

IMPACT OF TRANSPORT INDUSTRY AND ITS DYNAMICS ON THE
RESERVE FORESTS IN CHINA

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ABSTRACT

The transport sector in China has grown rapidly. China's transportation system is a vast network of nodes that cluster around economically developed coastal areas and inland towns along major rivers. The physical condition and comprehensiveness of China's transportation infrastructure varies greatly across the country. While isolated and rural areas still rely on non-mechanized modes of transportation, a modern maglev system connecting Shanghai to Shanghai Pudong International Airport has been built in China. Construction of airports, roads, and railways will create millions of jobs in China over the next decade. The role of transportation in promoting forest expansion and development cannot be overstated. We have a good chance of turning them into active and successful forest sites if we provide excellent transportation services to forest businesses and their dynamics. This study used a systematic review to gather data from books, journals, articles, and other related publications. To improve the outcome, secondary sources were used to gather qualitative data. A systematic review collects and analyzes secondary data using repeatable analytical methods. The collated paper was then used for the study's statistical analysis. As a result, comprehensive safety assessments of such drugs must include data from more study types than currently exist. Including comparative studies of any kind was made possible by anticipating the research available at the time of inclusion. According to the data gathered, the transportation industry has significantly expanded China's reserve forests. For example, increased accessibility has increased the number of tourists visiting the region to see the wild

animals and natural resources. This study suggests that forest managers expand forest reserves by allowing tourists to visit protected areas like national parks.

Keywords: forest site, forest expansion, forest protection, transportation, system

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1.0 Introduction

1.1 Background of the study

Transportation is considered one of the most fundamental requirements of human civilization (Gan, 2003). There may be no contact between people on this planet if there is no transportation on land, sea, or air. However, there are also negative side effects of transportation, such as pollution, that must be considered. Pollution refers to the toxic wastes produced by humans, which have a negative impact on our environment in a variety of ways. Communication, trade, exchange, and other forms of interchange between communities and localities are made possible by transportation, which is why it is so critical to the growth of the world. Transportation helps to the growth of a civilization's economic, social, political, and cultural domains and the improvement of their living standards in these fields.

In recent years, the transport sector in the People's Republic of China has witnessed significant growth and expansion. China's transportation system consists of a broad network of transport nodes spread across its vast territory, but the nodes cluster around the more economically developed coastal areas and inland towns along important rivers (Taylor, Zisheng, and Jie, 2016). China's transportation infrastructure's physical condition and comprehensiveness tend to differ significantly depending on where you are in the country. While isolated and rural areas continue to rely heavily on non-mechanized modes of transportation, a modern maglev system has been constructed in China to link the city center of Shanghai with Shanghai Pudong International Airport, allowing for faster travel times. Over the next decade, the construction of airports, roads, and railways will significantly increase employment opportunities in China.

According to the International Forestry Organization, China's forest market has quickly risen to become a key, if not the most important, driver of investment and sector shift, with implications for forests and forest-dependent lives worldwide. In determining the future of China's forest sector and the ramifications of that future for the rest of the globe, it is crucial to consider the government's commitment to expanding local supply and manufacturing and future economic growth in the country. The dedication of China to growing its domestic supply and manufacturing is crucial for the rest of the world's economic development. Following the International Monetary Fund's estimates, China's gross domestic product (GDP) accounted for 13 percent of global output in 2004 (measured in purchasing power parity). According to the International Monetary Fund, China is most likely the world's third-largest exporter, it is the largest beneficiary of foreign direct investment, and its imports have climbed by 40 percent in recent years. There are, however, reservations regarding China's ability to maintain its current rate of economic growth in the long term. Several unstable banks have given credit at an unsustainable rate, contributing to the formation of a property bubble while simultaneously pushing inflation well above the 5 percent barrier in some cases. To add insult to injury, there is a shortage of transparent institutions, evidence of corruption, excessive income inequality, inefficient state-owned enterprises, and significant environmental damage to contend with.

Forestry is an important fundamental industry with unique characteristics that benefit the general public. From the perspective of forestry, the process of social development is also the process of human use of forest, in which humans are reaching an even greater extent of forest utilization, changing how forestry is used, and improving the contents of

forestry uses following the principles of sustainable forestry development. Of course, the seed of these alterations was seeded in the first place by a shift in the human's cognitive perspective of the forest. Humans discovered the critical role that forests play in land ecosystem restoration, climate change mitigation, social and economic development, and reducing rural poverty and illiteracy. As a result, the human forest view is defined as being a global consensus on reducing deforestation, boosting forest preservation, and forest sustainable development, with global forest and forestry problems being politicized and internationalized.

