

Can infrastructure help ‘left behind’ places ‘catch up?’ Theorizing the role of built infrastructure in regional development

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The application of infrastructure as a regional development tool in resource peripheries has received little direct inquiry in both policy and scholarly debates. This article synthesizes theoretical and empirical directions across economic geography, regional studies and critical infrastructure studies to form a research agenda for investigating the role of built infrastructure in the development of ‘left behind’ peripheral regions in the USA. We argue that infrastructural systems’ material, social, fiscal and political dimensions potentially deepen rather than mitigate structural ‘left behind-ness’. Future research and policy design must account for such dynamics if infrastructure interventions are to prove generative for regional development.

Keywords: spatial inequality, economic development, periphery, uneven development, place-based policy, capital improvement projects

JEL Classifications: H54, R58, R12, O18

Introduction

Building a better America requires [Infrastructure Investment and Jobs Act] funds to reach rural communities that have been left behind for far too long. We see you, and major investments are on the way. With these investments in infrastructure in rural communities, President Biden is delivering for rural America.

- Mitch Landrieu, Biden-Harris administration Senior Advisor for Infrastructure (quoted in [The White House, 2022a](#)).

In 2021 and 2022, the 117th US Congress authorized over \$3.8 trillion for infrastructure investments and other national competitiveness priorities across four landmark bills ([American Rescue Plan Act, 2021](#); [Chips and Science Act, 2022](#); [Inflation Reduction Act, 2022](#); [Infrastructure Investment and Jobs Act, 2021](#)). The funds represent a mas-

sive and uncharacteristic fiscal experiment in the contemporary USA, aimed, in part, at transforming marginalized economies through infrastructure development ([The White House, 2022a, 2022b](#)). While US domestic economic policy has resisted progressive spatial interventions for decades on the grounds that such actions disturb market equilibrium ([Hendrickson et al., 2018](#)), public infrastructure expenditures are unusual in that they are a widely supported policy instrument which is necessarily spatial and rooted in place. Landrieu’s quote above demonstrates a central assumption embedded in recent US infrastructure expenditures: that widespread infrastructure repair will simultaneously mend socioeconomic deficits in marginalized places. Given this seismic shift in the American political appetite for federal infrastructure spending and place-based policy ([Parilla and Haskins, 2022](#)), the potential for such investments to catalyse generative outcomes for the ‘left behind’ regions and communities of US society deserves pointed inquiry.

Received: December 1, 2022; editorial decision: July 3, 2023; accepted on: September 25, 2023

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Evident in recent efforts to leverage infrastructure spending to transform ‘left behind’ economies is a logic that infrastructure investments are unquestionably positive development strategies. This logic has several compelling dimensions. Infrastructure is a material vehicle through which the state transfers capital to disinvested regions, and improved regional infrastructure systems can attract and subsidize industry (Bliss, 2018). For declining regions, capital improvements to the built environment are seen to be a key aspect of building competitive advantage in a globalized economy (Boschma and Lambooy, 2000). Water, energy, transportation and telecommunications networks facilitate human development goals: witness how a nationwide digital divide affecting urban and rural areas resulted in a lack of access to essential education and telehealth services during the COVID-19 Pandemic (The White House, 2022a).

While it is true that well-maintained infrastructure systems provide essential economic and social functionalities needed for regional prosperity (Baskaran, 2021; MacKinnon et al., 2021), the perspective that infrastructure is a ‘silver bullet’ for regional development in peripheral economies fails to meaningfully incorporate critical infrastructure studies, economic geography and regional studies knowledge. Critical infrastructure studies literature provides a basis to investigate how system governance and materiality might create, reinforce or express power imbalances across different scales (Anand et al., 2018; Carse, 2014; Graham and Marvin, 2001; Howe et al., 2016). Applying infrastructure uncritically to improve competitive advantage in peripheral economies fails to consider structural explanations of core-periphery value flows developed by economic geographers (Harvey, 2006; Hayter et al., 2003; Soja, 1985; Wallerstein, 2004). And, while neoliberal ideologies typically prescribe infrastructure as a supply-side intervention, contemporary regional studies perspectives advocate regional development approaches which incorporate social alongside economic goals (Addie et al., 2020; Pike et al., 2019; Vodden et al., 2019). If recent US policy efforts are to accomplish their stated aims and use infrastructure to improve ‘left behind’ economies, critical scholarship must question how regional infrastructure policy might be designed and implemented to repair chronic economic decline—and consider seriously the possibility that such outcomes are not guaranteed.

This article calls on economic geographers and regional studies scholars to problematize the assumption that infrastructure is necessarily generative for regional development and for overcoming spatial inequality. Speaking specifically to the context of resource peripheries in the USA, we draw from critical infrastructure studies, economic geography and regional studies to present a framework for investigating the relationship between infrastructure and regional development. First, we describe our approach to constructing this research agenda, which includes explicit definitions of ‘infrastructure’, ‘regional development’,

and ‘periphery’ for the purposes at hand. Then, we review the literature in each field to explicate four mechanisms by which infrastructure development may exacerbate regional inequality: (i) by (re)inscribing unequal exchange dynamics through material value flows, (ii) by contradicting or underinvesting in locally important social needs and values, (iii) by employing finance mechanisms which are unjust or reinforce resource dependency and (iv) by convening a scalar politics wherein extra- and intra-regional political values are negotiated. While we focus on the US institutional context, we hope that future efforts might adapt the framework to other contexts in the Global North where infrastructure is employed as a policy instrument intended to help ‘left behind’ regions ‘catch up’.

Approach and conceptual framework

Our arguments hinge on specific interpretations of a few key concepts. First, following conventions of infrastructure scholarship, we use the term ‘infrastructure sector’ to refer to the four categories of networked, critical infrastructure systems: water and wastewater, transportation, energy and telecommunications (Gómez-Ibáñez and Liu, 2022; Graham and Marvin, 2001). By analysing dynamics associated with the four critical infrastructure sectors together, this review responds to calls for expanded cross-sector knowledge development (Clements et al., 2022; Graham and Marvin, 2001). We recognize the limitations of taking a broad approach; namely, we cannot fully account for all differences in institutional, governance and finance structures across infrastructure sectors and national contexts. Conversely, a cross-sectoral approach enables us to “see like a region” by directly analysing and problematizing trade-offs of infrastructure strategies and public sector choices about land use and development (Addie et al., 2020, 19). This approach aligns with the viewpoint of regional political actors responsible for managing all four infrastructure sectors with limited resources.

Critical perspectives examine the material and institutional forms of infrastructure as terrains where power asymmetries are produced and reproduced (Anand et al., 2018; Hetherington et al., 2017). Politics, meaning activities through which power is negotiated and expressed (Gibson-Graham, 2006), determine which and whose development visions materialize in the built environment. Infrastructure production and management are multi-scalar in both a material and institutional sense. Infrastructure governance convenes political actors representing local, regional, national and potentially supra-national interests (Addie et al., 2020). Because infrastructure developments are fixed in space (Harvey, 2001), because they span greater-than-human lifetimes (Carse and Kneas, 2019; Howe et al., 2016), and because the built environment is co-constituted with place (Jenkins, 2021), infrastructure politics are necessarily historically and place-contingent (Estes, 2019)—making

them difficult to theorize (see: [Massey, 1995](#)). Yet such characteristics provide a lens into the interface between structural forces (for example, global markets, policy drivers) and place-based processes ([Carse, 2014](#)), making infrastructure a useful object of inquiry in analyses of regional political-economic change ([Addie et al., 2020](#); [Glass et al., 2019](#)). To negotiate the form of infrastructure development is to negotiate the form of place and future, giving infrastructural technologies an inherent, if complex, relationship to regional development.

