University of Colorado Boulder

Department of Geography
260 UCB
Boulder, CO 80309-0260

t 303 492 5438
f 303 492 7501
emily.yeh@colorado.edu

Congressional-Executive Commission on China
Hearing on *China's Environmental Challenges and U.S. Responses*
September 21, 2021

Written submission by Emily T. Yeh, Professor of Geography, University of Colorado Boulder

Thank you for this opportunity to speak briefly about environmental challenges facing Tibet and the effects of Chinese dam projects downstream.

Environmental challenges facing Tibet

Anthropogenic climate change

The most significant environmental challenge currently facing Tibet is climate change, insofar as climate change is interconnected with all other aspects of the environment and thus also with culture, economy, and society. The Tibetan Plateau is warming significantly more quickly than the global average. As elsewhere, what is most significant is not the rise in year-round average temperatures, but rather changes in extremes. Existing and projected changes in intensity, frequency, and duration of climate extremes are faster on the Tibetan Plateau than for China as a whole or for other places at equivalent latitudes.

The following are a few highlights from the latest climate science about the Tibetan Plateau (from the 6th IPCC Report):

- Increase in heat extremes/maximum temperatures.
- Increased minimum temperatures, decrease in cold spells.
- Increases in permafrost temperatures –permafrost thaw (which further releases carbon, accelerating warming)
- Positive feedback (i.e., accelerated warming) from dust and black carbon (pollution, including from distant sources)
- Decrease in snow-covered areas, snow volumes.
- Accelerating loss of glacier mass and volume. This has led to increased glacial runoff.
- Decreased frequency and increased mean intensity of snowfalls, i.e., more snowstorms. Intensification of heavy precipitation more generally.
- Overall increase in precipitation over eastern Tibetan Plateau, but also significant local heterogeneity so that some places are getting much wetter and others drier, with significant implications for vegetation (on which livestock depend).

Key ways in which climate change impacts Tibetans:

- Inundation of grazing lands. Rapid expansion of lakes due to melting permafrost and glaciers, decreased windspeed (lower evaporation), and increased precipitation have led to dramatic loss of grassland, decreased livestock health and viability, and displacement

of pastoralists from their rangelands. Thus, it contributes to drives to resettle pastoralists and loss of traditional forms of culture and livelihood tied to land.
    - From 1970-2010, total lake area on the Tibetan Plateau increased by 34%, with a faster rate of expansion occurring after 2000. The surface area of Lake Serling (now the 2nd largest lake) *doubled* over this period. In addition to loss of grazing land, the growing area of soil affected by saline lake water has caused further vegetation loss, expanding the radius of impacts.[1]
- Declining availability of caterpillar fungus. Caterpillar fungus (*Ophiocordyceps sinensis*), a prized Chinese medicinal, has become an extraordinarily significant source of income for rural Tibetans across the Plateau given low prices for agricultural and pastoral products and increasing demands for cash. Former herders who have been resettled are particularly reliant upon it for income. Harvests are declining as a result of climate change (frost-heave from permafrost thaw, changing soil temperatures, changes in habitat) as well as habitat disturbance and in some cases overharvesting, often from outsider harvesters (rather than local residents).[2]
- Hazardous events (risks to human life and infrastructure): permafrost thaw results in landslides; glacial lake outburst floods are also very dangerous, though these are more common in the southern Himalayas than on the Tibetan Plateau.
- Rangeland degradation -- although Chinese government policies to turn pastoralists into ranchers, or to move them out of pastoralism through ecological migration continue to be predicated on assumptions of herder overgrazing, there is now a significant body of evidence that precipitation is a more important driver of vegetation change than grazing intensity and thus that climate change is the most crucial driver of rangeland degradation. This makes it increasingly difficult for herders to maintain a livelihood, which in turn is important because Tibetan cultural practices, identity, and language often haver greater vitality in rural areas and in association with traditional territories than in large cities or resettlement sites.
- Habitat degradation more generally, due to the cascading effects of changing temperatures and precipitation (especially raising minimum temperatures above the critical 0-degree threshold) affects Tibetan livelihoods as well as wildlife.
- Hydrological changes affect downstream communities as well as those on the Tibetan Plateau. Hydrological changes due to melting glaciers, thawing permafrost, and changing precipitation patterns have downstream effects on flooding, drought, and timing of the hydrological cycle with implications for fisheries and agriculture (see below). Locally there is more water in the short term but likely drought in the long term, again also leading to degraded vegetation.

