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Research Article

Water and Soil Conservation from the Perspective of Stakeholders: Evidence from China and Policy Implications

Water and soil conservation is an important measure of ecological restoration in China. However, its success was elusive and often compromised the impoverished people who need to be protected most. Taking Changting County in southeast China as an empirical case, and within the framework of stakeholders, i.e. the government, the farmer, the business enterprise, and the non-government organizations, this article explored the benefits to the multiple stakeholders in the progress of water and soil conservation. The results show that all stakeholders played various but important roles and their benefit changes from period to period. It was demonstrated that the different roles, pursuits for the ecological or economic benefits directly and largely drive and affect the consequence of water and soil conservation in Changting. The benefit and cost of multiple stakeholders should be identified in a meaningful way and balanced. It is important to improve the livelihoods of the farmer, in particular the impoverished farmer who are heavily dependent on the environment and most affected by the projects. This study demonstrates a new perspective for exploring the relationship between ecological restoration and poverty alleviation, and is conducive to understand the internal mechanisms and provides some general implications for similar areas in developing countries.

Keywords: Benefit change; Developing countries; Ecological restoration; Poverty alleviation

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1 Introduction

Since the United Nations Conference on the Environment and Development in 1992 and the World Summit on Sustainable Development in 2002, the significance of synergy of ecological restoration and poverty alleviation was widely acknowledged and many programs were conducted and policies were formulated to achieve the "win-win" objective worldwide [1–3]. However, regardless of the common consensus and the aggressive efforts of the governments, most ecological restoration projects in China and other developing countries were still far from the expected results [4, 5], such as the Three-North Shelter Forest Project, the Grain for Green Project the World Food Programme by World Bank Loans [6–9]. The same kind of projects in Africa also failed to achieve the admired consequences [10]. A World Bank report revealed that only 16% of projects have made significant progress regarding the objectives of both poverty alleviation and biodiversity conservation [5]. Most, if not all, these projects did not allow the poor to access the natural resources and receive continuous financial support after the end of the compensation [6–9].

One important question for all of us is why the ecological restoration projects were so hard to be successful and often compromised the impoverished people who need to be protected most? The answer would be useful to formulate ecological restoration and poverty alleviation policies not only in China but also in other developing countries. The seeming causes include inappropriate technologies, single monolithic policies regardless of the specific conditions [11], and the ceasing of compensation. Instead, we would like to argue that lack of engaging stakeholders in the process of the policy formulation, particularly those impoverished members most affected by the projects could be a more important problem [12]. In order to achieve the "win-win" objective of ecological restoration and poverty alleviation, this study explored the relationship from a perspective of stakeholders. Few studies have integrated ecological restoration and poverty alleviation from the perspective of stakeholders and carefully considered the most vulnerable stakeholders: the poor [13, 14]. The relationship between ecological restoration and poverty alleviation is multi-dimensional, complex, varied, and locally specific, and the understanding of which requires detailed data and supporting cases.

Serious soil erosion has been a chronic environmental problem in China. While great efforts were made using vegetation restoration to control soil erosion, the effectiveness was not as satisfactory as expected for varied reasons [15]. Taking Changting in the southeast China as an empirical case study, this study aims to investigate water and soil conservation and poverty alleviation from the stakeholders' perspective.

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Abbreviations: **GDP**, gross domestic product; **NGO**, non-government organization

2 Material and methods

2.1 Site selection

Located in western Fujian Province in south-east China (25°18′40″ to 26°02′05″N, 116°00′45″ to 116°39′20″E), with a land area of 3099 km^2 and a population of 393 000 in 2010, Changting County has a subtropical humid monsoon climate, and a high mean annual precipitation (1730.4 mm/year) and a warm mean annual temperature (18.3°C). It typifies the characteristics of red-soil areas in South China, i.e. abundant rainfall and weakly soil-resistant capability. Historically, it was covered by luxuriant vegetation with light soil erosion. However, because of the feature of red-soil and half a century's worth of anthropogenic destruction of the vegetation, it has become one of the most severe and representative red-soil erosion areas in China [16]. According to a remote sensing survey, the area with erosion increased to 97 479 ha in 1985, which accounted for 31.47% of the mountain area. The severe environmental degradation caused by soil erosion greatly restricted the sustainable development of Changting [7].

