OECD-EC High-Level Workshop Series: Place-Based Policies for the Future

Placed-Based Global Environmental Goods, Local Public Bads? Place-Based Transitions as a Key Contribution to Global Stewardship

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Global commons, like the atmosphere and the biosphere, require global public action, such as climate change mitigation and biodiversity protection. This requires rapidly phasing out fossil fuels and land sparing economic activities, predicaments that challenge localities and their communities to highly varying degrees and ways. Conflicts arise as a 20th century understanding of local public good provision and economic development opposes new legal, economic, and ethical mandates to provide for global public goods. Here I consider three classes of place-based policies that are relevant for global climate stabilization: industrial infrastructures, urban mobility infrastructures and rural transitions. I demonstrate that a three-tiered tragedy of commons of human settlements is at the heart of the conflict between local transport and global public goods. I suggest that this conflict can be resolved by simultaneously addressing locally suboptimal public good provisions. I also address transition dynamics, identifying (place-based) identity as main barrier of but also opportunity for transitions of industrial structures. Transition policies will require co-design with and for local populations, but also a more encompassing understanding of positive freedoms that are generated by collective action.

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The outputs of the workshops are a series of papers and a summary report that outlines future directions for place-based policies. This work will ultimately be relevant for policymakers at all levels of government who are interested in improving the design and implementation of place-based policies to contribute to equitable and sustainable economic futures.

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Table of contents

TABLES

No table of figures entries found.

1 Introduction

As humanity transgresses planetary boundaries, it becomes clear that protecting global environmental goods, in particular a stable climate and biodiversity, is the predominant challenge of humanity. This requires global cooperation (Nordhaus 2015), the resulting rapid phase out of fossil fuels (Skea et al. 2022) and sparing of global land for nature (DeClerck et al. 2021). The required transition has started in many societies and is moving from comparatively straight forward solutions (such as switching from coal power plants to renewable energies) to more demanding tasks (such as mobility and heating systems where end users are deeply involved). As a result, local communities become increasingly affected, and encounter both the positive and the negative outcomes of such transitions. Job markets, mobility lifestyles, and household investments all experience substantial changes. Local communities are also major actors, and they require spatially differentiated strategies (OECD 2021; 2023). Intelligent global stewardship also harnesses local wellbeing benefits, in land use, climate and also in terms of well-being. In a broader sense, the action on providing global environmental goods interacts with the provision of local public goods.

There are two direct consequences for local communities. First, the nature of local public goods is changing, resulting in calls for fair transitioning and requiring an understanding on the differential impact in terms of jobs and lifestyles. This requires profound and broad transformations of regional economic activity, which includes local public goods provision, but also goes beyond. Not all of this can be intermediated by market processes, given the systemic nature of the environmental challenges and the collective choice requirements of infrastructures and networks. The local/regional scale, with its in-person networks, is therefore suitable to these transformation challenges. Second, established cultural values appear threated by the transitions, and often lead to polarizations and threats to democracy. This second dimension is closely related to the first one, but arguably also needs to be addressed on its own.

The focus of this paper is on the interaction between addressing global environmental goods and the required in changes in local public good provisions. While not part of this analysis, I would like to note that artificial intelligence is already rapidly transforming job markets (Creutzig, Acemoglu, et al. 2022) and poses its own existential risks to humanity (Russell and Bohannon 2015). The transition is hence supercharged with an additional layer of change.

Public goods are goods and services that benefit society as a whole and are not easily provided by the private sector. Public goods exist both on local and global scales. Examples of local public goods include transportation, education, and energy systems, which require finance and good governance to ensure their provision. Global public goods, such as climate change mitigation, require polycentric governance and coordination due to their inherently cross-border and long-term nature. However, the provision of local public goods can conflict with the provision of global public goods. For instance, increased provision of streets and car-based transport infrastructure, which is a local public good, can contribute to greenhouse gas emissions and climate change, which is a one of the key global public environmental goods of concern.

Efforts to stabilize the climate by limiting the concentration of greenhouse gases (GHG) in the atmosphere are considered a global public good because they have benefits that extend beyond national boundaries and cannot be restricted to any particular group or individual. Climate stability is essential for the survival of life on Earth, and it requires a collective effort to reduce GHG emissions quickly to net zero and move to net negative emissions to stabilize climate change at modest levels of global warming. No one can be excluded from a stable climate because everyone shares the same atmosphere and the same climate system. The impacts of climate change, such as rising sea levels, extreme weather events, and food and water scarcity, affect people and ecosystems worldwide.

The provision of local public goods and the goal of stabilizing the climate are two different issues that can sometimes conflict with each other but can also converge. Local public goods such as transportation and energy systems, or the presence of a healthy industrial base, are typically provided at a local or regional level to meet the specific needs of a community. In contrast, stabilizing the climate is a global issue that requires collective action from all nations to limit the concentration of greenhouse gas emissions in the atmosphere.

At times, the provision of local public goods can conflict with efforts to stabilize the climate. For example, the continued operation of carbon-intensive industries such as coal mining or fossil fuel extraction may provide jobs and revenue to a local community but can also contribute to the global emissions of greenhouse gases. In such cases, policymakers must balance the need to address the global climate crisis with the need to support local communities.

However, the provision of local public goods can also support efforts to stabilize the climate. For example, investments in clean energy infrastructure can both provide reliable and affordable energy to local communities and contribute to reducing greenhouse gas emissions. Similarly, policies that promote sustainable transportation options, such as public transit or cycling infrastructure, can reduce reliance on carbon-intensive transportation modes and improve local air quality.

Public goods are often under-supplied due to their non-rivalrous and non-exclusionary nature. Place-based policies can help provide public goods effectively, especially when the benefits and trade-offs span regional boundaries. For instance, shutting down coal mines to protect the climate, a public good enjoyed by everyone, may impact the industrial base, employment, and local finances. Place-based approaches allow for geographically differentiated approaches, even as goals of policies remain constant (Creutzig and Kammen 2009). Place-based policies can also improve the targeting of resources to local needs, particularly in declining regions. Indeed, climate and biodiversity challenges, many of them place-based, arguably require an intensified effort to enable local transitions that take everyone, or at least the majority on board. Utilizing place-based policies for public goods requires determining relevant public goods, targeting areas, addressing trade-offs, and considering the appropriate level for policy action. National and supranational level policies can help arbitrate collective action problems that arise at the local level.

In this paper, I motivate place-based policies and why a regional perspective is crucial for providing public goods. I will start with conceptualizing global environmental goods in the context of Planetary Boundaries, Earth system processes that are critical to maintaining the stability and resilience of our planet and explain their relation to local public goods and place-based policies. As a result, I will derive three local arenas where local public goods and global environmental goods conflict, or at least do not align well in their path-dependent provisioning: 1) Coal phase out, 2) Changing cities, and 3) Land use transitions. In the following three sections I will consider each of these three arenas in turn, providing game theoretic explanations suggesting that key challenges are nested local and global tragedy of commons (prisoners' dilemma). I provide examples and case studies and discuss place-based policies to support fair transitions. In section

6, I address political polarization and democratic threats that are partially resulting from transition dynamics and ways to respond to this polarization. In section 7, I conclude with an outlook on governance implications.

2 Conceptualization: From Global Environmental Goods to Place-Based Policies

We here clarify the concepts of the Anthropocene, Planetary Boundaries, Global Commons/Global Environmental Goods and Public Good provision and introduce the relevance of place-based policies to provide a localized contribution to global environmental goods, while negotiation synergies and trade-offs with local public goods.

2.1 Concepts

The Anthropocene, a term coined by Nobel laureate Paul Crutzen (Crutzen 2006), refers to the current geological epoch in which human activities have become the dominant influence on the environment, climate, and ecosystems of our planet. This epoch is characterized by the profound and often detrimental impact of human actions on the Earth's systems, including the alteration of more than half of the planet's land surface, the significant increase in greenhouse gases, and the widespread extinction and endangerment of species—hallmarks of climate change and biodiversity loss.

The Planetary Boundaries concept, proposed by a group of international scientists led by Johan Rockström and Will Steffen (Rockström et al. 2009; Steffen et al. 2015; 2018), identifies nine Earth system processes that are critical to maintaining the stability and resilience of our planet. These boundaries include climate change, biodiversity loss, land-system change, freshwater use, biogeochemical flows (nitrogen and phosphorus cycles), ocean acidification, stratospheric ozone depletion (appears currently largely resolved due to the Montreal protocol), atmospheric aerosol loading, and introduction of novel entities (e.g., synthetic chemicals, radioactive materials).

Transgressing these boundaries could push the Earth system out of its stable Holocene state, potentially leading to drastic environmental changes. Societal collapse and human extinction cannot anymore exclude, as about 3.3 to 3.6 billion people live in contexts that are highly vulnerable to climate change (Pörtner et al. 2022). Each boundary has a proposed 'safe' limit, beyond which the risk of destabilizing changes increases significantly. Actions to prevent transgressing these boundaries constitute global environmental public goods. These actions benefit all nations and generations, regardless of who contributes to them.

Consider the boundary of biogeochemical flows. Excessive use of nitrogen and phosphorus in agriculture can lead to eutrophication of water bodies and dead zones in oceans. By adopting sustainable farming practices and efficient use of fertilizers, I can reduce nutrient runoff, thereby contributing to the global public good. Similarly, preserving biodiversity, another planetary boundary, is a global public good. Protecting habitats and enforcing anti-poaching laws in one country helps maintain global biodiversity levels. Every species saved contributes to the health of global ecosystems.

Digitalization and artificial intelligence have not been explicitly identified in the context of planetary boundaries, although it is indirectly considered in the tenth tentative planetary boundary *novel entities* (Steffen et al. 2015). There is however evidence that digitalization already shapes the Anthropocene, albeit mostly via indirect channels (Creutzig, Acemoglu, et al. 2022). There is also a valid concern that artificial intelligence could lead to human extinction at short time scales (Russell and Bohannon 2015). Independent of humanity, artificial intelligence has already its own rationale of planetary extraction (Crawford 2021).

Altogether, the Planetary Boundaries concept provides a roadmap for global stewardship of the Earth system, emphasizing the collective responsibility of nations to provide global environmental public goods.

