

# "Cash Tree" or "Poisonous Tree": A Study on the Collective Action Dilemma of Eucalyptus Planting in Neilong Village, China

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Sustainable use of common pool resources is crucial, especially with China moving away from relying solely on resource stock for economic development. Managing common pool resources is vital for the shift in economic development practices. Using Elinor Ostrom's Institutional Analysis and Development framework, this study focuses on Neilong village in Fujian Province. It examines how overplanting by villagers for eucalyptus cultivation led to a decline in the water table. The villagers' unique utilization of groundwater as a common pool resource involves an indirect seizure. The village's distinctive clan culture, coupled with the absence of rules, results in a collective action dilemma. Villagers, boundedly rational and lacking corrective learning mechanisms, face challenges in self-correction. The paper suggests that government intervention is the most effective solution to address this dilemma.

Keywords: institutional analysis, collective action dilemma, common pool resources, indirect seizure

# Introduction

#### **Raise of Problem**

At the outset of the Reform and Opening-up era, resource depletion wasn't a pressing concern for the Chinese government and its citizens. Economic suspension over the past three decades resulted in the objective retention of significant resources, coupled with inefficient resource utilization due to technological limitations. However, the environmental toll of industrialization and modernization, exemplified by severe smog in the Beijing-Tianjin-Hebei region<sup>1</sup> (Jin, 2013; Sun, 2013; Zhao, 2013; Gong, 2014) and depletion of fishery resources in the Yangtze River basin<sup>2</sup> (Fu, 2013), has prompted a reevaluation of the balance between economic

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<sup>&</sup>lt;sup>1</sup> Since January 2013, quite a few places in China have experienced severe smog days, with the Beijing-Tianjin-Hebei region the most severe. A news release from the China Meteorological Administration said: "This stage is in a process of development, the fundamental response is still reasonable planning. While calling on the government to change the way it develops, ordinary people should also raise their awareness of environmental protection". Some studies have reported that coal combustion pollutants are the biggest source of haze in the whole Beijing-Tianjin-Hebei region, contributing 82% to sulfur dioxide. After National Day in 2014, two rounds of severe smog occurred in less than 10 days in the Beijing-Tianjin-Hebei area.

 $<sup>^2</sup>$  The Data from the Ministry of Agriculture show that in 2011, the natural catch in the Three Gorges reservoir area of the Yangtze River, Baxia Area, Dongting Lake, Poyang Lake, and Estuary Area was less than 50,000 tons. In the past two years, the fishery production of Poyang Lake and Dongting Lake has decreased by more than 50% compared with the highest production in history. Hubei's catch on the Yangtze River was 264,000 tons in 2010 and only 206,000 tons in 2011.

development and environmental protection. The call for "sustainable development" gained prominence, epitomized by the slogan "Green Water and Green Mountain are Golden Mountain and Silver Mountain". Yet, reversing the economic-environmental balance isn't an immediate task.

In rural areas, the principle of "Making a Living with Local Advantages" has guided livelihoods and production. For instance, Inner Mongolia's fertile grasslands support a thriving livestock industry, while coastal areas capitalize on offshore advantages for large-scale fisheries. Similarly, provinces like Fujian, Hainan, Guangdong, and Guangxi, endowed with abundant precipitation and fertile terrain, have embraced large-scale forest cultivation. However, the lack of scientific management and proactive guidance has led to issues such as grassland desertification from overgrazing, depletion of marine resources due to overexploitation, and a decline in water table and land fertility from over-cultivation.

The grasslands, fisheries, and groundwater highlighted are typical common pool resources<sup>3</sup> (Ostrom, 1999; Yuan & Qin, 2020), sharing a common challenge—the collective action dilemma arising from users' failure to reach a consensus on rational resource use. Consequently, the management dilemma of common pool resources has become a prominent topic in Chinese academia.

Numerous predecessors have extensively studied and established a nearly perfect theoretical system for the scientific and sustainable use of common pool resources<sup>4</sup>. However, the diverse nature of these resources and the various ways they are utilized have given rise to new collective action dilemmas in resource management. The analysis in this paper focuses on the collective action dilemma arising from eucalyptus planting in Neilong Village, Fujian Province.

In terms of typology, the groundwater involved in this case qualifies as a typical open common pool resource. However, its uniqueness lies in two aspects: First, the use of groundwater is indirect, as individuals plant eucalyptus on lands with defined property rights, yet the shared resource is the flowing groundwater. Consequently, resolving the dilemma isn't achievable through property rights definition alone. Second, owing to a distinct clan relationship, all villagers have formed a community marked by mutual trust and support. This unity results in a situation where, despite a collective understanding of the problem's cause, no one proposes a solution after the water table decline.

This case introduces a novel challenge to common pool resource management. The paper will commence with an analysis of the eucalyptus planting dilemma, attempting to offer a nuanced understanding of this unique problem. Subsequently, it aims to contribute to the development of a governance approach for effectively resolving this dilemma.

#### **Literature Review**

Throughout human history, the prudent and sustainable utilization of common pool resources has remained a pivotal concern. The initial step in addressing this challenge involves understanding the underlying reasons for

<sup>&</sup>lt;sup>3</sup> Unlike pure public goods (non-exclusive and non-competitive), club goods (exclusive and non-competitive), and private goods (non-exclusive and non-competitive), common pool resources are a class of public resources in which people share a resource system but have access to resource units separately (Ostrom, 1999), i.e. they are non-exclusive and competitive. The characteristics inherent in the common pool resources that all parties share the resource system but possess the resource unit exclusively render them in a state where they are utilized competitively (Yuan & Qin, 2020). When the use of service flows by one individual reduces the service flows that others can utilize, and service flows are scarce compared to demand, consumers, fearing that they will not have available resources in the future, try to obtain as many shares of the resource flows as possible (Ostrom, 2004), resulting in a tragedy of the commons.

<sup>&</sup>lt;sup>4</sup> For example, Elinor Ostrom's theory of autonomous governance of common pool resources.

its existence. Scholars from both the United States and China have fervently delved into the exploration of scientific and sustainable approaches to employing common pool resources, yielding numerous outstanding research findings.

In the United States, the evolution of the theory of collective action in public affairs governance has traversed three distinct stages. The initial idealistic phase, championed by thinkers like Arthur Bentley and David Truman, expressed optimism about collective action, asserting that individuals with common interests would willingly act to promote their shared goals within a collective (Bentley, 1949, p. 111). The subsequent empiricist phase, exemplified by scholars such as Mancur Olson and Garrett Hardin, adopted a more skeptical view. They contended that rational and self-interested individuals typically do not align with collective interests unless within a small group or compelled by external forces, often through coercion or special means (Olson, 2004). According to them, effective optimization of collective action is unlikely unless measures are in place to regulate individuals' tendencies to "free-ride" (Hardin, 1968).

The final institutionalistic stage, embodied by Elinor Ostrom, takes an active stance on collective action. Ostrom contends that, with a system designed to foster potential, interdependent members of collectives possess significant capabilities to autonomously reshape the gaming environment, circumventing issues like "free-riding" and opportunistic behavior. However, she emphasizes that discussions are limited to non-totalitarian systems (Ostrom, 2012).

