Lecture 23: Review of Modules 1 and 2 for Final Exam

Prof. Parthum

Environmental Economics

Econ 475

But first! Breaking news for Climate Economics

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- The climate benefits alone are estimated at $48 billion (NPV) over the next 10 years.

- In addition to announcing this major step, EPA released new updated estimates of the social cost of greenhouse gases. The updates account for major scientific advances in climate and economic sciences (complete with replication code and data!)

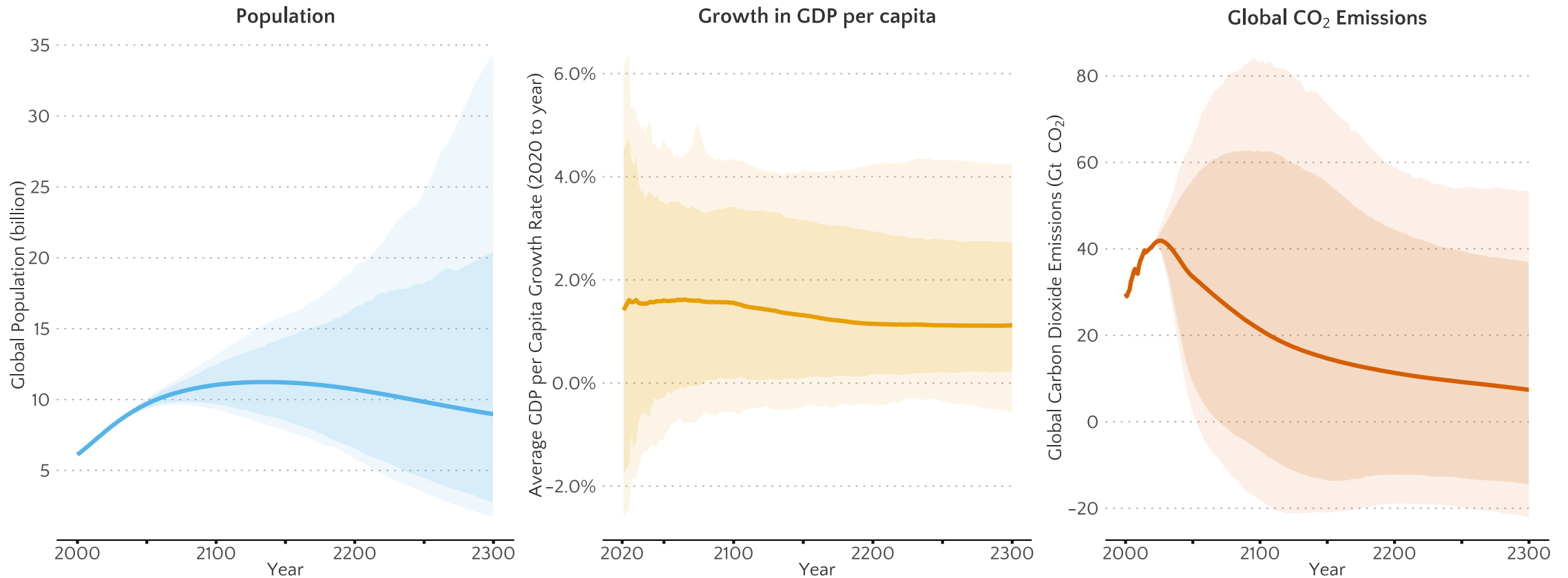# The 4 Main Climate-Economy Modules
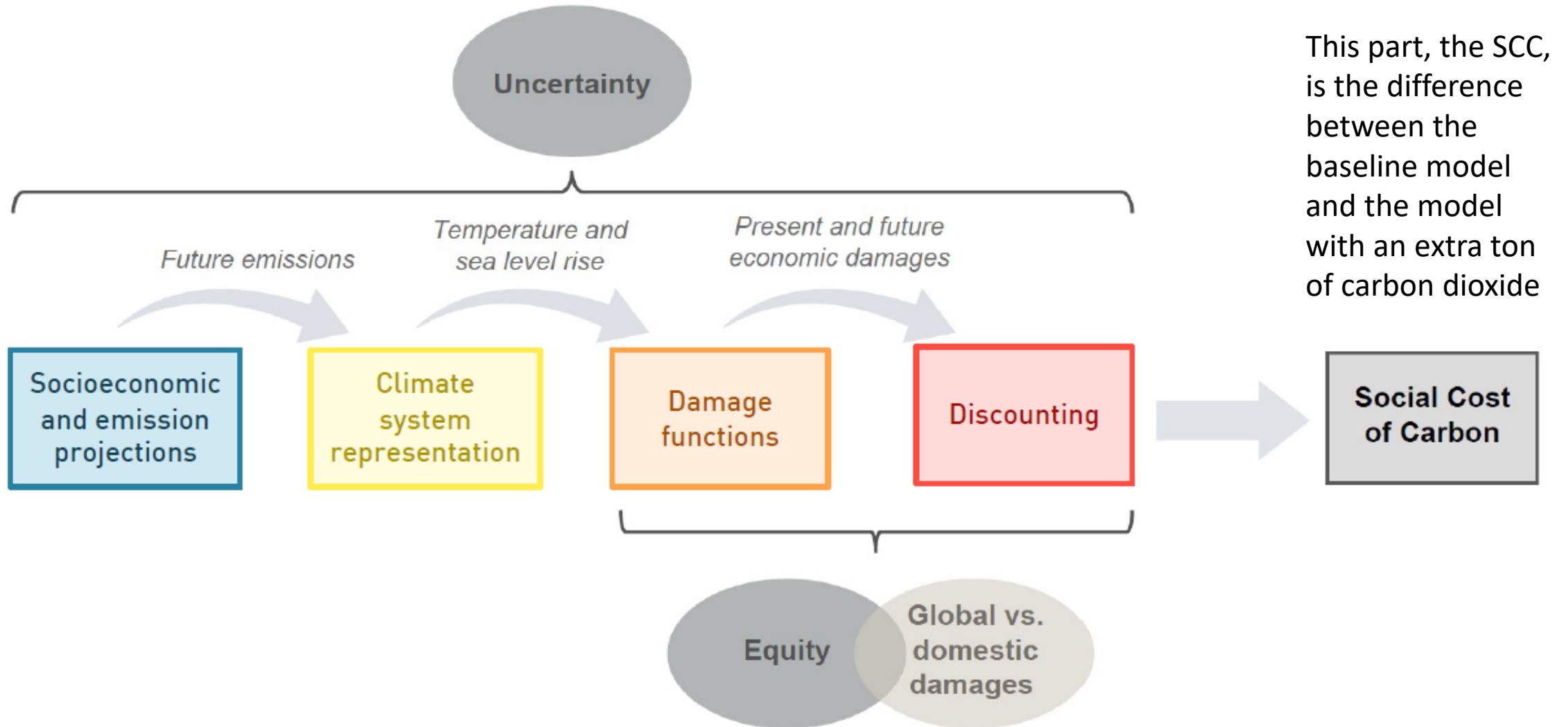
EPA Updated SC-GHGs

