Imagine air: Global commons, 'ecological civilization', and citizen visions beyond carbon markets in China

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Abstract
In global environmental governance, efforts to reduce greenhouse gas emissions often involve turning pollution rights into commodities, essentially privatizing the air. Policies like carbon pricing and market approaches are considered effective solutions, especially within capitalist systems, and continue to rely on logics of the tragedy of the (atmospheric) commons. In China, the Communist Party proposed environmental policies aligning with capitalist development principles under the concept of 'ecological civilization'. However, the perspectives on the ground differ from the government's plans. Citizens, including sci-fi enthusiasts and eco-utopian thinkers in both rural and urban areas, have their own visions for a shared future that go beyond the narrow focus on economic growth, markets and pricing. Contrary to official narratives, interviews, social media discussions and popular artworks reveal that many envision the future 'ecological civilization' with clean air as commons for the more-than-human world. I argue that anthropological perspectives must attend to such creative spaces in which political subjects become enfolded in the commons, without eclipsing their potential to reinforce class divisions and social inequalities in environmental aspirations.

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Carbon: From molecule to credit – and then back to element

Economic approaches to mitigating climate change largely assume the atmosphere as a global commons, focusing on pollution practices as "external" to conventional economic accounting, with degradation avoided by privatizing pollution rights and trading them on markets, carbon markets. In what follows, I explore questions and conundrums that emerge from understanding carbon through theories of commons, including: How did the carbon cycle become commodified? How is this process entangled with understandings of the atmosphere as a commons? How might shifting perspectives on commons contribute to forging horizons around an anthropology of carbon?

To address these questions, I begin by tracing the shift of carbon from molecule to a credit, and then outline possible horizons through theories of an elemental commons for carbon anthropology. The concept of carbon credits originally has its roots in discourse of the "tragedy" of the commons. These economic solutions, devised to combat climate change, transform carbon dioxide from a molecular entity into a tradeable credit. However, exploring recent theoretical interventions takes carbon back full circle to its elemental form. This raises the question whether an elemental commons tied to the air, the atmosphere, and carbon can be brought to bear on an emerging political subjectivity in China and beyond. Within the Chinese world, actions envelop individuals in bubbles of clean air, extending from lungs to domes, in highly uneven ways. Moreover, examining state policies reveals how unequal burdens, especially based on class and locality, fall on those subjected to the Chinese carbon economy.

Ethnographic insights from fieldwork conducted among carbon consultants, forest carbon offset workers, and sci-fi enthusiasts in the People's Republic between 2016 and 2019 highlight how ideas of carbon consciousness and atmospheric commons are taken up on the ground. Foresters critique the isolation of elements for commodification and a beekeeper pins holistic hopes on interspecies cooperation in ways that enfold carbon logics within grassroots conceptions of the commons for imagining the future. Literary examples of pan-species communism and artistic engagements with our shared atmosphere further deepen understandings of carbon's political potential within the elemental commons.

Carbon dioxide as a molecule

Antoine Lavoisier first put forward the idea of the carbon cycle between 1772 and 1790 (Galvez and Gaillardet, 2012). In the 1840s J.J. Ebelmen proposed a connection to atmospheric composition, describing the alteration of silicates on continents and carbonates in the ocean, and considering the latter a carbon dioxide sink (Galvez and Gaillardet, 2012). In the early 20th century, a synthetic model of the carbon cycle emerged that comprehensively linked carbon in sediments, atmosphere, oceans, and organisms, as well as fossil fuels (Galvez and Gaillardet, 2012). In 1896, Swiss electrochemist Svante Arrhenius argued that changes in terrestrial temperatures could be related to fluctuations in atmospheric carbon dioxide (CO_2) concentration (Galvez and Gaillardet, 2012). He and colleague Nils Ekholm predicted that industrial emissions would lead to a noticeable

increase in CO_2 levels within a few centuries, but these theories were initially dismissed (Calel, 2011: 5). Only in 1938 was British engineer Guy Stewart Callendar, a steam engineer and inventor, able to show that land temperatures had increased in the intervening 50 years (Weart, 2008). Callendar proceeded to link these findings to rising carbon dioxide concentrations in the atmosphere (Weart, 2008).

