

Article

Unraveling Forest Practice Policies in China: Subnational Comparisons through Policy Prescriptiveness Framework

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Abstract: Forest policy classification is critical to conducting comparisons and understanding performance variations across cases. Chinese-style forest policy has been in a black box to many outsiders, who tend to assume a decentralization policy model due to a great diversity of forest and socio-economic conditions in China. To test this hypothesis, we used the policy prescriptiveness framework to classify on-the-ground forest practice policies in central government and eight provinces, covering extensive territorial variations. We found that the eight subnational cases that implemented local policies appeared to be consistent with central policies, but there were also subtle differences within them. Our findings show that China utilized centralized and top-down policy models.

Keywords: forest policy regulations; subnational comparison; policy prescriptiveness framework

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1. Introduction

Forest policies are more important now than ever, given their increasingly crucial roles in mitigating global climate change, conserving biodiversity and enhancing the well-being of local communities. In response to the ongoing global trend of forest losses, many countries have been revising their public policies to halt deforestation and promote forest restoration [1–3]. Against this background, China initiated several national ecological restoration programs, including the Grain for Green Program (GFG), the Natural Forest Protection Program (NFPP) and the Key Shelterbelt Development Programs in the late 1990s [4,5]. These programs have been important regarding two aspects: first, encouraging afforestation and reforestation, and second, strictly protecting forests and controlling the volume of timber harvesting [5–7]. The realization of both depends on scientifically formulating policies and effectively implementing them. Therefore, paying attention to policies is especially important. Previous research indicated that forest decentralization or market-based approaches could help to improve forest management and reduce deforestation [8–10]. China has been the country with the fastest and largest net increase in forest area globally over the past thirty years [11], which requires a meticulous analysis of China's forest management practices and detailed implementation of regulations on the ground to gain a deeper understanding of policy characteristics and improve policies.

Against this background, our analysis contributes to forest policy analysis with a comparative study of subnational policies in China. Forest policies in China have received increasing attention but remain debatable [12,13]. In particular, recent literature on

China's forest governance bifurcates into two divided strands. One strand of literature claims that forest policies in China have undergone a decentralized trend [14]. Diverse policies stem from various actors situated at multiple political and administrative levels. Another strand of literature considers the Chinese case as typical authoritarian environmentalism whereby policies are homogenous and designed through centralized and top-down processes [15]. Further research to solve these debates necessitates detailing the contents of Chinese forest management policies, as well as including and comparing both central and subnational cases. However, significant challenges lie in developing an approach to classifying forest policies and making comparisons across cases within the Chinese context given the numerous forest policy contents, complex central–local relations and multiple jurisdictions. To address these challenges, this study adopted the policy prescriptiveness framework to assess the granular forest “policy settings” that govern forests in China [16,17]. This approach classifies forest “policy settings” according to their “structure” and “method”. Structure investigates whether policies are worded in a discretionary or a non-discretionary manner. Method investigates whether policies emphasize procedures or specify on-the-ground behavior. In so doing, this approach simplifies the complexity of policies and fits into longitudinal and cross-national/regional comparisons of policies.

Therefore, our research questions are formulated as follows: How can forest policies in China be classified through structure and method? What have been the variations in the classified forest policies between the central and provincial cases and across provincial cases? Based on this policy prescriptiveness model, our analysis planned to specify five aspects of forest policies, namely, riparian zone management, road building, clearcutting, reforestation and annual allowable cuts, and incorporate the case of the central governmental level and eight provinces. In doing so, our study can make three key contributions to the literature of forest policy and environmental governance. First, we offer a systematic description of ground-level forest policies in China, including eight provinces with rich forest resources. This descriptive analysis can not only contribute to more fine-grained research on China's forest policy to draw useful lessons and good practices but also furthers subnational comparative analysis to identify the forces shaping forest regulations across the country. Second, by considering the prescriptiveness of forest regulations in different subnational entities, we show a rich empirical finding for understanding China's forest governance and the relationships between policy prescriptiveness and relevant political and socioeconomic factors. Third, our study also contributes to the recent debate on China's decentralization reform in forest governance by demonstrating the cases and identifying possible conditions under which China's central government is willing to decentralize authority to provincial and subordinate agencies.

For the rest of the paper, Section 2 provides an analytical framework. Section 3 provides an overview of national forest governance in China. Section 4 details the methodology. Section 5 presents our empirical results, highlighting the similarities and differences in policy settings at the provincial level. Section 6 concludes by discussing the implications of our findings for forest governance in China and suggests directions for future research.

2. Analytical Framework

The analytical framework starts with clarifying the scope of forest policies in Section 2.1. Next, an approach to policy classification and policy prescriptiveness is detailed in Section 2.2.

2.1. What Rules to Study

As forest policies are complex and multi-faceted, an extensive assessment of all the forest regulatory policies would take thousands of pages. Instead of exploring the full multitude of policies that impact forestry, we focused on the regulations of forestry practices related to timber production rather than non-timber products and services. Meanwhile, to limit our scope, we focused on the environmental aspect of policies, and singled

it out from social factors, such as public participation in decision-making, the distribution of forest benefits and the recognition of indigenous peoples' rights. More specifically, we followed the approach used by McDermott et al. in their study [18] of 38 countries or jurisdictions worldwide to assess forest policies in five content areas (see Table 1): (1) riparian zone management, (2) road stream crossings and road decommissioning, (3) clearcut size limits and cutting rules, (4) reforestation and (5) annual allowable cut.