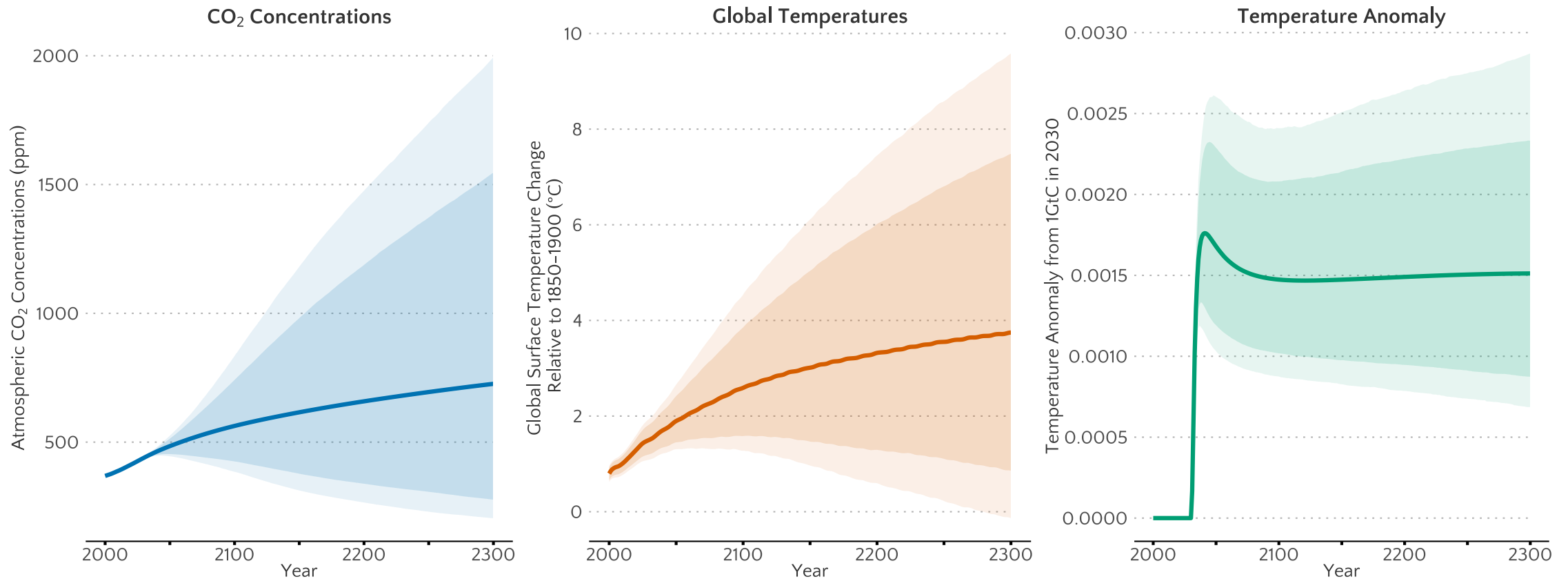Socioeconomic and emission projections

Statistical probabilistic growth scenarios linked to emissions

EPA's Updated SC-GHGs

Climate system representation

Reduced complexity climate systems model – FaIR1.6

EPA's Updated SC-GHGs

Damage functions

DSCIM

Mortality
Carleton et al. (2022)