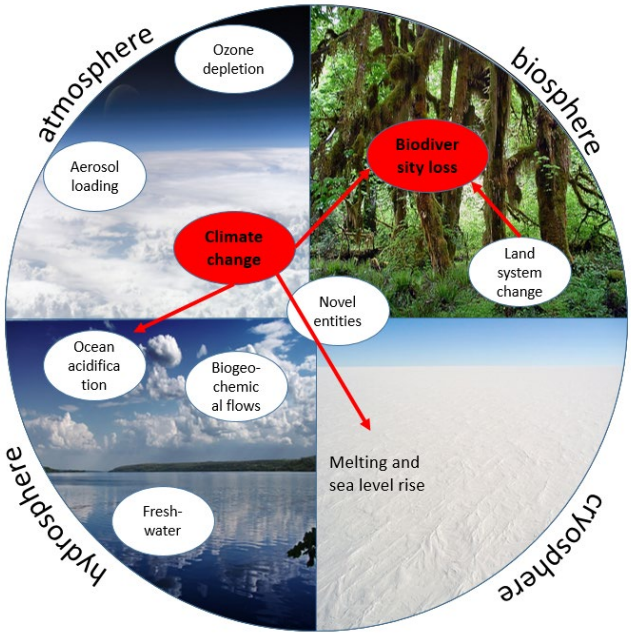


Figure 1. Relationship between four global commons (atmosphere, biosphere, cryosphere and hydrosphere) and nine planetary boundaries. Climate change and biodiversity are core planetary boundaries. Source: author. Planetary boundary concept: (Steffen et al. 2015)

2.2 Relationship between Global Commons and Planetary Boundaries

The four global commons—Atmosphere, Biosphere, Cryosphere, and Hydrosphere—represent the major domains of Earth and are commonly understood as global commons (McGinnis and Ostrom 1996; Creutzig 2017). The nine Planetary Boundaries can be mapped to these global commons as follows, and as illustrated in Figure 1:

1. **Atmosphere**: This global common includes the layers of gases surrounding our planet. The Planetary Boundaries that directly relate to the Atmosphere are:
    - Climate Change: This boundary is concerned with the concentration of greenhouse gases in the atmosphere.
    - Atmospheric Aerosol Loading: This boundary pertains to microscopic particles in the atmosphere that affect climate and living organisms. Aerosols affect the functioning of the earth system, notably regional ocean-atmosphere circulation. Currently ambient air pollution causes more than 3 million death per year (Who 2016).
    - Stratospheric Ozone Depletion: This boundary is about the concentration of ozone in the stratosphere, which protects life on Earth from the Sun's harmful ultraviolet radiation (large resolved due to 1986 Montreal protocol).
2. **Biosphere**: The Biosphere encompasses all life on Earth. The Planetary Boundaries that directly relate to the Biosphere are:
    - Biosphere Integrity (Biodiversity Loss): This boundary is concerned with the extinction rate and genetic diversity of species on Earth.
    - Land-System Change: This boundary pertains to the amount of land used for human purposes, such as agriculture and urbanization. Deforestation and land degradation compromise the availability of productive and ecologically valuable land.
3. **Cryosphere**: The Cryosphere includes all of Earth's frozen water, such as glaciers, ice caps, and permafrost. While there isn't a specific Planetary Boundary for the Cryosphere, it is closely linked to the Climate Change boundary, as global warming leads to the melting of ice, which in turn contributes to sea-level rise, changes in sea salinity, freshwater availability, affecting the Hydrosphere.
4. **Hydrosphere**: The Hydrosphere includes all of Earth's water, such as oceans, seas, rivers, and groundwater. The Planetary Boundaries that directly relate to the Hydrosphere are:
    - Freshwater Use: This boundary is concerned with the amount of freshwater that can be used by humans without disrupting ecological and climate stability.
    - Ocean Acidification: This boundary pertains to the decrease in the pH of the Earth's oceans, caused by the uptake of carbon dioxide from the atmosphere.
    - Biogeochemical Flows: This boundary, specifically the phosphorus and nitrogen cycles, is related to the Hydrosphere as these nutrients can cause eutrophication in water bodies.

The ninth boundary, Novel Entities, refers to new substances, new forms of existing substances, and modified life forms that have the potential for unwanted geophysical and/or biological effects. It can notably include artificial intelligence systems. This boundary can affect all four global commons. There is a wide and critical discussion on planetary boundaries (Biermann and Kim 2020), inter alia recommending a more refined treatment of biodiversity as measured in genetic library, functional diversity, and biome condition (Mace et al. 2014).

The planetary boundaries can also more directly be understood as representing global commons. Budgets associated to planetary boundaries can be interpreted as common pool resources that can be utilized within finite limits (Sureth et al. 2023). From a welfare-economic perspective, meeting the planetary boundaries requires a combination of cost-effectiveness analysis – not crossing thresholds in a cost-effective manner – and cost-benefit analysis – optimal pathways considering both benefits (avoided damages) and costs (Sureth et al. 2023). Pragmatically, and relevant for place-based approaches, this means reducing GHG emissions and land-use impacts of local activities as fast as possible without compromising local livelihoods (and optimally improving livelihoods). As I will argue below, this approach includes sociological and identity-based considerations, in additions to economic analysis.

2.3 Relationship between global environmental goods and local public goods

There are myriad relationships between local public goods and planetary boundaries and corresponding attempts to avoid transgressing them via the provision of global environmental goods. This raises the question of how to handle this complexity. Climate change and biodiversity are considered as central dimensions because they operate at the level of the whole Earth system, are regulated by the other boundaries and provide the planetary-level overarching systems within which the other boundary processes operate (Steffen et al. 2015). As land use change is the main driver of anthropogenic mass extinction, it's hence justified to focus on land use, in addition to climate change (GHG emissions) as central dimensions (Creutzig 2017). Land itself relates not only to biodiversity but also to geochemical flows (primarily via agriculture), and fossil fuel combustion is closely related to aerosol loading. Hence, the focus on climate and land partially also covers the provision of other global environmental goods.

Which local public goods and arenas are most relevant? Again, there are multiple choices and aspects to consider. Here I break down the complexity and focus on three key examples that relate both to climate and land environmental good provisions:

1. **Urban planning and changing cities** – relating to GHG emissions of transport and buildings and to land use via urban sprawl,
2. **Coal phase out** – relating to fossil fuel emissions,
3. **Agricultural transitions** – relating to land use change and non-CO2 GHG emissions.

The overall relationships are conceptualized in Figure 2.

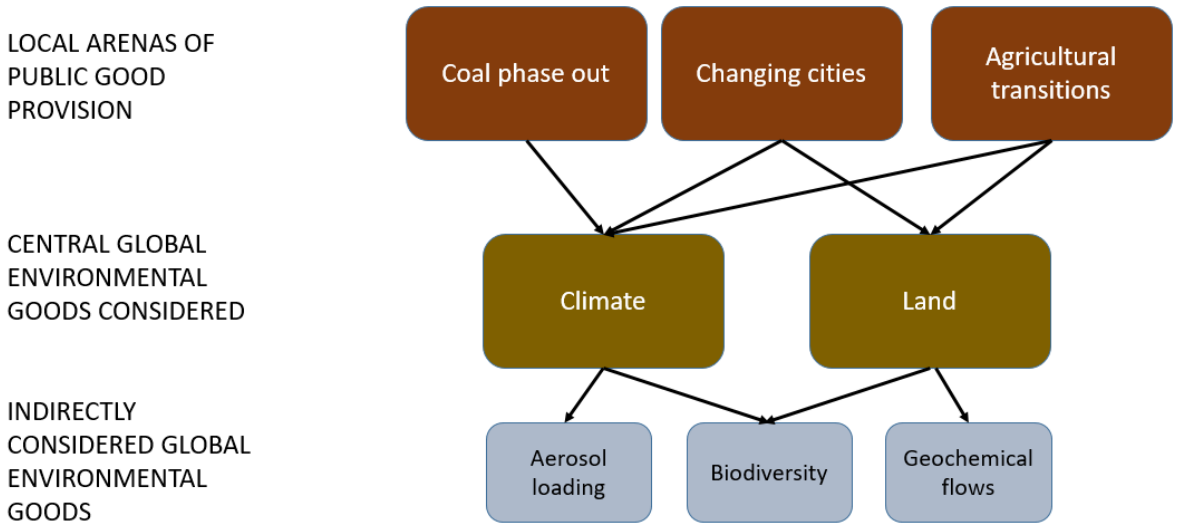


Figure 2. Local arenas of transitions and their relationship to central global environmental goods.

In sections 3, 4 and 5, I will investigate coal phase out, changing cities, and agricultural transitions respectively. The analysis demonstrates that the provision of global environmental goods is consistent with welfare enhancing measures at local level in most cases but that the corresponding cultural shift is major. In turn, well designed place-based policies are a key requirement to make the transition work.

2.4 Placed-based policies

Both the concept and the reality of place-based policies is shifting rapidly. Whereas a decade ago, place-based policies were judged by the economic literature as inefficient and generating deadweight losses (Rosen-Roback framework), the recent literature emphasized that marginal congestion costs can outweigh agglomeration benefits, arguing that in some cases place-based policies directed at smaller, less-dense places can improve welfare (Suedekum 2021). It is also argued that the place-based versus people-based policy framing is inadequate and should be replaced by “people-in-place” thinking, i.e., place-based policies as harnessing in-person networks of people, institutions, and physical assets (McCann 2023). Protecting the global commons also motivates two additional routes for place-based policies: 1) There is a diversity of local action to protect the global commons, and 2) there is a diversity of socio-economic impacts, with some of the regions most impacted also among the most vulnerable (e.g. climate change mitigation in industry; adaptation) – an important aspect given the „geography of discontent“ afflicting politics, which is in turn risking to prevent progress on addressing the global commons

Place-based policies (PBPs) refer to a diverse set of programs aimed at affecting the spatial resource allocation in a particular region or country. PBPs can be about the provision of local public goods, such as transport or education systems. Recent theoretical and empirical research has established a solid allocative case for spatial dispersion of economic activity, which has made PBPs more widely accepted among mainstream economists. Many countries have experienced political backlashes from rising spatial economic disparities, and PBPs have become an attempt to foster spatial economic cohesion and to save liberal democracies altogether. PBPs consist of a multitude of programs that can be direct, indirect, or horizontal in scope and design. Direct policies offer subsidies or tax credits to firms or prioritized infrastructure investments in clearly designated target regions, while other policies focus on priorities like education, research and development, transport, culture, among other domains. Finally, some policies have a horizontal setup that tries to equalize fiscal capacities across jurisdictions.

In the case of local transition protecting global environmental goods, such as coal phase out, changing cities, or agricultural transitions, PBPs become increasingly relevant. GHG emissions, land use and socio-economic conditions differ across regions in a way that systematically relates to these challenges. For example, in many instances poorer regions have higher industrial GHG emissions per capita on the production side whereas richer regions dominate consumption of GHG intensive goods. A phase out of fossil fuel emissions may hence exacerbate existing spatial inequalities and requiring PBPs and compensating measures.

Here I will analyze three place-based contexts and their corresponding place-based policies, as summarized in Table 1.

