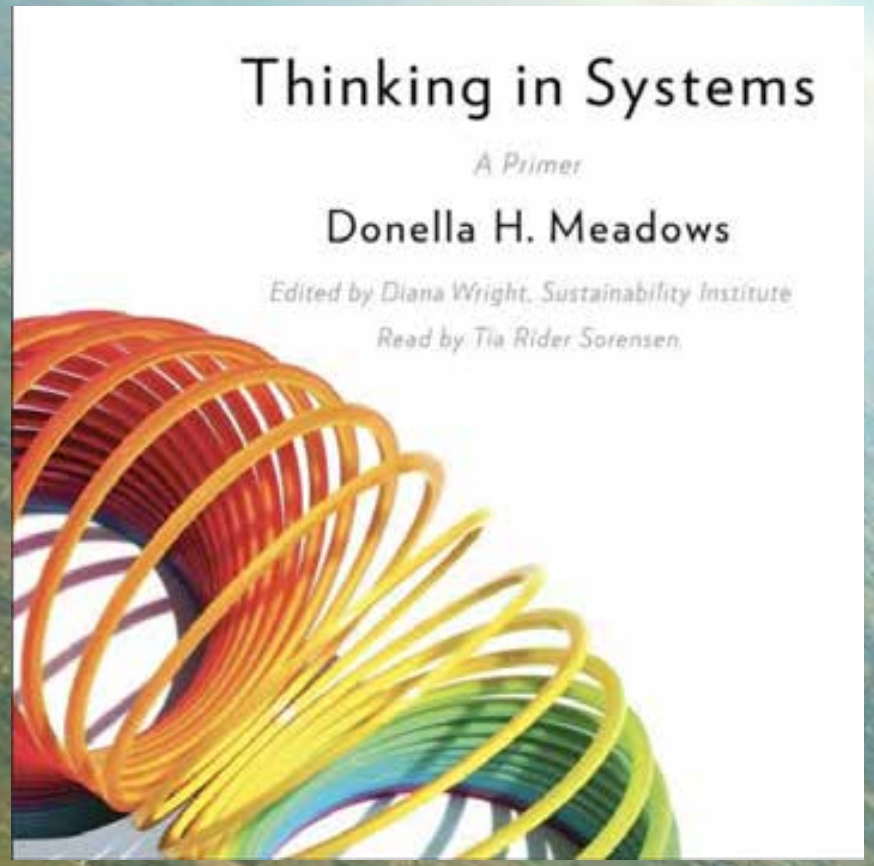
BALANCING OR RESTRAINING

REINFORCING OR RESTRAINING FEEDBACK LOOPS

Desertification exacerbates the drought in California's central valley

Market signal demands higher yield/acre → intensive mono-crop commodity production → tilling causes soil erosion → less organic matter in soil → higher use of fertilizer and pesticide + more irrigation → depletion of soil biome + less nutrients + moisture retained in soil → less robust plants → circle back to higher use of fertilizer, pesticide use + irrigation = runaway, self reinforcing feedback loop. We have lost 50% of the soil on planet earth in the last 150 years.

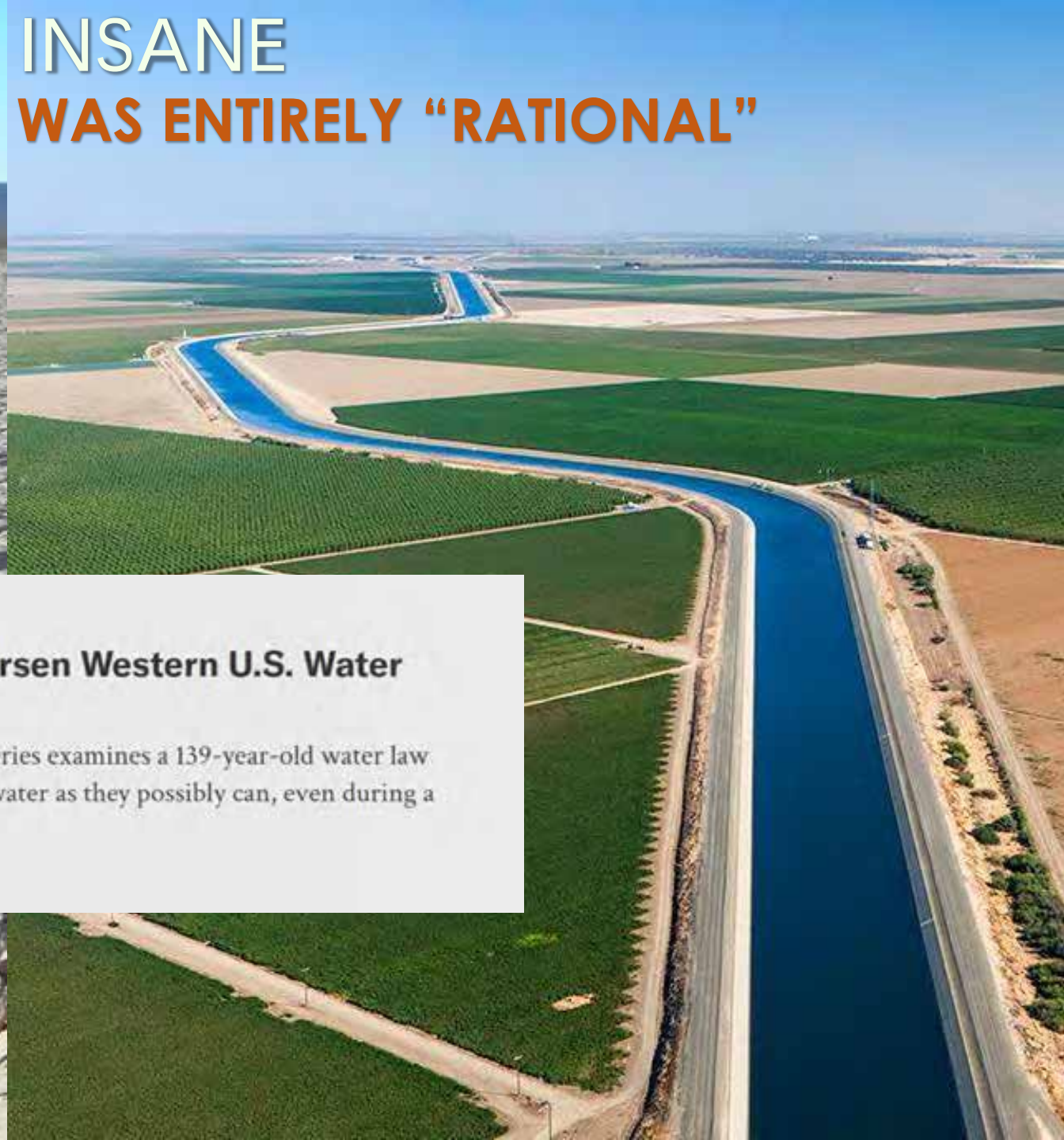
BOUNDED RATIONALITY



Most actors are behaving rationally within the confines of a defined set of boundaries with access to certain (limited) information, even if their behaviors seem irrational or are cumulatively destructive when viewed from a larger context.

OBVIOUSLY INSANE

AND YET EVERY BEHAVIOR WAS ENTIRELY "RATIONAL"



JUNE 9, 2015 | 19 MIN READ

Use It or Lose It Laws Worsen Western U.S. Water Woes

ProPublica's "Killing the Colorado" series examines a 139-year-old water law that pushes ranchers to use as much water as they possibly can, even during a drought

BY ABRAHM LUSTGARTEN & PROPUBLICA

BOUNDED RATIONALITY

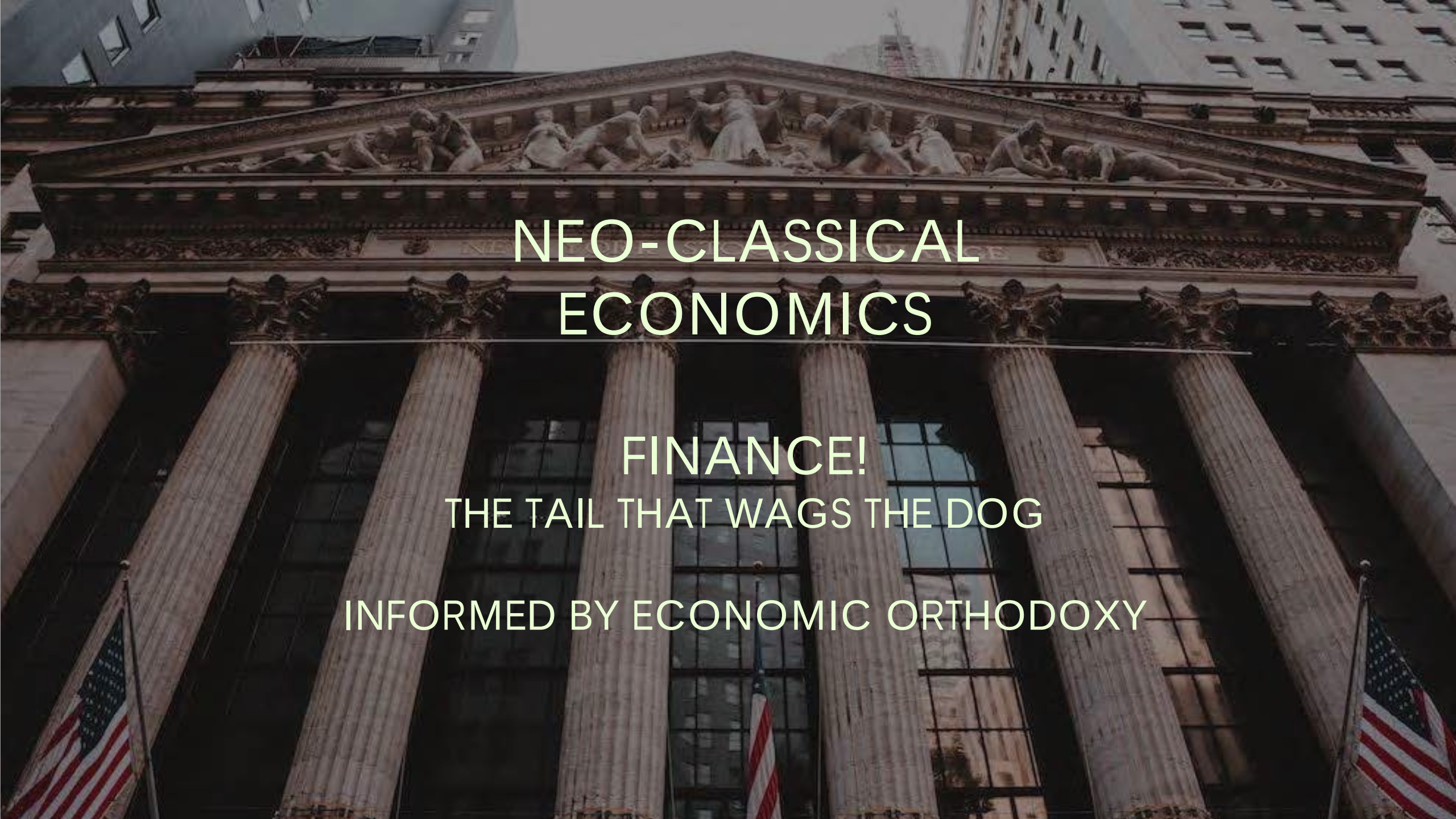
A CLEAR-CUT YIELDS A HIGH, SHORT-TERM YIELD OF ONE COMMODITY FOR SHAREHOLDERS, BUT DECIMATES THE ECOSYSTEM

INDIGENOUSLY MANAGED FORESTS LIMIT SHORT TERM YIELD, INCREASE YIELDS YEAR ON YEAR AND REMAIN HEALTHY

BOUNDED RATIONALITY

IF PUBLICLY TRADED TIMBER COMPANY HAS THE IMMEDIATE PRESSURE TO MAXIMIZE EARNINGS

A CLEAR-CUT YIELDS A HIGH, SHORT-TERM YIELD OF ONE COMMODITY FOR SHAREHOLDERS, BUT DECIMATES THE ECOSYSTEM



NEO-CLASSICAL ECONOMICS

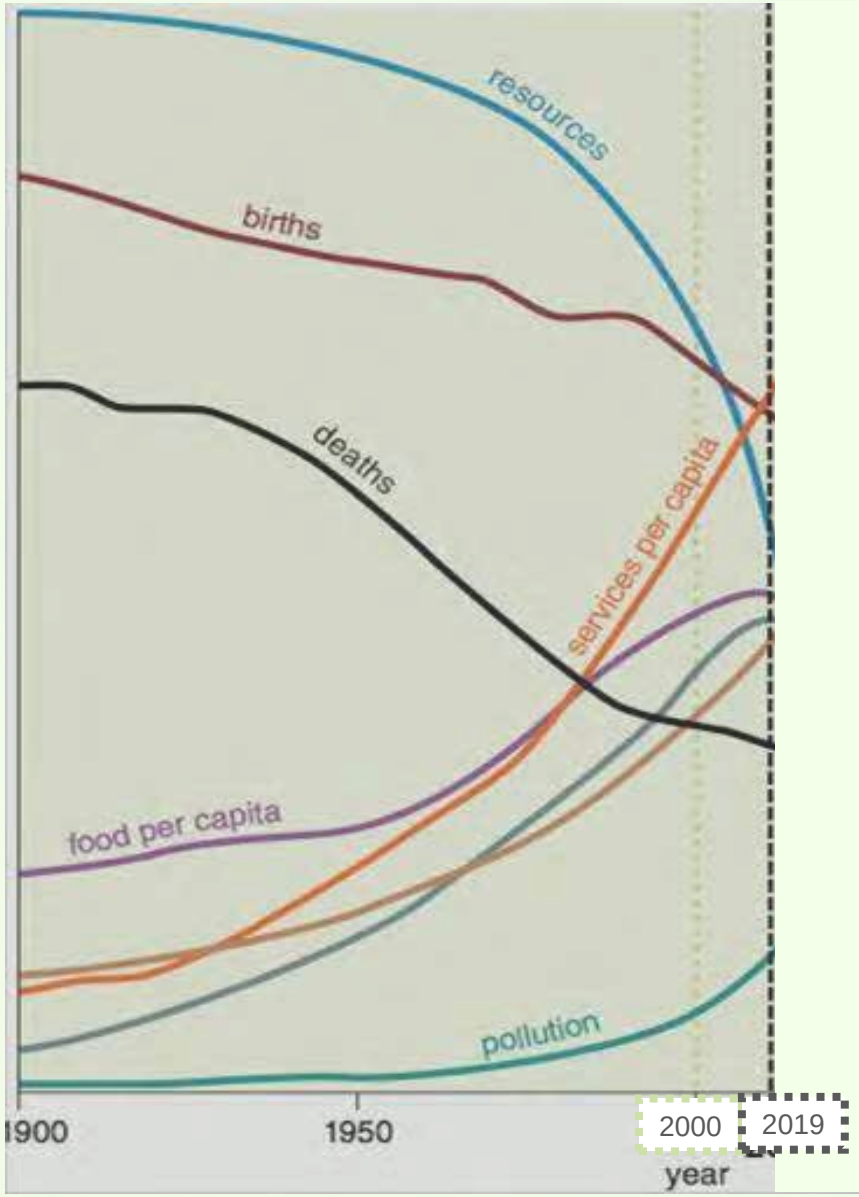
FINANCE!

THE TAIL THAT WAGS THE DOG

INFORMED BY ECONOMIC ORTHODOXY

THE PREVAILING PARADIGM OF GROWTH

NEO-CLASSICAL ECONOMISTS' ABSURD CONFIRMATION BIAS



I ONLY CONSIDER THE COST TO ME

FIRST COST IS PARAMOUNT

(VERY) SHORT TIME HORIZON

IF IT IS NOT ON MY PRO-FORMA IT MUST NOT EXIST

EXTERNALIZE LIABILITIES

WON'T THE MARKETS FIGURE IT OUT?

The efficient-market hypothesis (EMH) is a hypothesis in financial economics that states that asset prices reflect all available information.

This is obviously absurd!

BLINDNESS OF THE MARKETS

The efficient-market hypothesis (EMH) is a hypothesis in financial economics that states that asset prices reflect all available information.

Markets live in denial of limits. They are essentially blind to non-linear impacts, and work on incomplete information with numerous distortions and delays of feedback.

Paraphrased from "Limits to Growth"

BLINDNESS OF THE MARKETS + LAYERED LIMITS

BLINDNESS OF THE MARKETS + LAYERED LIMITS

BLINDNESS OF THE MARKETS + LAYERED LIMITS

BLINDNESS OF THE MARKETS + LAYERED LIMITS

BLINDNESS OF THE MARKETS + LAYERED LIMITS

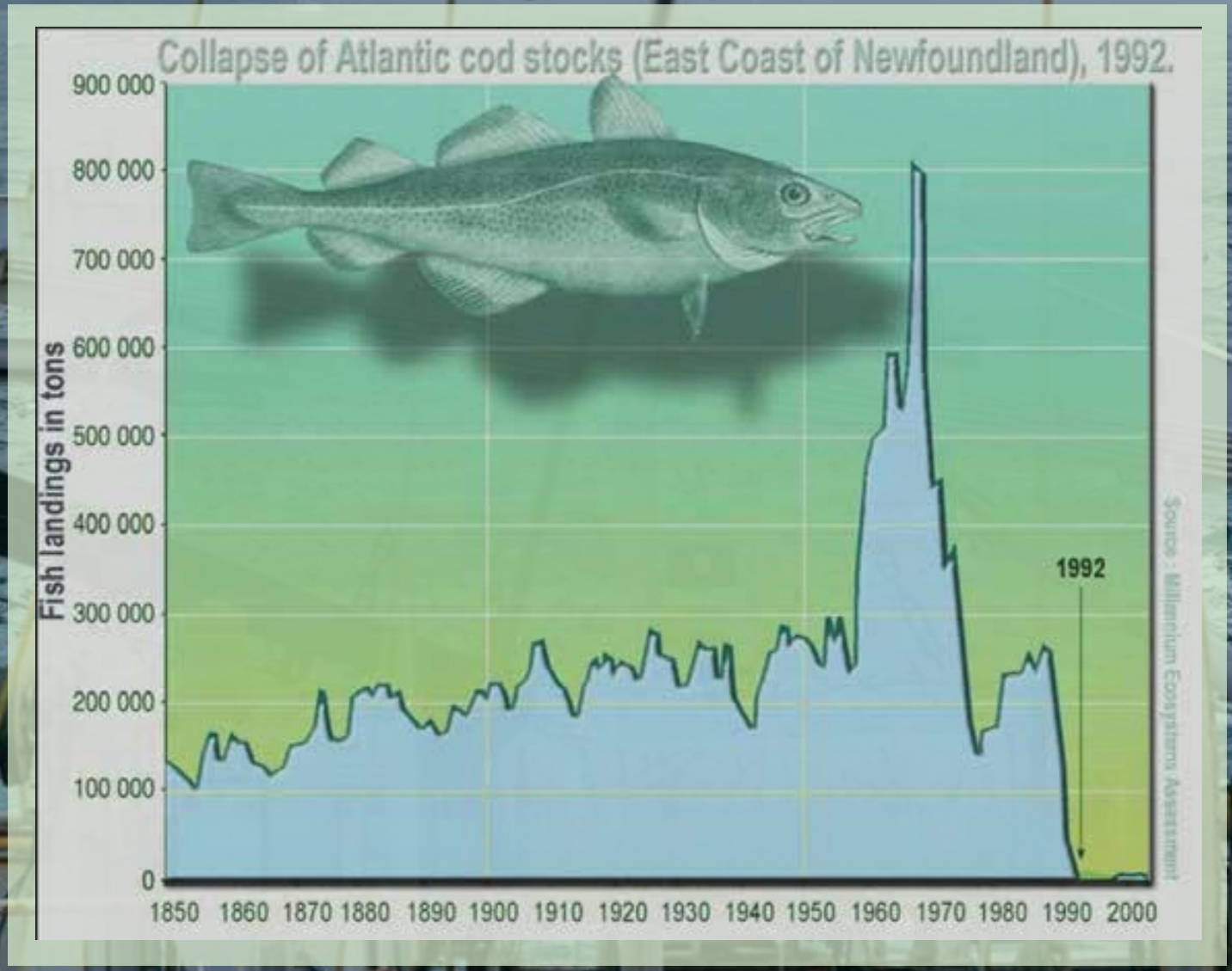
THE ULTIMATE **BOUNDED** RATIONALITY

PERPETUAL **GROWTH**

WHAT'S NOT TO **LOVE?**

Most actors are behaving rationally within the confines of a defined set of boundaries with access to certain (limited) information, even if their behaviors seem irrational or are cumulatively destructive when viewed from a larger context.

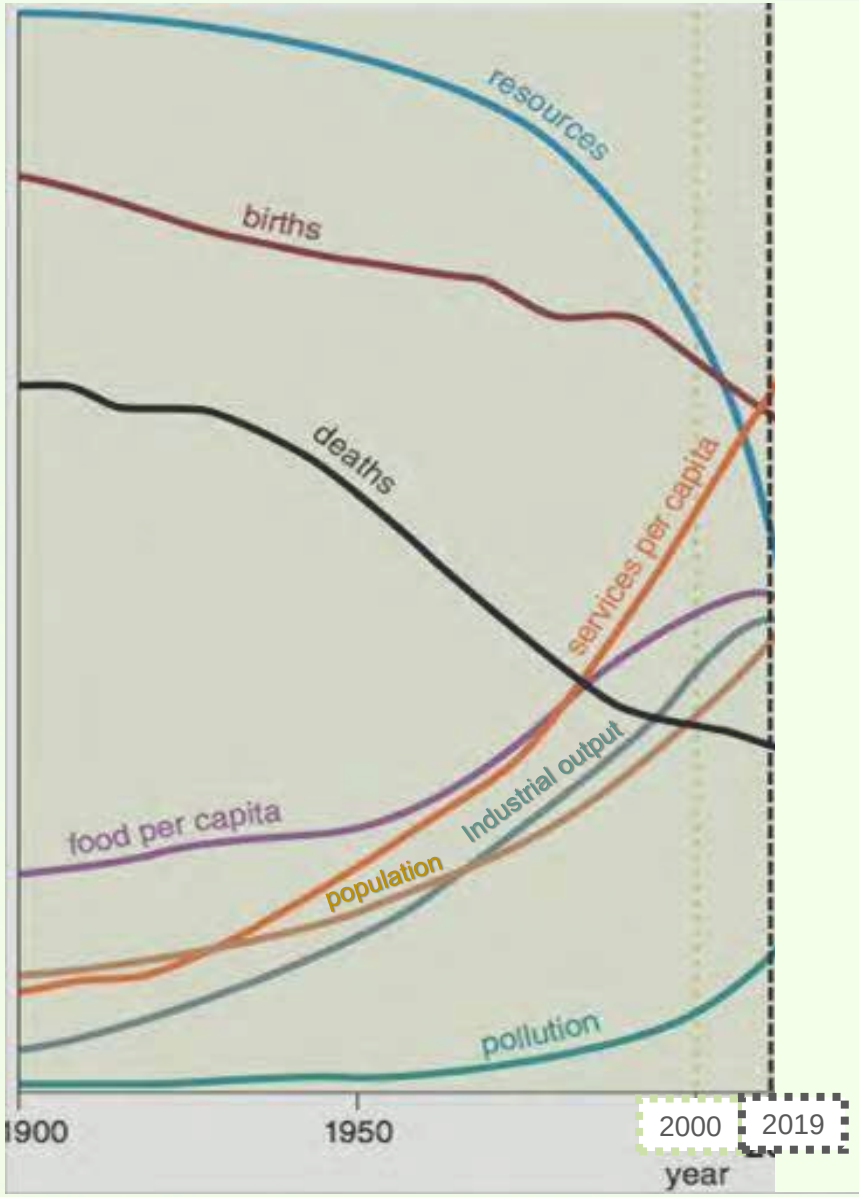
If markets recognize limits, they tend to invest MORE in extraction and accelerate decline of the resource, leading to collapse!



SYSTEMS ANALYSIS **BOUNDARIES**

THE PREVAILING PARADIGM OF **GROWTH**

NEO-CLASSICAL ECONOMISTS' ABSURD CONFIRMATION BIAS



I ONLY CONSIDER THE COST **TO ME**

FIRST COST IS **PARAMOUNT**

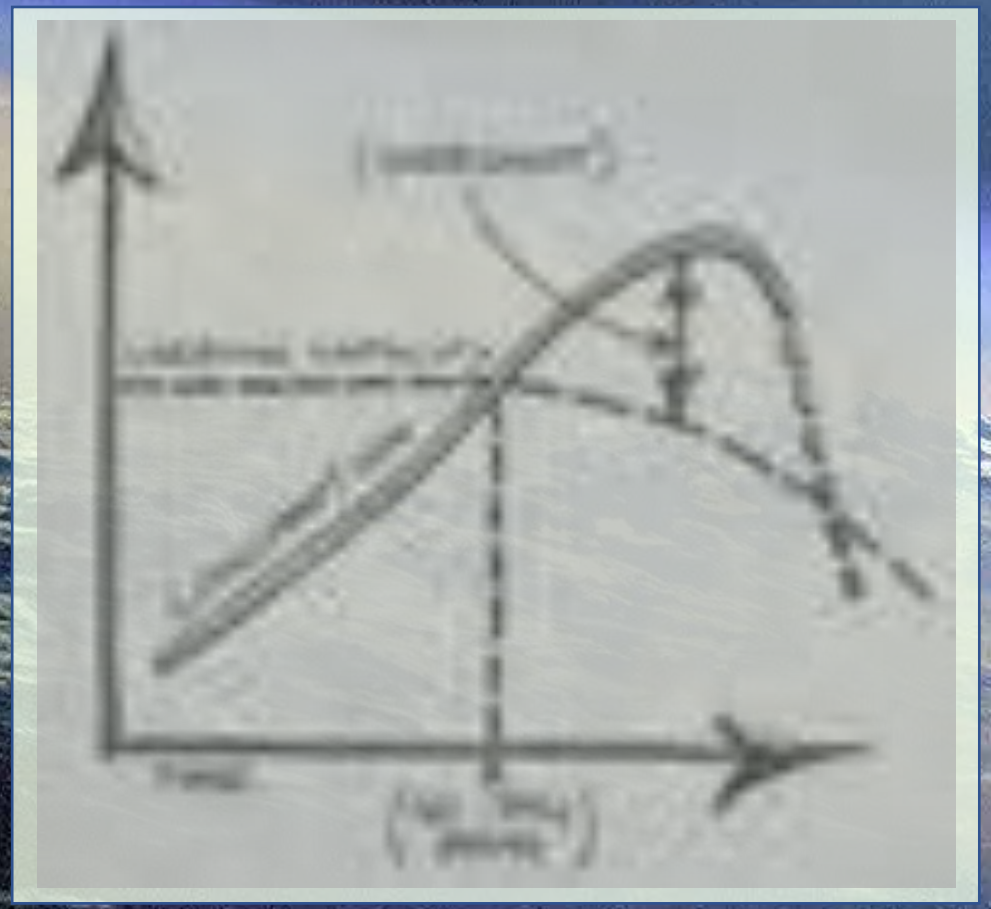
(VERY) SHORT TIME **HORIZON**

IF IT IS NOT ON MY PRO-FORMA **IT MUST NOT EXIST**

EXTERNALIZE **LIABILITIES**

CHANGE YOUR SYSTEMS ANALYSIS **BOUNDARIES**

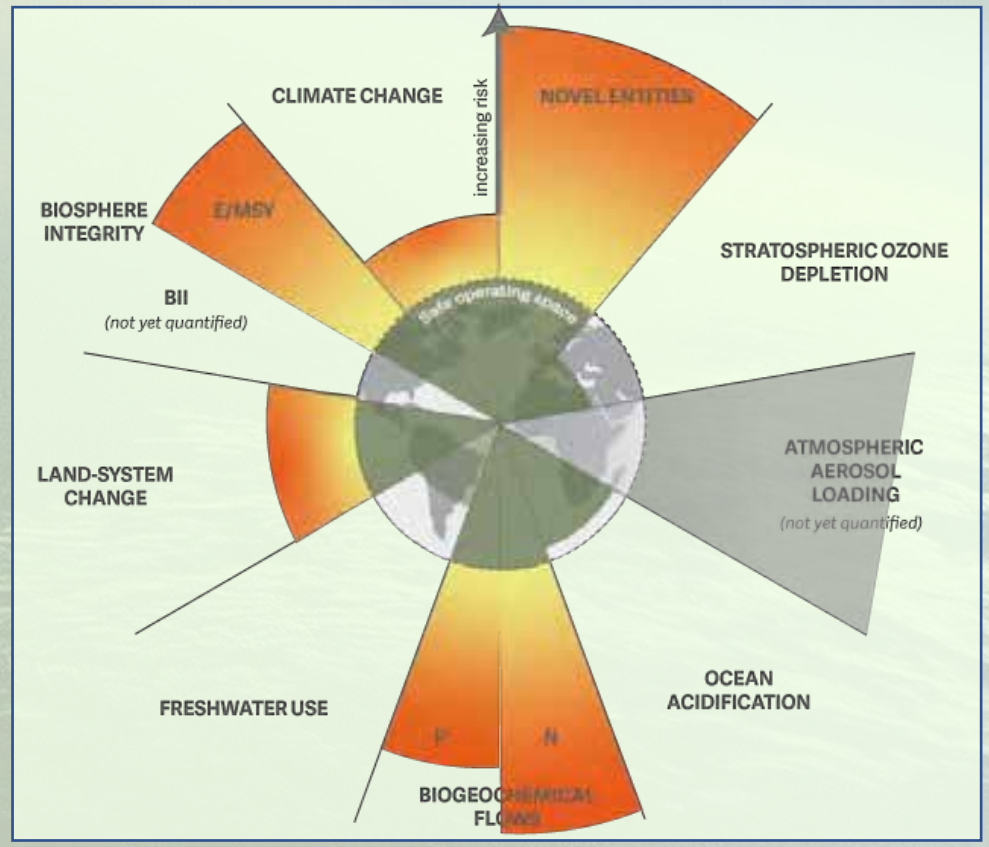
WE NEED THREE PLANETS

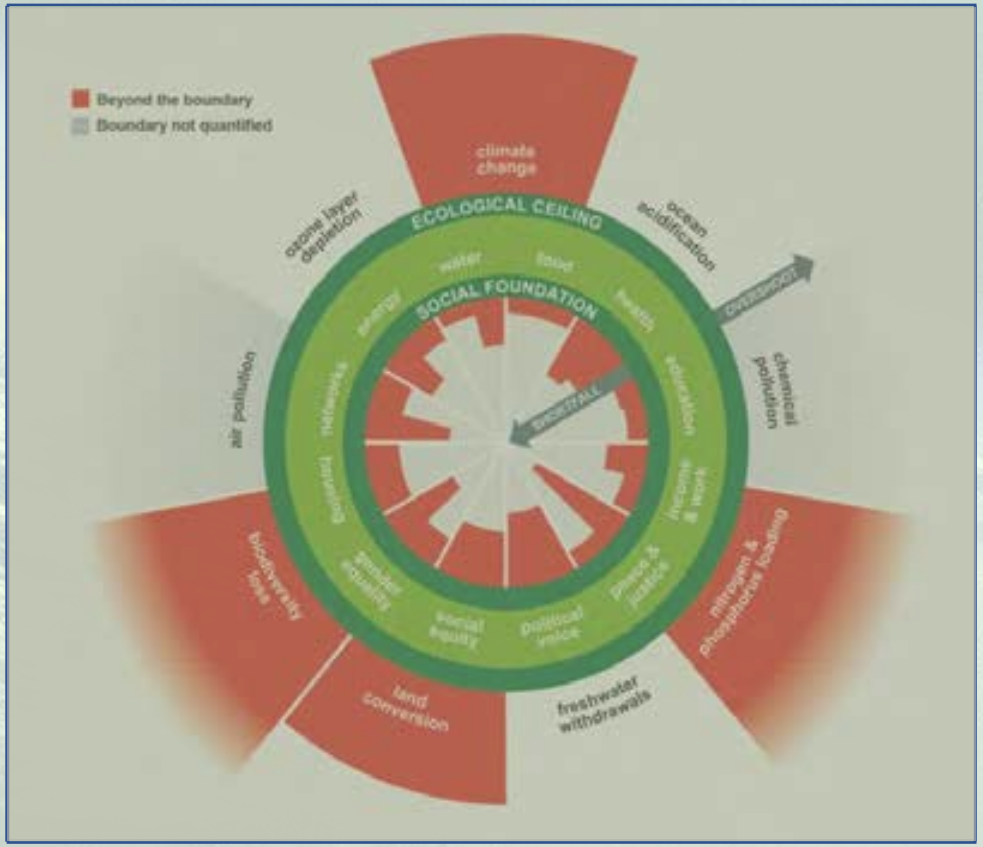


*FROM **"OUR ECOLOGICAL FOOTPRINT"** BY MATHIS WACKERNAGEL + WILLIAM REES,1962*

OVERSHOOT + COLLAPSE

WE NEED THREE PLANETS





OVERSHOOT + COLLAPSE

OVERSHOOT IS REALITY : WHAT IS OUR FUTURE?