Energy
Rode et al. (2021)

Agriculture
Hultgren et al. (2022)

Coastal Damages
Diaz (2016), Depsky et al. (2022), Kopp et al. (2016), Garner et al. (2021)

Labor Productivity
Rode et al. (2022)

GIVE

Mortality
Cromar et al. (2022)

Energy
Clarke et al. (2018)

Agriculture
Moore et al. (2017)
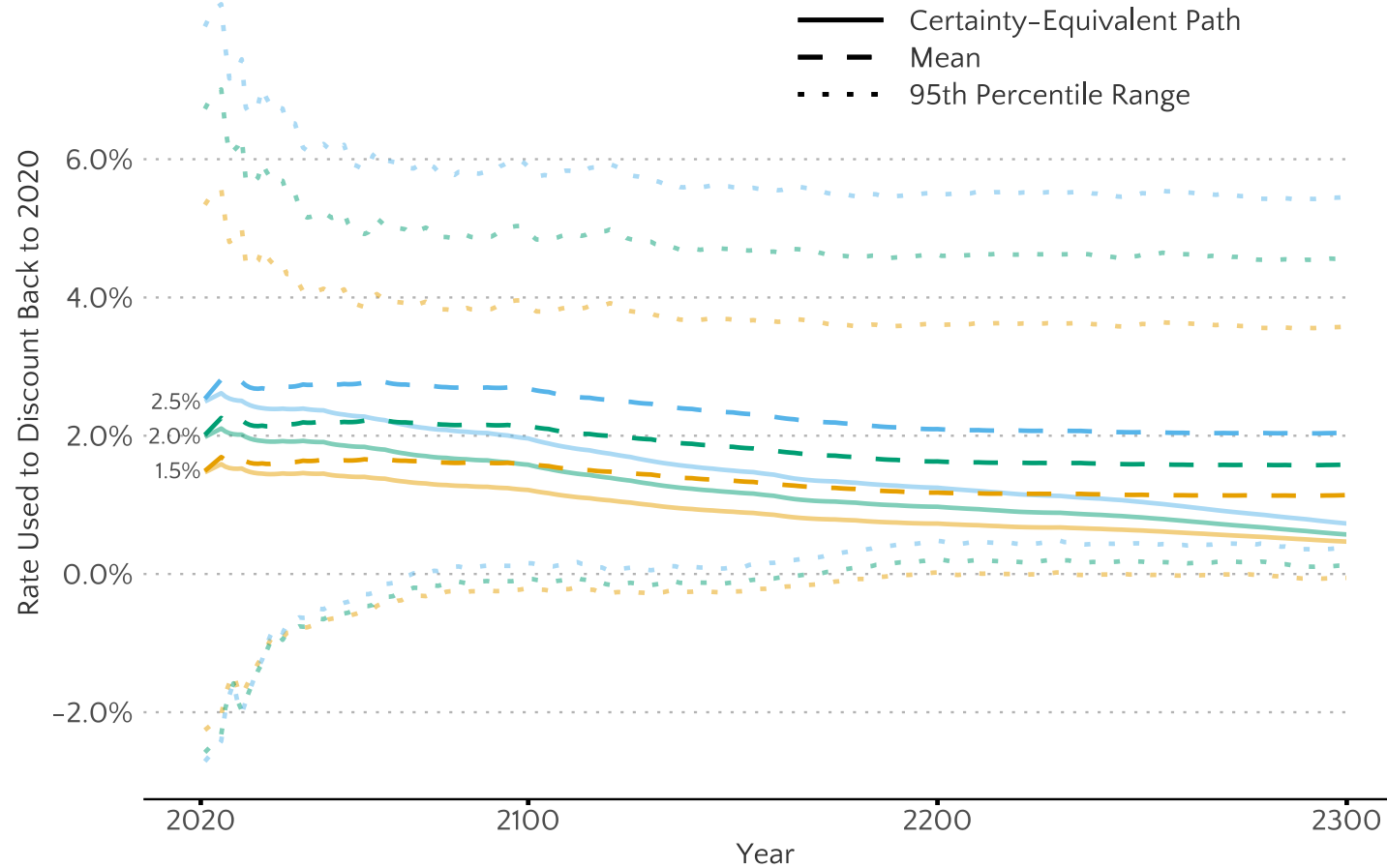
Coastal Damages
Diaz (2016), Wong et al. (2017)