There has been and continues to be debate about the impact of transportation on the forest industry. It is contentious in the sense that there are various schools of thought about how transportation affects the development of forest industries. Gromtsev (2002), for example, have categorized the impact of transportation on forest development into three categories: beneficial, neutral, and detrimental the positive effect of transportation is when it catalyzes the continued growth of forest industries, whereas the neutral effect is when transportation facilities do not directly result in productive activities in the forest sector. There is a bad instance associated with conditions in which it causes an increase in pollution, which results in a decrease in the amount of production in the forest industries.

Consider the relationship between transportation and the forest industry in the United Kingdom. According to the author, "transportation in the forest industry is confronted with a paradox: on the one hand, modern industrial societies pursue economic growth through the open exchange of people, raw materials, energy, goods, and services in an increasingly global marketplace; on the other hand, the transportation systems required to allow such exchange may be exerting pressures on the natural resources that are used to facilitate such

exchange." Shortly put, Masaki et al. (2009) remarked that we could not live without transportation development, but we will not be able to cope with its side-effects over the long term in the forest industries section if we do not act quickly.

The availability of stable and effective transportation infrastructure is one variable that contributes to a country's social and economic development and progress. Even though transportation can have a good, negative, or neutral impact on an economy, many people believe that it helps advance regional development in a country. Migration and the easy spread of illnesses are two of the negative consequences of transportation, but there are occasions where transportation facilities do not affect production at all. In the neutral case, transportation facilities do not affect productivity to attract investors who will use the nation's abundant resources. Transportation assists in the wealth creation of an economy. It also assists in the exportation of commodities and services. Transportation can contribute to the improvement of people's standard of life because it helps generate revenue for individuals who are involved in it and the citizens of the places where these transportation companies are located (Woods, 2010).

Because transportation is the engine that propels forest growth, it is impossible to fulfill the full potential of the forest. People sometimes use the terms "forest" and "transportation" interchangeably, but it is important to understand that they are two distinct concepts; for example, all forests are travelers, but not all passengers are forests (Liu et al., 2014). Road transportation is a widely popular mode of transportation among the Chinese population. Most Chinese prefer to travel by road, not because it is the safest mode of transportation, but because it is the most affordable mode of transit after water transportation. Considering that transportation and forest are both intertwined, road

transportation appears to be the most advantageous because it provides forest-friendly support services such as fuel stations, auto maintenance, and even rest stops (Lü et al., 2011). Travel and forest industries in China, on the other hand, have been expanding at a rapid pace in recent years. According to research published by Deng et al. (2010), this sector has contributed significantly to the growth of China's Gross Domestic Product (GDP) in recent years. Furthermore, despite the current economic downturn, the travel and forest industries are making significant contributions to the economy's recovery. As a result, the government has taken steps to ensure the long-term viability of the business while also using it as a tool to fulfill its 2030 objective (Shen et al., 2013).

The vast majority of research undertaken concerning the effects of transportation on forest reserves appear to characterize the link between forest and transportation in terms of the question of accessibility, except for a few studies that examine the effects of traffic on wildlife. It looked at the historical backdrop of a forest in how various forms of transportation have evolved. To develop the forest industry, it is required to take an interdisciplinary approach to transportation. It serves as one of several dynamic forces that work in concert to develop the forest business (Liu et al., 2019).

Over the years, China's road transportation infrastructure has fallen short of the country's needs in terms of promoting regional integration in the region. The united efforts of the member countries of the Asian Community, on the other hand, have made it feasible for improvements in the state of the road to be achieved. Increased building of new roads and restoration of existing roads have occurred between 1982 and 2009, with the most significant rise occurring between 1982 and 2009. Through government

programs, a great deal of work has been invested into expanding, restoring, and managing the roadways.

The Chinese economy has experienced unprecedented growth in terms of both economic and development growth, and as a result of the rapid growth that the country is currently experiencing, the government has developed policies that have been thoroughly researched to keep up with the pace of growth. However, this research investigates how enhanced transportation infrastructure in China can increase the dynamics of the reserve forests for the Chinese people.

The importance of transportation in fostering the expansion and development of existing forests in any country cannot be overstated (Zheng et al., 2012). It is crucial to highlight that by providing excellent transportation services to forest businesses and their dynamics, we have a good chance of transforming them into active and successful forest sites, and in the process, we may see a large number of people paying visits. Even though many writers have acknowledged the importance of effective transportation as a prerequisite for successfully implementing a forest development program Wang et al. (2013), there has been little research conducted to investigate the implications of transportation on reserve forests in China. Therefore, this study's main objective was to assess the impacts of the transportation industry and its dynamics on the reserve forests in China.