Over the past two decades of sustained high-speed economic development following the Reform and Opening-up, the issue of balancing economic growth with environmental protection has gained prominence on the Chinese agenda. Consequently, Chinese scholars have increasingly focused on and delved into the challenges of collective action in the management of common pool resources.

In the initial stages, scholars began with specific cases, examining characteristics of common pool resource management in China. For instance, one scholar analyzed the use of water resources by a small production team in Middle Anhui Province, applying the "Theory of Common Pool Resources" to highlight governance dynamics such as stage, times, and locality (Xu, 2006). Another set of scholars, using water resources management in the Lake Taihu basin as a case study, identified three key features: diversified participation, common goal orientation, and cooperative engagement (Zhou, Fan, & Zhang, 2009).

Building on foreign theories, subsequent scholars proposed localized theories. For example, one group introduced the concept of "sliding rod principle" based on the case of the lifting rod service team in the Mountain Fanjing Scenic Area, presenting a theory of folk voluntary corporatism (Jin & Zhao, 2010). Scholars also delved into the role of government in self-governance and explored relationships between various actors. Some highlighted the importance of a refined and complete system foundation as a prerequisite for self-governance and cooperative governance, emphasizing the need for government participation, infrastructure support, clear ownership, and external support for farmers' cooperative governance (Mao & Yang, 2010). Others emphasized the necessity of effective integration among government, enterprise, society, and village to ensure the success of multi-subject participation in the self-government system (Tan & Peng, 2013).

In recent years, scholars have explored effective governance methods considering two types of common pool resources: open common pool resources and closed common pool resources. For open common pool resources, researchers found that the government's willingness to grant autonomy to local groups and establish an authorization path enhances the social capital of these groups, proving crucial for independent management in the Chinese context (Tan, Cai, & Zhang, 2018). On the other hand, for closed common pool resources, scholars

emphasize the importance of perfecting the multi-level governance structure for effective management (Yuan & Jin, 2020).

While these studies offer profound insights, they also bring forth new challenges, as exemplified by the case to be analyzed in this paper. Groundwater, typically considered an open common pool resource, takes on a novel use in this case—villagers plant eucalyptus trees on land with clearly defined property rights, but the common pool resource in use is the flowing groundwater, introducing an element of "indirectness". This distinctive characteristic leads to significant changes in both subjective and objective aspects—the users and the use of resources, posing an undeniable influence on collective action. Therefore, the need to delve into the nuances of this issue arises from the indirect use, as opposed to direct use, of open common pool resources.

## **Question Definition and Research Method**

This paper will center on the collective action dilemma arising from eucalyptus planting in Neilong Village, Fujian Province. Employing the Institutional Analysis and Development framework as the foundational analytical tool, the study aims to investigate the factors contributing to the decline in the water table due to the villagers' overplanting during the collective action of eucalyptus cultivation. The primary objective is to develop a nuanced understanding of this emerging issue and subsequently propose a governance approach to address the dilemma. The research employs the following methods to identify the reasons behind the collective action dilemma in eucalyptus cultivation.

First, the author employed the field research method, conducting an extensive month-long investigation in Neilong Village. A comprehensive and multi-perspective interview approach was adopted, involving relevant subjects. First-hand information was collected through interviews, including:

- Interviews with five villagers engaged in tree planting and five who were not;
- Interviews with contractors involved in the tree planting activities;

• Interviews with the village party branch and the village committee, encompassing individuals such as the village secretary, the village chief, and the director of the village women's federation;

• Interviews with village elites, including the former secretary Mr. Lin<sup>5</sup>, the founder of the "Good Neighbors" program<sup>6</sup> Mr. Lusheng, and members of the "Good Neighbors" Women volunteer team;

• Interviews with government workers in Xiahe Town, to which Neilong Village belongs.

This approach aimed to gather a diverse range of perspectives and firsthand insights to better understand the collective action dilemma in eucalyptus cultivation.

The second method employed is the literature analysis approach. The author systematically collected, organized, and studied a substantial volume of literature materials to gain a comprehensive understanding of the historical and current context of eucalyptus cultivation. This included opinions from experts and society regarding eucalyptus, the government's stance on eucalyptus, and related aspects. The literature materials encompassed various sources such as:

• Policy documents like Several Provisions for Accelerating the Development of Artificial Forests in Fujian Province.

• Research reports like the Research Report on the Reforestation of Eucalyptus Trees and Their Ecological Problems in Fujian Province.

<sup>&</sup>lt;sup>5</sup> The term of office of ex-secretary Mr. Lin was 1979-1994, who was a STAR secretary then. In order to protect the privacy of all parties, this paper has covered up the names of all persons and some organizations.

<sup>&</sup>lt;sup>6</sup> After graduating from Peking University, Mr. Lusheng returned home to found and launched a non-profit program named "Good Neighbors" in Neilong Village aimed at constructing a rural community based on the local round earthen building.

• Local records on forestry development like Fujian Forestry Journal.

• Journal papers, such as "Review of the Elinor Ostrom's Institutional Analysis and Development Framework", etc.

• News coverage from platforms such as NetEase News, Phoenix.com, and other media outlets.

This literature analysis method aimed to provide a well-rounded perspective on the historical, ecological, and societal dimensions of eucalyptus cultivation, contributing to a more nuanced understanding of the collective action dilemma in the village.

# **Theoretical Basis and Analytical Model**

## **Elinor Ostrom's IAD Framework**

Institutional Rational Choice theory raises questions about the rationality of institutions and the impact of institutions on human action. Elinor Ostrom introduced the Institutional Analysis and Development (IAD) framework, depicted in Figure 1, to explore the collective action dilemma in public affairs governance through the lens of institutions. The framework aims to examine whether human actions remain rational when influenced by institutional structures.

In "The Three Worlds of Action: A Meta-Theoretical Synthesis of Institutional Approaches", Elinor Ostrom embarked on creating a universal framework to integrate the efforts of scholars across disciplines studying how institutions shape individuals' incentives and behaviors. The Institutional Analysis and Development (IAD) framework, initially presented in this work, has undergone continuous refinement in subsequent papers<sup>7</sup>. Central to the IAD framework is the concept of the "action arena"<sup>8</sup> (Sabatier, 2004, p. 56)—an abstract social space encompassing both the situations and actors involved. Through the analysis of these elements, the framework serves to understand, predict, and explain human behavior within institutional arrangements. Additionally, the action arena itself is considered a variable, influenced by three key variables<sup>9</sup> (Sabatier, 2004, p. 57).



Figure 1. Institutional analysis and development framework. Source: Sabatier, 2007, p. 27.

<sup>&</sup>lt;sup>7</sup> It is mainly manifested in two aspects: one is to distinguish between the three decision-making levels of constitution, collective choice and operational choice and their relationship, and the other is to clarify the basic elements that can be used to analyze the results and evaluate them at any of the three decision-making levels.

<sup>&</sup>lt;sup>8</sup> The Action Arena refers to the social space in which individuals interact, exchange goods and services, solve problems, dominate or struggle with each other (in many of the things that individuals do on the action arena).

<sup>&</sup>lt;sup>9</sup> The three variables are: the rules that participants use to regulate their relationships, the state structure of the world that works on the arena, and the more general community structure in which any particular arena is located.