Environment-related policy challenges for Tibetans

<u>Rangeland use rights privatization, fencing, and other policies that assume herders are the problem</u>

Pastoralism on the Tibetan Plateau has a history of about 8000 years. Historically, pastoralism was largely transhumant, livestock were privately owned, and grassland was managed as common property. Common use of lands allows mobility and flexibility, which are key to pastoralism systems around the world given their ecologically patchy and heterogeneous

nature. In China livestock and pastures were collectivized in the 1950s. Livestock were decollectivized/privatized in the early 1980s.

Beginning in the 1980s, the state became concerned with grassland degradation at the same time as agricultural models of land use privatization started to be seen as appropriate for rangelands as well. Policymakers began to adopt the view that a "tragedy of the commons" induced by collective use of land led to overgrazing, and that this, combined with herders' ignorance, was leading to degradation. As a result, the government began to implement the 'rangeland household responsibility system' or the privatization of grassland use rights to individual households. This was accompanied by a push toward fencing of boundaries as well as the building of houses, particularly on winter pastures. In addition to correcting a purported (but not actual) "tragedy of the commons," this was targeted at converting traditional pastoralism into a Western-style, sedentary and privatized ranching model, which is seen as more "modern" and developed.

These policies are based on several problematic assumptions. First, widely cited reports about the extent of degradation were not based on rigorous studies and are likely to have been exaggerated.[3] Second, recent studies increasingly find that climate change, particularly changes in precipitation, are much more important than overgrazing as a driver of vegetation cover changes on the Tibetan Plateau.[4] Third, they fail to account for the fact that trampling is more damaging to grasslands than grazing; the concentration of livestock around winter pasture as a result of privatization has resulted in greater trampling and thus increased degradation. Fourth, in some cases degradation is related much more to past state-directed activity, such as efforts to drain wetlands or cultivate grains on pasture, than to current grazing.

In some places, these policies have thus resulted in increased rangeland degradation due to the concentration of grazing and trampling. This is particularly the case where households have been allocated only one year-round pasture rather than seasonal pastures. and where allocated pastures are small, poor in quality, or lack water resources. Other problems have included growing inequality; increased labor demands because cooperative herding becomes much more difficult; increased vulnerability to snowstorms due to the loss of flexibility; and increased rangeland disputes due to division. A number of recent studies have found that where common grazing by multiple households has been maintained or restored, soil fertility, vegetation cover, and species richness are better compared to single-household pastures.[5]

Nevertheless, these policies of grassland division and reduction of livestock numbers have continued to be the dominant policy emphasis. In 2003, a new program called *tuimu huancao*, often translated "Retire Livestock, Restore Rangeland," was launched across the Tibetan Plateau. Like other policies and programs, implementation has largely occurred earlier on the eastern Plateau and only later in the TAR (Tibet Autonomous Region); implementation has also varied significantly. In addition to deepening the implementation of rangeland division, it also designated different zones for rotational grazing, grazing bans of 3-10 years, and permanent grazing bans. In the Sangjiangyuan (Source of the Three Rivers) area of Qinghai it was also combined with ecological migration, discussed below. This was followed in 2011 with a destocking policy ("Rangeland Ecological Protection Compensation Mechanism") which pays a subsidy to pastoralists for not grazing, or for not exceeding calculated carrying capacities in areas where grazing is still allowed. Both implementation and reactions have been mixed. In many places, pastoralists state that calculated carrying capacities are less than the number of livestock required to sustain a livelihood.

Ecological migration

The area of the headwaters of the Yangtze, Yellow, and Mekong Rivers ("Sanjiangyuan") in Qinghai province, often dubbed "China's water tower," is considered especially important for China's ecological security. As a result, the implementation of *tuimu huancao* there has been combined with ecological migration, the resettlement of Tibetan herders to new housing complexes that are usually built on the edge of existing towns and at a significant distance from original villages. From 2004-2010, based on government statistics, a total of approximately 55,000 herders in 10,000 households in the Sanjiangyuan area were moved into 86 settlements.