FOUR CONCEIVABLE OUTCOMES

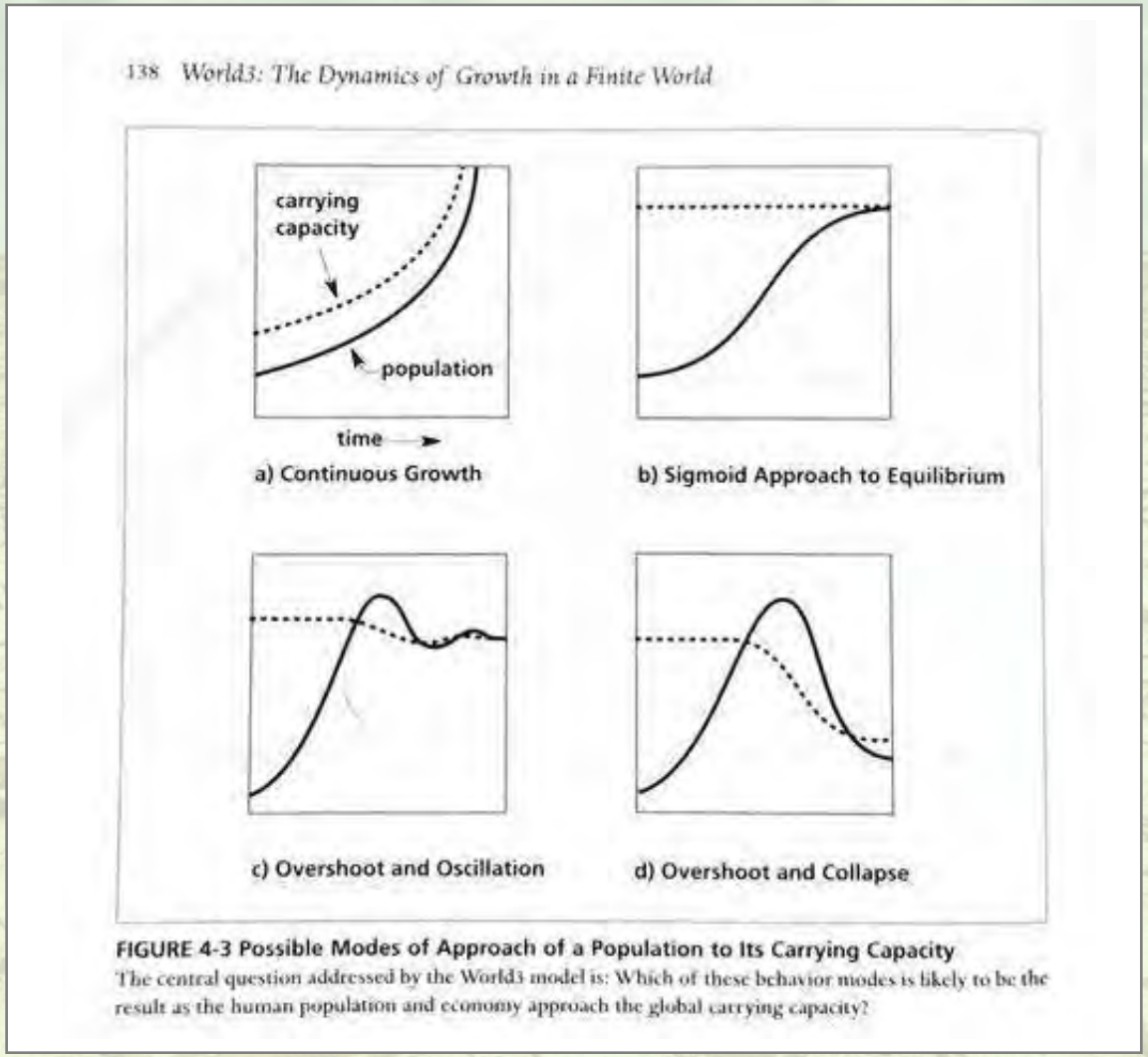


FIGURE 4-3 Possible Modes of Approach of a Population to Its Carrying Capacity
The central question addressed by the World3 model is: Which of these behavior modes is likely to be the result as the human population and economy approach the global carrying capacity?

a) Pure fantasy

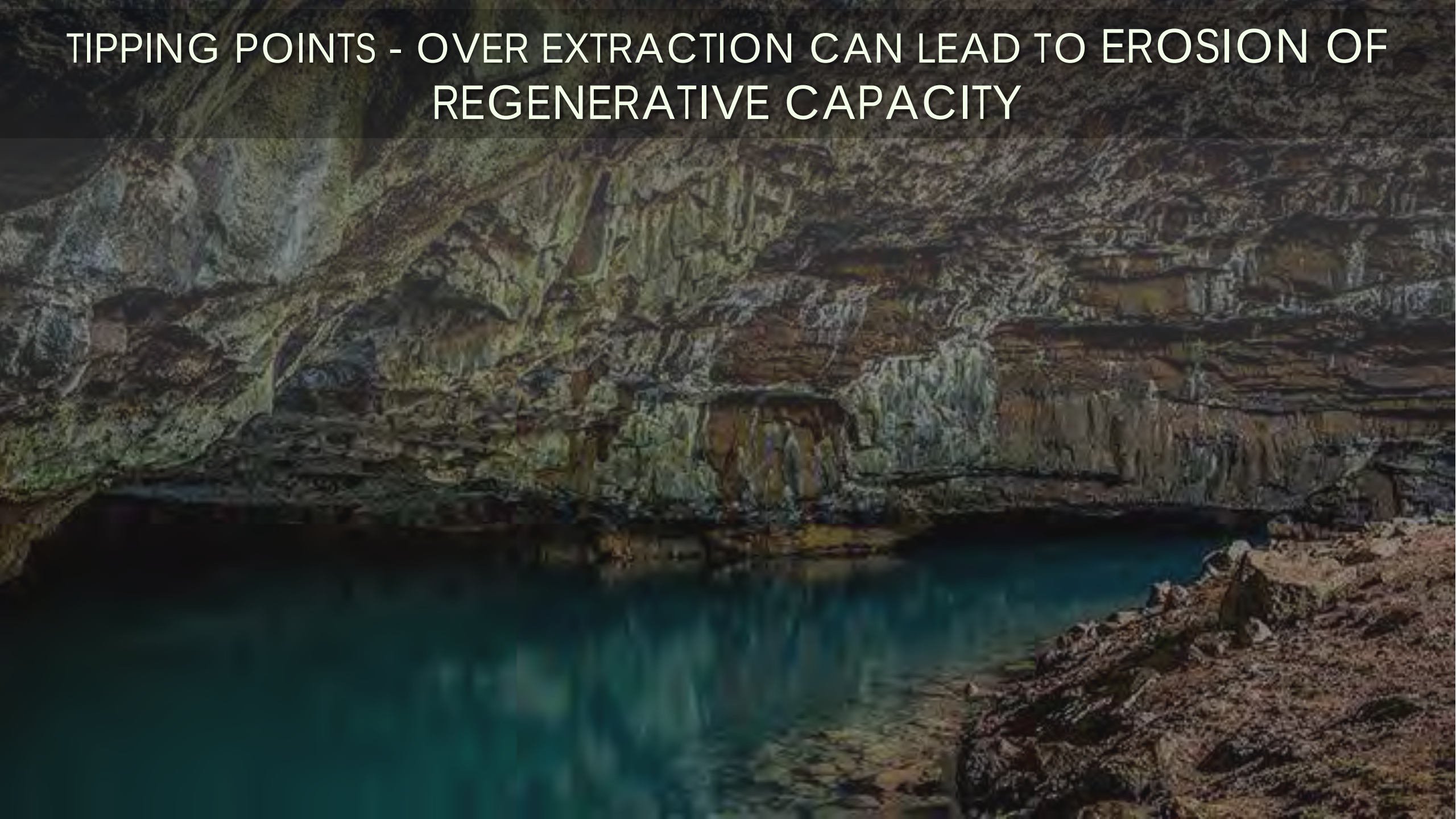
b) Too late

c) The *ONLY* available path

d) Our current trajectory

Recent Past, 1961 - 1979

TIPPING POINTS - OVER EXTRACTION CAN LEAD TO EROSION OF REGENERATIVE CAPACITY



FORMERLY RENEWABLE RESOURCES

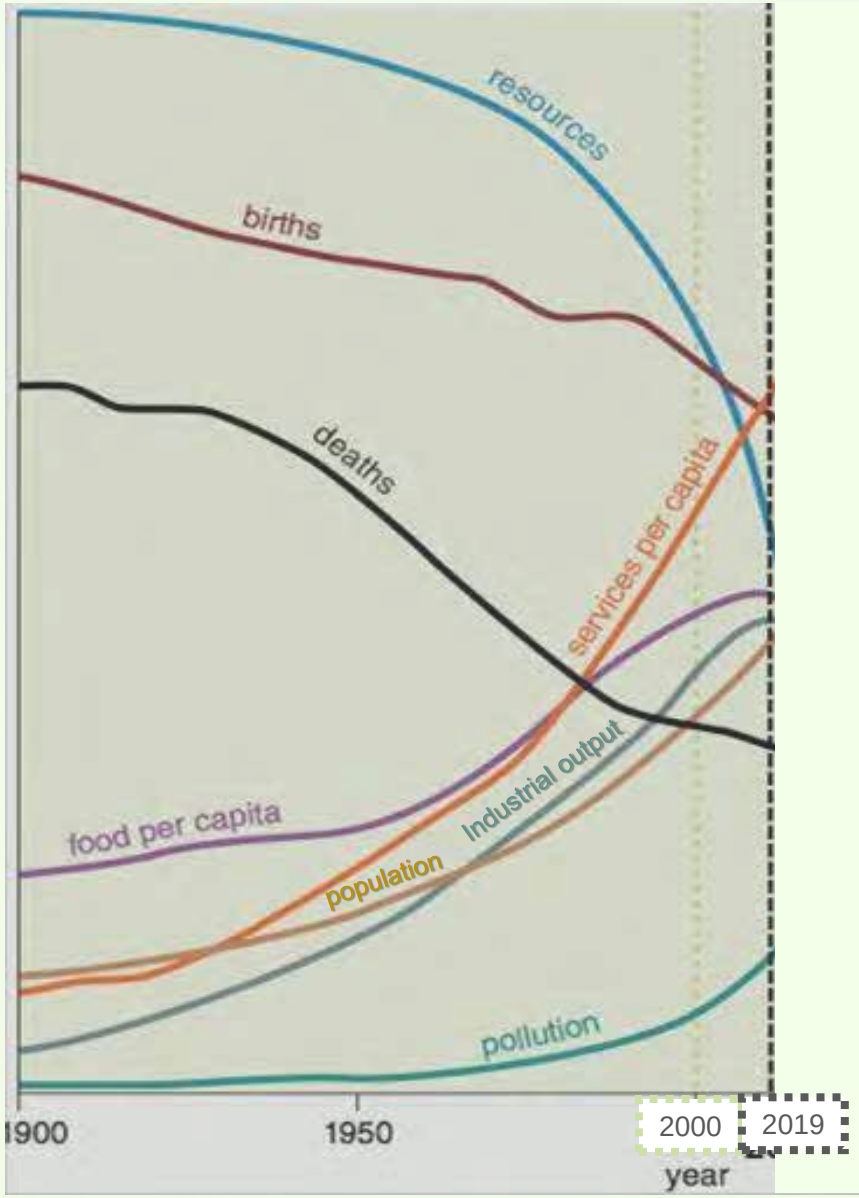
EROSION OF REGENERATIVE CAPACITY

ALL HAVE REGENERATION RATES - SOME ARE ERODABLE

MAY BE GONE FOREVER (FOR HUMAN TIMESCALE)

THE PREVAILING PARADIGM OF **GROWTH**

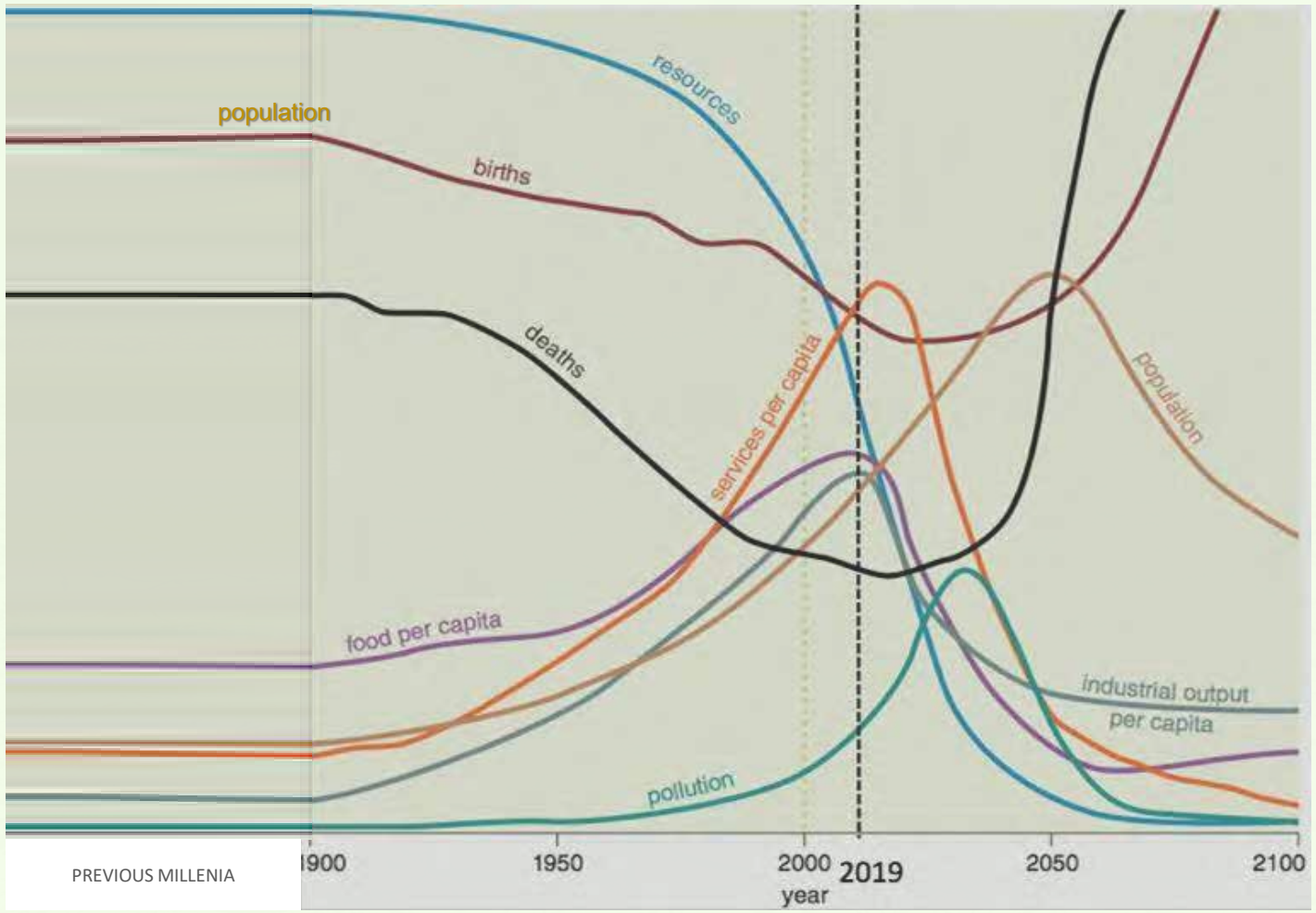
NEO-CLASSICAL ECONOMISTS' ABSURD CONFIRMATION BIAS



PERPETUAL **GROWTH**

WHAT'S NOT TO **LOVE?**

THE NON-DELUSIONAL VIEW



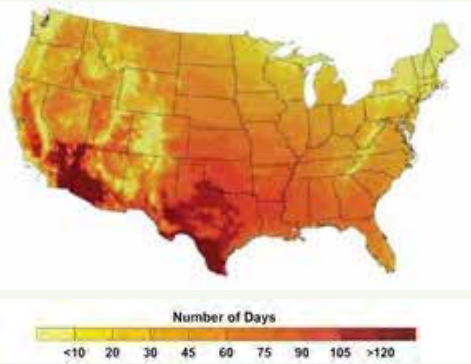
EXPONENTIAL, NON-LINEAR VARIABLES

DELAYED FEEDBACK

DESTRUCTION OF RESOURCES AND EROSION OF RENEWABILITY

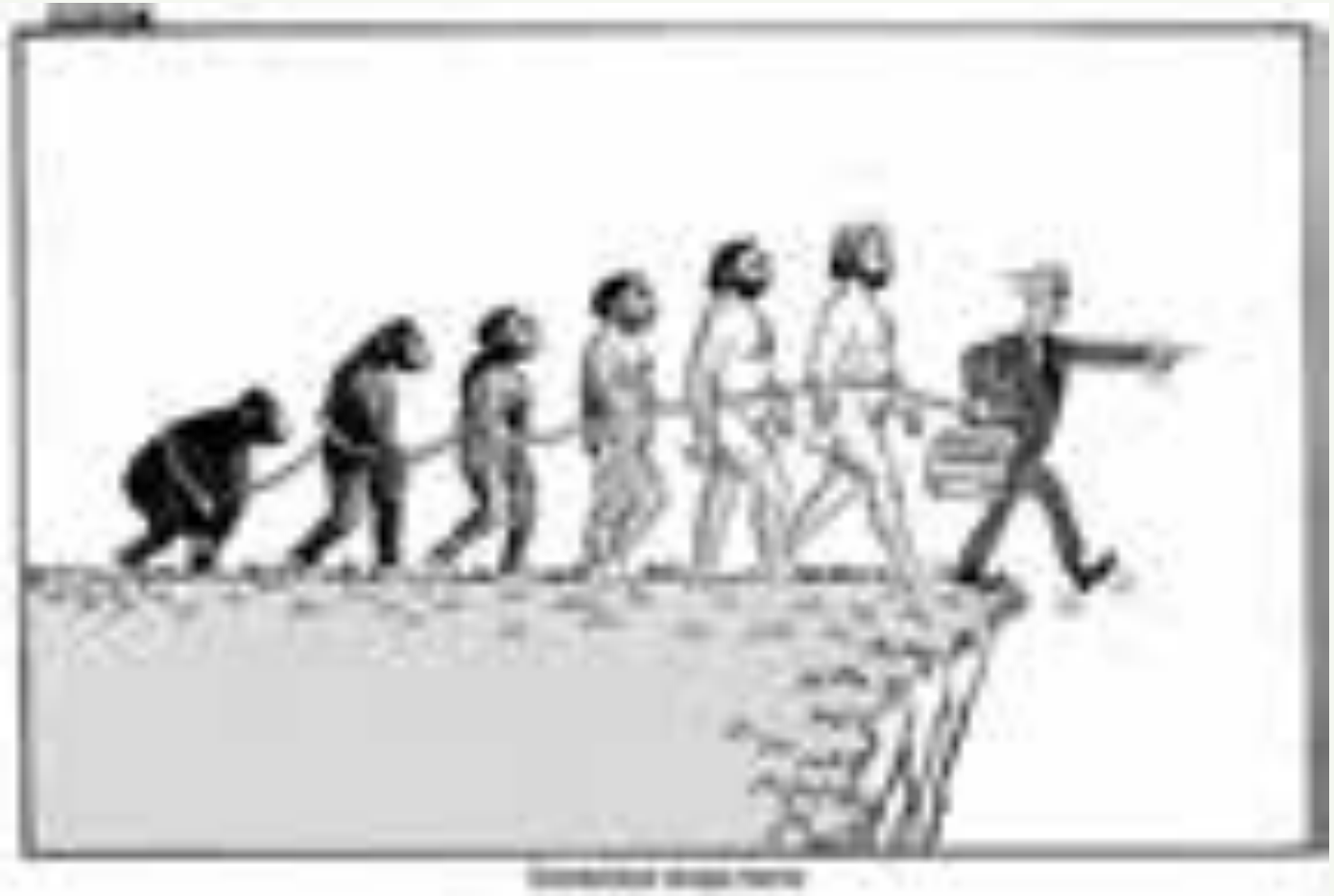
LAYERED LIMITS

OVERSHOOT AND COLLAPSE



temperature map images: U.S. Global Change Research Program

ECONOMIC ORTHODOXY



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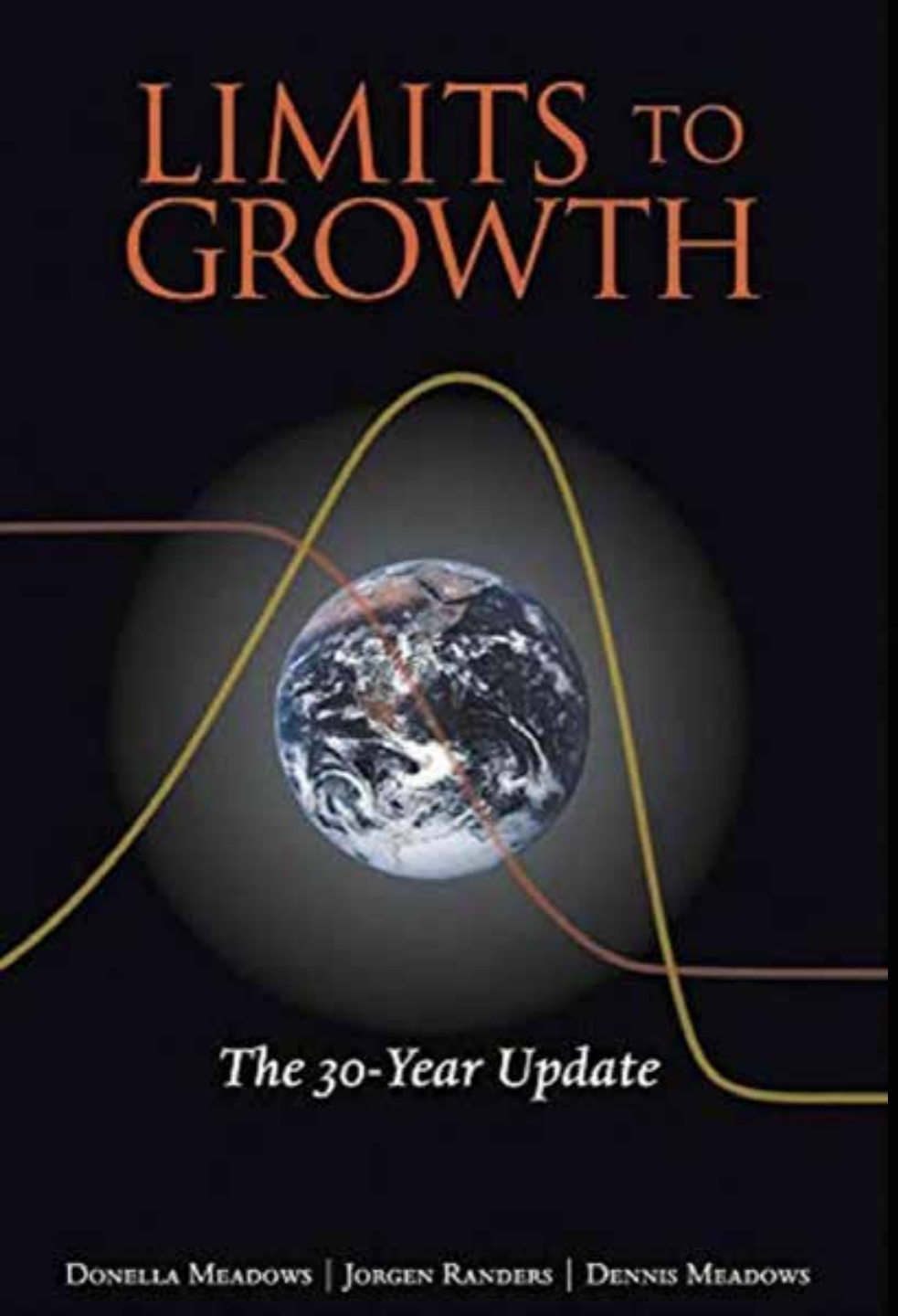
EXTERNALIZE LIABILITIES

WE ARE BEING COST BENEFITED TO DEATH

Image credit: Oregon Public Broadcasting

SO, I SAY

LONG LIVE THE DER



SYSTEMIC THINKING

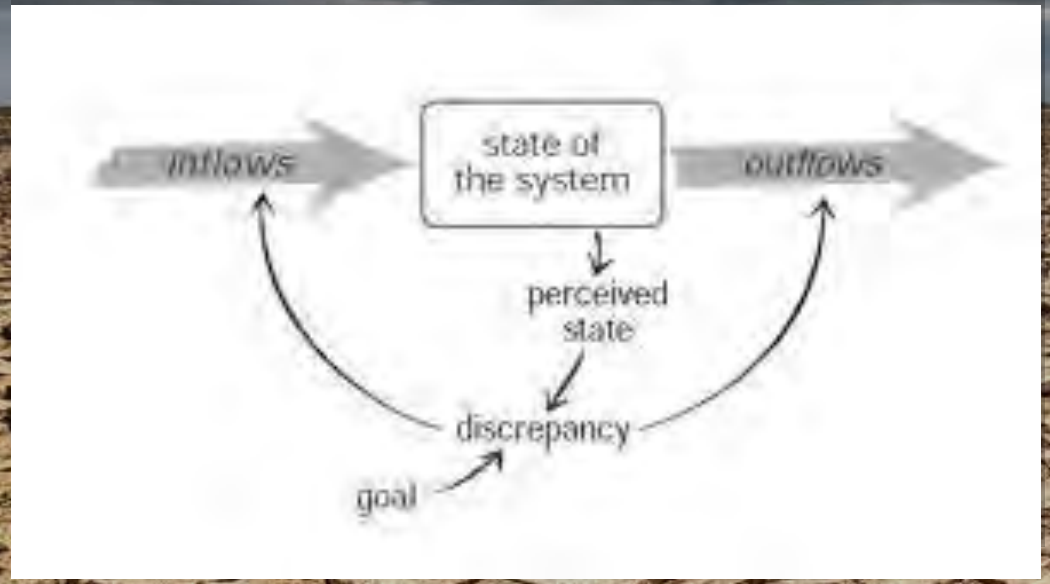
SYSTEMIC ACTION

HOW DO WE GAIN PURCHASE WITHIN THE SYSTEM?