In the IAD framework, Elinor Ostrom posits that individuals are prone to errors and possess the ability to learn, serving as foundational theoretical assumptions. Specifically, she assumes that individuals, while considering benefits and costs, are novices prone to errors. They base their actions on the perceptions of others regarding the importance of benefits and costs and on personal commitments that involve promises and reciprocity (Sabatier, 2004, p. 60). While beginners make mistakes frequently, environmental changes, with or without institutional incentives, prompt learning from these errors (Sabatier, 2004, p. 60). Consequently, within the action arena, actors often act in accordance with their error-prone nature, making flawed decisions under established institutional conditions. Simultaneously, they continually correct and improve their actions, leveraging their ability to learn. The capacity for actors to learn is crucial as it facilitates improvements in their actions based on institutional enhancements. In addition to these general theoretical assumptions about individuals, Elinor Ostrom introduces seven sets of common variables<sup>10</sup> describing the action context. Corresponding to each of these variables are rules-in-use<sup>11</sup>, providing a qualitative framework for institutional analysis and deconstruction of specific cases (refer to Figure 2).



Figure 2. Inner structures of action situations and corresponding rules-in-use. Source: Wang, 2010, p. 140.

## **Reasons to Choose IAD Framework**

Elinor Ostrom dedicated 38 years to developing and refining the IAD framework since its inception in 1982. The framework's extensive history and widespread adoption in academia globally attest to its effectiveness and practicality. It has been lauded as "operational guidance" for the autonomous governance of common pool resources. Given its interdisciplinary approach and foundation in numerous empirical studies, the IAD framework emerges as the preferred analysis tool for this paper. Two specific reasons underlie the selection of the IAD framework.

<sup>&</sup>lt;sup>10</sup> The seven typical variables that describe the action situation are: participants, positions, outcomes, set of permitted actions and their association with output, control performed by the participants, information, costs and benefits.

<sup>&</sup>lt;sup>11</sup> The rules-in-use corresponding to each of the above seven variables are: entry and exit rules, position rules, scope rules, authority rules, aggregation rules, information rules, payoff rules.

The first reason for selecting the IAD framework lies in its adoption of the assumption of bounded rationality, which is considered more realistic and empirically grounded compared to the previous assumption of Homo Economicus<sup>12</sup>. Under the Homo Economicus assumption, individuals were expected to possess complete information, stable and well-organized preferences, and superior information processing capabilities. However, the reality presents several challenges to these assumptions. First, information searching is costly, the rules for obtaining information are imperfect, and individuals' energy is limited, resulting in incomplete information when they take action. Second, while some preferences are stable, others are dynamic, making it challenging for actors to precisely know their preferences until the last moment. Third, individuals' ability to process information is not always superior and is influenced by variables such as mood fluctuations.

Herbert Simon also points to two Achilles heels of the Homo Economicus assumption that they are unlikely to be achieved in practice<sup>13</sup> (Zhao & Du, 2000). He introduced the concept of "Decision Makers" as an alternative to the perfectly rational Homo Economicus, proposing that individuals, under bounded rationality, tend to base their decisions on the "satisfaction" standard rather than the "optimal" standard (Simon, 1989). In the IAD framework, Elinor Ostrom emphasizes bounded rationality as a more general theoretical hypothesis about individuals. She states that individuals, considering benefits and costs, are beginners prone to making mistakes, but changes in the environment, with or without institutional incentives, encourage learning from these mistakes (Sabatier, 2004, p. 60). In the case of villagers planting eucalyptus trees, they align more with the concept of Decision Makers—possessing incomplete information, limited information processing abilities, and a propensity for mistakes, yet demonstrating learning abilities to adapt to their environment.

Additionally, influenced by clan relations, the villagers' actions align with Herbert Simon's assertion that individuals are never alone but operate within a particular social organization, and their behavior is shaped by mutual influence and integration with others and organizations. Therefore, the IAD framework is deemed suitable for this case, providing a realistic portrayal of decision-making dynamics under bounded rationality and social influence.

The second reason for selecting the IAD framework is its logical and highly operational approach from an institutional perspective. Institutions, as defined by Douglass North, are the rules of the game in society, shaping human behavior by providing constraints and incentives in various exchanges, be they political, social, or economic (North, 1990, p. 3). Institutions, both formal (such as constitutions and policies) and informal (like social norms and moral standards), play a crucial role in influencing people's actions. Aoki Masahiko (2001), in Comparative Institutions Analysis, defines institutions as "the obvious and common factor in the participant's subjective game model, that is, the SHARED BELIEFS in the actual way the game is played" (p. 4).

Indeed, institutions encompass not only explicit rules, like constitutions, policies, or contracts, but also implicit rules, such as social norms, practices, and moral standards. Douglass North distinguishes between these two categories, labeling explicit rules as formal institutions and implicit rules as informal institutions. Both formal and informal institutions play a pivotal role in shaping people's actions and behavior. The interplay between these two types of institutions influences how individuals navigate and participate in various aspects of societal,

<sup>&</sup>lt;sup>12</sup> There are two particularly important contents of the assumption of Homo Economicus: first, people are selfish, that is, the motivation of people's behavior is always to avoid harm, to their own benefit; Second, people are completely rational, that is, everyone can optimize the choice of all the opportunities and goals they face and the means to achieve them based on the costbenefit or profit-seeking principle.

<sup>&</sup>lt;sup>13</sup> First, it is assumed that the present situation and future changes have an inevitable consistency; the second is to assume that the possible results of all the alternatives and policies are known.

economic, and political interactions. This dual perspective acknowledges the nuanced and multifaceted nature of institutional influence on human behavior.

Elinor Ostrom's perspective on institutional analysis emphasizes a thorough understanding of the guiding rules<sup>14</sup> (Sabatier, 2004, pp. 68-69) that individuals employ in their decision-making process. In the case of villagers engaged in eucalyptus planting, a comprehensive set of rules, both explicit and implicit, shapes their actions. Institutional analysis, known for its logical rigor and systematic approach, becomes particularly valuable under the assumption of bounded rationality.

By delving into the guiding rules utilized by the villagers—encompassing both formal and informal institutions one can gain insights into the reasons behind their actions. The IAD framework, with its capacity for detailed institutional analysis, emerges as a powerful analytical tool. It facilitates a nuanced examination of the rules influencing the villagers' decision-making, offering a pathway to understand why specific actions were taken. In the context of the collective action dilemma, the IAD framework proves instrumental in unraveling the complexities of institutional dynamics and their impact on the actions of the villagers planting eucalyptus trees.

## **Case Description**

# Status Quo of Collective Action Dilemma of Eucalyptus Planting in Neilong Village

Neilong Village<sup>15</sup> falls under the administration of Xiahe Town in Yunxiao County, Zhangzhou City, Fujian Province. Due to its unique geographical location, the village is well-suited for the cultivation of eucalyptus trees<sup>16</sup> (Yang, Hong, Yao, & Zou, 2014). According to 2018 statistics, the eucalyptus forest area in Zhangzhou City covers 705.8 square miles, constituting approximately 56.4% of the province's total of 1251 square miles (Fujian Provincial Forestry Department, 2018). In this regional context, Neilong Village stands as a representative example<sup>17</sup> (Zhang, 2018; Fujian Provincial Committee for the Codification of Local History, 1996, p. 87) among numerous villages in Fujian Province engaged in eucalyptus cultivation. Consequently, studying Neilong Village provides valuable insights into the collective action dilemmas arising from eucalyptus planting, offering a realistic understanding of the challenges faced in these areas. Figure 3 depicts a realistic view of eucalyptus tree planting in Neilong Village<sup>18</sup>.

