Journal of Infrastructure, Policy and Development 2024, 8(7), 5198.
https://doi.org/10.24294/jipd.v8i7.5198

Article

Conservation leads to less income for rural residents? Evidence from a comparison of western and eastern China

Zihao Ma

Business School, Beijing Normal University, Beijing 100875, China; mazihao19970116@126.com

CITATION

Ma Z. (2024). Conservation leads to less income for rural residents? Evidence from a comparison of western and eastern China. Journal of Infrastructure, Policy and Development. 8(7): 5198. https://doi.org/10.24294/jipd.v8i7.5198

ARTICLE INFO

Received: 13 March 2024
Accepted: 11 April 2024
Available online: 19 July 2024

Abstract: Compared with their fellow citizens in the city, rural residents are more likely to be affected by ecological restoration programs and policies. Yet no one has conducted a large-scale study of how ecological conservation impacts rural livelihoods and the economic status of rural households, especially in China. To fill that knowledge gap, I collected and analyzed relevant data from 2007 to 2018 for western and eastern China. I found that the relationship between western China's green coverage rate and rural income followed an inverted U curve whereas that between its green coverage rate and urban-rural income gap was instead U-shaped, suggesting that ecological restoration has come to eventually negatively impact the economic welfare of rural residents in western China; however, the complete opposite was found in eastern China. Greater urbanization, financial support, and infrastructure such as education, medical, and Internet services would help to improve the current situation in western China. This suggests the government should take actions—such as improving the quality of farmer training to the rural residents and improving infrastructure construction—to help farmers acquire a new source of income and narrow the urban-rural income gap in parallel to implementing ecological restoration projects.

Keywords: ecological conservation; rural income; urban-rural income gap; poverty; econometric model

1. Introduction

Since the beginning of the 21st century, with sustainable development firmly rooted in people's hearts, environmental issues have gradually become the focus of much attention. Countries facing environmental pollution, ecological damage or excessive resource consumption have begun to implement various measures to mitigate or resolve those problems (Peng et al., 2020). In trying to protect the global environment, however, people have been asked to make considerable sacrifices to achieve those sought-after ecological improvements (Cao et al., 2021). For example, excessive water is being consumed by vegetation in afforested areas, with billions of dollars spent on ecological conservation projects around the world (Lu et al., 2018; Ouyang et al., 2016). Therefore, balancing ecological conservation with social and economic development is a difficult scientific challenge, but one that is worth studying nonetheless.

Since Grossman and Krueger (1991) found that the relationship between environmental pollution and economic growth follows an inverted U curve, namely the environmental Kuznets curve, numerous researchers have examined or tested this hypothesis, debating its shape (e.g., Alvarado et al., 2018; Dogan and Turkekul, 2020; Shahbaz et al., 2014). Unfortunately, many of them focused on the impact of economic development—especially urban socioeconomic or macroeconomic development—on the environment (e.g., Fan et al., 2019; Katircioglu and Katircioglu 2018; Tsuzuki 2009), with far fewer considering the impact of conservation programs on rural livelihood. Furthermore, of these latter studies (e.g., He et al., 2008; Karanth and Nepal, 2012; Spiteri and Nepal, 2008) most have focused spatially on small regions, such as a national park or natural reserve, or ecotourism zones; in other words, there is a glaring absence of large-scale research. Natural resources such as forest ecosystems are indisputably vital for rural households, accounting for 20%–30% of their total household incomes (Angelsen et al., 2014; Langat et al., 2016; Suleiman et al., 2017; Tugume et al., 2015; Vedeld et al., 2007). The implementation of ecological conservation programs inevitably limits the use of some natural resources, which forces rural residents to change their traditional way of life (Wang et al., 2013). The lack of any study done on a sufficiently large spatial scale will obscure recognition of the impact that certain large-scale programs or policies have upon rural livelihoods and the economic status of rural households, despite the known importance of both aspects (Bennett and Dearden, 2014; Wittmayer and Büscher, 2010). Therefore, it is imperative to conduct such empirical research and provide this missing information.

China is an ideal place to conduct this type of large-scale research, since its economic growth has ostensibly been driven by the unsustainable consumption of natural resources, leading to severe ecosystem degradation (Pang et al., 2019). In response, many large-scale ecological restoration programs (e.g., Natural Forest Conservation Program, Grain for Green Program and Three-North Shelter Forest Program) have been implemented across China to address its environmental problems. Nevertheless, conflict between natural protection and farmers' livelihood development in forest areas still persists, especially in nature reserves vis-à-vis their surrounding communities (Ma et al., 2018; Wang, 2017). In this paper, econometric models are established to study the impact of environmental conservation on rural livelihood income in 193 cities of western and eastern China, with the different situations in these two regions then compared. The results of this study provide scientific guidance for how to find a balance between ecological restoration and the rural economy in China and could, if tailored to unique local conditions, also be useful elsewhere around the world.