Context	Current state in specific regions	Place-based policy to align local public goods with global environmental good
Energy	Coal mining and/or coal power plants	Phase out coal, replace with renewable energy and similar technologies, retrain
Cities	Car-focused development	Provide infrastructure for cycling, public transit and shared mobility
Land-use and related activity	Food production with high intensity of land-use and GHG emissions	Provide incentives for replacing fodder and cattle production with focus on more diverse and nutritionally rich food provision

3 Coal Phase Out

Climate change mitigation is a global coordination problem and requires overcoming the overarching freerider problem (or prisoner's dilemma) that everyone is better off if everyone stops emitting GHG emissions but that benefits are smaller or even inverse if agents act only individually.

Game theory is the study of mathematical models of strategic interactions among rational agents. Prisoner's dilemma (a.k.a. tragedy of commons) is a classic example of a game theory problem, where two players must choose between cooperating or defecting, and their payoffs depend on their joint choices. Coal phase out is a clear and relevant case of this prisoner's dilemma.

3.1 The prisoner's dilemma of phasing out fossil-fuel dependent structures in specific regions

Consider that two players are the coal mining regions A and B, and their choices are to decarbonize their economy (cooperate) or not (defect). The payoffs are measured in terms of economic benefit (GDP) and CO2 emissions.

Here is the pay-off matrix using Gt CO2 emissions and GDP measured in billion dollars:

Region 1 / Region 2	Decarbonize	Don't Decarbonize
Decarbonize	(Region 1: $1 billion, 0 Gt CO2; Region 2: $1 billion, 0 Gt CO2)	(Region 1: $0.5 billion, 0 Gt CO2; Region 2: $5 billion, 50 Gt CO2)
Don't Decarbonize	(Region 1: $5 billion, 50 Gt CO2; Region 2: $0.5 billion, 0 Gt CO2)	(Region 1: $5 billion, 50 Gt CO2; Region 2: $5 billion, 50 Gt CO2)

If both regions choose to decarbonize their economy, they will both have a low economic benefit ($1 billion) but also low CO_2 emissions and associated economic damage. If one region chooses to decarbonize while the other does not, the region that decarbonizes will have a reduced economic benefit ($0.5 billion) but also low CO_2 emissions, while the region that does not decarbonize will have a high economic benefit ($5 billion) and high CO2 emissions (50). If neither region chooses to decarbonize their economy, they will both have a high economic benefit ($5 billion) and high CO_2 emissions (100 Gt). If the social costs of carbon are evaluated a €100/tCO_2, then the social and economic damage from emissions and resulting

climate change outweigh the economic benefits of continued coal combustion globally, while the local case for transition remains economically ambiguous as damages are distributed across regions.

This prisoner's dilemma can be overcome by global cooperation and polycentric governance (Ostrom 2009). In economic terms, CO2-pricing, trading, and climate clubs are efficient measures to achieve cooperation (Lessmann, Marschinski, and Edenhofer 2009; Nordhaus 2015). However, such measures predispose already an agreement on cooperation. Less refined cooperation could simply focus on phasing out fossil fuels (here: coal) in coordination.

Place-based policies have the potential to modify the pay-off matrix. In particular, place-based policies could increase the financial pay-off of decarbonization, e.g., by replacing coal-fired power plants with renewable energy, hydro storage or new clean tech industry. In times of labor shortages, it makes sense to concentrate to industrial facilities where labor force is available. A focus on worker's reemployment can also prevent or at least soften alliances between coal capital owners and workers.

Place-based strategies are encountering a psychological loss aversion problem for whole regions. People prefer what they have in their hand over what they might get in the future and what they don't yet understand. Loss aversion problem can be partially encountered with realignment in time. Specifically, it is important to deploy place-based policies before complete coal phase out to make alternative futures visible and tangible early on.

3.2 A case study from Lusatia, Germany

Lusatia, Germany (Figure 3), is a region heavily reliant on coal mining, with a significant portion of its economy and employment tied to this industry. Lignite mining, a staple of Lusatia's landscape and economy since the 19th century, has profoundly influenced the region's identity and residents' self-perception. However, this era is nearing its end as the German government, committed to its climate protection objectives, plans to terminate coal-based energy production by 2038 (or possibly earlier – as high prices of CO_2 emissions might make coal unviable already in 2030 (Pietzcker, Osorio, and Rodrigues 2021)). The coal sector provides jobs for over 20,000 people, with a majority of these workers being over 46 years old and nearing retirement age. Given existing early retirement programs, and an intended coal phase-out by 2038, 5,000 to 7,500 remaining workers would need to find new job opportunities (Rinscheid and Wüstenhagen 2019).

The German government accompanies the phase-out of coal with proactive support, not only compensating firms and workers but also providing very high structural funding for Germany's three coal regions including Lusetia (€40 billion until 2038). This funding commences before phase-out is initiated, intended to "prevent a local downward spiral and the erosion of social structures in the first place, rather than trying to repair damages ex post after they have occurred" (Suedekum 2023).

A shift towards renewable energy is anticipated to create new jobs, and job generation in renewables is already outcompeting job losses in coal mining. The coal phase-out will not only lead to the creation of new jobs in the renewable sector, but also in other sectors of the economy. For example, after the closure of the current open cast mines, jobs in restoring the destroyed landscapes will be created or remain in place for longer periods of time. However, current coal mining jobs are also well paid and were traditionally associated with high self-esteem. Right wing populism is taking up this case, inciting a polarized debate (see also section 6).

To ensure a just and fair transition (also in the face of the right-wing populism) the German government is considering various measures to support the transformation of the coal regions (Heer et al. 2021). These measures include financing for early retirement and re-training programs for coal industry employees. The government is also considering prioritizing the deployment of renewable energies in the coal regions, investing in modern infrastructure, providing incentives for the creation of new businesses, and making public investments in research and development. Specifically, the region is profiting from explicitly being chosen as center for a new Institute of Astrophysics, receiving €1.2 billion, and numerous well-paid academic jobs.

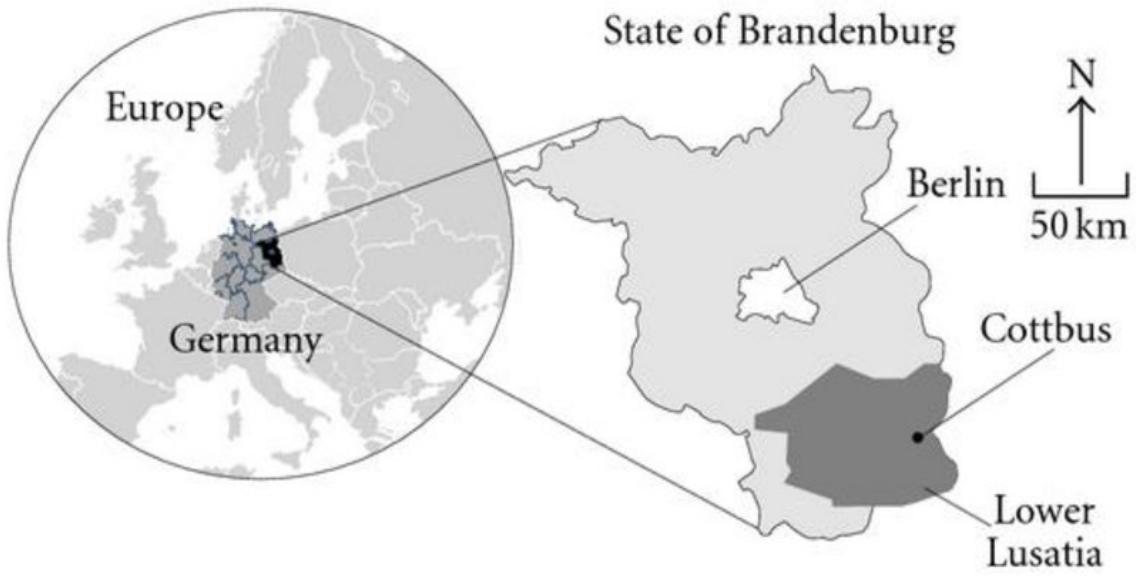


Figure 3. Location of Lusatia (Quinkenstein et al. 2012)

Education may play a key role to support the transition, not only in terms of retraining workers. Transformative educational science can help ensure that young people in Lusatia play a significant role in successful structural change (Beer and Holz 2021), ensuring that young people in Lusatia play a significant role in successful structural change. To achieve this, educational institutions must develop new forms of learning that enable young people to acquire the skills and knowledge they need to participate in shaping their future. This involves fostering specific knowledge, attitudes, and practices that address individual and collective action – especially that what is relevant in their own region, in this case Lusatia - , acknowledge value plurality, and promote sustainable development. It's important to approach structural change from multiple perspectives to highlight its complexity and enable reflective judgements. Active involvement of students in shaping structural change is desirable from both a democratic and educational standpoint, as it gives voice to those affected and offers valuable learning opportunities. This requires authentic negotiation processes that balance the assertion of interests with the experience of real-world democratic processes.

A concern is that better educated youth leaves rural regions for better paid jobs in cities. This is however happening anyway. For example, Eastern Germany has seen major emigration after 1990, especially

among young women. A lesson is that transformative education should focus on young men, providing them with agency over their own future. This notably involves the support of exit from right-wing extremism and related groups (e.g., https://www.exit-deutschland.de/) coupled with programs that provide education for future-oriented jobs. It supports both the employment force and reduces polarization in regions disadvantaged by the transformation of industry.

Transformative educational science should also aim to build long-term networks between various local actors and ensure that findings from local projects are communicated to the public and relevant political bodies. As coal phase it involves uncertain structural change, it's crucial to develop perspectives that enable young people to take ownership of the process, thereby creating a sustainable future for Lusatia. This requires bold initiatives on the ground to establish a school system that is participation-oriented and sustainability-focused (Beer and Holz 2021). The case study of Hoyerswerda demonstrates the importance of engaged civil society, in particular via participation and organization of local sport groups, and via grass root movements that provide public spaces and activities, such as re-utilizing old slab constructions (Erk 2023).

To properly understand the challenges of the coal phase out in Lusatia, I also need to consider the wider transformative perspective that looks at the roots of contested spaces and discourses. Crucially, this involves understanding that transitions incorporate both redistributive and recognition-based components (Fraser and Honneth 2003)[1]. Applied to Lusatia, an important study (Gürtler and Herberg 2023) identified three key insights:

1) Integration of Distributive and Recognition-Based Efforts: The need for distributive efforts should be closely tied with recognition-based efforts. In the context of Lusatia's coal phase out, this would involve initiating processes that value not only the identities of workers in the coal industry but also the diverse experiences of misrecognition that are not necessarily related to coal. For instance, experiences of misrecognition related to gender, ethnic belonging, or experiences of discrimination (by West Germany) should be addressed. This means that regions, such as Lutetia, that have experienced what some would call traumatizing structural change (the dismantling of coal jobs in the 1990ties), require additional recognition-based efforts to manage a new tradition, even it concerns only a small number of jobs. Local policy makers and credible opinion leaders are best situated to support such efforts.

