Decision-Making under Risk: Climate Ethics

CS 109

TURNING PROBABILITY INTO ACTION WITH DECISION THEORY …

AND ACTION INTO GOOD ACTION WITH ETHICS!

Making Decisions about the Future

Simple decision theory says:

- P = Probability of an outcome occurring <= you can figure this out now!
- V = Value/utility of that outcome

P x V = Expected Value

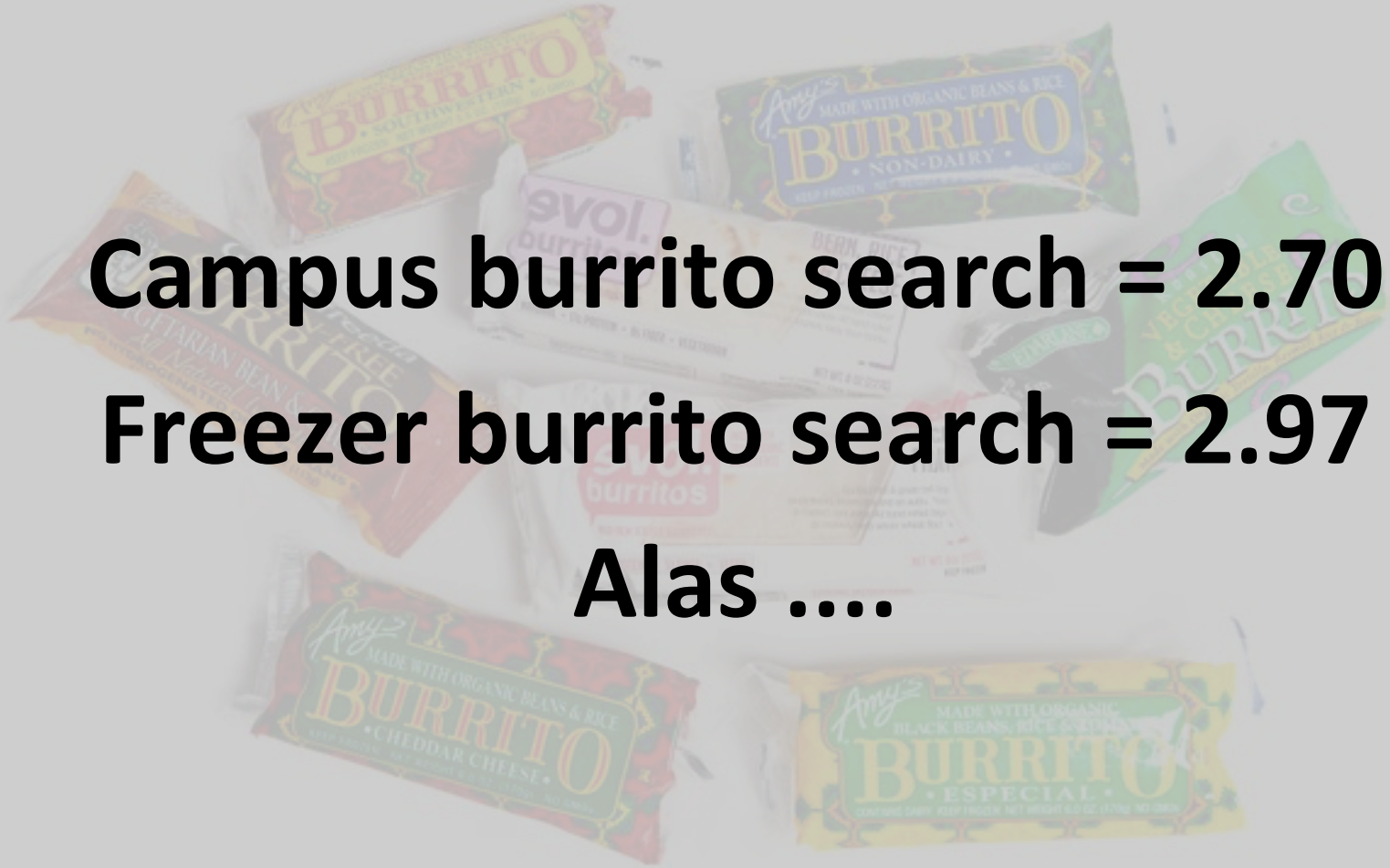
Example: BurritoQuest 2021

- Likelihood of finding a frozen burrito in my freezer = 0.99
- Value of frozen burrito = 3 ☹

