

RESEARCH ARTICLE

The Making of Natural Infrastructure in China's Era of Ecological Civilization

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Abstract

Campaign-style environmental enforcement that involves the destruction of infrastructure has become increasingly common. Scholars have theorized such crackdowns as a form of bureaucratic control. These explanations are compelling, yet incomplete. This paper adopts an infrastructural lens to call attention to the fact of infrastructural demolition. I argue that the reduction of existing infrastructure to rubble is a way of clearing space for other kinds of infrastructure, specifically natural infrastructure, which has become central in the pursuit of ecological civilization. The creation of natural infrastructure requires calculative tools, which work to obscure the profoundly political nature of the natural infrastructure that they create through spatial zoning, ecological functional zoning and ecological conservation red lines (ECRLs). The article then scales down to two case studies of villages in post-earthquake Sichuan that are within ECRLs and designated for the function of providing ecosystem services. In both, infrastructure within scenic areas that was previously encouraged by the state and central to village livelihoods was suddenly destroyed following ecological civilization enforcement campaigns. The arrival of natural infrastructure marks a national-scale infrastructural time that promises a new future in which village-controlled scenic areas have no part, leading to a ruination of their imagined futures.

摘要

涉及基础设施拆除的运动式环境执法已变得越发普遍。学者们将此种制裁打击理论化为官僚控制的一种形式。这些解释虽令人信服，但却并不完整。本文首先采用基础设施的视角来提醒人们注意基础设施拆除的事实。作者认为，将已有基础设施化为瓦砾是为其他类型的基础设施，尤其是为自然基础设施腾出空间的一种方式，这已然成为追求生态文明的核心。自然基础设施的创建需要通过空间分区、生态功能分区和生态保护红线等计算工具以掩盖其深刻的政治本质。本文随后聚焦至两个四川汶川地震后的村庄案例研究。两村庄均位于红线内并指定用于提供生态系统服务的功能。在两案例研究中，以前国家鼓励的关切村庄生计的风景区基础设施在随后的生态文明执法活动中却被突然被拆毁。自然基础设施的到来标志着国家级基础设施时代的到来。但其也预示着一个村控风景区未能参与其中而导致村民设想前景幻灭的新未来。

Keywords: natural infrastructure; ecological civilization; ecological conservation red lines; scenic areas; Sichuan; infrastructural destruction

关键词: 自然基础设施; 生态文明; 生态保护红线; 景区; 四川; 基础设施拆除

A small mountainous village in the Longmen Mountain Range 龙门山 in Pengzhou 彭州, a county-level city in Chengdu municipality, Sichuan, Summit Village was severely impacted by the 2008 Wenchuan earthquake.¹ It destroyed not only 90 per cent of the village's houses but

¹ I use pseudonyms for names of towns and villages.

also the two sites for which the scenic area around the village had been famous, and thus the tourism industry on which the village had come to depend. Six years after the earthquake, villagers developed a new scenic spot in their collective forests and formed a company that built infrastructure within it for tourists. The effort was wildly successful in attracting tourists and generating income and was praised by city and town party-state officials.

All of this changed abruptly, however. In August 2017, the Pengzhou government declared the operation illegal, shut it down, and posted security guards to block the entrance. The pavilions, pathways and toilets built by the company were dismantled. The city government's sudden about-face in its stance on the scenic spot resulted from the Central Fifth Environmental Inspection Group, which conducted investigations in Sichuan province that month, filing 8,966 reports of environmental problems, including for the scenic spot on the dubious charge of illegal construction.² With its closure, tourism ceased, the village company's earnings dropped to zero, and household income decreased by 70–80 per cent.

Central Environmental Inspection Groups are one of several key reform measures implemented beginning in 2015 toward the achievement of “ecological civilization” (*shengtai wenming* 生态文明) – the sweeping ecological modernist framework enshrined in the CCP constitution in 2012, and in the Chinese constitution in 2018.³ These centrally organized environmental protection supervision and inspection teams have carried out campaign-style enforcement in multiple provinces, resulting in the punishment of tens of thousands of companies and officials.⁴ A striking feature of these campaigns has been their accompanying infrastructural destruction, such as was carried out in Summit Village. For example, in Shandong, they led to the dismantling of 50 per cent of chemical industrial parks.⁵ In April 2017, the investigations of the Fourth Central Environmental Inspection Group resulted in the dismantling of an illegal, newly constructed VIP hotel in Zhongshan, Guangdong, that was located near a water source.⁶ Other examples include the demolition of two golf courses and 187 villas in a tourism resort in Jilin; the dismantling of a private oil refinery in Hunan; and the destruction of household pig raising operations in multiple provinces.⁷

Why have such events taken place? Political scientists have studied top-down, campaign-style and often arbitrary ways of addressing environmental concerns, or what Van der Kamp dubs “blunt force regulation.”⁸ Van der Kamp argues that China's use of such “blunt force” solutions presents a puzzle because they are so costly, lead to widespread unemployment, violate property rights

2 “Zhongyang huanbao duchazu xiang Sichuan sheng fankui ducha qingkuang” (The Central Environmental Protection Inspection Group reported the supervision situation to Sichuan province), 22 December 2017, http://www.gov.cn/hudong/2017-12/22/content_5249645.htm. Accessed 21 October 2019. “Yange duibiao shiken wenti zhenggai ‘yinggutou’ – wosheng diyi jieduan huanbao ducha ‘huitou kan toudi’” (Strictly benchmarking and swearing to tackle the problem and rectify the “hard bones” – perspective on the province's first phase of environmental protection inspectors “looking back”), *Sichuan ribao*, 18 June 2018, <http://www.sc.gov.cn/10462/10464/10797/2018/6/28/10454023.shtml>. Accessed 21 October 2019.

3 Wang 2018.

4 Goron 2018.

5 “Huangong yuanqu zao zhengdun chexiao! Huanbao fengbao yuyan yulie!” (Chemical industrial parks are rectified and revoked! Environmental protection storms are intensifying!), *Nongyao shichang xiaoxi*, vol. 14, 2018, 16.

6 Mai 2018.

7 Zhen Zeng, Chen Jiexong and Li Zhen, “Shaoyang jingkaiku yifa chaichu 3 chu feifa kuangshi jiagong dian” (Shaoyang Economic Development Zone dismantled three illegal ore processing sites), *Rednet.cn*, 7 July 2017, <https://hn.rednet.cn/c/2018/07/10/4675058.htm>. Accessed 8 October 2019. Zhu Jianhua, “Jilin duikuang ‘zhongyang’ jian bieshu” (Jilin confronts the “Center” to build a villa), *Dwnews.com*, 28 January 2019; Cao Xian, “Chai ‘jiulu’ xun ‘xinlu’” (Demolish “old roads” to find “new roads”), Hunan People's Government, 30 August 2018, www.hunan.gov.cn/hnyw/zwdt/201808/t20180830_5085522.html. Accessed 21 October 2019. Meng Chunrong and Peng Meilin, “Yongshun santian yifa chaichu yijia siren lianyou zuofang” (Yongshun dismantled a private oil refinery in three days), Ecology and Environment Department of Hunan, 5 July 2018, http://stjht.hunan.gov.cn/xxgk/xwdt/zxdt/201807/t20180705_5046005.html. Accessed 21 October 2019.