This has led to extraordinary transformations of traditional pastoral life, but with dubious ecological benefit. Ecological migration has been dubbed a "climate adaptation" strategy, but available ecological evidence suggests that it is not in fact adaptative. Experimental studies have demonstrated that climate warming leads to a variety of negative impacts on vegetation, but some of these negative impacts are modulated (made less severe) by moderate grazing.[6] In other words, given that climate warming is happening, grassland conditions are worse with complete grazing removal than with grazing. Other experiments have shown that grazing exclusion does not increase annual productivity of dominant species. Climate adaptation is crucial, but it is necessary to carefully evaluate whether particular measures are actually adaptive. Although studies have claimed based on overall greening of the Plateau that such policies have worked, more nuanced studies suggest greening is likely attributable more to climate change -induced increases in precipitation (which is dominant but not uniform) than to grazing removal as such.

Of greater concern to this commission are likely the social costs of resettlement on a large scale. While the government has provided subsidies, these are often delayed and inadequate in the face of inflation. Many settlements are poorly built and without water and sanitation infrastructure. Resettled households, a large proportion of which were relatively poor (with few livestock), have in many cases found that their standards of living have declined due to their new and unaccustomed need to purchase fuel and food. A major problem is employment and livelihood after displacement. Herding entails a complex set of skills that are no longer relevant after resettlement. Although some efforts have been made for job training and to provide opportunities for employment, these fall far short of needs. Instead, many resettled Tibetans live primarily on government subsidies and the sale of caterpillar fungus.[7]

Studies of herders resettled from Sanjiangyuan have found that while there are new opportunities for access to some public services such as health care, household investment in productive assets have declined. The deskilling of the rural labor force has worked together with other policies such as school consolidation to undermine the long-term viability of pastoral production. Some households are technically eligible to return to their grasslands after 10 years, but cannot because they have already sold their livestock, and do not have savings to purchase a new herd. Resettlement, along with broad political-economic forces and policies that encourage urbanization, also undermine traditional ties to territory (including territorial deities) and associated cultural practices. Resettlement thus works together with the current assimilationist push toward use of Mandarin Chinese to erode linguistic and cultural continuity.

In addition to the ecological migration program in Qinghai's Sanjiangyuan region, a program specific to the TAR was launched in 2017. The plan, "Extremely high-altitude ecological resettlement" calls for resettlement of 450 entire pastoral villages located at 4800 meters or above to lower-altitude areas by 2025. The rationales given are environmental (avoiding grassland degradation and competition with wildlife for forage) as well as for easier provision of health services and education.

In this project, resettled households (except those officially categorized as impoverished) are required to pay for a share of the cost of their new houses. These new houses, located largely in previously sandy and otherwise unused land, are reportedly of good quality. However, income is again a significant problem. The Chinese government has spent large amounts of money to create various new agricultural farms, but these can employ relatively few workers and former nomads generally do not have the necessary skills to work at them.

The government reports that all resettlement is "voluntary," which raises the question of what constitutes consent in the process of resettlement. There are no reports of threats of violence or demolition. Instead, these projects generally begin with a survey of how herders feel about moving. Following this, a variety of incentives are offered, and local officials begin to address the reasons pastoralists give for not wanting to move. Finally, for those who remain unconvinced, local officials begin to conduct individual "thought work" that mixes further incentives with warnings, for example about the withholding of future development projects; together these appear to have resulted in movement according to government targets. However, in some cases (as documented in Qinghai) households have also returned to their grasslands after resettlement.

Mining and conservation

Mining on the Tibetan Plateau has long been a flashpoint for protest, given both general objections to mining, which is understood to deplete the essence or fertility of the land at large, leading to natural disasters, as well as specific objections to mining on sacred mountains. Protests against mining have been met with harsh repression.