- Value of on-campus burrito = 9 ☺
- Likelihood of finding a burrito on campus = 0.3

- **Campus burrito search = 2.70**
- **Freezer burrito search = 2.97**

Making Decisions about the Future



Campus burrito search = 2.70

Freezer burrito search = 2.97

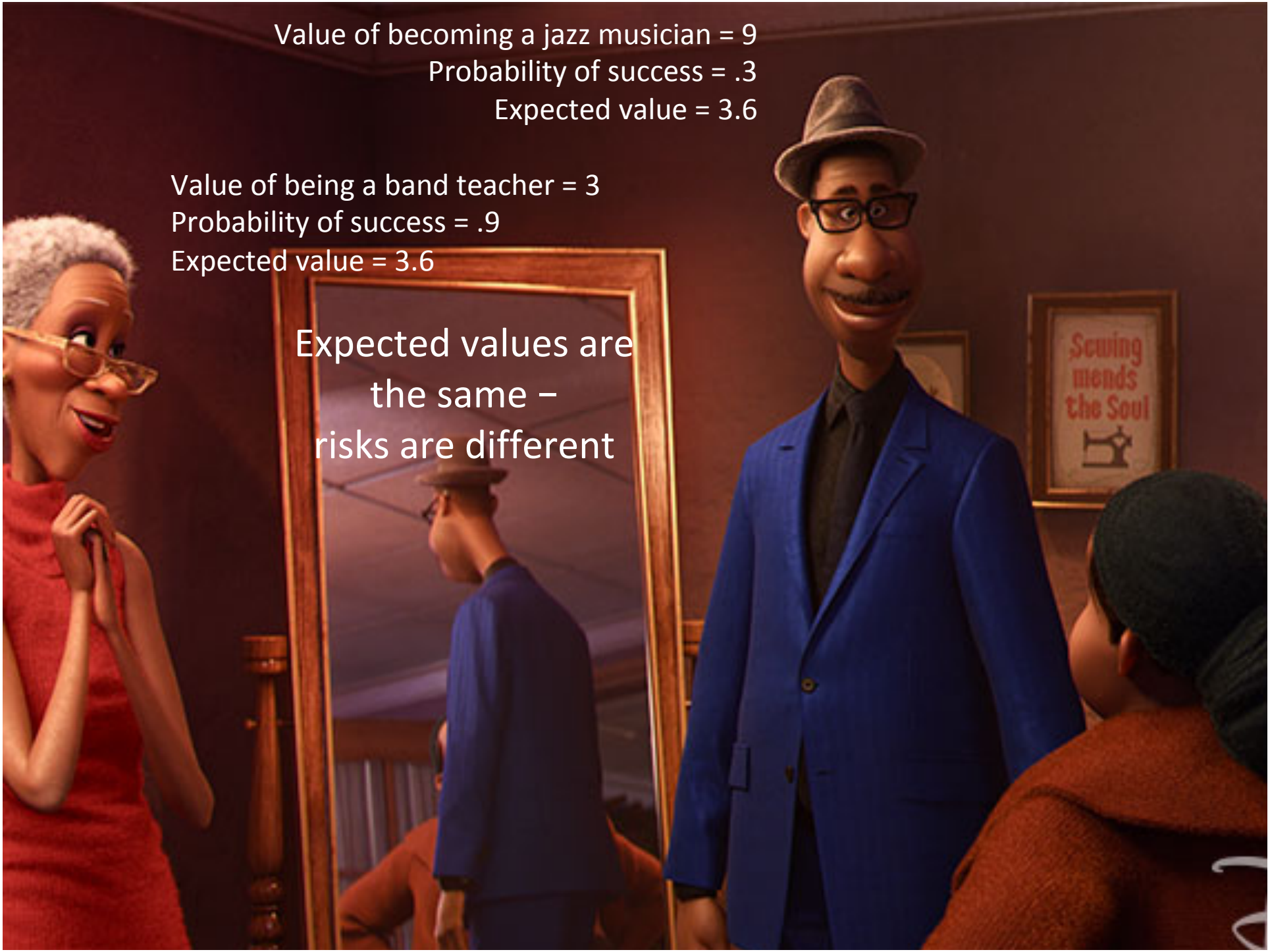
Alas ....

