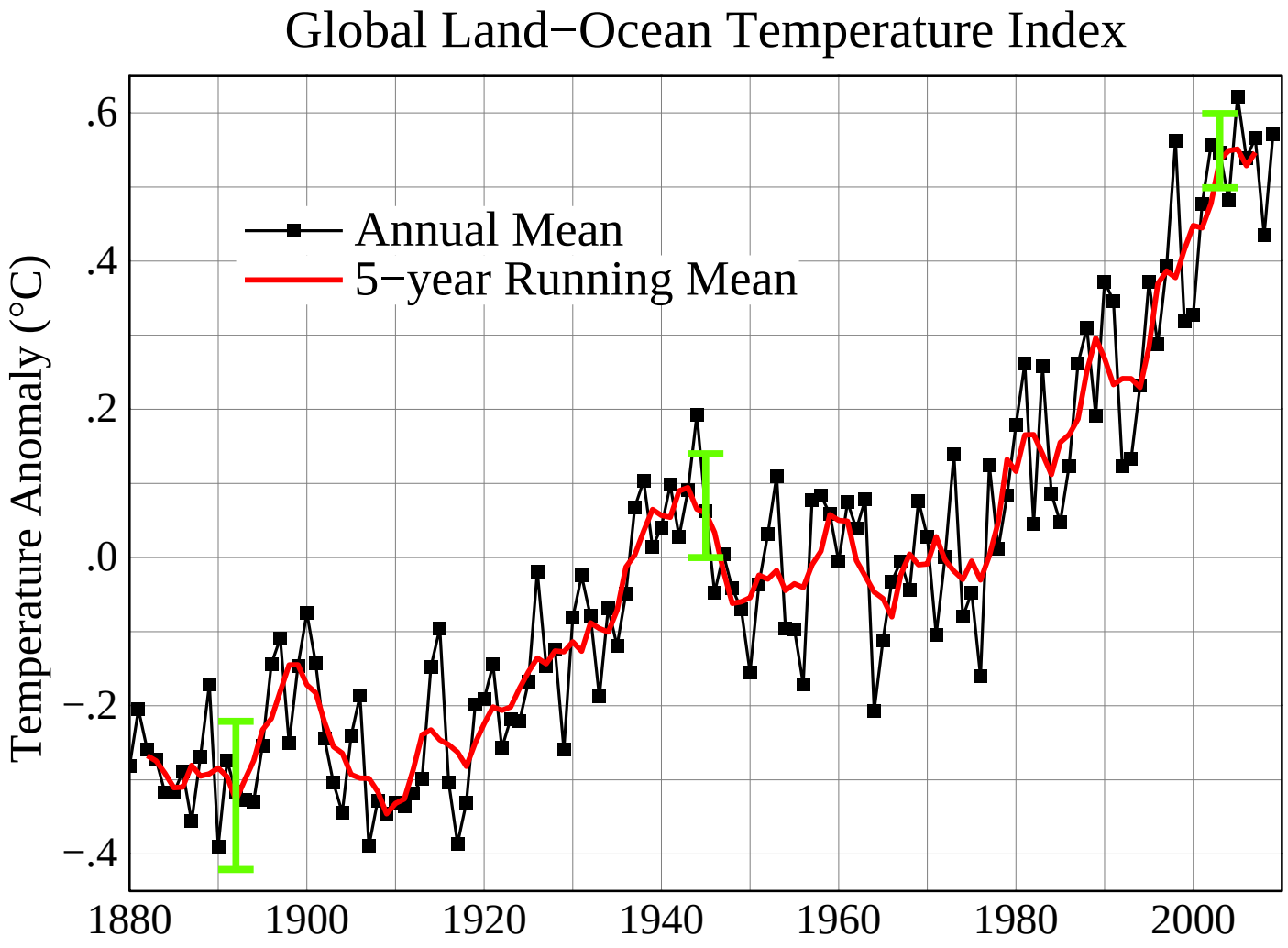
PS 138G:
The analytics of climate and energy