Table 1. Indicator system for forestry policy comparison.

Forest Practices		Policy Settings	
Riparian zone management	Policy requires the establishment of buffer zones	Buffer zone width	
		Management restrictions	(a) No-harvest zones (b) Special management zones
Road building	Policy has requirements for forest road construction	Culvert sizes	Minimum diameter of culvert
		Road decommissioning rules	Peak flow level
Clearcutting	Policy sets standards for clearcutting	Maximum clearcut sizes	
Reforestation	Policy sets standards for reforestation	Specification of time frames	
		Stock levels	
Annual allowable cut rules	Policy regulates annual allowable cutting quotas	Determined at the discretion of forest managers	
		Based on sustainable yield	
		Determined by "current consumption being lower than growth volume."	

2.2. Policy Classification and Policy Prescriptiveness

Next to the policy focus in Section 2.1, two analytical approaches were integrated into our framework to detail the policy settings. The first approach was the policy classification based on "prescriptiveness", whether a policy was voluntary or mandatory. The second approach was an assessment of "performance thresholds", namely, specific on-the-ground forest management prescriptions (see Table 2). Policy classification captures the structure of policy requirements, while the second approach focuses on the contents. Regarding structure, mandatory policies were more "prescriptive" than voluntary policies because they prescribed required behavior rather than allowed the discretion of the forest managers or practitioners. In terms of content, substantive policies detailed precise and compulsory on-the-ground management, which was more prescriptive than procedural policies.

Table 2. Policy classification framework.

Structure	Approach
Discretionary (voluntary)	Rules encourage, but do not require, a course of action
Non-discretionary (mandatory)	Rules require a specific course of action
Method	
Substantive	Rules address on-the-ground changes
Planning/procedural	Rules address management systems

These four categories can lead to four ideal-type policy styles, which are differentiated based on the extent of policy "prescriptiveness": voluntary procedural, voluntary substantive, mandatory procedural and mandatory substantive. Voluntary procedural policies allow for the voluntary development of processes or plans rather than prescriptions for on-the-ground practices. Voluntary substantive policies specify, but do not mandate, forest practice rules or guidelines. Mandatory procedural policies involve requirements for the development of plans or procedures.

Substantive mandatory policies refer to mandatory, on-the-ground requirements or restrictions. In addition to these ideal-type policy styles, “no policy” was added in contrast to the existence of any policy in a policy domain. For the very same reasons that this “ideal-type” approach creates clarity and transparency out of complexity, this classification may not always be able to accommodate the specifics of a given policy. Accordingly, we added the term “mixed” to refer to those policies that (a) include mandatory substantive requirements without precise, standardized thresholds (i.e., policies that allow for government discretion) and/or (b) apply to only a limited geographic area. Therefore, Figure 1 presents this stratified spectrum of policy prescriptiveness from the least prescriptive types to the most prescriptive ones.



Figure 1. Policy styles differentiated based on the extent of policy prescriptiveness.

We used a point system to quantify the results of our analysis on China’s forest policy prescriptiveness (see Table 3). This point system was based on McDermott and Cahsore (2010), which supports clear comparative analysis between different jurisdictions. The effectiveness of this scoring system was validated in previous studies. Of note, these scores are ordinal, only indicating different levels of policy prescriptiveness. In light of this, first, mandatory substantive policies were ranked as the most prescriptive because they spell out precise on-the-ground management actions and must be taken to achieve compliance, leaving no discretion to the forest management or practitioner; therefore, it was assigned a score of 2. Second, mandatory procedural policies have some level of compulsion but provide certain discretion in policy implementation. Their prescriptiveness was therefore weaker than that of mandatory substantive policies, and thus, assigned a score of 1.5. Third, voluntary substantive policies sit between compulsion and voluntariness, and therefore, had a score of 1. Fourth, voluntary procedure policies, regardless of whether they are substantive or procedural, are essentially voluntary. Hence, their normativity level is weaker, and they were assigned a score of 0.5. Fifth, no policy was assigned a score of 0.

Table 3. Point system of policy prescriptiveness.

Prescriptiveness of Forest Policy	Points
Mandatory substantive	2
Mandatory procedure	1.5
Mixed: allows for government discretion and/or apply to limited geographic area	1
Voluntary procedure/substantive	0.5
No policy	0

3. Research Subjects and Case Selection

A comparative case study approach was used to produce a fine-grained accounting of the “on-the-ground” forest regulations in Chinese subnational jurisdictions. To do so, eight provinces were selected, covering China’s major forested regions and considering different levels of economic development, forest tenure and forest characteristics. These provinces were Fujian, Guangdong, Guizhou, Guangxi, Hebei, Heilongjiang, Shanxi and Yunnan (alphabetical order). Specifically, we drew on the forest policy classification framework based on prior formulations from Cashore [19,20] to systematically compare key characteristics of these policies. In the framework’s emphasis on riparian zone management, road building, clearcutting, reforestation and annual allowable cut rules, we avoided the risk of conflating different components of the same “policies” that may

differentially impact forest outcomes. Thus, our study examined a total of eight case provinces. The forest area, coverage rate, GDP per capita, forestland usufructuary rights and their ranking in domestic China are presented in Table 4, as well as their distribution in Figure 2. Together, the selected provinces accounted for 32.66 percent of China’s forest cover and 43.93 percent of the annual forest harvested during 2014–2018.