Adding Risk

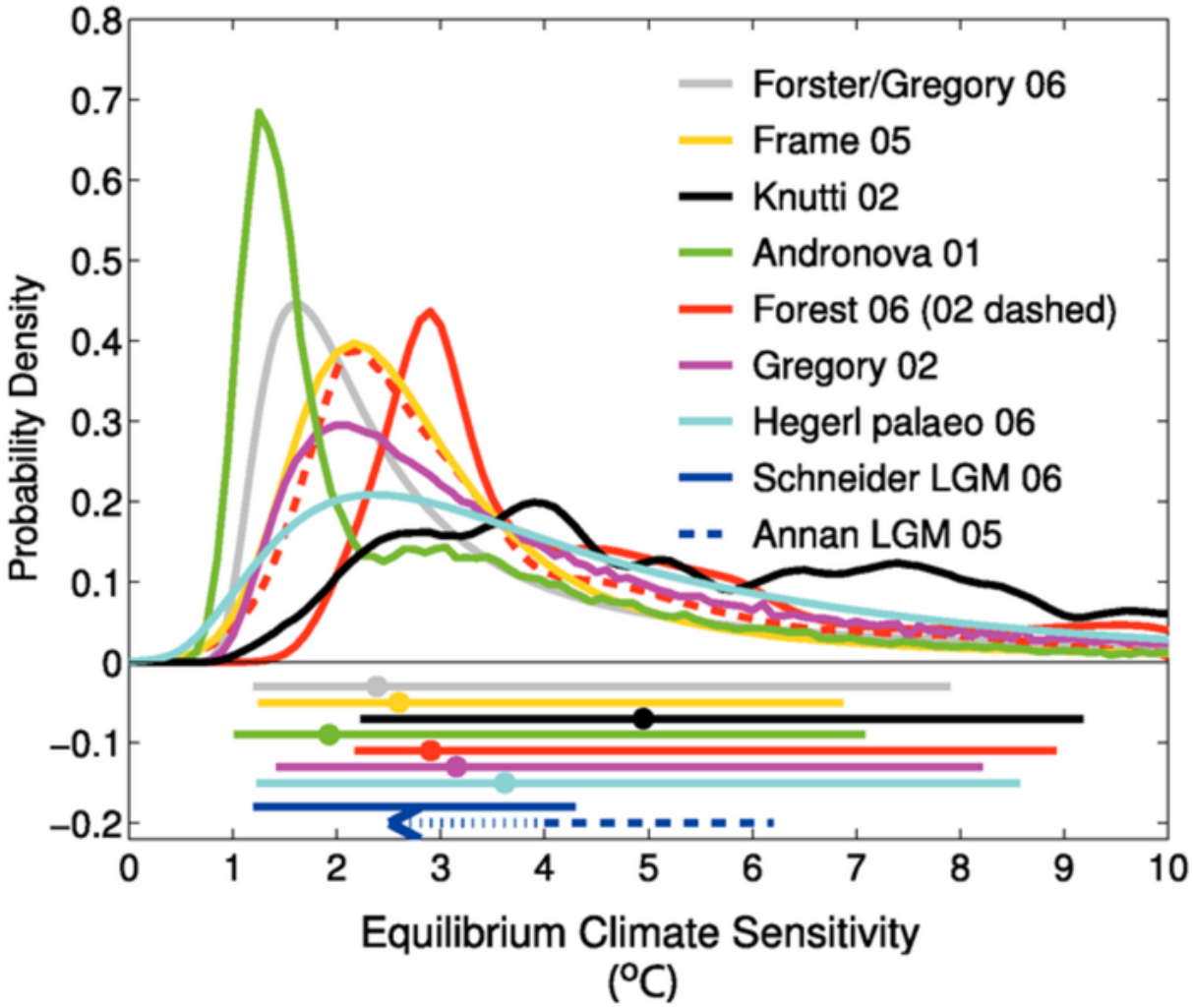
Now let's model **risk** of outcomes separately from their **probability** or their **value**. The combined score is the "risk weighted expected utility."

