HUMBOLDT-UNIVERSITÄT ZU BERLIN
Resource Economics

Are there new archetypes of environmental cooperation?

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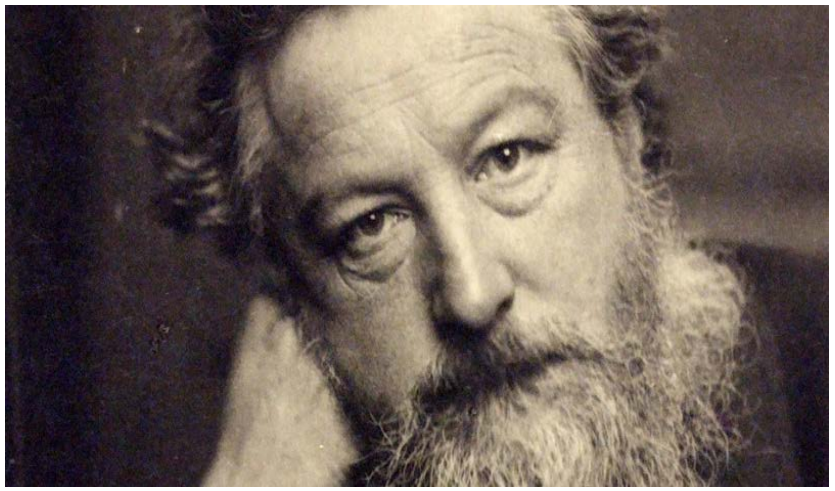
Progress in 40 years of dealing with environmental problems?

„I pondered all these things,
and how men fight and lose the battle,
and the thing that they fought for comes about
in spite of their defeat,
and when it comes turns out
not to be what they meant,
and other men have to fight for what they meant
under another name.“

William Morris (1886) *A Dream of John Ball*

*(British artist, writer and architect, 1*834-1896*)*



Progress in 40 years of dealing with environmental problems?

- Many sustainability problems are well known
  - Climate change (greenhouse effect: 19th century; rising CO2 concentration: 1962; public discourse: 1989)
  - Loss of biodiversity (nature conservation: 19th century, term coined: 1986)
  - Marine overfishing (stock assessments: 1902, IWC: 1946, EEZ in UNCLOS: 1982)
- Solutions are known, in theory…
  - Emissions trading / carbon price, UNFCCC (1994), but still rising greenhouse gas emissions
  - Less intensive land-use, CBD (1993), increasing extinction rates, insects' extinction prominent last year
  - Catch quota systems, EU common fisheries policy (1983), globally large and rising share of stocks overfished

➢We need to become smarter

Games

… as metaphor for interdisciplinary study of social-ecological-technical systems (players, rules, moves, goals, strategies, communication, cheating, etc.)

… as tools for science communication, transdisciplinary research, and possibly societal transformation