8 Van der Kamp 2021.

and create a hostile environment for future regulation. Indiscriminate crackdowns and sudden enforcement campaigns have been explained as a way of deterring non-compliance by corporate or other entities being regulated,⁹ and overcoming imperfect enforcement caused by local resistance and the fact that the law lacks local legitimacy.¹⁰ Others have suggested that in the case of pollution enforcement such campaigns are also a form of industrial restructuring.¹¹ However, Van der Kamp contends that, while these factors are at work, they do not explain why such campaigns shut down compliant and clean factories as well as dirty ones, nor why they are so sudden and concentrated.¹²

Instead, Van der Kamp argues, blunt force regulation is a form of bureaucratic control. It is an attempt by central and provincial leaders to reassert control over the bureaucracy – a “top-down solution to principal-agent problems” in the enforcement process.¹³ She argues that the need for such blunt force solutions reveals that the Chinese state does not have strong state “infrastructural power,” a term Mann defines as “the capacity of the state to actually penetrate civil society and implement its actions across its territories.”¹⁴ Like other forms of power, “infrastructural power” depends on infrastructures including “roads, railroads, education systems, computer networks.” In this latter sense, it is somewhat ironic to find that China has little infrastructural power, given that it has also been called the “paradigmatic infrastructural state”¹⁵ for its tremendous investments in built infrastructures that undergird state power.

Returning to Summit Village and other instances of infrastructural destruction, I argue that while blunt force regulation as a means of bureaucratic control is a useful explanatory framework, it is incomplete. In keeping with the theme of this special issue on Chinese infrastructure and infrastructural thinking in China, I argue that adopting infrastructure as an analytical lens onto the closure and dismantling of the villager-built scenic spot in Summit Village, as well as the many other instances of infrastructural destruction, points to the importance of the creation of *natural* infrastructure in China’s ecological civilization campaign.

This argument hinges on attention to materiality, focus on which has grown very significantly across the social sciences and humanities, though perhaps less so in China studies. Van der Kamp provides many startling examples of factories that are forcibly dismantled and irreversibly destroyed.¹⁶ In conventional analyses, all of this demolition is important primarily because it is a way of scaring bureaucrats who are not acting as good agents of the central state. But I suggest we dwell for a moment on the fact of demolition. Infrastructure as an analytical lens suggests that the reduction of existing infrastructure to rubble is a way of clearing space for other kinds of infrastructure – specifically natural infrastructure.

In what follows, I turn first to an explication of infrastructure as an analytical tool as well as an object of analysis. Next, I examine the role of natural infrastructure in China’s new ecological civilization campaign, and then proceed to analyse several aspects of the creation of natural infrastructure: InVEST, ecological zoning, and ecological “red lines.” Finally, I return to Summit Village and another post-earthquake locale, Meadow Village in Wenchuan county 汶川县, where another scenic area was also dismantled for the making of natural infrastructure. In discussing these two case studies, I use insights from infrastructural studies to reflect on infrastructural destruction and creation as different future-making projects and the place of rural residents in China’s imagined ecological future.

This article is based on semi-structured interviews with 58 villagers and village officials in Summit Village, Pengzhou, conducted between November 2018 and March 2019, and consultation

9 Shen and Ahlers 2019.

10 Van Rooij 2006.

11 Kostka and Hobbs 2012.

12 Van der Kamp 2021.

13 Ibid., 193.

14 Mann 2008, 355.

15 Bach 2016.

16 Van der Kamp 2021, 192.

of relevant laws and regulations about scenic areas. It is also based on participation in a meeting with village, township and county leaders in Wenchuan county about the Wolong Nature Reserve 卧龙国家级自然保护区, a visit to the closed Panda (*Pandaer* 潘达尔) Scenic Spot with these officials, and a follow-up, extensive interview with leaders of Meadow Village in May 2019, supplemented by news reports and policy documents.

Infrastructure as Simultaneously Analytic Lens and Object of Analysis

Since its origins in 19th-century French civil engineering, the term infrastructure has typically been used in reference to human-designed systems such as railroads, pipelines, tunnels and ports. However, in the decades following the Second World War, it began to take on an ever-wider range of meanings, from people themselves as a form of infrastructure, to protocols, standards and classification systems, and to landscapes and nature.¹⁷ The ascent and proliferation of infrastructure as a concept in use in social theory, in policy and in mainstream discourse indexes “a form of calculative reason” and a “modernist desire to render social and environmental heterogeneity manageable and amenable to standardized solutions.”¹⁸ Whereas policy and mainstream discourse take infrastructure to be an object, the growing infrastructural studies literature treats it simultaneously as an object of study and an analytical lens onto a range of social phenomena.

Drawing from science and technology studies, infrastructure as an analytical device has been used as an interpretive tactic to bring what was in the background into the foreground. Infrastructure is usually thought of as what is underlying, or the context for, something else; thus infrastructural analysis is a “figure–ground reversal.”¹⁹ It is precisely this type of “infrastructural inversion”²⁰ of figure and ground that I conduct on the campaigns to close tourist structures in scenic areas, polluting factories, buildings and so forth that have become so prevalent in China’s ecological civilization campaign, by drawing attention to the demolition of built infrastructure.

Destruction can be conceptualized as one moment in multiple possible temporalities of infrastructure; infrastructural projects build temporalities and configure time as much as they build material forms. As development projects, infrastructures are future-oriented, acting as “promissory notes” about a certain kind of future world, one which will unfold in a linear, teleological fashion.²¹ Indeed, nation-states often invest in infrastructures with capacities far beyond current needs in order to signify modernity and advancement, the arrival of a bright future.²² However, promised infrastructure frequently remains unbuilt or unfinished. In fact, the very idea of being “unfinished” makes sense only in relation to “project time,” a linear temporality in which an end point is defined in advance.²³ Infrastructures may “enrol people in communities of aspiration and anxiety” through their promised, but sometimes permanently deferred, futures.²⁴ In presents held in suspension, actors may, instead of accepting statist temporalities, “draw on a sense of historicity that is delinked” from what is promised or promoted by builders or planners of infrastructure.²⁵ The failures of a promised infrastructure to materialize constitute the ruins of an imagined future.

Decay, disrepair and destruction are also significant temporalities of infrastructure. All materials inevitably decay, but whether and how quickly or easily they are destroyed (e.g. the so-called “tofu-dreg” school buildings that collapsed in the Wenchuan earthquake) and whether that decay is met with state abandonment (such as water systems in the US city of Detroit) are deeply political

17 Bélanger 2009; Carse 2012; Tang 2019.

18 Carse 2017, 28.

19 Star and Ruhleder 1996; Hetherington 2019.

20 Bowker 1994.

21 Appel 2018, 45.

22 Appel, Anand and Gupta 2018; Gupta 2018.

23 Appel 2018.

24 Carse and Kneas 2019, 18; Hetherington 2014.

25 Campbell 2012; Carse and Kneas 2019, 20.

questions.²⁶ In China, large-scale resettlement of residents for urban real estate (re)development has been accomplished in part through deliberate infrastructural disrepair.²⁷ When households refuse to move after eviction, disruptions to electrical lines and disrepair of corroding sewage pipes are ways in which infrastructures can “attack” everyday life, encouraging houses to slowly come apart, but in a way that seems to diffuse agency, as deliberate destruction becomes mingled with “natural” wear and tear.²⁸

Such techniques have also been deployed by the Central Environmental Inspection Groups. For example, in Shantou city, Guangdong province, central-level environmental inspections targeted illegally constructed residential districts. Households that failed to move out within three days following the inspection “ended up lacking access to water and electricity,” a method that “helped to clear out everything in the illegally constructed district.”²⁹ This suggests that the destruction of household residences in the name of ecological civilization, like the large-scale demolition of houses across China for urban real estate (re)development, operates in part through infrastructural disrepair and attack, which Chu calls a form of the “infrastructuralization of state power.”³⁰

China’s very rapid infrastructural development over the past two decades has thus been accompanied by “an enormous amount of ruin, rubble and waste.”³¹ Ruins and rubble mark the abandonment of past promises of more perfect futures.³² In their place, new infrastructures as future-making projects are imagined and constructed. For example, Rippa finds that as the old town of Tengchong 腾冲, Yunnan, was demolished, residents rushed to dig out fabled pieces of jade from the rubble, turning the city into a mine in which residents dreamed of new fortunes.³³

Anthropologist Gaston Gordillo writes that rubble is a lens “through which to examine space negatively: by way of the places that were negated to create the geographies of the present.”³⁴ It marks a process of destructive production, which is often subject to what Ann Stoler has called “imperial disregard.” That is, the destruction is “affectively neutralized” through a refusal to take notice, “an attitude of inattention.”³⁵ The material presence of so much infrastructural rubble across China should prompt us to investigate what has been negated through destruction, and what new future-making projects are being produced in their place. In the ecological civilization campaign, natural infrastructure is a key new future-making project that has come to displace the built infrastructure that has been demolished.