How do you value the risk of:

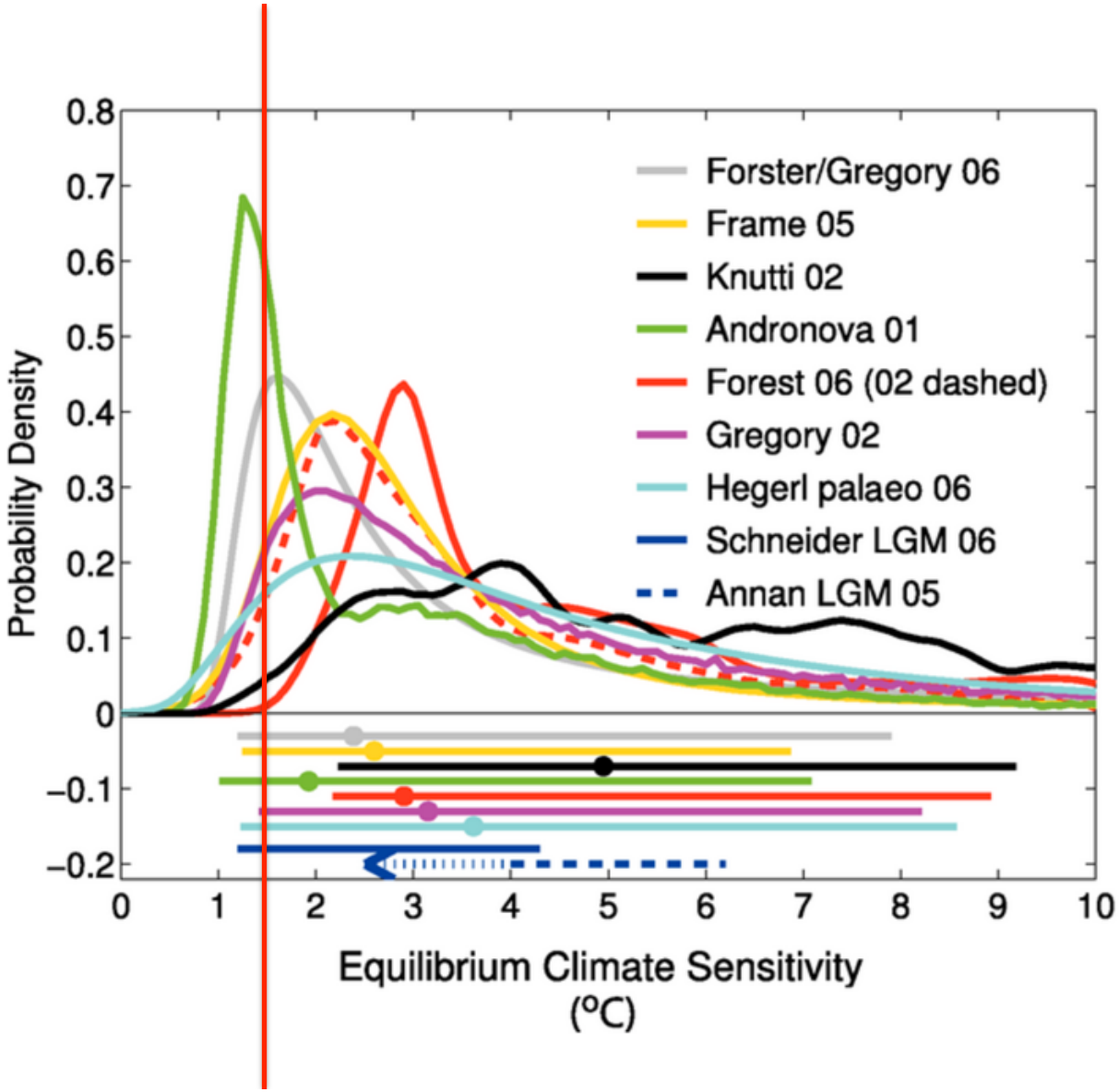
- High chance of acceptable outcome vs.
- Low chance of great outcome vs.
- Low chance of devastatingly bad outcome


Value of becoming a jazz musician = 9
Probability of success = .3
Expected value = 3.6
Value of being a band teacher = 3
Probability of success = .9
Expected value = 3.6
Expected values are the same – risks are different
Sewing mends the Soul

Problem Set 3: Climate Change
275 ppm x 2 = 550 ppm



How do we stay under 1.5C (or 2C)?