Meta-Analysis

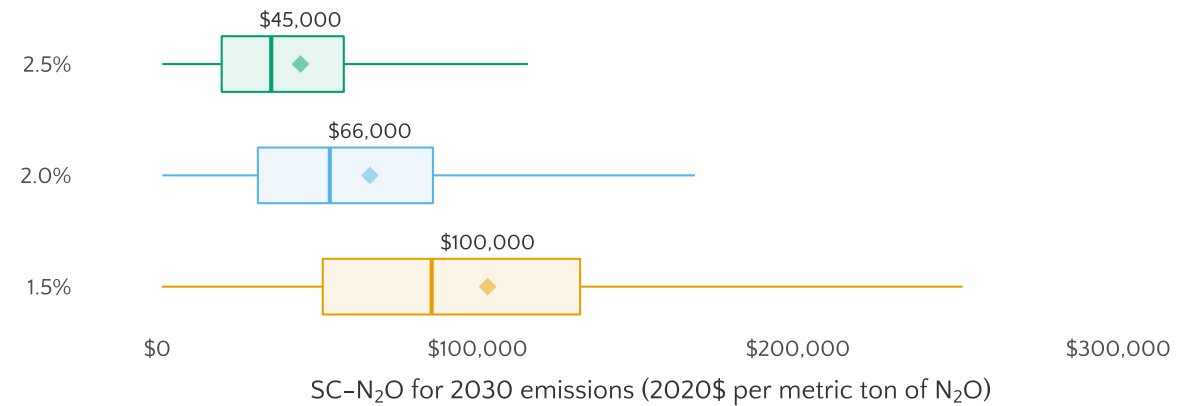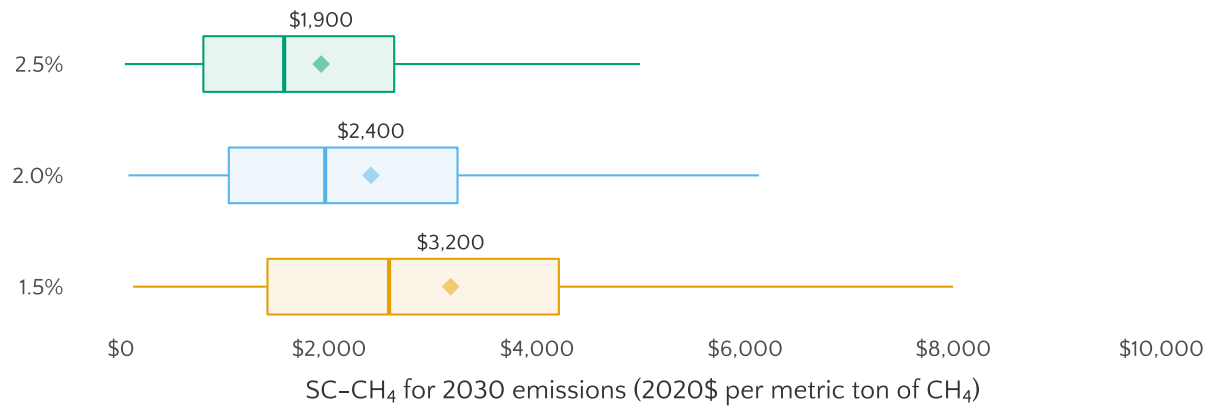No sectoral disaggregation
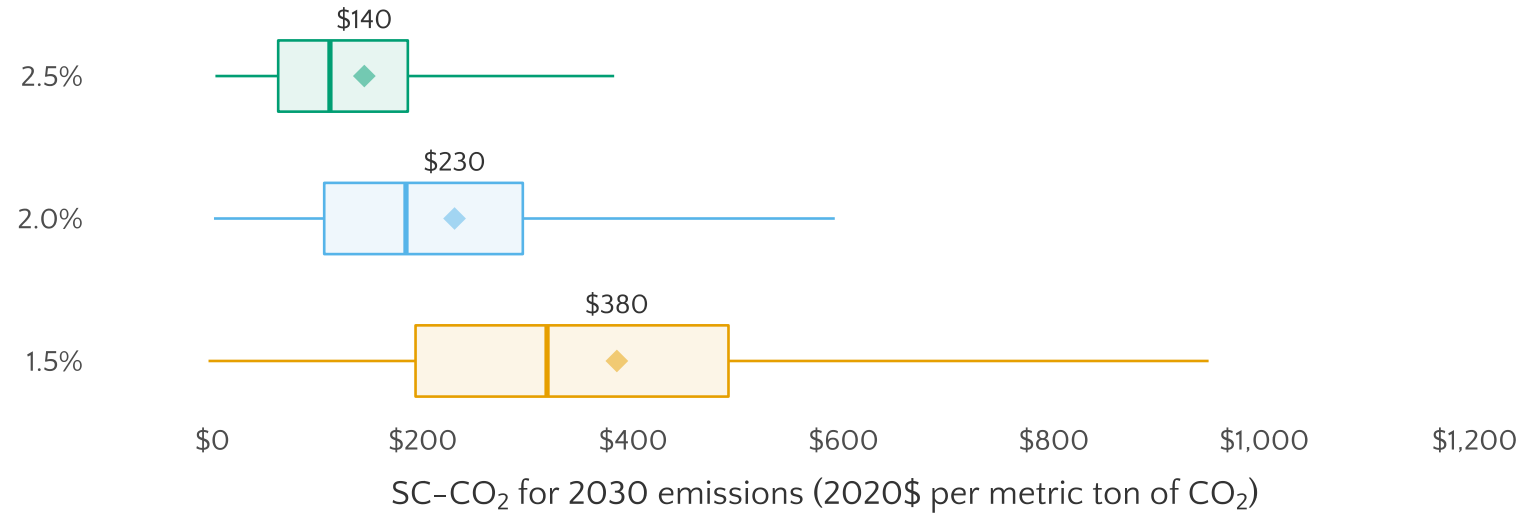Howard and Sterner (2017)