In subsequent decades, data linking rising temperatures and industrial emissions led to military funding for climate science, particularly in the US (Weart, 2008). By the 1970s, concerns about anthropogenic climate change grew, culminating in the 1985 Vienna conference, where climatologists warned of rising temperatures and sea levels. Economists translated these findings about atmospheric composition into policy, shaping environmental governance, including their explicit references to the atmosphere as a "global commons" – a perspective that persists in academic papers and research centers on climate policy.

Atmosphere as commons

Carbon trading as a mechanism to address climate change arose from economic debates on pollution management that, explicitly or implicitly, treated (clean) air as unbounded commons. In the 1920s, economist Arthur Cecil Pigou recommended taxing private entities for negative social outcomes not conventionally accounted for in economic calculations (Calel, 2011). His teacher, Alfred Marshall (1920) previously proposed that economic externalities (of costs beyond balance sheets) could be offset by a tax to factor the actual costs of economic activities into decisions (Choy, 2021: 239). By contrast, Ronald Coase (1960) argued that privatizing the commons and then trading the resulting property rights more efficiently integrated externalities (such as environmental costs) in economic calculations, especially if transaction costs stayed low (Hepburn, 2007). Although both Pigou and Coase referred to air pollution and factory smoke in making their arguments (Choy, 2021: 240), it took decades for their ideas to evolve into policy advocating government regulation and pollution limits for permit trading.

Support for this approach was augmented by Garrett Hardin's (1968) assertion that resource depletion was a result of property held in common and administered by open access. Within a "finite world" he argued that private property regulations could avert this disaster. However, Hardin himself exempted air and water pollution from this solution due to their potentially unbounded effects (see Pena-Valderrama, 2016: 44). Nonetheless, Hardin's thesis of the "tragedy of the commons" was extended to the claim that diminishing clean air was best countered by privatizing pollution rights. The resulting carbon markets effectively de-territorialize emissions reductions, supposedly displacing them to places where they can be sold at the highest price or produced at the lowest cost (Lo, 2016: 19).

Markets for greenhouse gas emissions

Early US environmental services markets paved the way for global CO_2 markets (Hepburn, 2007; Pena-Valderrama, 2016). The 1977 US Clean Air Act created an offset

program allowing firms to trade emission quotas and therefore also expand and build in non-regulated areas. Reagan's 1980s neoliberal policies further promoted emissions trading as a cost-effective strategy for pollution control. The 1990 Clean Air Act Amendments introduced a national sulfur dioxide emissions market to combat acid rain. Meanwhile, in 1988, the UN established the Intergovernmental Panel on Climate Change (IPCC) to assess the causes and consequences of global warming. Carbon trading gained global significance with the 1997 Kyoto Protocol that took effect in 2005, and extended the 1992 UNFCCC commitment to limit greenhouse gases.

Framing the atmosphere as a commons frequently arises in the context of new institutional economics, often emphasizing multi-stakeholder solutions and applying Elinor Ostrom's principles for managing common pool resources. For instance, Paavola (2011) delves into the issue, posing the question in a chapter title, "Climate change: The ultimate tragedy of the commons?" and responding by advocating polycentric climate governance to reduce carbon emissions. This approach treats the atmospheric commons merely as a resource for humans, with state-market governance and public-private cooperation as solutions for its depletion. Anthropologically, these policy approaches overlook the creative potential of carbon's political effects, and its ties to political subjectivity (Günel, 2014, 2016; Whitington, 2016, 2020). Nonetheless, China has put these theories into practice through carbon market experiments in recent years.

Carbon in China

As the "workshop of the world" China faces acute environmental challenges, reaping both profits and pollution from global industrial production and manufacturing. To address this, China's 2011 Five-Year-Plan set in motion the progressive establishment and institutionalization of a domestic carbon market. The government established its own Chinese Certified Emissions Reductions and launched eight trial cap-and-trade schemes in five cities (Beijing, Shanghai, Tianjin, Shenzhen, Chongqing) and three provinces (Guangdong, Hubei and Fujian). Each pilot tested alternative variables to inform best-practice scenarios for an eventually unified carbon market. Launched in 2021, it covered fewer sectors than initially anticipated, but remains the world's largest carbon market by the amount of emissions covered.