<sup>&</sup>lt;sup>14</sup> Guiding rules are a set of rules that participants will refer to if they are asked to explain and prove their actions to their partner participants.
<sup>15</sup> Neilong Village contains five natural villages: Maoping, WangDuban, Jiaoyuan, Fuzidong, Badoushi. The Committees are in Wangduban Village. The population of Neilong Village is about 1,800. The village has 1,807 acres of mountains, 118.6 acres of water fields, 136 acres of cultivated land. Because of its location in the mountains, economic development lags behind, most of the villagers go out to work. Sourced from the author's field research.

<sup>&</sup>lt;sup>16</sup> Located in the tropical region of South Asia, Zhangzhou City, to which Neilong Village belongs, has a subtropical monsoon humid climate, with an average annual temperature of 21 °C, annual rainfall of 1,000 to 1,700 mm. Because of its excellent natural conditions, Zhangzhou City is a suitable area for eucalyptus trees, and is also an important production base planned by the national afforestation and greening planning outline and the national timber strategic reserve planning.

<sup>&</sup>lt;sup>17</sup> At the end of the 20th century, China began to promote the cultivation of eucalyptus trees. In recent years, the area of eucalyptus trees has been expanding, and now covers 17 provinces in China, mainly in Guangdong, Guangxi, Fujian, and Hainan Province. Fujian is a province that introduced eucalyptus trees earlier, after Guangdong and Guangxi. According to records, Fuzhou City in Fujian Province introduced the wild eucalyptus trees in 1894. However, prior to 2002, eucalyptus trees were mainly planted sporadically in Fujian Province, mainly for greening on and around roads, as well as for testing and demonstration with the goal of cultivating short-cycle industrial raw material forests.

<sup>&</sup>lt;sup>18</sup> It is not all the time that Eucalyptus trees are planted in Neilong Village. According to ex-secretary Mr. Lin, since 1980, villagers have gradually gone to the surrounding cities to work. At present, about 54% of the villagers work in the city. The land of the migrant villagers who entered the city was mostly abandoned because of lack of care. The industrial structure of Neilong Village is simple, mainly in the cultivation industry, and has experienced four stages: first, rice as the main crop before 1958; second, rice, dates, pineapples, and tobacco were the main crops from 1958 to 1980; third, from 1980 to 2001, rice and gold dates were the main crops; fourth, fruit trees and eucalyptus trees have been the main crops since 2001.

The extensive cultivation of eucalyptus trees in Neilong Village did not happen overnight but is the result of government policies. Since 2002, both national and local policies<sup>19</sup> (Yan, 2005; Afforestation Project Office of Fujian Province Financed by the World Bank, 2006) have been implemented to incentivize the planting of eucalyptus trees in suitable areas. Motivated by these policies, external contractors initially took the initiative to lease land in Neilong Village for eucalyptus cultivation, hiring local villagers for tasks like weeding, fertilizing, and tree-cutting during the logging period. As some villagers observed the economic benefits during the first logging period, more joined the trend, leading to a widespread craze within the village.

However, with the increasing growth of eucalyptus trees and the growing wealth of villagers, various environmental issues surfaced around the village, accompanied by rumors of eucalyptus trees being toxic. Despite initial encouragement for eucalyptus planting from both the government and experts, subsequent assessments revealed that the trees themselves were not problematic. Instead, the environmental issues stemmed from unscientific farming practices driven by the economic interests of the growers<sup>20</sup> (Afforestation Project Office of Fujian Province Financed by the World Bank, 2006). Consequently, the decline in the water table in Neilong Village is not attributed to the eucalyptus trees per se but rather to the over-planting behaviors guided by the growers' interests. In essence, the water table decline in Neilong Village represents a collective action dilemma concerning the use of a common pool resource—groundwater.



Figure 3. Eucalyptus trees all over the Neilong Village. Source: photographed by the author.

<sup>&</sup>lt;sup>19</sup> In August 2002, the country invested more than 70 billion yuan to officially launch the construction of the fast-growing-forests base in 18 key provinces and regions, with Fujian Province among them. On December 12, 2002, the Fujian Provincial Government issued Several Provisions for Fujian Province to Accelerate the Development of Artificial Wood Forests and on April 4, 2003, the Fujian Provincial Government issued the Opinions on Promoting the Reform of the Collective Forest Rights System, which resolved the deep-seated contradictions that have long plagued forestry reform and opening-up of forestry from the institutional and policy aspects. In 2003, the provincial forestry department and the provincial finance department jointly issued a policy to implement the project of provincial rapid-growing forests, where the subsidies are available during the planting of eucalyptus trees and other short-cycle forests for industrial raw material and forests for wood of precious tree species.

<sup>&</sup>lt;sup>20</sup> A 2006 study led by the Fujian provincial government found: "A large number of facts show that eucalyptus trees are non-toxic and harmless, and the ecological problems of the so-called eucalyptus tree are not due to the eucalyptus tree species themselves, mainly due to unscientific farming practices." The term "unscientific farming practices" referred to here includes: first, the location is not limited, i.e. no attention is paid to the location of the mountain where eucalyptus trees are grown, even close to the water source; second, the density is too large, i.e. the number of eucalyptus trees planted per acre exceeds the recommended number of about 100; third, the conservation is inadequate, that is, the number of fertilization, watering and weeding throughout the year is less than the number recommended by the Institute of Eucalyptus Research of the Chinese Academy of Forestry; fourth, the rotation period is short, i.e. the period between when eucalyptus trees are planted and when trees are cut down is too short. Sourced from the author's field research.

# Attitudes of Community Members Towards Problem-Solving

Attitude of governments at all levels<sup>21</sup>. Within Neilong Village, the government maintains a neutral stance on governance issues. The cultivation of eucalyptus trees aligns with economic interests, contributing to GDP growth and generating significant tax and fee income. Given the perceived innocence of eucalyptus trees and the lack of immediate urgency regarding the harm caused by over-planting, there is no governmental rationale for restricting eucalyptus tree cultivation.

Government actions in response to the emerging issues appear more focused on justifying eucalyptus trees. Through research reports, expert opinions, and similar means, the government aims to clarify the non-hazardous nature of eucalyptus trees and highlight the unscientific planting practices leading to problems. While the government of Fujian Province issued a notice in 2011 limiting the development of eucalyptus artificial forests, explicitly prohibiting planting in important ecological areas and ceasing cultivation in state-owned forest farms and breeding farms, this restriction only applied to specific areas and entities. The policy did not restrict contractors and individual farmers in non-specified areas, and it was repealed in 2017.

Subsequent policies also refrained from restricting cultivation by contractors and individual farmers in nonspecified areas. Instead, the focus shifted towards promoting scientific management of eucalyptus forests, with a principle of disallowing new eucalyptus forests<sup>22</sup>. The government's approach reflects a balance between economic benefits and environmental concerns, with an emphasis on guiding practices rather than imposing outright restrictions on cultivation.