Figure 2. Sub-jurisdictions included in the study area.

Notably, forestland usufructuary rights are differentiated from forestland ownership according to Chinese legislation. Forestland ownership bifurcates into state ownership—owned by state forestry agencies—and collective ownership—owned by local collective organizations, namely, villages in most cases. Although owners of forestland usufructuary rights were identical to forestland ownership in the past, forest tenure reforms since the early 2000s introduced egalitarian allocations of forestland usufructuary rights within a village and market transactions over forestland usufructuary rights. Subsequently, owners of forestland usufructuary rights became diverse, including not only state and collective agencies but also private actors. Forestland usufructuary rights were intentionally used in this study due to our focus on who were the active practitioners on the forestland. More details about forest tenure reforms in China can be found in Yin et al. [21].

Table 4. Overview of the forest resources in the study area.

	Forest Area (10,000 ha)	Forest Coverage Rate (%)	Forestland Usufructuary Rights Area (%)			Origin of Forests Area (%)		Forest Harvesting Volume (100 Cubic Meters)
			State	Collective	Private	Nature	Plantation	
Fujian	811.58	66.80	11.41	35.24	53.35	52.49	47.51	176,865
Shaanxi	886.84	43.06	29.93	19.05	51.02	64.98	35.02	41,071
Guangxi	1429.65	60.17	6.59	26.41	67.00	48.69	51.31	477,244
Yunnan	2106.16	55.04	21.62	29.60	48.78	75.90	24.10	351,972
Heilongjiang	199.04	43.78	94.4	2.72	2.88	88.97	11.03	184,864
Guangdong	945.98	53.52	6.34	64.50	24.36	34.93	65.07	242,480
Guizhou	771.03	43.77	3.82	20.65	75.53	59.09	40.91	133,992
Hebei	50.27	26.78	9.79	56.11	34.10	47.57	52.43	83,976

Source: NGFA, China Forest Resources Report (2014–2018) [22].

We applied the index of policy prescriptiveness discussed in Section 2 to assess the forest practice policies in the relevant provinces. In the existing literature, this type of

policy index has been predominantly used in Western contexts and has not yet been carefully used to study China because of data deficiency [23]. To bridge this gap, we collected our data in three steps. First, we tested the key indicators with the general forest regulations in China to make sure our index was suitable, meaning that the relevant information was available and could be quantified. Once the key indicators were confirmed, we then collected all accessible formal policy documentation, including statutes, regulations and guidelines enacted by both the central and relevant local governments. Finally, after we had completed our initial analysis, we reported our results to forestry officials in charge of the forestry governance in each sub-jurisdiction studied for comments and used their feedback to ensure our data accuracy.

4. Brief Overview of Forests and Regulations in China

According to the Ninth National Forest Inventory by the National Grassland and Forestry Administration (NGFA) of China in 2020, China has around 22,044.62 million hectares of forest, which constitutes 22.96% of the total land area. Around 1404.152 million hectares (63.7%) are natural or naturally regenerated forests, and the remaining part, almost 800.31 million hectares (36.3%), is plantation forests [22]. China now has the largest plantation area in the world, principally of fast-growing species. Due to intense afforestation activities, China increased its forest cover from 12% in the early 1980s to approximately 23% in 2020 [11]. China plans to increase its forest coverage rate to 26 percent by 2035. By then, China's forest stock will rise to 21 billion cubic meters, and the area of natural forests will reach approximately 200 million hectares (see China's Sustained Afforestation Efforts Green the World | English.scio.gov.cn; available online: http://english.scio.gov.cn/chinavoices/2023-04/06/content_85213960.htm (accessed on 1 April 2024)).

According to article 47 of the new Forestry Law issued in 2019, Chinese forest stands are classified into two categories: ecological forests and commercial forests. Ecological forests are forests in ecologically important areas or ecologically fragile areas that are under strict protection for their ecological function, and commercial forests are forests that are not classified as ecological forests, with the main purpose for wood and other forest products production with economic benefits. In China, around 1236.232 million hectares (56.65%) are ecological forests, and the other part, 945.972 million hectares (43.35%), is commercial forests.

The ownership of China's forestland (including both ecological and commercial forests) is divided between the state (843.661 million hectares, 38.66%) and collectives (1338.544 hectares, 61.34%), whilst the ownership of commercial growing stock for production purposes is 35.34% state-owned, 15.85% collective-owned and 48.81% privately owned. State-owned forests are principally located in the Northeast and Southwest China regions and are primarily managed by either state-owned forestry enterprises or state forest farms, while collectively owned forests, mainly plantations, are situated in South China.

The State Forestry and Grassland Agency (SFGA, formerly named the State Forestry Agency before 2018), which is affiliated with the Ministry of Natural Resources of the People's Republic of China, is the central agency responsible for China's forestry and grassland activities. The SFGA is responsible for policy making, plantation establishment, conservation and wood industry management. In addition, subnational forestry bureaus at the provincial, municipal and county levels coordinate to enforce policy implementation.