2. Methods

2.1. Study area

This study first focuses on cities (please note that "cities" in China can also refer to large regions, and not only strictly metropolitan areas) in western China. The implementation area of many large-scale ecological restoration programs in China—e.g., Natural Forest Conservation Program, Grain for Green Program and Three-North Shelter Forest Program—is concentrated in western China, where the rural economic situation is often thought to lag behind the rest of the country. Accordingly, rural residents in western China are more likely to be negatively affected by strict conservation policies (e.g., no harvesting of trees for lumber or a total ban on grazing). According to the division defined by China's National Bureau of Statistics (**Figure 1**), 97 cities were selected for which all the relevant data are available, to conduct the research. Then, to enable a large-scale comparison, the situation of 96 cities in eastern

China was likewise studied as well (Hainan not included due to its lack of data). The rationale is that conditions for economic development there are thought to be much better than in western China, and many provinces in eastern China have also conducted large-scale ecological restoration projects, such as massive afforestation in Zhejiang and Shandong. For political reasons, those provincial-scale municipalities governed directly by the central government (i.e., Beijing, Tianjin, Chongqing, and Shanghai) usually receive more government financial support, and this bias could affect the objectivity of this study's results and conclusions. For example, more financial support means more funds or compensation directed towards rural livelihoods, which could offset some of the impact from ecological conservation on them. So, these cities were excluded from the analysis.

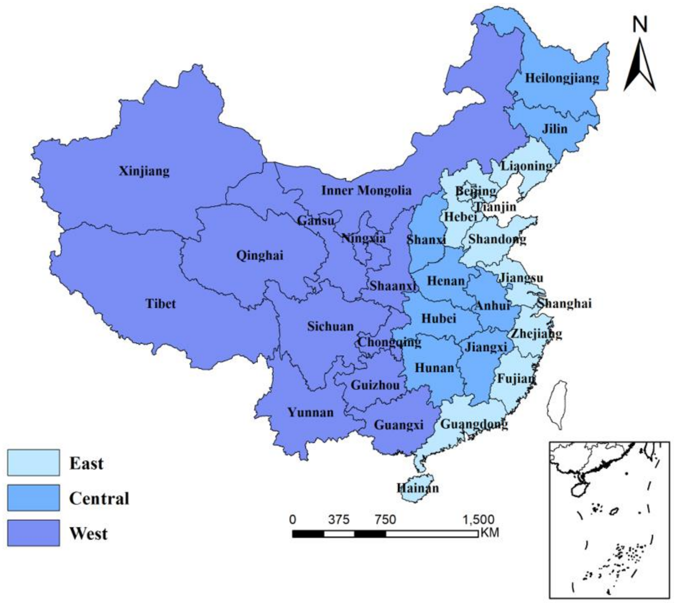

Figure 1. The locations of eastern, central, and western China.

2.2. Variable selection and data source

I chose the green coverage rate, which equals the ratio of the vertical projection area of all vegetation such as trees, shrubs and lawns in a city to the area of that city, to represent the level of ecological conservation. The rationale is that afforestation is a popular method of ecological restoration in China, and the green coverage rate is an intuitive index for gauging the effect of ecological restoration projects (Chen et al., 2019; Cao et al., 2021). The per capita annual net income of rural households was chosen to represent the size of rural economy. For the control variables, I consulted previous studies (e.g., Barnes et al., 2005; Li et al., 2020; Rizk and Slimane, 2018; Zou, 2019) and found seven indicators that potentially affect the rural economy: 1) urbanization (urb, proportion of a city's residents who live in an urban area); 2) agriculture (agri, per capita area of farmland); 3) government financial support (afinan, per capita fiscal expenditure), and infrastructure: Namely 4) education (aedus, per capita educational expenditure); 5) medical services (medi, the number of personnel in medical institutions per 10^4 persons); 6) internet service (anet, the number of people with broadband Internet access per 10^4 people) and 7) transportation (rden, road density, the total length of all classes of roads per km^2). The time span of this study is from 2007 to 2018, for which all data came from the statistical yearbook of each city from 2008 to 2019.