Natural Infrastructure and Ecological Civilization

Like dams, bridges and wastewater treatment plants, wetlands, forests, fields and other landscapes commonly called “natural” are also increasingly referred to in policy as “green” or “natural infrastructures” as they too can be made into objects of calculative and management techniques aimed at allowing or making them deliver services deemed necessary or useful for society.³⁶ The term was first used in the 1980s in the context of stormwater runoff management, referring primarily to the use of plants, soil and other permeable surfaces for urban stormwater runoff and infiltration.³⁷

26 Appel, Anand and Gupta 2018; Gupta 2018.

27 Chu 2014.

28 Ibid., 359–360.

29 “Luoshi huanbao ducha zhenggai shenru tuijin weijian chaichu” (Implement environmental protection supervision and rectification), *Sohu*, 9 July 2018, http://www.sohu.com/a/240159610_100175909. Accessed 21 October 2019.

30 Chu 2014, 352.

31 Oakes 2019, 70.

32 Lam 2019.

33 Rippa 2019.

34 Gordillo 2014, 11.

35 Stoler 2009, 256; Gordillo 2014, 80.

36 Carse 2012.

37 See: <https://www.epa.gov/green-infrastructure/what-green-infrastructure>. Accessed 1 December 2019.

Subsequently, “green infrastructure” and its synonym “natural infrastructure” gained considerable popularity in landscape architecture, land use planning and environmental design.

In recent years, a much more expansive understanding of natural infrastructure has gained traction in natural resource management. For example, it has been defined as “an interconnected network of natural areas and other open spaces that conserves natural ecosystem values and functions, sustains clean air and water, and provides a wide array of benefits to people and wildlife ... the ecological framework for environmental, social and economic health – in short, our natural life-support system.”³⁸ This and other definitions assert that the design and implementation approaches to harness ecosystem services are similar to those deployed for more conventional forms of built infrastructure.³⁹ In short, anything that is made or set aside to produce ecosystem services becomes natural infrastructure.

Over the past decade, China has become a global showpiece for natural infrastructure, for example through its Sponge Cities (*haimian chengshi* 海绵城市) programme. Launched in 2013, Sponge Cities is an initiative for cities intended to reduce the damage from urban floods by using dispersed wetlands and other green (and blue) landscapes and permeable surfaces rather than traditional, centralized stormwater drainage pipes.⁴⁰ It seeks to replace “grey infrastructure” of dikes, gutters and pump stations with the natural infrastructure of grass, ponds, wetlands and bioswales. The project had 30 pilot cities by 2016 and the goal is for 80 per cent of China’s cities to absorb, retain and recycle 70 per cent of their rainwater by 2030. China’s urban areas have also seen a rush of other green infrastructure initiatives, such as the construction of parks and greenways.⁴¹

These natural infrastructure initiatives have been implemented as part of a sweeping framework of ecological civilization. Under Xi Jinping 习近平, ecological civilization is frequently coupled with the “Chinese Dream” (*Zhongguo meng* 中国梦) and the “new era” of national rejuvenation – promises of a more perfect future. It is also associated with the building of “Beautiful China” (*meili Zhongguo* 美丽中国) and Xi’s “two mountains theory,” the slogan that “Clear waters and green mountains are as valuable as gold and silver mountains” (*lushui qingshan jiushi jinshan yinshan* 绿水青山就是金山银山).⁴² Ecological civilization has been variously interpreted as an ideological framework, a form of symbolic legitimation for the party-state and a socio-technical imaginary.⁴³

As an ideological framework, ecological civilization draws selectively on reductionist interpretations of China’s traditional philosophies while maintaining a long-standing focus on economic growth and on the need for scientific and technological solutions to ecological crises, that is, on ecological modernization.⁴⁴ This can be seen for example in claims that the concept of Sponge Cities is not Western but rather arises from Chinese philosophies, despite the actual use of technologies developed since the 1980s in Euro-American countries and Japan.⁴⁵ As a replacement for “sustainable development,” a term that originated from the West and that dominated in China in the 1990s and 2000s, ecological civilization sinicizes environmentalism, freeing it from the trajectory of Western societies, and allowing China instead to position itself as a new global leader. And indeed, ecological civilization is now regularly touted in the pages of prestigious scientific journals and in the halls of the United Nations as a model for other countries to emulate.⁴⁶

38 Benedict and McMahon 2006, 1.

39 See, for example: <https://www.rff.org/topics/disasters-resilience-adaptation/natural-infrastructure/>. Accessed 1 December 2019. Hamel et al. 2021.

40 Tang 2019.

41 Greenways are green spaces with pedestrian or bike paths surrounded by trees or streams.

42 Goron 2018.

43 Geall and Ely 2018; Hansen, Li and Svarverud 2018; Schmitt 2018.

44 Geall and Ely 2018; Hansen, Li and Svarverud 2018; Schmitt 2018.

45 Tang 2019.

46 For example, Xiao and Zhao 2017; Gao 2019. For example, “ecological civilization” was declared the theme of the 2020 United Nations Biodiversity Conference. See also: <https://seea.un.org/news/ecosystem-accounting-and-ecological-civilization-china>.

Within China, ecological civilization works as a discursive tool to persuade the public that the Party will guide the Chinese people to a sustainable future.⁴⁷ As with the other “civilizations” that preceded it (e.g. spiritual, material, socialist), the emphasis in ecological civilization is on the second term, which calls for the guidance and alteration of human behaviour toward particular governmental ends. Thus, even as it seeks to be persuasive, it has also marked a decidedly authoritarian turn in China’s environmental governance, characterized by military metaphors and campaign-style enforcement – that is, “blunt force regulation” has become more commonplace.⁴⁸

Tools for Natural Infrastructure: InVEST

The creation of natural infrastructure requires calculative tools to justify policy and investments by revealing or, more accurately, creating value. One of the most important calculative devices that has been developed for and used to this end is Integrated Valuation of Ecosystem Services and Trade-offs (InVEST), a suite of open-source, spatially explicit software models that quantify, map and value ecosystem services with the goal of informing decision-making based on trade-offs between different scenarios. InVEST is a creation of the Natural Capital Project, which is based at Stanford University and operates as a partnership with The Nature Conservancy, the World Wildlife Fund, the Chinese Academy of Sciences (CAS), the University of Minnesota, and the Stockholm Resilience Centre.⁴⁹ According to its co-director, Peter Kaveira, InVEST seeks to encourage investments into natural infrastructure, particularly by governments: “Governments build roads, governments build dams, governments build a lot of things. So why shouldn’t governments invest in ecosystem services? The natural infrastructure rather than the built infrastructure.”⁵⁰

In her study of the rise of global biodiversity conservation, geographer Jessica Dempsey argues that InVEST is best understood as a calculative device to make capitalism work better, not just by internalizing externalities, but also by catalysing investments in green infrastructure and improving state planning and zoning. It works as “a political-scientific strategy to translate crucial ecological science into forms that can create new interests in nature” – and thus new interests in creating natural infrastructure.⁵¹ It is also a tool for depoliticization through its “rendering technical” of what are in fact very political interventions.