The Chinese carbon market's "experimentation" approach has sparked cynicism and critique within the country, including from those charged with its roll-out (Bruckermann, 2023). As the government tries to maneuver the country away from heavy industries and manufacturing and towards an "ecological civilization" (*shengtai wenming*), the idea of harnessing the power of the economy to save the environment seems like a win-win. As propaganda expounds the virtues of "low-carbon life" (*ditan shenghuo*) to companies, households, and individuals, carbon has become a centerpiece of efforts to steer China into a greener future. At a more personal scale, even citizens unmoved by state rhetoric on "low-carbon development" and "ecological civilization" sometimes see themselves as evidence of an increasing "ecological consciousness" (*shengtai yishi*) in China (Bruckermann, 2024).

Carbon and the elemental commons

> Carbon: a chemical element, C, fifteenth most abundant element in the earth's crust, fourth most abundant element in the universe, second most abundant element in the human body, the key element for all known human and non-human life on earth.

> What might persuade you that anthropology should discard the distinction between life and non-life if not carbon? (Cross, 2019)

Starting with "the elements" as a cosmological and chemical point of departure, the hazards, hopes, and harms, as well as the efforts, struggles, and labor of elemental transformation become apparent, de-centering conventional framings of resources, productivity, and the market (Papadopoulos et al., 2021). Taking the poetics, and politics, of these shifts seriously, raises the question of how to locate sovereignty and subjectivity in these theoretical maneuvers.

In terms of elemental poetics, Dimitris Papadopoulos (2018) traces techno-scientific practices entangled with, and generative of, alternative ontologies as experimental processes. Elizabeth Povinelli (2016) theorizes the late liberal order through geonto-power, which distinguishes between life and non-life, and traces grassroots struggles that challenge this normative view, including incorporating the perspectives of fossils, fogs, and weirs. Deepening this methodological approach through "care" for the earth, María Puig de la Bellacasa (2015) engages with soil as a living community, not a lifeless receptacle for crop production. Moreover, Bellacasa's attentiveness to the temporalities of breakdown and reconstitution in soil's constitutive elements can be brought to bear on carbon cycles. For carbon, too, a myopic focus on raising productivity by burning fossil fuels, which took millions of years of vegetative decomposition to accumulate, cannot be "offset" by brief capture and containment in forest carbon. These temporal cycles simply cannot be made to sync up (see Lohmann, 2008).

Kathryn Yusoff (2017) expands the geologic notion of the commons, again not as standing reserves for capitalism, but as a domain for political subjecthood within Anthropocene thought, and defying invocation of a false "we". Yusoff's political subjectivity affirms historical rupture, burns with communist generosity, and refuses to serve capitalism. She calls for a political subjectivity that rejects calculative logics in favor of "awakening a private life that is organized around the depths of an emotional experience" (Yusoff, 2017: 265) From this political subjecthood, inequalities, exclusions, but also elements held in common through fragile alliances, emerge on the threshold of the self.

Pollution and politics of the self in the Chinese world

Extending this elemental approach to carbon, ethnographic studies can analyze state projects and societal responses to managing carbon emissions in China. This involves examining government policies, local engagement, and broader social dynamics surrounding carbon-related initiatives. Although not primarily focused on the notion of

carbon, Timothy Choy's work in Hong Kong and Jerry Zee's in Beijing offer insights into air and pollution in the region, opening up possibilities for an anthropology of carbon.

Choy (2021) explores the economic concept of "externalities," focusing on social and environmental costs ignored in pricing. Quoting his lecturer in environmental economics, Choy recalls the phrase, "Breathers pay," highlighting the unequal burden of air pollution. He calls for an "atmospheric reckoning" to address how unevenly the conditions of contaminated and clean air are distributed (Choy, 2021: 236). Choy also warns of the dangers in assuming the universality of the "breather" and emphasizes the speciest, racial and class inequalities within the "commons of breathing" (Choy, 2021: 241). From asthmatic baby rats exposed to particulate matter in laboratories to water bodies and ocean worlds sequestering carbon, Choy provides thought-provoking sketches of who populates a potential "museum of breathers." In an ethnographic exploration of the uneven distribution of air pollution in Hong Kong's urban fabric, Choy (2011: 159–60) shows how pockets of air, undulating topography, and architectural constructions merge with colonial histories and contemporary practices of mobility, race, and class to stratify exposure, thus segmenting environmental harm from toxic particulate matter.