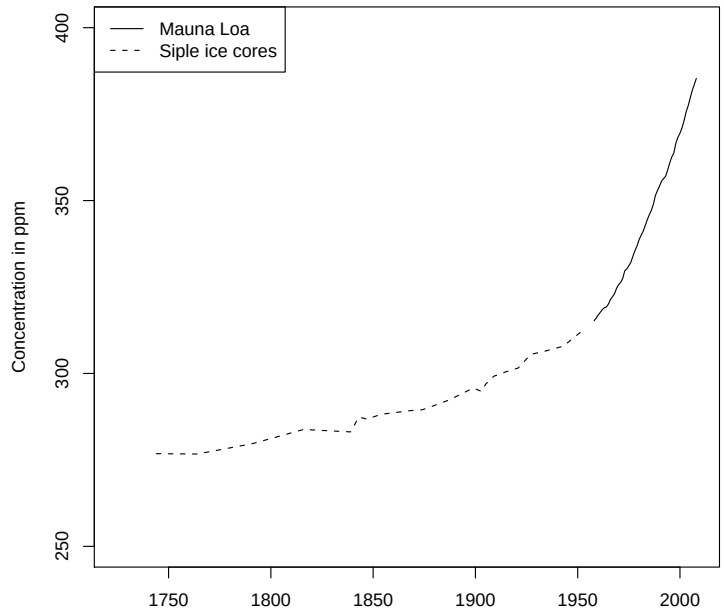
Mark Huberty

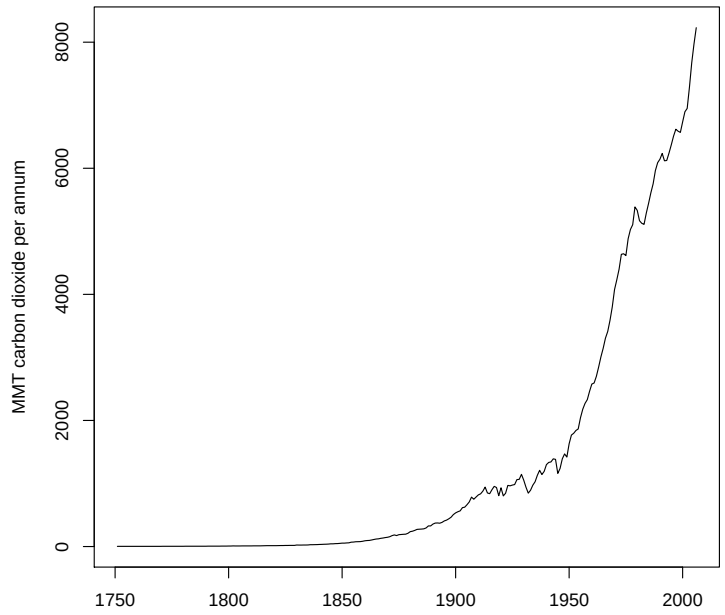
6 April 2010

Effects


Global Land−Ocean Temperature Index
Temperature Anomaly (°C)
.6
.4
.2
.0
−.2
−.4
Annual Mean
5−year Running Mean
1880
1900
1920
1940
1960
1980
2000