1.5C of warming VS 2C of warming

Heatwaves

1.5C of warming	2C of warming
Up to 1.1 months	Up to 1.5 months

Freshwater

*availability in the Mediterranean**

1.5C of warming	2C of warming
↓ 9%	↓ 17%

Heavy rainfall

*increase in intensity**

1.5C of warming	2C of warming
↑ 5%	↑ 7%

Crop yields

*in tropical regions**

1.5C of warming	2C of warming
Wheat production down ↓ 9%	Wheat production down ↓ 16%
Maize production down ↓ 3%	Maize production down ↓ 6%
Soy production up ↑ 6%	Soy production up ↑ 7%
Rice production up ↑ 6%	Rice production up ↑ 6%

Sea level rise

by 2100 relative to 2000

1.5C of warming	2C of warming
↑ 40cm	↑ 50cm

Coral bleaching

from 2050 onwards

1.5C of warming	2C of warming
90% of reefs at risk	98% of reefs at risk

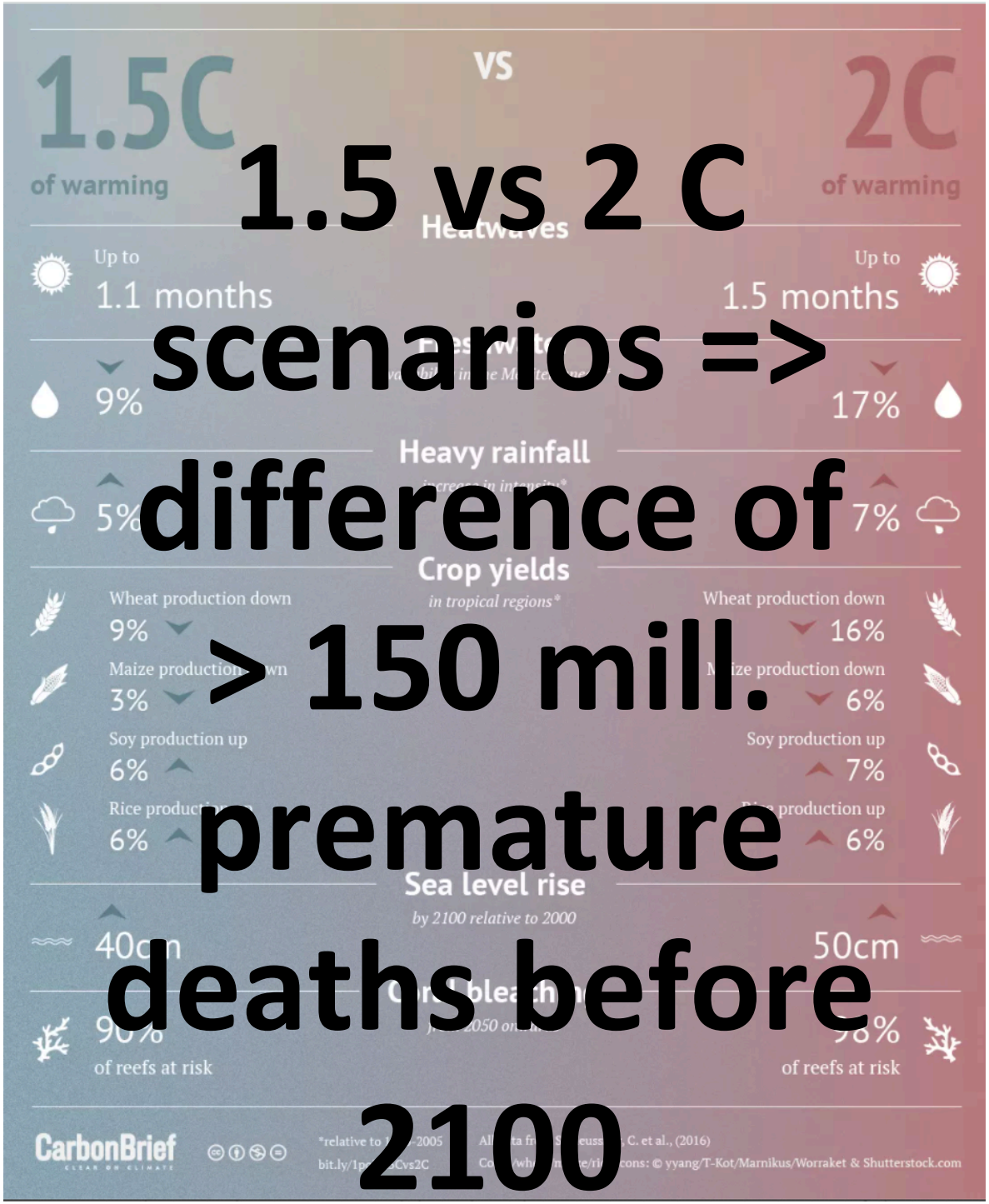
CarbonBrief
CLEAR ON CLIMATE

*relative to 1986-2005

bit.ly/1point5Cvs2C

All data from Schleussner, C. et al., (2016)

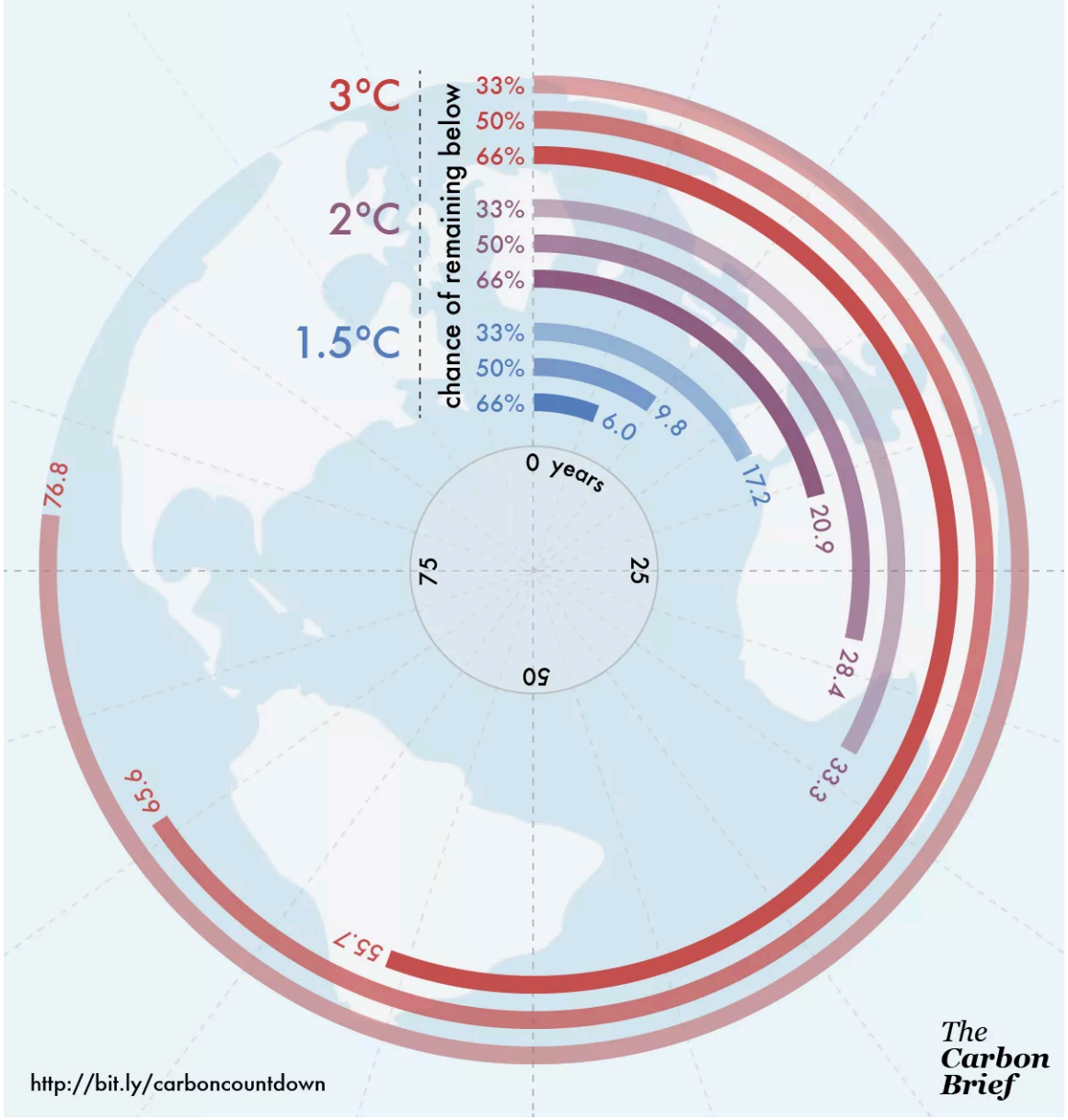
Coral /wheat/maize/rice icons: © yyang/T-Kot/Marnikus/Worraket & Shutterstock.com