Facing related ethnographic concerns, Jerry Zee (2015) begins his exploration of Beijing with Chen Guangbiao's 2013 stunt of selling fresh air in cans. As Zee points out, walking in the city is also breathing in the city, and the political consequences of pollution are manifold, yet stratified. When President Xi Jinping stepped in front of cameras without a mask on a polluted day in 2014, he nonetheless proclaimed we are "Breathing together, sharing a common destiny," eclipsing the lived realities of unequal exposure to noxious atmospheres (Zee, 2015: 49). While the air of Beijing is held in suspension by the mountains, inside the city's architectural spaces – from old courtyards to modern high-rises – act as enclosures for the consumption of clean(er) air. From face masks to air filters, experiments with massive chambers and covering over playgrounds, Zee points out how many solutions rely on privatized spaces and the creation of personal bubbles. As the cyborg meme "I don't want to be a human vacuum cleaner" circulated alongside masked selfies in 2011 exemplifies, the line between body and machine, with both lungs and buildings acting as permeable filters, are increasingly blurred in the production of spaces to breathe (Zee, 2015: 54).

Carbon offset forest in Fujian

I now turn to my own ethnographic fieldwork. Within a carbon offset project in rural Fujian, a lush, forested province in southeast China, the forest as commons was in tension with the notion of an atmospheric commons, as local ecological engagement with the forest outweighed global concerns of atmospheric composition and climate change. Moreover, class relations played a key role in restructuring forest work according to the logics of climate finance.

Yasen,[1] a state forest company, navigated the complexities of carbon trading due to the inclusion of forestry offsets in Fujian carbon markets. Yasen received a substantial provincial subsidy, and intended to profit from selling carbon credits on the Fujian emissions exchange. However, generating forest carbon credits involved intricate

accounting, requiring external consultants and significant bureaucratic hurdles. The company's dependence on financial expertise from carbon auditing and trading companies meant much of the funding went to these consultants, while pressure increased internally through sub-contracting forest management work to local villagers. One of the company's accountants, Kuaiji, criticized the temporal mismatch between slow ecological changes and rapid financial turnover, as well as how funds dissipated through the division of labor. Turning the forests into carbon reservoirs also required extensive measurements by the forest company itself.

Measuring the vegetation in mid-2017 for a carbon capture inventory involved marking trees and assessing their carbon capture capacities. Forester Celiang initially supported the carbon credit scheme, but later questioned whether monetizing individual forest elements was worthwhile, instead emphasizing a more holistic view that forests were a "public good" (*gongyi*). As he had spent months measuring sample plots, I asked whether he gained new perspectives on carbon through working on project. He answered:

> I didn't learn anything new [from taking measures for a carbon offset forest project] in relation to carbon. I am a biologist (*shengwuxuejia*), very familiar with the carbon cycle. I mean, all life is carbon-based (*tanji shengwu*), right? So, what I did learn, is how economists can monetize a natural process, and make money from a tree without cutting it down, but instead from growing it. It's quite clever, even if measuring the plots feels kind of absurd.

Beyond measuring and monitoring exemplary plots of carbon capture in the forest, the rationale of maximizing the carbon metric was also affecting management practices. Another forester, Haokan, explained how the size of the individual tree and therefore its capacity to bind carbon dioxide from the atmosphere had become its main measure of value according to the carbon logic. In a training on how to increase forest carbon, the foresters had been instructed to clear the brush and any competing seedlings around a given "target" tree that they marked with a cross. However, he found this painful, as saplings and trees designated for clearing often included rarer species that he found more ecologically valuable, or simply more aesthetically appealing, "just beautiful," and he found himself secretly leaving them in the forest.

Local forest guardians (*hulinyuan*), part of the "village committee" governing forest land held in common, lamented access difficulties. For instance, Hulin explained that he often turned a blind eye to activities he deemed inconsequential, despite their problematic status within carbon forestry rules. These included hunting, fishing, swimming, and gathering firewood in the forests that were officially administered by the village committee, but rented out to the forest bureau, which sought to minimize human "disturbance" in the forest.