There appear to be some real changes that have resulted from Xi Jinping's "ecological civilization" campaign, which has encompassed the current implementation of a new system of national parks and the specific designation of Qinghai and the TAR as regions whose prime function will be for ecological protection rather than industrial development. Since 2015, ecological civilization implementation has included increasing numbers of performance targets for government and Party officials related to environment and ecology (rather than only economic growth) as well as environmental enforcement based on findings by central-level inspection teams. Among other things, this has led to the shutdown of many of the small-scale mining operations that have had significant impacts on Tibetan land and livelihoods in the past. It also appears difficult for new mining operations to be approved if they are within the boundaries of parks or nature reserves. Several county-level mines have been closed due to the new Giant Panda National Park, for example. (Many small hydropower stations have also been closed in southwest China due to new environmental regulations.)

That said, mining operations that are large in scale and operate with significant backing of powerful central-level officials will almost certainly find ways to continue operation. Large-scale mining operations, such as the Yulong Copper Mine in the eastern TAR (Western Mining Tibet Yulong Copper Co. Ltd) and the Huatailong Mine in Gyama continue, while increasingly severe repression of dissent makes protest against such mines ever less likely.

Weather modification

Weather modification (i.e. cloud seeding to produce or prevent rain/snow) is strongly institutionalized in China and may become more prevalent as a response to climate-change induced changes in precipitation patterns. These can have negative localized effects; weather modifications to combat drought has produced heavy rainfall that caused injury to livestock in

Qinghai, for example. In one case, a gold mine in northern Sichuan (Amdo) engages in weather modification to prevent rain in summer, allowing mining to continue. Cannon blasts are loud, shells land on pastures, and pastoralists report it has led to localized decline in precipitation, worsening grassland conditions.

There are reports of a "Sky River" project to install and use tens of thousands of fuel-burning chambers on the Tibetan Plateau to seed clouds, with the goal of boosting rainfall on the Tibetan Plateau (diverting water vapor from the Yangtze to Yellow River Basin). This would almost certainly have unintended negative consequences for local residents, as well as regional climate ramifications.

Effects of Chinese dam projects downstream

The world is currently experiencing a second major global dam rush, this one led by China, which is rapidly building dams both inside its borders and around the world. As with coal-fired power plants, the continued building of dams within China is less about the need for power generation per se (given current overcapacity) but rather an outlet for capital investment and a way for China to seek to meet its target of becoming "carbon neutral" by 2060. The inclusion of large hydropower within the Clean Development Mechanism, despite its contributions to carbon emissions during construction, methane emissions from vegetation decomposition in reservoirs,[8] and other ecologically detrimental effects, has further bolstered dam construction. China is home to half of the world's large dams and adds dozens more each year. Much of the new dam construction is taking place in southwest China (Sichuan and Yunnan province and the TAR); this region has the world's largest hydropower potential under development, with significant deleterious effects downstream for the countries of South and Southeast Asia.[9] Specifically, large dams change river function by trapping sediment as well as gravel, logs and other habitat features, leading to significant erosion and habitat damage downstream. Dam operation also significantly alters seasonal water flows and flood pulses. Both the reduction in water held back in reservoirs and changed timing of water can significantly damage fisheries and downstream agriculture.

Southeast Asia's largest lake, Cambodia's Tonle Sap, supports one of the world's most productive freshwater fisheries. During the monsoon season, the lake expands five or more times its dry-season size, becoming an important breeding ground for fish. The Tonle Sap floodplain is home to more than 3 million people and up to 60% of Cambodia's protein intake comes from its fish. In 2019, however, fish catches were reportedly only 10-20% of previous years due to the combination of climate change, and dams upstream on the Mekong and its tributaries, including (though by no means exclusively) those in China. Currently there are 11 mega-dams in China's section of the Mekong, with more planned in the future. New water resources monitoring using satellite imagery and GIS analysis demonstrated that in 2019, during the severe wet-season drought in the lower Mekong Basin, China's dams were restricting nearly all upper Mekong wet season flow.[10] Rainfall and snowmelt within China's portion of the basin were at or above average, yet China restricted more water than ever, leading to the unprecedented drought downstream.