2.0 Data and Methodology

The methodology section covered the statistical approaches and strategies that involved for data collection, and analysis. Methodology is the study framework that enhance the alignment measures for data collection and analysis. The study embraced the quantitative method in the collection design. The study used an experimental design in the collection and analysis of data.

Experimental design, also known as the design of experiment, is described as the design of an information-gathering experiment in which a variation is present or not, and it should be executed under the complete control of the researcher in statistical terms (Tian et al., 2018). This is a term that is commonly used in the context of controlled studies. The effects of the variable are minimized in these trials, which increases the reliability of the results.

2.1 Data collection

This study applied the systematic review of the literature in the collection of data. The study used the quantitative method and collected books, journals, articles, and other related publications, to gather sufficient evidence for this study. Secondary sources were deemed effective in the study since there is no large pool of individuals that can reflect on the ideas of transportation and for4st industry as these sectors are known to be diversified, making hard to bet participants for this study. Additionally, primary data may have become expensive and time consuming as the result of traveling 60 get the participants required for the study. Therefore, secondary data was deemed efficient. The data sources were collected online through the use of key words, literature and abstracts.

The collection of data was done through the use of online website such as search engines, google scholar, PubMed and other related sites.

In addition to the google search, a manual search of key terms and literature was conducted. According to the findings, the study considered the literature, and information was obtained from 2010 to 2020 during the study period. Several internet search engines were employed to find web pages that could be utilized as references. It was discovered that there were 246 citations as a result of this endeavor, and it was from these those relevant articles were selected for inclusion in the review. We then found that 146 of the citations were irrelevant, and they were thus excluded from consideration for the study. It was necessary to evaluate the entire body of work from the remaining 100 citations to determine which primary human studies had been conducted directly related to transportation and dynamics and their impact on the Chinese reserve forests and thus should be included in the study. These criteria eliminated 48 papers from consideration, leaving 52 studies to be considered for inclusion in the review.

The collected paper was then used as the basis for the statistical analysis conducted as part of the study. Included comparative studies of any kind were made possible by considering the type and amount of research expected to be available at the time of inclusion. Consequently, selected research provided information concerning the impact of mobility on protected regions and forests in China, as well as the dynamics of transportation in such areas and forests.

Particularly, the collection of data systematically enhances the collection of diverse data from the past knowledge to ensure the data collected is significant to the present study (Yan and Crookes, 2010). The scope of this study is confined to providing a

narrative description of the research findings, which is the primary objective. The impact of transportation on China's reserve forests and transportation dynamics were the subjects of 26 research studies. The vast amount of published work related to safety that you have come across thus far strikes you as remarkable after you have spent some time reading and comprehending the review. Additionally, it was discovered that 10 of the data collection sources that were selected for data collection discovered mentioned about the transportation and its adverse effect on China's reserve forests. As well, it was noted that 11 of the sources has explanation on the challenges encountered transportation to forest region. As a result of the collection, it was discovered that 12 publications found no relationship between transportation and reserve forest dynamics in China, and 19 publications discovered a significant development of reserve forests in China as a result of improved transportation and dynamics development.

2.3 Data analysis

The collected data was summarized using graphs to efficiently represent the information. A systematic approach was used to gather information from sources and summarize it with citations to guarantee that the appropriate inference was drawn. Additionally, the systematic analysis was done on the papers to enhance the discussion of the result.