2.3. Model settings

Given that studies on the environmental Kuznets curve usually find a linear, U-shape, or N-shape relationship between the economy and the environment, three different forms were examined here: linear, quadratic, and cubic models. Here, the following parametric settings were separately estimated:

$$\ln rinc_{it} = a_1 \ln gcov_{it} + x_{it}\beta + \gamma t + u_i + \varepsilon_{it} \tag{1}$$

$$\ln rinc_{it} = a_1 \ln gcov_{it} + a_2(\ln gcov)^2 + x_{it}\beta + \gamma t + u_i + \varepsilon_{it} \tag{2}$$

$$\ln rinc_{it} = a_1 \ln gcov_{it} + a_2(\ln gcov)^2 + a_3(\ln gcov)^3 + x_{it}\beta + \gamma t + u_i + \varepsilon_{it} \tag{3}$$

where *rinc* is the rural income; *gcov* is the green coverage rate; x_{it} are control variables; t denotes the temporal trend term; u_i represents the city-level feature term, which is time invariant; and ε_{it} is the error term. The appropriate model was chosen by testing the significance of a_1, a_2, and a_3; then, according to the results of Hausman test, the fixed effect (FE) or random effect (RE) model used for inference. That test's results and those of the regressions appear in **Tables 1** and **2**. The variance inflation factors of all models were below 10, suggesting that multicollinearity did not pose a problem.

Table 1. Regression results of models for green coverage rate and rural income in western China. Significance levels: ***0.01, **0.05, *0.1.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	FE	RE	FE	RE	FE	RE
ln*gcov*	0.003	0.023	0.127***	0.155***	0.223	0.260**
	(0.016)	(0.019)	(0.032)	(0.036)	(0.118)	(0.126)
(ln*gcov*)^2	-	-	−0.020***	−0.021***	−0.063	−0.069
	-	-	(0.006)	(0.007)	(0.056)	(0.060)
(ln*gcov*)^3	-	-	-	-	0.006	0.006
	-	-	-	-	(0.008)	(0.008)
ln*urb*	0.137***	0.172***	0.132***	0.168***	0.133***	0.168***
	(0.047)	(0.042)	(0.048)	(0.042)	(0.048)	(0.042)
ln*agri*	−0.012	−0.012	−0.012	−0.012	−0.012	−0.012
	(0.017)	(0.015)	(0.017)	(0.015)	(0.017)	(0.015)
ln*afinan*	0.076***	0.079***	0.078***	0.081***	0.079***	0.082***
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
ln*aedus*	0.067***	0.052***	0.066***	0.050***	0.065***	0.050***
	(0.017)	(0.015)	(0.017)	(0.015)	(0.017)	(0.015)
ln*medi*	0.003	0.018	0.003	0.018	0.003	0.018
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
ln*anet*	−0.001	0.005	0.001	0.006	0.001	0.006
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
ln*rden*	0.004	0.007	0.004	0.008	0.004	0.008
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
R^2	0.791	0.814	0.792	0.815	0.792	0.815
Hausman test (p)	89.940 (0.000)		92.450 (0.000)		91.570 (0.000)	

Table 2. Regression results of models for green coverage rate and rural income in eastern China. Significance levels: ***0.01, **0.05, *0.1.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	FE	**RE**	**FE**	**RE**	**FE**	**RE**
ln*gcov*	0.112***	0.118***	−0.661**	−0.688**	−4.383	−4.943*
	(0.03)	(0.03)	(0.39)	(0.39)	(2.64)	(2.67)
(ln*gcov*)^2	-	-	0.111**	0.115**	1.216	1.379*
	-	-	(0.06)	(0.06)	(0.81)	(0.82)
(ln*gcov*)^3	-	-	-	-	−0.109	−0.124
	-	-	-	-	(0.08)	(0.08)
ln*urb*	0.089**	0.098***	0.090**	0.099***	0.091**	0.100***
	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
ln*agri*	−0.097***	−0.097***	−0.096***	−0.096***	−0.096***	−0.096***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
ln*afinan*	0.210***	0.211***	0.210***	0.212***	0.210***	0.212***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
ln*aedus*	0.074***	0.070***	0.075***	0.070***	0.074***	0.070***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
ln*medi*	−0.006	−0.026	−0.008	−0.028	−0.007	−0.029
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
ln*anet*	0.002	0.000	0.002	0.001	0.002	0.001
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
ln*rden*	0.000	0.075**	−0.001	0.074**	0.000	0.077**
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
R^2	0.735	0.733	0.736	0.734	0.736	0.734
Hausman test (p)	53.080 (0.000)		53.500 (0.000)		58.030 (0.000)	

2.4. Robustness test and endogenous test

To prove the robustness of the obtained results, I changed the dependent variable from rural income to urban-rural income gap. If the situation of rural livelihood gets better, this gap ought to narrow. Here, this gap is expressed as the ratio of the per capita disposable income of urban residents to the per capita annual net income of rural households. Next, the relationship between that gap and the green coverage rate was analyzed in the same way as for rural income (**Tables 3** and **4**). To test for potential endogeneity caused by reverse causality in this study's modeling, precipitation was set as the instrument variable of green coverage rate, since it has a significant positive relationship with vegetation growth and should not be too affected by rural income. According to the Hausman test results for the instrument variable regression and ordinary least squares regression, I found no significant endogenous bias in the models.