WHAT IS THE GOAL?

REINFORCING OR RESTRAINING FEEDBACK LOOPS

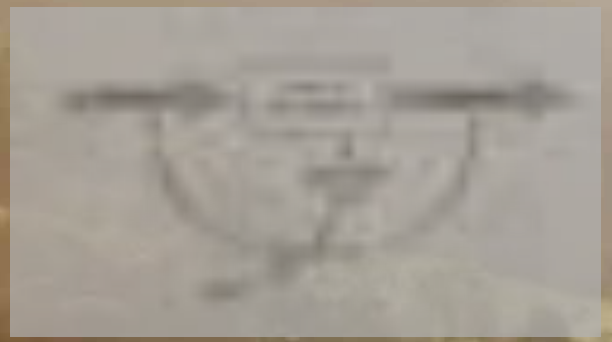
WHAT IS THE MARKET SIGNAL?



Desertification exacerbates the drought in California's central valley

Market signal demands higher yield/acre → intensive mono-crop commodity production → tilling causes soil erosion → less organic matter in soil → higher use of fertilizer and pesticide + more irrigation → depletion of soil biome + less nutrients + moisture retained in soil → less robust plants → circle back to higher use of fertilizer, pesticide use + irrigation = runaway, self reinforcing feedback loop. We have lost 50% of the soil on planet earth in the last 150 years.

WHAT IF WE PROVIDE A DIFFERENT MARKET SIGNAL?



REGEN
NETWORK

Platform for a Thriving Planet

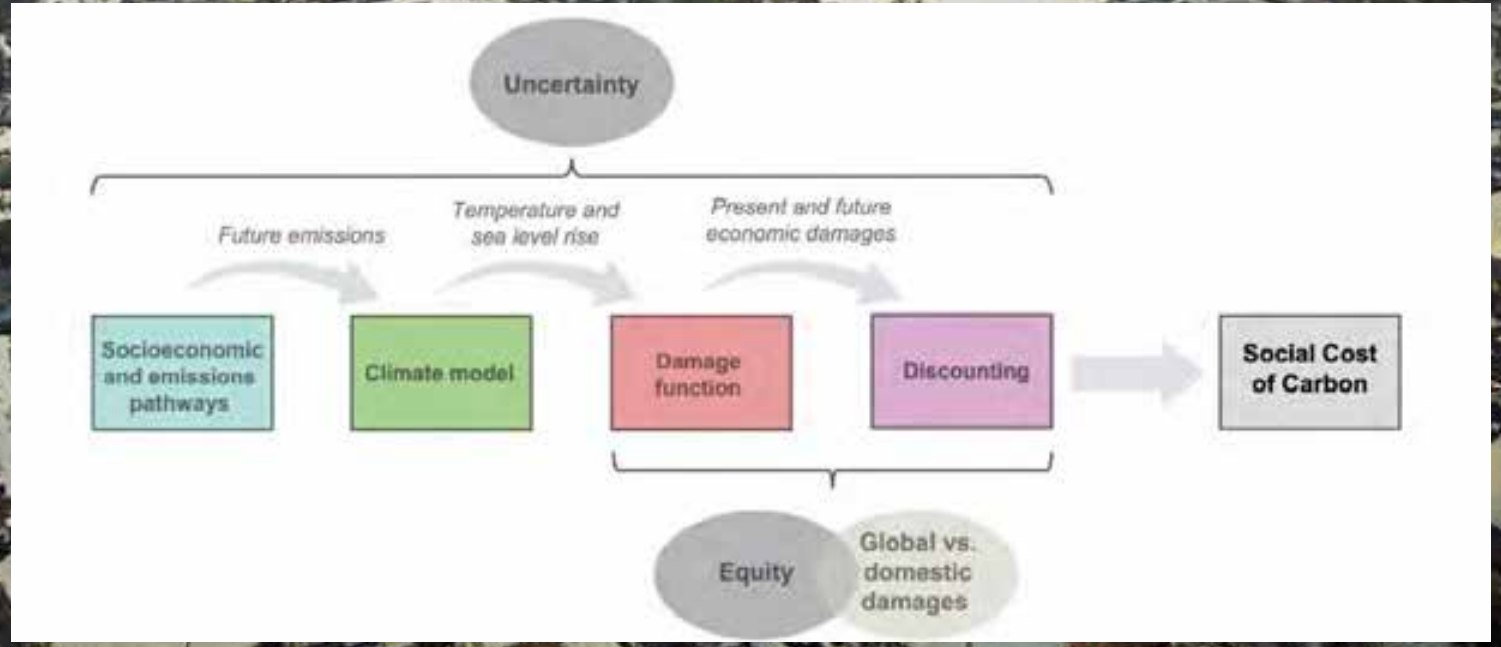
Science Team Deep Dive
1/22/2021

Regen Network Science Team
Gisel Booman
Sam Bennetts
Sophia Leiker

Satellite Carbon monitoring in soil pays farmers to engage in regenerative agriculture

WHAT IS THE COST OF EMITTING CARBON?

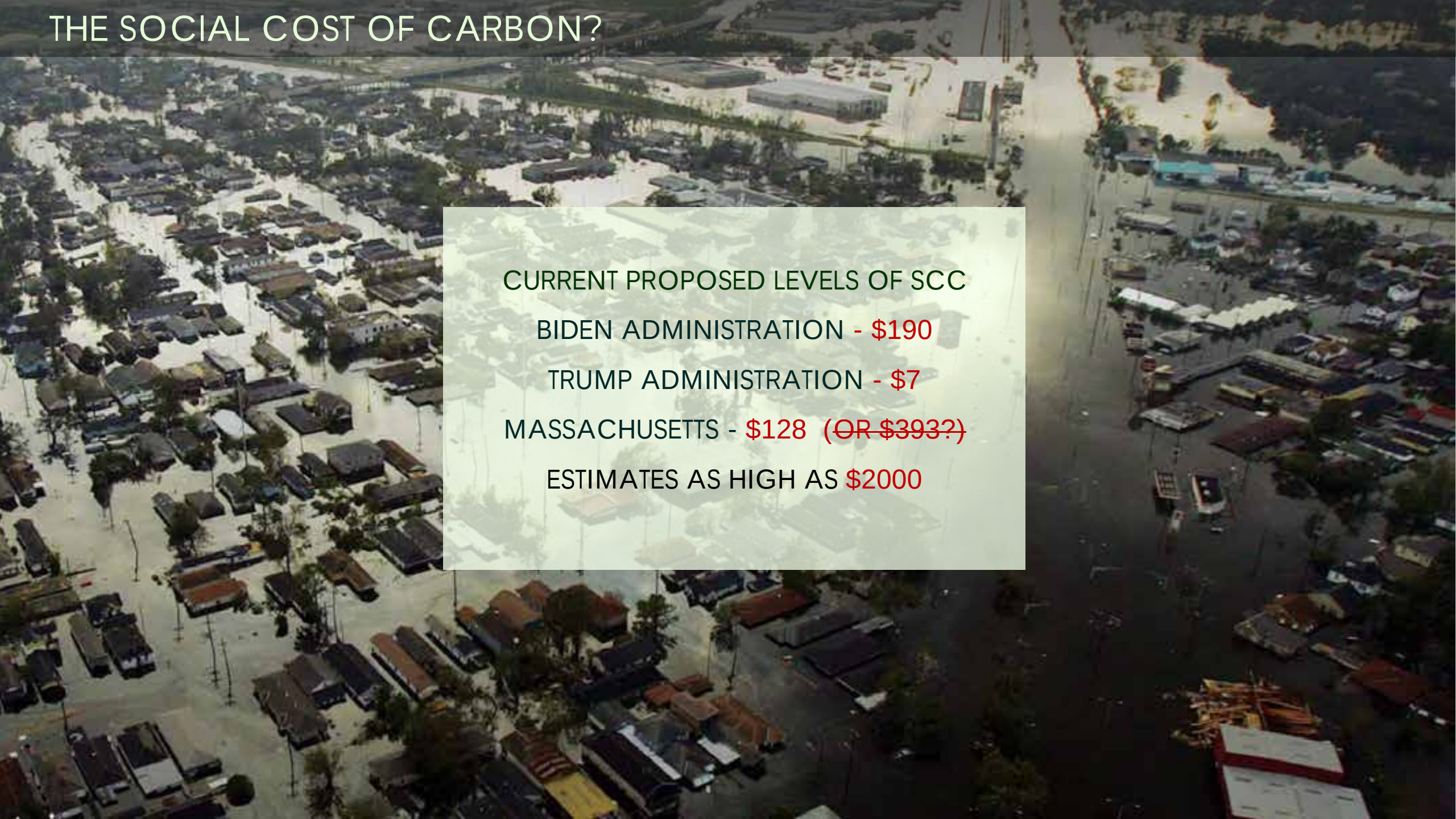
THE SOCIAL COST OF CARBON?



- Cost of Future Damages
- vs.
- Cost of Mitigation

- To Determine *"Optimal"* Policy

THE SOCIAL COST OF CARBON?



CURRENT PROPOSED LEVELS OF SCC

BIDEN ADMINISTRATION - $190

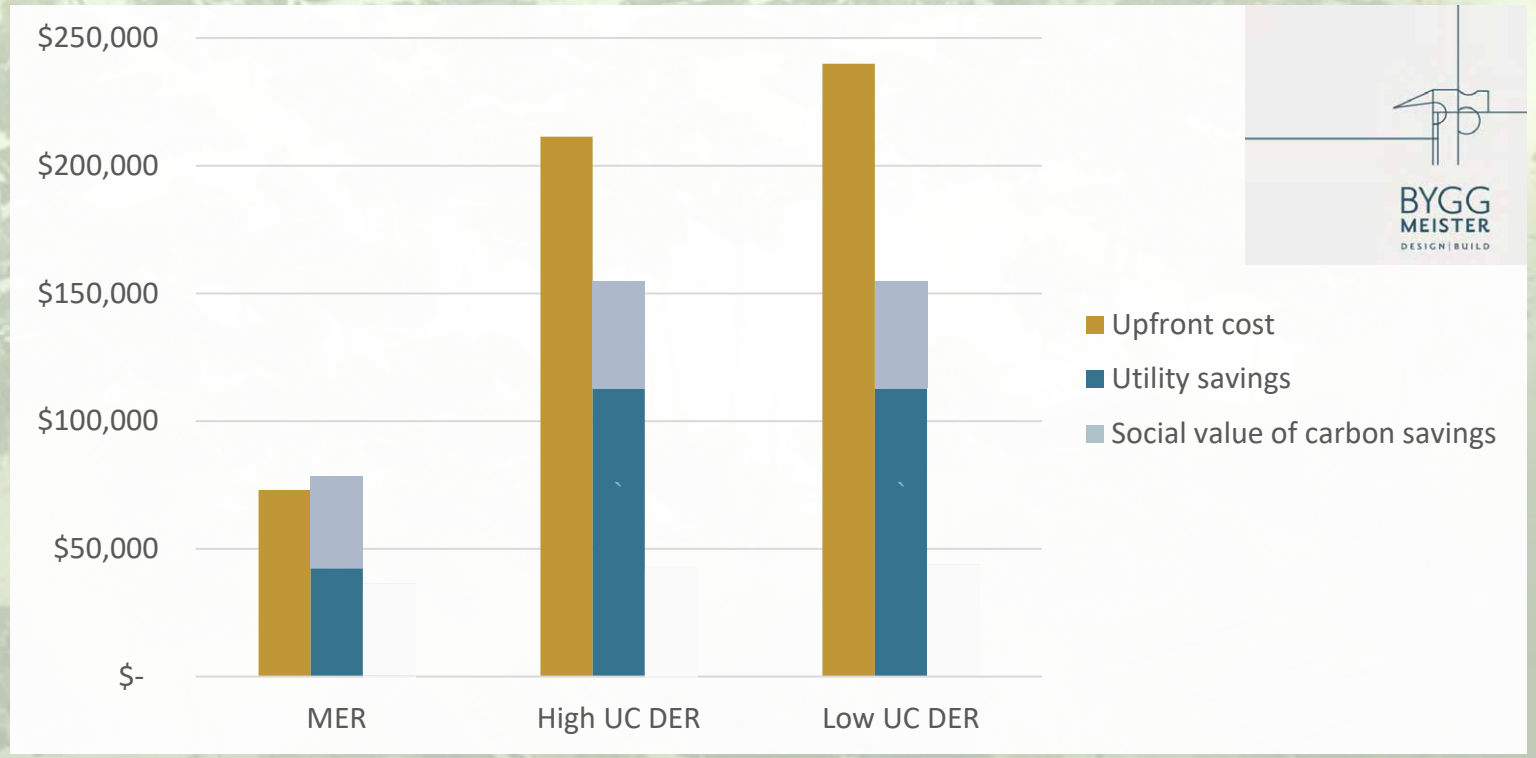
TRUMP ADMINISTRATION - $7

MASSACHUSETTS - $128 (~~OR $393?~~)

ESTIMATES AS HIGH AS $2000

THE SOCIAL COST OF CARBON?

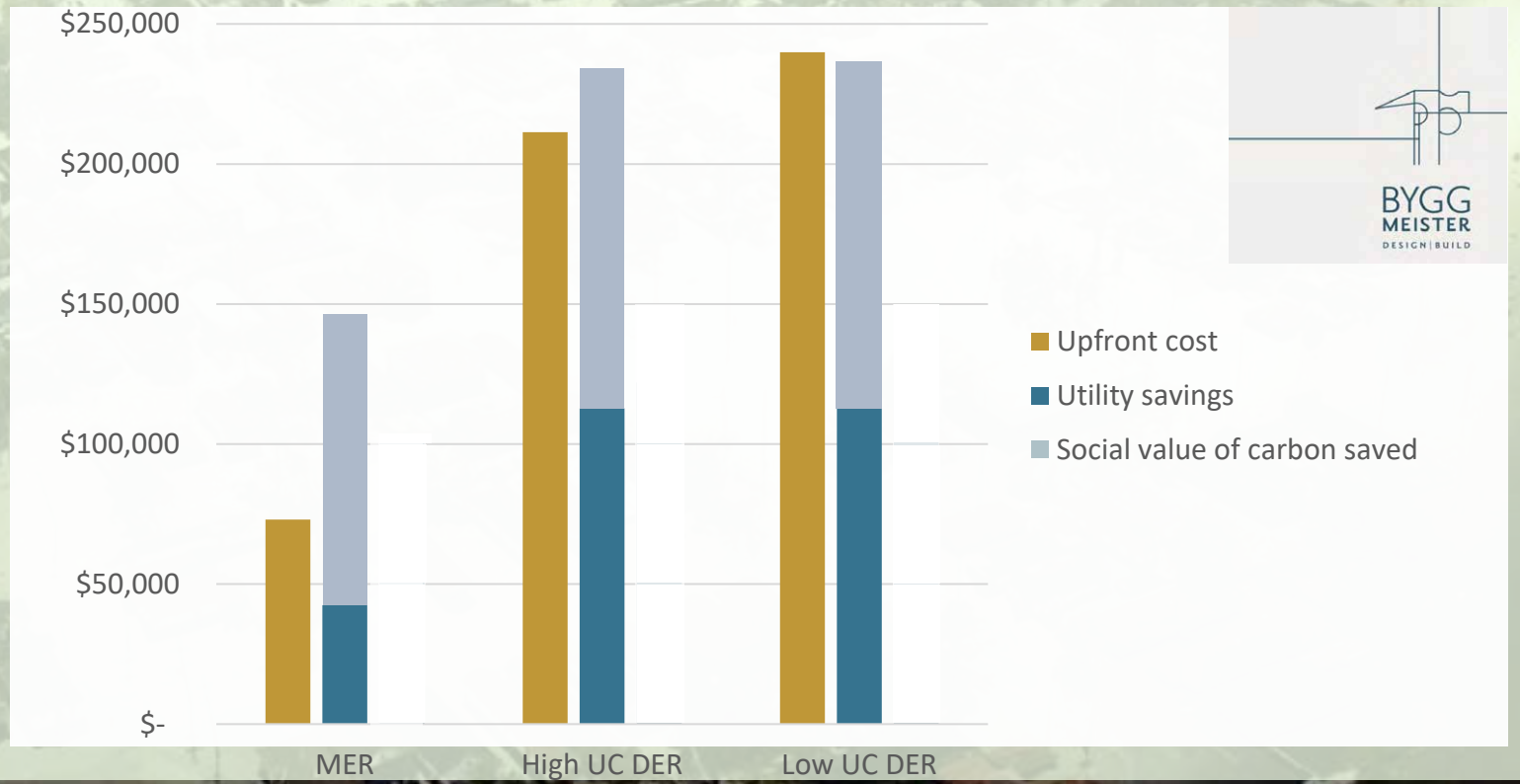
NET COST 2020-2050 **MASSACHUSETTS' SCC** - $128



	Net Cost (Savings) 2020-2050
Moderate Retrofit	$(4,881)
High UC DER	$56,574
Low UC DER	$84,180

THE SOCIAL COST OF CARBON?

NET COST 2020-2050 **MASSACHUSETTS' SCC** - $393



	Net Cost (Savings) 2020-2050
Moderate Retrofit	$(72,654)
High UC DER	$(23,379)
Low UC DER	$2,173

THE CARINA, PITTSBURGH, PA

Passive to POSITIVE
PASSIVE HOUSE AND LOW IMPACT DESIGN

Team

Developer:
Beacon Communities
Architect: Desmone
Structural: Atlantic
MEP: Staengl Engineering
Landscape Architect: Pashek/MTR
Passive House Consulting:
Passive to Positive
GC: Mistick Construction

Program

45 units of affordable
first floor amenities
Adjacent Community Center

Stats

Passive House
(PHIUS 2021) Design Certification

Roof-top solar array for further reductions of operational energy

Phase

Phase 1 Complete and Occupied

Passive House, Retrofit - Mixed use Development

The 1954 Hebrew School was retrofitted to Passive House standards with a 2 story addition to provide 45 units of affordable housing and amenity space.

The adjacent 1923 synagogue will be retrofit to Passive House Standards in Phase 2 to provide a community theater and arts space.

Rooftop solar will provide a significant percentage of the building's energy requirements, and energy storage will provide for grid citizenship and resiliency.

THE CARINA, PITTSBURGH, PA

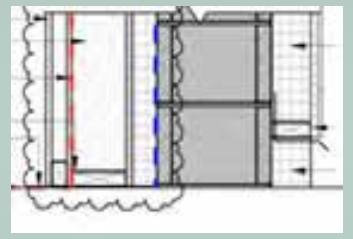
THE CARINA, PITTSBURGH, PA

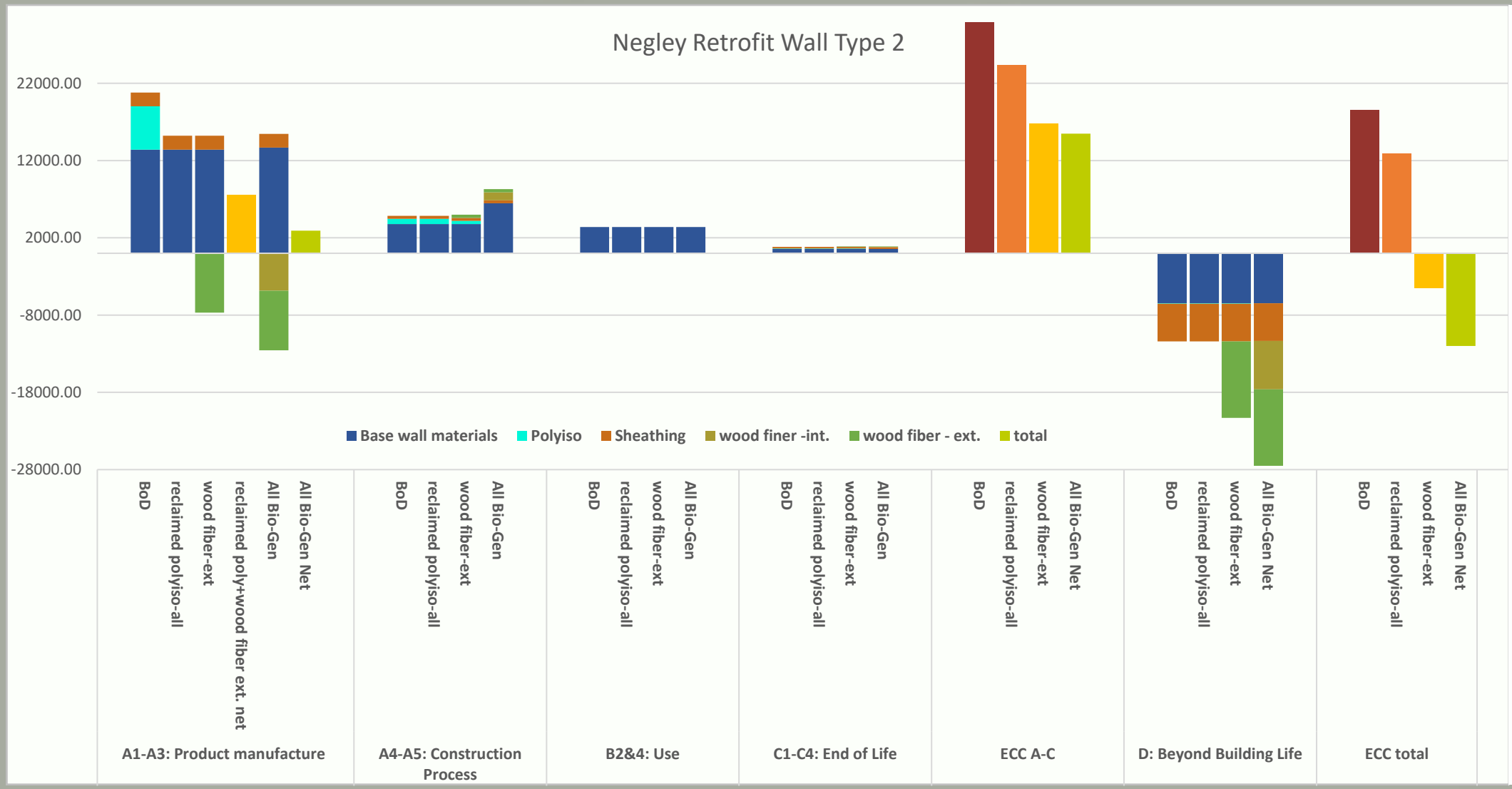
THE CARINA, PITTSBURGH, PA

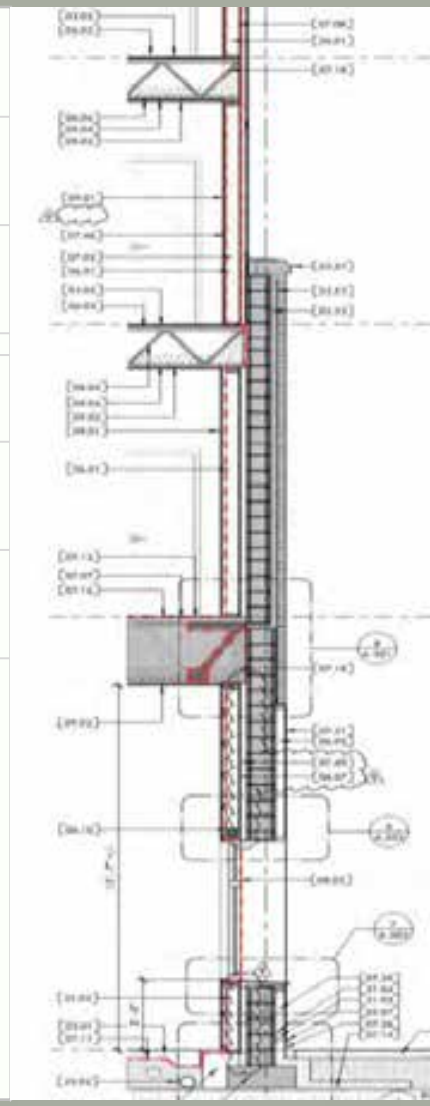
NEGLEY WALL TYPE ANALYSIS

RETROFIT WITH POLYISO vs. BIOGENIC INSULATION

ATHENA IMPACT ESTIMATOR +
EXTERNAL EC3 DATA







NEGLEY WHOLE-ISH BUILDING ANALYSIS

CONVENTIONAL CONSTRUCTION vs. BoD

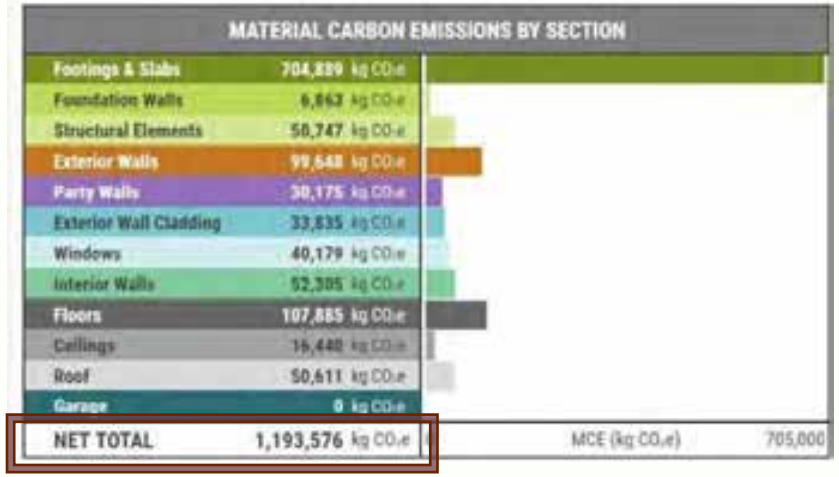
BEAM IMPACT ESTIMATOR +
EXTERNAL EC3 DATA

MATERIAL CARBON
PROJECT RESULTS

BUILDERS FOR CLIMATE ACTION | BEAM

PROJECT INFORMATION			
Project Name	North Negley Residences	Construction Year	
Design Firm(s)	Desmone Architects	Number of Bedrooms	
Engineering Firm(s)		Stories Above Grade	4
Builder / Developer			
Development Project		CONDITIONED AREA	
Street Address	321 N. Negley Avenue	Above Grade	64072 ft²
City	Pittsburgh	Below Grade	1999 ft²
Province / State	Pennsylvania	Total	66071 ft²
Country	United States		
		GROSS AREA	
Building Type	Apartment (all units)	Excluding Garage	66071 ft²
Construction Type	Energy Retrofit	Garage	0 ft²
Project Stage	Construction in Progress	Total	66071 ft²

MATERIAL CARBON EMISSIONS BY SECTION



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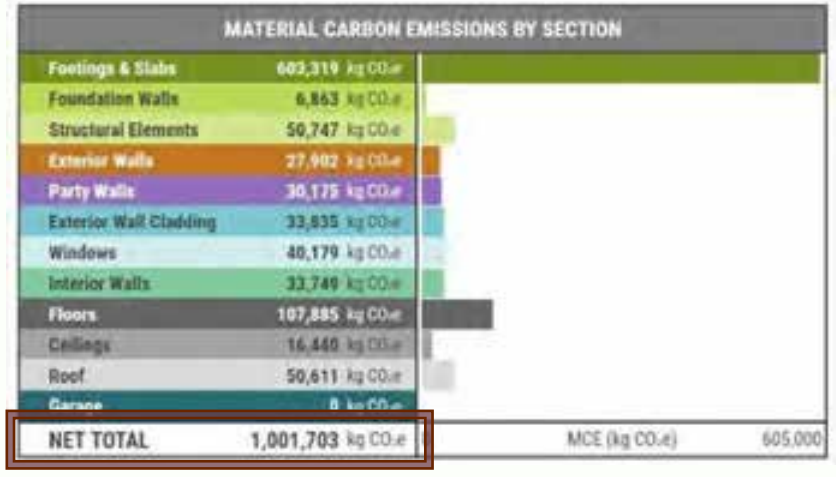


Embodied carbon of Building Envelope + Structure

192 metric tons CO_2 emissions avoided

- at $128/ton = $24,576 (Mass Save)
- At $190/ton = $36,456 (Biden EPA @2% discount)
- At $393/ton = $75,406 (Mass Save high end – rejected)
- At $1000/ton = $191,873 (Pure Hypothetical)

PASSIVE HOUSE OPERATIONAL CARBON REDUCTIONS + SOLAR AND EC REDUCTIONS

Savings CO2e operational 10 years = 1558 MT

Savings CO2Ee Embodied = 192 MT 192+1558 = 1750 MT avoided Carbon

- at $128/ton = $224,000 (Mass Save)
- At $190/ton = $336,000 (Biden EPA @2% discount)
- At $393/ton = $687,750 (Mass Save high end – rejected)
- At $1000/ton = $1,750,000 (Pure Hypothetical)

THE NEW CARBON ARCHITECTURE CAPTURE AND STORE CARBON

A THOUGHT EXPERIMENT USING 11 E LENOX ST. ROXBURY MA

Best Case Design (low refrigerant) + PV + 10 years of operation

1375 metric tons CO_2 emissions avoided

- at $128/ton = $91,284 (Mass Save)
- At $190/ton = $135,501 (Biden EPA @2% discount)
- At $393/ton = $280,272 (Mass Save high end – rejected)
- At $1000/ton = $713,162 (Pure Hypothetical)

Best Case Design (low refrigerant) + PV + 10 years of operation

+ CARBON STORAGE IN TIMBER

1610 metric tons CO_2 emissions avoided

- at $128/ton = $206,120 (Mass Save)
- At $190/ton = $305,960 (Biden EPA @2% discount)
- At $393/ton = $632,854 (Mass Save high end – rejected)
- At $1000/ton = $1,610,316 (Pure Hypothetical)

WILL PUTTING A VALUE ON CARBON MAKE RETROFITS COST-EFFECTIVE?