This article addresses development issues in peripheral economies with functionally connected labour markets and industrial ecosystems, pointing toward the practical motivations of mobilizing planning efforts at the regional scale ([Lu, 2011](#)). Building on literature which speaks to regional development concerns in peripheral and post-industrial areas (as opposed to city regions), our view of regional development moves beyond conventional indicators such as Gross Domestic Product (GDP), value added, competitive advantage and employment to include social and environmental values ([Lewis et al., 2013](#); [MacKinnon et al., 2021](#); [Ryser et al., 2019](#)). In addition to indicators of economic stability (for example, economic diversification versus single-industry dependence) ([Martin and Sunley, 2015](#)), regional development in our conceptualization includes place-attachment, belonging and a preservation of local autonomy ([MacKinnon et al., 2021](#)). The term place-based regional development codifies such holistic approaches by emphasizing community agency in envisioning and pursuing development trajectories ([Halseth, 2016](#); [Ryser et al., 2019](#)). Colonial legacies and persistent racial capitalism make it problematic to presume a coherent and just set of regional priorities in the hinterlands of the USA exist or were neutrally achieved ([Curley, 2021](#)); Peripheries themselves and the values brought forward in their development pathways are deeply contested ([De Souza, 2018](#); [Hayter et al., 2003](#)). Thus, we problematize the classed, racialized, gendered, and historically contingent politics associated with setting regional development agendas and planning infrastructure developments (for example, [Bennett, 2018](#); [Curley, 2021](#); [Estes, 2019](#); [Pannu, 2018](#)), and pinpoint this as a critical direction for future research.

Finally, this article primarily responds to concerns facing resource peripheries of the USA. The term 'periphery' in economic geography has been used to refer to absolute, relative and relational conceptualizations of space ([Pugh and Dubois, 2021](#)). Here we draw on a Global North application of the relational definition put forward by world systems theory, wherein spatial value flows which are unstable over time create core (that is, where value is accumulated) and peripheral (that is, where value is extracted) spaces ([Wallerstein, 2004](#)). Resource peripheries, then, are regional economies with unfixed territorialities, defined as primary-product exporters in global value chain networks ([Allen and Cochrane, 2007](#); [Hayter et al., 2003](#)). As such,

resource peripheries experience cycles of market- and policy-driven economic volatility ([Halseth, 2016](#); [Wilson, 2012](#)). Hence, the timing and volume of industrial activity in resource peripheries is unstable ([Freudenburg, 1992](#)), putting them at risk of boom-bust dynamics and transitional crises ([Roemer and Haggerty, 2022](#); [Smith, 2020](#)). As exogenous market and policy factors influence the pace and scale of economic transition in resource peripheries ([Wilson 2012](#)), such places are, whether now or in the future, vulnerable to becoming 'left behind' by national economic and political priorities ([Edelman, 2019](#); [Ulrich-Schad and Duncan, 2018](#)). Therefore, this article focuses on resource peripheries as one type of 'left behind' place with a recognition that peripherality and 'left behind-ness' are contingent phenomena in both spatial and temporal senses ([Massey, 1979, 1995](#)).

Infrastructure and the (re)production of peripherality

The following discussion explicates four themes as the basis for a research agenda which scrutinizes the capacity for infrastructure development to realize place-based regional development values in peripheral geographies.

Infrastructure, dependency and value extraction

Resource peripheries' niche in the global economic system is to provide primary products and labour at cheap enough rates to enable capital accumulation in core geographies ([Soja, 1985](#)). In world systems theory, peripheries are defined by an unequal exchange of value with core regions ([Emmanuel, 1972](#)); that is, peripheries are places where surplus value produced through cheap labour inputs is extracted and exported to enable value accumulation in the core ([Wallerstein, 2004](#)). Theorized vis-à-vis both international and interregional trade, the unequal exchange concept builds on Marx's labour theory of value to describe a spatial mismatch between the geographic origins of value in production (that is, the input of human labour necessary to produce a given commodity) and the geographic distributions of value in circulation (measured by the quantity of money needed to purchase a commodity) ([Ricci, 2019, 229](#)). Accordingly, resource peripheries face a fundamental regional development paradox in that the surplus value they produce is extracted and accumulated elsewhere ([Wallerstein, 2004](#)).

Capital accumulation in the core is, in part, made possible by dispossessing peripheral geographies of value ([Harvey, 2006](#)). [Barnes and Christophers \(2018\)](#) emphasize that capital accumulation refers not only to the process of netting profits and stockpiling wealth, but critically, *reinvesting* capital into the production process, thereby enabling capitalist growth and expansion.

Infrastructure is a key mechanism by which states (re) invest in production (Mazzucato, 2018). Through built infrastructure development, public institutions offset costs of production and circulation, thereby protecting capital accumulation in the private sector (Harvey, 2006; Wallerstein, 2004). Yet because peripheral spaces by definition do not net accumulated capital, public and private reinvestment is inherently limited: to particular industries, infrastructure sectors and moments in time with the highest potential for value extraction. Thus, rural sociologist Freudenburg (1992, 324) describes how firms justify disinvestment in peripheral production by fabricating a ‘myth of [resource] exhaustion’ not when the resource is physically spent, but when it is no longer profitable to extract it.

Infrastructure systems, a mechanism through which governments distribute capital investments to intervene in markets and support capitalist growth (Mazzucato, 2018; Wallerstein, 2004), thus manifest the contradictions of reinvestment in the periphery. Quite literally, extracting value from peripheries and circulating it at global scale relies on the construction and maintenance of extremely large and interconnected technological networks (Carse, 2014), such as energy grid systems, oil and gas transmission lines, road and rail transportation corridors and water pipeline systems where rural watersheds are leveraged to meet growing urban water demands. Infrastructure is hence an expression of geographic and temporal rhythms of value extraction and reinvestment in peripheral space.

Addressing circumstances in the Global South, dependency theorists of the 1970s recognized that infrastructure development directed by core imperial states ossified exploitative trade relationships with peripheral colonies (Galli, 1981; Graham and Marvin, 2001). While the institutional and political dynamics differ in a Global North context and have changed in the decades since dependency theory’s heyday, infrastructural configurations linking value-sending peripheries to value-receiving cores are nonetheless ubiquitous in the development history of peripheral regions within Global North countries (for example, Estes, 2019; Ryser et al., 2019). Infrastructures, in a material sense, network peripheries into global value flows, embed them in unequal exchange relationships and uphold export-oriented regional market structures. Such dynamics pose four key problems for regional development.

First, because export-oriented infrastructure systems are constructed to enable value extraction from the periphery and capital accumulation in the core, they constrain *in-situ* value retention. Failure to retain and circulate value within peripheral and ‘left behind’ regions—places characterized by value and capital flowing outward—is a perennial and fundamental impediment to economic development.

Second, and relatedly, under such conditions the peripheral built environment risks becoming over-adapted to the

technological mobilities of a single industry (Freudenburg, 1992). Considering the significant sunk costs of human, financial and political capital needed to support infrastructure development, infrastructure networks over-adapted to a single industry’s needs potentially act as material lock-in mechanisms by disincentivizing diversification (Smith, 2020).