Table 3. Regression results of models for green coverage rate and urban-rural income gap in western China. Significance levels: ***0.01, **0.05, *0.1.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	FE	**RE**	**FE**	**RE**	**FE**	**RE**
ln*gcov*	−0.016	−0.025	−0.164***	−0.176***	−0.038	−0.024
	(0.02)	(0.02)	(0.04)	(0.04)	(0.16)	(0.16)
$(\ln gcov)^2$	-	-	0.024***	0.025***	−0.033	−0.043
	-	-	(0.01)	(0.01)	(0.08)	(0.08)
$(\ln gcov)^3$	-	-	-	-	0.007	0.009
	-	-	-	-	(0.01)	(0.01)
ln*urb*	−0.165***	−0.168***	−0.160***	−0.163***	−0.159***	−0.162***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
ln*agri*	0.013	0.009	0.014	0.009	0.014	0.009
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
ln*afinan*	−0.072***	−0.073***	−0.075***	−0.077***	−0.074***	−0.076***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
ln*aedus*	−0.003	0.007	−0.002	0.009	−0.002	0.008
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
ln*medi*	−0.037**	−0.047***	−0.036**	−0.047***	−0.036**	−0.046***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
ln*anet*	−0.013**	−0.015***	−0.014**	−0.016***	−0.014**	−0.016***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
ln*rden*	−0.002	0.002	−0.003	0.001	−0.003	0.001
	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)
R^2	0.492	0.491	0.494	0.494	0.495	0.494
Hausman test (p)	38.030 (0.000)		36.950 (0.000)		36.710 (0.000)	

Table 4. Regression results of models for green coverage rate and urban-rural income gap in eastern China. Significance levels: ***0.01, **0.05, *0.1.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	FE	**RE**	**FE**	**RE**	**FE**	**RE**
ln*gcov*	−0.236***	−0.235***	1.849***	1.859***	2.024	2.479
	(0.04)	(0.04)	(0.58)	(0.58)	(5.14)	(5.16)
$(\ln gcov)^2$	-	-	−0.298***	−0.299***	−0.350	−0.483
	-	-	(0.08)	(0.08)	(1.58)	(1.58)
$(\ln gcov)^3$	-	-	-	-	0.005	0.018
	-	-	-	-	(0.16)	(0.16)
ln*urb*	−0.147*	−0.022	−0.150*	−0.026	−0.150*	−0.027
	(0.09)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
ln*agri*	−0.012	−0.038	−0.012	−0.039	−0.012	−0.039
	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)

Table 4. (*Continued*).

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	FE	**RE**	**FE**	**RE**	**FE**	**RE**
ln*afinan*	−0.232***	−0.234***	−0.232***	−0.234***	−0.232***	−0.234***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
ln*aedus*	−0.088*	−0.035	−0.088*	−0.036	−0.088*	−0.036
	(0.05)	(0.05)	(0.05)	(0.04)	(0.05)	(0.04)
ln*medi*	−0.010	0.056	−0.009	0.057	−0.009	0.056
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
ln*anet*	0.004	0.008	0.003	0.007	0.003	0.007
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
ln*rden*	−0.002	−0.058	0.000	−0.055	0.000	−0.055
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
R^2	0.820	0.819	0.823	0.821	0.823	0.821
Hausman test (*p*)	73.830 (0.000)		73.930 (0.000)		73.340 (0.000)	

3. Results

According to the Hausman test results shown in **Tables 1–4**, the fixed effect models performed better than the random effect models. Therefore, it was reasonable to focus on model (1), (3), and (5) in each table. The significance of the coefficients suggested that, among all models, the quadratic models (model (3) in each table) were the most appropriate. Hence the following is based on the model (3) results of each table.

Opposite results were found for western versus eastern China. The relationship between green coverage rate and rural income featured an inverted U curve in western China (**Table 1**), which meant the rural income had a trend of rising and then declining. However, the relationship between green coverage rate and rural income followed a U-shaped curve in eastern China (**Table 2**), meaning that rural income there displayed a trend of declining and then rising. Presented in **Figure 2a, b** is a more intuitive demonstration of the main results.