2) Critical Scrutiny of Recognition-Based Justice Claims: The need for recognition-based justice claims must be critically examined to avoid the risk of exclusion by inclusion. Interviews conducted in Lusatia (Gürtler and Herberg 2023) reveal that recognition-based claims often emerge from incumbent positions. For example, those who previously enjoyed a privileged position in the coal

[1] Recognition-based approaches, as conceptualized by Nancy Fraser, focus on addressing social injustices that are not merely distributive but also involve patterns of cultural value that can impede parity of participation in social life. In the context of coal exit, recognition-based approaches involve acknowledging the identities, contributions, and concerns of coal-dependent communities and workers, recognizing the historical and cultural significance of coal mining in these communities, the potential loss of identity and community cohesion with the phase-out of coal, and the need for strategies that respect and incorporate the perspectives of these communities in the transition process.

Recognition alone is insufficient. Fraser argues for a dual approach that combines redistribution (economic restructuring, job creation, etc.) with recognition (respecting cultural identities, community cohesion, etc.)

industry now fear economic decline and status subordination. At the same time, marginalized voices, such as citizens whose villages have been displaced due to extractivist industries and parts of the Sorbian minority, struggle to challenge incumbent positions at the local level. Such historically inherited positionalities and multi-dimensional power relations need to be taken into account when analyzing claims for greater recognition-based justice.

3) Risk of Right-Wing Populism: There is a risk that rightful claims to recognize local communities may overlap with problematic claims of homogeneity and exclusion, particularly in the context of the recent rise of right-wing populism that simplifies, consolidates and reifies group identities. Some interviews with people from Lusetia (Gürtler and Herberg 2023) resonate with populist figures of thought, such as the ideas of a voiceless people dominated by disconnected elites, a relatively homogeneous territory and population, and the prioritization of natives or locals being more entitled to redistribution benefits than alleged outsiders. It remains crucial to distinguish between legitimate recognition claims and populist narratives. Place-based policies should hence connect to local histories and economies, supporting legitimate social and environmental claims, and honor local identities.

3.3 Overcoming challenges of spatially fair transitions

A shift away from fossil fuels, and coal in particular, to renewable energies is beneficial to the overall economy, generating additional jobs.

The effect of the potential job shifts in the energy sector as a result of the transition from fossil fuels to renewable energy sources has been comprehensively investigated in a study that utilizes a novel dataset of job footprints in over 50 countries and its application to an integrated assessment model to analyze the potential impacts (Pai et al. 2021). The paper finds that:

a) By 2050, jobs in the energy sector would grow from today's 18 million to 21 million in the reference scenario and even more, to 26 million, under a well-below 2°C scenario. In a 100% renewable scenario jobs are even projected to increase to 35 million (Ram, Aghahosseini, and Breyer 2020).
b) In 2050, under a well-below 2°C scenario, 84% of the total jobs would be in the renewable sector, 11% in fossil fuels, and 5% in nuclear jobs.
c) While fossil fuel extraction jobs would rapidly decline, these losses would be compensated by gains in solar and wind jobs, particularly in the solar and wind manufacturing sector, and also in the battery sector, considering projected power-to-X scenarios (Ram et al. 2022). The vast majority in jobs are in solar PV and are better qualified ones compared to jobs in the extraction sector.

In some countries, the transition is more difficult than in others. In the context of India, extracting one million tons of coal in India requires significantly more workers than in the US (725 versus 73). This indicates that the transition away from coal in India would have a significant impact on employment, given the labor-intensive nature of the industry in the country. In contrast, a case study of Ethiopia, with fewer jobs in coal mining, demonstrates that a transition to renewable energy is not only feasible but also the least cost option with greatest social welfare (Oyewo et al. 2021).

Correspondingly, studies of the barriers to coal phase out find that constraints are political not economic. For example, in Vietnam vested interests of state-owned coal power companies overrule other rationalities (Dorband, Jakob, and Steckel 2020). In other cases, perceived (but not demonstrated) economic benefits of coal dominate, while environmental concerns remain sidelined (Ohlendorf, Jakob, and Steckel 2022).

Vested interested also mean that last century rules of electricity markets, preferring base load over intermittency (i.e. coal over renewables) remain in place, as shown in the case of the Philippines (Manych and Jakob 2021).

Overall, negative employment effects crystallize in the in the extraction sector, and countries with relevant coal extraction have a specific challenge to overcome. Examples of these countries, include Poland, Germany, South Africa, and India. In each case, the challenge is a place-based one, with Lusetia, Germany, or Katowice, Poland, as important European examples. The dominant challenge is one of the political economy (power sector enterprises maintaining stable control over regulatory environment). However, there are nonetheless place-specific challenges: 1) new jobs are not necessarily appearing where they are lost, and 2) new jobs are not equivalent in skills to old jobs.

Corresponding to these challenges are hence two key strategies.

First, repurpose coal power plant and coal extraction side locations with clean energy projects, such as solar PV, wind, battery or pumped storage. Key examples, from the US, Canada, and Australia prove that this concept works, and an analysis of potential India coal power plant repurposing to such options reveals a strong economic rationale (Jindal and Shrimali 2022). Case studies from Indian states and Spain demonstrate that financial benefits accrue from reutilizing up to 90% of materials and infrastructure left behind from thermal coal plants, making best use of available grid connection; total benefits typically outweigh costs of decommissioning of former coal plants (Bhattacharjee and Sen 2023). In other words, investments into renewables and associated technologies should be directed to places where coal phase out is happening, possibly even if siting is suboptimal from the perspective of other economic factors.

Second, retrain workers and provide transformational educational science (see section 3.2). Relevant policies to address workers in the extraction sector include retraining programs for workers to move into renewable energy jobs, but also social safety nets to protect workers during the transition, and economic diversification strategies for regions heavily dependent on coal mining.

The Lusatia example also demonstrated the clear case for recognition-based transformation policies. I will revisit this in section 6.

4 Changing Cities

Cities are directly and indirectly responsible for more than two thirds of global GHG emissions (Lwasa et al. 2022). The two sectors where cities have direct influence on are transport and buildings, totaling more than 10 $GtCO_2$ annually (Felix Creutzig et al. 2016). There are ample opportunities to reduce GHG emissions in cities and also reduce land use impacts.

Here, I investigate the prisoner's dilemma of urban transport infrastructures and associated global environmental harm, demonstrating that there is a nested cascade of prisoner's dilemmata, associated with the public good of road (for cars) transport infrastructure provision (section 4.1). Then I show that there is a solid economic case for tackling these prisoner's dilemmata (section 4.2). Finally, I assess potential place-based policies to remediate the urban tragedy of commons (section 4.3).

4.1 Three nested tragedy of commons of human settlements

GHG emissions and land take of cities have a joint cause: the coupled transport-land-use system. Structures are often car dependent, and, associated with this car dependency, sprawled into single family houses that expand into rural, agricultural, and sometimes biodiversity rich areas.

We investigate the incentive system behind this tragedy and work out three nested tragedies of commons in urban systems, demonstrating that the root cause is a misleading understanding of street provision for cars as public good. For investigation, I rely on game theory. In the subsection section 4.2 I also provide empirical evidence for why current public good provisions of transport infrastructures fails most citizens.

Here I use stylized examples that demonstrate how urban transport results into prisoners' dilemma.

4.1.1 Congestion and individual utility

A Game between individual car drivers and collective public transit patrons

Understanding the prisoner's dilemma of choosing between a private car and public transport requires defining actors, strategies, and benefits. Here, actors are two commuters who live in the same area and work in the same place. Strategies include using your own vehicle or public transport. Benefits can be measured in terms of time, money, convenience, environmental impact, or other relevant criteria.

Suppose using your own car takes 30 minutes and costs $10 per day, but using public transportation takes 40 minutes and costs $5 per day. Also assume that if both commuters use their own cars, they will face additional traffic congestion and add 15 minutes to their travel time. Car commuters also add a bit delay to

public transit. When both commuters use public transport, it reduces congestion and cuts his travel time by five minutes. The payoff matrix for this example could look like this:

		Private car	Public transport
Private car		(45 min, $10),(45 min, $10)	(30 min, $10),(50 min, $5)
Public transport		(50 min, $5),(30 min, $10)	(40 min, $5),(40 min, $5)

This is a prisoner's dilemma because each commuter has a dominant strategy to use private car, regardless of what the other commuter does. However, if both commuters use private car, they will end up worse off than if they both use public transport.

Note that key assumptions are about time it takes in each mode of transport. Time for transport use is based in infrastructure provision, i.e. in streets for cars and bus lanes. It's a public choice which system is supported how much. This highlights the relevance of transport infrastructure provision as key variable in inciting this prisoner's dilemma.

Game between individual car drivers and individual cyclist

Let's say the car takes 30 minutes and costs $10 per day, but the bike ride takes 45 minutes and costs $0 per day. I also assume that if a commuter both uses a car, he faces more traffic jams and safety hazards, travel time increases by 15 minutes, and his risk of being in an accident increases by 5%. When both commuters use bicycles, there is less congestion, fewer safety risks, five minutes less travel time for him, and a five percent reduction in his risk of getting into an accident.[2]

The payoff matrix for this example could look like this:

	Car driving	Cycling
Car driving	(45 min, $10, 5%),(45 min, $10, 5%)	(30 min, $10, 0%),(50 min, $0, 10%)
Cycling	(50 min, $0, 10%),(30 min, $10, 0%)	(40 min, $0, 0%),(40 min, $0, 0%)

[2] To derive the percentages related to security risk, I used the following logic: When both commuters use cars, they will encounter more vehicles on the road, increasing the chances of a collision. I assumed this probability to be 5%, but you can change it based on your own data and assumptions. When both commuters ride bicycles, fewer cars are encountered on the road, reducing the chance of collisions. I thought this probability was also 5%, but it was the other way around. This means that the risk of getting into an accident is 5% lower for him than if he were driving. A mixed situation arises when one commuter uses a car and the other uses a bicycle. With fewer cars on the road, drivers are less likely to collide than if both drivers were on the road. I assumed this probability to be 0%. This means that there are no additional safety risks for drivers from using the car. Due to the number of cars on the road, the chances of a cyclist crashing are higher than if both cyclists were on their bikes. I assumed this probability to be 10%. This means that a cyclist has a 10% higher risk of being in an accident than a car driver. These percentages are arbitrary and may change depending on your scenario or data source. They are intended to explain the concept of security risk as an element of his payoff matrix.

This is also a prisoner's dilemma because each commuter has a dominant strategy to use car driving, regardless of what the other commuter does. However, if both commuters use car driving, they will end up worse off than if they both use cycling.