Third, the infrastructural footprint inherent to resource export economies tends to be nodal in nature: such systems not only place termini in relation to one another, but also traverse—and potentially bypass—a great deal of space along the way. Studies in the energy (NASEM, 2021b; Righetti, 2017), water (Gansauer and Haggerty, 2021) and transportation (Katz, 2021) sectors point toward service provision inequities in remote areas which host segments of vast infrastructural networks but remain unconnected. Such projects risk producing new forms of peripheral sacrifice zones by assuming that peripheries are frontiers of *empty space*—uninhabited and ready to be exploited for the needs of global capital—rather than *peopled and historied place* with social-infrastructural needs in their own right (Schouten and Bachmann, 2022; Zucman, 2019). The implications of leveraging peripheral space as an infrastructural pass-through, sacrifice zone or dumping ground for global capital will be a critical area for future research. The need is particularly relevant to the energy sector as the USA and other advanced economies put forward ambitious decarbonization plans which require rapid scaling-up of energy generation and transmission infrastructure that will exploit peripheral space and resources for new purposes (NASEM, 2021a).

The final problem concerns a contradiction between the fixity of infrastructure and the temporal rhythms of peripheral economies. Infrastructure is a form of fixed capital, meaning it is a non-liquid asset built for its use value as opposed to exchange value. Fixed capital assets require labour and maintenance inputs to remain functional (Harvey, 2001; Howe et al., 2016). In his spatial fix thesis, Harvey (2001) describes how spatially-fixed assets such as infrastructure paradoxically enable capital to flow freely across space and time, but risk outliving the timespan of profitability or industrial activity. Just as quickly as capital constructs new infrastructure systems in response to market needs, infrastructural and fixed capital ‘zombies’ are left behind when profitability dwindles and capital vacates (Carse and Kneas, 2019, 22; Freudenburg, 1992). Because regional resource economies are directly exposed to commodity market volatility (Halseth, 2016), infrastructure networks adapted to particular production regimes risk rapid devaluation in the context of market fluctuations. Such ‘stranded assets’ may quickly transition from high-use value capital to public liability, a frontline concern for energy decarbonization efforts at the moment (Grubert, 2020; Roemer and Haggerty, 2022). In the USA, the burden of managing, maintaining or repurposing devalued infrastructure assets often shifts, at least in part,

to local governments (Smith, 2020). Thus, a regional development dilemma: resource communities facing the loss of industry (and associated public revenues) may simultaneously gain new fiscal liabilities to maintain or remediate legacy infrastructural systems (Roemer and Haggerty, 2022). Researchers should therefore take a long-run view to understand how infrastructure developments adapted to present market structures may produce future vulnerabilities for local and regional institutions.

Future research must question the extent to which infrastructure systems reinforce or overcome extractive value flows in resource peripheries. To do this, researchers should trace value extraction and accumulation processes as enabled by infrastructure systems which originate or pass through peripheral geographies. Economic geography research on regional lock-in and path dependence should consider the extent to which the built environment contributes to such phenomena and vice versa. In addition, theoretical advancements which incorporate critical infrastructure studies with the uneven development literature are needed to consider possibilities for infrastructure development to enable value retention and circulation within the periphery.

Infrastructure policy, social welfare and regional priorities

In the Keynesian era, demand-side economic development logics made spatial uniformity in infrastructure provision a central policy goal, with the intention of maintaining social reproduction, quality of life and effective demand (Ansell and Lindvall, 2020; Stern and Hall, 2015). In the USA, this was accomplished through direct federal leadership in infrastructure development (for example, the Interstate Highway System was developed this way) and through transfer payments from senior to junior governments for public works operations and maintenance (Flora et al., 2016, Ch. 11). The Reagan administration's omnibus spending bill of 1981 marked a stark transition for local governments and infrastructure management in the USA as it rolled back guaranteed transfer payments to local government entities—cutting programs all together or replacing them with competition-based distribution mechanisms (ibid.).

By prioritizing the infrastructural needs of industry and rescaling responsibility for infrastructure provision to localities and states, the supply-side development logic inherent to neoliberalism resulted in uneven spatial outcomes (Gray and Barford, 2018; Kelly and Lobao, 2021). Deficits persist today. Fiscal austerity motivated public service rationalization which meant that infrastructure and service provision in the least efficient geographies was cut back and consolidated (Beecher et al., 1996; Syssner, 2020). The corresponding expectation for communities to be entrepreneurs responsible for their own development trajectories demonstrated the erosion of a historical moral

public economy in which central states provided universal and standardized public service access at the literal margins of society as a matter of course (Halseth et al., 2019; Stern and Hall, 2015). The neoliberal era also contorted and expanded the role of the private sector in infrastructure and public service provision (Ansell and Lindvall, 2020; Bakker, 2010). By opening infrastructure markets up to privatization and investor-driven financialization, neoliberal policies transformed infrastructural networks from quasi-public goods to a new private asset class (Furlong, 2020). Thus, the actors and interests involved in infrastructure governance shifted as firms sought to capture rents from natural monopoly market structures typical of utilities (Pike et al., 2019). By expanding the profit imperative associated with infrastructure development, neoliberalism over-emphasized economic justifications of infrastructure (Ali, 2021; Pike et al., 2019; see also Gómez-Ibáñez and Liu, 2022), even though infrastructure systems, it must be underscored, serve social welfare as well as economic ends.

The North American infrastructure policy space today, characterized by 'reactionary incoherence' rather than an overarching logic (Halseth et al., 2019, 6), reflects such legacies. Federal policy making in the context of calcified national politics in the USA likely takes place through executive action or 'Omnibus legislating', that is, through large budgetary bills which are highly circumscribed as instruments of policy reform or innovation (Krutz, 2021, 35). In the absence of a mission-oriented agenda from the central state and a politically viable pathway to get there, market imperatives and industry lobbies are highly influential in directing federal infrastructure distributions (Ali, 2021).

Three problems for social sustainability arise from emphasizing market logics in infrastructure development. First, the geographic distribution of public works investments is uneven, as states and private investors prioritize regions and projects with the highest economic development potential (or, as discussed in the previous section, the highest potential for value extraction) (Jenkins, 2021; Pike et al., 2019). This dynamic produces variegated geographies of infrastructure development. Infrastructural 'cold spots' may spiral into self-reinforcing cycles of public and private disinvestment, with long-run consequences for regional wealth generation and retention (Aalbers and Bernt, 2019; Coward, 2015; Jenkins, 2021). Such economic pathologies pose clear threats to regional development tenets including competitive advantage, social welfare and quality of life.

The second problem concerns the uneven distribution of public investment across the four critical infrastructure sectors. As states channel public investments toward sectors which most directly fulfil national economic imperatives (Pike et al., 2019), they potentially overlook infrastructures which answer primarily local-scale and social goals. Given the inherent inefficiencies of providing public

services in low-population, isolated regions (Gansauer and Haggerty, 2021; Halseth et al., 2019; Sysner, 2020), the social-infrastructure needs of the periphery are acutely vulnerable to underinvestment. Yet universal use of the term underinvestment is potentially inaccurate in that it implies neutrality. Considering the history of public service rationalization and fiscal austerity described above, it must be emphasized that over the last several decades public and private infrastructure actors have actively and intentionally disinvested in peripheral regions, particularly Tribal, Latine and Black communities (Doyle et al., 2018; Estes, 2019; Pannu, 2018). Future research must therefore problematize under- and dis-investment in the periphery as active, political, potentially racialized processes rather than passive, apolitical outcomes of technocratic decision making.

Finally, market-driven and top-down infrastructure development in peripheral regions may directly contradict locally held values. The last few decades of infrastructure politics in North America provide several examples of indigenous-led resistance movements to infrastructure developments which traverse First Nations' territory and impede social, environmental and cultural values (Estes, 2019; Gilio-Whitaker, 2019). Simply put, infrastructures developed under purely economic imperatives cannot be expected to deliver commensurate social welfare benefits. By pitting capital against grassroots political actors, such projects risk producing environmental injustices and steamrolling local development aspirations with unwanted infrastructural change (Gilio-Whitaker, 2019). The risk is heightened when regional development visions are poorly articulated or lack procedural justice in their creation.