This depoliticization is clearly illustrated in a 2016 *Science* article that reported on China’s National Ecosystem Assessment, which was led by the Ministry of Ecology and Environment (MEE), the CAS Research Centre for Eco-Environmental Sciences and Xi’an Jiaotong University. The assessment involved more than 3,000 researchers from 139 institutions. The InVEST analysis reported in *Science* found that China’s national conservation policies between 2000 and 2010 – which included the Sloping Land Conversion Project (SLCP; *tuigeng huanlin* 退耕还林), the Natural Forest Protection Project (*tianbao gongcheng* 天保工程), “Retire Livestock and Restore Grassland” (*tuimu huancao* 退牧还草) and “ecological migration” (*shengtai yimin* 生态移民), among others – resulted in an overall increase in all modelled ecosystem services, other than habitat provision, which decreased slightly.⁵² The authors make an ecological modernist argument, asserting that the results of the modelling exercise show that economic growth can coexist with the improvement of ecosystem services as long as there is “intelligent policy design.”⁵³

In doing so, the authors use InVEST to render technical programmes that have disempowered already marginalized Chinese citizens. One of the three key regions they highlight for having

47 Wang 2018.

48 Kostka and Zhang 2018; Li and Shapiro 2020.

49 For more information see: <https://naturalcapitalproject.stanford.edu>.

50 Dempsey 2016, 116.

51 Ibid., 117.

52 Ouyang et al. 2016.

53 Ibid., 1457.

significantly improved ecosystem services, purportedly due to these conservation policies, is Sanjiangyuan 三江源, the headwaters and upper reaches of the Yellow, Yangtze and Mekong rivers in Qinghai province. Here, Retire Livestock and Restore Grassland has been implemented with ecological migration; between 2004 and 2010 roughly 55,000 herders were moved from pastoral livelihoods to new and often poorly built settlement sites on the edges of distant cities, leading to social dislocation, unemployment, health problems, declining living standards and significant cultural and linguistic loss.⁵⁴ The optimization of ecosystem services through modelling for “intelligent policy” obscures the profoundly political nature of these programmes. Writing about similar programmes of ecological migration and grazing bans in Xinjiang, Salimjan argues that ecological civilization has reinforced biases against ethnic minorities and works as “a powerful technique to maintain political stability.”⁵⁵

The *Science* article’s lead author, Ouyang Zhiyun 欧阳志云, director of the CAS Research Centre for Eco-Environmental Sciences and president of the Ecological Society of China, is a key figure in China’s conservation policymaking at multiple scales.⁵⁶ Ouyang was a student of both Wang Rusong 王如松 and Ma Shijun 马世骏, prominent earth systems scientists who were key figures in introducing systems science approaches to sustainable development in China, and ultimately, as Jesse Rodenbiker argues, in making “ecological civilization” a form of technocratic, green modernization.⁵⁷

Thus these InVEST modelling exercises have broad consequences. CAS and MEE have provided training in InVEST to over 200 people spanning 18 key state laboratories.⁵⁸ Moreover, MEE and the National Development and Reform Commission have used InVEST in the Chinese Ecosystem Assessment to create natural infrastructure in the sense of land that produces ecosystem services. This has been accomplished through the delineation of Ecological Functional Zones (*shengtai gongnengqu* 生态功能区; also translated as Ecosystem Function Conservation Areas), an effort also led by Ouyang Zhiyun, and the national-level Ecological Conservation Red Lines (ECRLs; *shengtai baohu hongxian* 生态保护红线) planning processes.⁵⁹

Functional Zoning and Ecological Red Lines

Conceptually, national functional zoning mobilizes non-human nature to provide ecosystem services to support the whole country indefinitely into the future. This requires the “enframing” of nothing short of the entire national territory as an object of ecosystem services production and optimization. Following Timothy Mitchell, “enframing” is a method of dividing up and containing by “conjuring a neutral surface or volume called ‘space’.”⁶⁰ Through enframing, the national territory becomes a picture that can be comprehended in its totality from the outside, divided up into standardized units with designated functions, and optimized for the good of the whole. Dempsey quotes one interviewee who reports excitedly, “China now has entire provinces designated as conservation provinces or development provinces, and they are basically targeting to development based on that planning and then within every province they have another plan that ... basically says where activities can be done and it’s all driven by biodiversity and ecosystem services.”⁶¹ Indeed, certain provinces, such as Qinghai, Hainan and the Tibet Autonomous Region, have been designated as places whose primary function is to provide ecological services for the rest of the country.

54 Yeh 2009, 891; Zinda et al. 2016; Shan Jie, “Tibetan villager resettlement program leads to improved ecology in Qinghai,” *Global Times*, 16 April 2019, <https://www.globaltimes.cn/content/1146161.shtml>.

55 Salimjan 2021, 59.

56 See: http://sourcecdp.rcees.cas.cn/yw/yjy/200906/t20090612_1038153.html.

57 Rodenbiker 2021.

58 Ruckelhaus et al. 2015.

59 Ouyang et al. 2016.

60 Mitchell 1991, 44.

61 Dempsey 2016, 118.

However, political-economic forces at different scales shape the reality on the ground such that the actual production of ecosystem services is often not the only, or even the primary, way in which decisions are made. Thus, while the declaration of ECRLs can be productively conceptualized as an effort to turn land (or water) into natural infrastructure serving the nation-state, implementation may not result in actual production of new ecosystem services. As we will see in the cases of the scenic areas, this goes beyond a principal-agent problem to competing and changing priorities within the central state itself.

ECRLs were incorporated into law and policymaking when they were written into China's revised National Environmental Protection Law in 2015. However, they are but the latest in a panoply of overlapping designations of conservation and protection zones, which also include nature reserves, Ecological Function Zones (EFZs) and Major Function-oriented Zones (MFOZs; *zhuti gongnengqu* 主体功能区). The plan for EFZs was released in 2008 and revised in 2015 by CAS and MEE, compiled from data from 14 government departments.⁶² Based on calculations of ecosystem services, 25 per cent of China's land area was designated as being within 50 "Key EFZs." In 2015, this was expanded to 49.4 per cent of China's land area in 63 Key EFZs.⁶³ These have been calculated to provide "77.7% of carbon-sequestration services, 75.3% of soil-retention services, 60.7% of sandstorm-prevention services, 76.8% of water-retention services, 60.2% of flood-mitigation services, and 67.6% of natural habitats."⁶⁴ Counties within these Key EFZs receive central-state-level subsidies as payments for ecological services, at a budget of UD\$9 billion in 2017.⁶⁵

These Key EFZs were then used as a basis for MFOZ planning, which was approved by the State Council in 2010 to optimize the spatial pattern of regional development and environmental conservation across China. It divides China's territory into four major types of zones: development optimized, development prioritized, development restricted, and development prohibited. Development-restricted zones, which constitute 40 per cent of China's territory, are "composed of 25 regions with high potential for ecological functions, including biodiversity conservation, freshwater provisioning, soil and nutrient conservation, and carbon sequestration." Like development-prohibited zones, which constitute 12.5 per cent of China's landmass, they are to function as natural infrastructure. However, there are significant overlaps between these four types of zones, which add up to 122 per cent of China's land area.⁶⁶