Mifeng, a driver for Yasen, also navigated this terrain of the forest as a commons for conservation with his wild beekeeping activities. Raised in the mountains in the 1980s, he joined Yasen in 2013, finding satisfaction in both his day job and parallel practice of beekeeping. His beekeeping skills, learned from his grandfather, had first attracted the attention of the forestry experts who hired him as a driver. After placing bee boxes in protected areas, he returned annually to harvest honey. Mifeng claimed to have spread

thousands of boxes to preserve ancient knowledge and native bee species. Refusing to quantify his efforts or monetize the honey, he emphasized passion over profit.

In January 2018, we climbed a rockface to find some of these hives. Pouring golden honey, Mifeng marveled at the bees' "miraculous" (*shenqi*) labor. Rejecting extractive thinking, he believed they shared honey with him in return for his stewardship in providing housing. Far from conforming to the financialization of nature in the heart of the carbon forest, Mifeng embodied an "ecological consciousness," according to local media that praised him for his forest beekeeping. His vision rejected green arithmetic, and instead represented a reclaimed pocket of ecological thinking based in a homegrown, non-human labor theory of value that included his apian co-workers.

Carbon in speculative fiction in Guangzhou

In downtown Guangzhou, a vibrant mega-city in the Pearl River Delta, employees of a local government carbon accounting scheme I call Inclusive Carbon were developing an everyday carbon footprint app for consumers. Discussing their work in a local fast-food restaurant in late 2017, they shared their thoughts on building ecological civilization with me. All three believed decarbonization must surpass environmental protection, and advance technological development to fully realign "humanity and nature" (*renyuziran*).

Aike, a fervent proponent of technological solutions, attributed China's ecological progress to advanced data integration through mobile phone tracking. However, his enthusiasm extended to a dystopian vision where robotics and artificial intelligence, despite potentially saving the planet, could lead to a confrontation with humanity, resulting in either extinction or enslavement. Aike's imaginative musings reached a climax as he humorously envisioned a future where humans might be confined to zoos, observed by robots as evolutionary relics. His colleague Yuntian, who had spent several years working on carbon offsets for the UN's Clean Development Mechanisms, attempted to steer our conversation back to carbon-related matters. However, she also found herself unable to redirect our trajectory from the realms of science fiction. Instead, Yuntian elaborated on her favorite book, *The Three-Body Problem* (Liu, 2008), part of the contemporary science fiction boom sweeping across China. The narrative revolves around a pact between scientists and a superior alien species to either destroy or reform humanity.

Yuntian empathized with characters who, frustrated by human destructiveness, engage in a quest for the annihilation or violent reform of humanity to save the planet. In the novel, this mirrors the protagonists' experiences during Maoist high socialism, marked by political campaigns and ecological devastation. Yuntian admired the American character Mike Evans, who moves to China disaffected with exploitative fossil capitalism, hoping to initiate "pan-species communism" through reforestation. Yet, when confronted with the negative impacts of environmental degradation in the People's Republic, Evans supports a faction seeking humanity's total annihilation. The novel entangles frustrated utopian communism, extractive capitalism, and alien intervention in shaping humanity's destiny, reflecting on the complex relationship between ideology and ecological salvation in the Chinese context.

Carbon in artistic expressions

As discussed above, dystopian impulses around carbon also surfaced in infrastructural poetics and art installations addressing pollution, like the cynical sale of cans of fresh air or the circulation of "human vacuum cleaner" memes. Some artworks, however, offer a more hopeful horizon for an atmospheric commons in China. For instance, artist Kong Ning frequently merges intimacy and resistance in her performance art on Chinese streets (Johnson and Fürst, 2022). Notably, the evocative union of human matrimony and environmental defiance in her October 2014 piece entitled "Marrying the Blue Sky" epitomizes this fusion of the personal and the political. Adorned in a wedding dress crafted from 999 white 3M anti-pollution face masks, Kong emerged as a "smog bride" who longs to wed the blue sky (Johnson and Fürst, 2022). The artwork's poignant irony lies in its impossible realization, as the emergence of the clear sky heralds the demise of smog and its emblematic face masks (Johnson and Fürst, 2022). Arguably, this wedding of the human and the atmosphere captures the intimate union between carbon-based life within a carbon-infused environment.