Research is needed to understand the extent to which current and future infrastructure developments in peripheral geographies respond to place-based social-infrastructure needs and enable regions and localities to express autonomy. Community agency may be investigated by tracing procedures which enable localities and regions to effectively advocate for their needs, whether that be through fulfilling infrastructural deficits (Bennett, 2018; Gansauer and Haggerty, 2021), negotiating community benefit agreements (Argent, 2017; Rose, 2020) or, as Estes (2019) and Gilio-Whitaker (2019) emphasize, honouring local resistance movements. For indigenous communities, exercising autonomy in infrastructure and regional development planning is a matter of sovereignty (Curley, 2021; Gilio-Whitaker, 2019). Program evaluations should assess the potential for top-down infrastructure policy to effectively correct market failures in infrastructure provision in the periphery, and the extent to which planning and implementation techniques incorporate local values. As regional studies scholars call for progressive infrastructure planning and policy developments to prioritize social need (Addie et al., 2020; Pike et al., 2019), theoretical, comparative and historical analyses are needed to examine regional-scale outcomes which arise

when central states develop infrastructure under contrasting logics: as a supply-side growth intervention, as a demand-side growth intervention, or as a social welfare intervention.

Infrastructure finance and peripherality

Endeavoring to “see like a region” (Addie et al., 2020, 19), this section profiles the systems which US local governments in resource peripheries navigate to fund infrastructure. First, a caveat: funding strategies differ by sector and project due to variables including state-level fiscal policy, regulatory oversight, role of the private sector, asset ownership and more. Given such particularities, future analyses must attend to how infrastructure projects are financed, as fiscal design may reinforce spatial inequalities or serve as a mechanism for value extraction itself.

Rescaling infrastructure governance to junior governments (described in the previous section) made local governments centrally responsible infrastructure finance, planning and management. As local governments increasingly function as economic development ‘entrepreneurs’ (Halseth et al., 2019), they leverage infrastructure as a tool to enhance competitive advantage (Bliss, 2018). A consequence of remote geography and low-population density, institutional capacity and tax bases in resources peripheries are typically inadequate relative to the demands of infrastructure development and maintenance. Peripheral local governments rely on narrow tax bases to finance intensive infrastructure demands, an especially wicked problem in jurisdictions experiencing demographic decline (Sysner, 2020). In such contexts, constructing networked infrastructures which traverse great distances and serve relatively small populations produces a diseconomy of scale characterized by extremely high costs per capita (Gansauer and Haggerty, 2021). Expanded infrastructure governance and provision responsibilities strain already limited local administrative and financial capacity (Breen and Markey, 2019; Gansauer et al., 2023).

Distribution criteria for federal transfer payments may also deepen funding inequities for low-population regions. For example, the US Department of Housing and Urban Development (HUD) provides allocations through its Community Development Block Grant program to metropolitan regions with more than 50,000 people and counties with more than 200,000 people (HUD, 2022). In contrast, regions which fall below these population thresholds must compete for Block Grant awards from the state (ibid.). The combined outcome is chronic rural infrastructure deficits in certain places and critical infrastructure sectors (for example, broadband, water), which have emerged as focal points for repair in recent federal expenditures (The White House, 2022a).

Local governments' fiscal structure in resource peripheries also creates challenges for the long-run needs of infrastructure finance. Local governments in peripheral

economies in North America often derive public revenues directly from resource production (Haggerty and Haggerty, 2021; Ryser et al., 2019), exposing public institutions to market volatility and creating vulnerabilities as long-run infrastructure provision needs potentially mismatch the temporal rhythms of peripheral production. This is a problem for regional development because such fiscal relationships reproduce single-industry dependence, making industrial transition potentially catastrophic for the regional public sector (Morris et al., 2021; Raimi et al., 2022; Roemer and Haggerty, 2022). Furthermore, resource revenues may directly subsidize infrastructure production through property taxes, royalties and formal or informal public-private partnerships (Roemer and Haggerty, 2022; Smith and Haggerty, 2020). Such schemes may give the private sector a vested interest in peripheral infrastructure development, and thus risk reproducing over-adaptation and unequal exchange dynamics described previously.

Credit is ubiquitous in infrastructure finance and poses unique challenges in peripheral contexts. Borrowing costs may be high in resource peripheries given the uncertainty and year-on-year volatility of public revenue. Thus creditors view peripheries and other 'left behind' places as risky geographies with relatively high chances of default, and adjust interest rates accordingly (Jenkins, 2021). Intensive infrastructural needs of resource booms may exceed local government debt limits (Smith et al., 2019), posing a critical constraint to regional growth and long-run public value retention. Localized lending capacity is also an issue. Corporate consolidation of US banking institutions has led to 'banking deserts' in rural and impoverished areas, leading local governments to access private capital outside the region as local financial institutions potentially lack the capacity to finance multi-million-dollar capital improvement projects (Edelman, 2019).

As the role of national and global financial actors in local and regional infrastructure development expands (Furlong, 2020; Pike et al., 2019), so does remote ownership of assets with consequences for *in-situ* wealth retention (Edelman, 2019). To lenders, an infrastructure project is essentially a bet on the borrowing government's ability to repay with interest; hence, local governments are incentivized to design and pitch infrastructure projects with the strongest potential to generate and sustain economic returns (Gibson, 2022; Jenkins, 2021). Local government borrowers and financiers are therefore disincentivized from mobilizing funds for projects which risk defaulting on loan repayment—specifically, those in blighted neighbourhoods (Aalbers and Bernt, 2019), those which serve communities of colour (Jenkins, 2021; Pannu, 2018), those which lack predictable revenue streams (Gibson, 2022) and those which are economically inefficient or not poised to be lucrative (Baskaran, 2021). Through this process, infrastructure becomes abstracted as *capital* rather than *place*, which could influence the values brought forward its production and governance (Jenkins, 2021).

US federal and state governments increasingly deliver fiscal support for local infrastructure projects in the form of competitive awards, where localities must win grant or loan capital by demonstrating outstanding merit or need for proposed projects. Local governments leverage such programs to generate capital for both special projects and basic infrastructure provisioning, construction and maintenance (Stern and Hall, 2015), implying that sustaining basic public services such as drinking water provision relies (at least in part) on highly uncertain funding streams (Baskaran, 2021; Gansauer et al., 2023). Collating and managing competitive award applications may overextend local administrative, knowledge and technical capacities in peripheral communities (Gansauer et al., 2023), posing opportunity costs on the same capacities leveraged for local economic development. Further, competitive award models are poorly suited to generating structural change because they typically fund short-run, one-off projects over long run, sustained and strategic interventions delivered through programs (Stern and Hall, 2015).

Award criteria may reflect spatial biases against peripheral and under-performing economic geographies. For example, Pape and Smith (2021) critique benefit-cost analyses for defining benefits and costs too narrowly, privileging projects in places with high property values, and under-valuing long-run effects. Smith et al. (2023) demonstrate how award programs with local match requirements unevenly exclude rural and low-income communities which lack the matching capital up front. While it is common for a single infrastructure project to depend on multiple and separate award programs, doing so forces uncertainty and inefficient inputs of administrative capacity as localities hope for a lottery-like alignment of success in multiple awards across appropriate fiscal calendars (Gansauer et al., 2023).