At present, the main forest codes in effect are the "*Forest Law of The People's Republic of China (2019 Amendment)*" (hereafter "*the Forestry Law*"), which was adopted in 1984 and most recently revised in 2019, and the "*Regulation on the Implementation of the Forestry Law of the People's Republic of China (2018 Revision)*", which entered into force in 2000 and was most recently revised in 2018. As required by the Forestry Law, timber harvesting requires a valid forest authority certificate or forest tenure certificate, which states who has the authority over a forest. One of the key documents for harvesting is the forest-harvesting permit (the so-called "*Wood Harvesting Admission Certificate*"), which is in

accordance with the annual allowable logging quota approved by the State Council. For companies renting forestland for forest management, a forestland contract is required, in addition to the certificate mentioned above. Converting forestland to another use (usually for construction) is under strict control by the government. Forestland that is to be converted should not exceed the annual government quota, and the organization should have an official approval permitting the conversion of land use, which is issued by the relevant forestry administration. All harvesting activities in terms of harvesting species, area, quantity, size and others must comply with or not exceed the limitations on the forest-harvesting permit. Logging records and harvest volume records are required to verify compliance.

Furthermore, under the Chinese political system, laws and regulations established by provincial governments cannot violate those set by the central government. When formulating provincial policies and standards, most provincial governments tend to interpret the policies and standards set by the central government based on local conditions. However, the final standards are often more stringent.

5. Analysis with Forest Prescriptive Index in Sub-Jurisdictions of China

In this section, we compare the forest practice policies across eight selected subnational jurisdictions with respect to riparian zone management, road stream crossings and road decommissioning, clearcut size limits and cutting rules, reforestation and annual allowable cuts, and then outline the full picture of China's forest management system. After a careful analysis with the analytical framework, we found that the eight subnational cases implement local policies that appear to be consistent with central policies, but there were also subtle differences within them. The results can be found in Table 5, and more detailed analysis follows in subsequent sections.

Table 5. The prescriptiveness of the central level government and 8 subnational cases in China.

Cases	Riparian Zone	Road Building		Clearcutting	Reforestation		AAC	Prescription Level (Total Points)
		Culvert Sizes	Decommission		Reforestation Timeframe	Reforestation Stocking Levels		
Central government	1	0.5	0.5	2	2	2	2	7.5
Fujian	1	0.5	0.5	2	2	2	2	7.5
Shaanxi	1	0.5	0.5	2	2	2	2	7.5
Guangdong	1	0.5	0.5	2	2	2	2	7.5
Heilongjiang	1	0.5	0.5	2	2	2	2	7.5
Yunnan	1	0.5	0.5	2	2	2	2	7.5
Guangxi	1	0.5	0.5	2	2	2	2	7.5
Guizhou	1	0.5	0.5	2	2	2	2	7.5
Hebei	1	0.5	0.5	2	2	2	2	7.5

5.1. Riparian Zone Management

The use of riparian zones is one of the most common best management practices (BMPs) in many regions of the globe, particularly in Europe and North America, but research with China's data is rare if not nonexistent. Our study found that China adopted a different system, but the results are almost similar. A riparian zone is the interface between land and a river or stream. Establishing forest buffers in riparian zones can deliver a number of benefits, including maintaining aquatic-terrestrial complex ecosystems, protecting biodiversity, improving water quality, reducing the impact of floods, optimizing carbon storage and regulating the local climate [24,25]. A number of factors can impact the effectiveness of riparian forest buffers, where the buffer width is a sensitive and measurable one. In this study, we examined the presence or absence of requirements to

establish buffer zones in streamside riparian areas and then spelled out specifications for buffer zones for streamside harvesting and harvest-related activities within these buffers. More specifically, “no-harvest” zones prohibiting commercial harvests and “special management zones (SMZs)” placing special limits on harvest activities within the zone are distinguished.

In China, riparian forest buffers are regulated by a group of laws and rules. At the beginning of the 21st century, China adopted and implemented classification-based forest management to classify forests into public welfare forests and commercial forests according to the primary function of forests. *Forest Law of the People’s Republic of China (2019 Revision)* stipulates that forests on both sides of the streams and tributaries of important rivers and drinking water sources shall be designated as public welfare forests to be strictly protected, and the development of forest farming and forest tourism within these areas must be under the premise of meeting the ecological location protection requirements for public welfare forests and not affecting the ecological functions. In addition, *Measures for the Demarcation of National Public Forests (2017 Revision)* states that state-owned class I national public welfare forests shall not be used to carry out any form of production and management activities. Class I public welfare forests that are collective-owned or privately owned and class II public welfare forests are only allowed for tending and regenerative cutting on the premise of strict protection and do no damage to ecological conditions. The extent of national public welfare forests is defined using both the length and maximum width of the river (see Table 6).

Table 6. Demarcation of national public forests related to riparian forests.

Class of Public Welfare Forest	Definition
Water source of main stream of the important rivers	Take the watershed of the water source as the boundary, extending 20 km downstream and within a maximum of 20 km on both sides of the river in the catchments
Water source of class I tributaries	Where their catchments exceed 10,000 square kilometers, take the watershed of the headwater as the boundary, extending 20 km downstream and within a maximum of 20 km on both sides of the river in the catchment
Water source of the Yellow, Yangtze, and Mekong Rivers	Core area of Sanjiangyuan National Park
Both sides of main stream of those important rivers	
Class I tributaries located north of the Yangtze River, length ≥ 150 km and watershed area ≥ 1000 square kilometers	Both sides from the forest edge, extending 2 km outward for flat land and outward to the first ridge for mountainous land within 2 km of the embankment
Class I tributaries located south of the Yangtze River, length ≥ 300 km and the watershed area ≥ 2000 square kilometers	

More specifically, *Measures for the Administration of Regenerative Felling of Forests (2011 Revision)* points out that forests in the following areas are only allowed to undergo tending and regenerative cutting: (1) forests inside ridges around large reservoirs and lakes, forests within 150 m of flat ground and protective belts of a trunk canal; forests within 150 m on both sides of important rivers and within 50 m on both sides of the main tributaries of important rivers; and the first layer of a ridge shall be the boundary if there are ridges within this range. For the other rivers, the *Code of Forest Harvesting (LY/T 1646-2005)*, which is a recommended forestry industry standard, proposes a specific quantitative threshold with the establishment of riparian forest buffer zones (see Table 7).