EPA's Updated SC-GHGs

Discounting

Dynamic growth-consistent discount rate

EPA's Updated SC-GHGs

Social Cost of Carbon

SC–CO_2 for 2030 emissions (2020\$ per metric ton of CO_2)

- 2.5% $140
- 2.0% $230
- 1.5% $380

SC–CH_4 for 2030 emissions (2020\$ per metric ton of CH_4)

- 2.5% $1,900
- 2.0% $2,400
- 1.5% $3,200

SC–N_2O for 2030 emissions (2020\$ per metric ton of N_2O)

- 2.5% $45,000
- 2.0% $66,000
- 1.5% $100,000

Topics from Module 1:
Why Markets Fail

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2. Markets are great! But they are *not perfect*.

3. Markets provide powerful incentives for innovation, production, price discovery, a **general move towards economic efficiency,** and many more desirable outcomes that improve the wellbeing of societies (note, "wellbeing" is a general term that is used to describe more than just income!)

Topics from Module 1:
How Markets Fail

There are many different types or root causes of market failures. Think of some examples under each of these categories.

1. Information Asymmetries
   - One party in a transaction knows more than the other

2. Market Structure/Power
   - One party can influence the market equilibrium

3. Public Goods
   - Nonrival and nonexcludable

4. Externalities
   - Private actions have unintended consequences

An Example:
The Market for College Education
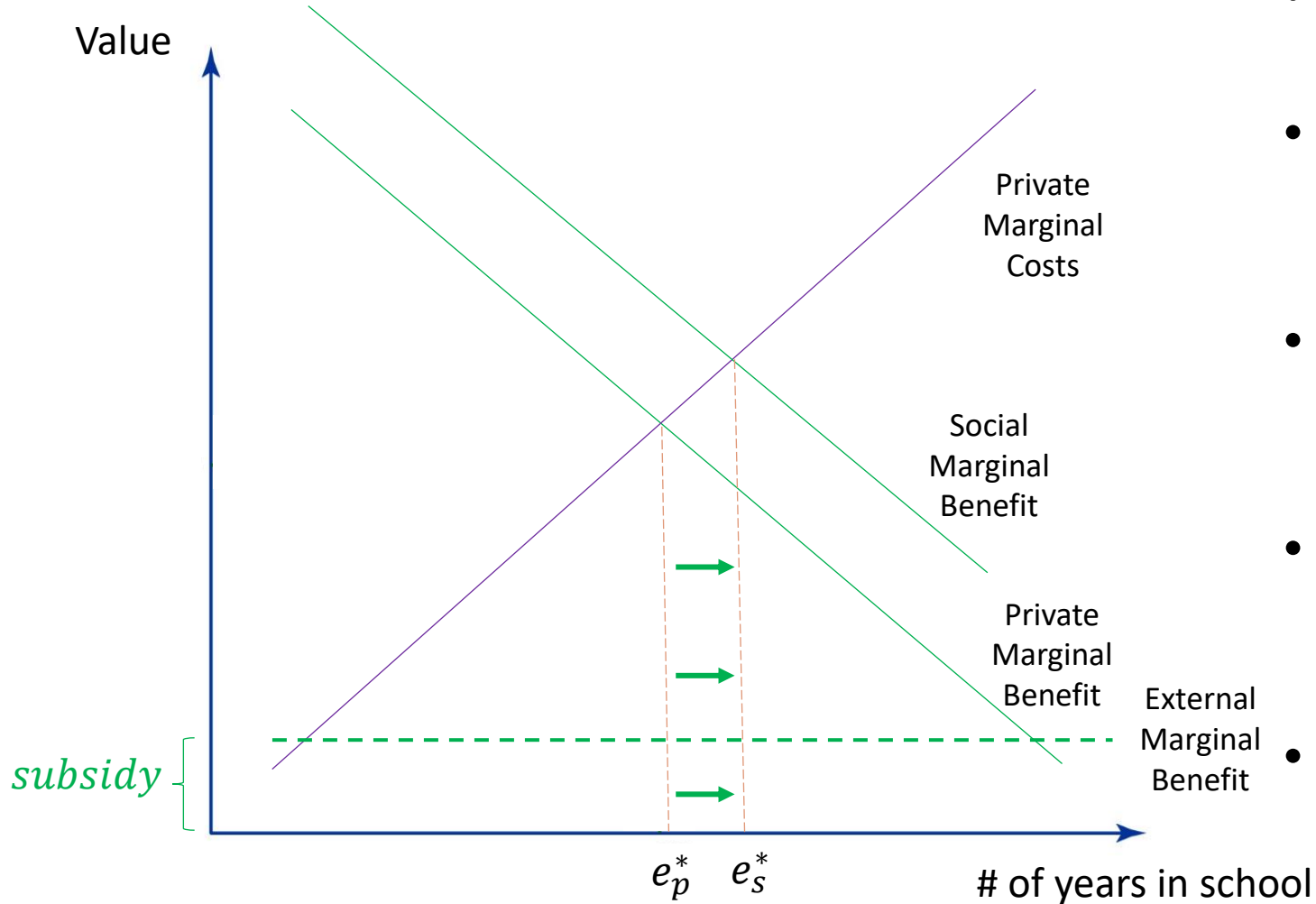
- In education, the externality is a "good"