In general, the government maintains a moderate stance concerning environmental issues arising from the over-planting of eucalyptus trees. It actively controls important areas while adopting a neutral position towards other regions. At the level of Neilong Village, the government's attitude is perceived as absent or non-engaged by the villagers. When questioned about the government's actions to address the village's issues, villagers responded, "We don't see any action from the government." In this case, the government's governance attitude can be characterized as neutral.

Attitude of village party branch and village committee. The Village Party Branch and Village Committee (hereinafter referred to as Committees) of Neilong Village adopt a neutral stance on governance issues, with recent poor performance in fulfilling their responsibilities and seeking government funds for village development. This contrasts sharply with neighboring villages that actively pursue funds for infrastructure projects and provide public services.

Given the Committees' failure to fulfill basic duties and their limited authority over villagers, they lack the capacity to impose restrictions on eucalyptus tree planting. Even if the Committees possessed stronger executive power, it is unlikely they would impose restrictions. Several factors contribute to this: first, contracting out

<sup>&</sup>lt;sup>21</sup> Hereinafter referred to the governments at all levels as Governments.

<sup>&</sup>lt;sup>22</sup> For example, *The Notice of the Office of the People's Government of Zhangzhou City Forwarding the Opinions of the Municipal Forestry Bureau on the Implementation of the Scientific Planting of Eucalyptus* in 2011 provides for further establishing a scientific management consciousness, further improving the scientific management level of existing artificial forests in eucalyptus-fit areas, strictly regulating the scope and measures of new eucalyptus artificial forests, accelerating the afforestation of *multi-tree* species, and increasing scientific and technological demonstration and policy support. For another example, *The Notice of the Office of the People's Government of Zhangzhou City on the Issue of the 2012 Comprehensive Water Environment Rehabilitation Work Plan for the Kowloon River Basin (Zhangzhou Section) stipulates that, in principle, no new eucalyptus artificial forests will be planted, and that no new artificial forests of eucalyptus trees are allowed on both sides of the main stream of Kowloon River and its first tributary, around reservoirs, drinking water source areas and other ecologically fragile areas, solving the problem of excessive fertilization and spraying of pesticides for eucalyptus trees, leaving hidden dangers to the safety of the water environment.* 

collective land for eucalyptus planting enhances the fiscal accumulation of Neilong Village through contract fees; second, large-scale eucalyptus cultivation can be seen as a political achievement, boosting villagers' income; and third, Committees in China are not government entities, so they generally do not prohibit villagers unless directives from higher authorities, such as the county government, mandate restrictions on eucalyptus cultivation.

Attitude of villagers planting trees and those who not. Villagers in Neilong can be categorized into treeplanting and non-tree-planting individuals, with distinct attitudes. Among tree-planting villagers, there are two subgroups with differing views. The first group relies predominantly on income from eucalyptus cultivation and generally opposes governance measures. Restricting tree planting would either limit their income or require additional effort and time before harvesting, reducing overall earnings. Importantly, the perceived harms such as "water-pumping" and "fertility-deprivation" are not immediately impactful, making these villagers less concerned about the long-term consequences.

The second group of tree-planting villagers treats eucalyptus cultivation as a secondary income source. Many of them work outside the village throughout the year, generating sufficient income. They plant eucalyptus trees as a form of subsidy for the abandoned lands, finding the process simple and profitable. This subgroup tends to be neutral regarding governance; if the government imposes restrictions or bans, they may cease cultivation, and conversely, they would continue if allowed.

Non-tree-planting villagers can also be categorized into two groups, each with distinct attitudes. The first group is neutral on governance and typically has alternative income sources, such as cultivating fruit trees or working in the city. These villagers tend to remain silent due to the non-urgent nature of the mentioned harms and the cultural characteristics of rural China. Additionally, some may earn wages through activities like weeding, fertilization, and cutting.

The second group of non-tree-planting villagers supports governance and is often composed of village elites, including college students and rural leaders. These individuals possess a broader vision, aspire to improve their hometown, and actively contribute to its development.

Attitude of contractors. Contractors strongly oppose governance measures. During the government's initial promotion of eucalyptus tree planting, contractors played a pivotal role as they were the primary recipients of government subsidies, attracting villagers enticed by the profitability of eucalyptus cultivation. Contractors function essentially as businessmen aiming to minimize costs for higher returns. With substantial contracted land and established business models, governance represents a threat to their existing, well-established money-making strategies. For contractors, the implementation of governance measures implies increased costs or even the loss of opportunities for eucalyptus tree planting.

#### **Interactions Between Community Members**

The last section highlights that the subjects are not independent but highly interconnected. This interwoven relationship between subjects forms an organic community (see Figure 4).

Firstly, the government has provided robust policy support to contractors, including subsidies. By contracting substantial land in rural areas for eucalyptus tree planting, contractors not only generated significant profits from policy dividends but also facilitated the government in collecting substantial taxes and fees. Additionally, the Committees received substantial contracting fees through this arrangement.

Secondly, at the onset of the promotion, villagers were unfamiliar with eucalyptus trees and their profitability. Initially, they maintained an observing stance. However, as the eucalyptus tree planting process

demanded a significant labor force for tasks such as weeding, fertilization, and felling, many villagers earned substantial wages. As contractors played a leading role, more villagers became aware of the considerable benefits associated with eucalyptus trees, leading to increased participation in the planting activities.

Thirdly, the government and the Committees share administrative ties, and this administrative connection extends across all four levels of government. They participate in the policy formulation for eucalyptus tree planting through the communication and implementation of superior policies. While the village Committees do not fall under the government's jurisdiction, they are elected by the villagers, creating an administrative link between the Committees and the villagers. The Committees are tasked with conveying and implementing policies issued by the governments, allowing the government's influence to reach the grassroots level.



Figure 4. Interactions between community members. Source: drawn by the author.

In summary, the subjects in this collective action dilemma are interrelated and form an organic community. The government provides policy support to contractors, and the contractors, in turn, contribute to the government's revenue through taxes and fees. Villagers, initially uninformed about eucalyptus trees, join the planting efforts due to employment opportunities and financial incentives provided by contractors. The government and Committees are administratively connected, sharing roles in policy communication and implementation. Finally, villagers, whether engaged in tree planting or not, may transition between these categories based on factors such as awareness of environmental risks, economic incentives, and cultural influences like the Herd Mentality and Clan Culture. This intricate web of relationships contributes to the complexity of the collective action dilemma in Neilong Village.

The Community members have created a cohesive network driven by shared interests. Each member relies on the path of profiting from eucalyptus tree planting for personal benefit, resulting in limited support for governance. Path dependence is a gradual development and cannot be dismantled instantly. Analyzing the causes of path dependence, considering the impact of institutions on the behavior of those with bounded rationality, serves as a crucial step towards breaking this pattern.

# **Case Analysis**

Following the analytical logic of the IAD framework, which focuses on the action arena, this section will initially outline the action arena itself, encompassing actors and action situations. It will then discuss the three variables influencing the action arena.