Conclusion:

it all depends on the value of carbon **–** *with current valuation it appears we are no where near COST EFFECTIVE.*

SO HOW DO WE VALUE CARBON? PROBLEM #1

IAM's = INTEGRATED ASSSESSMENT MODELS

ARE NOT APPROPRIATELY TARGETED

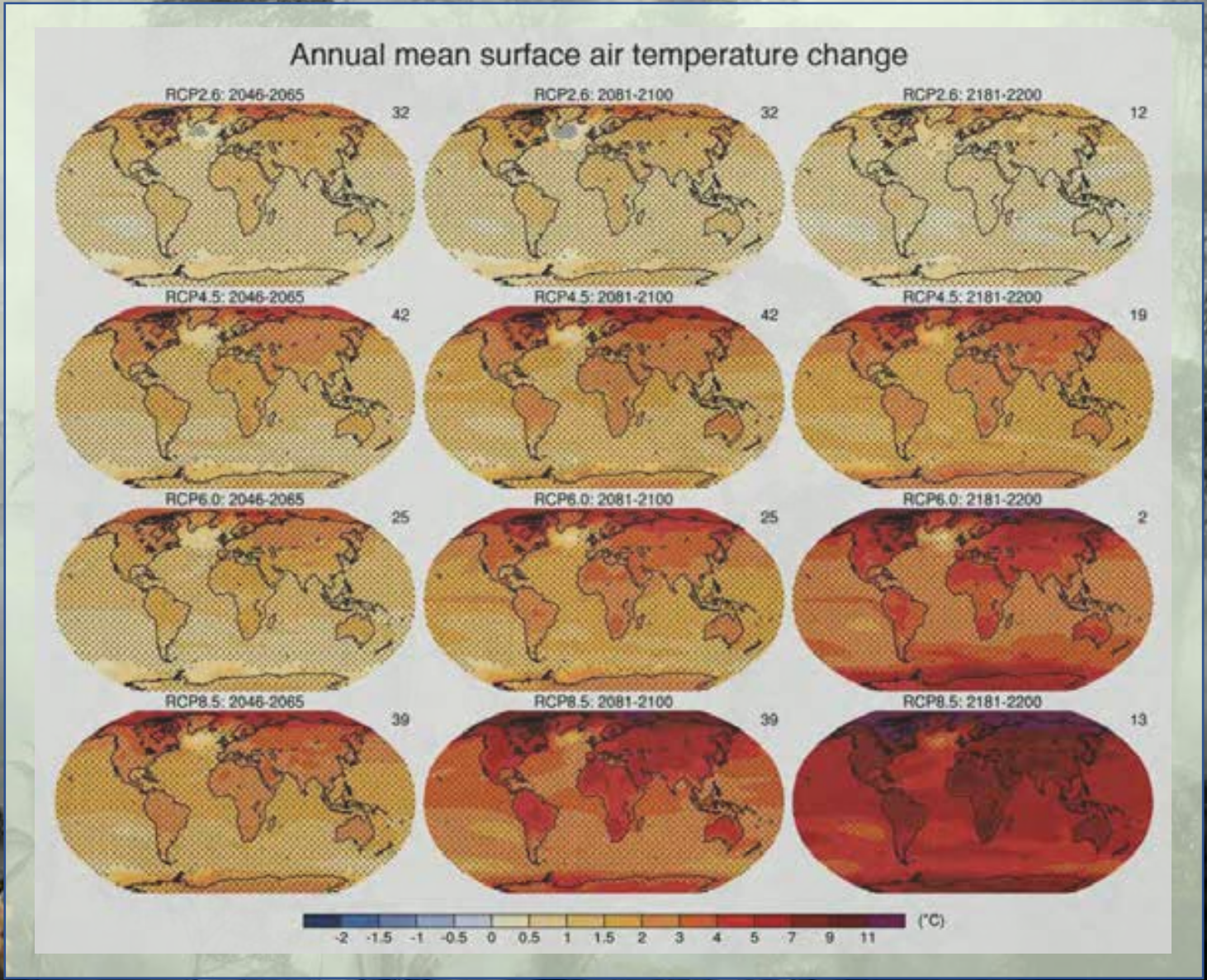
MODELS' SCC's ARE CONSISTENTLY TOO LOW TO SUPPORT THE COST OF MITIGATION

*MOST SET PARAMETERS THAT WOULD YIELD 3-**4˚ C** TEMPURATURE RISE*

NOT EVEN AN ACCEPTABLE OUTCOME

*DERIVED FROM **"A SOCIAL COST OF CARBON CONSISTENT WITH A NET-ZERO CLIMATE GOAL"** BY NOCHOLAS STERN, JOSEPH STIGLITZ, KRISTINA KARLSSON + CHARLOTTE TAYLOR ; 01/2022*

SO HOW DO WE VALUE CARBON? PROBLEM #1



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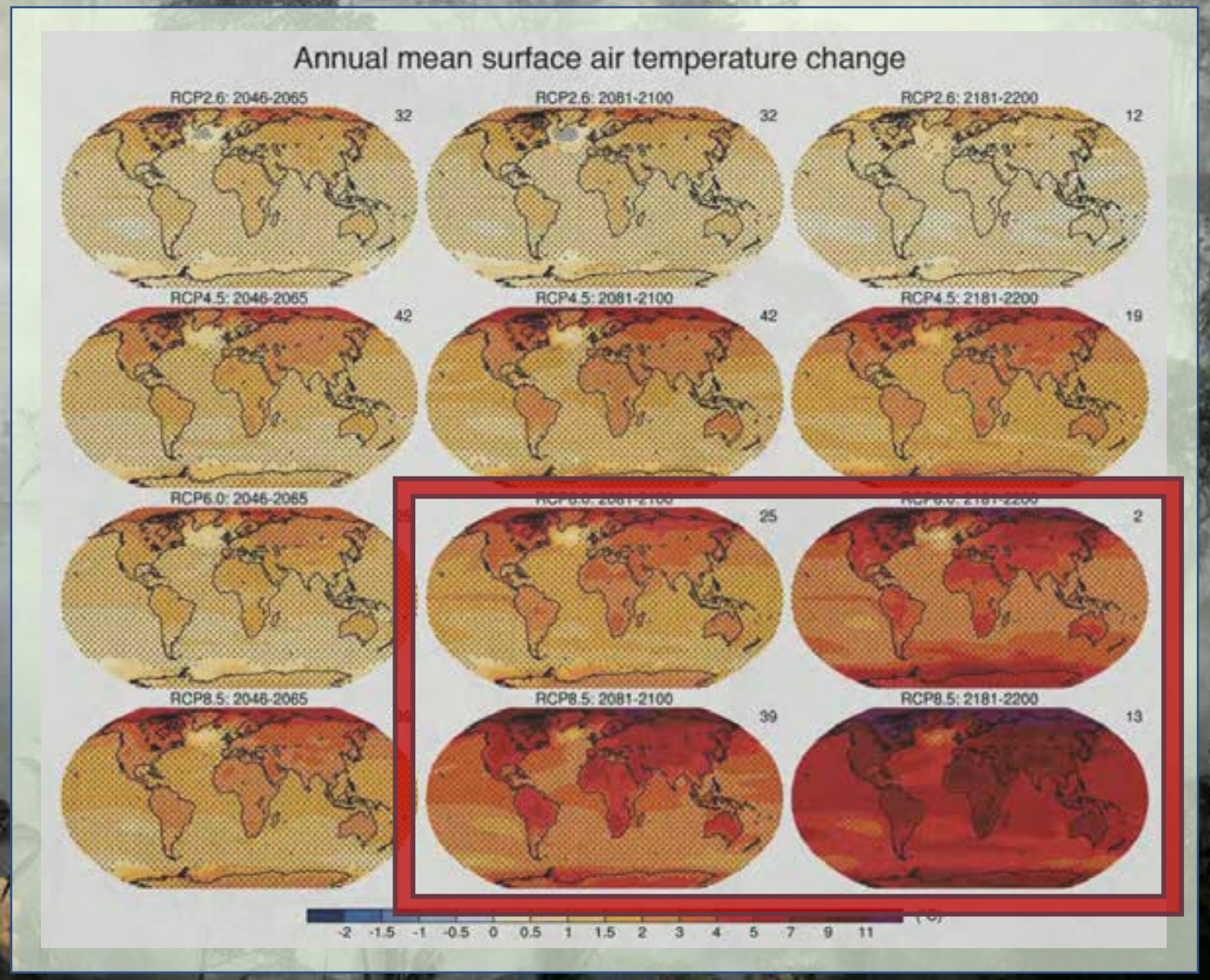
SO HOW DO WE VALUE CARBON? PROBLEM #1



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SO HOW DO WE VALUE CARBON?

PROBLEM #1

IAM's = INTEGRATED ASSSESSMENT MODELS

MUST SET A BASELINE OF SURVIVAL
OR
IT IS POINTLESS

DERIVED FROM ***"A SOCIAL COST OF CARBON CONSISTENT WITH A NET-ZERO CLIMATE GOAL"*** *BY NOCHOLAS STERN, JOSEPH STIGLITZ, KRISTINA KARLSSON + CHARLOTTE TAYLOR ; 01/2022*

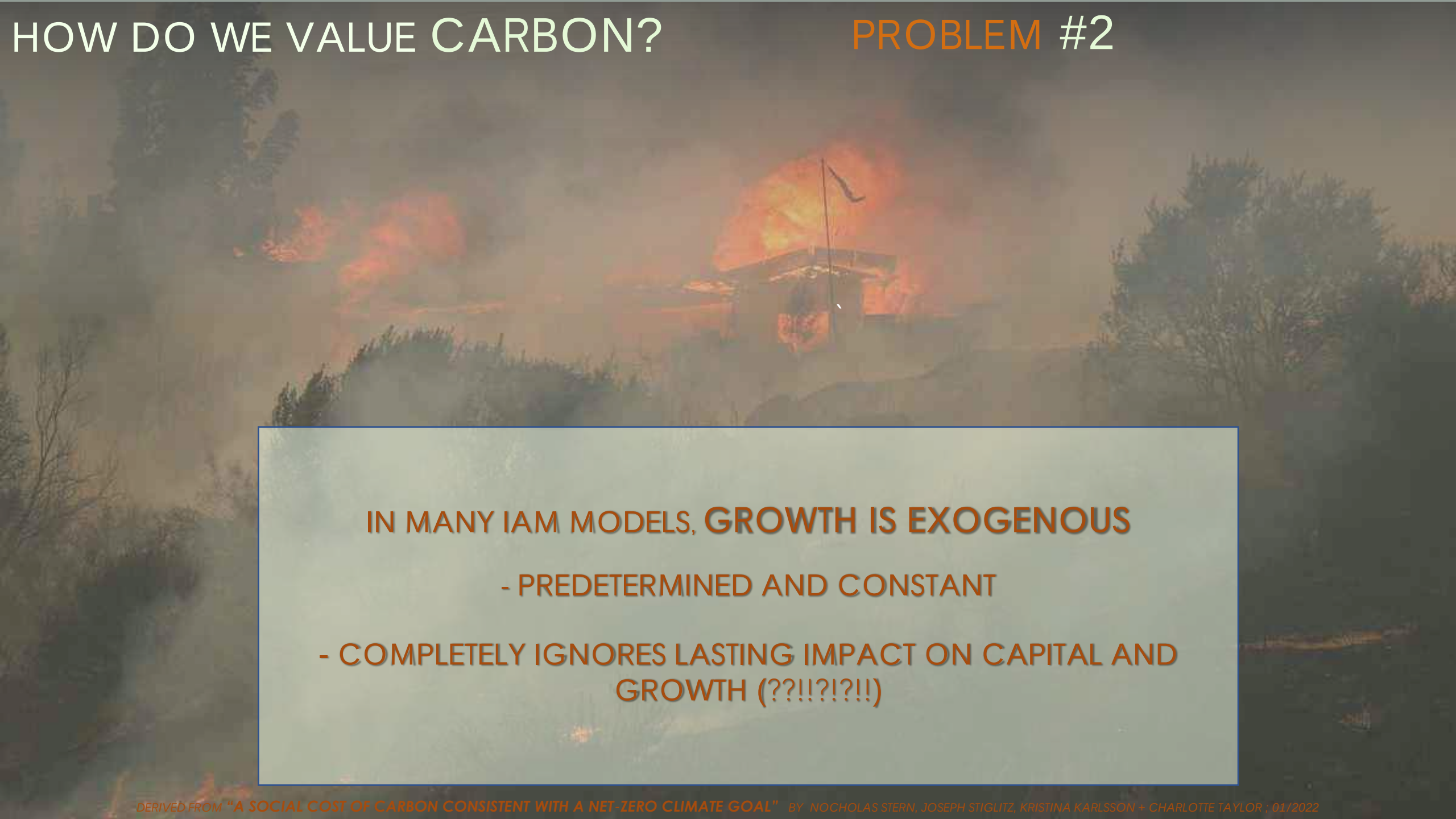
HOW DO WE VALUE CARBON?

PROBLEM #2

DERIVED FROM ***"A SOCIAL COST OF CARBON CONSISTENT WITH A NET-ZERO CLIMATE GOAL"*** *BY NOCHOLAS STERN, JOSEPH STIGLITZ, KRISTINA KARLSSON + CHARLOTTE TAYLOR ; 01/2022*

HOW DO WE VALUE CARBON?

PROBLEM #2



IN MANY IAM MODELS, **GROWTH IS EXOGENOUS**

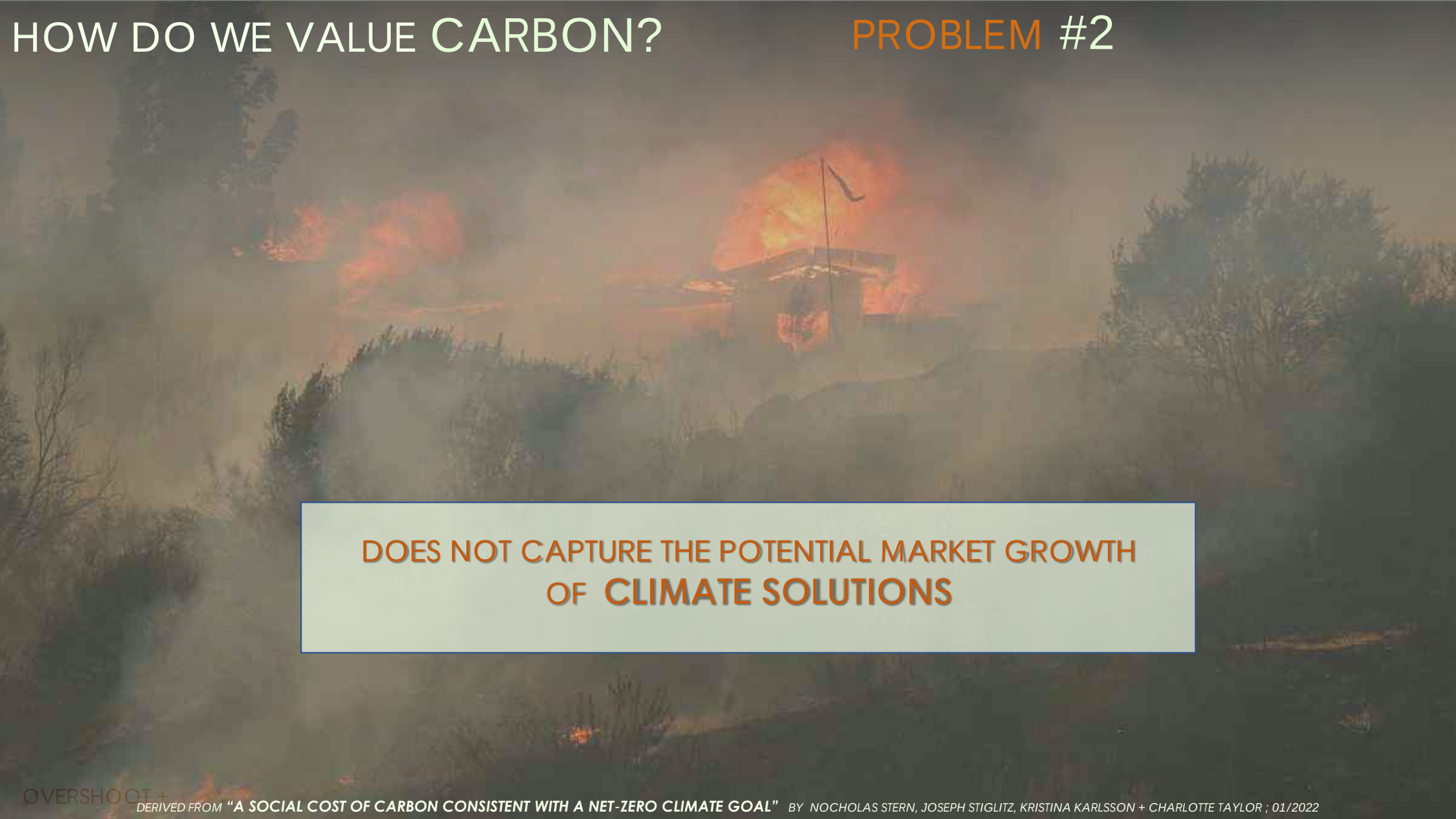
- PREDETERMINED AND CONSTANT

- COMPLETELY IGNORES LASTING IMPACT ON CAPITAL AND GROWTH (??!!?!?!!)

DERIVED FROM "A SOCIAL COST OF CARBON CONSISTENT WITH A NET-ZERO CLIMATE GOAL" BY NOCHOLAS STERN, JOSEPH STIGLITZ, KRISTINA KARLSSON + CHARLOTTE TAYLOR ; 01/2022

HOW DO WE VALUE CARBON?

PROBLEM #2



DOES NOT CAPTURE THE POTENTIAL MARKET GROWTH
OF **CLIMATE SOLUTIONS**

*DERIVED FROM **"A SOCIAL COST OF CARBON CONSISTENT WITH A NET-ZERO CLIMATE GOAL"** BY NOCHOLAS STERN, JOSEPH STIGLITZ, KRISTINA KARLSSON + CHARLOTTE TAYLOR ; 01/2022*

SO HOW DO WE VALUE CARBON?

PROBLEM #3

*DERIVED FROM **"A SOCIAL COST OF CARBON CONSISTENT WITH A NET-ZERO CLIMATE GOAL"** BY NOCHOLAS STERN, JOSEPH STIGLITZ, KRISTINA KARLSSON + CHARLOTTE TAYLOR ; 01/2022*

SO HOW DO WE VALUE CARBON?

PROBLEM #3

IAM'S DO NOT ACCOUNT FOR UNCERTAINTY OF RISK

UNKNOWN UNKNOWNS

MARGIN OF ERROR IN ESTIMATES GOES UP WITH INCREASE IN TEMPERATURE

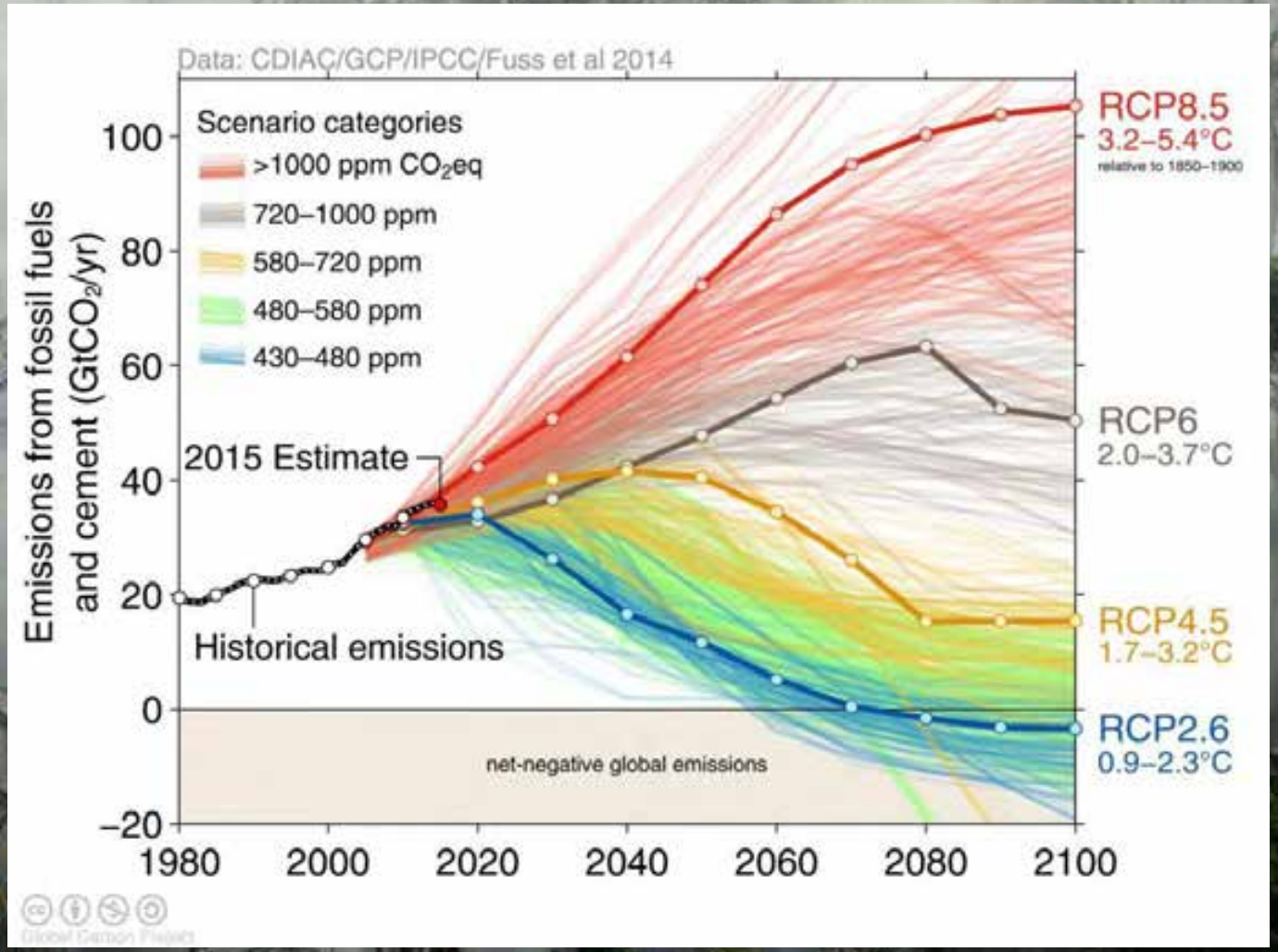
*DERIVED FROM **"A SOCIAL COST OF CARBON CONSISTENT WITH A NET-ZERO CLIMATE GOAL"** BY NOCHOLAS STERN, JOSEPH STIGLITZ, KRISTINA KARLSSON + CHARLOTTE TAYLOR ; 01/2022*

SO HOW DO WE VALUE CARBON?

PROBLEM #3

THE HIGHER WE LET THE TEMPERATURE RISE,

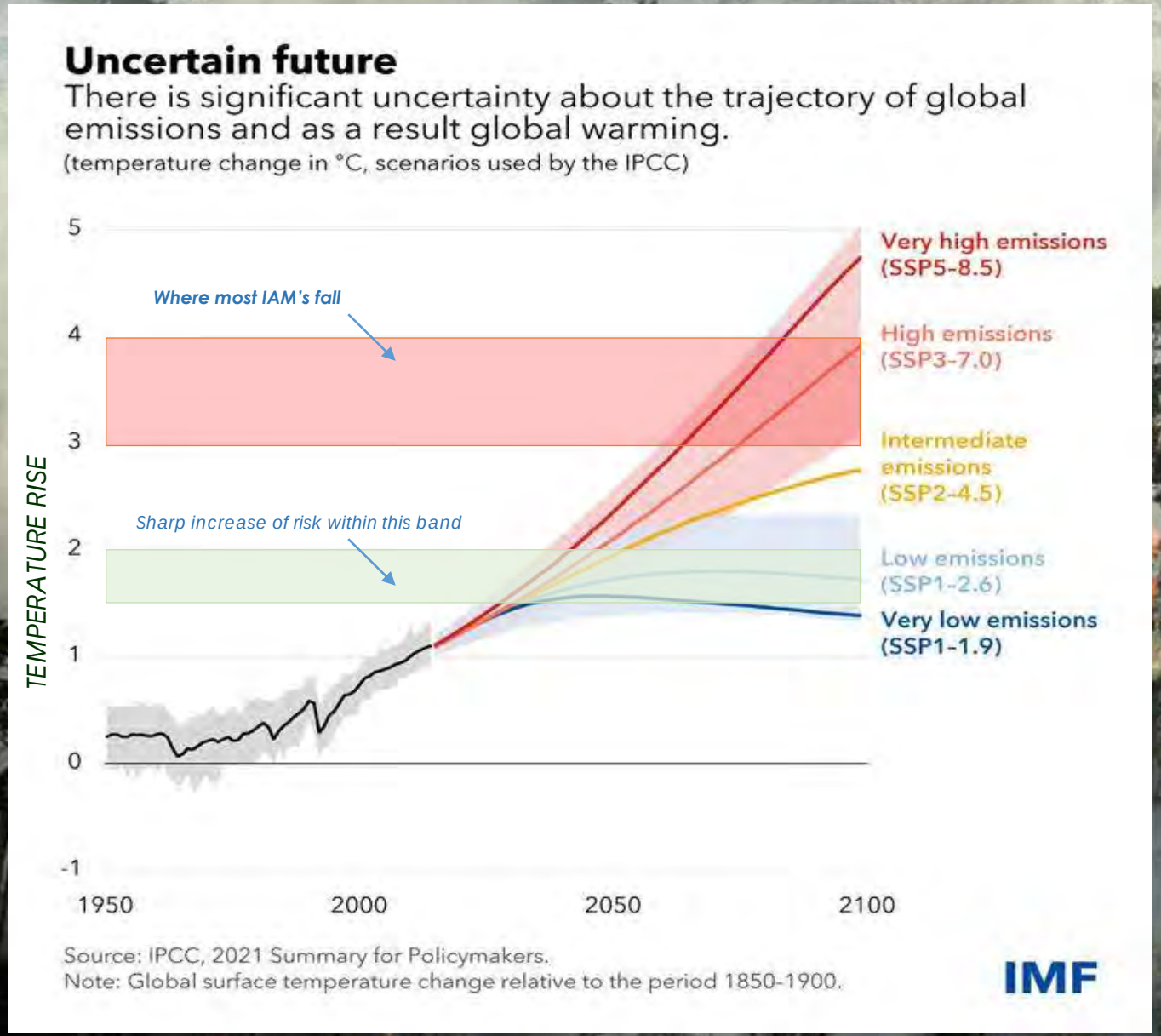
THE WIDER THE UNCERTAINTY



DERIVED FROM ***"A SOCIAL COST OF CARBON CONSISTENT WITH A NET-ZERO CLIMATE GOAL"*** *BY NOCHOLAS STERN, JOSEPH STIGLITZ, KRISTINA KARLSSON + CHARLOTTE TAYLOR ; 01/2022*

SO HOW DO WE VALUE CARBON?