Changting is one of the most representative red-soil erosion area and facing serious environmental degradation in China [16]. Its modern history since the Foundation of the People Republic of China in 1949 can be described as a struggle against the soil erosion. Based on different characteristics and consequences of water and soil conservation (Fig. 1), and taking into consideration of the iconic events, such as the Soil Erosion Control Pilot Program (1985) and the Project for Benefits of the People in Fujian (2000), the process of Chanting's Water and Soil Conservation can be categorized into three phases, i.e. 1949–1985, 1986–1999, and 2000–2009 (which will be discussed in detail in the following sections). Changting is also one of the 592 poorest counties identified in the National Poverty Alleviation Plan. It epitomizes China's poverty alleviation practices and makes remarkable achievements. The gross domestic product (GDP) sharply increased from $19.6 million in 1985 to $1067.8 million in 2010 and the per capita income of local farmers increased from $36.8 to $721.4 accordingly [17]. The stakeholders have been actively engaged in the entire process of water and soil conservation [6, 18, 19].

Changting has been a research hot-spot in the academia recently [6]. For example, Cao et al. [7] explored the successful practices of environmental policy in poverty eradication from the perspective of government, while Wang et al. [18] established a "push–pull model" to analyze the livelihood changes as one part of ecological restoration from the perspective of the farmers. However, the varied roles and benefit changes of multi-stakeholders in different periods, which could be crucial have been largely ignored. Therefore, the complex relationship between water and soil conservation and poverty alleviation was not able to be discovered.

2.2 Analytical framework

The stakeholders' theory originated from the popular concept of collaboration and co-operation in the 19th century [23]; the Stanford Research Institute used the term "stakeholders" for the first time in 1963. Recently, Freeman's definition, i.e. anybody or any organization that affects or is affected by an organization's objectives, is widely accepted [24]. Originally, its application was limited within the management field, but it is now applied widely. Hemmati explained how the multi-stakeholder processes can be organized to deliver their potential for successful resolution of complex issues and for governance and sustainability [25]. Koontz and Johnson [26] pointed out that collaboration among multiple stakeholders was a substantially shift in US environmental policy making during the past several decades. The collaboration or settling and managing the conflicts of the stakeholders' theory, can be extended to ecological restoration, which requires the cooperation of all participants [27, 28]. The success of ecological restoration cannot be achieved without the substantive and active participation of the crucial stakeholders.

What are the stakeholders in water and soil conservation? Like most developing countries, the government plays an important actor in the process of water and soil conservation [19].Without financial and technical support from governments, it is difficult if not impossible to escape the poverty trap [7]. The farmers, especially those poor farmers, whose livelihoods heavily depend on the natural resource and seriously affected by the projects, are the key stakeholder. Only when they perceive the project is valuable and their personal benefits and the cost to be acceptable, will they support the projects [30]. Most business enterprises, including local and non-local companies, hardly laid hands on soil and water conservation

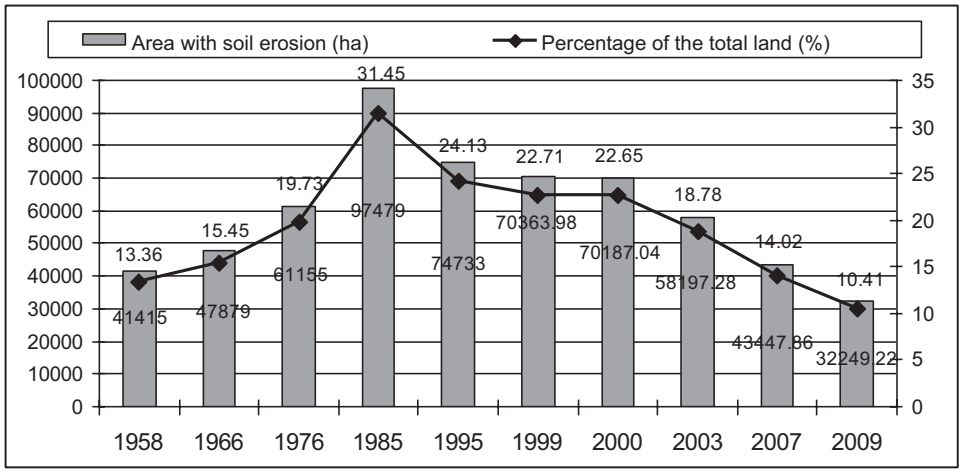

Figure 1. Area and percentage of soil erosion in Changting, 1958–2009. Based on [20–22].

due to its limited economic return before 2000. Only recently considerable economic return has been perceived, some business enterprises are able to consider social responsibility to protect the environment and active participate in water and soil conservation.