Causes



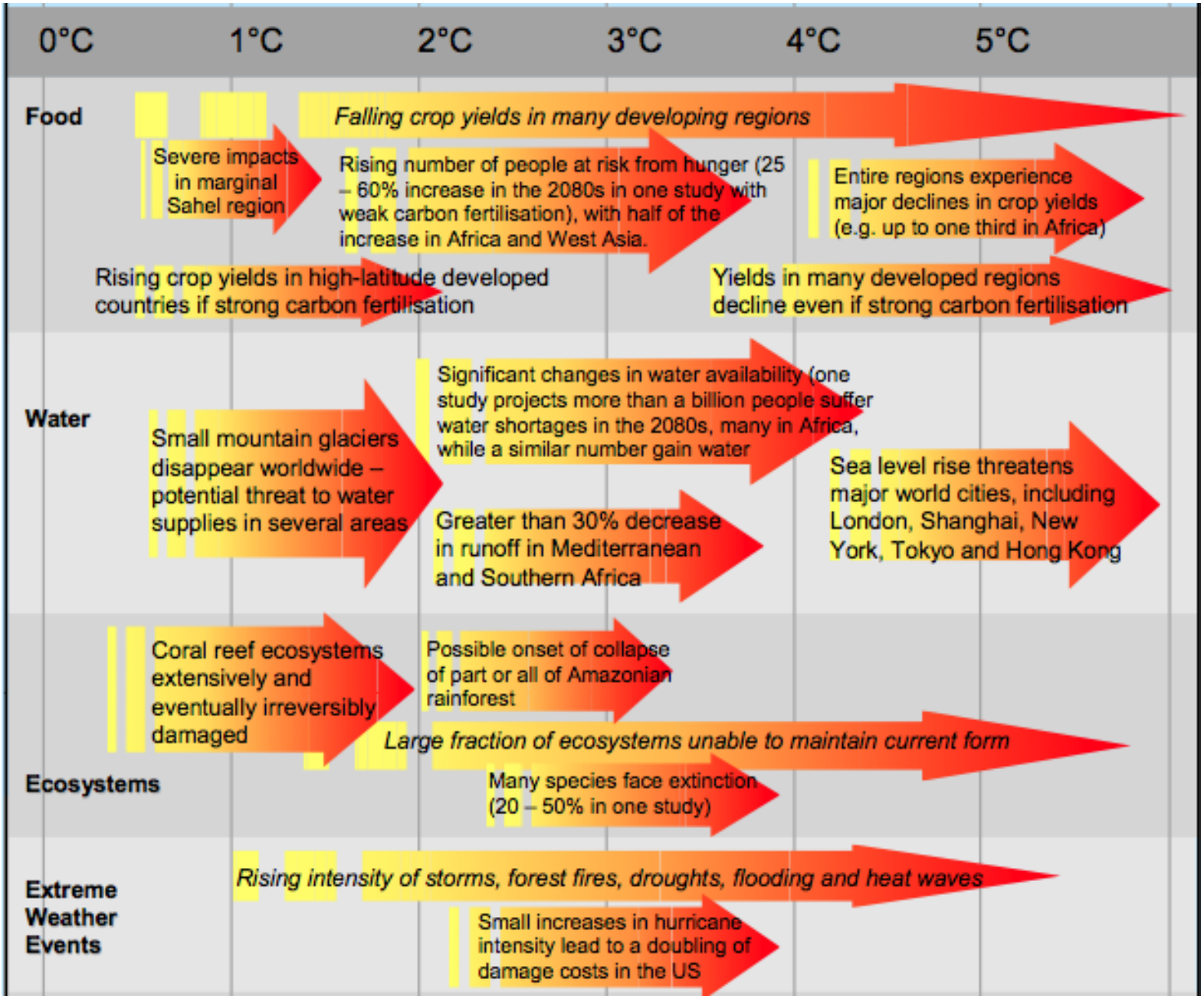


(a) Atmospheric CO_2 concentration since the 18th century. Source: Data from 1750-1953 come from the Siple ice core samples. Data after 1958 come from the Mauna Loa observatory monthy record.

(b) Global annual emissions of CO_2.

Figure: Global concentration and emissions of carbon dioxide.