Game between individual car drivers and individual cyclist with focus on fun

Fun can be defined as a joyful experience that makes one happy or satisfied. It can be measured by different factors, such as physical health, mental health, emotional well-being, social interaction, etc. In this example, I assumed that cycling gives more fun than car driving because it has more positive effects on these factors.

Suppose that using car driving takes 30 minutes and gives no fun per day, while using cycling takes 45 minutes and gives 10 units of fun per day. Also suppose that if both commuters use car driving, they will face more traffic congestion and safety risk, which will increase their travel time by 15 minutes and reduce their fun by 5 units. If both commuters use cycling, they will enjoy less congestion and safety risk, which will decrease their travel time by 5 minutes and increase their fun by 5 units.

The payoff matrix for this example could look like this[3]:

	Car driving		Cycling
Car driving	(45 min, -5),(45 min, -5)		(30 min, 0),(50 min, 5)
Cycling	(50 min, 5),(30 min, 0)		(41 in, 15),(40 min, 15)

Again, this constitutes a prisoner's dilemma. Car driving reduces the fun, health and enjoyment of cycling in urban areas. This makes cycling less convenient and attractive for people who want to use it. It also reduces the quality of life and choice of people who do not have access to cars.

4.1.2 Local environment

[3] To explain each entry of the pay-off matrix in more detail: If both commuters use car driving, they will spend 45 minutes on the road, which is 15 minutes more than if they used cycling. They will also have no fun from their commute, and in fact they will have a negative fun of -5 units, because they will face more stress and frustration from the traffic congestion and safety risk. This is the worst outcome for both commuters. If one commuter uses car driving and the other uses cycling, they will have different outcomes. The car driver will spend 30 minutes on the road, which is the shortest travel time possible. They will also have no fun from their commute, because they will not enjoy the benefits of cycling. The cyclist will spend 50 minutes on the road, which is 5 minutes more than if they used car driving. They will also have 5 units of fun from their commute, because they will enjoy some benefits of cycling, such as better physical health and well-being. However, they will also face more stress and danger from the car drivers on the road. This is a mixed outcome for both commuters. If both commuters use cycling, they will spend 40 minutes on the road, which is 10 minutes less than if they used car driving. They will also have 15 units of fun from their commute, because they will enjoy many benefits of cycling, such as better physical health and well-being, less stress and frustration from traffic congestion and safety risk, and more joy from riding a bike. This is the best outcome for both commuters.

Urban transport also contributes to local environmental burden, such as air pollution and noise. This constitutes an environmental tragedy, in which collective amenities (noise, air pollution, quality of life) deteriorate if people act only in line with their individual interests.

Specifically:

- Environmental burden is the impact of human activities on the natural environment. At local level, it can be measured by different indicators, such as air pollution, noise pollution, land use, water use, waste generation, etc (greenhouse gas emissions constitute the global dimension here). Car driving has higher environmental burden than public transport or cycling because it has more negative effects on these indicators.

- Air pollution is the contamination of the atmosphere by harmful substances, such as carbon monoxide, nitrogen oxides, particulate matter, etc. It can cause health problems for humans and animals, such as respiratory diseases, cardiovascular diseases, and cancer. It can also damage the environment, e.g., via acid rain, smog, ozone depletion. Car driving is a major source of air pollution in urban areas.

- Noise pollution is the excessive or unwanted sound that disturbs the normal functioning of humans and animals. It can cause health problems for humans and animals, such as hearing loss, stress, sleep disturbance, cognitive impairment, etc. It can also affect the quality of life and well-being of people living in noisy areas. Car driving is a major source of noise pollution in urban areas.

- Loss of place is the degradation or destruction of the social and cultural values of a place due to human activities. It can affect the identity and sense of belonging of people living in a place. It can also reduce the opportunities for recreation and leisure activities in a place. Car driving is a factor that contributes to loss of place in urban areas. For example:

    - Car driving reduces the space available for pedestrians and cyclists on the streets. This makes the streets less safe and attractive for walking and biking. It also limits the possibilities for social interaction and community building among people on the streets.

    - Car driving increases the demand for parking spaces in urban areas. This leads to more land being used for parking lots and garages. This reduces the green space and open space available for other purposes in urban areas. It also affects the aesthetic and historical value of some places.

A pay-off matrix that demonstrates that urban transport is a prisoner's dilemma with details on time costs and air pollution for each entry separately is shown below:

	Car driving	**Environmental mode**
Car driving	(10, 10) (0.4 kg NOx)	(15, 5) (0.2 kg NOx)
Environmental mode	(5, 15) (0.2 kg NOx)	(12, 12) (0 kg NOx)

The numbers in each cell represent the payoffs for the two travelers, where the first number is the payoff for the traveler on the left and the second number is the payoff for the traveler on the top based on a scale from 0 to 20 (higher is better), and the second number is the time cost in minutes and the air pollution in kilograms of nitrogen oxides (NOx) per year for each traveler. The payoffs are based on the preferences

and choices of travelers who value both time and air quality. The time costs are based on some assumptions and estimates from various sources. The air pollution is based on the average emission factors of different transport modes.

For example, car driving has a lower time cost but a higher air pollution than an environmental mode. If both travelers choose car driving, they will spend 30 minutes on average to reach their destination, but they will also emit 0.4 kilograms of NOx per year each. This gives them a payoff of 10 each, which is lower than the payoff of 12 each if they both chose an environmental mode. If one traveler chooses car driving and the other chooses an environmental mode, the car driver will spend 20 minutes and emit 0.2 kilograms of NOx per year, while the environmental mode user will spend 40 minutes and emit 0.1 kilograms of NOx per year. This gives them a payoff of 15 and 5 respectively, which is higher for the car driver than for the environmental mode user.

If both travelers choose an environmental mode, they will spend 30 minutes on average to reach their destination, but they will not emit any NOx per year. This gives them a payoff of 12 each, which is higher than the payoff of 10 each if they both chose car driving.

There is an important complexity here: external costs are not carried equally by everyone. This is most visible from a commuter model in monocentric cities (cities are not completely monocentric but the assumption is viable for most cities (Liotta, Viguié, and Lepetit 2022)). In monocentric cities where commuters use cars, the external costs of cars by residents living at the urban fringe are carried by everyone living further inside, while the inner city resident does not burden anyone else with their own traffic but receive the external costs of all other car drivers (Smit 1984).

4.1.3 Land-use mobility system and global environmental change

The interplay between transport systems and land use is a critical aspect of urban development and spatial planning. The provision of transport infrastructure, particularly roads, is not merely a response to existing demand, but also a catalyst for generating additional demand. This phenomenon, known as induced demand, is a key factor in urban sprawl and the expansion of cities into previously agricultural or untouched lands. The empirical literature indeed demonstrates that accessibility is more important as driver of urban sprawl than population growth (Weilenmann, Seidl, and Schulz 2017).

The construction of roads facilitates the establishment of new settlements, thereby transforming the land use pattern. However, these new settlements, once established, often become heavily reliant on automobiles for transportation due to the spatial configuration and the lack of alternative transport modes. This dependence on cars further reinforces the need for road infrastructure, creating a self-perpetuating cycle, creating automobile dependence (Kenworthy et al. 1999).

Moreover, the entrenched reliance on automobiles in these settlements makes it politically challenging to repurpose road space for other modes of transport, such as cycling or public transit, also in inner cities where suburbanites commute to (Mattioli et al. 2020). This is due to the resistance from residents who have become accustomed to the convenience and flexibility offered by private vehicles. Public transport provision in sprawled areas is possible but due to low ridership and inefficient scheduling unattractive (Camagni, Gibelli, and Rigamonti 2002).

In essence, the automobile, through its influence on land use patterns and transport infrastructure, engenders its own spatial rationality. It shapes the physical landscape of cities and settlements, and in

doing so, it also shapes the behaviors, preferences, and political attitudes of the residents within these spaces. This spatialized rationality of the automobile underscores the complex and reciprocal relationship between transport systems and land use, and the challenges involved in transitioning towards more sustainable and equitable modes of transport.

Place-based policies often worsen this cycle. First, municipalities often chose to attract new housing developments with low taxes in the hope of expanding their overall taxpayer base. For example, a relatively low property tax rate in suburbs is associated with increased urban sprawl (Song and Zenou 2009). Second, the expansion of road infrastructure itself is sometimes used as placed-based policy (Neumark and Simpson 2015).

The overall result of urban sprawl is a problem also on global scale. Theory demonstrates that urban transport GHG emission increase strongly nonlinearly with urban sprawl, which in turn worsens the financial viability of urban transport (Creutzig 2014). Transport variables (in this case transport fuel costs) and low population density are main drivers of urban GHG emissions at global scale (Creutzig et al. 2015). The land use impact appears bearable, with less than 2% of global land covered by cities, but becomes problematic when understanding that urban expansion often consumes the agriculturally most productive land (Bren d'Amour et al. 2016).

4.2 The social costs of transport, spatially differentiated

Automobility's external costs are widely spread, with urban driving being the most detrimental. Greenhouse gas emissions have a uniform impact, but other external costs like air pollution, congestion, noise, and accidents are location-dependent.

Traffic congestion's social costs rise with urban density. This is due to the frequency of congestion in densely populated areas and the larger number of people affected. Research indicates that congestion primarily affects urban areas and significant bottlenecks in Europe, depending on urban density and infrastructure quality, particularly public transport availability (Van Essen et al. 2019). Congestion is generally not a result of insufficient road infrastructure but rather excessive demand for motorized transport. An analysis of U.S. cities shows that congestion costs vary with city size and density, with larger cities reporting the highest values (at the higher end are Boston with $2,300 and New York City with $1,859 per rider per year; at the low end, congestion costs in low-density cities like Wichita, Canada, are as low as $304 per rider per year (Reed 2019)).

Noise pollution, like congestion, disproportionately affects people in densely populated urban areas (Peris 2020). The European Environment Agency estimates that about one in five Europeans is exposed to harmful noise levels daily, with a disproportionate number of them living in urban areas. In some urban centers, more than half the population is exposed to noise levels above EU recommended levels, primarily because they live and work near busy roads.

Air pollution's social costs have a similar relationship with urban density. The costs of air pollution are about twice as high in urban areas as in rural areas. For instance, people in U.S. urban areas breathe at least ten times more car exhaust than those in rural areas (Apte et al. 2012). This impact fraction increases tenfold in global megacities. When comparing U.S. cities of different sizes, researchers find a significant pollutant density elasticity of 0.14 (Carozzi and Roth 2023). Given the high economic, health, and psychological impacts of air pollution, these estimates indicate that the social costs of air pollution from automobile traffic are much higher in dense urban areas than in rural areas.