The research institutes, international organizations and other non-governmental organizations (NGOs) are the important technology providers, contributing to water and soil conservation. For example, the Chinese Academy of Sciences Nanjing Institute of Soil Science, Fujian Agriculture and Forestry University, Fujian Normal University, Xiamen University, Fujian Academy of Forestry and others have co-operated with the relevant administrative departments of Changting. Their findings support the effective water and soil conservation. Recently, international organizations are presented in the water and soil conservation of Changting, acting as an investor, such as Asian Development Bank. With the further development of China's opening up to the outside world, the role of the international organization in ecological restoration may become more and more significant than before.

The four crucial stakeholders, i.e. the government, the farmer, the business enterprise and the NGOs are evolving throughout the whole process of water and soil conservation in Changting, and play various but important roles. As in the analytical framework, the benefit and cost of multiple stakeholders should be identified and considered. Their different roles, pursuits for the ecological or economic benefits directly and largely drive and determine the consequence of water and soil conservation [4, 6, 18, 19, 29].

3 Results

3.1 Benefit non-integrating: 1949–1985

From the establishment of the People Republic of China in 1949 to the opening-up to the outside world in the early 1980s, the whole country was centralized on recovering from the civil war and political movements (such as the Great Leap Forward in 1958 and the Cultural Revolution during 1967–1976), and much less attention had been paid on ecological restoration. Changting was not an exception. The water and soil conservation was constantly disrupted by political movements. The size of the soil erosion area increased from 44 415 ha in 1958 to 97 479 ha in 1985, and the percentage to the total land increased from 13.36 to 31.45% accordingly (Fig. 1).

During this period, the government was aware of the negative consequence of soil erosion and began some attempts to control the soil erosion. The Water and Soil Conservation Offices and Stations at all hierarchies were established around the county. Some practices focusing on closing access to forest and afforestation had gained certain ecological benefit. However, due to the poor social-economic conditions (less investment and non-compensation) and limited environmental awareness, as well as inappropriate technology, most efforts were still focused on political and economic issues, while the ecological benefit was actually regarded as a byproduct. In addition, nearly all the efforts were limited within Hetian, one of townships of Chanting, while other townships were totally excluded. Therefore, the achievement was limited and unstable. Especially, when political movements were active, the property rights became unclear and deforestation was prevailed in Changting. Hence, water and soil conservation was setback and the previously accumulated gains lost. It was reported that the newly increasing soil erosion area amounted to 13 000 ha in Hetian alone during the ten years' Cultural Revolution [30].

The farmers worked hard to improve their basic living standards within the context of poor conditions and low productivity. Naturally, they lacked the environmental awareness and economic capacity to pursue ecological benefit. It was undeniable that the afforesting activities did have some ecological benefit. However, due to closing access to forest, they lost some important necessities coming from nature sources, such as fuel-wood, fruit, and mushroom. In addition, the local farmers were encouraged to plant trees on the soil erosion areas driven by political will without any compensation. Hence, combined by the constantly changing political conditions, the economic capacity of the farmers, especially the livelihoods of the impoverished farmers, did not improve accordingly. Most of them still struggled at the edge of poverty and did not care the ecological benefit or actively took part into the practices of water and soil conservation.

Most scientists and researchers from research institutes enthusiastically devoted themselves to water and soil conservation at first, with the expectation of the dual objectives of ecological and economic benefits. For example, the researchers from Fujian Agricultural College, Fujian Forestry College, and Fujian Normal University were invited by the Fujian Water and Soil Conservation Office to conduct the studies and practices on water and soil conservation in Hetian in 1962. At the same time, the collaborated teams were set up in every village and many local staff was trained for the purpose of water and soil conservation. As the consequence, considerable progress was made through both short- and long-term approaches at the early period. However, the promising situation did not last a long time. During the turbulent Cultural Revolution, almost all of the sectors, including the Water and Soil Conservation Research Institutes, were seriously impacted. They were dismissed and many researchers were even politically persecuted. The routine water and soil conservation was seriously challenged and interrupted. Neither the economic benefit nor the ecological benefit accumulated formerly could avoid the serious destroy.