#### **Action Arena of Eucalyptus Planting**

Actors. In the IAD framework, Elinor Ostrom considers error-proneness and learning ability as broad assumptions about individuals. Here, the actors are contractors<sup>23</sup> and tree-planting villagers. Herbert Simon's analogy of needle-hunting in straw piles characterizes a bounded rational Decision Maker as someone content with finding a needle that can be sewn, not necessarily the sharpest one. This parallels the behavior of tree-planting villagers cultivating eucalyptus trees. Their methods may not align with a perfect cost-benefit analysis, but they find satisfaction in their approach, showcasing typical bounded rationality. Due to limited information processing, they may not recognize that groundwater, a shared resource, should factor into the cost. Despite seemingly profitable practices like unrestricted site selection and short rotation periods, their actions, viewed as irrational by outsiders, represent a satisfying and rational solution under bounded rationality. The observers perceive the tree-planting villagers' actions as "error-proneness" according to Elinor Ostrom's terminology.

Under the bounded rationality assumption, a new game analysis theory, evolutionary game theory<sup>24</sup> (Zhao & Du, 2000), has emerged. In this theory, each player faces numerous potential actions (strategies) within a given set of conditions. The strategic equilibrium, achievable under perfect rationality, is disrupted by the reality of bounded rationality, where players may not adopt optimal strategies. Instead, equilibrium is often reached through a learning process. This learning involves the "error-proneness" of the actor and their "learning ability". Theoretically, in eucalyptus tree planting, tree-planting villagers should continually adjust their behavior, seeking a balanced solution through learning. However, in this case, it appears that the learning ability of the villagers has diminished, preventing them from achieving equilibrium. The reasons behind this learning failure will be analyzed and addressed later in this paper.

<sup>&</sup>lt;sup>23</sup> There is no dispute about the application of bounded rationality to tree-planting villagers, but are the contractors also boundedly rational? Doesn't them have complete, good preference sequence and complete information compared to the villagers, so as to maximize the net value of their expected income? The answer is no. The contractors are businessman, and the businessman per se are in the market competition environment for a long time, so their characteristics of Homo Economicus are unquestionable and the expectations of the society to the businessman also confirmed this. It is for this reason that this paper will focus more on the tree-planting villagers among the actors and less on contractors. The reason is: first, the contractors have the ability to withdraw, that is, after the local resources are exhausted, they can shift positions, which constitutes a fundamental difference with the local villagers; second, the contractors are external, i.e. when the local villagers form a satisfactory effective governance model, they can be "compromised" or "retired", for example, the Committees may choose not to renew the contract with the contractors, or the local villagers can collectively protest and resist the contractors' non-compliance.

<sup>&</sup>lt;sup>24</sup> According to the bounded rationality hypothesis, bounded rationality means that the gamer can't or won't adopt the optimal strategy under the conditions of complete rationality, and the strategic equilibrium between the game parties is often the result of adjustment from learning, not a one-time choice, and even if the equilibrium is reached, it may deviate again.

Action situations. The action situation encompasses the external elements surrounding the actors on the action arena. If actors are likened to performers on a stage, the action situation includes lighting, sound, props, directors, the audience, and their applause. Analyzing the action situation of eucalyptus tree planting helps elucidate the patterns in people's actions and outcomes. In the IAD framework, seven variables are typically employed to depict the action situation, as outlined in Table 1. These variables are applied to describe the action situation of eucalyptus tree planting in Neilong Village.

#### Table 1

Variables	Depictions		
Participants	Governments		
	Committees of village		
	Contractors		
	Tree-planting villagers		
	Non-tree-planting villagers		
Positions	None		
Outcomes	The water table has declined and the geographical area is Neilong Village		
Set of permitted actions	Decide on the planting area at will		
	Decide on the planting density at will		
	Decide on the frequency of maintenance at will		
	Decide on the rotation period at will		
Controls performed by	med by Contractors/tree-planting villagers: strong		
participants	Governments/committees of village/non-tree-planting villagers: weak		
Information	Relatively complete		
Costs and benefits	Costs: relatively low		
	Benefits: extremely high, and the beneficiaries are numerous		

Analysis of Current Action Situation of Eucalyptus Planting in Neilong Village

Source: Drawn by the author.

Firstly, participants in Neilong village's eucalyptus planting include five parties: Governments, Village Committees, Contractors, Tree-planting villagers, and Non-tree-planting villagers. Secondly, "positions" refer to specific roles held by participants in the cultivation of eucalyptus trees. While the government and Village Committees play roles of public power, there are no specialized positions for specific eucalyptus planting actions, such as eucalyptus planting associations or scientific planting inspectors. Thirdly, the output of eucalyptus planting action is manifested in the unreasonable decline of the water table<sup>25</sup> within Neilong village. Fourthly, the set of permitted actions involves deciding on planting areas arbitrarily (e.g., near water sources), determining planting density, choosing the frequency of maintenance (fertilization, watering, weeding), and deciding the rotation period. Together, these constitute over-cultivation actions, with a strong causality in output. Fifthly, growers have significant control over the decision-making process for the actions in the specified set, while governments, Committees, and non-tree-planting villagers have little control over this process. In other words, growers don't need permission from other villagers, Committees, or governments to take the specified actions. Sixthly, the characteristics of an acquaintance society in rural China mean that villages have numerous information exchange places (physical and virtual), enabling growers to obtain relatively complete information about the action situation's structure, such as groundwater conditions, cost and benefit functions of other growers,

 $<sup>^{25}</sup>$  In addition to the decline of the water table, the output also includes a decrease in soil fertility, but the decline in soil fertility is limited to the land owned by the growers themselves, which is not a common pool resource discussed in this paper, so it is not considered.

and how their actions contribute to common results. Seventhly, in terms of cost, the various actions in the set taken by growers have relatively low costs, mainly for saplings, fertilizer, and worker employment; in terms of benefits, growers can earn profits from sales, helping villagers can receive high wages, Committees can gain substantial contract fees, and governments can collect significant taxes and fees.

# Three Variables Influencing the Structure of Action Arena

**Rules in use.** The rules-in-use correspond to seven variables in the action situation, influencing these variables. The set of operating rules affecting these variables should constitute the rules of the smallest unit, defining the regulations necessary to explain participants' actions and their outcomes. This set can be employed to regulate their interrelations within the action arena (refer to Table 2 for an analysis of the rules-in-use in the process of eucalyptus trees planting in Neilong village). However, it is crucial to note that action situation is not only influenced by rules-in-use but also by physical/material conditions and community attributes. Therefore, rules-in-use alone cannot provide the necessary and adequate explanation of action situation and the structure of its results (Sabatier, 2004, p. 71). Discussions on the latter two will be addressed later.

Variables	Corresponding rules-in-use	Current situation
Participants	Entry and exit rules	Both explicit and implicit
Positions	Position rules	Implicit
Outcomes	Scope rule	Absent
Set of permitted actions and its relation to outcomes	Authority rules	Implicit
Controls performed by participants	Aggregation rules	Implicit
Information	Information rules	Absent
Costs and benefits	Payoff rules	Absent

Analysis of Current Rules-in-Use of Eucalyptus Planting in Neilong Village

Source: drawn by the author.