Table 7. Widths of the buffer zones.

The Width of the Riverbed (m)	Minimum Width of Single-Sided Buffer Zone (m)
>50 m	30 m
20 to 50 m	20 m
10 to 20 m	15 m
<10 m	8 m

Source: 7.2 in Code of Forest Harvesting (LY/T 1646-2005).

Based on the analysis above, we found that the central government requires the rule of a mandatory SMZ (special management zone) to be followed for those important rivers and their main tributaries, and a voluntary SMZ for the others. Moreover, if the riparian forests are demarcated to class I national public welfare forests and are state-owned, then these forests are mandatory no-harvesting zones. The remaining collective-owned, private-owned class I national public welfare forest and class II public welfare forests are regulated by mandatory SMZs (see Figure 3).

According to the provisions of the *Legislative Law of the People’s Republic of China*, local governments, including provinces, autonomous regions and municipalities, can formulate local regulations for the specific circumstances of the administrative region and the actual needs on the premise that local rules do not contradict the higher level of government. In our study sub-jurisdictions, all the provincial governments enacted rules or standards states that complied with the regulation of central government. Usually, the local regulations act as a supplement or explanation to the national rules, or they specify details about how to implement the policy enacted by the government of a higher level. For example, *Measures for the Administration of Forest Felling in Fujian (2020 Revision)* not only fully complies with the central law but also emphasizes that when regenerative felling mature forests in riparian zones, the harvesting intensity shall be no more than 40% of the pre-logging stand volume, which is more specific than the central rule requires. In our study cases, the riparian zone management policies formulated by provincial governments all followed the provisions made by central government.

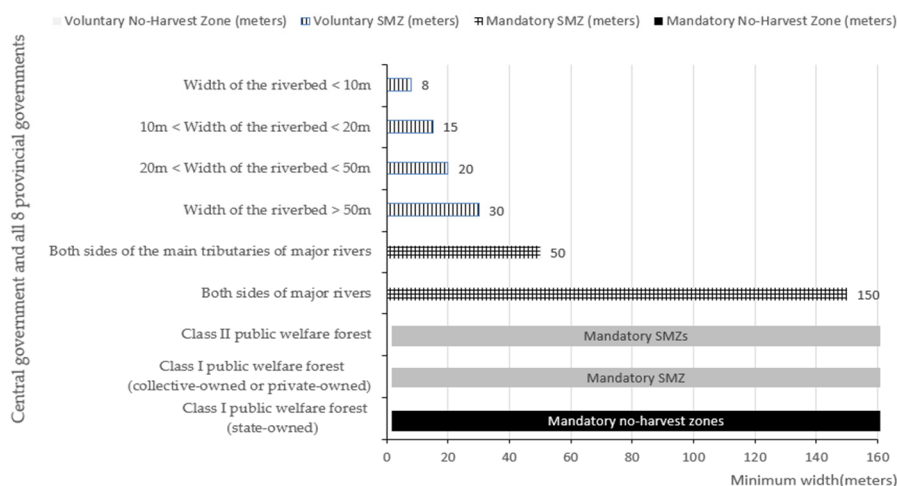


Figure 3. Riparian buffer zone policies in China case study jurisdictions.

5.2. Road Building

Roads facilitate development in remote forest regions, often with detrimental consequences for ecosystems. Road decommissioning after logging could play a crucial role in reducing the negative impacts of timber extraction on forest ecosystems [26]. For this

section, we used culvert size at stream crossing and road decommissioning as key indicators to measure forestry road construction and maintenance regulation.

In terms of the culvert size at a stream crossing, the minimum diameter of the culvert and peak flow level are two main indicators. Design Specification for Highway in Forest Area (LY/T 5005-2014) (a forest highway is a road used both for forestry management and local residents' transportation), which is a recommended forestry standard, states that stream culverts in a forest area refer to those with a single span of less than 50 cm, and the peak flow (peak flow means a road standard that can withstand a high level of rainfall that occurs once every few decades) should be more than 25 years for a grade I forest highway and 50 years for a grade II highway (see Figure 4).