3.2 Benefit conflicting: 1986–1999

That depressed situation seemed to change since the mid-1980s when water and soil conservation in Changting embarked upon a new stage. By 1999, a total of 25 700 ha of soil erosion had been effectively controlled, and the total soil erosion area was reduced from 97 479 ha in 1985 to 70363.98 ha in 1999 (Fig. 1), which greatly improved the environment of the County.

During this period, with the development of economy and restoration of the Water and Soil Conservation Committee, the local government introduced some effective water and soil conservation projects that primarily focused on ecological benefit. For example, during 1986–1999, supported by the Chinese Water Resources Ministry and relevant administrative departments of Fujian Province, the local government initiated the water and soil conservation attempts focusing on Hetian that was selected as the pilot. Various approaches of water and soil conservation, such as afforesting, building reservoirs etc., were carried out and resulted in certain achievements. Lately, they were extended to other townships, which considerably increased the vegetation, and the trend of soil erosion seemed to be curbed once more.

Unfortunately, with the criteria of official promotions, the local government was eager for short-term economic achievement [31]. As the consequence, these efforts of ecological restoration were dwarfed and counteracted by the overdue exploitation of the natural resource,

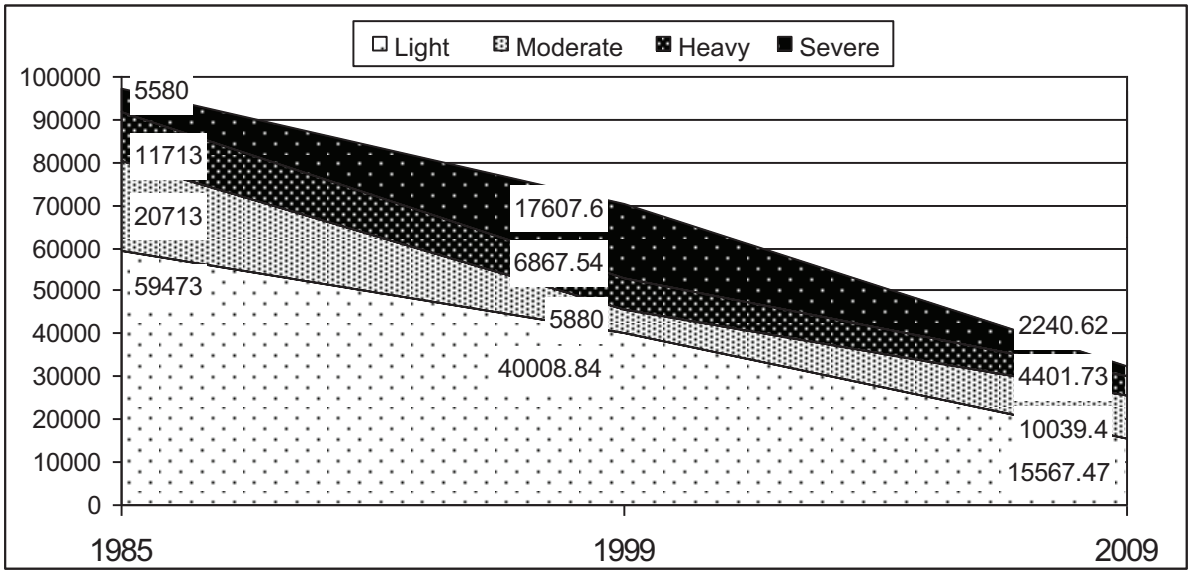

Figure 2. Change area of soil erosion in Changting, 1985–2009. (1) Light soil erosion (<2500 t/km^2 per year); (2) moderate soil erosion (2500–5000 t/km^2 per year); (3) heavy soil erosion (5000–8000 t/km^2 per year); (4) severe soil erosion (>8000 t/km^2 per year). Based on [20–22].

including forest, coal, and rare earth etc., which actually degraded the environment and caused new soil erosion [6, 18]. Regardless of the decrease of total area mentioned above, the heavy and severe soil erosion area increased from 17 293 ha to 24 475.14 ha instead (Fig. 2).