- The private market would *underprovide* public education

- A government *subsidy* can help correct this market failure

- In this context, is the external marginal benefit actually fixed (flat)?

- Try drawing an example of what you think external marginal benefits are

An Example:
Dynamic Externalities

- Pick a number between 0 and 100.

- The person who is closest to 75% of the average number wins an extra point on the exam.

The Dust Bowl

As one "black blizzard" hit after another, harmful dust particles accumulated in people's lungs, causing hundreds of deaths and sickening thousands.
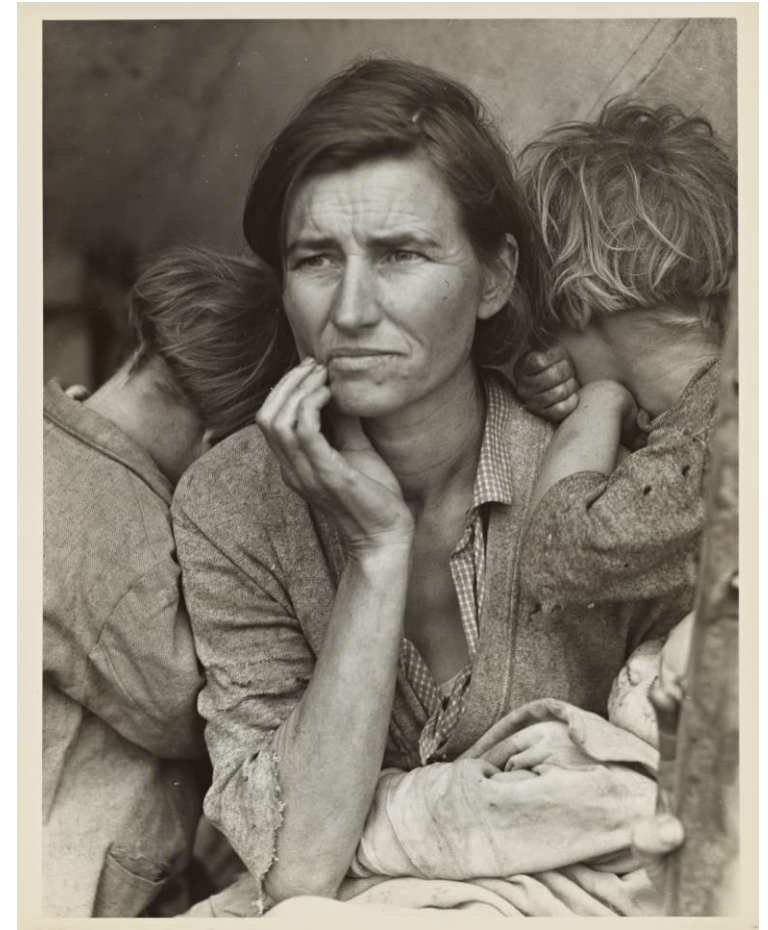
Source: history.com

Topics from Module 1:
Positive vs. Normative Notions in BCA

"The original theoretical underpinnings of BCA rest on the Kaldor–Hicks criterion—that is, for any given policy option, could those who gain from an economic change compensate the losers and still be better off than before? The use of this criterion to assess such a potential Pareto improvement is a positive scientific exercise that requires relying on a consumer sovereignty principle in assessing benefits and costs." – Dr. Al McGartland

"Yet despite what many of these practitioners are taught, the Kaldor-Hicks star around which so many regulatory and policy decisions now orbit is not a value neutral or objective methodology but rather, as seen in the Panamanian example above, a powerful – and yet oft-overlooked – intellectual engine of global inequality." – Dr. Eli Cook

Topics from Module 2:
Environmental Econometrics

When applying a data science toolkit to economic problems, there is oft a specific focus on *causality*

- Why is there such a focus on causality? Correlations are still interesting.
- We want to *know* with some degree of confidence that an intervention/policy etc. affects an outcome. Resources are constrained and interventions cost money!