In all, a lack of funding coordination at the senior government level translates to an increased need for coordination at the local level. Junior governments perform fiscal gymnastics to fulfil the social-infrastructure needs of their constituencies, potentially engaging financial tools which produce long-run vulnerabilities (Smith and Haggerty, 2020). Projects with the strongest economic justification likely attract capital investment, leaving projects with weaker or indirect economic returns underfunded (Pike et al., 2019). And, overreliance on local capacity in the funding process produces highly uneven geographic distributions of peripheral public service delivery and physical infrastructure development (Halseth et al., 2019; Kelly and Lobao, 2021).

Because funding models shape system governance, influence regional social-infrastructure welfare, define the contours of asset ownership and affect a region's capacity to retain wealth, future research questioning the regional development potential of infrastructure must address infrastructure finance. Recently authorized US federal infrastructure programs are unlikely to fund new projects

in full, nor are programs designed to fund long-run maintenance needs. Research should focus on how new and expanded top-down infrastructure funding opportunities interface with existing finance mechanisms. Key to such inquiries will be critical evaluation of, first, the extent to which projects' fiscal design enables regional wealth retention and circulation, and second, whether and how fiscal tools available (dis)empower localities and regions to address place-based social-infrastructure needs. Research in this direction should adopt regional studies' emphasis on the inter-scalar nature of regional governance (MacLeod and Jones, 2007); local governments' public revenue schemes, sub-national and sub-state fiscal coordination and federal program design must all be considered.

Scalar infrastructure politics

Accepting poststructuralist perspectives which argue that horizontal relations between political actors construct and 'perform' the region through shared inputs (Allen and Cochrane, 2007), we emphasize that hegemonic regional imaginaries materialize as infrastructure augments the built environment (Addie et al., 2020; Glass et al., 2019; Valler et al., 2021). Regional infrastructure governance inherently involves a multitude of political actors representing differing scalar interests from the local to the supra-national (MacLeod and Jones, 2007; Willi et al., 2020). Therefore, future research should consider potential asymmetries between scalar interests in their power to effect infrastructural outcomes in the periphery. For this purpose, we find MacKinnon's (2011) conceptualization of scalar politics useful. It makes four contentions: (i) that "particular political projects and initiatives have scalar aspects and repercussions" (p. 29), (ii) that various actors, organizations and movements deploy scale for specific purposes (p. 29), (iii) that political projects engage pre-existing scalar constructions (p. 30) and (iv) that new scalar arrangements and configurations emerge through political discourses (p. 31). While place-based infrastructure politics are highly heterogeneous and difficult to theorize (see: Massey, 1995), this section surveys common scalar interests in US infrastructure planning as a basis for future empirical research which investigates the motives, goals and relative power position of public and private interests in infrastructure production.

In the USA, decades of neoliberal efforts to rescale service and infrastructure provision to junior governments from the federal level mean that state, regional and local governments, along with quasi-government entities and non-government organizations, are central stakeholders in infrastructure development and planning. Localities, regional institutions, quasi- and non-government entities likely have an interest in advocating for the social-infrastructure needs of their constituencies (for example, Smith and Haggerty, 2020). Tribal govern-

ments, each operating under treaty rights which vary by Tribe (Estes, 2019), are also important figures because they have responsibilities for on-reservation infrastructure provision (Doyle et al., 2018), and because of Tribes' historic and present-day territorial control (Gilio-Whitaker, 2019). While existing scholarship focuses on how local and regional interests interact with extra-regional actors (such as the state and international firms) in peripheral infrastructure planning (Bennett, 2018; Ryser et al., 2019), given the prevalence of local institutions in infrastructure production, there is a need to investigate intra-regional politics of regional development and infrastructure visioning (for example, Gansauer and Haggerty, 2021; Valler et al., 2021). It is imperative to problematize intersectional identity-based variables including race, gender and class and their interaction with the spatial political economy to assess how existing power disparities are expressed or repaired through infrastructure and regional development planning (for example, Jenkins, 2021; Massey, 1995). This space is well-suited to research which investigates the extent to which procedural justice translates into distributional justice, since infrastructural systems quite literally distribute public service access and resource flows across space.

US federal and state governments also shape peripheral infrastructure politics. As recent 'once in a generation' investments materialize across the country (The White House, 2022a), there is an urgent need to evaluate alignments between the aims of the US federal state and place-based social-infrastructure need. State governments are also powerful intermediaries in fund distribution and program implementation in the US federalist system, giving them power to assert their own priorities in the process. While Tribal governments generally access federal programs directly (Doyle et al., 2018), state-level institutions often act as intermediaries to federal funding access in non-Tribal low-population communities (see previous HUD example). Given the potential for spatial heterogeneity in funding award distribution, comparative and composite research designs are needed to investigate the geography of federal policy diffusion.

While invigorating 'left behind' regional economies is a priority of recent US legislation (The White House, 2022a), it bears noting that in the US context regional institutions lack standardization, which may influence policy outcomes in regional development. Both multi-state organizations (for example, the Appalachian Regional Commission) and sub-state, inter-local associations express 'regional development' aims and employ infrastructural means to achieve them. As many US regional development efforts scaled up from collaborations among local institutions, such organizations are highly variegated across the country (Parker and Harloe, 2015). Federal policy goals supporting regional growth may misalign with institutional context on-the-ground. This scalar mismatch is particularly common in 'institutionally thin' peripheral

geographies, which may lack organizational structures to effectively pursue regional-scale development goals (Lu, 2011; Morrison, 2014). Future scholarship should engage poststructuralist perspectives which argue that scalar forms are social constructions and therefore put forward toward particular political ends (Allen and Cochrane, 2007; MacKinnon, 2011). Investigation is needed to understand what and whose interests are served by regional-scale interventions and infrastructure development, particularly in peripheral geographies which may lack the same 'regional impulses' as functionally connected city regions (Foster, 1997).

As multinational firms increasingly intervene in peripheral resource economies (Argent, 2017), extra-local private sector interests hold a stake in regional infrastructure debates alongside government and local entities (for example, Carse, 2014; Estes, 2019). It may be in the financial interest of private stakeholders to leverage infrastructure in ways that reproduce the dynamics of peripherality and unequal exchange to maximize capital accumulation potential. Resource-extracting firms, for example, will need assurance that commodities produced in the periphery can flow with minimal friction to manufacturing or consumption centres (Freudenburg, 1992). Financialization adds another dimension to the infrastructure-productivity relationship since investors might expect infrastructure networks to uphold the production process not only in a material sense, but also by generating financial returns in their own right (Furlong, 2020). Questioning the effects of financialization on the spatial distribution of infrastructure investment across England, Pike et al. (2019) find that infrastructure development is more directly driven by profitability prospects than by regional needs. Thus, a critical research direction will be investigating the political dimensions of infrastructure projects deemed 'investments' by powerful, extra-regional interests, compared to projects which fail to attract capital investment.

In summary, infrastructure production in the periphery involves a variety of scalar public and private interests with potentially conflicting aims. Investigating infrastructure and regional development politics should integrate insights from critical infrastructure studies and regional studies to question how power is expressed through infrastructures' planning and materiality, and to assess relations between a suite of scalar interests. Because infrastructure systems form the fabric of the built environment and are co-constituted with place (Jenkins, 2021), this area is ripe for in-depth case study research which focuses on the historical and geographic contingencies shaping infrastructure politics (for example, Curley, 2021; Estes, 2019). Thematically, future inquiries might address which political actors and interests are represented (or not), and which values are expressed and eclipsed through the infrastructure development process (that is, planning, construction, operation, retrofit, abandon, disinvestment [Howe et al., 2016]).