… climate change game KEEP COOL

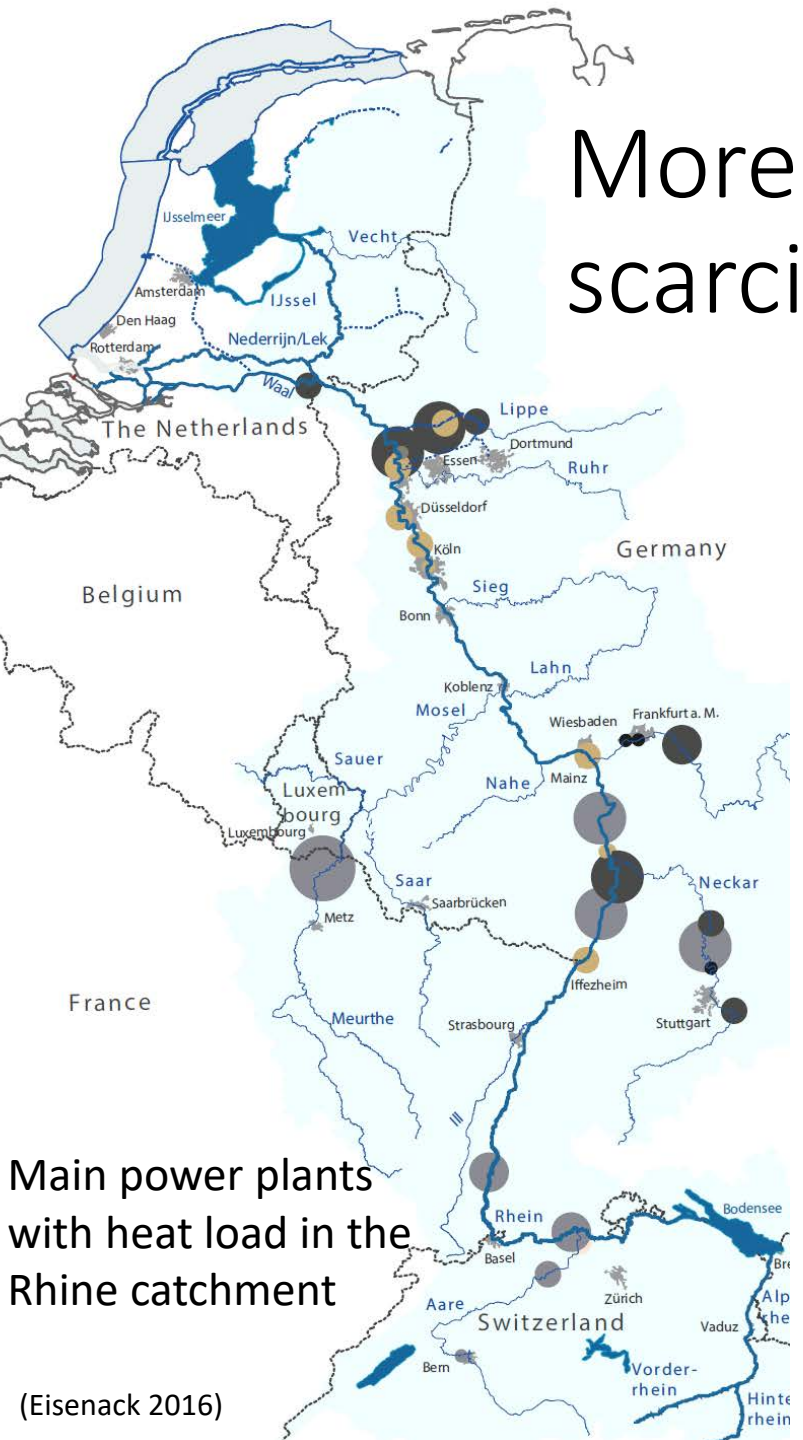
- 3rd most successful environmental board game so far
- Still available from publisher
- Recent mobile version

(www.climate-game.net)

… game theory as rigorous approach in economics

- Conceive actors/organisations/states as players
- Outcomes depend on own decisions and decisions of others
- How to anticipate how others will respond to own decisions?
- How to anticipate others' decisions, and what is the best own response?

More severe cooling water scarcity in electricity production



Main power plants with heat load in the Rhine catchment

(Eisenack 2016)