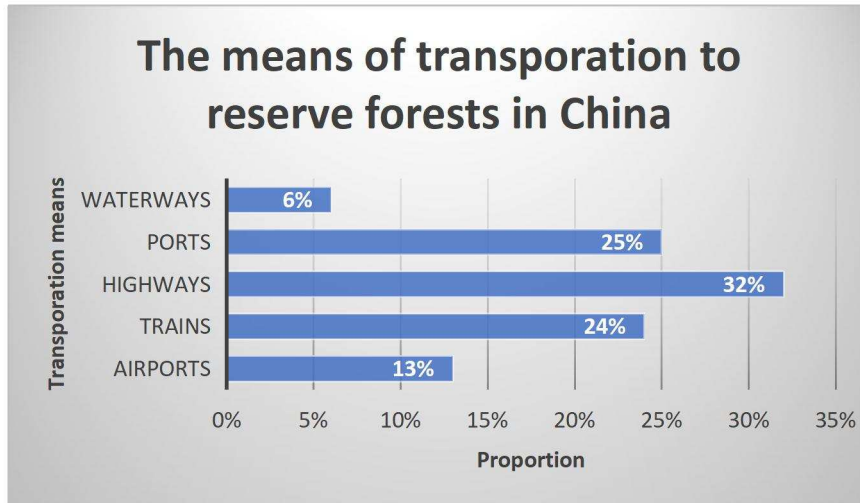
3.0 Result and findings

In this section of the paper, the evidence gathered from the literature, as well as the sources are chosen for investigation, were evaluated and analyzed in detail. Transportation is involved in every element of human life, economics, commerce, services, and problems all over the world, including space travel. Transportation is also important in the development of new technologies (Chen and Innes, 2013). It provides transportation for systems. The transportation of personnel is advantageous since it saves them both time and effort. Contrary to popular belief, commodities are only delivered to a particular spot. Forest ecosystems have profited from the transportation sector, but they have also been degraded by the business. In order to better understand the overall impact of transportation and the dynamics of transportation in China's reserve forests, it was important to investigate the overall impact of transportation and the dynamics of transportation in China's reserve forests.

3.1 Different strategies for forest protection

Through the analysis, it was evident through the papers that China has a comprehensive transportation network of airports, trains, highways, subways, ports, and waterways. Among these, high-speed rail lines, highways, and many new subways have perhaps improved the daily lives of local people most dramatically. These were examined in the graph below:

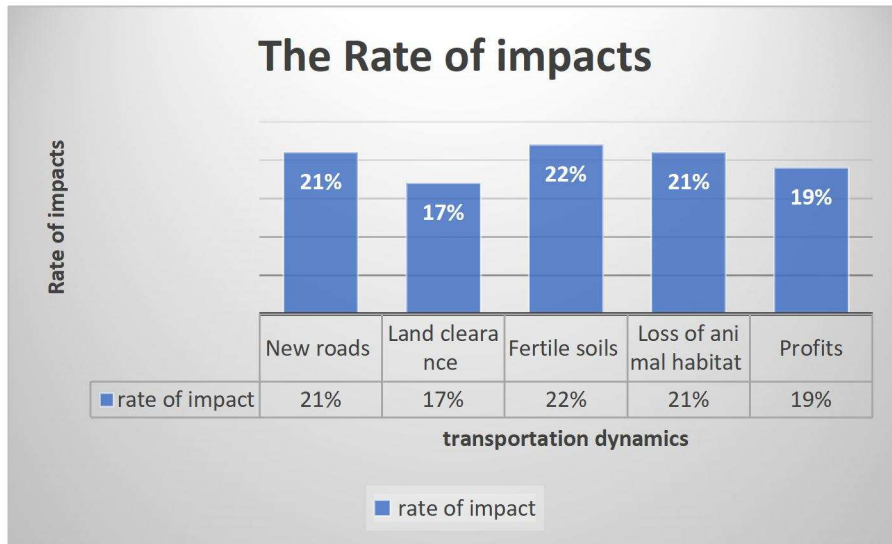
Figure 1: Transportation means to forest reserves in China



According to the data, highways are the most popular mode of transportation in China, accounting for 32 percent of all trips to these destinations. A 25 percent success rate is achieved by using ports as a technique, as opposed to other approaches. The influence of waterways was 6 percent, the influence of railroads was 24 percent, and the influence of airports was 13 percent.

The evidence supplied by Zhong et al. (2015) was in direct opposition to the evidence presented by Zhong et al. (2015), which stated that the train is one of the most important modes of transportation in China and that the national rail network is one of the largest in the world. It is estimated that the entire mileage of railways in China that are open to traffic is 124 thousand kilometers. The number of people transported by train has surpassed 2.5 billion for the first time in history. However, according to the most recent studies, the vast majority of Chinese tourists who visit the protected woods rely on highways as a reliable mode of transportation to get there.

Figure 2: The rate of impact of transportation industry dynamic on reserve forests in China



Through the evidence gathered from the sources, the various assessments were examined to yield the following result. For instance, it was examined that new roads constriction along the reserve forests for transportation can result in division among the rainforest parts and loss of connection between biotic and abiotic systems as indicted with 21%. Following the evidence, the results that new roads divide up areas of the rainforest and can cut off connections between distinct biotic and abiotic systems were supported by Chen, Wu, and Hong, 2012). According to Taylor, Zisheng, and Jie (2016), a road can prevent monkeys such as the golden lion tamarin from traveling to seek food, preventing them from dispersing seeds to re-sow plants in the forest, as mentioned in the literature.