The paradigm of "red lines" was first established in 2006, when the State Council, responding to concerns about grain security, announced that cropland area nationwide must not fall below the red line of 120 million hectares. In 2010, additional red lines were declared for forestry cover and area. This was followed by a State Council declaration in 2011 on the need to "spatially determine" red lines for species conservation and ecosystem conservation, merging the minimum quantity approach together with spatial-functional zoning. These are based on a tripartite division of space into production space, living space and ecological space. Production spaces include agricultural and industrial zones; living spaces are cities and other residential areas; and ecological spaces, within the ECRLs, are "areas with an ecological function."⁶⁷

The declaration of ECRLs is intended to overcome existing overlaps and conflicts among different types of zones as well as implementation problems with national Key EFZs and MFOZs,⁶⁸ though the extent to which they will do so successfully is yet to be seen. ECRLs were proposed nationally in 2011 and formally adopted in 2017, when the Party Central Committee and State

62 Ouyang et al. 2019.

63 Ouyang et al. 2016; 2019.

64 Ouyang et al. 2016, 1457.

65 Ouyang et al. 2019, 185.

66 Lü et al. 2013.

67 Liu 2017.

68 Gao et al. 2020.

Council issued a document declaring that the exact spatial boundaries of ECRL areas must be completed for all provinces by 2020. In July 2021, China announced that this process was “basically completed,” with one-quarter of the country’s land area demarcated as being within these lines.⁶⁹ More than half of the Inner Mongolia Autonomous Region, about 30 per cent of Yunnan province, and roughly 30 per cent of Sichuan province are within the ECRLs.⁷⁰

ECRLs are described as “a ‘lifeline’ to protect ecosystem functioning,” and “the ecological area needed to guarantee and maintain ecological safety and functionality, and biological diversity for national security,” as well as “a strategy for building the nation’s ecological civilization” and “a key determinant of the Chinese ecological civilization process.”⁷¹ An article by Xi Jinping himself states that the guidelines for achieving ecological civilization include the “optimiz[ation] of the layout of China’s territorial space, and set[ting] red lines for environmental protection.”⁷² As with built infrastructures such as large dams and railroads, certain people living on land designated to be within ECRLs will have to be relocated.⁷³

In short, the demarcation of spatial zones for the purpose of creating natural infrastructure to produce ecosystem functions is a central part of “ecological civilization.” In the next section, I scale down from these national-level plans, to examine the lived reality and temporal experiences of rural residents when these abstract zones are materialized through the un-making of place. Specifically, I consider case studies from two scenic areas, located in Pengzhou city and Wenchuan county, both of which were heavily affected by the 2008 Wenchuan earthquake, and both of which overlap with Sichuan’s designated ECRLs.

Scenic Areas in Post-earthquake Sichuan

Within three months of the 2008 earthquake, the State Council ratified the “Overall Plan for Post-earthquake Restoration and Reconstruction,” which called for tourism to be the “pioneer industry” throughout the earthquake zone, which included both Pengzhou and Wenchuan. This focus on tourism dovetailed with the 2007 “Metropolitan Chengdu” strategy, later upgraded to the “World Modern Garden City,” as well as the 2018 new Chengdu Master Plan, all of which designated the Longmen Mountain Area, where Summit Village is located, as an “ecological belt” subject to controlled growth and conservation. Higher elevation parts of both Summit Village and Mountain Village are within ECRLs and are thus sites for the manifestation of Xi Jinping’s “two mountains” ecological civilization slogan.

Wolonggu Scenic Spot in Pengzhou

Until the establishment of Summit Mountain Scenic Area in 1986, villagers in Summit Village relied primarily on timber extraction for their livelihoods. In 1986, the implementation of logging restrictions began. Further regulations were put in place when it was promoted to a provincial-level scenic area in 1989. Thus, villagers gradually became involved with tourism, opening farm guesthouses (*nongjiale* 农家乐).⁷⁴ This became even more important after SLCP implementation began in 2000; households lost access to about 90 per cent of their farmland, leaving them with only small plots for potatoes and corn, which have little market value. Simultaneously, the rapid growth of the middle class and the relatively cool summers of Summit Village’s higher-altitude location brought growing numbers of visitors, including retirees from Chengdu and other cities who

69 Ouyang et al. 2016; Gao 2019; “China’s ecological red lines provide wisdom for global environmental conservation,” *Xinhua*, 16 September 2021, http://www.news.cn/english/2021-09/16/c_1310192064.htm. Accessed 4 March 2020.

70 Gao et al. 2020.

71 Jiang et al. 2019, 112; Xu et al. 2018, 447.

72 Xi 2019.

73 Gao 2019.

74 For more details see Fayazi, Yeh and Li 2019.

spent several months each summer living in *nongjiale*, which evolved from simple, modest houses to much more elaborate and expansive two-and-three-floor buildings. By the time the earthquake struck, tourism generated more than 80 per cent of household income in Summit Village.

Starting in 1989, the Pengzhou County Tourism Bureau operated the Summit Mountain Scenic Area. This had the greatest impact on Production Team 16, located at the highest elevation part of the village closest to the main scenic spots, because several government units expropriated land to build hotels. These residents thus became particularly reliant on tourism, taking on significant debts to enlarge their *nongjiale*. Most still owed substantial loans when the 2008 earthquake struck.

Soon after the establishment of the provincial-level Summit Mountain Scenic Area the Pengzhou county government sought to upgrade it to a national-level scenic area, with expanded boundaries and a new name, the Longmenshan National Scenic Area 龙门山国家级风景名胜區. The State Council approved the application and listed the Longmenshan National Scenic Area in the fifth batch of national scenic areas. The “Regulations on the Administration of Scenic and Historic Areas” stipulate that within two years of the listing of a national scenic area, the relevant provincial-level construction departments must organize the creation of a master plan and detailed plan and submit them to the State Council for approval. Failure to complete such a plan within two years “shall be given a sanction in accordance with the law.”⁷⁵ However, the provincial department never completed or submitted plans for the Longmenshan National Scenic Area.

Because the earthquake destroyed the Large and Small Dragon Pools, the two sites for which the Summit Mountain Scenic Area was most famous, the Pengzhou County Tourism Bureau abandoned its operations there. Due to the destruction of their houses, the lack of tourism and the fact that the road through the highest part of the village was not initially rebuilt, most residents of the village’s upper production teams spent the early years after the earthquake undertaking labour migration. In 2012, a town leader encouraged them to return to rebuild their houses and livelihoods. However, the lack of income due to the absence of tourism remained an immense challenge. Thus, in 2014, the village Party secretary and village head convened a meeting to discuss the challenge, resulting in a decision to try to develop a new scenic spot. Members of Production Team 16, along with neighbouring Production Team 15, explored a spot with several picturesque waterfalls, and which had not been affected by either the earthquake or a subsequent large debris flow in 2012. Villagers maintain that this site, previously called Shewoer 蛇窝儿 (Snake’s Lair), is in the collective forests of Production Teams 15 and 16. It had not been part of the provincial-level Summit Mountain Scenic Area, and though it was to have become part of the Longmenshan National Scenic Area, village leaders, who had carefully studied the national regulations, considered the national designation to have no legal status given that the provincial government had never submitted a master plan or detailed plan for approval.