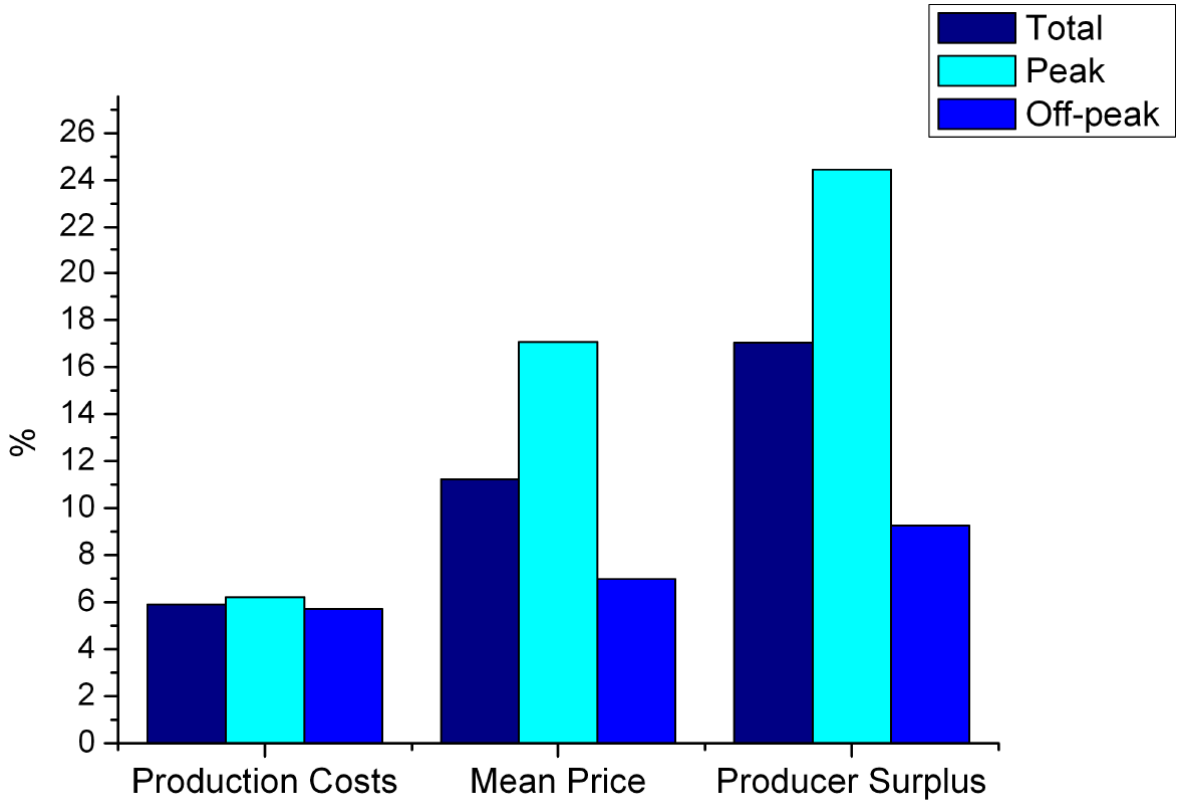
- Waste heat from thermoelectric power plants
  - Cooling by water bodies
  - Rhine: ≈75% (17 GW) of German heat load from electricity production
- Consequences for aquatic ecosystems and downstream users
- Heat waves 2003, 2006: curtailment of power plants (> 2800 MW) because of environmental regulation

➢ What happens with climate change?

- Rising energy costs, risk of blackouts
- Trading off security of supply for integrity of ecosystems?

Implications from simulation model and institutional analysis

Economic effects of the 2006 heat wave



(Pechan & Eisenack 2014, Eisenack 2016)

- Some can benefit from power plant curtailment
- Invention and implementation of new institutional arrangement
  - "Mindestkraftwerkskonzept" in Baden-Württemberg (2003)
  - Contract between power plant operators and state government
  - Negotiations consider environmental damage and blackout risk
  - Defines verifiable rules for temporary exemptions of environmental regulation
- Co-benefit of energy transition: avoiding this problem

Adapting water governance to climate change

- Climate change also requires adaptation to its consequences
- For example: more frequent droughts can lead to water scarcity for cooling, drinking, irrigation