Concluding discussion

This article engages an urgent policy problem in the USA: that incoming federal infrastructure investments' potential to deliver regional development outcomes in 'left behind' places is highly uncertain. While infrastructure development is often uncritically prescribed as a beneficial regional development policy instrument, we argued that certain aspects of infrastructure systems' material and institutional design may undermine, rather than contribute to, place-based regional development. Therefore, critical research which problematizes the assumption that infrastructure necessarily benefits regional development is needed. The article proposed four tenets for a research agenda which responds to such concerns: first, that peripheral infrastructure development potentially reproduces unequal exchange dynamics, locking peripheries into poorly diversified economies; second, that social infrastructure provision in the periphery is vulnerable to dual market failures which reflect deep disinvestment under neoliberalism; third, that project finance may itself serve as a dependency trap or value extraction mechanism; and finally, that regional infrastructure production engages a variety of scalar political interests with potentially conflicting values.

These points serve as a framework and an invitation for future efforts to investigate and theorize the role of infrastructure in resource peripheries' development trajectories, and in the spatial economy more broadly. Here we have shown that historical under- and dis-investment processes in peripheral regions have political motivations; it is not that such regions are neutrally 'left behind', but rather that the state, private capital and other hegemonic interests actively leave them out. Thus, adopting this research agenda requires a recognition that the process of reinvestment is also not neutral. Renewed interest in the "places that don't matter" (Rodríguez-Pose, 2018, 189) should itself be interrogated for its political motives, as should sudden and rapid endeavours by the US central state to reinvest in such places.

In its broadest sense, this article contributed to efforts to theorize the role of power and the state in the reproduction of uneven development (Martin, 2015; Smith, 2011). Thus a key contention must be carried forward into future research: that through infrastructure and under the guise of development agendas, states become active agents in reproducing domestic regional inequalities. Research which responds to pressing needs of the current political moment must interrogate the social, economic, historical and place-based dimensions of infrastructure production (see: Massey, 1995), lest the process of state reinvestment reinforce existing uneven development dynamics.

Acknowledgements

The authors are grateful to the Resources and Communities Research Group whose collective knowledge and research

efforts inspired this article. We are also grateful for feedback from anonymous reviewers, *Edgy Matters* session participants at the 2022 RSA Winter Conference, and David Steele, who provided editing assistance. This work was financially supported by the US Department of Agriculture, National Institute of Food and Agriculture predoctoral fellowship #2021-09489 and National Science Foundation EPSCoR OIA#1757351.

References

- Aalbers, M. B. and Bernt, M. (2019) The political economy of managing decline and rightsizing, *Urban Geography*, **40**: 165–173. <https://doi.org/10.1080/02723638.2018.1524654>.
- Addie, J. -P. D., Glass, M. R., Nelles, J. (2020) Regionalizing the infrastructure turn: a research agenda, *Regional Studies, Regional Science*, **7**: 10–26. <https://doi.org/10.1080/21681376.2019.1701543>.
- Ali, C. (2021). *Farm Fresh Broadband: The Politics Of Rural Connectivity*. Cambridge, Mass: MIT Press.
- Allen, J. and Cochrane, A. (2007) Beyond the territorial fix: regional assemblages, politics and power, *Regional Studies*, **41**: 1161–1175. <https://doi.org/10.1080/00343400701543348>.
- American Rescue Plan Act [ARPA], Public Law No. 117-2. (2021). Available online at: <https://www.congress.gov/bill/117th-congress/house-bill/1319/text> [Accessed 28 November 2022].
- Anand, N., Gupta, A., Appel, H. (2018). *The Promise of Infrastructure*. Durham: Duke University Press.
- Ansell, B. W. and Lindvall, J. (2020). *Inward Conquest: The Political Origins of Modern Public Services*. Cambridge: Cambridge University Press.
- Argent, N. (2017) Rural geography I: resource peripheries and the creation of new global commodity chains, *Progress in Human Geography*, **41**: 803–812. <https://doi.org/10.1177/0309132516660656>.
- Bakker, K. (2010). *Privatizing Water: Governance Failure and the World's Urban Water Crisis*. Ithaca: Cornell University Press.
- Barnes, T. J. and Christophers, B. (2018). *Economic geography: A critical introduction*. New York: John Wiley & Sons.
- Baskaran, P. (2021). Thirsty Places, *Utah Law Review*, **3**: 501–576. <https://doi.org/10.2139/ssrn.3779629>
- Beecher, J. A., Higbee, J., Menzel, A., Dooley, R. (1996). *The Regionalization of Water Utilities: Perspectives, Literature Review, and Annotated Bibliography*. Columbus, OH: National Regulatory Research Institute. <https://pubs.naruc.org/pub/48860212-155D-0A36-3115-26BCFC16B761>
- Bennett, M. (2018) From state-initiated to Indigenous-driven infrastructure: the Inuvialuit and Canada's first highway to the Arctic Ocean | Elsevier Enhanced Reader, *World Development*, **109**: 134–148. <https://doi.org/10.1016/j.worlddev.2018.04.003>.
- Bliss, D. (2018). *Economic Development and Governance in Small Town America: Paths to Growth*. New York, Routledge.
- Boschma, R. and Lambooy, J. (2000) The prospects of an adjustment policy based on collective learning in old industrial regions, *GeoJournal*, **49**: 391–399.
- Breen, S. -P. and Markey, S. (2019) Half empty? Drinking water systems and regional resilience in rural Canada. *Planning Practice & Research*, **34**: 168–183. <https://doi.org/10.1080/02697459.2018.1548212>.
- Carase, A. (2014). *Beyond the Big Ditch: Politics, Ecology, and Infrastructure at the Panama Canal*. Cambridge, Mass: MIT Press.
- Carase, A. and Kneas, D. (2019) Unbuilt and unfinished: the temporalities of infrastructure, *Environment and Society*, **10**: 9–28.
- Chips and Science Act, Public Law No. 117-167. (2022). Available online at: <https://www.congress.gov/117/plaws/publ167/PLAW-117publ167.pdf> [Accessed 28 November 2022].
- Clements, R., Alizadeh, T., Kamruzzaman, L., Searle, G., Legacy, C. (2022) A systematic literature review of infrastructure governance: cross-sectoral lessons for transformative governance approaches, *Journal of Planning Literature*, **38**: 70–87. <https://doi.org/10.1177/08854122221112317>.
- Coward, M. (2015) Hot spots/cold spots: infrastructural politics in the urban age, *International Political Sociology*, **9**: 96–99. <https://doi.org/10.1111/ips.12081>.
- Curley, A. (2021) Infrastructures as colonial beachheads: the Central Arizona Project and the taking of Navajo resources, *Environment and Planning D: Society and Space*, **39**: 387–404.
- De Souza, P. (2018). *The Rural and Peripheral in Regional Development: An Alternative Perspective*. New York, Routledge.
- Doyle, J. T., Kindness, L., Realbird, J., Eggers, M. J., Camper, A. K. (2018) Challenges and opportunities for tribal waters: addressing disparities in safe public drinking water on the crow reservation in Montana, USA, *International Journal of Environmental Research and Public Health*, **15**: Article 4. <https://doi.org/10.3390/ijerph15040567>.
- Edelman, M. (2019) Hollowed out Heartland, USA: how capital sacrificed communities and paved the way for authoritarian populism, *Journal of Rural Studies*, **82**: 505–517. <https://doi.org/10.1016/j.jrurstud.2019.10.045>.
- Emmanuel, A. (1972). *Unequal Exchange: A Study of the Imperialism Of Trade*. New York: Monthly Review Press.
- Estes, N. (2019). *Our History is the Future: Standing Rock versus the Dakota Access Pipeline, and the Long Tradition of Indigenous Resistance*. New York: Verso Books.
- Flora, C. B., Flora, J. L., Gasteyer, S. (2016). *Rural Communities: Legacy and Change* (5th ed.). Boulder, Colorado: Westview Press.
- Foster, K. A. (1997) Regional impulses, *Journal of Urban Affairs*, **19**: 375–403. <https://doi.org/10.1111/j.1467-9906.1997.tb00503.x>.
- Freudenburg, W. R. (1992) Addictive economies: extractive industries and vulnerable localities in a changing