The villagers renamed the spot Wolonggu 卧龙谷 (Crouching Dragon Valley) and developed it for tourism. They registered a new company in 2014, with the village Party secretary serving as its legal representative. Approximately 300 households invested in the company by purchasing 5,000-yuan shares. Some spent 100,000–200,000 yuan and the company was established with 10 million yuan in registered capital. With the investment, the company hired around 30 village employees, built a new four-kilometre road from Production Team 16 to the new scenic spot, and a 100-metre-by-7-metre hanging bridge over the river running through the village, with an investment of two million yuan. Within the new scenic area, the company built small paths, pavilions, toilets and a wastewater treatment facility.

75 Scenic areas were under the purview of the Ministry of Construction until the administrative reorganization of March 2018, when they were put under the National Forestry and Grassland Administration, administered by the Ministry of Natural Resources. The Ministry of Construction was renamed the Ministry of Housing and Urban-Rural Development in 2008.

The village company carefully charged only a 10-yuan parking fee per vehicle and a 10-yuan “cleaning fee” per person, rather than selling “tickets.” Visitors were soon so numerous that they generated significant income both from the fees and from the large numbers of tourists who once again flocked to stay as guests at the village’s many *nongjiale*. During the summer, tens of thousands of tourists arrived every day. Even during the much colder Spring Festival holiday period as many as 10,000 visitors came. Villagers recorded 600,000–700,000 visitors for the 2015, 2016 and 2017 seasons, bringing in four million to six million yuan for the village company each year. Some households reportedly made upwards of 100,000 yuan annually during these years, prompting new investments in expanded guesthouses. Of the profits from fees, 80 per cent was reinvested in the company. The remaining 20 per cent was allocated to the village committee and five teams based on collective forest property rights. In addition to investments in pavilions, toilets and paths, the company also paid social insurance for company employees. The village committee share was used to pay salaries to 40 additional villagers, mostly poor and disabled, to work on small tasks during the busy tourist season.

The local government was supportive of these efforts. In December 2016 a deputy mayor of Pengzhou and a vice chair of the standing committee of the Pengzhou People’s Congress visited Wolonggu where, according to official news reports, they “fully affirmed the construction work” and urged “ensuring quality, speeding up progress and completing the construction of the scenic spot.” Moreover, in February 2017, the Party secretary of Pengzhou visited Wolonggu together with the town Party secretary, where they learned about “the industrial [i.e. tourism] development of the local people” and “fully affirmed the construction and safety work of Wolonggu.”

As discussed above, this came to a precipitous end in August 2017 when the scenic area was shut down and its infrastructure destroyed during the Central Fifth Environmental Inspection Group’s visit to Sichuan. According to the official notice, the shutdown was due to the company’s failure to obtain government authorization to operate inside the scenic area. Legally, no construction activities within a national scenic area can be authorized before a master plan has been approved, but as Summit Village leaders are quick to point out, after more than a decade, the government still had not submitted a plan for the national scenic area for approval, making the national scenic area itself invalid. The following August, the head of the Chengdu Municipality Urban-Rural Construction Bureau Party Committee conducted a follow-up visit to Wolonggu to “investigate the rectification of relevant issues concerning the illegal construction in the Longmenshan Scenic Area based on feedback from the Central Environmental Protection Inspector.”⁷⁶

The closure of Wolonggu devastated village livelihoods. Yet, it did not end plans for having a scenic area. Instead, the Pengzhou government turned planned management of Wolonggu Scenic Spot over to a state-owned company of the Pengzhou Municipality Tourism Bureau. After the Pengzhou Municipality Tourism Company valued the village company at 42 million yuan, the village leadership requested compensation in that amount, but they were denied. One angry villager exclaimed, referring to the “rural revitalization” (*xiangcun zhenxing* 乡村振兴) campaign, “it’s like they don’t want to revitalize the countryside!” and another argued that this was contrary to the national goal of achieving a “moderately prosperous society.”

Significantly, the village leadership held to their interpretation of the illegitimacy of the national-level scenic area, the pretext for the local state to seize the scenic area as an income-generating opportunity as a result of the central-level environmental inspection. Indeed, the village Party secretary also pointed out that the new arrangement was also illegal according to the national regulations on scenic areas, which state that administrative agencies – rather than companies – should sell tickets for entering scenic areas.⁷⁷ Chu notes that the growing role of infrastructure in state power

76 Chengdu government, 20 August 2018. Contact author for citation for these news reports.

77 “Zhonghua renmin gongheguo guowuyuan ling di 474 hao” (Order of the State Council of the People’s Republic of China no. 474), *Gov.cn*, 19 September 2006, http://www.gov.cn/zwgk/2006-09/29/content_402732.htm. Accessed 15 May 2019.

has also diffused politics into legal structures in a way that deflects accountability. State infrastructural power involves public notices, plans and documents about infrastructures and their dismantling, which “dispel ongoing conflicts by simultaneously narrowing and proliferating sites of accountability for making claims and counterclaims.”⁷⁸ As of December 2021, the situation remained unresolved.

Panda Scenic Spot in Wenchuan

A similar set of dynamics have shaped Meadow Village, River Town, in Wenchuan county, Aba prefecture, just west of Chengdu municipality. Meadow Village was the site of Panda Scenic Spot, which was established in 1999 by a Chengdu-based entrepreneur. The location, in the upper forested area of the village, was on the boundary of the buffer and core zones of the Wolong Nature Reserve, which was first established in 1963. The reserve’s 1975 expansion incorporated some of Meadow Village’s collective forests, leaving them only with lower-elevation collective forests. The village relied largely on agriculture until the implementation of SLCP, which resulted in more than 75 per cent of household farmland being planted with trees, leaving households with an average of 0.7 *mu* of remaining farmland.

Fortunately for the households, Panda Scenic Spot was established at the same time as they lost their subsistence farmland to SLCP. Given its location at the boundary of the buffer and core zones of the Wolong Nature Reserve, the provincial forestry department had to issue a special memorandum allowing the construction of the scenic area, which included several hotels. Panda Scenic Spot featured horse rides, rafting, ziplines, camping, a three-kilometre mini train track and hiking opportunities. The construction of the scenic spot brought a well-paved road to the village, as well as income-earning opportunities such as carrying tourists up the path on wooden sedans, carrying packs for rafters, guiding hikers and running barbecues. Villagers began to turn their houses into *nongjiale* for tourists.

Despite its proximity to the earthquake epicentre, Meadow Village was not severely affected and the main hotel in Panda Scenic Spot remained standing. Nevertheless, the county invested significantly in reconstruction and purchased the scenic spot from the initial investor for over 100 million yuan. As part of the earthquake recovery effort, the National Tourism Administration bestowed “AAAAA Special Tourist Attraction” status on several sites in Wenchuan county, including Panda Scenic Spot. This rating is supposed to indicate China’s most important and best maintained attractions and was meant to spur tourism in Wenchuan. Beginning in 2012, the county operated the entire AAAAA Wenchuan Special Tourist Attraction as a county-owned enterprise. As part of it, the Panda Scenic Spot was officially described as being “an important part of the Wolong National Nature Reserve.” River Town’s primary economic strategy after the earthquake was to develop its “ecological and health cultivation” tourism industry, catering to urban residents from Chengdu, Mianyang 绵阳 and Chongqing. Among the 101 households of Meadow Village, 77 were operating *nongjiale* in 2017.