The local farmers were not provided with economic development assistance and long-term compensation from the water and soil conservation. Instead, like other kinds of project in China [12], the local farmers were not allowed to access to forest and vegetation on the soil erosion areas and not compensated for the loss by the government except for one initiative attempt of "Job for Aid" (yi gong dai zhen). The central government invested $454.41 thousand in the water and soil erosion conservation in seven small watersheds, such as Liuyuan River, Mahang River, etc., during 1986–1989. The impoverished farmers were encouraged to take part in this project and those who evolved would be paid according to their own workloads. The enthusiasm of the farmers was activated to some extent in the early stage. However, with the fast growth of the coastal area <100 km away, the farmers could easily find better jobs there than "Job for Aid". Combined with the excessive exploitation on the natural resource on which they heavily depended, the practice of water and soil actually harmed the livelihoods of the farmer to some extent from this angle [12]. Due to the loss of the economic benefit, it was understandable that the local farmers, especially the impoverished ones, passively participated in water and soil conservation in the later period.

The research institutes actively engaged in the academic and practical attempts at water and soil conservation during this period. When Changting was selected as a key pilot area for water and soil conservation in 1985, the research institutes cooperated with the related departments of Changting and started with the so-called "Eight Institutes Joint Soil Erosion Conservation Program", in which every village was allocated with and supported by one unit assigned, i.e. Fujian Provincial Water Protection Committee, Agriculture Department, Forestry Department, Water Source and Electrify Department, Forestry Science Institute, and Fujian Forestry College etc., respectively. They initiated some engineering and biological methods, such as building the reservoirs, introducing exotic species in soil erosion areas, which resulted in a lot of achievements. They were generally caring more about ecological benefit and did not take into account the integration of economic and ecological benefits. Therefore, there were still some deficiencies at this stage. Many exotic species could not adapt to the mountain soil, and a large number of trees died. In addition, too much effort was focused on the severe soil erosion areas, and the moderate and light soil erosion areas were not paid enough attention to. In particular, the comprehensive management of small watersheds was totally ignored. The factors that caused soil erosion could not be fundamentally dealt with.

This situation can be verified by the correlation between the water and soil conservation indices (area change of different intensity and scale of soil erosion) and the poverty alleviation indices (GDP and per capita income of farmers) (Tabs. 1 and 2). The correlation coefficient of the heavy and severe soil erosion with GDP and per capita net income of farmers are significant at 0.05 and 0.01, respectively, which suggests that the water and soil conservation and the poverty alleviation are in the different trend. That partly demonstrated that the excessive pursuit of the economic benefit jeopardized the ecological benefit to some extent [8, 12], which also be confirmed by other scholars [7, 18].

3.3 Benefit integrating: 2000–2009

During this period, the whole society was mobilized to participate in the project of comprehensive water and soil conservation. Some successful efforts in tune with local conditions were developed with exciting results. The soil erosion area decreased from 70 187.04 ha in 2000 to 32 249.22 ha in 2009, and the proportion of the total land area reduced from 22.65 to 10.42% accordingly. More importantly, the most significant change was the heavy and severe soil erosion with the area of 24 475.14 ha sharply reduced to 6642.35 ha, a net decrease of 17 832.79 ha (Fig. 2).

The governments realized that pure conservation excluding the livelihoods of the poor farmers was inadequate to achieve the

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Table 1. GDP and per capita net income of farmers of Changting

Year	Population (1000 persons)	GDP ($ million)	Per capita net income of farmers ($)
1958	226.7	2.1	–
1966	247.8	2.3	–
1976	336.3	4.3	11.9
1985	388.7	19.6	36.8
1988	404.6	32.7	61.8
1995	463.7	144.7	160.9
1999	480.3	220.1	294.0
2000	485.4	222.0	300.6
2003	405.5	276.3	332.2
2007	410	522.3	518.4
2008	410.8	640.4	593.7
2009	400.1	879.0	647.6
2010	393.39	1067.8	721.4

Note: All the price is constant at 2000 (US$1 equaled approximately RMB 8.27 in 2000).
Source: [17].