According to Nicholls et al. (2022), land clearance for farming, transportation, and mining can result in deforestation, as proven by the fact that 17 percent of the world's population lives in forest areas. Following the information provided by the sources,

hardwood trees take several years to grow, and, as a result, it can be difficult to refill them once they have been harvested (Wang et al., 2012). When forests are destroyed to construct transportation infrastructure, the fertile soils that make farming possible are quickly washed away. As a result, the rapid development of reserve forests in China has been slowed, as evidenced by 22 percent of reserve forests being destroyed. When trees are cut down, as the findings of the inquiry revealed with a percentage of 21 percent, animal habitat is lost to people, according to the investigation findings. As a result, deforestation can result in the extinction of particular species, the endangerment of other species, and the extinction of entire ecosystems (Yan and Crookes, 2010). Rather than benefiting the rainforest people who have been displaced as a result of deforestation during road construction, profits from large-scale agricultural and resource sales are usually returned to large enterprises. Evidence for this was provided by statistical data obtained from the study results, which accounted for 19 percent.

Table 1: Forest plantation rate and plantation per region

Region	Total Area	Annual Planting Rate of New Plantation
Northern Frontier	8 036	194
Northeast China	115 847	3 500
North China	32 015	5
Central China	17 533	234
Western China	3 201	50
South China	10 455	509
China Total	187 086	4 493

As examined in the analysis, it was evident that Northeast China recorded the highest total area for forest with 115847 ha, as Western China recorded the lowest with 3201 ha. As well, Northeast China recorded the highest annual plantation of 3500.

4.0 Discussion of the Result

Following the evidence provided by 34% of the data collection sources, it was demonstrated that transportation development along forest routes shares the same negative effects as other human activities that degrade the natural environment, with their unique development impacting the forests in China through appropriation reserve forest land.

In the case of highway expansion, one of the most direct effects on ecosystems is the destruction of natural habitat as a result of its "conversion" into a transportation land use or "right of way," as previously explained (Hishe et al., 2021). Nature may be preserved within the right-of-way, but natural characteristics of the land are lost within the paved area and along the sides of nearby roadways. The following are the most significant modifications: the removal of vegetation (trees, bushes, and grasses) and leveling activities in conjunction with it (which ruin the native topography and soil profile). According to the scenario, natural vegetation may be replaced, alternative species may be planted, and habitat values may be amended. If a road is being built across a wetland, it may be necessary to perform filling and draining operations, which can devastate the ecosystem. Altering flow (by damming or channelization) in aquatic environments can result in the extinction of habitat. All of the activities associated with

road construction, including dredging, filling, and draining, have the additional effect of degrading aquatic habitat. Sixty-seven percent of the sources collected for evaluation were provided as evidence, which consisted of 40 extracted sources that contained a variety of sources such as papers, journal articles, books, and other publications, among others.

According to 56 percent of the information gathered, transportation and dynamics have improved transportation services. Examples include the development of new highways and airports to facilitate the travel of people to protected forest areas, which has resulted in more rapid development of the woods themselves. According to Zhong et al. (2019) evidence, improved transportation means that raw commodities such as minerals and timber are more readily available to the general population. Rainforest products can be removed from the forest and sold in other locations outside of it.

Moreover, positive evidence may be examined, with 80 percent of the collected sources indicating that infrastructure development through forest materials has occurred in China due to effective ways of communication provided by the transportation industries, which can be analyzed further. As a result of the cash earned by lumber and other forest natural resources, a significant amount of money has been invested in forest development.

According to the information gathered, earnings from the sale of natural resources can be utilized to improve the infrastructure of a country's economy. This was the case for 78 percent of those who took part in the survey. Sales of rainforest resources, for example, can generate profits that are used to fund the construction of schools and clinics in developing countries. According to the article, when it comes to the

transportation dynamics of China's transportation industry, there are two fundamental elements to consider, which are joined by the following: (Zhong et al., 2019). Economic dynamics have increased pressure on natural resources due to the rise of the middle class and the consequent increase in vacation time and interest in outdoor recreational opportunities. This has resulted in a greater need for conservation and ecological protection, which is made possible by the easy access to protected areas such as reserve forests, which are becoming increasingly common.