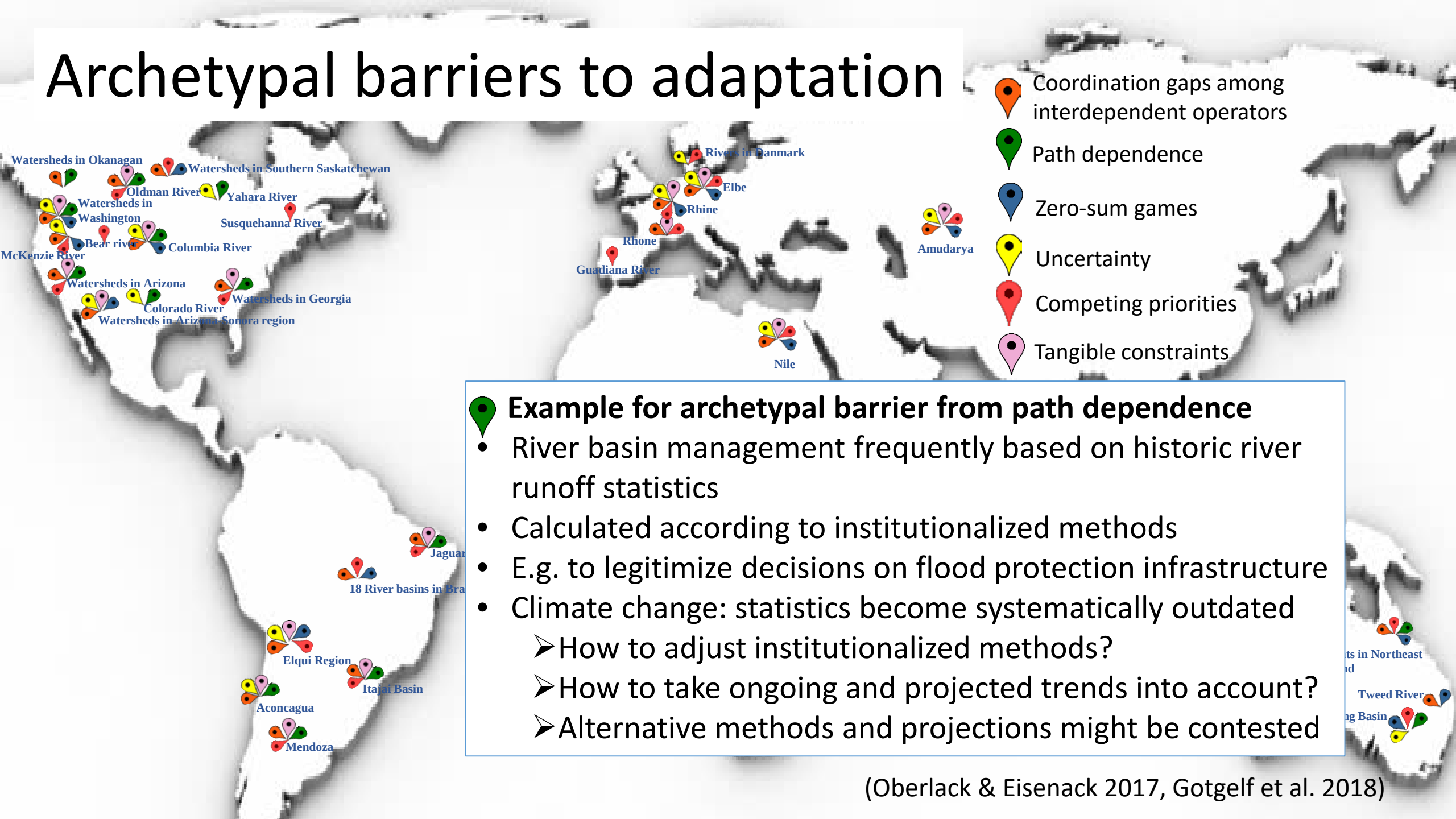
➢How to deal with such scarcity?

- Literature reports many barriers to implement adaptation (Moser & Ekstrom 2010, Eisenack et al. 2014), e.g. conflicts over scarce resources

➢Re-appearing barriers? Opportunities to overcome them?

- Archetype analysis of mechanisms that cause barriers in water governance
- Meta-study of systematically identified cases in the empirical literature (26 publications, more than 40 cases, 21 archetypes)

Archetypal barriers to adaptation



- Coordination gaps among interdependent operators
- Path dependence
- Zero-sum games
- Uncertainty
- Competing priorities
- Tangible constraints

Example for archetypal barrier from path dependence

- River basin management frequently based on historic river runoff statistics
- Calculated according to institutionalized methods
- E.g. to legitimize decisions on flood protection infrastructure
- Climate change: statistics become systematically outdated
  - ➢How to adjust institutionalized methods?
  - ➢How to take ongoing and projected trends into account?
  - ➢Alternative methods and projections might be contested

(Oberlack & Eisenack 2017, Gotgelf et al. 2018)

Can adaptation improve global cooperation?

- International climate negotiations: scepticism about adaptation (1990ies)
- If countries adapt more, they might be less willing to reduce greenhouse gas emissions (GHG)

➢Valid argument?