expected "win-win" goals, and tried their best to integrate and maximize the ecological and economic benefits of the water and soil conservation. The government of Fujian Province launched the Project for Benefits of the People in Fujian and allocated $1.2 million annually on the energy subsidies and green enterprises in the comprehensive water and soil conservation. For example, in order to reduce fuel-wood use, the affected farmers were compensated at $5 for per 1000 lump of coal (25% of the local cost), $120.92 for $<8\,m^3$ of capacity or $181.38 for $>8\,m^3$ of capacity per methane-generation facility. In order to improve the livelihoods of the farmers, $181.38 for each ha of fruit trees, $12.09 for each pig, and $1813.79 for each ha fish pond were paid to the farmers engaged. In order to improve the farmers' income and reduce the producing cost, the local government paid farmers $3.63/day for planting fruit trees or forage vegetation and provided freely tree seedlings or the seeds [7].

In accordance with the initiative efforts of the governments, the local framers got considerable compensation in fuel-wood and planting trees from the projects. Most importantly, they could depend on alternative and sustainable livelihoods such as fish ponds, fruit trees etc., even when the compensation ended. This kinds of comprehensive treatment benefitted seven towns, 106 villages and nearly 20 000 people [22]. The local framers gradually benefited from ecological management and recognized the inseparable relationship between economic development and water and soil conservation. Thus, they actively involved in practice and changed their living habits relying on the fuel-wood and transformed to electricity and natural gas, or developed green vocations such as planting fruit trees or ecological tourism.

During this period, the research institutes also changed their conventional conceptions and approaches, and took ecological and economic benefits into account simultaneously. They explored the water and soil conservation approaches that were adaptable for local situations. For example, they figured out the initiative models of "grass–husbandry–biomass–fruit", "closing access to the hillsides and afforestation", and "tea and fruit trees improvement", etc., which resulted in promising ecological and economic benefits simultaneously. At the same time, the international organization also paid attention to and invest in ecological restoration in Changting. For example, Asian Development Bank launched the loan project of "Water and Soil Conservation and Rural Development in Changting" that resulted in fruitful achievements.

Many business enterprises joined in the projects of water and soil conservation at this stage. While they benefited from ecological restoration projects, the enterprises must shoulder the social responsibility to protect the environment. Some of them developed environment-friendly and green industries, hoping to gain economic profits, as well as protect the environment. For example, the Yuangsan Limited Company allied with 9510 householders and encouraged them to plant fruit trees and vegetable and raise chickens and pigs in the soil erosion areas, increasing income by $143.41 for the average household in 2008 [22].

During this period, the total erosion area is negatively correlated with GDP and per capita income at −0.95 and −0.95, respectively (statistically significant at 0.05) (Tab. 2), suggesting the progress of water and soil conservation is in the same trend with the poverty

Table 2. Correlation analysis of poverty alleviation and water and soil conservation

	Area experiencing different intensity and scale soil erosion	GDP	Per capita net income of farmers
1986–1999	Total erosion	−0.62	−0.63
	Light erosion	−0.46	−0.51
	Moderate erosion	−0.90	−0.85
	Heavy and severe erosion	0.953[a)]	0.983[b)]
2000–2009	Total erosion	−0.95[a)]	−0.98[a)]
	Light erosion	−0.75	−0.71
	Moderate erosion	0.66	0.70
	Heavy and severe erosion	−0.33	−0.46

Note: Due to lacking of data, the regression analysis is only for the period of 1985–1999 and 2000–2009.
[a)] Correlation is significant at the 0.05 level.
[b)] Correlation is significant at the 0.01 level.

alleviation, which is also consistent with the results by other studies [7, 18].

4 Discussions and policy implications

As the most important kind of ecological restoration that aims at protecting the environment as well as the welfare of the poor farmers in China, the success of water and soil conservation cannot be achieved without the active participation of the stockholders, i.e. the government, the farmer, the business enterprise and the NGOs. They play various but important roles in different periods, and their ecological and economic benefits change from non-integrating, to conflicting, to integrating (Fig. 3).