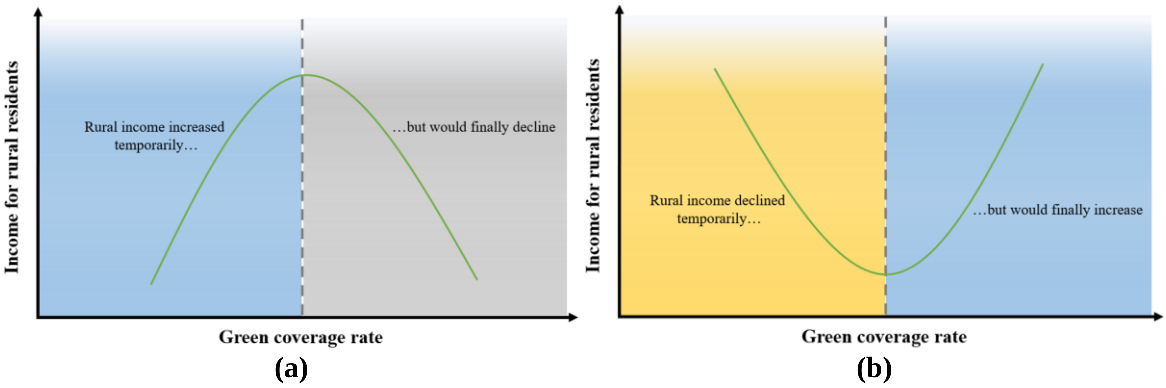

Figure 2. Contrasting theories about the relationship between the green coverage rate and rural income for western **(a)** and eastern China **(b)**.

The robustness test also gave similar results from another prospective. For western China, the relationship between its green coverage rate and urban–rural income gap featured a U-shaped curve (**Table 3**). This suggested that gap would shrink and then expand, which has the same meaning of the inverted U curve found for rural income in **Table 1**. For eastern China, in contrast, the relationship between green coverage rate and urban–rural income gap followed a U-shaped curve (**Table 4**). Accordingly, this suggested its income gap would expand and then shrink, equivalent in meaning to the U curve for rural income in **Table 2**. These outcomes proved the robustness of this research.

I also calculated the green coverage rate at inflection points for each curve. Those values were 23.93% and 19.64% for the rural income curve in western and eastern China, respectively, while 34.59% and 22.44% for the urban-rural income gap curve in western and eastern China, respectively. Then I checked green coverage rate data in 2018 and found that, for western China, almost all of its cities had exceeded the inflection point on the rural income curve, with more than half above the inflection point on the urban-rural income gap curve. This finding suggested a non-harmonious relationship between the rural economy and environmental protection in western China. By contrast, only two cities failed to exceed the inflection point on either curve in eastern China, which suggested that almost all cities there are characterized by a situation in which the rural economy and environmental restoration have developed harmoniously.

The results also indicated that urbanization and financial support were capable of significantly improving rural income (**Tables 1** and **2**) and narrowing the urban–rural income gap (**Tables 3** and **4**) in both western and eastern China. Although education could significantly improve rural income in western China (**Table 1**), its effect on the urban-rural income gap there was not statistically significant (**Table 3**). On the contrary, medical and Internet services were able to significantly narrow the income gap in western China (**Table 3**) yet their effects on rural income were not statistically significant (**Table 1**).

4. Discussion

The relationship between rural livelihoods and the environment is arguably complex and geographically dependent (Wu et al., 2020). In studying the relationship between rates of green vegetation coverage and mean incomes of rural households in China, my research uncovered worrying results, namely that rural livelihood income in western China may be negatively affected by ecological conservation there. However, we cannot simply stop those conservation efforts, because the results from eastern China suggest that the rural economy and environmental restoration can develop harmoniously once beyond the inflection point, a feat that almost all cities in eastern China have achieved. These results indicate that high-quality development conditions—e.g., employment opportunities, educational attainment, social discrimination—can stop ecological restoration and conservation from reducing rural income. Unfortunately, farmers in less developed areas are more likely to accept income inequality, which they tend to ascribe to their own failure instead of social injustice (Wang and Li, 2016). Moreover, poor people are the main agents of environmental degradation because they lack accessibility to resources and must struggle to ensure day-to-day basic needs because subsistence costs (food namely) account for a relatively huge proportion of poor people's income (Jalal, 1993; Reardon and Vosti, 1992). Hence, it is pivotal that government and social scientists discern the actual problems faced by farmers, and try to find ways to improve their livelihoods.

The Chinese government does provide subsidies to farmers affected by ecological protection to compensate for their income losses, and these funds have helped farmers in less developed areas, even improving their economic standing (Uchida et al., 2005), at least in the short-term (corresponding to the rising part of the curve). However, low-income farmers in remote rocky mountainous, border, and minority areas are poor, relying on products of natural (primary as well as secondary) forests such as timber, herbs, and fruits (namely non-timber forest products) for their livelihood (Liu and Li, 2017; Sietz et al., 2011). Because they lack access to education and incur severe social discrimination (e.g., Guo, 2015; Xie and Yao, 2006), it is extremely hard for those poor farmers to adopt another way of living. Consequently, they lose their main source of income and become poorer after ecological conservation projections are implemented because activities that potentially damaged the forest are now forbidden (Cao et al., 2021; Ma et al., 2020). Their quality of life quickly worsens in a downward spiral after having spent the entire subsidy they received (corresponding to the declining part of the curve).