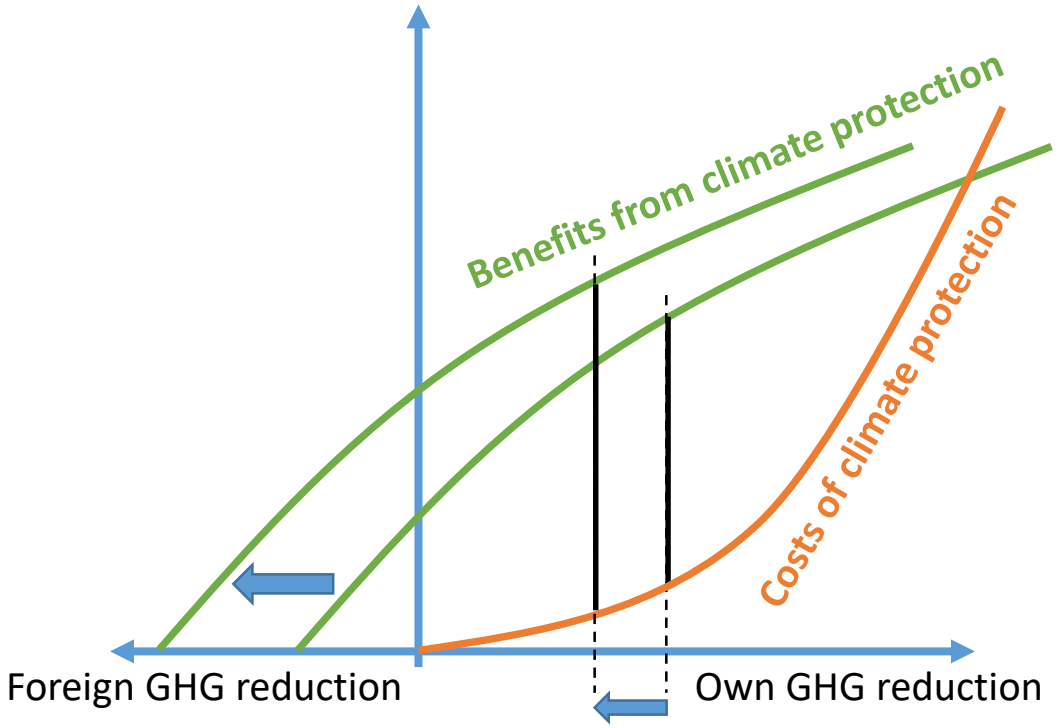
- Game-theoretic model: strategic incentives for GHG reduction if countries can also adapt to climate change
- Results
  - Adaptation can change a countries' damage profile
  - Then, the "free-rider effect" is reversed
  - Opens up new strategic options

(Ebert & Welsch 2011, Eisenack & Kähler 2016, Kähler & Eisenack 2016)