During the period of 1949–1985, due of backward socio-economic conditions, less investment and non-compensation, immature technology, and constant political movements, neither the government nor the farmers and research institutes would pay much attention to ecological benefit in water and soil conservation. The economic benefits were not integrated with the ecological benefit as a whole. During the period of 1986–1999, the limited investment, inappropriate technology, and narrow range (ignoring the more broadly moderate and light soil erosion areas and the small watersheds) have made some limited ecological restoration progress. Most importantly, under the pressure of rapid economic development in coastal areas, the local government had to rely on the over-exploitation of the natural resources on which the farmers heavily depended, while they could not be substantially compensated, which actually harmed the livelihoods of impoverished farmers. So, the "win-win" objectives were not achieved, or the economic and ecological benefits were conflicting in general. During the period of 2000–2009, relying on the Project for Benefits of the People in Fujian, all stakeholders were actively engaged in water and soil conservation. Through the effective efforts, such as the energy subsidy, green enterprises, the degraded environment was greatly improved, as well as the livelihoods of the affected farmers. Thus, water and soil conservation at this stage achieved the "win-win" objective and the ecological and the ecological benefits were successfully integrated.

In order to achieve the "win-win" objective of ecological restoration and poverty alleviation in water and soil conservation, the needs and concerns of all affected stakeholders, especially the vulnerable poor farmers, must be definitely identified and well addressed. The multiple shareholders must work together, and their benefits should be carefully balanced and integrated. The livelihoods of the improvised farmers must be regarded as the ultimate goal of the ecological restoration programs, which is vital to the economic effectiveness of the ecological restoration programs [12].

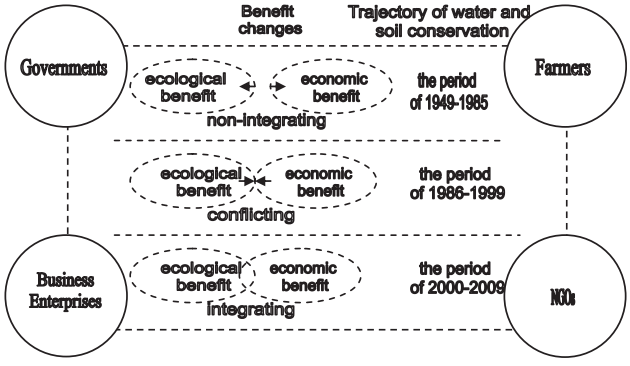

Figure 3. Benefit changes of multiple stakeholders in water and soil conservation. The arrows show the benefit orientation of the stakeholders concerning on ecological or economic benefit.

This article mainly discusses the benefit changes in water and soil conservation among stakeholders. The inherent mechanism of the relationship between ecological restoration and poverty alleviation has been investigated [32]. In addition, more attention must be paid to two significant heterogeneities of the stakeholders, such as the poor farmers and the rich farmers, and the different government departments. The benefit orientation of the poor and the rich farmers is very different. The poor farmers need money of maintenance while the rich farmers need environmental restoration to improve their life quality. In the first two periods, the rich farmers benefited most from water and soil conservation while the poor farmers, who heavily dependent on the environment, bear most of the cost [32, 33]. Three departments were in charge of water and soil conservation: the Water and Soil Conservation Bureau, the Forestry Bureau, and the Environment Protection Bureau. They belonged to different sectors and overlap on water and soil conservation. Due to the sector benefit and lack of inter-agency cooperation, they often competed for water and soil conservation funds, and often conducted their own programs without coordination or long-term thinking, which not only wasted a lot of money, but also compromised their ability to achieve the expected goals [34].

This study has some policy implication for similar areas in China as well as in other developing countries. Stakeholders must be identified by the policy designers to decide who to involve, who has an interest in, or will be affected by ecological restoration to have effective policy. The policy designers must encourage the meaningful involvement of all shareholders, and ensure the needs and concerns of all affected stakeholders are well addressed. Due to the significant heterogeneity, various shareholders care different economic and/or ecological costs and benefits from period to period. So policies must be addressed and adapted to this heterogeneity and benefit changes. Most importantly, effective policies must be designed to protect the long-standing benefit of the vulnerable poor farmers who are most heavily depending on and severely affected by the related projects. The ecological restoration policies must be formulated and implemented to improve the nature as well as the livelihoods of the poor farmers [35], through the compensation, employments provision, training, and green enterprises [7].

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