In 2017, however, the scenic spot was abruptly closed as a result of environmental inspections, due to its location on the border of the buffer and core zones of the Wolong National Nature Reserve, where such construction and commercial activity was, in fact, never permitted. The provincial forestry department, which had approved the construction, was not held accountable. All of the infrastructure except for one hotel, deemed too large to remove without excessive damage, was dismantled and removed. This included train tracks, a small hydropower plant and several hotels. The action shocked the residents of Meadow Village. “I was so angry. I didn’t believe it as it happened overnight,” said one leader. He reported that many villagers cried, because they realized they now had no way to recover the loans they had taken out to build and expand their *nongjiale*. Village income reportedly fell immediately by half.

78 Mann 2008; Chu 2014, 355; Bach 2016.

This closure, which coincided with the end of SLCP subsidies, was followed almost immediately by the village leaders' discovery that the entire village had been slated for inclusion into the newly declared Giant Panda National Park 大熊猫国家公园. At the time of this surprise discovery, Meadow Village leaders had been negotiating with a company for new rafting operations outside of the core and buffer areas of the Wolong Nature Reserve, in a bid to bring tourists back in the wake of the scenic spot's closure. However, in 2019, as they planned to reach a deal with the company, the county government informed them that rafting would not be allowed at all inside the new national park.

Unusually, the leaders of Meadow Village do not blame local officials, but rather Xi Jinping himself, and his ecological civilization drive, for making peasants, in their words, "the last of the last" in today's China:

I'm a Party member, but I have some critiques of the Party's policies. During that era [when the scenic spot was established and after earthquake reconstruction] – they gave us the opportunity for livelihood. The current Party has closed this off. If the policies at that time were wrong – well it was still the Communist Party. It's like two sisters, born of the same mother. You can't say the elder sister is wrong and reject it completely after the second is born. I'm a bit against Xi Jinping doing this. Especially his two mountains theory. We peasants are not afraid of saying things like this.

Harkening back to CCP priorities from an earlier period, this village leader draws on a different sense of historicity than that promoted by current CCP leaders. Ecological civilization only looks forward to a promised future of a "Beautiful China" and the Chinese Dream, whereas this villager insists on looking back to earlier promises made but now as studiously ignored as infrastructural rubble.

In both Summit Village and Meadow Village, post-earthquake infrastructural time was experienced as a process of accretion, a slow building-back of *nongjiale*, scenic areas and livelihoods with a hoped for but not guaranteed endpoint of a good life. The arrival of ecological civilization and its prioritization of natural infrastructure demolished many of these investments, to clear the way for a national-scale infrastructural time that promises a new future in which village-controlled scenic areas have no part. Rather than the failure of a promised infrastructure to materialize, here the unfortunate arrival of the promise of natural infrastructure leads to the ruination of an imagined future.

Conclusion

The cases of Meadow Village and Summit Village illustrate what happens to places when the central state's interests shift from the production of built infrastructure to support livelihoods in the aftermath of a destructive earthquake to a focus on parcelling national territory into functional zones and red lines, creating natural infrastructure to produce ecosystem services to support the continuation of the capitalist economy. In the combination of technical calculations to optimize ecosystem services and top-down campaign-style enforcement, oil refineries, chemical industry parks and pavilions built by villagers with collective assets are rendered equivalent as infrastructures that embody promissory notes of a future no longer considered valid.

Ecosystem services provision has taken a decidedly authoritarian turn under Xi Jinping. This authoritarianism has given technical tools for the production of natural infrastructure more purchase in China than in many other countries, where the conversion of built to natural infrastructure impinges on multiple interests. However, the demolition of built infrastructure that is deemed necessary in zones set aside for ecosystem services, serves the interests of central state power and the urban consuming middle classes, while the resulting infrastructural rubble of peasants'

livelihood resources is the subject of “imperial disregard” – it is ignored or regarded as irrelevant in the pursuit of ecological civilization.

At the same time, however, the calculative work of demarcating zones and ECRLs does not mean that China has seamlessly become an idealized ecological state. The territorialization of one-quarter of China’s land area as a surface dedicated to the optimization of ecological services is inevitably deeply political. Top-down campaigns to enforce environmental regulations have effects beyond disciplining wayward local officials. They can also allow powerful actors to expropriate ecological, aesthetic and entrepreneurial resources from villagers, producing resentment from those who find themselves with no legitimate place, while diffusing contestation into the legal sphere.

Finally, I have used the term infrastructure in two interrelated ways – as an object of analysis and as a medium of social analysis that draws attention to the often obscured technopolitical work done by things that take the form of infrastructure. The figure–ground reversal of infrastructural analysis suggests we pay attention not only to bureaucratic politics in campaign-style enforcement, which has been amply discussed within Chinese studies, but also to the material fact of demolition itself, which receives considerable attention in infrastructural studies but not as much within Chinese studies. Grounding ecological civilization in two case studies of post-earthquake Sichuan, we see multiple forms of infrastructure at work: the built infrastructure that is dismantled and the abstract “natural” infrastructure that provides the rationale for the demolition of villagers’ paths and pavilions, and their imagined futures. Rubble is the result of the displacement of village infrastructural time to make way for a nation-state-scale temporality.

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References

- Appel, Hannah.** 2018. “Infrastructural time.” In Nikhil Anand, Akhil Gupta and Hannah Appel (eds.), *The Promise of Infrastructure*, 41–61. Durham, NC: Duke University Press.
- Appel, Hannah, Nikhil Anand and Akhil Gupta.** 2018. “Introduction: temporality, politics and the promise of infrastructure.” In Nikhil Anand, Akhil Gupta and Hannah Appel (eds.), *The Promise of Infrastructure*, 1–40. Durham, NC: Duke University Press.
- Bach, Jonathan.** 2016. “China’s infrastructural fix.” *Limn* 7. <https://limn.it/chinas-infrastructural-fix/>.
- Bélanger, Pierre.** 2009. “Landscape as infrastructure.” *Landscape Journal* 28 (1), 79–95.
- Benedict, Mark, and Edward McMahon.** 2006. *Green Infrastructure: Linking Landscapes and Communities*. Washington, DC: Island Press.
- Bowker, Geoffrey C.** 1994. *Science on the Run: Information Management and Industrial Geophysics at Schlumberger, 1920–1940*. Cambridge, MA: MIT Press.
- Campbell, Jeremy.** 2012. “Between the material and the figural road: the incompleteness of colonial geographies in Amazonia.” *Mobilities* 7 (4), 481–500.
- Carse, Ashley.** 2012. “Nature as infrastructure: making and managing the Panama Canal watershed.” *Social Studies of Science* 42 (4), 539–563.
- Carse, Ashley.** 2017. “Keyword: infrastructure.” In Penny Harvey, Casper Jensen and Atsuro Morita (eds.), *Infrastructures and Social Complexity: A Companion*, 27–39. New York: Routledge.
- Carse, Ashley, and David Kneas.** 2019. “Unbuilt and unfinished: the temporalities of infrastructure.” *Environment and Society* 10, 9–28.
- Chu, Julie.** 2014. “When infrastructure attack: the workings of disrepair in China.” *American Ethnologist* 41 (2), 351–367.
- Dempsey, Jessica.** 2016. *Enterprising Nature: Economics, Markets, and Finance in Global Biodiversity Politics*. Malden, MA: John Wiley & Sons.
- Fayazi, Mahmood, Emily T. Yeh and Fan Li.** 2019. “Development and divergent post-disaster trajectories in a mountain village: temporal dynamics of differentiation after the 2008 Wenchuan earthquake.” *World Development* 124, 1–12. DOI: 10.1016/j.worlddev.2019.104663.
- Gao, Jixi.** 2019. “How China will protect one-quarter of its land.” *Nature* 569, 457.