PROBLEM #3



THE HIGHER WE LET THE TEMPERATURE RISE,

THE WIDER THE UNCERTAINTY

SHARP INCREASE OF RISK OF SERIOUS DISLOCATION AND LARGE-SCALE LOSS OF LIFE

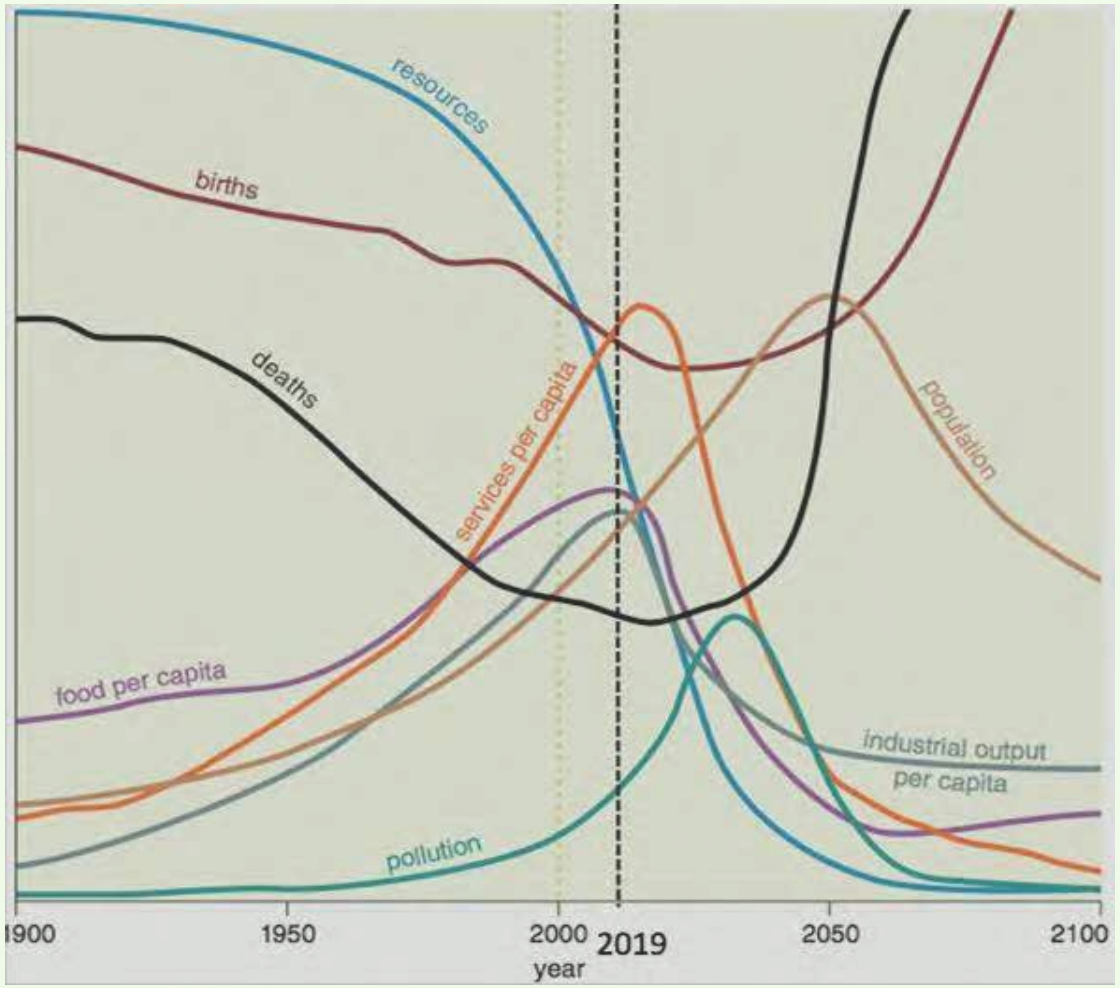
BETWEEN 1.5˚ + 2˚C

THIS IS WITHIN THE MARGIN OF ERROR FOR OPTIMISTIC SCENARIOS

DERIVED FROM ***"A SOCIAL COST OF CARBON CONSISTENT WITH A NET-ZERO CLIMATE GOAL"*** *BY NOCHOLAS STERN, JOSEPH STIGLITZ, KRISTINA KARLSSON + CHARLOTTE TAYLOR ; 01/2022*

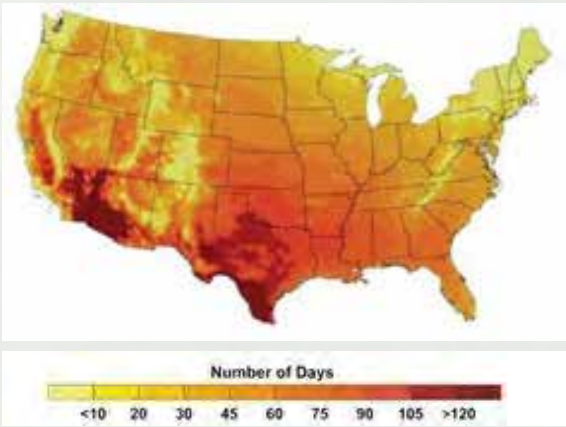
HOW DO WE VALUE CARBON?

PROBLEM #3



COMPLEX NON-LINEAR RELATIONSHIPS

TIPPING POINTS AND SYSTEMIC COLLAPSE



temperature map images: U.S. Global Change Research Program

OVERSHOOT + COLLAPSE

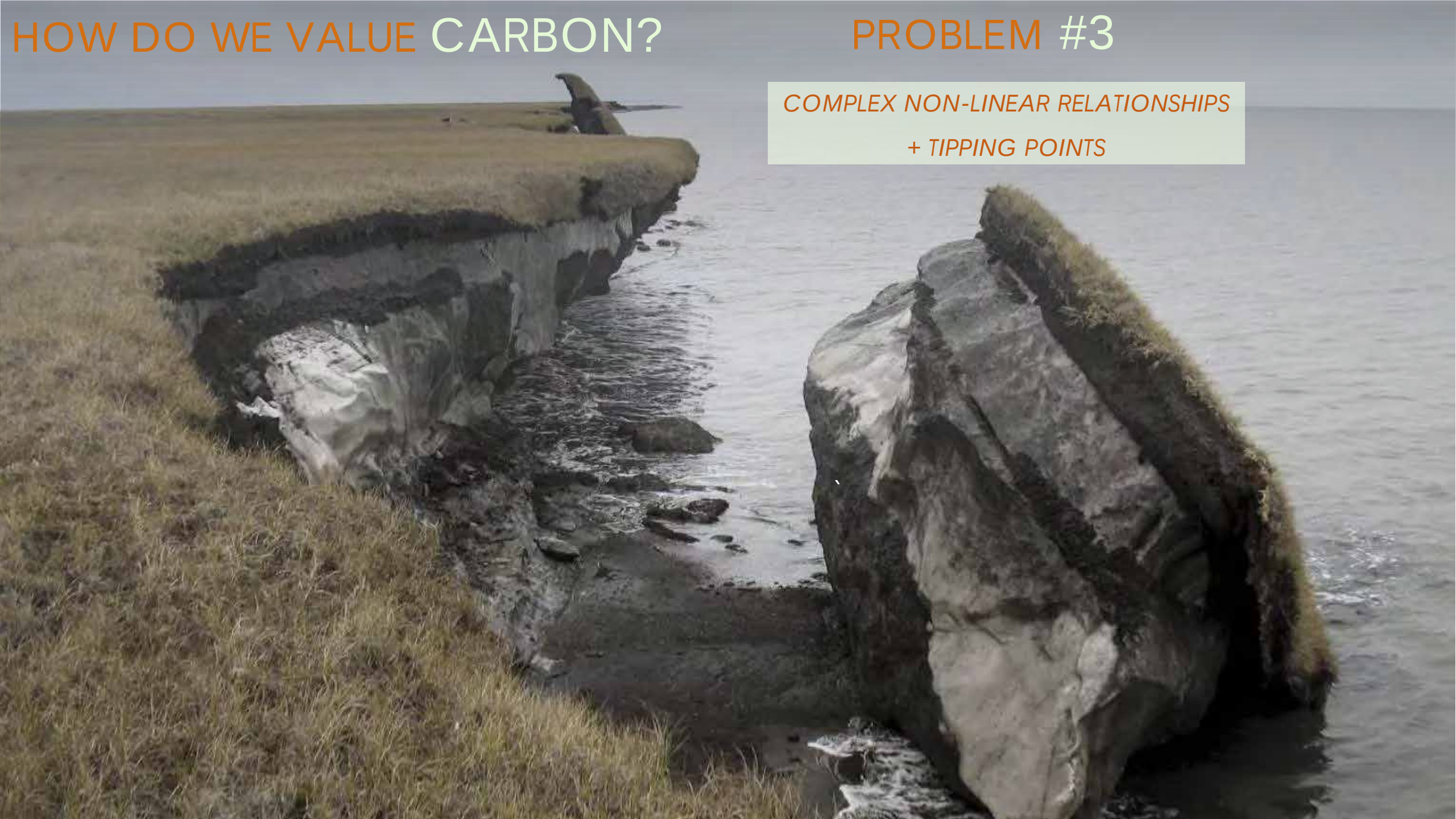
DERIVED FROM ***"A SOCIAL COST OF CARBON CONSISTENT WITH A NET-ZERO CLIMATE GOAL" + LIMTS TO GROWTH 30 YEAR UPDATE***

HOW DO WE VALUE CARBON?

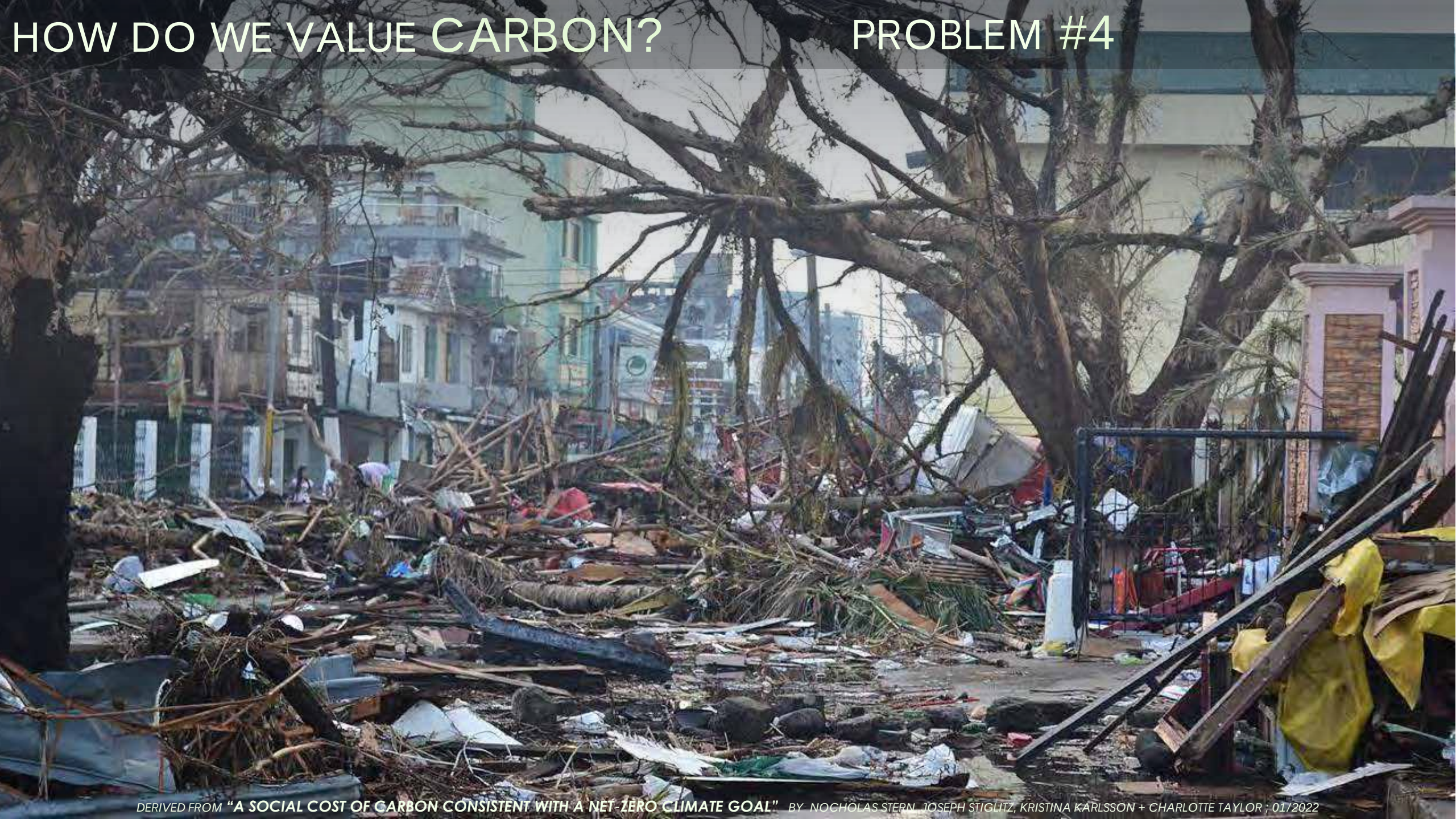
PROBLEM #3

COMPLEX NON-LINEAR RELATIONSHIPS

+ TIPPING POINTS



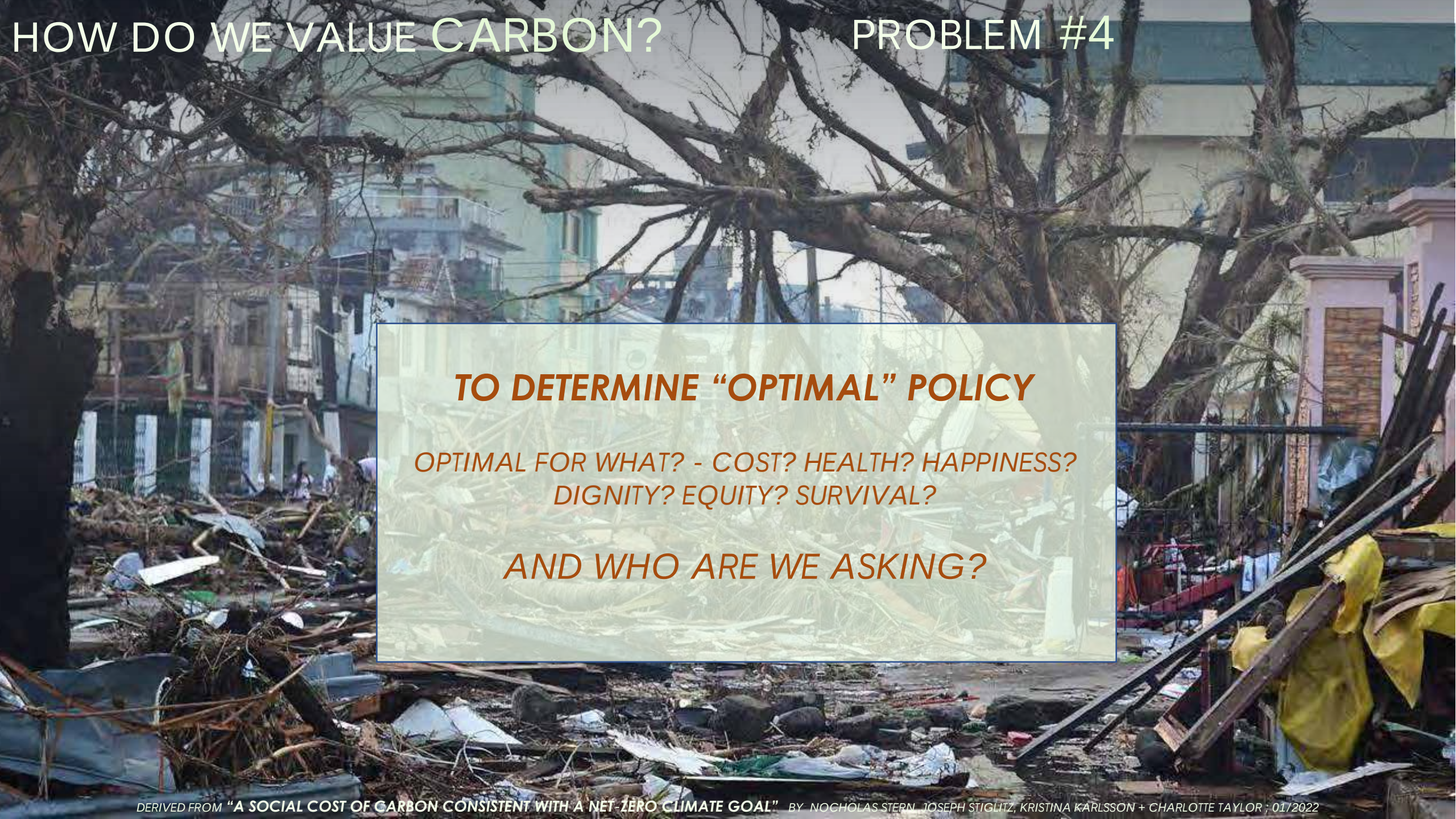
HOW DO WE VALUE CARBON? PROBLEM #4



DERIVED FROM ***"A SOCIAL COST OF CARBON CONSISTENT WITH A NET-ZERO CLIMATE GOAL"*** *BY NOCHOLAS STERN, JOSEPH STIGLITZ, KRISTINA KARLSSON + CHARLOTTE TAYLOR ; 01/2022*

HOW DO WE VALUE CARBON?

PROBLEM #4



TO DETERMINE "OPTIMAL" POLICY

OPTIMAL FOR WHAT? - COST? HEALTH? HAPPINESS?
DIGNITY? EQUITY? SURVIVAL?

AND WHO ARE WE ASKING?

DERIVED FROM ***"A SOCIAL COST OF CARBON CONSISTENT WITH A NET-ZERO CLIMATE GOAL"*** *BY NOCHOLAS STERN, JOSEPH STIGLITZ, KRISTINA KARLSSON + CHARLOTTE TAYLOR ; 01/2022*

HOW DO WE VALUE CARBON? PROBLEM #4

IAM'S IGNORE INEQUALITY

OF IMPACTS . . .

. . . AND RESPONSIBILITY

DERIVED FROM ***"A SOCIAL COST OF CARBON CONSISTENT WITH A NET-ZERO CLIMATE GOAL"*** *BY NOCHOLAS STERN, JOSEPH STIGLITZ, KRISTINA KARLSSON + CHARLOTTE TAYLOR ; 01/2022*

HOW DO WE VALUE CARBON?

PROBLEM #4

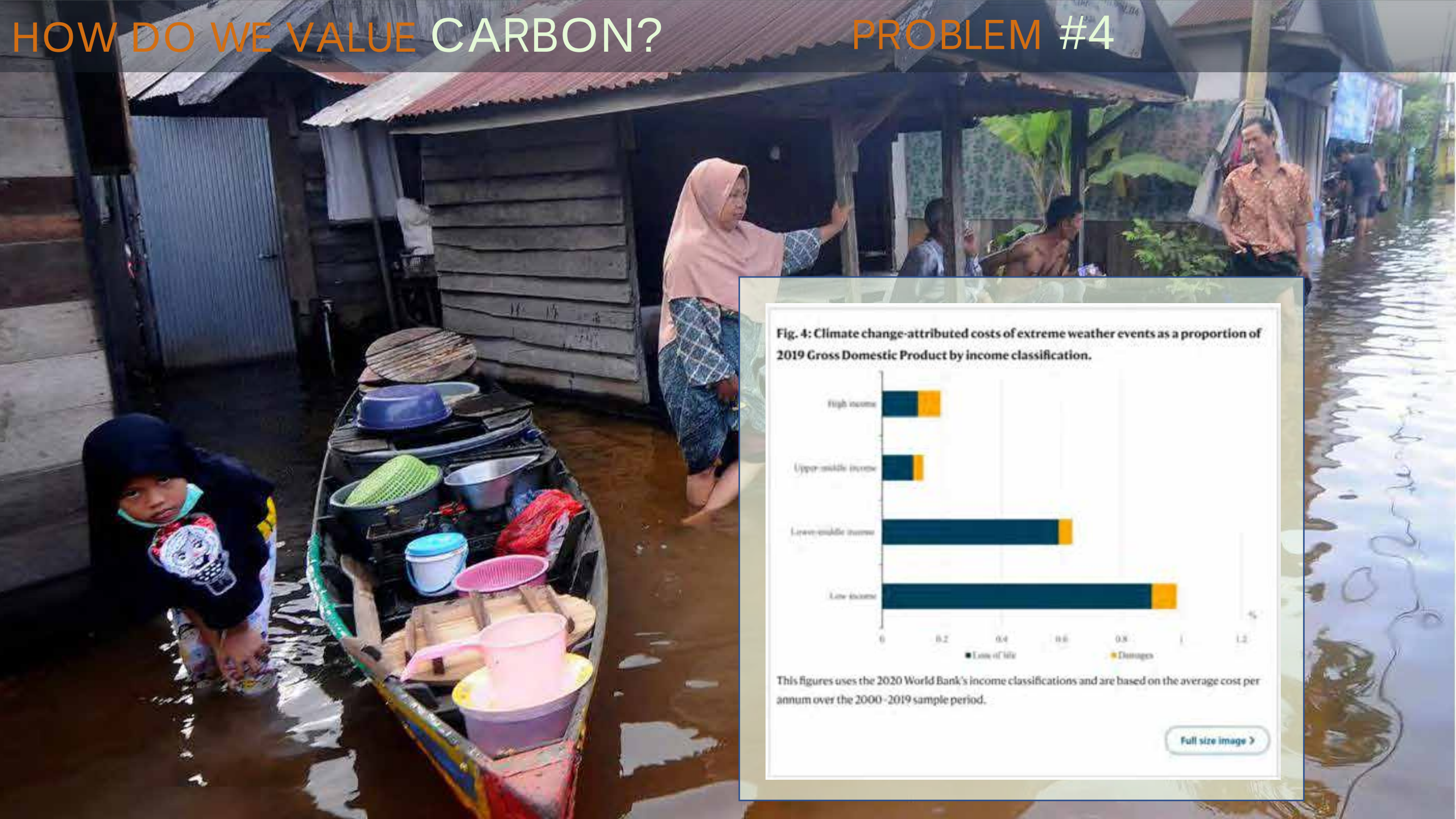


Fig. 4: Climate change-attributed costs of extreme weather events as a proportion of 2019 Gross Domestic Product by income classification.

This figures uses the 2020 World Bank's income classifications and are based on the average cost per annum over the 2000–2019 sample period.

Full size image >

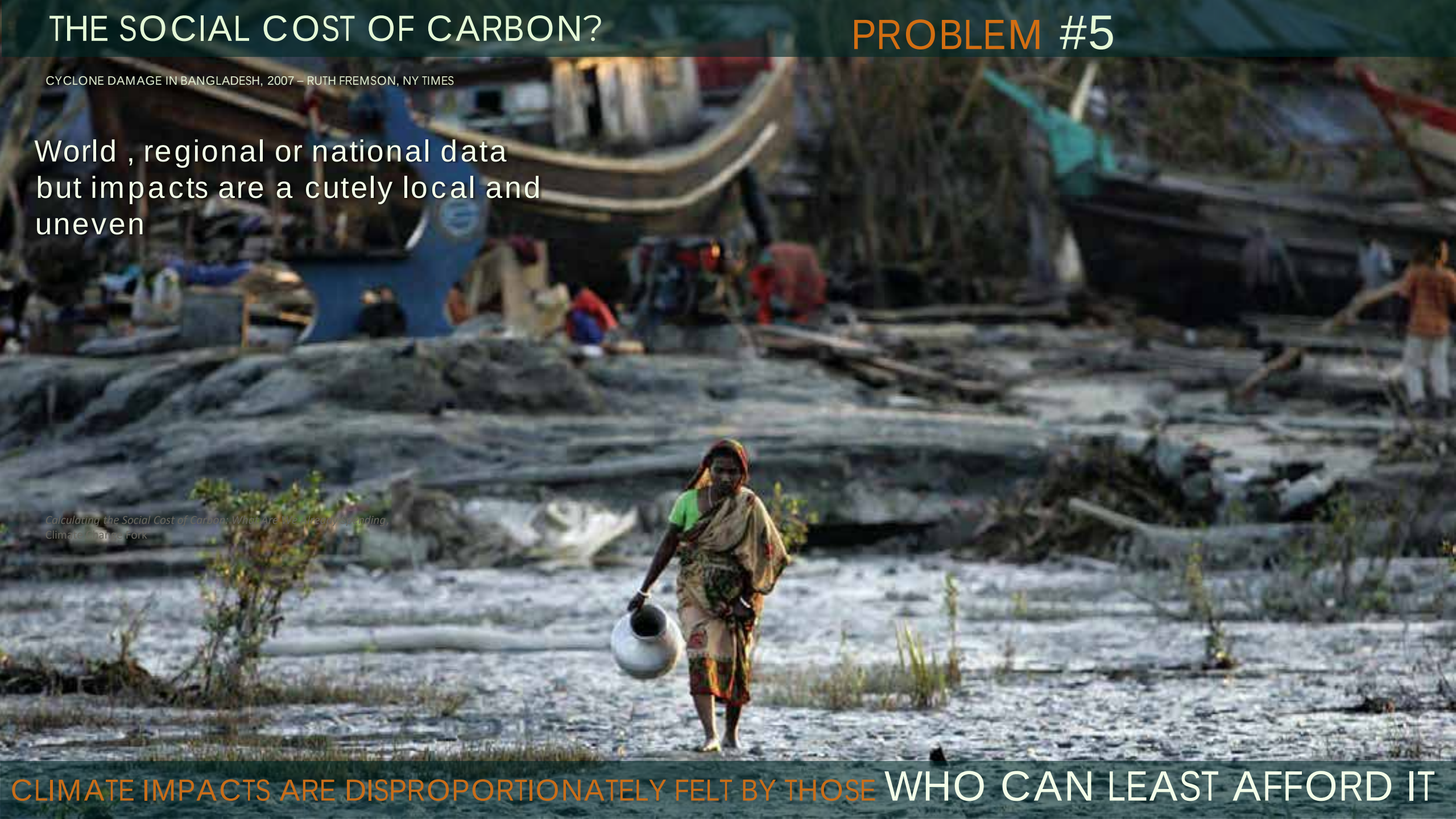
WHAT IS THE COST OF CARBON?

PROBLEM #5

DERIVED FROM **"A SOCIAL COST OF CARBON CONSISTENT WITH A NET-ZERO CLIMATE GOAL"** BY: NICHOLAS STERN, JOSEPH STIGLITZ, KRISTINA KARLSSON + CHARLOTTE TAYLOR : 01/2022

THE SOCIAL COST OF CARBON?

PROBLEM #5



CYCLONE DAMAGE IN BANGLADESH, 2007 – RUTH FREMSON, NY TIMES

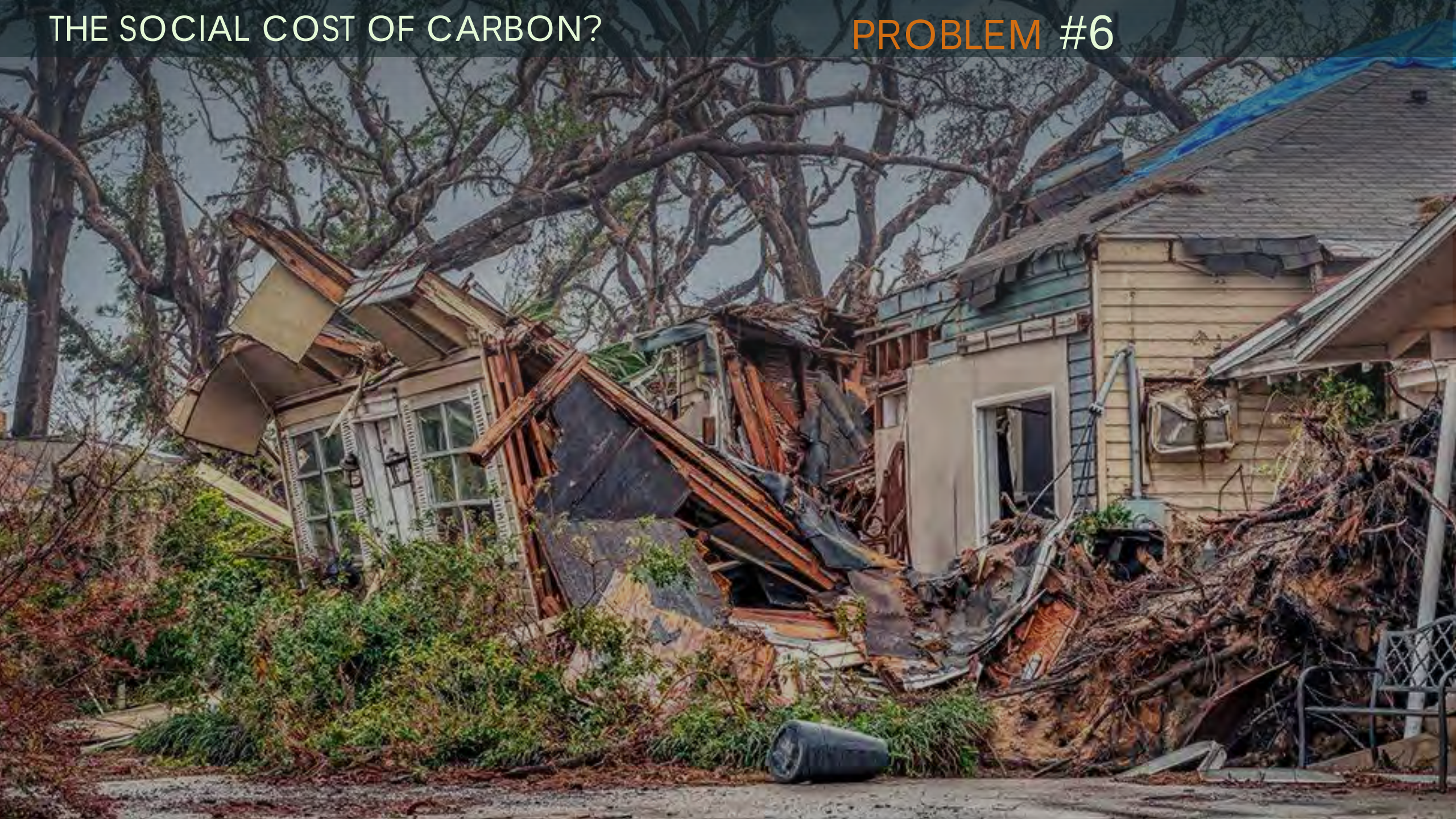
World , regional or national data but impacts are a cutely local and uneven

Calculating the Social Cost of Carbon: What Are We Already Spending,
Climate Change Fork

CLIMATE IMPACTS ARE DISPROPORTIONATELY FELT BY THOSE WHO CAN LEAST AFFORD IT

THE SOCIAL COST OF CARBON?