The relationship between location and traffic accidents is more nuanced. Based on data from 300 European cities, researchers find no significant relationship between urban areas and road traffic crashes per person (Cabrera-Arnau and Bishop 2021). In the U.S., urban traffic tends to be safer in areas with more polycentric design and less sprawl (Najaf et al. 2018). It is estimated that a 10% increase in urban density can reduce the rate of fatal crashes by more than 15% on average. The fatality rate in rural areas is proportional to the distance driven per capita and not necessarily to population density. Overall, variations in urban mortality rates cannot be significantly and consistently explained by population density as such (Clark and Cushing 2004).

An analysis shows that the United States, the United Kingdom, and Germany suffered economic losses of between $500 to $1,300 per capita in 2016 due to these external costs. This means that in large cities, these social (external) costs can sometimes outweigh the social costs of CO2 emissions. On average, the full costs of road transport in urban areas can be three to five times higher than in rural areas, assuming a social carbon cost of US$420 tCO2-1 according to the EU Handbook on External Costs in Transport.

In addition to the social costs of car transport generally, suburban and rural areas are more vulnerable to changes in fuel prices due to higher fuel expenditure (higher exposure) and the lack of viable transportation alternatives (lower adaptability). Given the increasing trend toward "suburbanization of deprivation," i.e., the displacement of low-income households to the outskirts of cities due to the lack of affordable housing, these low-income households are trapped in car dependency. I know from other research in more than 50 countries that an increase in car ownership rate by one standard deviation leads to a decrease in population density by more than 30%, creating a feedback loop between low density and car ownership (Koster et al. 2020).

A systematic comparison between urban and rural areas demonstrates the following (Creutzig et al. 2020; Figure 4): First, in cities, the vulnerability to CO2 pricing or overall externality pricing in the transport sector is relatively low. Second, the external costs of car traffic are several times higher in cities than in rural areas (due to congestion, air pollution, and noise, but not because of climate impact costs). Third, in cities, there are more alternatives to car transport - accordingly, the price elasticity is higher.

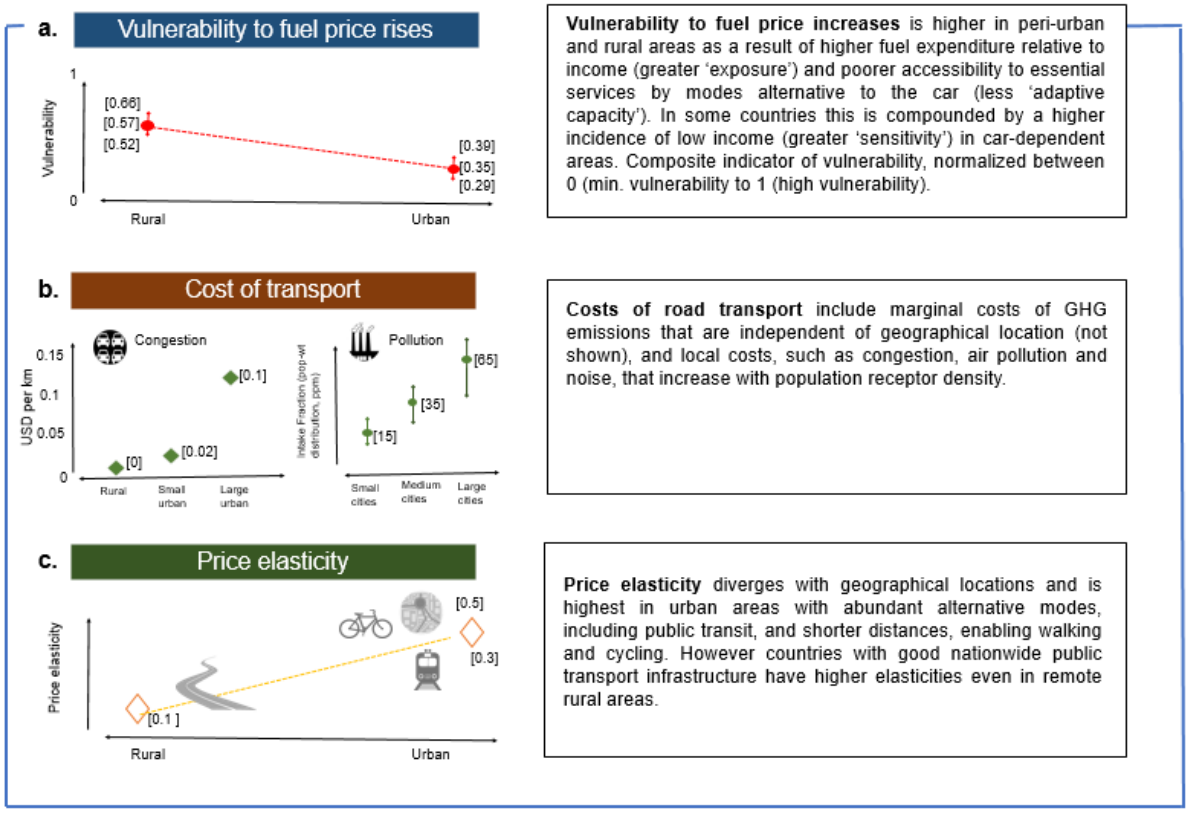


Figure 4. The difference between rural and urban areas lies in a. vulnerability to gasoline and CO2 prices, b. the social costs of car mobility, and c. the flexibility in choosing modes of transport. From this, it can be inferred that particularly in urban areas, it is justified and appropriate to charge parking and road usage by cars considerably higher than in rural areas (Creutzig et al. 2020).

4.3 Place-based policies to align local transport public goods with global environmental goods

Place-based urban transport policies are designed to address the specific needs and characteristics of individual urban areas. Here are some suggestions of place-based policies that align local public goods, reduce local externalities, and improve global environmental goods:

Provision of Environmental Modes: This involves the improvement and expansion of environmentally friendly modes of transportation. This can include the development of infrastructure for safe cycling and e-scooters, as well as adding tramlines and separate bus lanes. By providing alternatives to private car use, these measures can help to reduce traffic congestion, air pollution, and greenhouse gas emissions. For example, cities like Copenhagen and Amsterdam have invested heavily in cycling infrastructure, making it easier and safer for residents to choose biking over driving. Similarly, cities like Paris and Barcelona have expanded their public transport networks and introduced e-scooter sharing programs to provide more sustainable transportation options. Box 1 illustrates an example of collective decision making relying on expanding weak-tie networks in civil society.

Box 1. Citizen engagement to foster public modes – a case study from Berlin

A network of citizens successfully lobbied for a law that promotes safe cycling infrastructure in Berlin. The resulting Berlin Mobility Act (Mobilitätsgesetz) is a pioneering piece of legislation in Germany, enacted in 2018, that prioritizes sustainable modes of transportation in the city's transport policy ("Berliner Mobilitätsgesetz" 2023). The law aims to make Berlin's transport system more environmentally friendly, safer, and more efficient, by setting a clear hierarchy of modes of transport, with pedestrians at the top, followed by cycling, public transport, and finally motorized private transport. This hierarchy guides the planning, development, and operation of the transport system. The law also includes specific measures to promote cycling, such as the creation of a citywide network of cycle paths, the expansion of bike parking facilities, and the improvement of road safety for cyclists.

Analysis demonstrated that the formation of weak-tie networks was central in creating a broad lobby for this law (Becker, Bögel, and Upham 2021). Weak-tie networks refer to networks that are characterized by loose connections between individuals or organizations. In the context of promoting the Berlin mobility law, weak-tie networks allowed for more diverse perspectives and ideas to be brought to the table, as well as greater flexibility in adapting to changing circumstances. One factor that contributed to the success of the weak-tie network in promoting a mobility law that improves cycling infrastructure was the development of a common ingroup identity. This means that the campaign induced people to recategorize ingroup and outgroup members within a common category boundary based on a common identity, which redirected those motivational and cognitive processes that produce ingroup-favoring biases to increase positive feelings, beliefs, and behaviors toward others who were previously regarded primarily in terms of their outgroup membership. This helped to increase positive evaluations of others and cross-group friendship development, helpfulness, trust, confidence in suggestions for innovation, and forgiveness. Additionally, the weak organizational ties and resulting flexibility for creating an inclusive but still clear vision were also identified as a key success condition.

Reducing Private Automobile Use: This involves implementing measures to discourage the use of private cars in city centers. These can include congestion charging schemes, which impose a fee on vehicles entering certain areas during peak times. This has been successfully implemented in cities like London and Stockholm, leading to significant reductions in traffic congestion and air pollution. The mobility and environmental benefits of congestion charging are large, but the political economy of congestion charging remains difficult. Typically, suburbs maintain a voting majority against congestion charging. Hence, administrative boundaries around the inner city, as is the case with Stockholm, help to provide local majorities in favor of congestion charging. Another consideration is loss aversion: motorists see the additional monetary costs but find it difficult to imagine the saving in time and convenience attached with congestion charging. Once experienced, e.g., in trial schemes as had been done in Stockholm, more road users are convinced of the benefits of congestion charging schemes. The London experience, in turn, demonstrate the importance of user-specific dialogues (e.g., with local shop owners) to communicate advantages and disadvantages and address specific issues that can help constituents in managing the new scheme.

Parking management is another effective strategy. By reducing the availability of parking spaces and increasing parking fees, cities can discourage car use and encourage people to use public transport, cycle, or walk. San Francisco, for example, has implemented a demand-responsive pricing system for parking, which adjusts parking fees based on demand. Environmental zones, also known as low emission zones, restrict or ban certain vehicles from entering specific areas based on their emission standards. These zones have been implemented in many European cities, including Berlin, Madrid, and Rome, and have been effective in reducing air pollution levels.

Urban planning: Urban planning plays also a crucial role in reducing greenhouse gas (GHG) emissions in urban transport. Transit-oriented development (TOD), for instance, focuses on creating compact, walkable communities centered around high-quality public transportation systems. This approach, exemplified by cities like Portland, Oregon, and Stockholm, Sweden, reduces the need for car travel, thereby lowering GHG emissions. Densification of inner-city areas, as seen in cities like Barcelona with its "superblocks" concept, also contributes to emission reduction by promoting walking, cycling, and public transit use over private cars. A big data based case study of Porto demonstrates that a transit-oriented densification is the best strategy for reducing new GHG emissions (Silva et al. 2018). Furthermore, designing car-free new housing structures, such as the Vauban district in Freiburg, Germany, not only eliminates direct emissions from residential car use but also fosters a culture of sustainable mobility. These strategies, when implemented effectively, can significantly contribute to the decarbonization of urban transport.

These place-based policies can be highly effective in promoting sustainable urban transport. However, their success depends on a range of factors, including political support, public acceptance, and the availability of resources for implementation. I will discuss the dimension of political support again in section 6.