Outcomes: general



Outcomes: agriculture

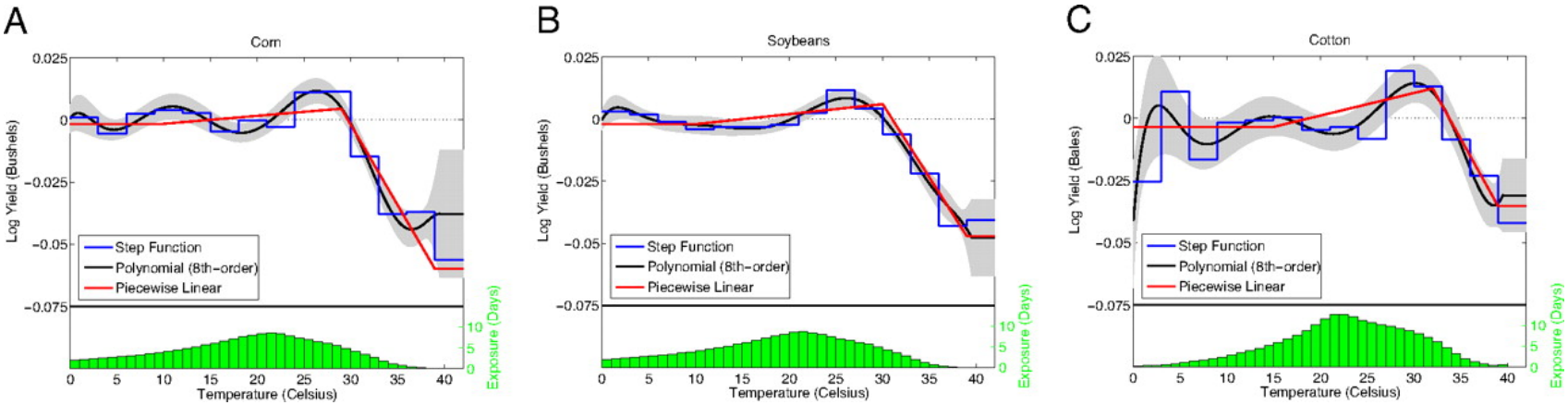
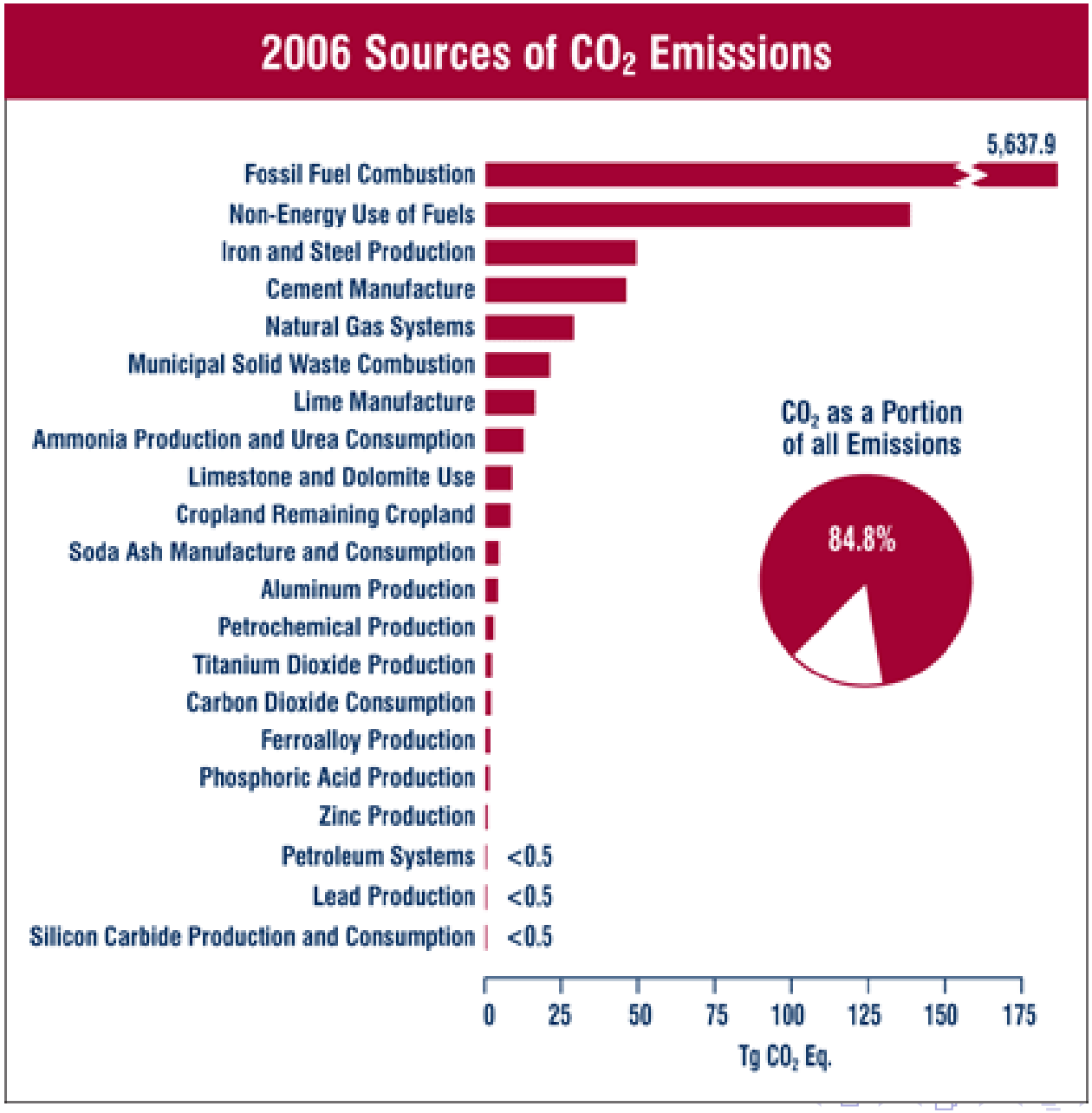