PROBLEM #6



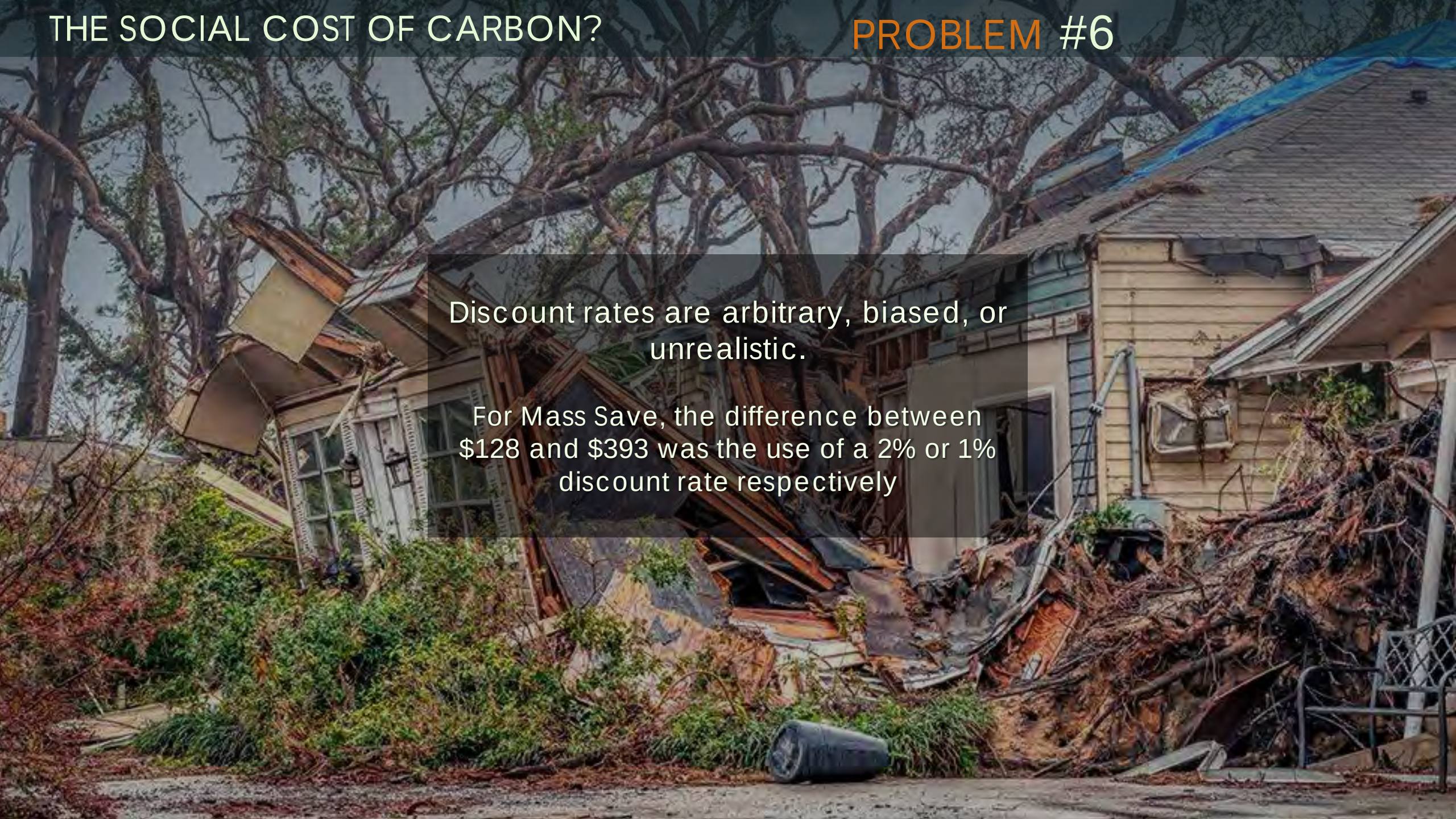
THE SOCIAL COST OF CARBON?

PROBLEM #6

Discount rates are arbitrary, biased, or unrealistic.

THE SOCIAL COST OF CARBON?

PROBLEM #6

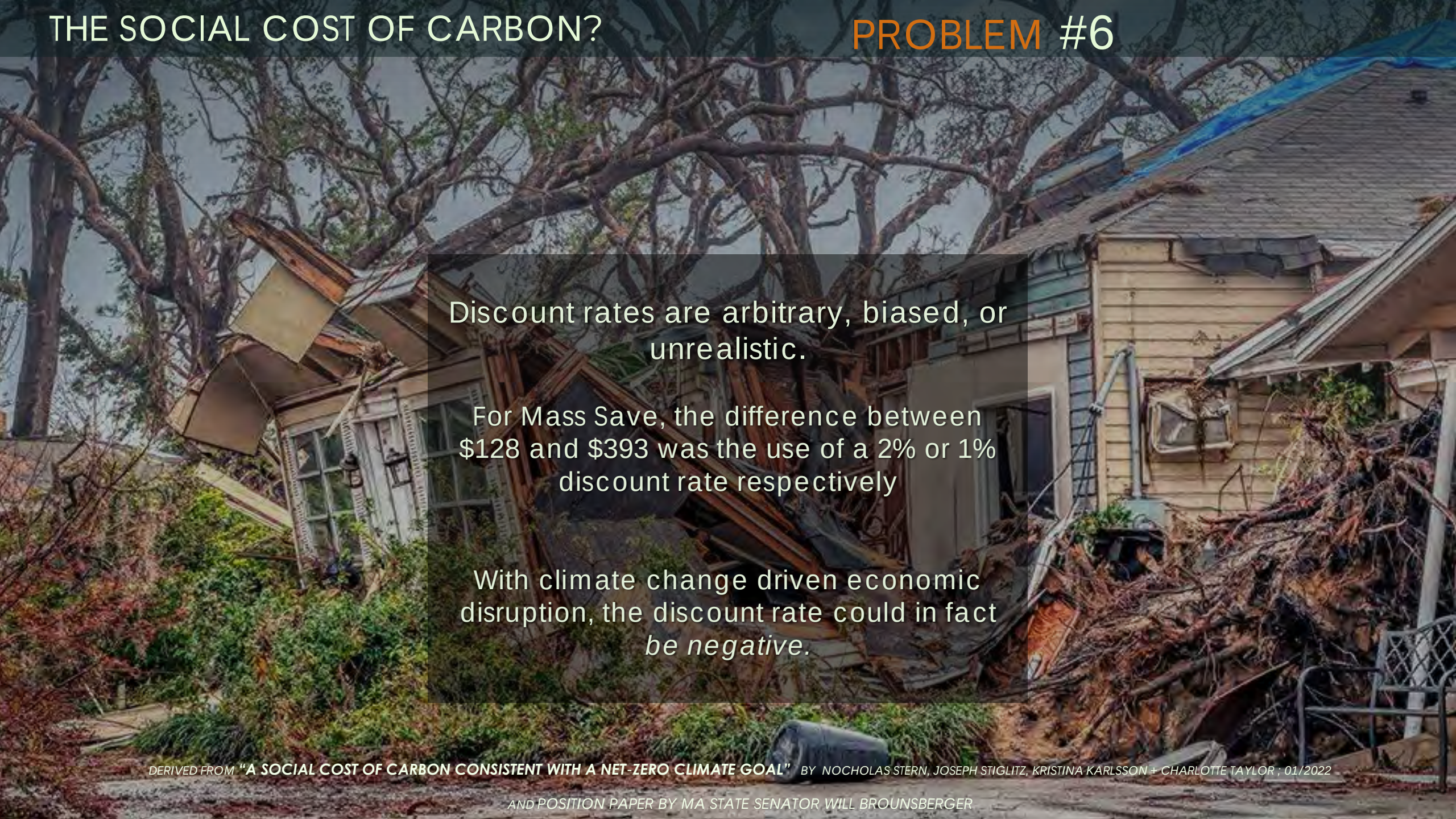


Discount rates are arbitrary, biased, or unrealistic.

For Mass Save, the difference between $128 and $393 was the use of a 2% or 1% discount rate respectively

THE SOCIAL COST OF CARBON?

PROBLEM #6



Discount rates are arbitrary, biased, or unrealistic.

For Mass Save, the difference between $128 and $393 was the use of a 2% or 1% discount rate respectively

With climate change driven economic disruption, the discount rate could in fact *be negative.*

DERIVED FROM ***"A SOCIAL COST OF CARBON CONSISTENT WITH A NET-ZERO CLIMATE GOAL"*** *BY NOCHOLAS STERN, JOSEPH STIGLITZ, KRISTINA KARLSSON + CHARLOTTE TAYLOR ; 01/2022*

AND POSITION PAPER BY MA STATE SENATOR WILL BROUNSBERGER

HOW DO WE VALUE CARBON?

PROBLEM #7

INCOMPLETE (INHUMANE) DATA DATA

. . . WE ARE NOT GETTING THE COSTS RIGHT
. . . WE ARE NOT EVEN GETTING THEM ON THE LEDGER.-
BRANDON TERRY, HARVARD POLITICAL THEORIST

HOW DO WE VALUE CARBON?

PROBLEM #7

EMPIRICAL DATA

Climate change is costing the world $16 million per hour
World Economic FORUM

". . . our headline number of $140bn is a significant understatement," Noy explained, noting that heat wave data on human deaths was only available in Europe. ***"We have no idea how many people died from heatwaves in all of sub-Saharan Africa."***

Further, authors Noy and Rebecca Newman. . . wrote . . . that there are also immeasurable effects from extreme weather, such as trauma, loss of educational access, and job loss that would further increase the costs

. . . WE ARE NOT GETTING THE COSTS RIGHT
. . . WE ARE NOT EVEN GETTING THEM ON THE LEDGER.-
BRANDON TERRY, HARVARD POLITICAL THEORIST

TO WHOM DOES THIS COST APPLY?

TO WHOM DOES THIS COST APPLY?

IN MASSACHUSETTS, IT IS PURELY TO JUDGE COST EFFECTIVENESS OF MASS SAVE INCENTIVE PROGRAMS

TO WHOM DOES THIS COST APPLY?

THIS IS NOT A COST APPLIED TO THE PRODUCERS OF A PRODUCT

WHAT ABOUT CARBON TRADING?

MARKET - BASED SOLUTIONS!!

WHAT ABOUT CARBON TRADING?

MARKET - BASED SOLUTIONS!!

TWO KINDS OF MARKETS

COMPLIANCE + VOLUNTARY

WHAT ABOUT CARBON TRADING?

MARKET - BASED SOLUTIONS!!

COMPLIANCE MARKETS

Compliance markets are created and regulated by mandatory national, regional, or international carbon reduction regimes.

WHAT ABOUT CARBON TRADING?

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COMPLIANCE MARKETS

Compliance markets are created and regulated by mandatory national, regional, or international carbon reduction regimes.

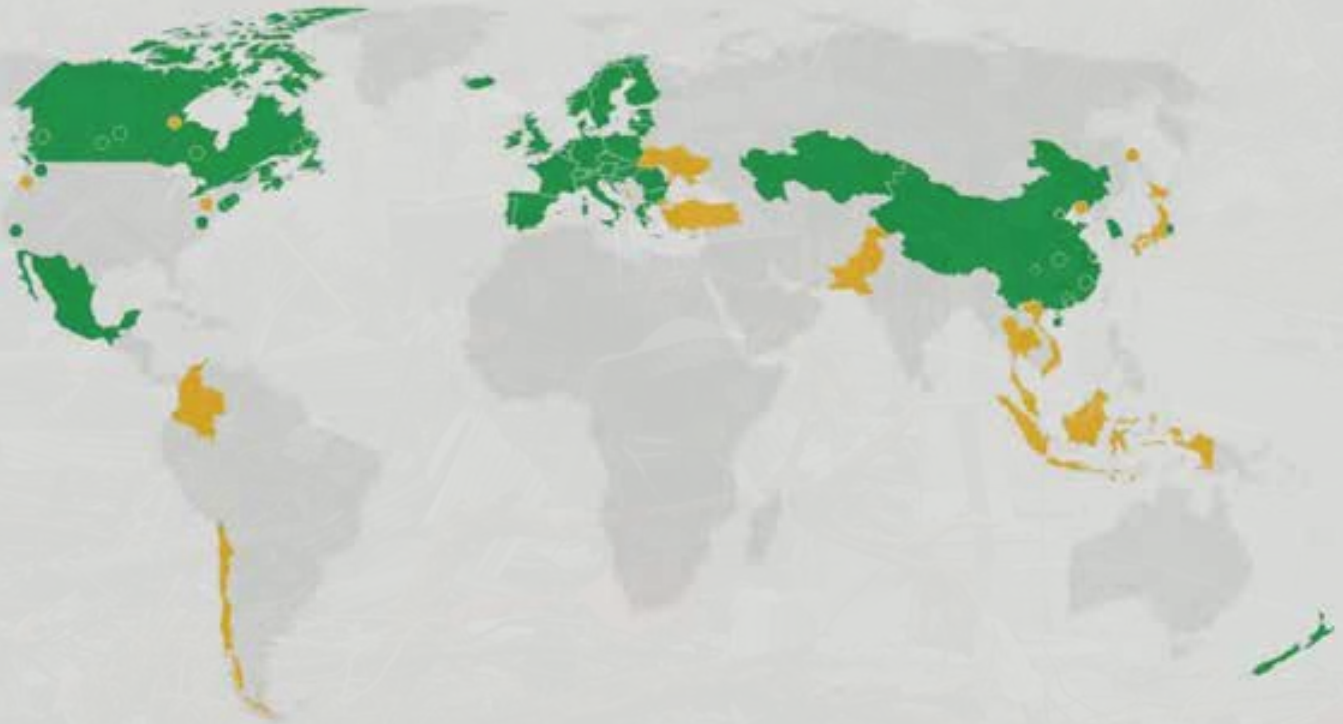
Regulated utilities and industries must meet % carbon emissions reductions or by credits.

WHAT ABOUT CARBON TRADING?

MARKET - BASED SOLUTIONS!!

COMPLIANCE MARKETS

Figure 1: Global ETS Map of Current Compliance Credit Market Landscape



These markets reflect the value of credits to companies who must reach emissions targets, i.e. 55% below 1990 levels - *not a* ***value of carbon's effects***

WHAT ABOUT CARBON TRADING?

MARKET - BASED SOLUTIONS!!

COMPLIANCE MARKETS

CARBON CREDITS .com

Live Carbon Prices

	Last	Change	YTD
Compliance Markets			
European Union	€56.31	-0.23 %	-30.16 %
UK	£35.60	-0.11 %	-21.76 %
California	$28.66	-	0.00 %
Australia (AUD)	$36.75	+2.80 %	+9.70 %
New Zealand (NZD)	$66.25	-0.75 %	-4.19 %
South Korea	$6.86	-	+1.33 %
China	$11.21	-2.41 %	+0.31 %
Voluntary Markets			
Aviation Industry Offset	$0.83	-	+40.68 %
Nature Based Offset	$1.53	+0.66 %	+68.13 %
Tech Based Offset	$0.65	-	+10.17 %

CarbonCredits.com Real-time Pricing

Click here to learn how carbon credits are priced.

These markets reflect the value of credits to companies who must reach emissions targets, i.e. 55% below 1990 levels - *not a* ***value of carbon's effects***

WHAT ABOUT CARBON TRADING?

MARKET - BASED SOLUTIONS!!

VOLUNTARY MARKETS

WHAT ABOUT CARBON TRADING?

MARKET - BASED SOLUTIONS!!

VOLUNTARY MARKETS

Generally, corporations looking to improve reputation.

There has been a decline in confidence in the quality of carbon offsets sold in these markets.

And a backlash against ESG

BUT ACCESS IS ONLY FOR CORPORATIONS AND THE RICH

WHAT ABOUT CARBON TRADING?

MARKET - BASED SOLUTIONS!!

VOLUNTARY MARKETS

These markets require intermediaries to act as third-party verifiers of carbon reductions.

BUT ACCESS IS ONLY FOR CORPORATIONS AND THE RICH

WHAT ABOUT CARBON TRADING?

MARKET - BASED SOLUTIONS!!

VOLUNTARY MARKETS

These markets require intermediaries to act as third-party verifiers of carbon reductions.

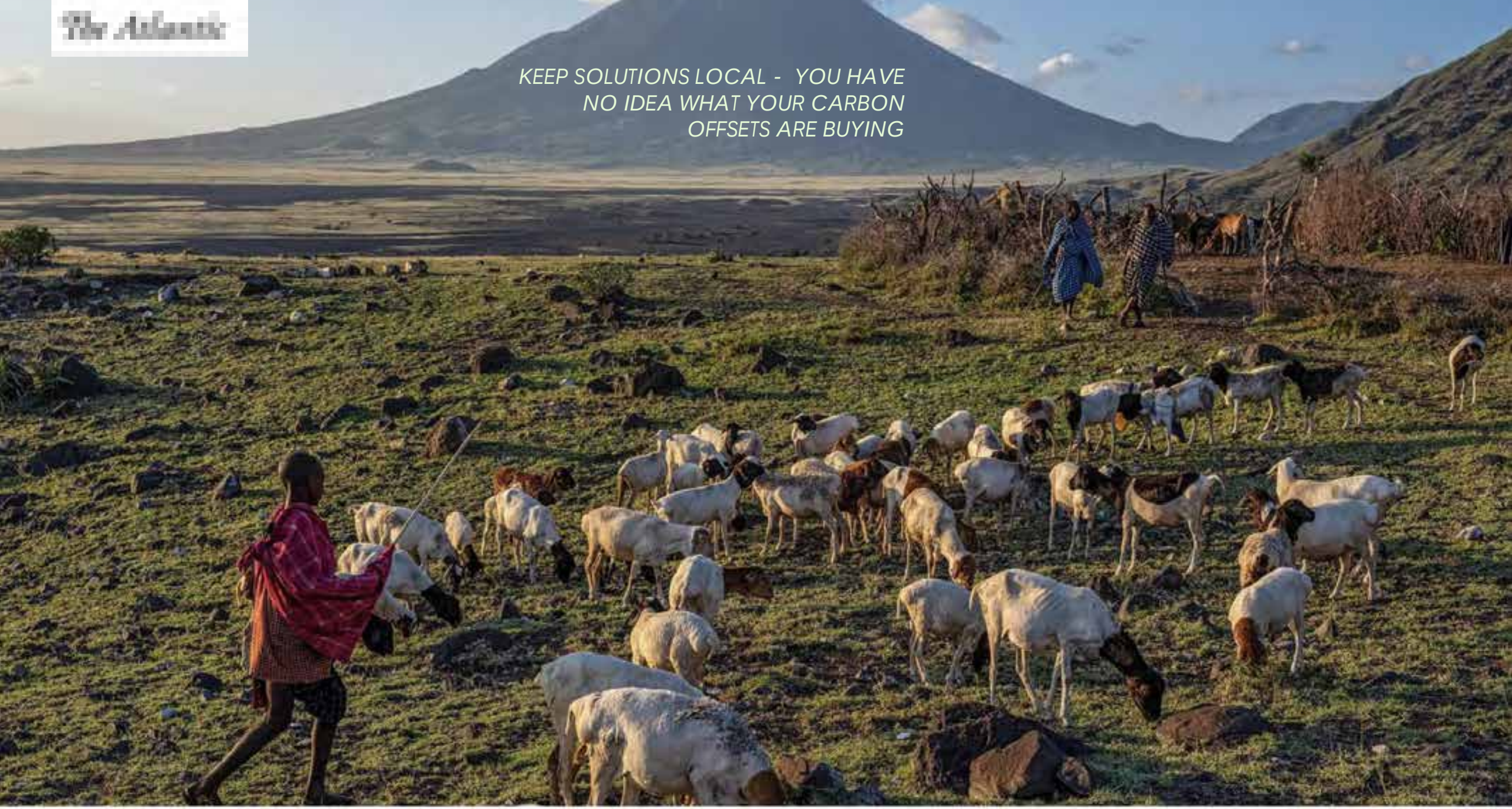
Under the patronage of Sheikh Ahmed Dalmook Al Maktoum, Blue Carbon was formed to create environmental assets, nature-based solutions and register carbon removal projects using modern methodologies.

"The ***UAE Carbon Alliance*** aims to establish the UAE as a leading hub for **high integrity, high quality carbon markets**. Carbon abatement efforts are fundamental and non-negotiable for the health of our planet, and this partnership commits to focus on the **financial**, **environmental**, and **social viability** of these efforts."

BUT ACCESS IS ONLY FOR CORPORATIONS AND THE RICH

The Atlantic

KEEP SOLUTIONS LOCAL - YOU HAVE NO IDEA WHAT YOUR CARBON OFFSETS ARE BUYING



A Maasai boy herds goats and sheep in the shadow of Ol Doinyo Lengai—known to the Maasai as the Mountain of God—in northern Tanzania. Government plans call for the removal of the Maasai from this region, the latest in a long series of evictions.

The Atlantic

BETTER PRESERVE THIS . . . FOR THE DUBAI ROYALS

A Maasai boy herds goats and sheep in the shadow of Ol Doinyo Lengai—known to the Maasai as the Mountain of God—in northern Tanzania. Government plans call for the removal of the Maasai from this region, the latest in a long series of evictions.

WIZARDS OF FINANCE AND TECH BRO'S

MARKET - BASED SOLUTIONS!!


REUTERS World Business Markets Sustainability Legal Breakingviews Technology Investigations

Sustainability | Sustainable Markets | ESG Investors | Climate Change | Climate Solutions

JPMorgan Chase to spend $200 million on carbon dioxide removals

By Susanna Twidale

May 23, 2023 10:14 AM EDT - Updated 8 months ago

Aa


Climeworks' Orca plant. Photo: Climeworks

$200 million on:

- 25,000 tons CO_2 removal by Direct Air Capture over 9 years +
- 28,500 tons from Bio-Oil over 5 years
- = 53,500 and $3,738/ton

TECHNOLOGY OR CONSERVATION?

REUTERS World Business Markets Sustainability Legal Breakingviews Technology Investigations

Sustainability | Sustainable Markets | ESG Investors | Climate Change | Climate Solutions

JPMorgan Chase to spend $200 million on carbon dioxide removals

By Susanna Twidale

May 23, 2023 10:14 AM EDT · Updated 8 months ago

A view of the exterior of the JP Morgan Chase & Co. corporate headquarters in New York City May 20, 2015. REUTERS/Mike Segar

$200 million on:

- 25,000 tons CO_2 removal by Direct Air Capture over 9 years +
- 28,500 tons from Bio-Oil over 5 years
- = 53,500 and $3,738/ton

- 1375 tons CO2 emissions avoided
- at $3,738/ton = $5,139,750

- **Why couldn't we claim this kind of support?**
- CONSERVATION IS PREFERABLE TO HIGH TECH

TECHNOLOGY OR CONSERVATION?

WHAT ABOUT CARBON TRADING?

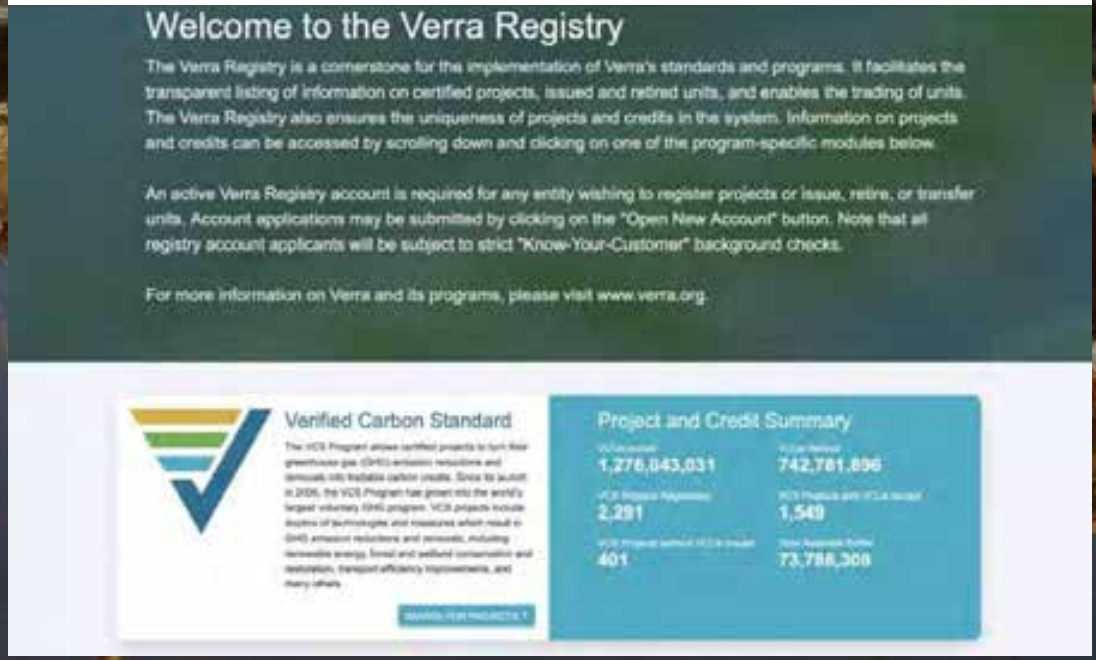
MARKET - BASED SOLUTIONS!!

VOLUNTARY MARKETS

These markets require intermediaries to act as third-party verifiers of carbon reductions.

To be fair . . . There is a ton of good work being done to quantify and verify carbon benefits

Verified Carbon Standard



There is a ton of good work being done to quantify and verify carbon benefits

APPROACHES FOR CARBON ACCOUNTING

APPROACH 4: Compares net Carbon removals from “supply area” over “period of interest” .

Ongoing Harvest | Product Manufacture | Product Use | End of Life

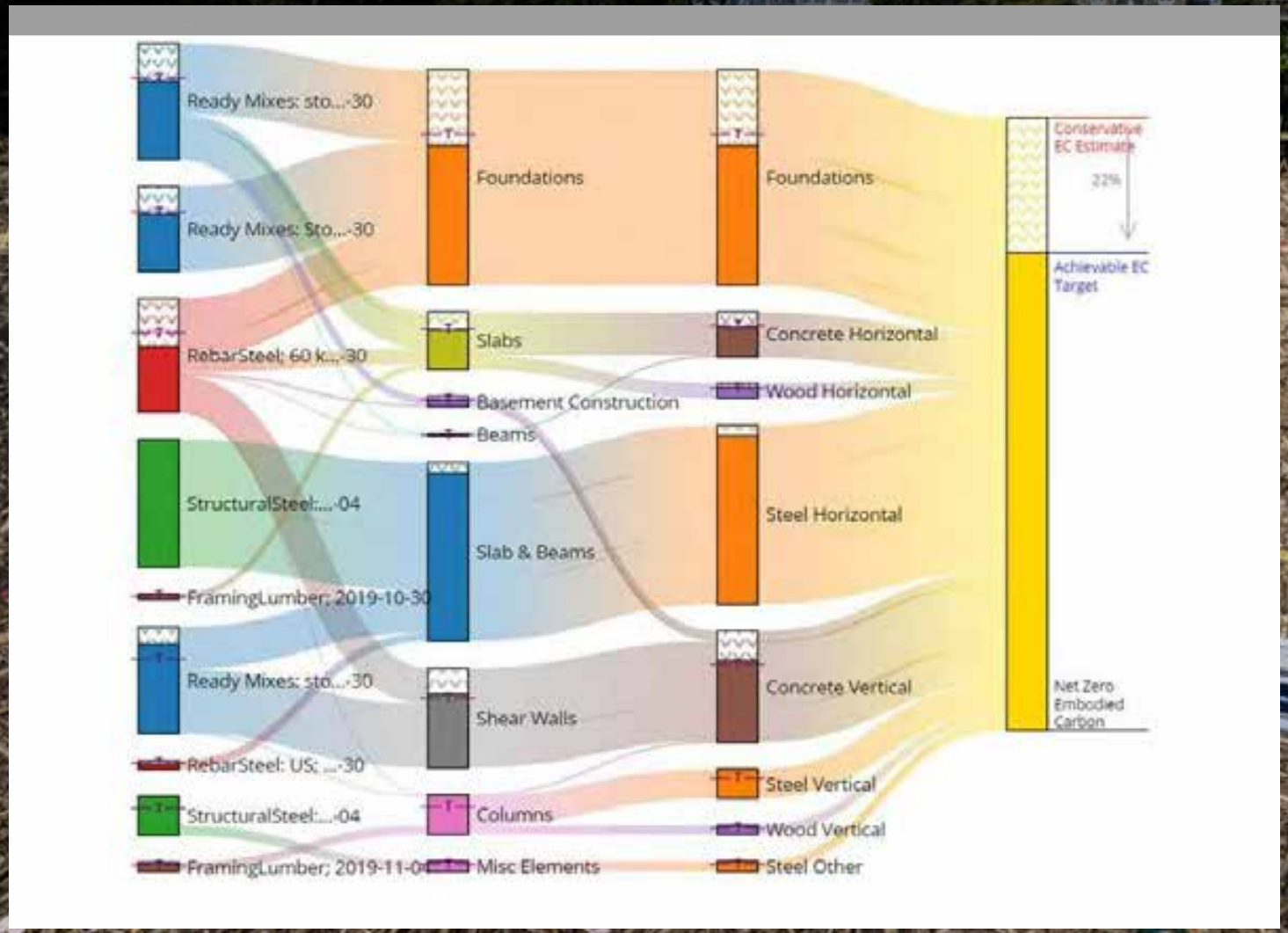
TIME

Ongoing growth + harvest

Modeling of alternate scenario to evaluate carbon cost of removal.