- world economy, *Rural Sociology*, **57**: 305–332. <https://doi.org/10.1111/j.1549-0831.1992.tb00467.x>.
- Furlong, K. (2020) Geographies of infrastructure 1: economies, *Progress in Human Geography*, **44**: 572–582. <https://doi.org/10.1177/0309132519850913>.
- Galli, R. (1981). *Political Economy of Rural Development*. Albany: SUNY Press.
- Gansauer, G. and Haggerty, J. (2021) Beyond city limits: infrastructural regionalism in rural Montana, USA, *Territory, Politics, Governance*: 1–19. <https://doi.org/10.1080/21622671.2021.1980428>.
- Gansauer, G., Haggerty, J. H., Dunn, J. (2023) Public water system governance in rural Montana, USA: a 'slow drip' on community resilience, *Society and Natural Resources*: 1–20. <https://doi.org/10.1080/08941920.2023.2212363>.
- Gibson, C. W. (2022) 'How will this affect our credit rating?': municipal debt and governing the environment, *Environmental Sociology*, **8**: 362–375. <https://doi.org/10.1080/023251042.2022.2054131>.
- Gibson-Graham, J. K. (2006). *A Postcapitalist Politics*. Minneapolis: University of Minnesota Press.
- Gilio-Whitaker, D. (2019). *As Long as Grass Grows: The Indigenous Fight for Environmental Justice, From Colonization to Standing Rock*. Boston: Beacon Press.
- Glass, M. R., Addie, J. -P. D. Nelles, J. (2019) Regional infrastructures, infrastructural regionalism, *Regional Studies*, **53**: 1651–1656. <https://doi.org/10.1080/00343404.2019.1667968>.
- Gómez-Ibáñez, J. A. and Liu, Z. (2022). *Infrastructure Economics and Policy: International Perspectives*. Cambridge, Mass: Lincoln Institute of Land Policy.
- Graham, S. and Marvin, S. (2001). *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition*. London: Psychology Press.
- Gray, M. and Barford, A. (2018) The depths of the cuts: the uneven geography of local government austerity, *Cambridge Journal of Regions, Economy and Society*, **11**: 541–563. <https://doi.org/10.1093/cjres/rsy019>.
- Grubert, E. (2020) Fossil electricity retirement deadlines for a just transition, *Science*, **370**: 1171–1173.
- Haggerty, M.N. and Haggerty, J.H. (2021). Rethinking fiscal policy for inclusive rural development. In Dumont, A. and Davis, D. P. (eds.) *Investing in Rural Prosperity*. St Louis: Federal Reserve Bank of St. Louis.
- Halseth, G. (2016). *Transformation of Resource Towns and Peripheries: Political Economy Perspectives*. New York: Routledge.
- Halseth, G., Markey, S., Ryser, L. (2019). *Service Provision and Rural Sustainability: Infrastructure and Innovation*. New York: Routledge.
- Harvey, D. (2001) Globalization and the 'Spatial Fix', *Geographical Review*, **3**: 23–30.
- Harvey, D. (2006). *Spaces of Global Capitalism*. New York: Verso.
- Hayter, R., Barnes, T. J., Bradshaw, M. J. (2003) Relocating resource peripheries to the core of economic geography's theorizing: rationale and agenda, *Area*, **35**: 15–23.
- Hendrickson, C., Muro, M., Galston, W. A. (2018). *Strategies for Left Behind Places*. Washington, DC: Brookings Institute, pp. 44.
- Hetherington, K., Harvey, P., Jensen, C. B., Morita, A. (2017). *Infrastructure and Social Complexity: A Companion*. New York: Routledge.
- Howe, C., Lockrem, J., Appel, H., Hackett, E., Boyer, D., Hall, R., Schneider-Mayerson, M., Pope, A., Gupta, A., Rodwell, E., et al. (2016) Paradoxical infrastructures: ruins, retrofit, and risk, *Science, Technology, & Human Values*, **41**: 547–565. <https://doi.org/10.1177/0162243915620017>.
- Inflation Reduction Act [IRA], Public Law No. 117-169. (2022). Available online at: <https://www.congress.gov/bill/117th-congress/house-bill/5376/text> [Accessed 28 November 2022].
- Infrastructure Investment and Jobs Act [IIJA], Public Law No. 117-58. (2021). Available online at: <https://www.congress.gov/117/plaws/publ58/PLAW-117publ58.pdf> [Accessed 28 November 2022].
- Jenkins, D. (2021). *The Bonds of Inequality*. Chicago: University of Chicago Press.
- Katz, A. L. (2021). *Miracle Miles: From Roadbuilding to American Highway Engineering, 1893-1933*. PhD Thesis, Carnegie Mellon University.
- Kelly, P. and Lobao, L. (2021) Whose need matters?: the local welfare state, poverty, and variation in US counties' social service provisioning, *Social Currents*, **8**: 566–590. <https://doi.org/10.1177/23294965211047886>.
- Krutz, G. S. (2021). Omnibus legislating in the U.S. congress. In I. Bar-Siman-Tov (ed.), *Comparative Multidisciplinary Perspectives on Omnibus Legislation*, pp. 35–51. Cham, Switzerland: Springer International Publishing. https://doi.org/10.1007/978-3-030-72748-2_2
- Lewis, N., Le Heron, R., Campbell, H., Henry, M., Le Heron, E., Pawson, E., Perkins, H., Roche, M., Rosin, C. (2013) Assembling biological economies: region-shaping initiatives in making and retaining value, *New Zealand Geographer*, **69**: 180–196. <https://doi.org/10.1111/nzg.12031>.
- Lu, M. (2011) Ad hoc regionalism in rural development, *Geographical Review*, **101**: 334–352. <https://doi.org/10.1111/j.1931-0846.2011.00100.x>.
- MacKinnon, D. (2011) Reconstructing scale: towards a new scalar politics, *Progress in Human Geography*, **35**: 21–36. <https://doi.org/10.1177/0309132510367841>.
- MacKinnon, D., Kempton, L., O'Brien, P., Ormerod, E., Pike, A., Tomaney, J. (2021) Reframing urban and regional 'development' for 'left behind' places. *Cambridge Journal of Regions, Economy and Society*, **15**: 39–56. <https://doi.org/10.1093/cjres/rsab034>.
- Macleod, G. and Jones, M. (2007) Territorial, scalar, networked, connected: in what sense a 'regional world?', *Regional Studies*, **41**: 1177–1191. <https://doi.org/10.1080/00343400701646182>.
- Martin, R. (2015) Rebalancing the spatial economy: the challenge for regional theory, *Territory, Politics, Governance*, **3**: 235–272. <https://doi.org/10.1080/21622671.2015.1064825>.