The regression results point to potential ways to improve the current situation in western China. For example, rapid urbanization, which requires an ample supply of labor, can offer employment opportunities for rural residents and thus provide new sources of income. Almost always, however, these people lack the prerequisite training for the skills demanded by new industries, so their main source of employment is limited for now to low-end private sector jobs (Kuhn and Shen, 2015). The Chinese government has never collected statistics on the unemployment conditions of migrant workers, leaving the obstacles they face neglected, which reinforces the fragility of their livelihoods (Zhu, 2002). It is thus imperative for the government to provide more targeted technical training and subsidies for the poor (Li et al., 2017, 2020) and assist in their shift to and adoption of work that is friendly to environment (e.g., ecotourism or establishing nature reserves).

Infrastructure is also crucial, such as in the case of education which is proven to assist farmers in augmenting their income (Hayami, 2003; Yao et al., 2010). My results support this point of view (**Table 1**). Yet, although education's effect on the urban–rural income gap is statistically significant in eastern China (**Table 4**), it is not so in western China (**Table 3**). China's current system of governance for higher education has failed to account for the growing disparity in income between urban and rural residents, and the burden this imposes on the latter (Yao et al., 2008). Accordingly, the government should provide more funds for educating the young generation in poor regions in addition to facilitating their entry into good schools; for example, by lowering minimum entrance test scores or increasing the number of admitted students.

The government of each province in western China should track the living conditions (e.g., income, life pressure, and mental health) of local farmers affected by ecological conservation projections and collect pertinent data. Furthermore, given the context of living in harmony with nature, as recognized by the Kunming-Montreal Global Biodiversity Framework, a better index to measure ecological restoration achievements would be changes in levels of biodiversity. Unfortunately, such data are not yet available at the municipal level. When such data do become available, further research on balancing rural socioeconomic development vis-à-vis environmental protection can be carried out, thereby enhancing the possibility of fulfilling the dual objectives of poverty alleviation and ecological restoration in tandem. The central and provincial government should also engage in more constructive communication with local residents rather than simply imposing laws and administrative measures to formulate protection resolutions or policies (Hosseininia et al., 2013; Shukla and Sinclair, 2010). Obviously, the inverted U curve in western China is at odds with sustainable development, at least for now. In the future, China and other countries under such similar circumstances ought to search for ways to manage and change the shape of the curve so it follows the U- or N-shaped trajectory (either curve would be suitable I believe).

Acknowledgments: I thank Julian Norghauer, at Statistical Scientific Editing, for his help in polishing this paper. I am also grateful to our colleagues and the journal's reviewers for their comments and criticisms on an early version of this manuscript.

Data availability statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflict of interest: The author declares no conflict of interest.

References

Alvarado, R., Ponce, P., Criollo, A., et al. (2018). Environmental degradation and real per capita output: New evidence at the global level grouping countries by income levels. Journal of Cleaner Production, 189, 13–20. https://doi.org/10.1016/j.jclepro.2018.04.064

Angelsen, A., Jagger, P., Babigumira, R., et al. (2014). Environmental Income and Rural Livelihoods: A Global-Comparative Analysis. World Development, 64, S12–S28. https://doi.org/10.1016/j.worlddev.2014.03.006

Barnes, D., Krutilla, K. and Hyde, W. (2005). The urban household energy transition: Social and environmental impacts in the developing world. In: Resources for the Future S. Routledge

Bennett, N. J., & Dearden, P. (2014). Why local people do not support conservation: Community perceptions of marine protected area livelihood impacts, governance and management in Thailand. Marine Policy, 44, 107–116. https://doi.org/10.1016/j.marpol.2013.08.017

Cao, S., Liu, Z., Li, W., et al. (2021). Balancing ecological conservation with socioeconomic development. Ambio, 50(5), 1117–1122. https://doi.org/10.1007/s13280-020-01448-z

Chen, C., Park, T., Wang, X., et al. (2019). China and India lead in greening of the world through land-use management. Nature Sustainability, 2(2), 122–129. https://doi.org/10.1038/s41893-019-0220-7

Dogan, E., & Turkekul, B. (2016). CO2 emissions, real output, energy consumption, trade, urbanization and financial development: testing the EKC hypothesis for the USA. Environmental Science and Pollution Research, 23(2), 1203–1213. https://doi.org/10.1007/s11356-015-5323-8

Fan, P., Ouyang, Z., Nguyen, D. D., et al. (2019). Urbanization, economic development, environmental and social changes in transitional economies: Vietnam after Doimoi. Landscape and Urban Planning, 187, 145–155. https://doi.org/10.1016/j.landurbplan.2018.10.014

Grossman, G., & Krueger, A. (1991). Environmental Impacts of a North American Free Trade Agreement. National Bureau of Economic Research. https://doi.org/10.3386/w3914

Guo, Z. (2015). Analysis of the Inequality of China's Urban Labor Market: Evidence from the Employment Discrimination of Migrant Workers (Chinese). East China Economic Management, 29(7), 97-101.