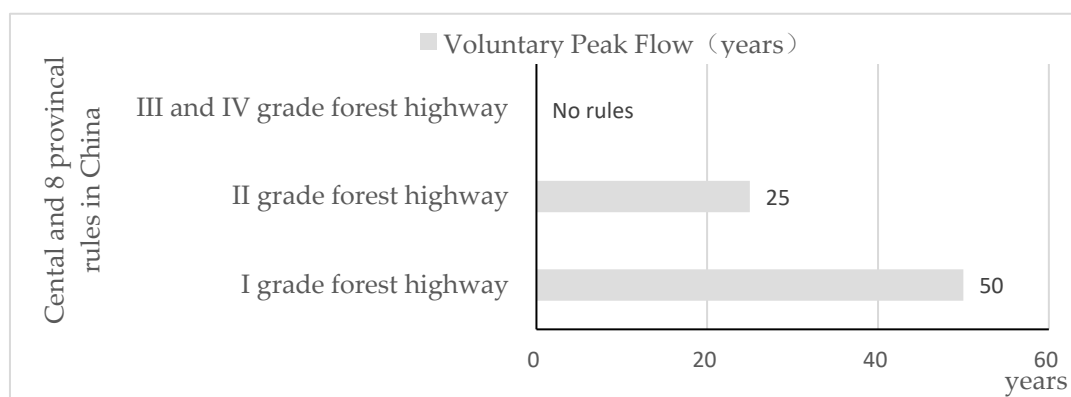


Figure 4. Peak flow specifications for culvert design in forest area of China.

China has a large number of indigenous people living in mountainous and forested areas, and their production and livelihoods are closely related to forestry. The construction of forest roads is not only to facilitate forest management but also important infrastructure that meets the transportation needs of local residents. It causes the absence of rules regulating the decommissioning of forest roads, whether in central government or local government. In contrast, the roads are required to be reconsolidate and converted to forest fire protection usage.

Therefore, we classified China's road-built policy as voluntary substantive because substantive peak flow is specified but it is voluntary. In addition, all eight provincial cases we chose in this study did not have forestry policies for regulating the construction of forest roads, they just followed the *Design Specification for highway in Forest Area (LY/T 5005-2014)*.

5.3. Clearcut Size Limits

Clearcutting is one of the most controversial issues in forest management. In the past, clearcutting was the most popular measure and easiest way to cut down trees, which can harvest timber with the lowest cost. However, many foresters have questioned whether clearcutting can cause habitat loss and fragmentation. Here, we took the maximum clearcutting limits as an indicator to compare the clearcutting regulations in different countries and divisions.

In China, the clearcutting of forests is strictly controlled by laws and regulations. For mature forests, which are the mainstay and essence of forest resources and the most stable and biologically diverse terrestrial ecosystem in nature, the central government launched the *Natural Forest Protection Project* in key state-owned forest areas, such as upstream of the Yangtze River, the middle reaches of the Yellow River, Northeast China and Inner Mongolia in 1998, marking a shift in China's forestry from wood production to ecological construction. In the past 20 years, China has continuously increased its efforts to protect natural forests and comprehensively stopped the commercial logging of natural forests.

Article 32 of the latest *Forest Law of PRC (2019 Revision)* proposes to implement a comprehensive protection system for natural forests and strictly limit the logging of natural forests to restore natural forest resources. Forests other than natural forests were classified into public welfare forests and commercial forests according to their main function. Among them, public welfare forests are also strictly protected, where only tending and regenerative cutting are allowed. For commercial forests, Article 55 of *Forest Law of PRC (2019 revision)* proposes to adopt different harvesting methods based on different circumstances, and the area of clearcutting shall be strictly controlled. Further more, article 8 of *Measures for the Administration of Regenerative Felling of Forests (2011 Revision)* stipulates that for single-layer overmatured forests and unevenly aged forests with less juvenile and mid-aged trees, clearcutting can be permitted with a maximum cutting size of less than 5 hectares each time. In areas with gentle slopes and good soil conditions, the limit can be loosened to 20 hectares each time. Further specified regulations in consideration of clearcutting are set in Article 6.1.1.2 of the *Code of Forest Harvesting*, which recommends the clearcutting specifications related to the degree of the slope (see Table 8).

Table 8. Maximum clearcut size in China.

	Degree of Slope				
	≤5	6 to 15	16 to 25	26 to 35	≥35
Clearcutting size limit (ha)	≤30	≤20	≤10	≤5 (S): 0 (N)	0

Source: Article 6.1.1.2.1 of the Code of Forest Harvesting.

According to the discussion above, the selection of forest-harvesting methods is usually determined by multiple factors, including the forest age, tree species and slope. Clearcutting is strictly controlled, and the cutting size limits are regulated based on the degree of the hill slope. Therefore, we defined China's clearcutting policy at the central level as mandatory substantive.

For the subnational cases in our study, on the one hand, these local governments followed the policies formulated by the central government. On the other hand, they also made regulations tailored to local conditions; though all the provincial rules governing clearcutting may be classified as mandatory substantive policy, we can find the final results in Figure 5, where for local governments, mandatory or voluntary rules are required according to different slopes of the forest stand and other factors.