In other words, contrary to claims that the lack of water was due to a lack of rain that China was also experiencing, this remote sensing and satellite evidence showed that the upstream dams "turned off the tap" to downstream countries. The rationale for wet season impounding of water was to generate maximum electricity output in the dry season, during which electricity market prices are significantly higher. The withholding of wet season water and unexpected

releases of water during the dry season damages not only fisheries and other ecological processes, but also causes considerable economic damage. It is not clear whether there were disagreements between Chinese government actors who have pledged to release water during drought downstream and those concerned about the imperatives of profit making by Huaneng and China Southern Grid (both state owned enterprises) in this instance.

Furthermore, it is important to remember that all of this dam-building is happening in the context of higher future temperatures. This will continue to alter the seasonal profile of real hydrological droughts in the future. While there may be more water now due to glacial melt and permafrost thaw, climate change is likely to lead long-term to a decline in river flow (specific contributions of different sources to overall flow vary by river).

All of these issues point both to the urgent need for substantive dialogue between China and downstream countries, as well as the problems created by China's designation of data about water flow and hydropower operations as a state secret. China has never been part of the Mekong River Commission, established in 1995, and instead engages with it as a Dialogue Partner, one of several factors that have made the commission relatively ineffective. China established the Lancang-Mekong Cooperation Mechanism 2016 as its own initiative; to date, the emphasis has been on finance and construction of hydropower dams in Lower Mekong countries. China did sign a new agreement in 2020 to share hydrological data from two monitoring stations on the Lancang (Upper Mekong) year-round rather than only during the rainy season. Hopefully, this will lead to more transparency and cooperation.

Finally, the Mekong is only one of the major rivers on which China is building dams, with significant current and potential future downstream effects. In 2020, China announced plans to develop a hydropower dam on the Great Bend at the lower reaches of the Yarlung Tsanpo in the TAR, which flows into India as the Brahmaputra and then through Bangladesh. This extremely risky infrastructure near the disputed border, if built, would certainly inflame tensions with India.[11]

Chinese coal-fired power overcapacity

China has positioned itself as a global leader in renewable energy generation through aggressive investments in wind and solar as well as low-carbon transportation manufacturing. Despite this, more than 60% of China's electric power comes from coal-fired power plants, and China is continuing to add capacity at an astounding rate. Since 2000, China has installed more than 810 gigawatts (GW) of new coal-fired generation capacity (which works out to the equivalent of about one plant per week) and in 2020 China approved more than 38 GW of new coal power capacity. The total capacity now in planning or development is almost 250 GW.[12]

What is particularly important to understand is that this capacity increase is largely unnecessary because China currently has a significant overcapacity in electricity generation – it is producing far more than it can use. Its existing power capacity is enough to meet electricity demand through 2030, even if annual demand grows at a rate of five percent (which is not the case).[13] As a result, many plants are operating far below capacity, and renewable sources are often curtailed as a result. This overcapacity also has very significant implications for climate change given the embedded emissions of the newly built plants (i.e. those expected over the lifetime of the plants). Continuing to build plants locks in momentum toward further climate change. While many analyses focus on failures of policy implementation or insufficient marketization of the sector, political economic analyses demonstrate that the problems are not of

policy implementation failure but rather China's macro-economic capital accumulation and the need for capital to find a place to invest over long time horizons.

Policy related recommendations

- Climate change will only exacerbate problems faced by both Tibetans living in the PRC and citizens of South and Southeast Asian countries living downstream from Chinese dams. Thus, continued US-China cooperation following the April 2021 agreement is extremely important. What seems particularly important to focus on is not the fact that China is the biggest annual emitter (it is far behind the US in terms of per capita and cumulative emissions). Rather, what is important is managing an energy transition in both China and the US, with a focus on how to avoid the locked in emissions of recently built coal-fired power plants and to commit to stop building new coal-fired power plants. More specifically and modestly, asking China to decommission its coal generators ahead of schedule on a yearly basis is an important first step. In the longer term, it is important to push for China to have a coal consumption cap that has regulatory consequences.
- Care should be taken that efforts and agreements made toward action on climate change are not simply existing policies given new names, that they are based in scientific (including social scientific) evidence about what is actually adaptive (e.g. resettling nomads off pastures does not satisfy this criteria) or mitigatory, do not further marginalize those who are already marginalized, and do not have significant potential for future catastrophic consequences (e.g. solar radiation management should be put off the table globally). It is also important globally and bilaterally to move away from treating large dams as part of genuine strategies toward "carbon neutrality" given their greenhouse gas emissions and other damaging impacts.
- It will be helpful to downstream communities for China to provide greater data transparency on water use, and to engage cooperatively on the use of transboundary rivers. Any efforts the US can undertake to encourage this will be helpful.
- China is currently in a period of heightened cultural assimilation, nationalism, and repression. Direct international pressure is sometimes useful; at other times it can lead to unintended consequences for some PRC citizens. The situation is thus quite fraught. In responding to U.S. policy and pressure, China is very likely to point to the U.S.'s own record on a variety of issues, and this should be taken into account in the framing of policy.