Hayami, Y. (2003). Development economics. Chinese Social Science Press.

He, G., Chen, X., Liu, W., et al. (2008). Distribution of Economic Benefits from Ecotourism: A Case Study of Wolong Nature Reserve for Giant Pandas in China. Environmental Management, 42(6), 1017–1025. https://doi.org/10.1007/s00267-008-9214-3

Hosseininia, G., Azadi, H., Zarafshani, K., et al. (2013). Sustainable rangeland management: Pastoralists' attitudes toward integrated programs in Iran. Journal of Arid Environments, 92, 26–33. https://doi.org/10.1016/j.jaridenv.2013.01.003

Jalal, K. (1993). Sustainable development, environment and poverty nexus. Asian Development Bank.

Karanth, K. K., & Nepal, S. K. (2012). Local Residents Perception of Benefits and Losses from Protected Areas in India and Nepal. Environmental Management, 49(2), 372–386. https://doi.org/10.1007/s00267-011-9778-1

Katircioğlu, S., & Katircioğlu, S. (2017). Testing the role of urban development in the conventional Environmental Kuznets Curve: evidence from Turkey. Applied Economics Letters, 25(11), 741–746. https://doi.org/10.1080/13504851.2017.1361004

Kuhn, P., & Shen, K. (2015). Do employers prefer migrant workers? Evidence from a Chinese job board. IZA Journal of Labor Economics, 4(1). https://doi.org/10.1186/s40172-015-0038-0

Langat, D. K., Maranga, E. K., Aboud, A. A., et al. (2016). Role of Forest Resources to Local Livelihoods: The Case of East Mau Forest Ecosystem, Kenya. International Journal of Forestry Research, 2016, 1–10. https://doi.org/10.1155/2016/4537354

Li, C., Li, S., Feldman, M. W., et al. (2017). The impact on rural livelihoods and ecosystem services of a major relocation and settlement program: A case in Shaanxi, China. Ambio, 47(2), 245–259. https://doi.org/10.1007/s13280-017-0941-7

Li, Y., Gong, P., & Ke, J. (2021). Development opportunities, forest use transition, and farmers' income differentiation: The impacts of Giant panda reserves in China. Ecological Economics, 180, 106869. https://doi.org/10.1016/j.ecolecon.2020.106869

Liu, Y., and Li, J. (2017). Geographic detection and optimizing decision of the differentiation mechanism of rural poverty in China (Chinese). Acta Geographica Sinica, 72, 161-173.

Lu, C., Zhao, T., Shi, X., et al. (2018). Ecological restoration by afforestation may increase groundwater depth and create potentially large ecological and water opportunity costs in arid and semiarid China. Journal of Cleaner Production, 176, 1213–1222. https://doi.org/10.1016/j.jclepro.2016.03.046

Ma, B., Cai, Z., Zheng, J., et al. (2018). Conservation, ecotourism, poverty, and income inequality – A case study of nature reserves in Qinling, China. World Development, 115, 236–244. https://doi.org/10.1016/j.worlddev.2018.11.017

Ma, Z., Xia, C., & Cao, S. (2020). Cost–Benefit Analysis of China's Natural Forest Conservation Program. Journal for Nature Conservation, 55, 125818. https://doi.org/10.1016/j.jnc.2020.125818

Ouyang, Z., Zheng, H., Xiao, Y., et al. (2016). Improvements in ecosystem services from investments in natural capital. Science, 352(6292), 1455–1459. https://doi.org/10.1126/science.aaf2295

Peng, B., Sheng, X., & Wei, G. (2020). Does environmental protection promote economic development? From the perspective of coupling coordination between environmental protection and economic development. Environmental Science and Pollution Research, 27(31), 39135–39148. https://doi.org/10.1007/s11356-020-09871-1

Reardon, T., and Vosti, S. (1992). Issues in the analysis of the effects of policy on conservation and productivity at the household level in developing countries. Quarterly Journal of International Agriculture, 31(4), 380-396.