Table 2

In this case, some rules-in-use either exhibit implicit characteristics, not conceptualized as rules by participants, or are absent due to a lack of corresponding rules. Only the entry and exit rules of contractors are explicitly defined.

*Explicit rules.* Among the seven rules, only the entry and exit rules for contractors are explicitly outlined. Contractors can enter by securing a land contract with Committees, requiring permission, and their exit is contingent on the agreement's expiration or renewal.

*Implicit rules.* The entry and exit rules, position rules, authority rules, and aggregation rules for villagers exhibit implicit characteristics. Villagers can enter or exit based on individual land ownership rights, representing a form of "self-determination". Position rules are implicit but follow customary practices, involving villagers in elections and direct involvement of village elites<sup>26</sup>. Authority rules are implicit, such as the unanimous choice of a four-five-year rotation period. Growers, although not requiring consultation or permission, share implicit aggregation rules: (1) minimal care for eucalyptus trees; (2) shorter rotation periods increase returns; (3) groundwater reduction is not an immediate concern due to over-cultivation.

<sup>&</sup>lt;sup>26</sup> The village elite here includes college students, villagers, elders, and so on. For example, after graduating from Peking University with a master's degree, Mr. Lusheng, who launched the "Good Neighbors" program in Neilong Village, is a village elite.

*Absent rules.* Scope rules, information rules, and payoff rules exhibit an absence of explicit or implicit characteristics. There are no rules on prohibited geographical areas or eucalyptus tree density (scope rules). Participants lack rules on obtaining information about the action situation, relying on random gossip without distinguishing between confidential and disclosed information (information rules). Moreover, explicit or implicit payoff rules are absent—no sanctions, criteria for sanctions, responsibility for sanctions, monitoring of sanctions, or rewarding behaviors during eucalyptus planting are specified.

**Physical/material conditions: Indirect seizure of common pool resources.** As mentioned earlier, one of the particularities of this case lies in the features of rules-in-use. In this section, this paper discusses another particularity of this case—the indirect seizure of common pool resources<sup>27</sup> (Sabatier, 2004, pp. 73-74).

The term "indirect seizure of common pool resources" refers to activities where actors, while owning the property rights to certain resources, may not be fully aware or have low awareness of their use of common pool resources, leading to an implicit decrease in these resources. This process is characterized by its atypical and indirect form of resource use compared to traditional activities like fishing or grazing. Additionally, the consequences of indirect seizure are less visible, making it challenging to attribute responsibility for resource reduction. Furthermore, the harm caused by this practice is often non-urgent and may not prompt a change in behavior unless it accumulates into a crisis.

In this case, the indirect seizure of common pool resources occurs as both contractors and tree-planting villagers cultivate eucalyptus trees on land they have the right to use. They are often unaware or have low awareness that their eucalyptus cultivation is utilizing groundwater, which is a common pool resource. Eventually, their collective action leads to a decline in the water table, causing annual water shortages in Southern China, an area that shouldn't be facing severe water scarcity. The use of groundwater by growers is indirect, and they may not fully realize that they are consuming a common pool resource. Interestingly, while some growers and non-tree-planting villagers have gradually recognized the connection between eucalyptus planting and water shortages, responsibility remains unclear. Moreover, the drop in the water table hasn't immediately impacted lives, as there is still some water flowing from faucets. In the face of scarcity, people opt for an alternative—several families pooling resources to seek water from higher mountain springs<sup>28</sup>.

Attributes of community: Clan culture. The attributes of the community<sup>29</sup> (Sabatier, 2004, p. 79), usually manifested as the culture of the community, are the third set of variables that affect the structure of the action arena. In this case, the most special and important community attribute is their clan culture. This is also the third particularity of this case. Clan culture has a wide and profound influence and the infiltration of clan culture is everywhere in villagers' life.

In Fujian Province, the concept of the clan is pervasive, with most rural areas maintaining the tradition of "one village, one ancestral hall". In Neilong Village, unlike the city, nearly all villagers are relatives within the same branch, predominantly surnamed Lin. Only those marrying into the village from outside adopt a different

<sup>&</sup>lt;sup>27</sup> Although the framework of rules-in-use affects all elements of the action situation, some variables in the action situation are also influenced by the attributes of physical and material world. Depending on the type of event in the world in which the participant acts, the same set of rules can produce completely different types of action situations.

<sup>&</sup>lt;sup>28</sup> Unlike urban tap water, which is supplied uniformly by waterworks, tap water in rural areas is usually paid for by neighboring families to help find water in nearby mountains to manage drinking water, or to hire someone together to help dig a well next to the house. The water from these piped mountain springs or wells is shared by the funders.

<sup>&</sup>lt;sup>29</sup> Important attributes of community include four types: (1) norms of conduct generally accepted by the community; (2) the criteria shared by potential participants for a common understanding of a particular type of arena structure; (3) the homogeneity of the preferences of people living in a community; (4) distribution of resources among those affected.

surname. According to the Yunxiao Pedigree of Lin, Neilong Village's Lin family belongs to Lin's sixth branch, with a history dating back to around 1390 when Fu Lin, the sixth son of Weizhi Lin, relocated from Wailong Village. The village's Ancestral Hall, tracing back to the Yongle Era in the Ming Dynasty (1420-1424), stands as a representative of clan relations. This Ancestral Hall plays a crucial role in village life, serving as the focal point for various public activities<sup>30</sup> (Lin, 2017, p. 89).

Although the clan's impact on villagers has diminished over time, it still plays an organizational role in significant village matters, such as the restoration of the round earthen building Taoshulou and the reconstruction of the Ancestral Hall of Lin. Beyond its explicit influence, the implicit impact of clan relations on villagers is noteworthy. Scholars like Xuewei Zhai argue that rural society exhibits high integration among individuals due to close contact and mutual trust among relatives and in-laws, facilitated by the low mobility of rural society (Luo, Sun, & Chu, 2014, p. 197). In Neilong village, this clan dynamic has shaped a distinctive culture, influencing collective action and interpersonal relations. For instance, in the context of eucalyptus planting, when some villagers decide to forgo planting due to time constraints or a vague awareness of environmental concerns, fellow relatives step in. They express willingness to take over the land tenancy for eucalyptus planting, offering annual rent, often accepted due to clan ties.

#### Analysis of Current Collective Action Dilemma of Eucalyptus Planting

The previous analysis of the eucalyptus planting action arena and its influencing variables reveals the collective action pattern in Neilong village. The overall picture illustrates a distinct feature: the misdirection of existing rules and the absence of necessary rules, particularly under the influence of Rules-in-use, Physical/Material Conditions, and Attributes of Community. As noted earlier, villagers, characterized by bounded rationality, are prone to errors and have learning capabilities. Lacking complete information and optimal information processing capabilities, villagers may make mistakes in deciding whether to plant eucalyptus trees and how to do so. In the absence of guiding rules to correct these mistakes, their learning ability remains underutilized, prolonging the collective action dilemma.