Similarly, in December 2015, Kong donned an orange dress embellished with orange plastic horns that resembled megaphones, amplifying the warning calls of "orange alerts" during Beijing's polluted days. Notably, she reflected on this piece by saying,

> I want to use this type of approach to remind people, to urge everyone to take care of themselves and to pay attention to environmental protection. This is because controlling smog isn't just the government's business. Everybody can take action to save energy and reduce emissions. (China Radio International, 2015, quoted in Johnson and Fürst, 2022: 82)

Here Kong's emphasis on care, and care for the self, as part of caring for the environment, come together in a call to action to protect the atmosphere. As I have argued elsewhere (Bruckermann, 2023), the confluence of care for the self, the family, and the environment intersect very acutely in crises of social reproduction and sustainability. Moreover, Kong's defiance of pollution is not individual, but relational. She draws on ritual idioms and symbolic power to reject reducing a blue sky, or clean air, to a matter of mechanical, infrastructural, or architectural intervention. Instead, the carbon self emerges from the fusion of cosmological and chemical elements in her performance.

Conclusion

This article traced carbon credits back to their roots in the "tragedy" of the commons. I examined how economic solutions to climate change involved transforming carbon dioxide from the molecular level to a tradeable credit, before exploring how recent theoretical interventions could return carbon to its elemental form. My central question was how an elemental commons in relation to air and atmosphere, could shape vibrant political subjectivities. I argued that an anthropology of carbon shatters the dualism of life and non-life both ethnographically and theoretically (Cross, 2019).

Theoretically, I sketched how resources-for-humans perspectives on the commons, often found in academic literature contributing to resource management, offer direct paths to policy, including the establishment of carbon markets. However, these approaches are inadequate for understanding carbon encounters on the ground, which can enter realms of speculation, imagination, and potentiality. Recent interdisciplinary literature on the more-than-human commons challenges these earlier (often institutional) approaches for being too formalistic, exclusionary, and anthropocentric (Bodirsky, 2023). "New commons" literature, grounded in ethnography of urban commons, is emerging from a Marxian anthropological perspective (Bodirsky, 2023). This research points towards postcapitalist possibilities, while challenging the stubborn persistence of inequalities of class, race, and gender (Kalb and Mollona, 2019; Susser, 2017).

Ethnographic investigation of air and atmosphere in the Chinese world shows that individuals protect themselves from pollution with masks, filters, and buildings (see Zee, 2015), while sharing in the concern, consequences, and crises of breathing noxious particles, as they, quite literally, form a community of "a-spiration" (Choy, 2021). In relation to my own fieldwork, the metric of carbon opened unexpected pathways to the hopes and dreams that participants in the carbon economy harbor for a world where the commons become a constitutive element of imagination. Forest carbon offset workers in rural areas, as well as sci-fi enthusiasts who doubled as carbon app developers and users, drew on natural sciences, carbon economics, local histories and speculative futures to envision possibilities for a more-than-human commons. Specifically, foresters reflected upon the contradictions of isolating carbon dioxide for commodification in biologically and ecologically informed ways, while others, such as the beekeeper focused on interspecies cooperation, took an even more holistic approach. For instance, interactions with science fiction enthusiasts led to visions of human nihilism and pan-species communism, and they even entertained the possibilities of extraterrestrial and AI entanglements. Artistic examples, such as Kong Ning's intimate act of marrying the atmosphere, challenged the boundaries of the body while reinforcing how care for the self and the environment can go hand-in-hand.

Building on the above theoretical critiques, utopian impulses of commoning emerged from fieldwork in the People's Republic of China. These encounters raised the possibilities of a carbon poetics suspended in atmospheres and elements, while simultaneously uncovering the contradictory forces of extraction and exploitation in carbon economies, and the intimate yet political subjection to its logics. Moreover, my research revealed the contributions rural imaginaries and digital engagements could make to a coming anthropology of carbon, not only by blurring the distinction between life and non-life, but also by enfolding temporal horizons of the future into past experiences and present lives. Crucially, through this theoretical and ethnographic exploration I emphasized a critical yet under-acknowledged concern for any future carbon anthropology: the unequal burden placed on those sharing in the atmospheric commons.

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