- Gao, Jixi, Yan Wang, Changxin Zou, Delin Xu, Naifeng Lin, Lixiang Wang and Kun Zhang. 2020. "China's ecological conservation redline: a solution for future nature conservation." *Ambio* 49 (9), 1519–1529.
- Geall, Sam, and Adrian Ely. 2018. "Ecological civilization in contemporary China." *China Quarterly* 236, 1175–1196.
- Gordillo, Gaston. 2014. *Rubble: The Afterlife of Destruction*. Durham, NC: Duke University Press.
- Goron, Coraline. 2018. "Ecological civilization and the political limits of a Chinese concept of sustainability." *China Perspectives* 2018 (4), 39–52. <http://journals.openedition.org/chinaperspectives/8463>.
- Gupta, Akhil. 2018. "The future in ruins: thoughts on the temporality of infrastructure." In Nikhil Anand, Akhil Gupta, and Hannah Appel (eds.), *The Promise of Infrastructure*, 62–79. Durham, NC: Duke University Press.
- Hamel, Perrine, Maike Hamann, Jan Kuiper, Erik Andersson, Katie Arkema, Jess Silver, Gretchen Daily et al. 2021. "Blending ecosystem service and resilience perspectives in planning of natural infrastructure: lessons from the San Francisco Bay Area." *Frontiers in Environmental Science*. <https://www.frontiersin.org/articles/10.3389/fenvs.2021.601136/full>.
- Hansen, Mette Halskov, Hongtao Li and Rune Svarverud. 2018. "Ecological civilization: interpreting the Chinese past, projecting the global future." *Global Environmental Change* 53, 195–203.
- Hetherington, Kregg. 2014. "Waiting for the surveyor: development promises and the temporality of infrastructure." *Journal of Latin American and Caribbean Anthropology* 19 (2), 195–211.
- Hetherington, Kregg. 2019 "Introduction." In Kregg Hetherington (ed.), *Infrastructure, Environment and Life in the Anthropocene*, 1–14. Durham, NC: Duke University Press.
- Jiang, Bo, Yang Bai, Christina Wong, Xibu Xu and Juha Alatalo. 2019. "China's ecological civilization program – implementing ecological redline policy." *Land Use Policy* 81, 111–114.
- Kostka, Genia, and Chunman Zhang. 2018. "Tightening the grip: environmental governance under Xi Jinping." *Environmental Politics* 27 (5), 769–781.
- Kostka, Genia, and William Hobbs. 2012. "Local energy efficiency policy implementation in China: Bridging the gap between national priorities and local interests." *China Quarterly* 211: 765–785.
- Lam, Tong. 2019. "Futures and ruins: the politics, aesthetics and temporality of infrastructure." *Made in China* 4 (2), 78–83.
- Li, Yifei, and Judith Shapiro. 2020. *China Goes Green: Coercive Environmentalism for a Troubled Planet*. Cambridge: Polity Press.
- Liu, Qin. 2017. "Ecological red lines: from words to action." *Chinadialogue*. <https://www.chinadialogue.net/article/show/single/en/9689-Ecological-red-lines-from-words-to-action>.
- Lü, Yihe, Zhimin Ma, Liwei Zhang, Bojie Fu and Guangyao Gao. 2013. "Redlines for the greening of China." *Environmental Science & Policy* 33, 346–353.
- Mai, Wanhua. 2018. "Zhongshan shuiyuan di weijian jiudian guibinlou – quanbu chaichu fulü 2,500 pingfangmi" (VIP building of illegally built hotel in the Zhongshan water source – completely demolished to restore a green area of 2500 square meters). *Xiao kang* (Insight China) 14, 42–43.
- Mann, Michael. 2008. "Infrastructural power revisited." *Studies in Comparative International Development* 43: 355–365.
- Mitchell, Timothy. 1991. *Colonising Egypt*. Berkeley: University of California Press.
- Oakes, Tim. 2019. "China Made: infrastructural thinking in a Chinese register." *Made in China* 4 (2), 66–71.
- Ouyang, Zhiyun, Hua Zheng, Yi Xiao, Stephen Polasky, Jianguo Liu, Weihua Xu, Qiao Wang et al. 2016. "Improvements in ecosystem services from investments in natural capital." *Science* 352 (6292), 1455–1459.
- Ouyang Zhiyun, Changsu Song, Christina Wong, Gretchen C. Daily, Jianguo Liu, James Salzman, Lingqiao Kong et al. 2019. "China: designing policies to enhance ecosystem services." In Lisa Manlde, Zhiyun Ouyang, James Salzman and Gretchen Daily (eds.), *Green Growth that Works*, 177–194. Washington, DC: Island Press.
- Rippa, Alessandro. 2019. "Infrastructure of desire: rubble, development and salvage capitalism in rural China." *Made in China* 4 (2), 103–107.
- Rodenbiker, Jesse. 2021. "Making ecology developmental: China's environmental sciences and green modernization in global context." *Annals of the American Association of Geographers* 111 (7), 1931–1948.
- Ruckelhaus, Mary, Emily McKenzie, Heather Tallis, Anne Guerry, Gretchen Daily, Peter Kareiva, Stephen Polasky et al. 2015. "Notes from the field: lessons learned from using ecosystem service approaches to inform real-world decisions." *Ecological Economics* 115, 11–21.
- Salimjan, Guladana. 2021. "Naturalized violence: affective politics of China's 'ecological civilization' in Xinjiang." *Human Ecology* 49: 59–68.
- Schmitt, Edwin. 2018. "Living in an ecological civilization: ideological interpretations of an authoritarian mode of sustainability in China." *CADAAD Journal* 10 (2), 69–91.
- Shen, Yongdong, and Anna Ahlers. 2019. "Blue sky fabrication in China: science-policy integration in air pollution regulation campaigns for mega-events." *Environmental Science & Policy* 94, 135–142.
- Star, Susan, and Ruhleder, Karen. 1996. "Steps toward an ecology of infrastructure: design and access for large information spaces." *Information Systems Research* 7 (1), 111–134.
- Stoler, Ann. 2009. *Along the Archival Grain: Epistemic Anxieties and Colonial Common Sense*. Princeton, NJ: Princeton University Press.

- Tang, Dorothy.** 2019. "Between poetics and utility: landscape infrastructure in China." *Made in China* 4 (2), 90–96.
- Van der Kamp, Denise.** 2021. "Blunt force regulation and bureaucratic control: understanding China's war on pollution." *Governance* 21, 191–209.
- Van Rooij, Benjamin.** 2006. "Implementation of Chinese environmental law: regular enforcement and political campaigns." *Development and Change* 37 (1), 57–74.
- Wang, Alex** 2018. "Symbolic Legitimacy and Chinese Environmental Reform." *UCLA School of Law, Public Law Research Paper No. 17-39*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3052010.
- Xi, Jinping.** 2019. "Pushing China's development of an ecological civilization to a new stage." *Qiushi* 11 (2), 39. http://english.qstheory.cn/201909/17/c_1124932126.htm.
- Xiao, Liangang, and Rongqin Zhao.** 2017. "China's new era of ecological civilization." *Science* 358 (6366), 1008–1009.
- Xu, Xibao, Yan Tan, Guishan Yang and Jon Barnett.** 2018. "China's ambitious ecological red lines." *Land Use Policy* 79, 447–451.
- Yeh, Emily T.** 2009. "Greening western China: a critical view." *Geoforum* 40, 884–894.
- Zinda, John, Kelly Hopping, Edwin Schmitt, Emily Yeh, Stevan Harrell and Eugene Anderson.** 2016. "China's ecosystems: sacrificing the Poor" *Science* 353 (6500), 657–658.

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