1.5 vs 2 C scenarios => difference of > 150 mill. premature deaths before 2100

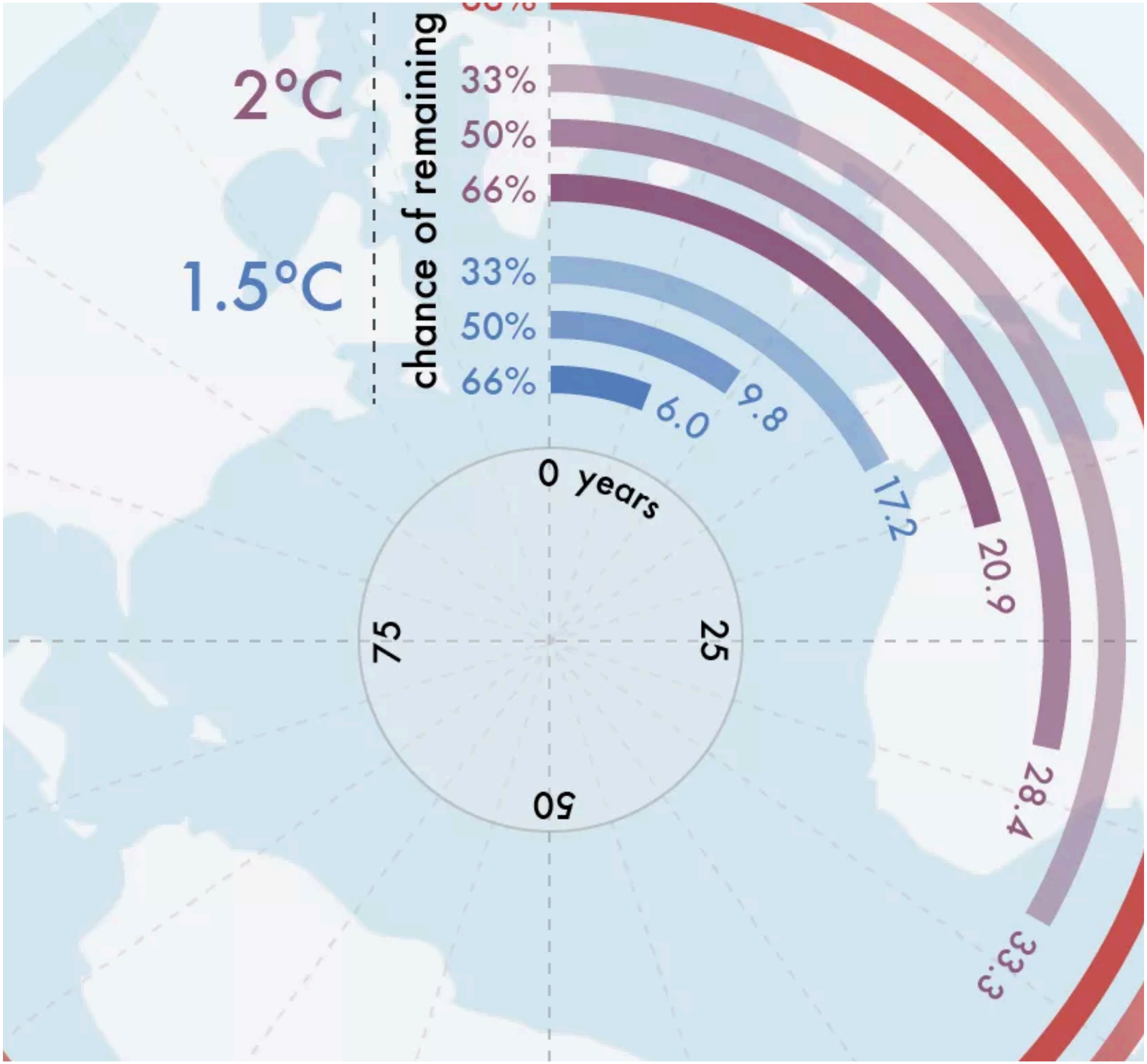
Carbon Countdown

How many years of current emissions would use up the IPCC's carbon budgets for different levels of warming?



http://bit.ly/carboncountdown

The Carbon Brief



2°C
1.5°C
chance of remaining
33%
50%
66%
33%
50%
66%
6.0
9.8
17.2
20.9
28.4
33.3
0 years
25
50
75

Getting to 1.5: Risk and Uncertainty

Total Remaining Carbon "Budget"	Likelihood of staying under 1.5C of climate change if we emit exactly this amount
420 GtCO2	66% chance of meeting target
840 GtC02	33% chance of meeting target

Decision-making under uncertainty

- **That** the climate is changing is totally certain, but **how much** CO2 will cause how much change = still some uncertainty.

- How should we choose between 420 GtC02 and 840 GtCO2?

Precautionary principle

If we cannot rule out the possibility of serious environmental harm, then we should take precautions to prevent this harm.

Future Risk-Avoidance Principle

"If we are making a decision whose largest effects concern a large group of future individuals, then we should make a very risk-avoidant choice: a choice which weights the worse consequences proportionally much more heavily than the better consequences."

Buchak 2018

Maximin Principle

Prioritize *avoiding very bad outcomes*:

(1) Consider the worst possible outcome under each alternative path available to us.

(2) Choose the path whose "worst outcome" is better than the "worst outcomes" of all other paths.

All three principles require avoiding a 60% chance of 2+ C!

(Rawls 1971, Gardiner 2006)

What can you do:
individually or in small groups

** Gigatons CO2 Equivalent Reduced / Sequestered (2020–2050)*

SOLUTION	SECTOR(S)	SCENARIO 1 *	SCENARIO 2 *