ADAPTED FROM CLF SEMINAR PRESENTATIONS BY REID MINER, RETIRED NCASI

BUT THESE ARE CUMBERSOME AND TIME CONSUMING – AND WE ARE OUT OF TIME



CURRENT MARKET RESPONSE

THERE IS A MARKET SIGNAL

CURRENT MARKET RESPONSE

CUT AND RUN

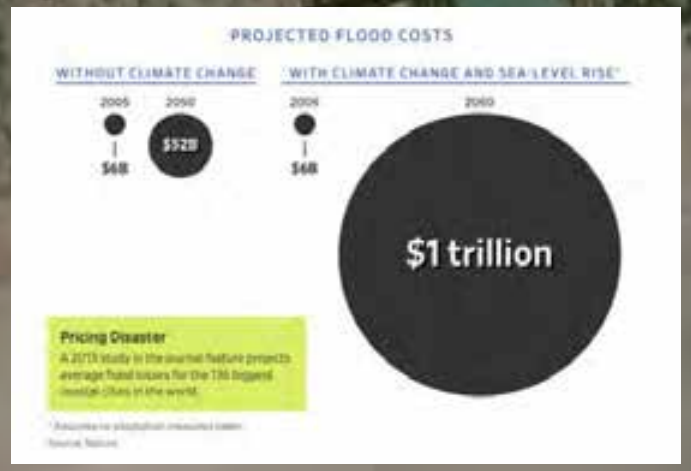
ECONOMY

Home insurers cut natural disasters from policies as climate risks grow

Some of the largest U.S. insurance companies say extreme weather has led them to end certain coverages, exclude natural disaster protections and raise premiums

By Jacob Bogage

. . . WHAT WOULD IT MEAN TO CAPTURE THAT VALUE IN THIS MARKET SIGNAL



THERE IS A MARKET SIGNAL

CURRENT MARKET RESPONSE

THERE IS A MARKET SIGNAL

CURRENT MARKET RESPONSE

CUT AND RUN

A firefighter tried to save a home in Meyers, Calif., in 2021. Max Whittaker for The New York Times

. . . WHAT WOULD IT MEAN TO CAPTURE THAT VALUE IN THIS MARKET SIGNAL

WHAT SHOULD WE DO ?

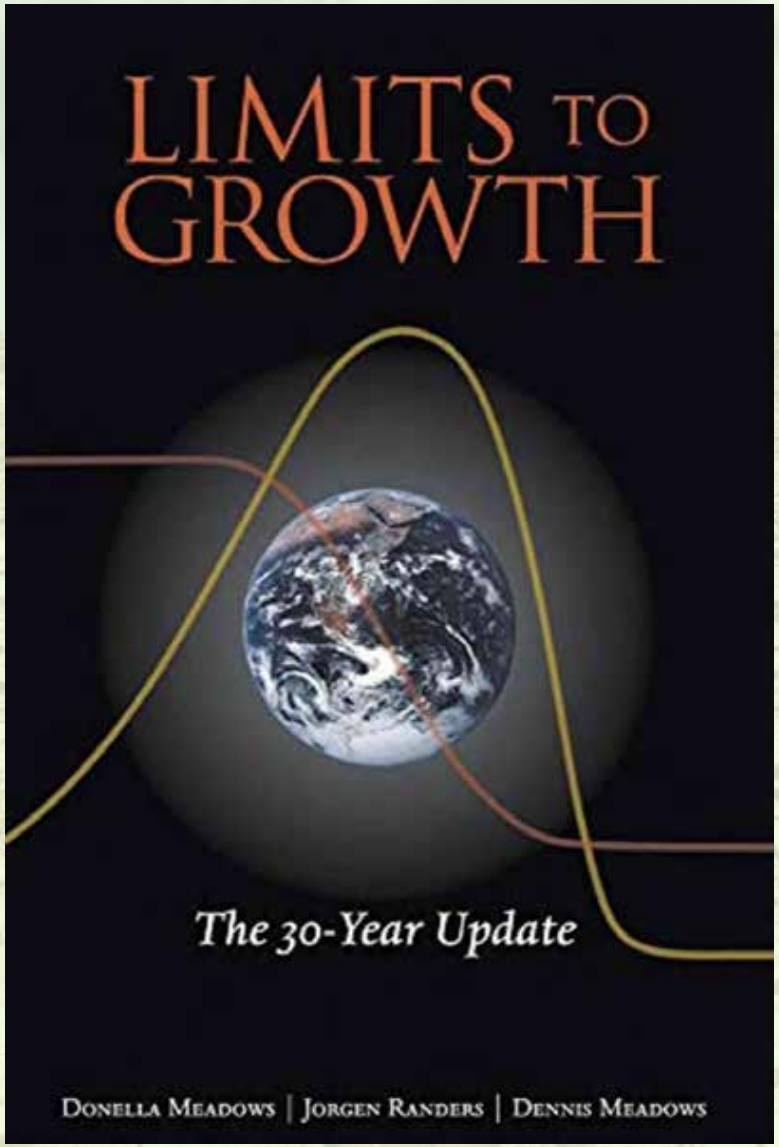
DO NOT WAIT FOR SOMEONE TO DEMONSTRATE COST EFFETIVENESS

. . . WE ARE NOT GETTING THE COSTS RIGHT,

WE ARE NOT EVEN GETTING THEM ON THE LEDGER.

- BRANDON TERRY, HARVARD POLITICAL THEORIST

WILL TECHNOLOGY AND EFFICIENCY SAVE US?



WORLD 3 IS NOT A PREDICTOR OF THE FUTURE

HOWEVER:

MIT lab has run thousands of simulations

Updated and compared against 30-year and 50-year data.

They are remarkably accurate.

So what do they suggest?

Recent Past, 1961 - 1979

WILL TECHNOLOGY AND EFFICIENCY SAVE US?

MORE RESOURCES AND GREATER EFFICIENCY

FANTASY – NO LIMITS

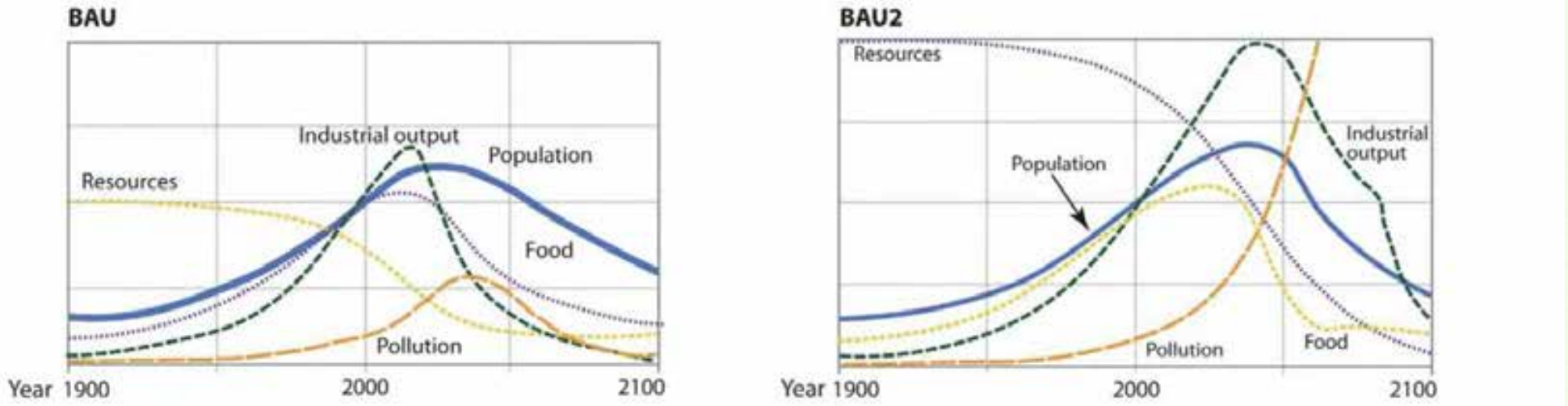
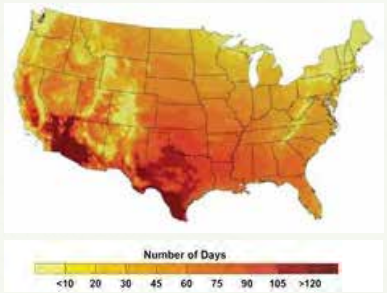


FIGURE 1 The BAU, BAU2, CT, and SW scenarios. Adapted from *Limits to Growth: The 30-Year Update* (p. 169, 173, 219, 245), by Meadows, D. H., Meadows, D. L., and Randers, J., 2004, Chelsea Green Publishing Co. Copyright 2004 by Dennis Meadows. Adapted with permission.

EVEN WITH:

- 200% LAND YIELD INCREASE
- NO LAND ENCROACHMENT DESPITE HUGE POPULATION
- PERPETUAL 4% REDUCTION IN EMISSIONS
- TOTAL RECYCLING
- ACCELERATED TECHNOLOGICAL IMPROVEMENTS

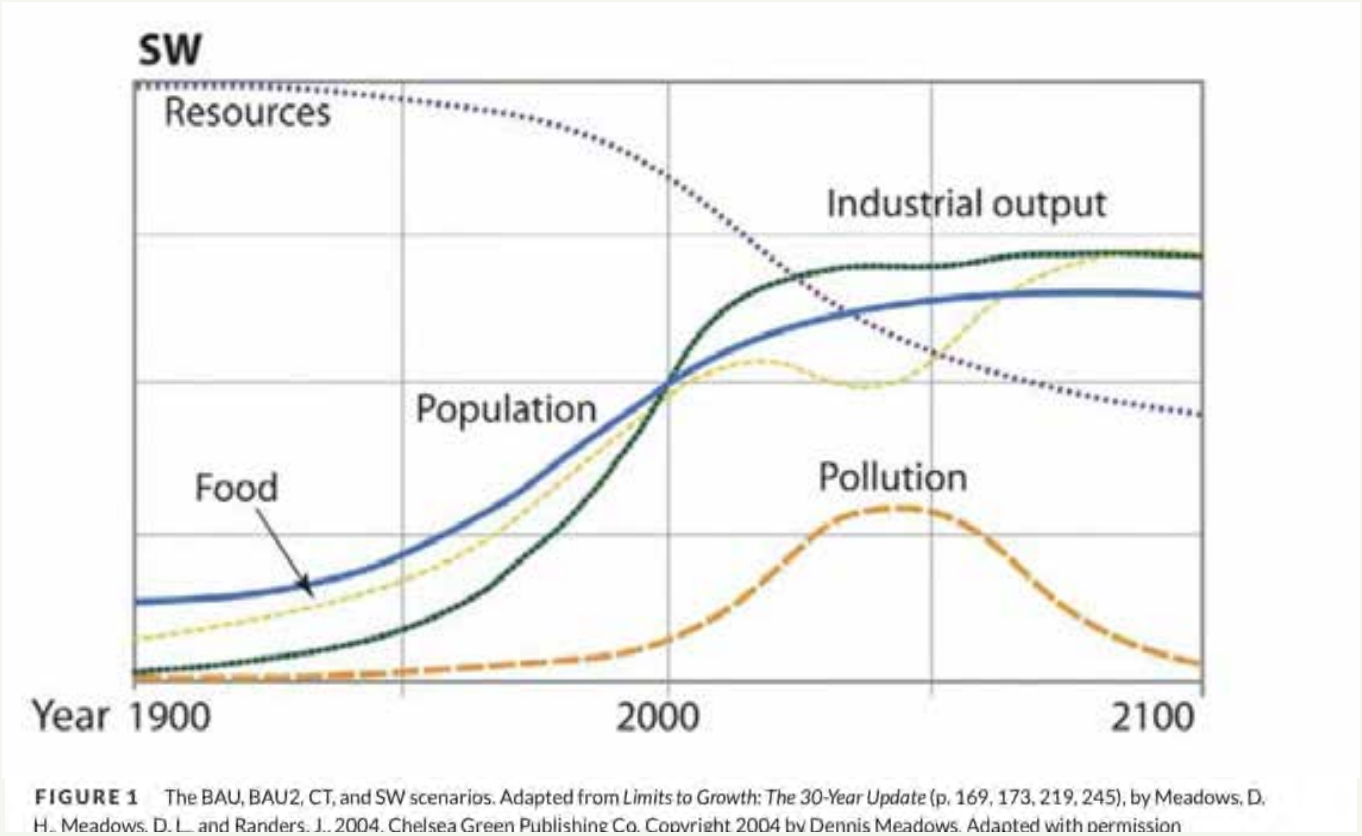


temperature map images: U.S. Global Change Research Program

WHAT IS ENOUGH ?

THE PATH TO ZERO:

- Stabilize population at 7.5 Billion
  - 2 children per couple with perfect birth control
- Technological increase
  - Abate pollution
  - Increase land yields
  - Protect renewable resources from erosion
- Reduce industrial output
  - ***"enough"*** material wealth at 10% higher than 2000 levels ***"for all"***
    - reduction for the rich
    - increase for the poor



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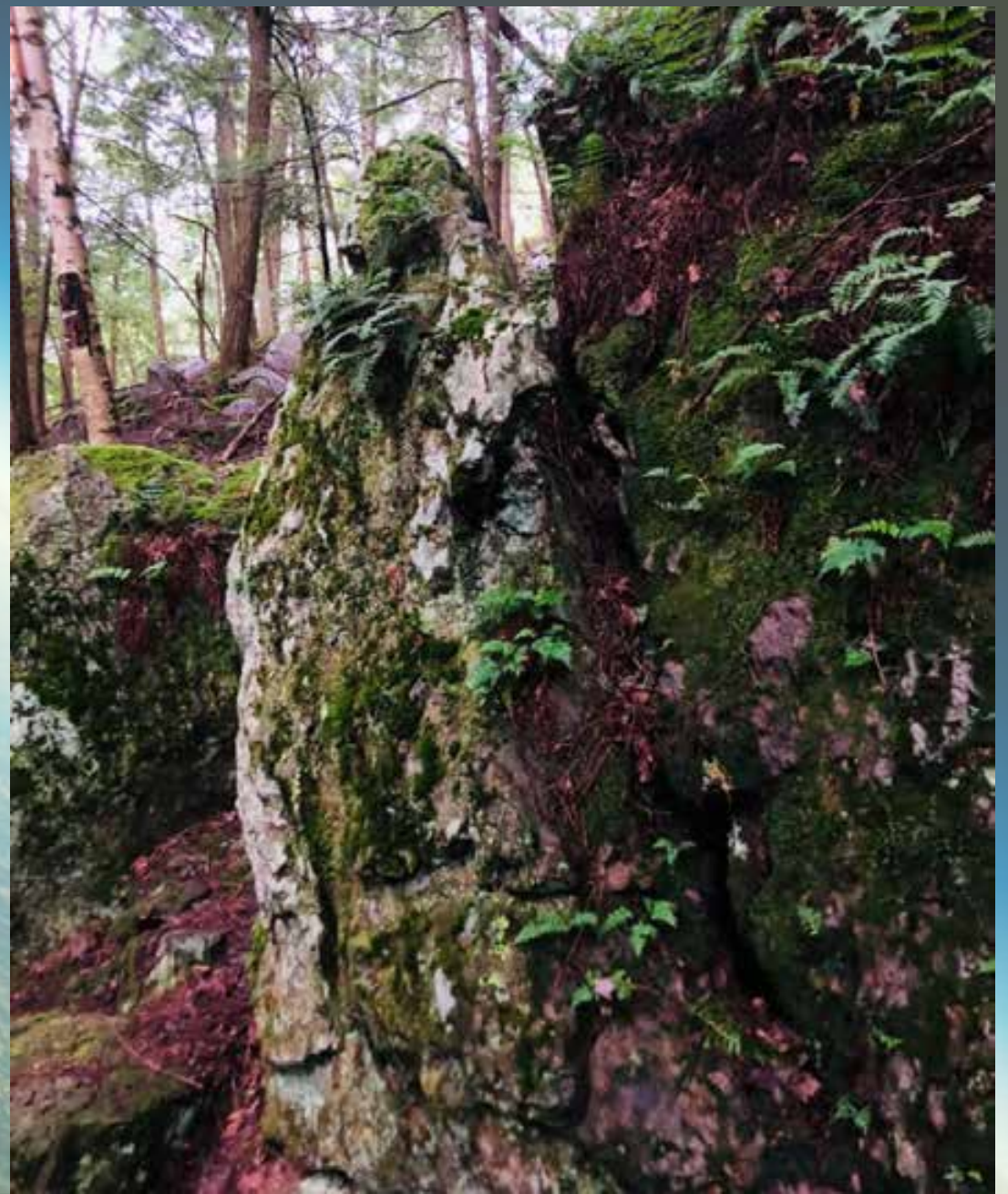
CAN ENOUGH BE ENOUGH?? + HOW DO WE USE TECHNOLOGY??
THESE TURN OUT TO BE THE MOST IMPORTANT QUESTIONS

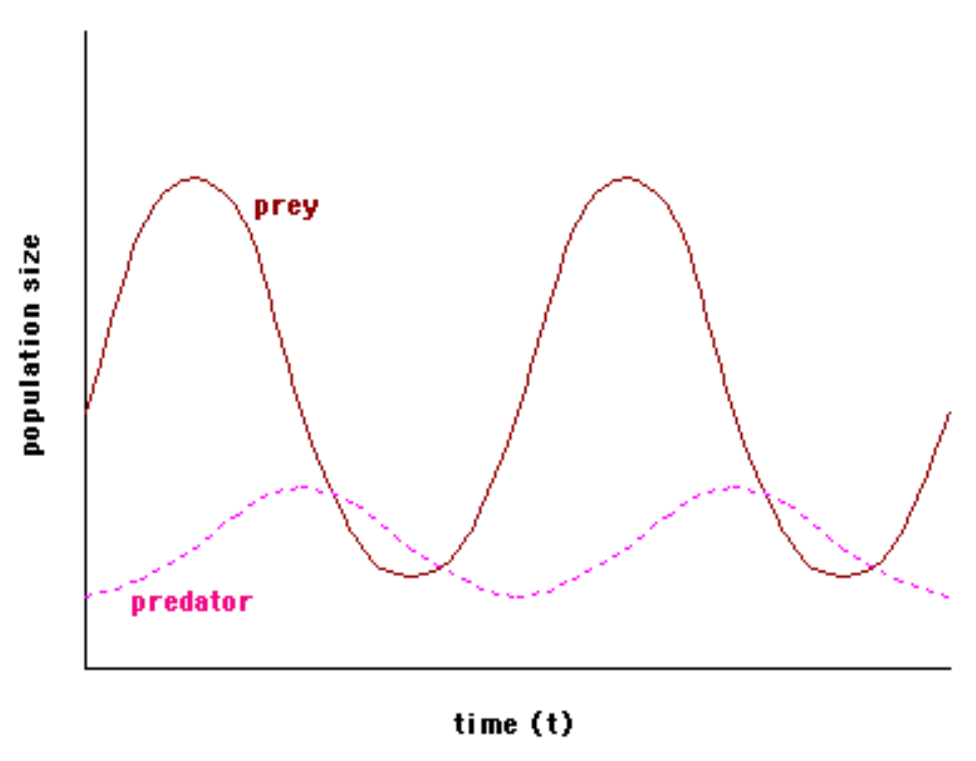
THINK LIKE NATURE

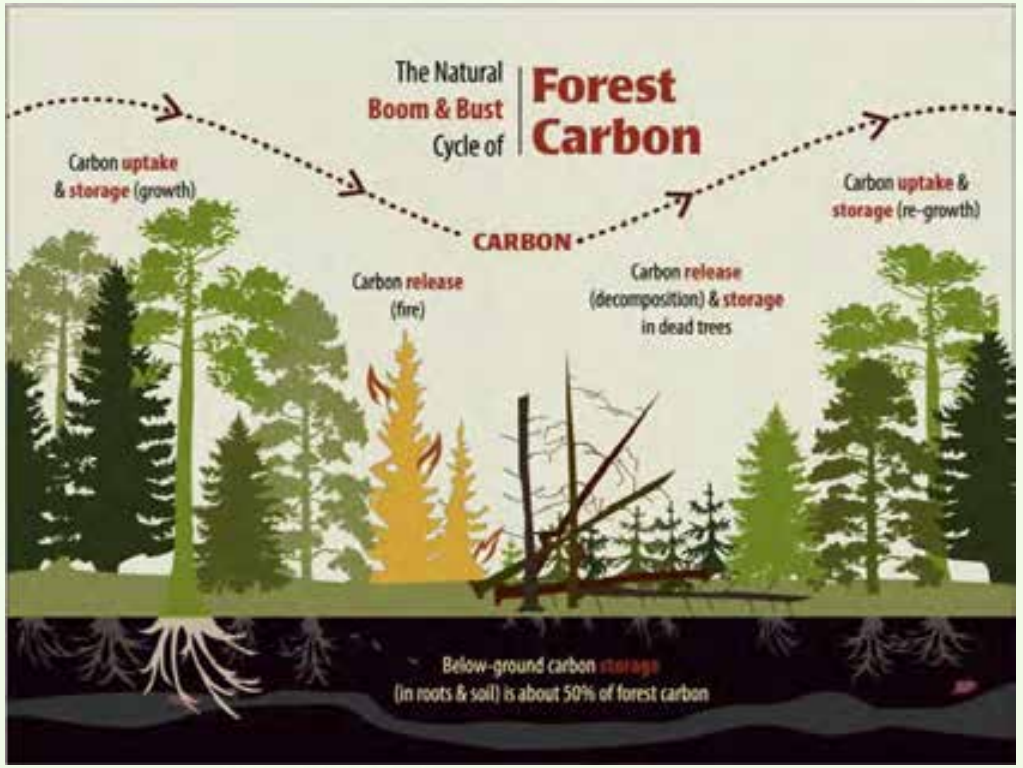
DIVERSE , RESILIENT ABUNDANCE



NATURAL SYSTEMS

FUNCTION WITHIN RESOURCE LIMITS – NO WASTE



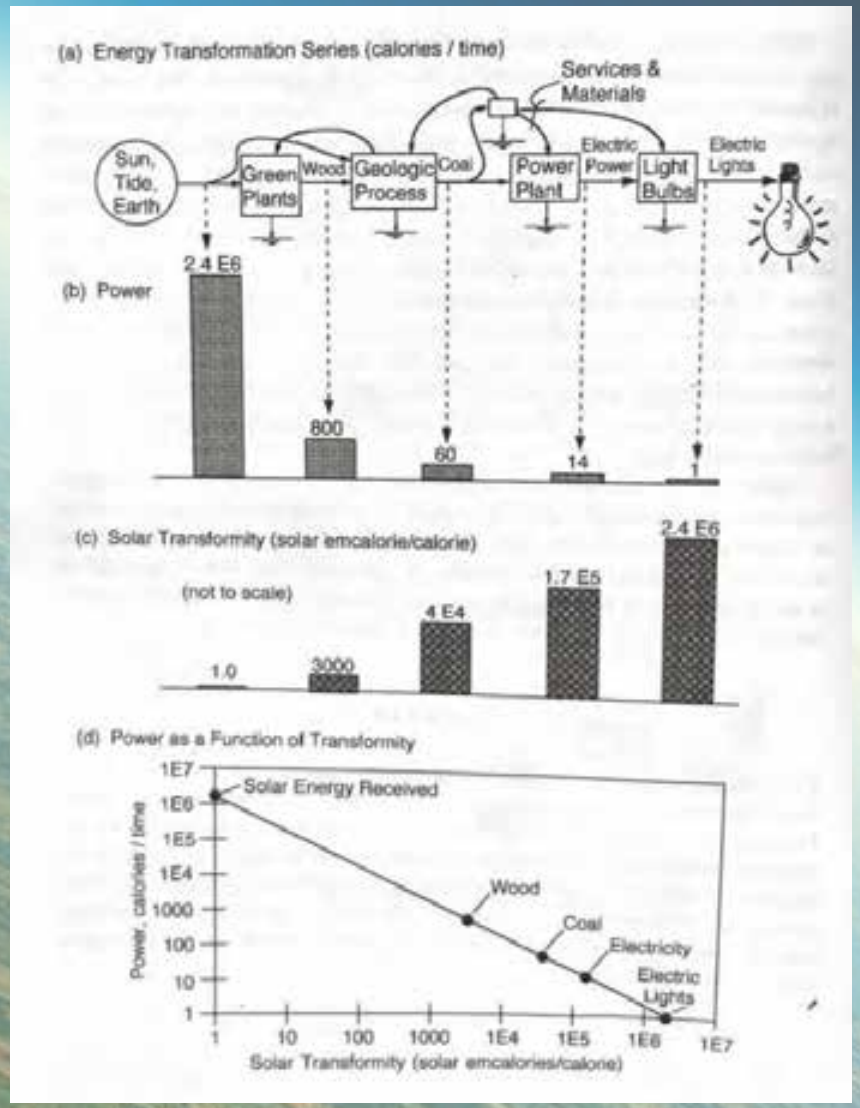


THE CAPACITY FOR REGENERATION

Recent Past, 1961 - 1979

CLASSIC OSCILLATION - DYNAMIC EQUILIBRIUM

THE SECOND LAW OF THERMODYNAMICS AND THE PATH TO ZERO



LOW TECH IS THE TRUE HIGH TECH – PRIORITIZE PASSIVE + NATURAL SYSTEMS

RENEWABLE MATERIALS GROWN SUSTAINABLY

MAKE WISER INVESTMENTS

Resilience Through Conservation

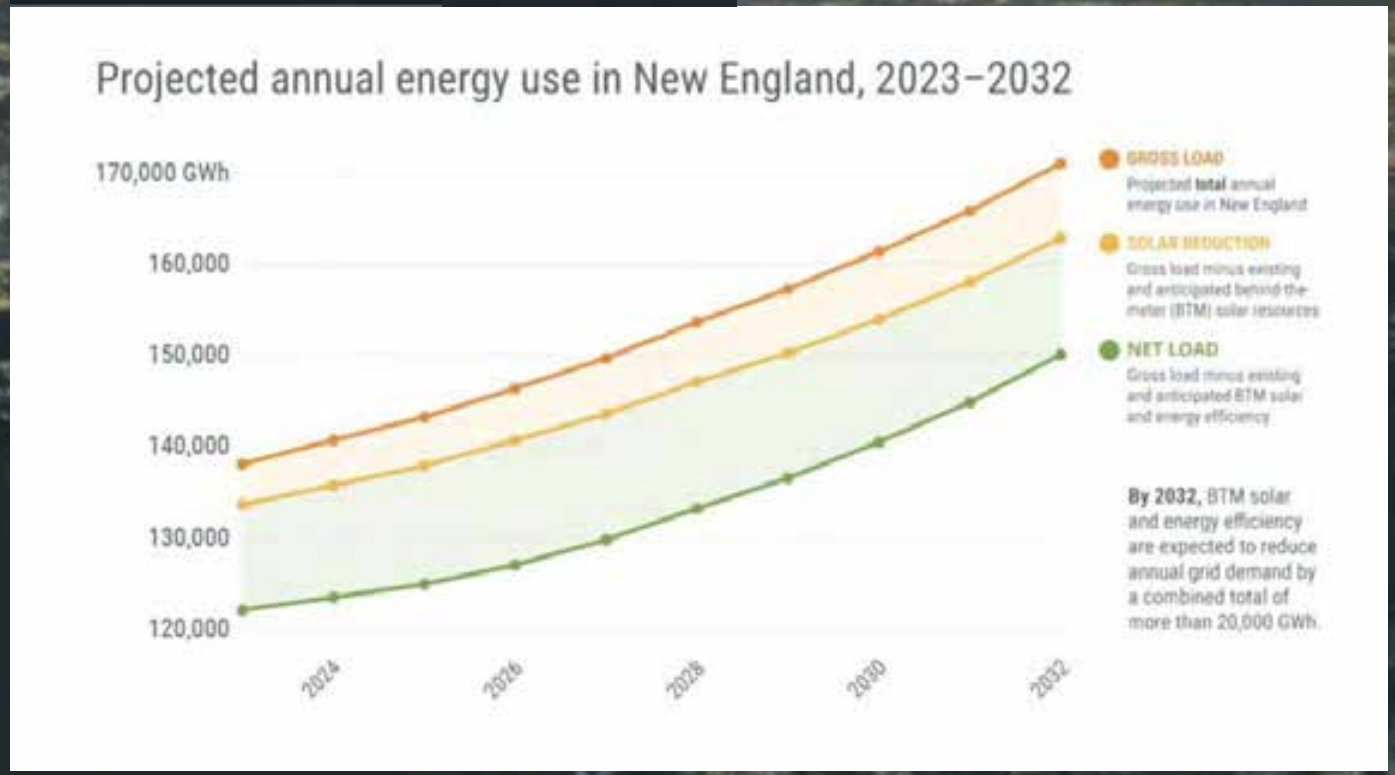
- *AVOIDED INFRASTRUCTURE INVESTMENTS AND MAINTENACE*
- *GRID SERVICES*
- *PUBLIC HEALTH IMAPCTS*
- *CLIMATE IMPACTS*