When estimating the benefits of a policy intervention, we want to know the causal effect of the policy on the outcome of interest. In this simple representation, δ would be the effect of cleanup on Y.

$$Y_i = \boldsymbol{X}\beta + \delta Cleanup_i + \phi_i + \varepsilon_i$$

Imagine a policy being proposed to clean up the Cuyahoga River, what are possible outcomes of interest?

The Travel Cost Model

$$V_{ijt} = \lambda cost_{ijt} + \beta X + \phi + \varepsilon_{ijt}$$

The Hedonic Price Model

$$Price_{ijt} = \beta X + \phi + \varepsilon_{ijt}$$
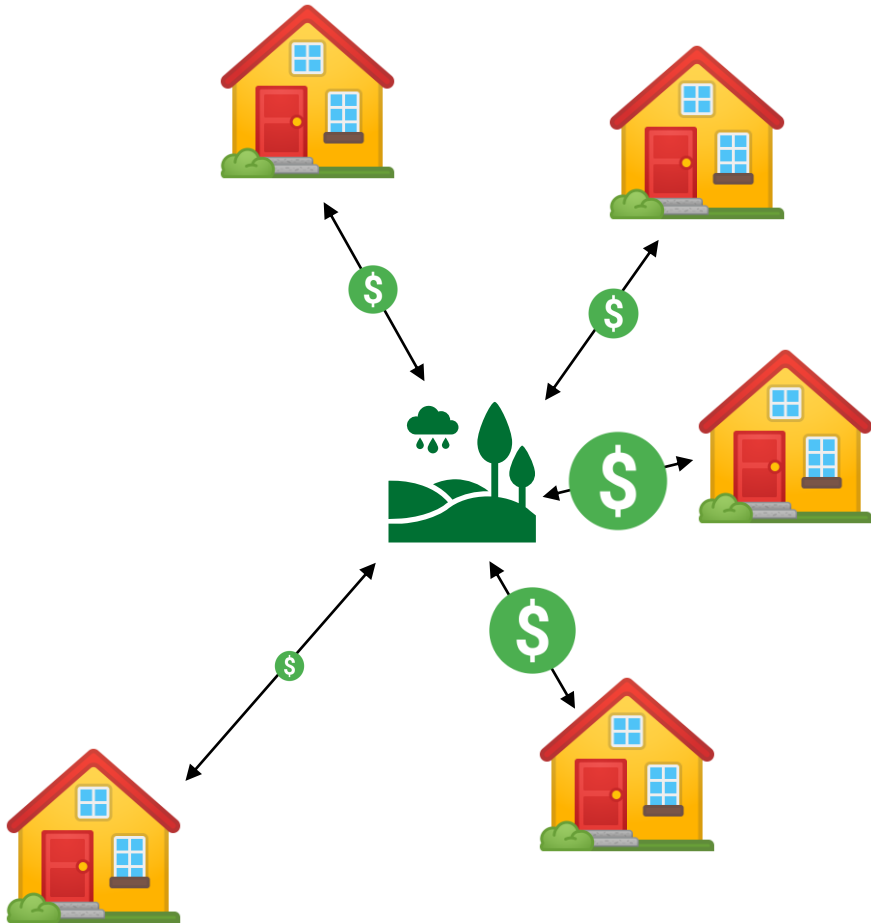
- The housing market is a useful tool to estimate the value of nonmarket goods and services.

- Can be a cross-section (e.g., one observation per home, or maybe one year, etc.) or panel (e.g., observe a home sell more than once, multiple years of data, etc.).

- By incorporating distance to an amenity as a characteristic/attribute of the home, it's possible to identify the relationship between home prices and the nonmarket amenity.

Stated Preferences

- Markets cannot capture intrinsic value (value for things simply existing)
- Stated Preferences (Choice Experiments, etc.) construct a hypothetical market
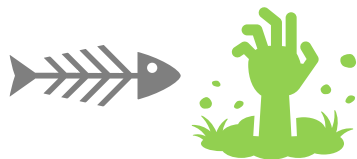
$$U_{ijt} = -\alpha_i price_{jt} + \beta_i' x_{ijt} + e_{ijt}$$

The Random Utility Model (RUM) is often used in many settings that have a "discrete" choice setting.

The model predicts the probability of a particular choice based on a set of explanatory variables ("right hand side").

$$P_{ijt} = Prob(U_{ijt} > U_{ikt}) = \frac{\exp(U_{it,j=1})}{\sum_j^J \exp(U_{ijt})}$$

Topics from Module 2: Natural Capital

Who is better off?