- Martin, R. and Sunley, P. (2015) On the notion of regional economic resilience: Conceptualization and explanation, *Journal of Economic Geography*, **15**: 1–42. <https://doi.org/10.1093/jeg/lbu015>.
- Massey, D. (1979) In what sense a regional problem?, *Regional Studies*, **13**: 233–243. <https://doi.org/10.1080/09595237900185191>.
- Massey, D. (1995). *Spatial Divisions of Labour: Social Structures and the Geography of Production*. London: Bloomsbury Publishing.
- Mazzucato, M. (2018). *The Value of Everything: Making and Taking in the Global Economy*. London: Hachette UK.
- Morris, A. C., Kaufman, N., Doshi, S. (2021) Revenue at risk in coal-reliant counties, *Environmental and Energy Policy and the Economy*, **2**: 83–116.
- Morrison, T. H. (2014) Developing a regional governance index: the institutional potential of rural regions, *Journal of Rural Studies*, **35**: 101–111.
- National Academies of Sciences, Engineering, and Medicine [NASEM]. (2021a). *Accelerating Decarbonization of the U.S. Energy System*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/25932>.
- National Academies of Sciences, Engineering, and Medicine [NASEM]. (2021b.) *The Future of Electric Power in the United States*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/25968>
- Pannu, C. (2018) Bridging the sage drinking water gap for California's rural poor, *Hastings Environmental Law Journal*, **24**: 253.
- Pape, E. and Smith, K.K. (2021). *Improving benefit-cost analyses for rural areas*. Headwaters Economics. Available online at: <https://headwaterseconomics.org/equity/improving-benefit-cost-analyses/> [Accessed 1 November 2022].
- Parilla, J. and Haskins, G. (2022). Six keys to unlocking a new era of place-based federal investment. Brookings Institute. Available online at: <https://www.brookings.edu/blog/the-avenue/2022/11/28/six-keys-to-unlocking-a-new-era-of-place-based-federal-investment/> [Accessed 28 November 2022].
- Parker, S. and Harloe, M. (2015) What place for the region? reflections on the regional question and the International Journal of Urban and Regional Research, *International Journal of Urban and Regional Research*, **39**: 361–371. <https://doi.org/10.1111/1468-2427.12175>.
- Pike, A., O'Brien, P., Strickland, T., Tomaney, J. (2019). *Financialising City Statecraft and Infrastructure*. Cheltenham: Edward Elgar Publishing.
- Pugh, R. and Dubois, A. (2021) Peripheries within economic geography: four 'problems' and the road ahead of us, *Journal of Rural Studies*, **87**: 267–275. <https://doi.org/10.1016/j.jrurstud.2021.09.007>.
- Raimi, D., Carley, S., Konisky, D. (2022) Mapping county-level vulnerability to the energy transition in US fossil fuel communities, *Scientific Reports*, **12**: 1–10.
- Ricci, A. (2019) Unequal exchange in the age of globalization, *Review of Radical Political Economics*, **51**: 225–245. <https://doi.org/10.1177/0486613418773753>.
- Righetti, T. K. (2017) Siting carbon dioxide pipelines, *ONE J*, **3**: 907.
- Rodríguez-Pose, A. (2018) The revenge of the places that don't matter (and what to do about it). *Cambridge Journal of Regions, Economy and Society*, **11**: 189–209. <https://doi.org/10.1093/cjres/rsx024>.
- Roemer, K. F. and Haggerty, J. H. (2022) The energy transition as fiscal rupture: public services and resilience pathways in a coal company town, *Energy Research & Social Science*, **91**: 102752.
- Rose, J. C. (2020). *Navigating the Local Costs and Benefits of Modern Mineral Mines: The Role of Non-regulatory Agreements* (Master's Thesis, Montana State University-Bozeman, College of Letters & Science).
- Ryser, L., Halseth, G., Markey, S., Gunton, C., Argent, N. (2019) Path dependency or investing in place: understanding the changing conditions for rural resource regions, *The Extractive Industries and Society*, **6**: 29–40. <https://doi.org/10.1016/j.exis.2018.10.009>.
- Schouten, P. and Bachmann, J. (2022) Infrastructural frontiers: terrains of resistance at the material edge of the state, *Geoforum*, **136**: 219–224. <https://doi.org/10.1016/j.geoforum.2022.06.002>.
- Smith, K. K. (2020). *The Inner Workings and Long-term Impacts of Unconventional Oil and Gas Development in the Bakken Shale Formation*. PhD Thesis, Montana State University.
- Smith, K. K. and Haggerty, J. H. (2020) Exploitable ambiguities & the unruliness of natural resource dependence: public infrastructure in North Dakota's Bakken shale formation, *Journal of Rural Studies*, **80**: 13–22. <https://doi.org/10.1016/j.jrurstud.2020.05.006>.
- Smith, K. K., Haggerty, J. H., Kay, D. L. and Coupal, R. (2019) Using shared services to mitigate boomtown impacts in the bakken shale play: resourcefulness or over-adaptation?, *Journal of Rural and Community Development*, **14**: 66–86.
- Smith, K. K., Hernandez, P., Clark, J. (2023) *Match Requirements Prevent Rural and Low Capacity Communities from Accessing Climate Resilience Funding*. Headwaters Economics. <https://headwaterseconomics.org/equity/match-requirements/> [Accessed 12 March 2023].
- Smith, N. (2011) Uneven development redux, *New Political Economy*, **16**: 261–265. <https://doi.org/10.1080/13563467.2011.542804>.
- Soja, E. W. (1985) Regions in context: spatiality, periodicity, and the historical geography of the regional question, *Environment and Planning D: Society and Space*, **3**: 175–190.
- Stern, P. and Hall, P. (2015). *The Proposal Economy: Neoliberal Citizenship in 'Ontario's Most Historic Town'*. Vancouver: UBC Press.
- Syssner, J. (2020). *Pathways to Demographic Adaptation: Perspectives on Policy and Planning in Depopulating Areas in Northern Europe*. New York: Springer.

- Ulrich-Schad, J. D. and Duncan, C. M. (2018) People and places left behind: work, culture and politics in the rural United States, *The Journal of Peasant Studies*, **45**: 59–79. <https://doi.org/10.1080/03066150.2017.1410702>.
- US Department of Housing and Urban Development (HUD). (2022). *Community development block grant program*. Available online at: https://www.hud.gov/program_offices/comm_planning/cdbg [Accessed 1 November 2022].
- Valler, D., Jonas, A. E. G., and Robinson, L. (2021) Evaluating regional spatial imaginaries: the Oxford–Cambridge arc, *Territory, Politics, Governance*, **11**: 434–455. <https://doi.org/10.1080/21622671.2020.1851751>.
- Vodden, K., Douglas, D. J. A., Markey, S., Minnes, S., Reimer, B. (eds.). (2019). *The Theory, Practice, and Potential of Regional Development: The Case of Canada* (1st ed.). London, UK: Routledge. <https://doi.org/10.4324/9781351262163>
- Wallerstein, I. (2004). *World-systems Analysis*. Durham: Duke University Press.
- The White House. (2022a). *Biden administration releases rural playbook, launches Building a Better America rural infrastructure tour to highlight impact of Bipartisan Infrastructure Law on rural America*. [News release]. Available online at: <https://www.whitehouse.gov/briefing-room/statements-releases/2022/04/11/biden-administration-releases-rural-playbook-launches-building-a-better-america-rural-infrastructure-tour-to-highlight-impact-of-bipartisan-infrastructure-law-on-rural-america/> [Accessed 1 November 2022].
- The White House. (2022b). *Justice40: a whole-of-government initiative*. Available online at: <https://www.whitehouse.gov/environmentaljustice/justice40/> [Accessed 1 November 2022].
- Willi, Y., Pütz, M., Jongerden, J. (2020) Unpacking legitimacy in regional development: asymmetric justification and the functioning of regional development agencies, *Territory, Politics, Governance*, **11**: 158–173. <https://doi.org/10.1080/21622671.2020.1805352>.
- Wilson, G. (2012). *Community Resilience and Environmental Transitions*. New York: Routledge.
- Zucman, G. (2019) Global wealth inequality, *Annual Review of Economics*, **11**: 109–138. <https://doi.org/10.1146/annurev-economics-080218-025852>.