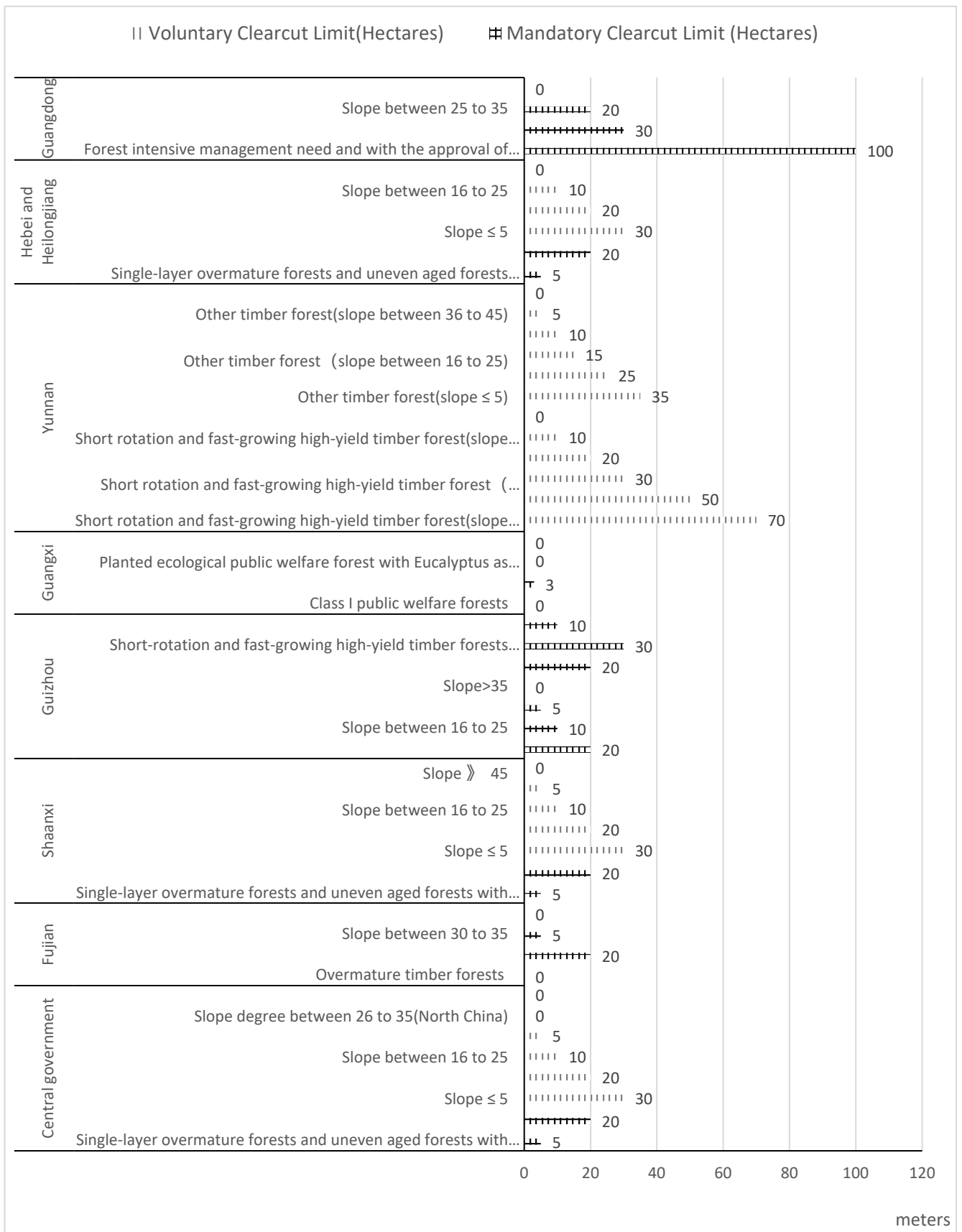


Figure 5. Maximum clearcutting size specifications of sub-jurisdictions of China.

5.4. Reforestation

Reforestation is another important measure of ecological restoration, and our study examined reforestation policy by considering whether legislation dictates minimum stocking levels (i.e., seedlings/stems per hectare) and/or specific time frames in which to achieve these levels.

In China, reforestation is mandatory after timber harvesting – organizations and private individuals who cut trees must reforest the cut-over land. The Forest Law of PRC (2019) stipulates that the number of afforested trees and total area should be not less than the primary status before harvesting. Likewise, Article 14 of Measures for Managing Forest Harvesting and Regeneration (2011) requires that reforestation be accomplished within the same year of harvesting or the year after. In addition, the law also stipulates standards regarding the tree survival and reservation rates. Article 15 requires that any afforestation meet the following criteria: (a) the survival rate of manual regeneration forests should be no less than 85% percent in that year and the success rate should be no less than 80% after 3 years, and (b) in natural regeneration forests, each hectare should reserve at least 3000 seeding treelets or at least 6000 saplings.

According to China's Cutting License System, which is applied across the country, all social organizations or individuals who harvest forests must reforest within the same year or before the next year. Article 30 of the Regulation on the Implementation of the Forestry Law of the PRC (2018 Revision) further stipulates that state-owned forestry enterprises, public institutions, and any other entities or individuals cannot receive tree-cutting licenses if they do not accomplish reforestation and provide proof. Therefore, we classified China's national reforestation policies as mandatory substantive, as they dictate the time frame, number of trees, survival rate and reservation rate of reforestation.

Likewise, all the provinces we studied also implement mandatory substantive reforestation policies. The concrete reforestation rules are similar to the national policies, including a required time frame of two years and specified substantive species, minimum stocking levels and other requirements. Forest survival rates are strictly monitored by provincial forest departments.

5.5. Annual Allowable Cuts (AACs)

The AACs refer to limits on the volume of timber that may (or must) be harvested within a year; such a policy can have a profound influence on the environmental impacts of forest management. While the AACs may be designed to meet a variety of other objectives in addition to, in conflict with or in place of environmental concerns, here we analyze the "stringency" of the AACs policy, which is based on not only the existence of AAC requirements but also the establishment of a sustained yield as a threshold-limiting maximum for allowable cut volumes. More specifically, we identified those policies that base AAC limits on the non-declining even-flow principle of sustained yield as the most prescriptive. If laws require that the AACs be capped by sustained yield but make no reference to the time frame over which sustained outputs would be calculated, we classified this as a "mandatory substantive" policy. If the balance of economic, social and environmental factors was left to the discretion of government agencies, we called this a "mandatory procedural" policy.