Onshore Wind Turbines	Electricity	47.21	147.72
Utility-Scale Solar Photovoltaics	Electricity	42.32	119.13
Reduced Food Waste	Food, Agriculture, and Land Use / Land Sinks	87.45	94.56
Plant-Rich Diets	Food, Agriculture, and Land Use / Land Sinks	65.01	91.72
Health and Education	Health and Education	85.42	85.42
Tropical Forest Restoration	Land Sinks	54.45	85.14
Improved Clean Cookstoves	Buildings	31.34	72.65
Distributed Solar Photovoltaics	Electricity	27.98	68.64
Refrigerant Management	Industry / Buildings	57.75	57.75
Alternative Refrigerants	Industry / Buildings	43.53	50.53
Silvopasture	Land Sinks	26.58	42.31
Peatland Protection and Rewetting	Food, Agriculture, and Land Use / Land Sinks	26.03	41.93

Check out Project Drawdown, https://drawdown.org/

What can you do as *a computer scientist*?

- Convince your university or company to commit to *net-zero emissions*.
- They can afford it! Industrial scale solar energy right now is cheap.
- If they have already committed, get them to commit to *negative emissions* (carbon capture and storage).

Why is this tech's responsibility?

- **Polluter Pays Principle:** burdens incurred by mitigation and adaptation should be borne in proportion to how much an agent has emitted.

- **Beneficiary Pays Principle:** agents should pay because, and to the extent that, they have benefited from the activities that involve the emission of greenhouse gases.

- **Ability to Pay Principle:** burdens incurred by mitigation and adaptation should be distributed according to agents' ability to pay. The greater an agent's ability to pay the greater the proportion of the cost that they should be expected to pay.

(Page 2012; Shue 2014; Moellendorf 2014)


Questions?
Come talk to me!
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