The increased transportation industry and its dynamism, as evidenced by 56 percent of the sources gathered, have facilitated easier access to the forest, which has resulted in improved economic development among the Chinese population. The availability of improved routes has piqued the attention of employees and job seekers alike, who are keen to begin working in the forest as soon as possible. As a result, people's quality of life has improved, as has their level of productivity increased. Furthermore, according to Zhong et al. (2019), the development of roads and accessibility infrastructures contributes to effective sustainability. As a result, this evidence was likewise consistent with the investigation results.

Furthermore, the data gathered has revealed that the transportation industry has made significant contributions to expanding China's reserve forests. For example, the improvement in accessibility has prompted an increase in the number of tourists who come to the region to observe the different wild species and natural resources from the forests. According to 82 percent of the gathered sources, simple access to forest materials such as goods and other natural resources has been gained. These resources have been transported to manufacturing enterprises to make money. This has had a big

and substantial impact, and it has resulted in the construction of reserve forests in China, among other things.

5.0 Conclusion

This research has proven that reserve forests in China receive a wide range of benefits due to the transportation systems and dynamics that are in place. Some are direct, some are indirect, and some are induced.

Our research resulted in broad conclusions about the influence of transportation infrastructure on the dynamics of reserve forests in China based on our findings. First, it appeared that China's transportation infrastructure was still playing a big role in expanding the country's reserve forests, even though the country had advanced to the upper-middle-income stage. First and foremost, quality improvements in transportation infrastructure (measured in terms of expressways and high-speed rail development) and structural upgrades to the transportation infrastructure (measured in terms of the increasing share of government expenditure for transportation) both contributed significantly to the expansion of reserve forests. On the other hand, the investigation did not discover a statistically significant positive impact on the overall quantity increase of the land transportation network. Third, government development policies that are at odds with local comparative advantages result in lower per capita GDP growth rates and have the potential to limit the contribution of transportation infrastructure to overall GDP growth rates. Finally, regional heterogeneity in Western China may differ depending on the form of transportation used, particularly commodities versus passenger transit and motorways versus trains, among other things.

In recent decades, as a result of the country's growing economy and a growing population with more discretionary expenditure, vacation time, and personal mobility, the number of National Forest Parks in China has increased alarmingly, resulting in an alarming increase in the number of National Forest Parks in China. The parks system's large-scale social and economic drivers are frequently intact (i.e., ticket sales and employment increase in direct proportion to park and visitor numbers), but parks frequently fail to meet the requirement of sustainability, even though parks frequently meet the requirement of sustainability (Ranagalage et al., 2020). It is also challenging to meet the long-term viability and sustainability criteria because the social and economic advantages are not usually concentrated in a certain geographical area. It is possible that ecosystems and species that attract visitors would be lost due to the current operating model of China's parks, while poverty and socioeconomic inequities among indigenous and rural people will worsen. Like Hishe et al. (2021), several researchers have shown that putting too much attention on one or two goals can negatively affect other parameters. Specifically, we believe that environmental protection is being compromised for the sake of jobs, ticket sales, and corporate growth pressures. Using a new organizational structure and increased participation from local communities, the country's parks may be able to adhere to the principles of sustainability and support Eco forestry, which helps to conserve both the natural environment and the livelihoods of local people—all without becoming a financial burden on the system.

5.1 Future Direction

Problems have beset China's forest reserves since 2003, and the central government has cooperated with provincial and local governments to address many of the problems.

This has included enhanced transportation and forest management. To strengthen the reserve forest system, initiatives include encouraging environmental preservation, demolishing inappropriate structures, designating core protected areas, and establishing effective transportation means to monitor the forests' accessibility. Restoration efforts, on the other hand, have not always been effective. Nevertheless, the transportation industry and its dynamics have been left as an impediment to the growth of China's national parks and reserves. This study has established a method for better development through improved transportation for access to natural resources, demonstrated in previous research. As a result, this study proposes that forest managers expand forest reserves by employing effective means for tourists to have access to the forest to witness the beauty that envelops these forests in China, particularly when it comes to protected areas like national parks.

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Appendix

Transportation means	Proportion (%)	
Waterways	6	
Ports	25	
Highways	32	
Trains	24	
Airports	13	
Rate of impacts on transportation dynamic	Proportion	
New roads	21	
Land clearance	17	
Fertile soil	22	
Loss of animal habitat	21	
Profits	19	
Region	Total Area	Annual Planting Rate of New Plantation
Northern Frontier	8 036	194
Northeast China	115 847	3 500
North China	32 015	5
Central China	17 533	234
Western China	3 201	50
South China	10 455	509
China Total	187 086	4 493