---

[1] Nyima, Yonten and Kelly Hopping. 2019. "Tibetan lake expansion from a pastoral perspective: Local observations and coping strategies for a changing environment." *Society & Natural Resources* 32(9): 965-982. https://doi.org/10.1080/08941920.2019.1590667

[2] Hopping, Kelly, Stephen Chignell and Eric Lambin. 2018. "The demise of caterpillar fungus in the Himalayan region due to climate change and overharvesting." *Proceedings of the National Academy of Sciences* 115(45): 11589-11494.

[3] Harris, Richard B. 2010. "Rangeland degradation on the Qinghai-Tibetan plateau: A review of the evidence of its magnitude and causes." *Journal of Arid Environments* 74: 1-12.

[4] Lehnert, L.W., K. Wesche, K. Trachte, C. Reudenbach and J. Bendix. 2016. "Climate variability rather than overstocking causes recent large cover changes of Tibetan pastures." *Scientific Reports* 6. https://www.nature.com/articles/srep24367

[5] E.g. Cao, JJ, Xiong YC, Sun J, Xiong WF, Guo ZD 2011. "Differential benefits of multi- and single-household grassland management patterns in the Qinghai-Tibetan Plateau of China. *Human Ecology* 39(2): 217-227. Cao, J.J., Xu, Xueyun, Ravinesh Deo, N. Holden, J. Adamowski, Yifan Gong, Qi Feng, et al. 2018. "Multi-household grazing management pattern maintains better soil fertility." *Agronomy for Sustainable Development* **38,** 6 (2018). https://doi.org/10.1007/s13593-017-0482-2

[6] Julia A. Klein, John Harte, and XQ Zhao, 2007. "Experimental Warming, Not Grazing, Decreases Rangeland Quality on the Tibetan Plateau," *Ecological Applications* 17: 541-557;
Tsechoe Dorji, Kelly Hopping, Shiping Wang, Shilong Piao, Tenzin Tarchen, Julia Klein. 2018. "Grazing and spring snow counteract the effects of warming on an alpine plant community in Tibet through effects on the dominant species" *Agricultural and Forest Meteorology* 263: 188-197.

[7] See for example special issue of *Nomadic Peoples,* Vol 19, Issue 2, 2015.

[8] Deemer, B. et al. 2016. "Greenhouse gas emissions from reservoir water surfaces: a new global synthesis" *BioScience* 66(11): 949-964.

[9] Hennig, Thomas, Wenling Wang, Darrin Magee, and Daming He. 2016. "Yunnan's fast-paced large hydropower development: A powershed-based approach to critically assessing generation and consumption paradigms" *Water* 8(10); 476. Tilt, Bryan. 2014. *Dams and Development in China: The Moral Economy of Water and Power.* Cornell University Press.

[10] https://www.stimson.org/project/mekong-dam-monitor/; https://www.stimson.org/2020/new-evidence-how-china-turned-off-the-mekong-tap/

[11] https://www.abc.net.au/news/2021-05-25/chinas-plan-to-build-mega-dam-on-yarlung-tsangpo-brahmaputra/100146344

[12] https://www.carbonbrief.org/analysis-will-china-build-hundreds-of-new-coal-plants-in-the-2020s; https://globalenergymonitor.org/wp-content/uploads/2021/02/China-Dominates-2020-Coal-Development.pdf

[13] For detailed analysis see Xi Wang. 2021. Powering China: Industrial Surplus, Infrastructure Overcapacity and Social Reorganization in The Post-Opening Up and Reform Era. PhD Dissertation. University of Colorado Boulder.