5 Agricultural Transition

With the green resolution, agriculture has seen a shift to exponentially higher productive in the 20th century, solving, in principle, the problem of sufficient food production for the world's population (Evenson and Gollin 2003). While consumers and international food corporations profited, farmers only saw increases in their incomes where cost reductions exceeded price reductions and were having to meet increasing pressure to scale up production to reduce marginal costs per unit of food. Current agricultural market and subsidy systems guarantee sufficient and low-cost food production. However, they are also associated with the death of small farmers, also in other world regions, such as Africa (due to price pressure on food markets) and a rapid decline in biodiversity in plants, insects, and birds. Agriculture and land use change is responsible for 22% of global GHG emissions (Lamb et al. 2021). In Europe, agricultural emissions are divided as follows (European Court of Auditors 2021): Land use change, in particular the draining of peatland, is responsible for 14% of agricultural emissions in the EU (as CO_2), whereas fertilizer application is responsible for 36% of GHG emissions (mostly as nitrous dioxide, N_20). Livestock itself requires little land but indirectly is in charge of a high proportion of global agriculture for fodder. The direct emissions of livestock, mostly as methane (CH_4) are responsible for 50% of Europe's GHG emission in agriculture. Cattle has also outsized implications from the perspective of the demand side of climate change mitigation: meat consumption reduction is the single most effective consumer side strategy reducing GHG emissions (Creutzig, Niamir, et al. 2022).

Agricultural economies are largely market driven. However, I can point to three examples, where place-based policies can make marginal progress: Social Farming, Support of Young Farmers, and Support of Biocultural Diversity.

5.1 Social Farming

Social Farming (SF) is suggested as a promising method in advancing agricultural transition to enhance sustainability in rural and peri-urban areas (García-Llorente et al. 2016). Four vivid examples illuminate this exploration: "La Fattoria Verde" in Calabria, Italy; the SF network in the Turin area, Italy; "L'Olivera Cooperative" in Catalonia, Spain; and the SF network in the Madrid region, Spain. These cases present SF as a practical solution offering innovative social services, job inclusion, and fresh services for the local population (García-Llorente et al. 2016).

SF, a multifunctional agricultural approach, offers social, health, educational, and employment services to disadvantaged groups, aligning with sustainable and biological farming practices (Basset 2023). It focuses on social inclusion, gender equality, and sustainable production, often revitalizing abandoned farmlands. This approach supports the 2030 Sustainable Development Goals (SDGs), particularly goals 5, 8, 10, and 12, by promoting employment, inclusion, and equality across various demographic groups.

SF offers a unique solution to collective action problems through its emphasis on collaboration, innovation, and a holistic approach to welfare and service provision (Basset 2023). By promoting the co-design and co-implementation of services, it brings together diverse stakeholders, including the public and private sectors, encouraging them to work towards shared solutions to complex problems. This collaborative effort is vital in overcoming the typical hurdles of collective action, where conflicting interests or lack of coordination can impede effective outcomes. The practice of SF introduces innovative approaches to welfare, engaging multiple actors and mitigating the inefficiencies often found in traditional welfare systems. By breaking down silos and fostering network creation, it encourages a more comprehensive approach to problem-solving. This is crucial in addressing the complexities of collective action, as diverse groups working together increase the chances of finding sustainable and widely acceptable solutions. SF encourages stakeholders to consider long-term benefits over immediate economic gains. This perspective is essential in resolving collective action problems, as it shifts the focus from individual interests to collective well-being.

Transitioning agriculture towards more sustainable practices is a complex task. One key challenge is governance: having meaningful conversations among different stakeholders is tough, and moving from personal to community interests takes a lot of collaboration. The complexity of the governance system can affect how it works and responds. Additionally, there are legal and market obstacles. Top-down legal interventions might limit local decision-making and fail to result in decision that take local stakeholders and conditions into account. Market-based solutions can commodify nature, reducing the diversity needed to manage social-ecological systems effectively, and failing to take into account of the systemic nature of ecosystem interactions which even sophisticated pricing of externalities cannot capture.

Cooperative solutions like SF can work well. In the Mediterranean context, community-based management and a bottom-up approach offer and manage social services. This leads to institutional change where many private and public actors work together proactively. SF also focuses on helping vulnerable groups. Direct beneficiaries are people at a disadvantage who find their personal skills valued and improved. Indirect beneficiaries are farmers who can make new connections with consumers, create shorter supply-consumption chains, involve more stakeholders in farming activities, and improve agriculture's image in society.

The case studies also suggest that SF practices can improve wellbeing and provide cultural ecosystem services to communities. Combining farming and social activities can empower farmers and boost agriculture's societal image. SF can also have positive health effects by encouraging contact with nature. Nature-based solutions like SF can help reconnect people's wellbeing with natural landscapes through the ecosystem services and benefits they provide.

5.2 Support for Young Farmers

Comprehensive strategies enable effective place-based approaches in rural communities. Rural resilience is based on weaving together local empowerment, economic revitalization, environmental sustainability, policy innovation, social capital reinforcement, strategic external connections, and educational initiatives. It is hence key to support local initiative.

The case of Caggiano, a rural community in Southern Italy, demonstrates the effectiveness of place-based policies in enhancing rural resilience through a series of interconnected initiatives (Salvia and Quaranta 2017). The community’s approach to revitalizing its economy and strengthening social bonds was characterized by a deep engagement with local resources and traditions. For instance, the introduction of

local produce in school meals, as part of the "0 km School Meals" project, not only supported local agriculture but also involved families and promoted a sense of community ownership. Similarly, the "Caggianese Bread" project, which used traditional local grains, involved everyone from farmers to bakers, reinforcing the local economic cycle.

Environmental and social sustainability were also key aspects of Caggiano's initiatives. Projects like the "Water Hut," which provided low-cost water to reduce plastic consumption, and the promotion of recycling and home compost bins, underscored the community's commitment to ecological responsibility. These efforts were complemented by innovative solutions to navigate bureaucratic challenges, particularly evident in the school meals project, showcasing the community's ability to adapt policies to local needs while adhering to regulatory frameworks.

Further strengthening of the community fabric was evident in projects that built social capital, such as food festivals and public wineries, which not only stimulated the local economy but also reinforced community identity and solidarity. Additionally, Caggiano effectively connected with external markets, particularly urban areas, to promote its local products, which helped in reducing economic and social isolation.

Education and awareness were also central to Caggiano's strategy, with initiatives focusing on nutrition, environmental sustainability, and the benefits of local produce, thereby fostering a well-informed and engaged community.

5.3 Fostering biocultural diversity

There is potential to connect local food chains with biocultural diversity. Place-based policies can support such food-biodiversity networks, as highlighted by an analysis of case studies in the European and Japanese context (Plieninger et al. 2018).

In the European context, one example is the integration of scenery and tourism. This model successfully combines the aesthetic appeal of the landscape with the production of local foods, attracting tourists and boosting local economies. Another model links food production with biodiversity conservation, ensuring that farming practices contribute to the preservation of local ecosystems. Lastly, there's a model that connects food networks with cultural heritage, promoting traditional farming methods and local food varieties.

Acroecology is a key example of a place-based approach. Agroecology is defined as farming systems rooted in ecological science, emphasizing relationships between organisms, including humans, and their environment (Ikerd 2019). As a place-based approach, it respects the uniqueness of each agroecosystem, integrating farms and farmers with specific communities. Key policy principles supporting agroecology include promoting local food movements, education, respecting community and societal connections, and focusing on sustainable farming methods. These measures aim to produce healthy, culturally appropriate foods while retaining the rights of people to define their food and farming systems.

In Japan, models that address the aging of rural societies and rural depopulation are noteworthy. These models involve urban residents in the management of rural landscapes, fostering a sense of community and shared responsibility. Japan also has innovative certification systems that ensure the quality and sustainability of local food products. Non-market exchange systems, where goods and services are traded without the exchange of money, are also prevalent, strengthening social ties. Lastly, joint land management combines food production with sustainability-oriented education, teaching the younger generation about sustainable farming practices.

Policy measures that can support these models include:

1. Strengthening efforts to raise societal awareness of existing models and to enhance the capacity for fostering biocultural diversity in landscapes.
2. Support local community initiatives that can make use local knowledge and context to make approaches work.
3. Creating a flexible legal framework based on the knowledge and experiences generated by place-based food networks, to protect the interests and reduce political constraints for collaborative efforts.
4. Defining local quality standards complementing the abundance of (inter-)national food standards, to ensure the diversity of locally adapted breeds, varieties, cultivation, and processing practices.
5. Advancing existing labeling and certification approaches to reinforce linkages between quality products, distinct production processes, and biocultural diversity in landscapes also beyond local scales, engaging consumers for landscape stewardship across larger geographic distances.
6. Stronger consideration of place-based food networks in international trade and discourses on global food security.

Local communities can contribute by participating in these networks, supporting local food producers, and promoting sustainable farming practices. They can also engage in non-market exchange systems, contribute to the management of rural landscapes, and participate in sustainability-oriented education programs.

5.4 Summary of place-based approaches in agricultural transitions

The three examples highlight that education and social networks are at the center of place-based policies in agricultural transitions. Currently, examples arise mostly as bottom-up developments and are based on the initiatives and the engagement of local communities. Geographical indications - an EU mechanism that establishes intellectual property rights for specific products, whose qualities are specifically linked to the area of production – has unrealized potential to support agricultural transition. Embedding agroecology in the product specification documents of the geographical indications mechanism could foster agricultural transitions (Owen et al. 2020).

From the perspective of planetary boundaries, place-based approaches that spare land and reduce meat production and consumption have highest value for preserving climate and biodiversity stability. Connecting different goals and contexts, e.g., in agro-tourism, can enable local sustainable agriculture. In additional, agricultural transition should be seen in the relation to strengthening local social networks and support connecting diverse actors.

6 The politics of Transitions: Polarisation and Threats to Democracy

Place-based policies that offer economic support for transitions in regions are one side of the medal. From this perspective, transitions may work in terms of economic outcomes and providing opportunities for the future. However, transitions invariably produce (perceived) winners and losers. Transitions threaten established cultural values and lifestyles and hence meet opposition by affected communities including opposition to needed transformation. Hence, understanding transitions requires not only an economic but also a sociological perspective. I will discuss this shortly and then consider the politics of urban and industrial transitions.

6.1 Libertarian authoritarianism – a sociological perspective

The rise of right-wing populism is grounded in a novel development in how individuals see their role in society. An understanding of this perspective is important also for transitions, as novel populist movements are often strongly opposed to any change related to climate change measures and similar concerns.

Key is a new libertarian authoritarian type that is authoritarian in the conventional sense – mistrust in outside group, superstition, projection, cynicism, destructive attitudes – but that is novel in that it accepts only one authority: itself (Amlinger and Nachtwey 2022). Driving purpose of libertarian authoritarians is the idea of freedom, defined in the negative way: their freedom to do as they please is absolute, not constrained by social relationships or rules, and hence, especially governments and experts are to be opposed. Sociologists argue that this is the logical consequence of the neoliberal idea that puts individual material satisfaction at the cost of public good provisions. The idea of negative freedom is antagonistic to climate change measures or other approaches to manage the global commons, as these require an understanding of positive freedom: joint rules and constraints that preserve and enhance the potential for a human agency and a good life.