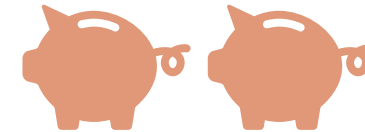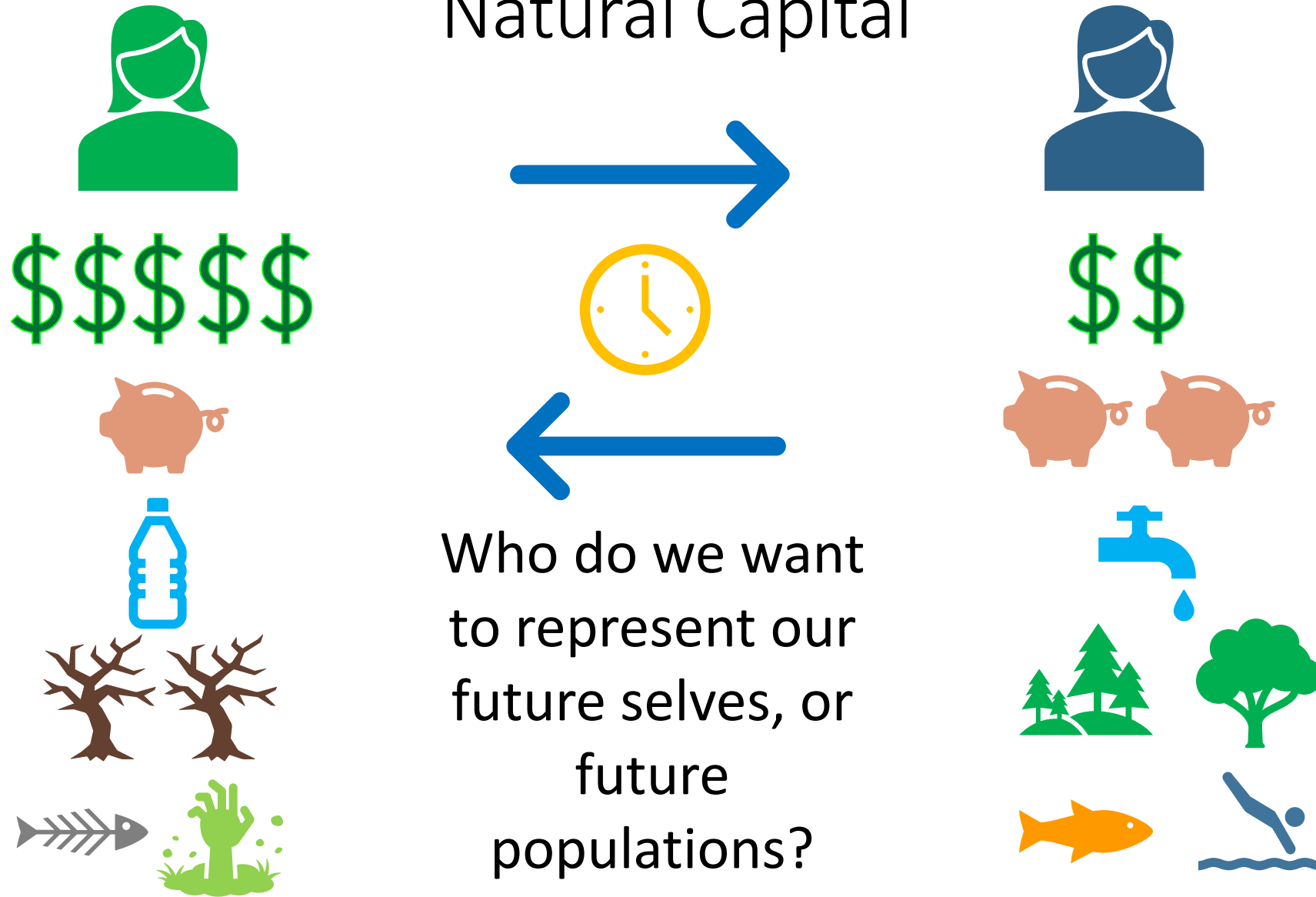|	Income (GDP)	
$$$$$		$$
	Savings (stocks)	
	Drinking Water	
	Forest Health	
	Aquatic Health	

Topics from Module 2: Natural Capital

Who do we want to represent our future selves, or future populations?

Topics from Module 2: Natural Capital

- "Sustainability requires that we leave future generations the capacity to be as well off as we are, as to avoid enriching ourselves by impoverishing our successors." - Solow

- Is extracting a scarce resource (natural nonrenewable resources) necessarily a bad thing? Likely depends on what we do with those scarcity rents (revenues)!

- If we deplete specific natural resources in the process of economic growth, we must leave equivalent capital assets of other types to future generations so that their welfare is not diminished by this depletion.

- We can think of capital investment as another form of Pareto Efficiency, but with an intertemporal dimension.

Next class

- Final Exam Review Part 2 of 2 (Prof. Austin)

- **Final Exam:** Saturday, December 10th ; 4pm-6pm in Car Barn 204
  - Same structure as midterms with additional material from module 4

- **Course Evaluations:** click here or scan QR
  - Your feedback is very very important and valued!
  - This is your opportunity to grade your instructors