Reversing the free-rider effect

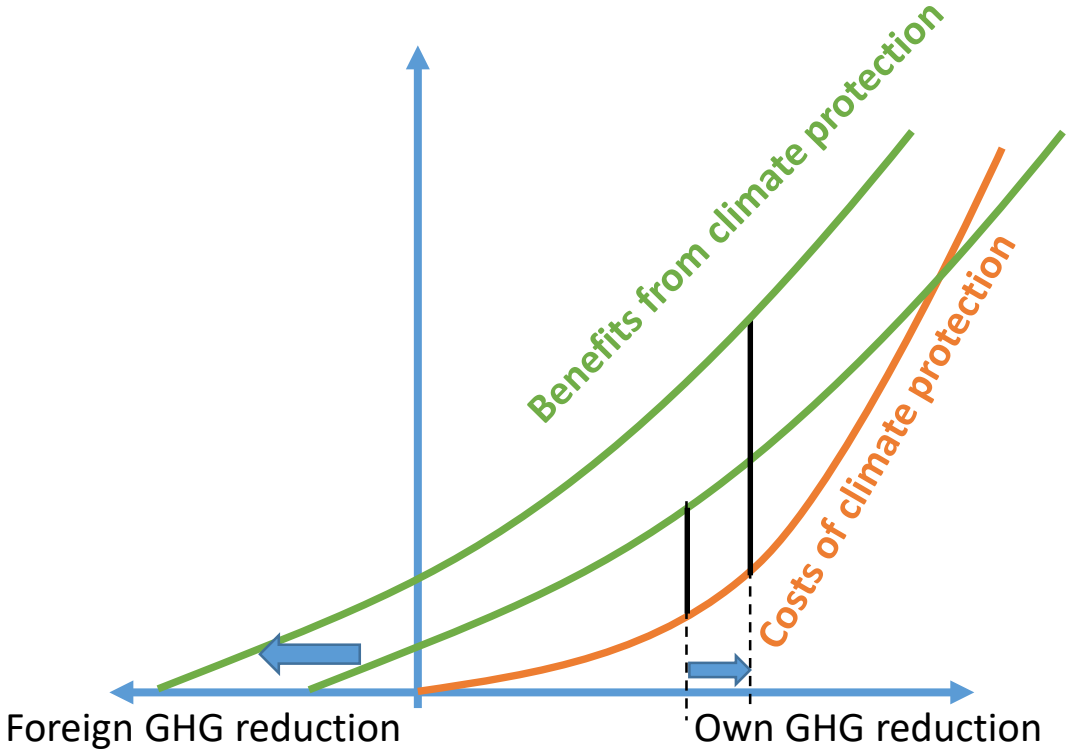
Standard free-riding effect

if some countries reduce more GHG, other countries reduces less



Reversed effect

if some countries reduce more GHG, others countries do the same



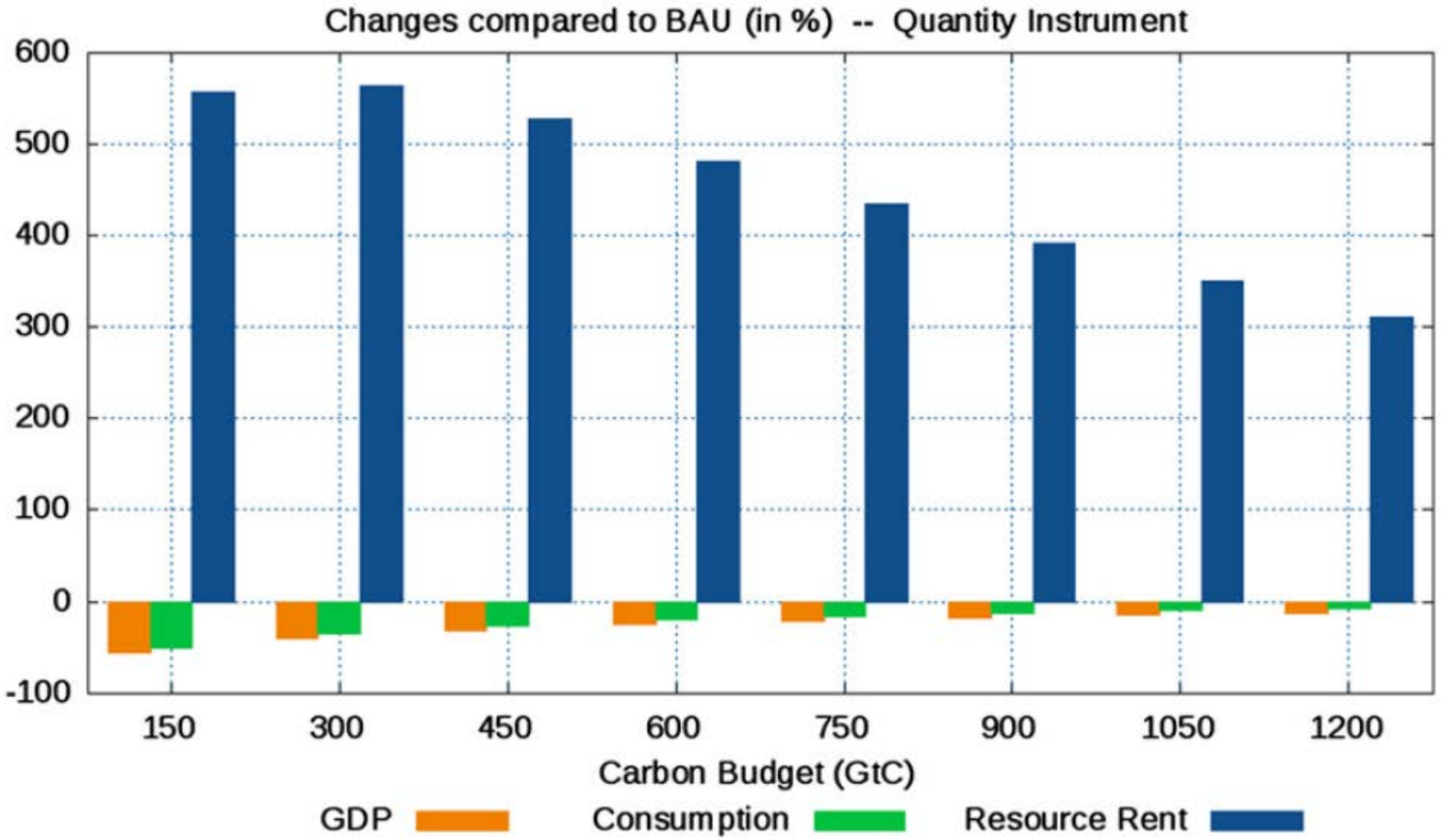
Might owners of fossil fuels support global cooperation?