Figure: Crop yields and temperature change (Schleker and Roberts 2009)

Climate α Energy



Two analytic questions

1. Why do we continue to emit if we know it causes damages?

Two analytic questions

1. Why do we continue to emit if we know it causes damages?
2. How should we respond given some plausible estimate of its cost?

Why: the externalities paradigm

The economics of externalities:

- In a perfect market, the price P commanded by a good internalizes all information about its benefits and costs
- But many markets–famously pollution–fail to do so
- Thus both producers and consumers of the good (in this case, energy) make decisions based on prices that don't reflect the true cost

Climate change and its responses face **two** negative externalities: pollution and innovation

The pollution externality

How: possible frameworks for analysis

Two big questions here:

1. Mitigation or adaptation?

How: possible frameworks for analysis

Two big questions here:

1. Mitigation or adaptation?
2. Policy choices in either case

How: possible frameworks for analysis

Two big questions here:

1. Mitigation or adaptation?
2. Policy choices in either case

We're going to emphasize mitigation over adaptation on the grounds of unintended consequences

How should we think about policy choices?

Two questions:

1. What policy should we pick?
2. Who will implement the policy
3. What interests align for/against the policy?

These are **not** separable

Mitigation: policy choices

Consider two (not necessarily mutually exclusive) possibilities:

1. Correct relative prices

Mitigation: policy choices

Consider two (not necessarily mutually exclusive) possibilities:

1. Correct relative prices
2. Engage in industrial policy

Mitigation: policy choices

Consider two (not necessarily mutually exclusive) possibilities:

1. Correct relative prices
2. Engage in industrial policy

To date, (1) has received the most attention

Emissions pricing

Two theoretically equivalent* methods are proposed:

1. Assign a tax to emissions that would increase at some rate k
2. Auction off a set of permits equivalent to t_p tons of emissions in each period p, with $t_{p+1} < t_p \forall p$

*Price vs. Quantity equivalency

One issue (see Weitzman (1974) for the details:

Depending on shape of the mitigation and emissions cost curves change, prices **may not** produce the same results as quantities

Proposed costs and benefits

In this framework, some costs and benefits:

- Stern (2007) found that spending 1% of global GDP annually on mitigation through 2100 would pay for itself
- Nordhaus (2007) disputes this on the choice of the discount rate δ

Some issues

Some concern by economists themselves that this framework has issues:

- People aren't good at factoring long-term savings vs. short-term costs
- Taxes sometimes have weird effects
- Many markets aren't perfect/private: public utilities, very large energy firms
- Policy may not be credible: doubts about whether it's politically sustainable dilute the effect of the policy