Crucially, the conflict is about power and ideology, not economics. Libertarian authoritarians defend their own position in society and see issues like Corona health policies, gender equity measures, and climate

change mitigation through the lens of their potential loss of privileges (e.g., men have to share power with women more equally). They also see transitions through the lens of their definition of freedom (as negative freedom abstaining from public good provisions that limits individual space of action). Direct economic considerations are usually not at the top of their concerns.

It follows that place-based policies that focus on economic transfer and structural policies alone are likely insufficient in addressing grudges of local populations. Instead, other measures are needed, many of them related to the design of democracy and the idea of freedom.

First, what is needed is a radical critique of freedom that remains reduced to the individual. Instead, freedom that considers the good life for everyone, and collective survival (Skudlarek 2023). This does not negative individual freedom, but supplements individual wants with individual responsibilities. This also has an intergenerational component. It is the core of the decision by the German constitutional court that this generation can't put the burden of climate change mitigation only on the next generation. Public intellectuals but also policy makers, especially those of conservative parties, bear a responsibility to counter destructive ideologies of freedom and appeal to duties.

Second, more democracy will stabilize democracy. This includes mandatory voting and rank-order voting, two measures that increase participations and make votes count more.

Third, political decision making requires more courage. Too often, decision as framed as being without alternative. This frustrates engaged citizens and reduces democratic agency. Instead, political decisions must be framed in terms of several alternatives and their pros and cons must be actively discussed, admitting deep uncertainties (Amlinger and Nachtwey 2022). More broadly, this translates into a culture of ambiguity tolerance that is essential to deal with transitions into known and unknown unknowns (Bauer 2011).

Let us shortly investigate two exemplary transitions.

6.2 Coal transitions – the example from Aragonese coal fields

The Aragonese coal field region had been heavily dependent on coal mining for a long time, and the impending closure of the mines sparked significant social mobilisation and public debate, showing how cultural identities and narratives play a significant role in the resistance to coal phase-out. As a result of phase out, local resistance identities form and morph over time, affected by discontinuities and ruptures altering the ties of dependence (socioeconomic, cultural, and territorial) created by coal over a century. Resistance identities cling to the institutionalized cultural attributes that made up the legitimizing identities in the minescape. Energy transition calls into question the legitimacy of daily life in historically coal-reliant communities (HCRCs), vital experiences linked to mining past, and consequently, the coal identities. Many subjects revalue and give priority to a set of coal-based cultural attributes as a reactive response to the energy transition. This is both a process of (re)building coal identities and (re)establishing oneself as an individual and as a collective.

This resistance is manifested in three main identity planes: occupational identity, class-belonging identity, and community identity.

An occupational identity associated with mining is visible in most individuals, even after the mine has closed or the employment relationship with the mining concern has ended. This identity is characterized by a high degree of self-identification, proud reaffirmation, strong perception of continuity, and an emotional and

cultural dependence. For instance, expressions like "The mine forms part of us, of our very being" and "Whoever has been a miner never stops being a miner" illustrate the deep-rooted cultural identity tied to coal mining. The resistance also manifests in the form of class-belonging identities, where the community identifies with the working class associated with the coal industry. The community identity is tied to the territory, with the community's identity being redefined as the coal industry phases out. This resistance is further fueled by a sense of territorial injustice, where the community feels that they are the 'losers' in the transition due to the disruption of the continuity that coal provided them.

Resistance identities have three strong components: opposition to the disappearance of coal, refusal to renounce identity, and inability to imagine futures without carbon. These components contribute to the resistance to coal phase-out, making the transition to a decarbonized future challenging.

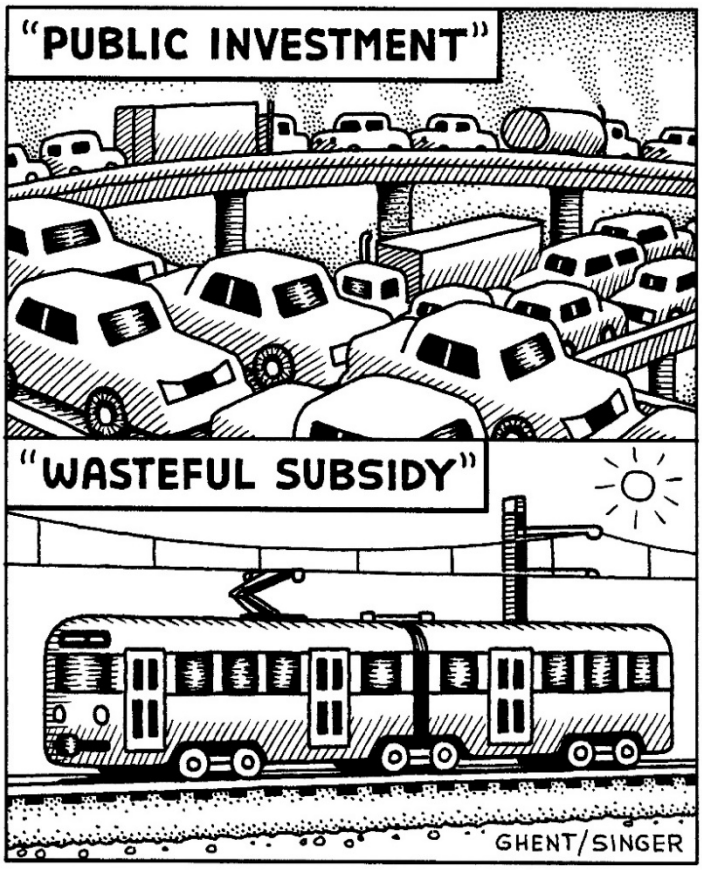
In the wider context, individuals in former coal mining regions end up on the wrong side of both modernity and post-modernity: they lose well-paying industrial jobs, and they hardly have access to self-efficacy and the wide array of options for self-actualization in big cities. Hence, besides economic support, also politics of compassion and new opportunities for engagement in communities are central.

6.3 Microtransitions in cycling infrastructure

The micro-transitions of cycling infrastructure offer another vivid illustration of these dynamics. While miniscule in scale, they nonetheless polarize local politics. For example, there is conflict between inner and outer city in Leipzig regarding the construction of new bike lanes (Maxwill 2023). The conflict is not only about the *Verkehrswende* (transport transition) but also in the wider sense about the future of the city. While the city of Leipzig is one of the cities in Germany that has been most successful in promoting cycling, this success has led to conflicts between cyclists and car drivers.

There are two main reasons for these conflicts. Firstly, many drivers feel that they are being pushed out of the city center by the new bike lanes. Secondly, many residents of the outer city feel that they are being neglected.

Similar conflicts even determined outcomes in local elections in the cities of Bremen and Berlin. A new regulation requiring car drivers paying for parking also for short shopping lead to considerable losses in voting shares of the Green party in Bremen (Reiber and Teevs 2023). In Berlin, an election and a referendum about climate goals were predominantly shaped over climate traffic policies (cycling networks, parking management), and lead to a previously less visible polarization between inner and outer city (Zeit online 2023).



Behind the challenge in urban transport transitions, there are powerful paradigms that are difficult to change. Andy Singer's illustrates an important case of such a paradigm that understands car infrastructure as a public investment, but public transit as a wasteful subsidy, even as the case is mostly the opposite (Figure 5).

Figure 5. @AndySinger (https://www.andysinger.com/). Reprinted with permission

Urban transitions share with industrial transitions that there is a substantial class of people who disbenefit from action: those who rely on their cars for daily activities. Conflicts may be partially handled in economic domains, however. Car users have direct interest in mobility services, and offering novel modes of transport, and making cycling and public transit more convenient and reliable can accommodate some concerns. Urban planning policies can also provide new opportunities for car-free lifestyles. Nonetheless, cars are often status symbols and part of modern identity. In that sense, it can be valuable to focus on car use in central cities rather than on car ownership more broadly. Societies will also need new ideas and narratives of what constitutes status in mobility.

Box 2. Overcoming the prisoner's dilemma in urban transport

Governance challenges for overcoming urban transport and planning related prisoners' dilemma involve i) making alternative modes more attractive, ii) planning for climate-friendly mobility, and iii) providing new solution for settlements already locked-in into car-dependent structures.

One challenge is to make cycling and public transit more attractive than car transport. This requires investing in safe and comfortable infrastructures for cycling, such as bike lanes, parking facilities, and bike-sharing systems. It also requires improving the convenience and reliability of public transit, such as reducing waiting times, increasing frequencies, and integrating fares and schedules. Moreover, it requires offering new gadgets and services that enhance the user experience of public transit, such as Wi-Fi access, mobile apps, loyalty programs, and entertainment options.

Another challenge is to move away from car dependency and promote compact and mixed-use urban development. This requires prohibiting new constructions on green field sites that encourage sprawl and car

use. It also requires planning new constructions that are car-free or car-reduced and that have easy access to safe cycling and public transit infrastructures. Furthermore, it requires creating incentives and regulations that discourage car ownership and use, such as congestion pricing, parking fees, and low-emission zones.

A third challenge is to provide high-quality multi-modal services for those who are stuck in car-dependent places. This requires developing and integrating shared and pooled mobility options, such as car-sharing, ride-hailing, ride-sharing, and micro-mobility. It also requires ensuring that these options are accessible, affordable, and sustainable, and that they complement rather than compete with public transit. Additionally, it requires fostering a culture of collaboration and innovation among different mobility providers and stakeholders.

7 The Outlook on Governance Implications

In this document, I discuss the role of place-based policies in addressing the conflict between local public good provisions and global environmental goals. It highlights the importance of urban mobility, industrial infrastructures, and rural communities in local contexts to contribute to global environmental stewardship. The analysis underscores the need for policies that are sensitive to local needs while addressing broader environmental challenges.

To advance place-based policies, I suggest: 1) Deepening integration of local cultural values and identities in policy frameworks to ensure community engagement; 2) Strengthening co-design processes with local populations for policies that are both relevant and effective; 3) Integrating economic with wider sociological and identity-based narratives and overall reconsideration of the idea of freedom.

All of this requires a deepening of democratic institutions and engagement. Rank-order voting and mandatory voting will increase democratic participation and will make every vote count. Citizen councils have demonstrated potential to engage with issues and enable interaction between different constituencies (Creutzig 2021). Examples from Ireland and France demonstrate that citizen councils come to sweeping but also acceptable conclusions. It is key to implement conclusions of citizen councils to provide real political power to participants and thus revitalize democracy.

Only an encompassing approach will harmonize local and global interests, making place-based policies more effective and sustainable. The protection of global commons starts with the provision of local commons.

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