- Global cooperation is likely hampered by free-riding, but also by particular interests
- One-to-one relation between carbon emissions from combustion and carbon extraction from energy reserves
- Carbon budget: climatological modelling studies show that global warming depends primarily on cumulative emissions, not so much on rate of emissions (Meinshausen et al. 2009)
- If climate policy introduces a limited carbon budget, considerable coal, oil and gas reserves need to be "sealed" (McGlade & Ekins 2015)

➢Which institutional arrangements can dissolve incentives for opposition from the fossil resource industry?

(Eisenack, Edenhofer & Kalkuhl 2012, Mendelevitch 2018)

Carbon budget can raise fossil resource rents



(Eisenack et al. 2012)

Economics & the environment: researching pathways into the future

Design policies that acknowledge barriers to implementation

- Identifying institutional conditions for effective collective action
- Factoring in political resistance and 'gaming' of policy instruments
- Learning from new empirical developments

Resource Economics Group

Renate Judis (not on picture), f.r.t.l. Achim Hagen, Jasper Meya, Dr. Roman Mendelevitch, Paul Neetzow, Prof. Dr. Klaus Eisenack, Ines Jeworski, Anastasia Gotgelf, Dr. Matteo Roggero, Sigrid Heilmann, Patrick Lutz, Dr. Ulan Kasymov, Patricia Perez

Are there new archetypes of environmental cooperation?

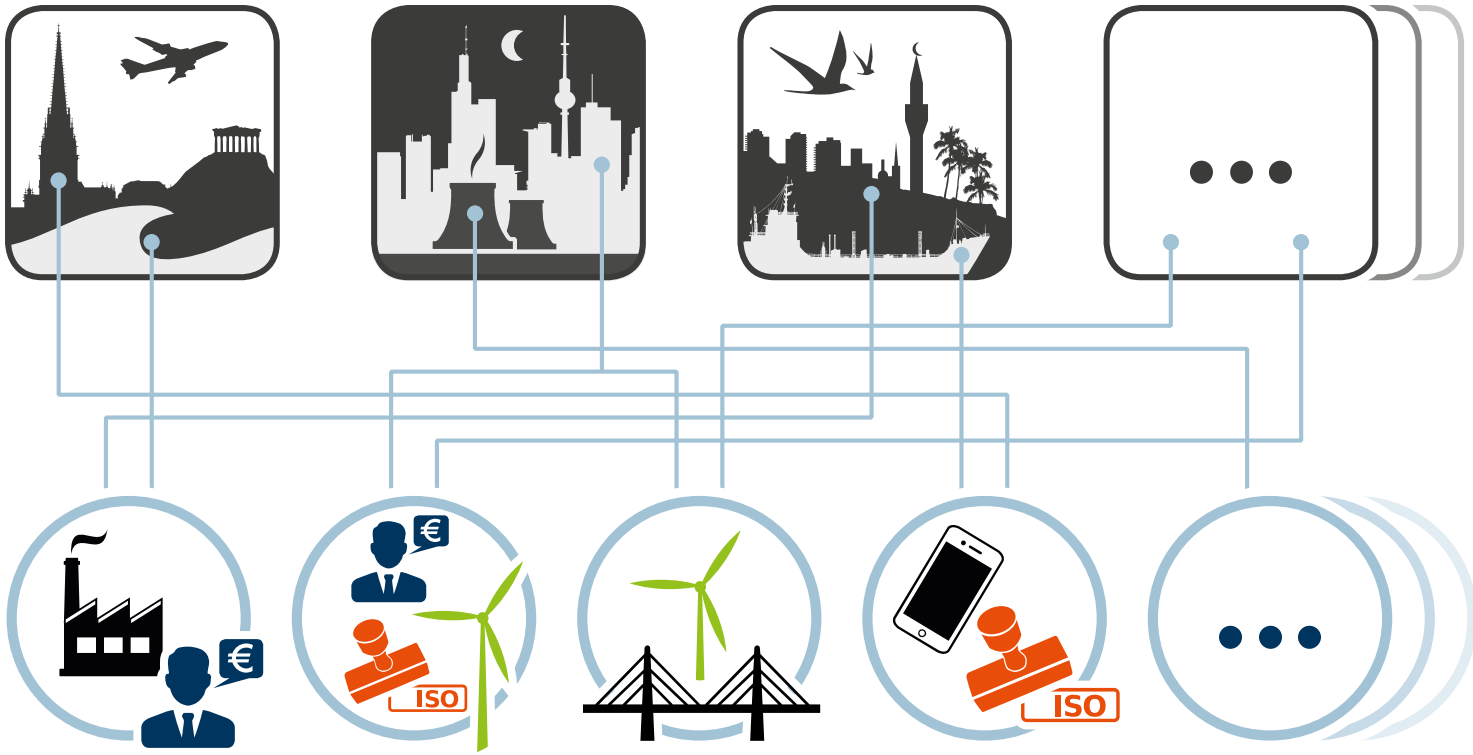
Trump: "*elected to represent the citizens of Pittsburgh, not Paris*".
Peduto, Mayor of Pittsburgh: "*Pittsburgh stands with the world & will follow Paris Agreement […] It's now up to cities to lead*" (CNN 2017).