The key indicator concerned the limits of annual harvest levels. In the Forest Law of PRC (2019 Revision), the AACs quota calculation process is described in three steps (Article 28). First, state-owned forestry enterprises or other public forest-related institutions formulate a harvest quota of state-owned forests or wood, while county governments calculate the demand quota for collectively and individually owned forests. Second, the forestry authorities of each local government gather and balance the harvesting quotas of state-owned forests, collectively owned forests, and individually owned forests and review them. Finally, the forestry authority of the State Council reviews the annual forest-harvesting quotas for a key forest zone and reports their findings to the State Council for

approval. The State Council then approves the annual forest-felling quotas, which are reviewed every five years. Article 29 of the Forest Law expressly states that the annual forest-cutting volume is to be strictly controlled in compliance with the principle that the consumption of timber shall be lower than the growth, which means that the AACs policy is required and the calculation of harvest quotas is based on a non-declining even-flow policy. Given that this is the most prescriptive way to set the AACs and establish maximum AACs, we classified China's AACs policy at the national level as mandatory substantive.

Article 54 of the Forest Law of PRC (2019) requires that the forestry departments at the provincial level shall prepare annual harvest quotas for their respective administrative areas based on the principles of consumption lower than growth. In our study, the local rules formulated by the local government was consistent with the central government. For instance, in Fujian, Article 8 of Measures for Forests Felling Management of the Fujian Province provides total forest harvesting quotas according to the logging type (e.g., final cutting, tending cutting, low production forests improvement, regeneration felling and other harvesting quotas), consumption structure (e.g., commercial timber, self-consumption timber by farmers and fuel wood) and forest origin (e.g., commercial timber of plantation forests and commercial timber of natural forests). In this situation, the harvesting quota system is managed by both the total quota control and sub-item control. In other words, once quotas have been specified and distributed according to the logging type, consumption structures and forest origin, they cannot be shifted from one item to another. Such AAC regulations were almost the same in each province studied and could thereby be classified as mandatory substantive.

6. Discussion and Conclusions

Our findings revealed little variation between the national and subnational levels and between different provinces regarding their prescriptiveness. Riparian zone management, road building, clearcutting, reforestation and annual allowable cuts in the selected provinces were virtually the same as the rules set by the central government. In addition, the central and provincial cases exhibited a high prescriptive level. On the other hand, variations in policy settings between provinces were found, while being limited. Provincial governments may formulate rules that are stricter than ones at the national level, or some of them may appropriately adjust policy calibrations based on their local forest conditions.

The policy prescriptiveness model was applied for empirical analysis in previous studies. McDermott et al. analyzed 47 countries and conducted a comparative analysis. Based on their findings, this study enriches the literature on the policy prescriptiveness model through detailing the Chinese cases. While they analyzed the Chinese case as a single entity, our study incorporated both the central level and provincial cases into the analysis. In so doing, our cases revealed nuanced policy patterns, particularly in terms of the convergence between central and provincial cases and variations across provinces. Our analysis showed converging policy prescriptiveness between the central government and provincial cases. It suggests that local governments did not have much discretion but obeyed the central government's rule. On the other hand, limited variations of policy prescriptions existed across provinces. These variations, however, were only confined to the aspect of clearcut size limits. Of note, our findings echo those previous study, who found that forest practice policies are likely to have higher average prescription in developing countries.

In the literature on decentralized forest policies in China, many studies claimed that the Chinese central government has substantially decentralized its authority to localities and given more flexibility in on-the-ground forest management [8,27]. Our study, however, showed minimal support for this claim given the strong convergence between central and provincial cases and limited provincial variations. Instead, our analysis supports recent studies of central–local relations in China's environmental governance. For example, Kostka (2017) showed that the central government is still vested with strong authority

to exert influences on localities. Policy processes are therefore still characterized by top-down policy delivery and implementation [28]. Of note, this study contributes to nuanced findings that forest policy settings at the provincial level—in terms of their contents on paper—are equally or even more stringent than national requirements. This finding is slightly different from previous studies, whereby local governments in China are likely to lower the intensity of environmental regulations, such as for the sake of economic reasons [29–31] (e.g., Eaton and Kostka, 2014; Lorentzen et al., 2014; Lichtenberg and Ding, 2008). Our findings may invite future research to examine a potential phenomenon of “racing-to-the-top” in terms of the environmental regulations at the subnational level in China. Meanwhile, future research may also caution upon the gaps between policy “content” and policy in implementation. Existing literature shows considerable selective policy implementations in China.

Our findings may invite further research. Future studies may unravel the relationships between the political system and policy prescriptiveness in China, especially regarding the governmental behaviors and purposes of policy convergence between the central and local governments. In addition, our study revealed that forest practice policies are inclined to be mandatory substantive rules, being characterized by high control and command from the central government. Future studies may investigate how such policy characteristics can be accommodated with diverse provincial contexts and how policies are actually implemented across the country. Moreover, our analysis may facilitate future studies to extend the analytical scope into more extensive regions and temporal ranges in China and serve as a basis for a more substantive comparison between China and other countries.

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