Rizk, R., & Slimane, M. B. (2018). Modelling the relationship between poverty, environment, and institutions: a panel data study. Environmental Science and Pollution Research, 25(31), 31459–31473. https://doi.org/10.1007/s11356-018-3051-6

Shahbaz, M., Khraief, N., Uddin, G. S., et al. (2014). Environmental Kuznets curve in an open economy: A bounds testing and causality analysis for Tunisia. Renewable and Sustainable Energy Reviews, 34, 325–336. https://doi.org/10.1016/j.rser.2014.03.022

Shukla, S., and Sinclair, A. (2010). Strategies for Self-organization: Learning from a Village-level Community Based Conservation Initiative in India. Human Ecology, 38, 205-215.

Sietz, D., Lüdeke, M. K. B., & Walther, C. (2011). Categorisation of typical vulnerability patterns in global drylands. Global Environmental Change, 21(2), 431–440. https://doi.org/10.1016/j.gloenvcha.2010.11.005

Spiteri, A., & Nepal, S. K. (2008). Evaluating Local Benefits from Conservation in Nepal's Annapurna Conservation Area. Environmental Management, 42(3), 391–401. https://doi.org/10.1007/s00267-008-9130-6

Suleiman, M. S., Wasonga, V. O., Mbau, J. S., et al. (2017). Non-timber forest products and their contribution to households income around Falgore Game Reserve in Kano, Nigeria. Ecological Processes, 6(1). https://doi.org/10.1186/s13717-017-0090-8

Tsuzuki, Y. (2009). Comparison of pollutant discharge per capita (PDC) and its relationships with economic development: An indicator for ambient water quality improvement as well as the Millennium Development Goals (MDGs) sanitation indicator. Ecological Indicators, 9(5), 971–981. https://doi.org/10.1016/j.ecolind.2008.11.006

Tugume, P., Buyinza, M., Namaalwa, J., et al. (2015). Socio-economic predictors of dependence on Non-timber forest products: lessons from Mabira Central Forest Reserve Communities. Journal of Agriculture and Environmental Sciences, 4(2). https://doi.org/10.15640/jaes.v4n2a23

Uchida, E., Xu, J., & Rozelle, S. (2005). Grain for Green: Cost-Effectiveness and Sustainability of China's Conservation Set-Aside Program. Land Economics, 81(2), 247–264. https://doi.org/10.3368/le.81.2.247

Vedeld, P., Angelsen, A., Bojö, J., et al. (2007). Forest environmental incomes and the rural poor. Forest Policy and Economics, 9(7), 869–879. https://doi.org/10.1016/j.forpol.2006.05.008

Wang, C., Wen, Y., Duan, W., et al. (2013). Coupling relationship analysis on households' production behaviors and their influencing factors in nature reserves: A structural equation model. Chinese Geographical Science, 23(4), 506–518. https://doi.org/10.1007/s11769-013-0608-7

Wang, C. (2017). What has China's nature reserves granted to surrounding rural communities based on the survey data of farmers in Shaanxi, Sichuan and Gansu provinces from 1998 to 2014 (Chinese). Management World, 3, 41-53.

Wang, H., & Li, D. (2016). Attitudes toward income inequality: perspectives from farmers living in a poverty-stricken rural area of China. Chinese Journal of Population Resources and Environment, 14(3), 159–166. https://doi.org/10.1080/10042857.2016.1138745

Wittmayer, J. M., & Büscher, B. (2010). Conserving Conflict? Transfrontier Conservation, Development Discourses and Local Conflict Between South Africa and Lesotho. Human Ecology, 38(6), 763–773. https://doi.org/10.1007/s10745-010-9360-0

Wu, Z., Li, B., Dai, X., et al. (2020). Coupled Relationship between Rural Livelihoods and the Environment at a Village Scale: A Case Study in the Mongolian Plateau. Land, 9(2), 38. https://doi.org/10.3390/land9020038

Xie, S. and Yao, X. (2006). Econometric analysis of migrant workers wage discrimination (Chinese). Chinese Rural Economy, 4, 49-55.

Yao, S., Wu, B., and Su, F. (2008). The impact of higher education expansion on social justice in China: A spatial and inter temporal analysis. The University of Nottingham.

Yao, S., Guo, Y., & Huo, X. (2009). An Empirical Analysis of the Effects of China's Land Conversion Program on Farmers' Income Growth and Labor Transfer. Environmental Management, 45(3), 502–512. https://doi.org/10.1007/s00267-009-9376-7

Zhu, N. (2002). The impacts of income gaps on rural-urban migration decisions in China (Chinese). China Economic Review, 13(2), 213-230. https://doi.org/10.1016/S1043-951X(02)00074-3

Zou, B. (2019). Research on the Influence of People's Livelihood Fiscal Expenditure on Chinese Urban and Rural Income Inequality. World Scientific Research Journal, 5(12).