- Examples
  1. Emerging transnational city networks cooperate on GHG emission reductions & adaptation (e.g. Bulkeley 2005, Andonova et al. 2017)
  2. 'Minilateral' climate clubs of countries (Weischer et al. 2012, Falkner 2015, Hagen & Eisenack 2015)
  3. Rising number of voluntary and networked climate initiatives (MA thesis: Epp 2018)
  4. Emission targets of firms as members of industry associations (MA thesis: Fink 2018)
  5. Labour unions cooperating internationally on 'energy democracy' (MA thesis: Möller 2018)
  6. Carbon divestment movement to withdraw fossil assets (student project: Deckert et al. 2016)
  7. Potential of new communication technologies and gamification? (Reckien & Eisenack 2013, Wu & Lee 2015, Meya & Eisenack 2018)
- Overarching questions on patterns of cooperation
  - ➢ Are they indeed new archetypes?
  - ➢ How can their existence be explained?
  - ➢ Are they environmentally effective?

Approach: Archetype analysis

An emerging comparative approach to identify patterns in a medium or large number of heterogeneous cases (Eisenack et al. 2006, UNEP 2007, Václavík et al. 2013, Levers et al. 2016, Sietz et al. 2017, Oberlack & Eisenack 2017)

1. Archetype analysis produces a whole suite of archetypes
2. Archetypes re-appear in multiple but not necessarily all cases
3. Archetypes are building-blocks: can be combined in different ways to explain individual cases
4. Archetypes are characterized by theory, attributes and cases



Entry point: Path dependence

- Might (new) archetypes of cooperation cause a domino effect?
- On the other hand: barriers to environmental cooperation from existing path dependence
  - E.g. carbon lock-in from a combination of incumbent economic power, specific policy instruments, vocational training, etc. (Unruh 2000)
- What is path dependence? (Arthur 1989, David 1985)
  - "History matters": system locked-in to a state the cannot be changed easily
  - Example: Pólya urn
    1. Initially 2 black & 2 white balls in the urn
    2. One is drawn randomly, put back to the urn **together** with a new ball of the same colour
    3. Today: repetition 5 times – who bets on black? – on white?
- Several mechanisms can cause path dependence
  - Self-enforcing mechanisms
  - Economies of scale
  - Network externalities
  - Lobbyism & rent-seeking, long-lived infrastructure, technological standards
  - …

Governing path dependence

Strategies or institutions that purposefully or unintentionally (i) sustain, (ii) create or (iii) dissolve path dependence

- There might be good reasons for any of (i-iii)
  - Dissolve: e.g. carbon lock-in
  - Sustain: e.g. trends in renewable energy
  - Create: e.g. safe storage of nuclear waste
- How to dissolve or create path dependence?
  - Example with Pólya urn, suppose:
    1. Again, initially 2 black & 2 white balls
    2. Everyone who guesses right colour in 5th turn gets € 100
    3. In the beginning, you can put one additional ball of your choice into the urn, but this costs € 10
    4. Who would buy – a black ball? – a white ball?
  - Change rent-seeking games: Using additional resource rents from one fuel to compensate another
  - Foster new technologies
  - Expand / reduce long-lived infrastructure

Conclusions

- There likely are candidates for new archetypes of environmental cooperation
- But this still needs validation and qualification
- Requirements are
  - Explicit research on how to design policies that acknowledge barriers to implementation
  - Advanced institutional arrangements
  - An advanced methodological and analytical toolbox
- In the game metaphor:

  Better strategies, improved rules, new games

(www.keep-cool-mobil.de)

Thank you very much for your attention

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