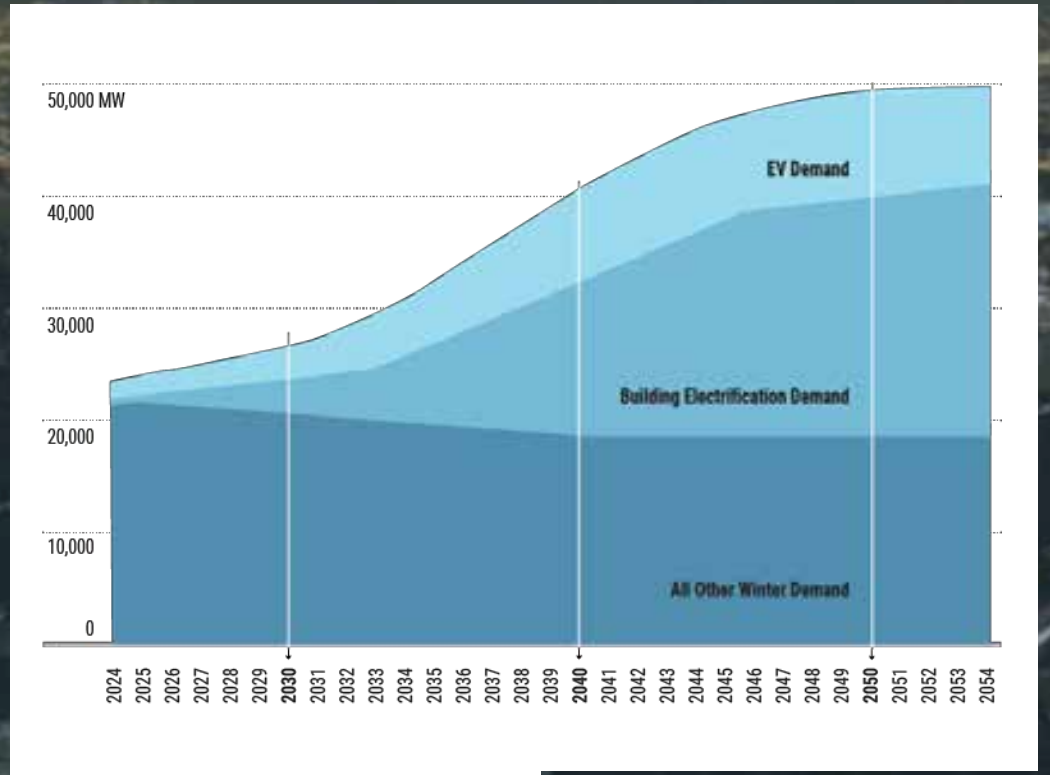
A WISER INVESTMENT

THE US IS ABOUT TO SPEND
$1.5 TO $2 TRILLION UPDATING AGING POWER INFRASTRUCTURE

ISO NEWSWIRE
A Wholesale Electricity Industry Update

ISO new england





New York ISO
Independent System Operator

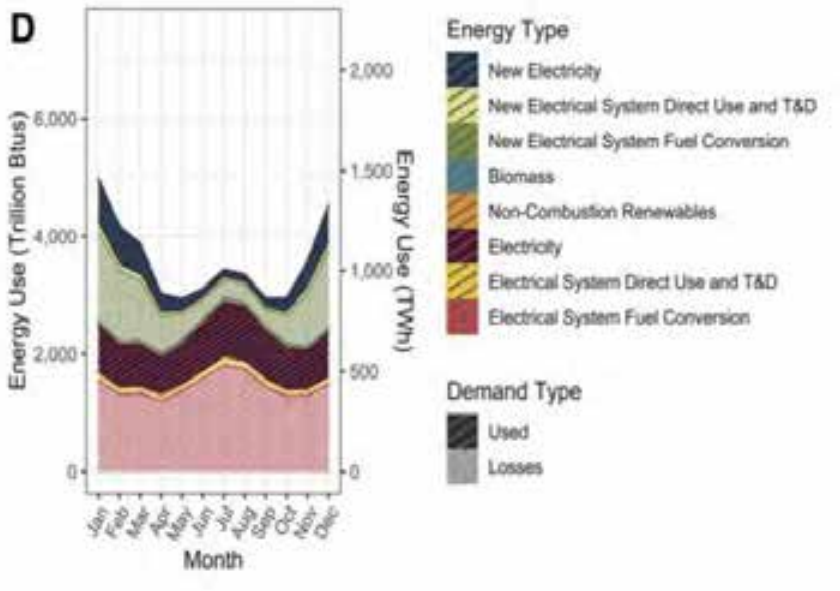
- *AVOIDED INFRASTRUCTURE INVESTMENTS AND MAINTENACE*
- *GRID SERVICES*
- *PUBLIC HEALTH IMAPCTS*
- *CLIMATE IMPACTS*

A WISER INVESTMENT

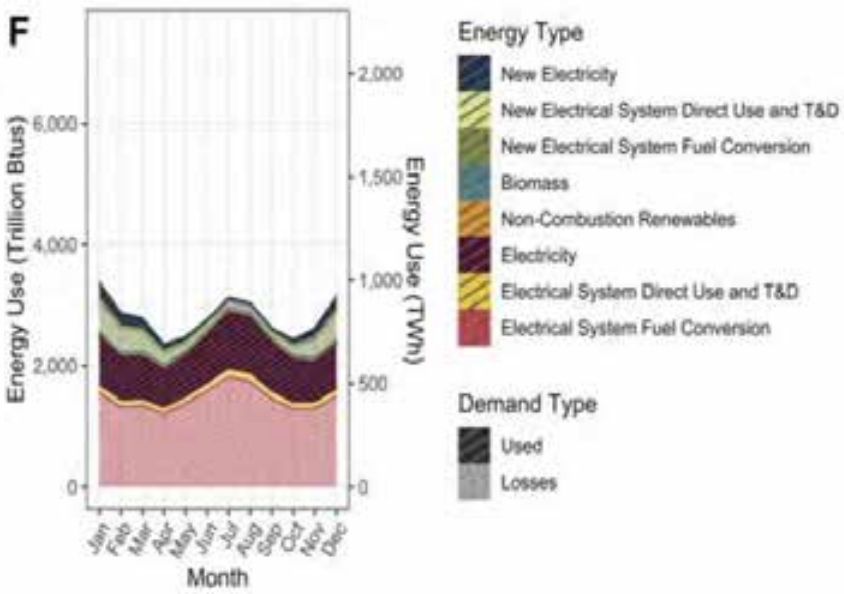
THE US IS ABOUT TO SPEND
$1.5 TO $2 TRILLION UPDATING AGING
POWER INFRASTRUCTURE

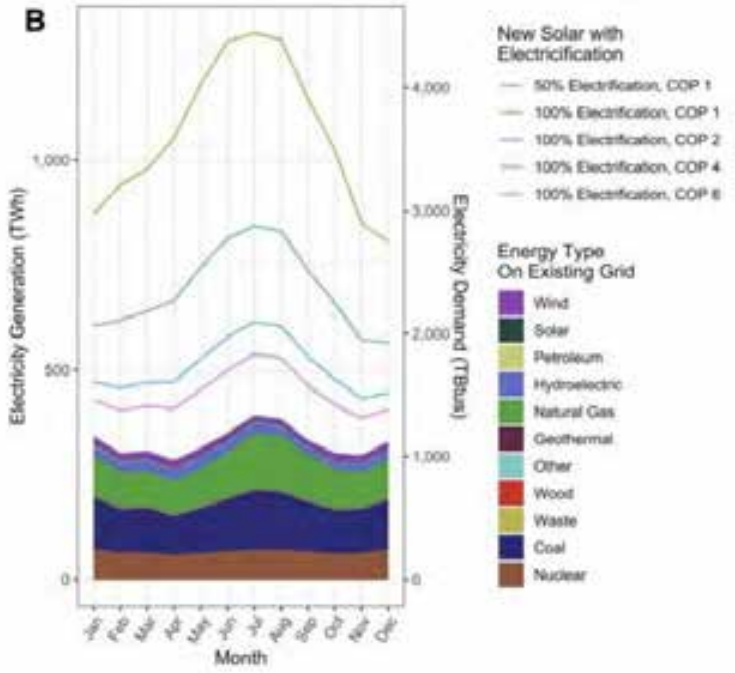
scientific reports

COP of 2



COP of 6

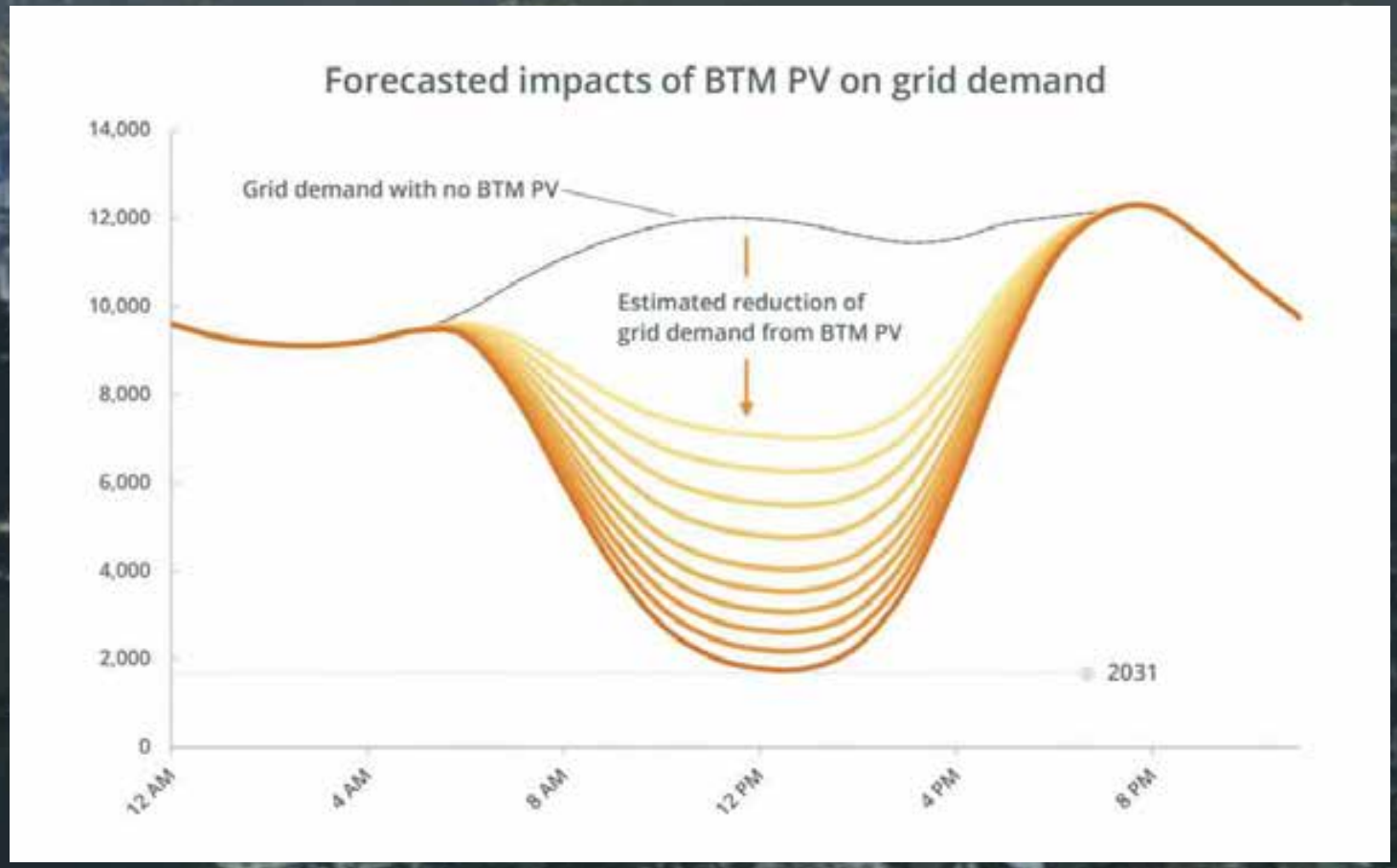




- *AVOIDED INFRASTRUCTURE INVESTMENTS AND MAINTENACE*
- *GRID SERVICES*
- *PUBLIC HEALTH IMAPCTS*
- *CLIMATE IMPACTS*

A WISER INVESTMENT

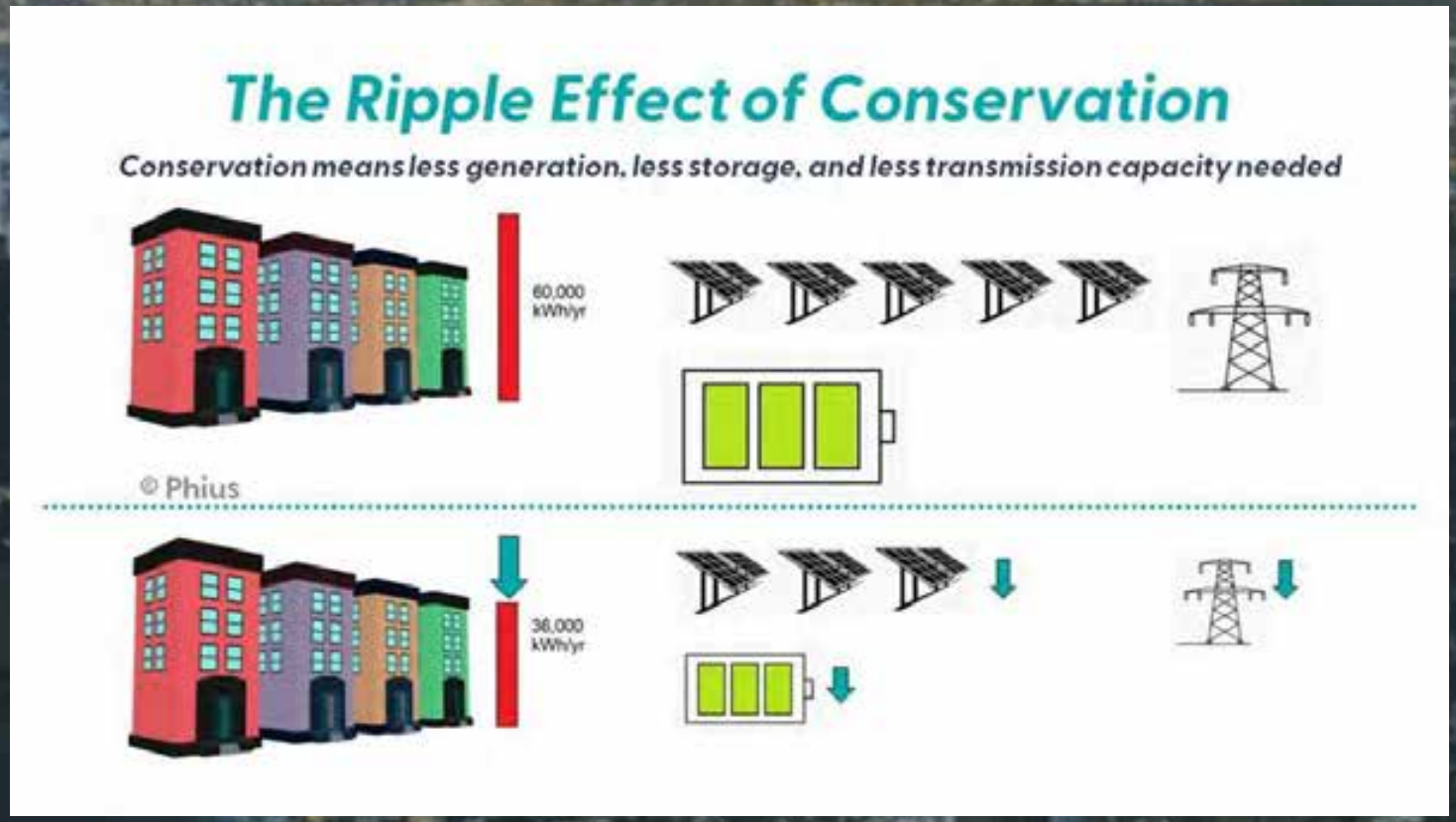
Peak load ramps are tough on the grid!



. . . AND UTILITY DEMAND RESPONSE AND CURTAILMENT INCENTIVES MAY BE A REVENUE STREAM

A WISER INVESTMENT

The More We Spend on Efficiency, the Less We Need to Spend on the Grid



Facilitating the Renewable Transition Part. 1: Passive Buildings and the Grid, Lisa White

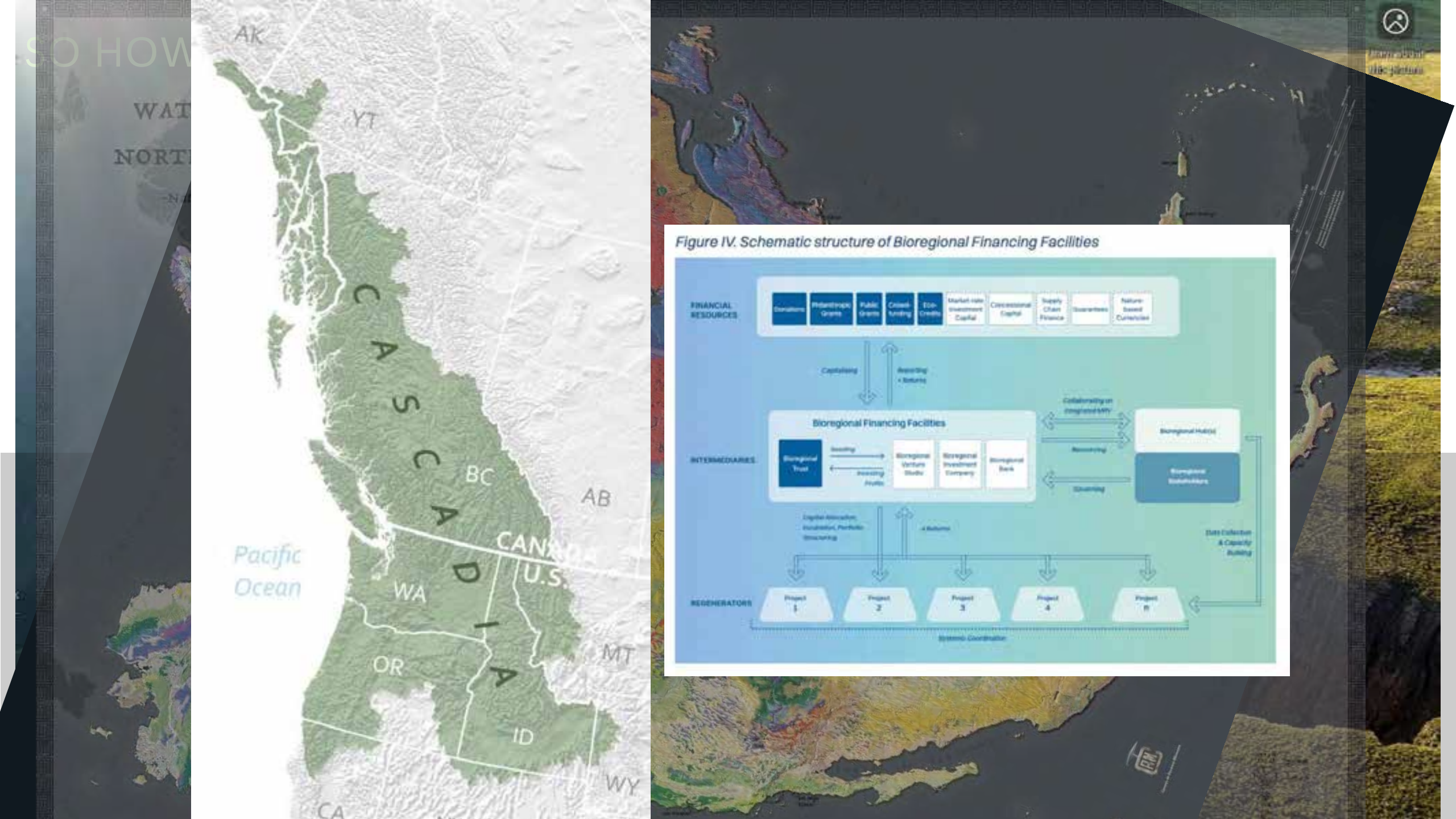
WE NEED TO ADVOCATE FOR THE IMPLEMENTATIONOF A MEANINGFUL PRICE ON CARBON?

We need a "A Social Cost of Carbon":

- **Consistent with a "Net-**Zero Climate Impact **Goal,"**
- Accounting for the increased uncertainty of delay and increased total emissions
- That accounts for climate impact on growth
- With sensitivity to regional and localized threats
- And proportional impacts and responsibility by income

SO HOW S

Figure IV. Schematic structure of Bioregional Financing Facilities


AK
YT
BC
AB
CANADA
U.S.
WA
OR
ID
MT
WY
CA
Pacific Ocean
Figure IV. Schematic structure of Bioregional Financing Facilities
FINANCIAL RESOURCES
Donations
Philanthropic Grants
Public Grants
Crowdfunding
Eco-Credits
Market-rate Investment Capital
Concessional Capital
Supply Chain Finance
Guarantees
Nature-based Currencies
Capitalising
Returning + Returns
Bioregional Financing Facilities
INTERMEDIARIES
Bioregional Trust
Investing
Investing Profits
Bioregional Venture Studio
Bioregional Investment Company
Bioregional Bank
Collaborating on Integrated MRV
Resourcing
Governing
Bioregional Hub(s)
Bioregional Stakeholders
Capital Allocation, Investment, Portfolio Structuring
+ Returns
Data Collection & Capacity Building
REGENERATORS
Project 1
Project 2
Project 3
Project 4
Project n
Systemic Coordination

LEVERAGE POINTS

PLACES TO INTERVENE IN A SYSTEM

(in increasing order of effectiveness)

9. Constants, parameters, numbers (subsidies, taxes, standards).

8. Regulating negative feedback loops.

7. Driving positive feedback loops.

6. Material flows and nodes of material intersection.

5. Information flows.

4. The rules of the system (incentives, punishments, constraints).

3. The distribution of power over the rules of the system.

2. The goals of the system.

1. The mindset or paradigm out of which the system — its goals, power structure, rules, its culture — arises.

1. CHANGE YOUR MENTAL FRAME

ASSUME IT MUST BE DONE AND LOOK FOR OPPORTUNITY

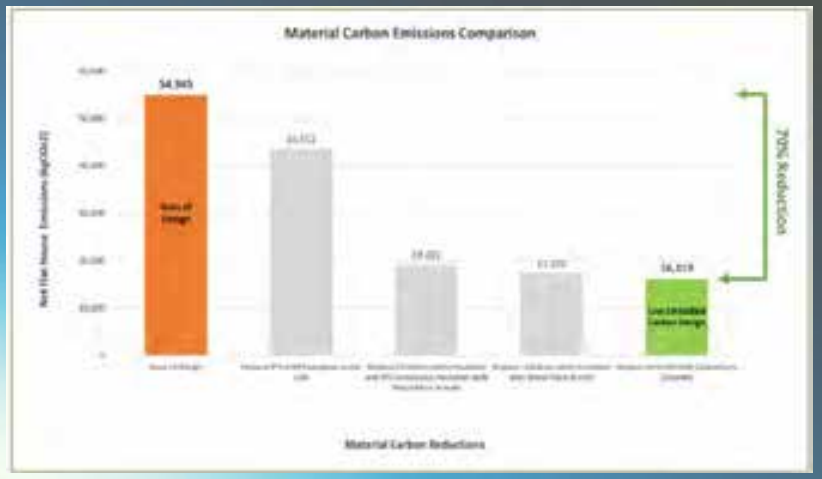
2. PROVIDE INFORMATION

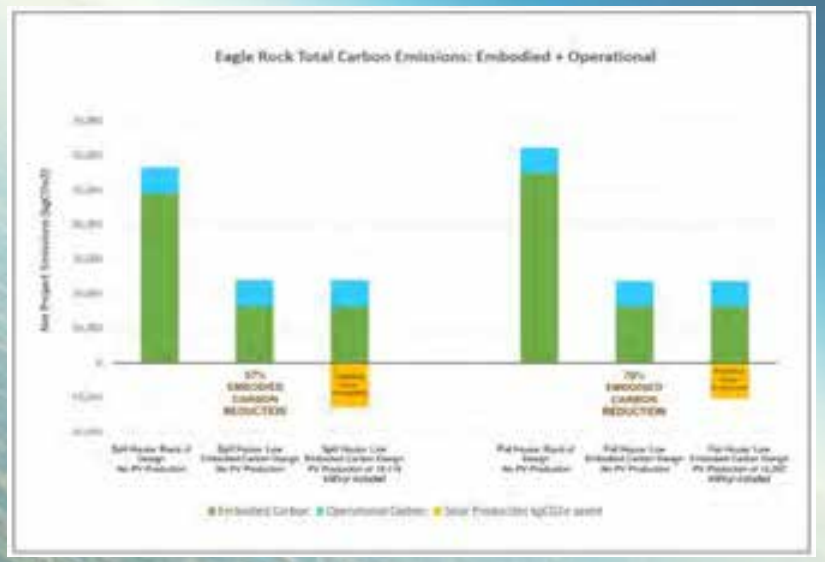
START WITH A HOLISTIC ASSESSMENT TO REVEAL OPPORTUNITIES

SHOW THE IMPACTS AND SOLUTIONS

WHEN PRESENTED WITH ABSTRACTIONS CLIENTS TEND TO DEFAULT TO SKEPTICISM AND ASSUME ADDITIONAL COST

WHEN WE SHOW THEM A COMPARISON THEY GET INTERESTED IN THEIR CHOICE





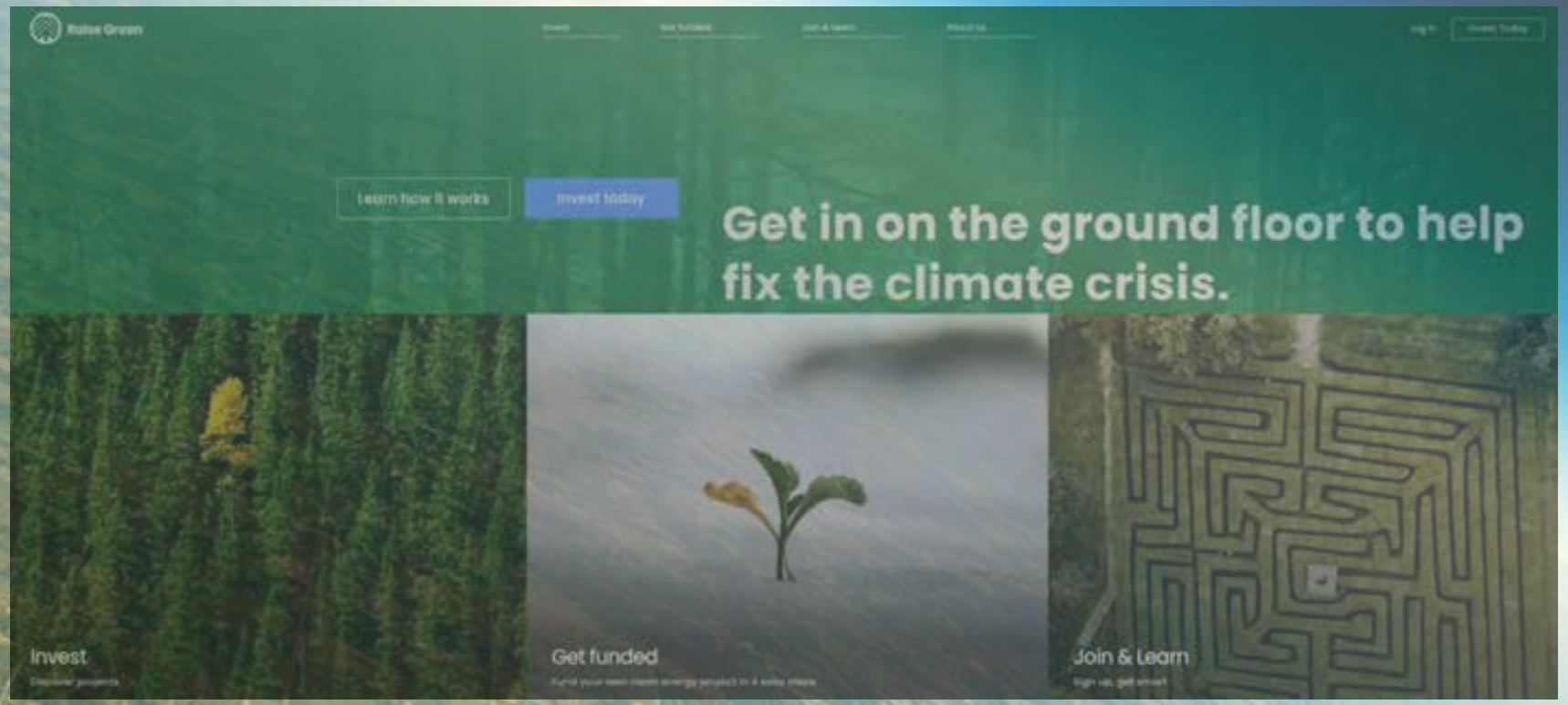
2. PROVIDE INFORMATION

SHOW A SOCIAL COST OF CARBON ON YOUR PRO-FORMA
+ COST EFFECTIVENESS CALCULATIONS (EVEN IF YOU CAN NOT CLAIM IT YET)

OUR CLIENTS GET TO CHOOSE, BUT THEY SHOULD BE INFORMED

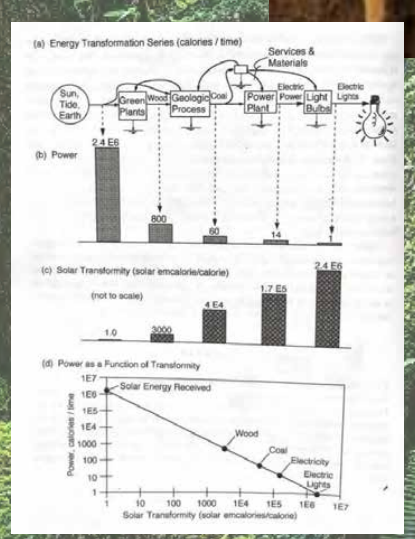
3. COME TOGETHER

LET'S GET TOGETHER AND DEMAND EQUITABLE, COMMUNITY-BASED ACCESS TO **CARBON VALUE** THROUGH AGGREGATION COOPERATIVES AND IMPACT FUNDS



4. PRIORITIZE LOW IMPACT

LOW TECH, PASSIVE + NATURAL SYSTEMS



A CONCEPTUAL EMERGY GRAPH COLLAGE OF THE PATH TO ZERO

5. DO IT YOURSELF