Rules serve as the basis for human actions. In the given context of available information, people employ rules to assess whether to take specific actions through rational calculation, resulting in rational behavior under certain conditions. However, due to people's bounded rationality, the actions are not necessarily correct. Rules aren't always explicitly stated; many are embedded in habits, morals, customs, etc., representing the informal institutions as described by Douglass North. In this case, villagers acted under the influence of such informal institutions. During the initial promotion of eucalyptus planting, contractors provided information to villagers that eucalyptus trees were easy to grow and offered high returns. Some villagers, comparing their current living situation with the potential benefits of planting eucalyptus trees, decided that cultivation was a cost-saving and lucrative option. Others, guided by clan relations and the trust established, followed the Herd Mentality. This group might not fully comprehend the specific costs and benefits of eucalyptus trees, but the trust and support from clan relations influenced their actions.

However, the information relied upon by the villagers who took the initial action was incorrect. Is eucalyptus planting truly time-saving and effortless? The answer is NO. Adhering to scientific planting standards for eucalyptus forests requires higher costs—increased weeding, scientific fertilization, and watering expenses—and

<sup>&</sup>lt;sup>30</sup> For example, near the end of each year, the village sages of WangDuban will choose a good day, called all the villagers to hold the "Year-end Blessing" worship activities in front of the Ancestral Hall, worshiping the "Three Mountain King".

yields relatively fewer benefits due to limitations on planting density and rotational periods. Consequently, both the villagers who initially took action and those who joined based on trust and support from clan relations fell into a state of error, exacerbated by the Herd Mentality. To rectify this, urgent application of their learning ability is needed. However, the misdirection of existing rules and the absence of necessary rules hinder their escape from this state, causing them to adhere more strongly to the practice of over-planting eucalyptus trees.

Eventually, the decline in the water table resulted from the over-cultivation of eucalyptus trees, constituting an indirect seizure of common pool resources as villagers, while planting eucalyptus trees on their own land, consume the flowing groundwater. Villagers are generally aware that the water shortage for daily life is linked to eucalyptus cultivation, but assigning responsibility and determining the extent of culpability remains unclear. The non-urgent nature of the harm allows for temporary mitigation through alternatives like searching for water. Consequently, despite tasting success in multiple planting cycles and forming a path dependence, villagers lack the incentive to break this pattern. As a result, while the village's eucalyptus cultivation thrives, few villagers address the problems arising from the planting, merely expressing occasional complaints. This collective action dilemma emerges as villagers enjoy significant benefits from planting eucalyptus trees without anyone proposing a solution to the issue of unreasonable cultivation.

In fact, the collective action dilemma resulting from over-planting eucalyptus trees could have been resolved through the villagers' learning ability and rules. However, explicit formal rules are lacking: first, the government appears inactive at the village level, with no governance policy specifically addressing the issue; second, without government instructions on eucalyptus trees, Committees lack justification to interfere with villagers' cultivation decisions. Moreover, implicit informal rules mislead. For instance, regarding authority rules, villagers chose a four-five-year rotation period for eucalyptus trees instead of the scientific nine-ten years, impacting yield. In terms of information rules, implicit informal information exchange lacks structure, leading to trivial or incorrect information, preventing a unified understanding of eucalyptus planting among villagers.

Therefore, when villagers with bounded rationality make initial mistakes, the misdirection of existing rules and the absence of due rules hinder their learning ability. This inefficiency prevents them from generating effective reasons for action, exacerbating the problem of over-planting and creating a collective action dilemma. Solving this dilemma requires thoughtful consideration. Reconstructing rules-in-use is a viable solution, and the initiation of this reconstruction could be driven by village elites such as college students and village sages, given the specific context in Neilong Village.

# Conclusion

## **Causes of the Collective Action Dilemma of Eucalyptus Planting**

The collective action dilemma in Neilong Village's eucalyptus planting has three distinct features: (1) It involves the indirect seizure of common pool resources, specifically, groundwater, by contractors and treeplanting villagers who are unaware or unconscious of this fact; (2) Some rules-in-use are implicit or absent, lacking conceptualization or corresponding regulations; (3) The deep implicit influence of clan relations, fostering close relationships among villagers, inevitably impacts collective action and interpersonal dynamics.

Villagers in Neilong Village, characterized by bounded rationality, are prone to mistakes and have learning abilities. However, the lack of complete information and effective rules prevents them from correcting errors in eucalyptus planting decisions. The misdirection and absence of rules hinder their learning, impeding their ability to address the issue of over-planting and leading to a collective action dilemma.

The government's initial goal of promoting eucalyptus cultivation is well-intentioned, aiming for national economic development and individual income growth. However, achieving a good goal may lead to significant deviations, as seen in Neilong Village, which is representative of regions like Fujian, Hainan, Guangdong, and Guangxi. Balancing economic development and environmental protection has become a pressing issue. Analyzing the collective action dilemma in Neilong Village offers insights into this broader topic. Acknowledging the author's current knowledge and academic limitations, ongoing research in public administration is planned to address these gaps.

## **Actuality and Prospect**

Without external intervention, the collective action dilemma in Neilong Village, linked to eucalyptus cultivation, cannot be resolved through self-governance due to the strong profit-driven motives of villagers with bounded rationality. While market competition and the pursuit of maximum benefit seem potential paths, the ongoing surging market value of eucalyptus trees renders this option ineffective. Government intervention emerges as the primary solution, as seen in the examples of eight cities in Guangdong Province<sup>31</sup> (Wu, 2014). However, this reliance on government action hinges on officials' awakening, pursuit of the public good, and the presence of effective alternative economic development strategies. While national and local authorities maintain a positive stance on eucalyptus<sup>32</sup> (Guangdong Natural Resources Department, 2019), local bans in Guangdong signal a nuanced approach based on officials' vision, attitudes, or responsibilities, or the availability of more viable economic alternatives. In essence, government intervention appears as the most viable solution not only for Neilong Village but also for numerous troubled villages across Fujian, Hainan, Guangxi, and Guangdong provinces.

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<sup>&</sup>lt;sup>31</sup> According to incomplete statistics, eight cities in Guangdong Province—Zengcheng, Jieyang, Heyuan, Foshan, Jiangmen, Yunfu, Meizhou, Guangzhou—banned the planting of eucalyptus. In July 2013, Zengcheng City issued a ban. According to the plan, the landscape eucalyptus trees on both sides of Zengcheng highway, and the sporadic eucalyptus trees next to villagers' houses, will be cleared in 2014; 250,000 acres of eucalyptus forests in Zengcheng City will be cleared completely in 2017. Huixiong Jiang, deputy mayor of Zengcheng City at that time, explained that the destruction of vegetation, water source and ecological damage in the eucalyptus forest was very serious, and that it was part of Zengcheng City's implementation of the great ecological project. In fact, as early as March 2013, when news of Zengcheng City's retreating eucalyptus trees got around, it caused dissatisfaction among several researchers at the Eucalyptus Research and Development Center of the Chinese Forestry Administration. They jointly wrote to the media: *I'll justify for eucalyptus trees*. They believe that Zengcheng City's blame on eucalyptus trees is "unwarranted" and hope that Zengcheng City will show pieces of evidence before the eucalyptus trees are cleared.

<sup>&</sup>lt;sup>32</sup> On June 24, 2019, the Guangdong Provincial Department of Natural Resources, in its reply to the NPC representatives, affirmed the innocuousness of eucalyptus trees and the re-confirmation of ecological problems caused by growers' planting methods and management.

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