

Article

Eco-Wisdom in Coexistence with Huai River: Flood, Memory and Sustainability

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Received: Aug 17, 2022; Accepted: Sep 17, 2022; Published: Sep 30, 2022

Abstract: The purpose of this study is to explore the application of eco-wisdom to environmental sustainability. Small-scale eco-wisdom has received much attention in recent years because local practices tend to better reflect the characteristics of the environment. In this study, the texts of the in-depth interviews were coded into three stages to define three sub-categories including flooding disaster, relocation and returning to the homeland, regeneration of the living environment, and six property-dimension including disaster and losses, relocation and returning to the homeland, infrastructure, and agricultural reform. It is found that in the event of natural disasters, residents in the study area accepted and adapted flooding as a survival strategy, developed the ability to observe the environment well, improved the sensitivity of disaster awareness, and carried out agricultural reforms in the coexistence of flooding. These practices jointly shape an environmentally sustainable eco-wisdom.

Keywords: Disaster, Adaptation, Doing nothing

1. Introduction

Survival wisdom comes from the adaptation of organisms to the environment, so it is essentially ecological wisdom [1]. For example, the Dujiangyan Irrigation System, led by Li Bing, laid out ecological infrastructure on the Chengdu Plain. It was built in 256 BC, and developed and improved in the past 2,278 years, making the area of 6,687 m² permanently free from floods and natural disasters [2]. On the other hand, more studies focus on small-scale ecological wisdom research. International academics have begun to focus on the importance of traditional disaster-prevention knowledge—especially in the area of small regional, local, and community-based knowledge research—and believe that it must be regarded as a form of disaster-prevention technology [3–6]. For example, coastal residents know how to interpret changes in the walrus' behavior and the environment to predict tsunamis and earthquakes [7,8], while mountain residents in areas with frequent orogeny carefully select their sites during the monsoon season before settling down to avoid landslide disasters [9]. Residents living in the water resources area also know how to use the power of culture and clans in the early stage of reclamation to live in flood seasons or with artificial disasters through the reorganization of the population to maintain the unique local water resources [10]. The Huai River is located in China and is an important geographical feature to divide areas with different soil and water between the north and the south. The terrain in the middle of the basin is low, so floodings are frequent and difficult to control [11]. Although the Huai River is prone to floods, as a major transportation route connecting the north and south of China, there are many settlements around ports scattered along the Huai River which have not disappeared even with frequent floods. The disasters in the Huai River make the research focus on the governance of regional watersheds [12–14] or government-led construction projects [15] while ignoring the small effects of riverside village residents who contribute to the stability of the Huai River. However, the issue of how to respond to flooding and survival is rarely discussed. We believe that local and small-scale responses in villages better reflect the eco-wisdom of residents facing natural changes.

2. Materials and Methods

2.1. Study Methods and Process

At present, only a simple village history record is left in Wangliu town. In March 1950, under the leadership of the Communist Party, a land reform movement was launched. At the same time, a small township government and its institutions were established.

In October 1953, the township government organized the residents to actively participate in the Huai River improvement project. According to traditional living habits and distribution, the residents along the Huai River were divided into "Dagang Enclosure" and "Chenzuwan Enclosure". In 1954, the embankment of the Huai River was breached by floods, the farmland was flooded, and the residents were forced to relocate. In 1960, according to the arrangement of the superiors, the residents moved to Tangji and Dengwei to live in. At the end of 1961, the displaced people returned to their hometowns to live on their initiative, and the production team allocated 0.03 ha of the field to each person.

Therefore, to fully gather the details of the flooding disaster, we adopt the method of in-depth interviews and field investigation to carry out four steps of asking, keying, coding, analysis, and discussion (Fig. 1).

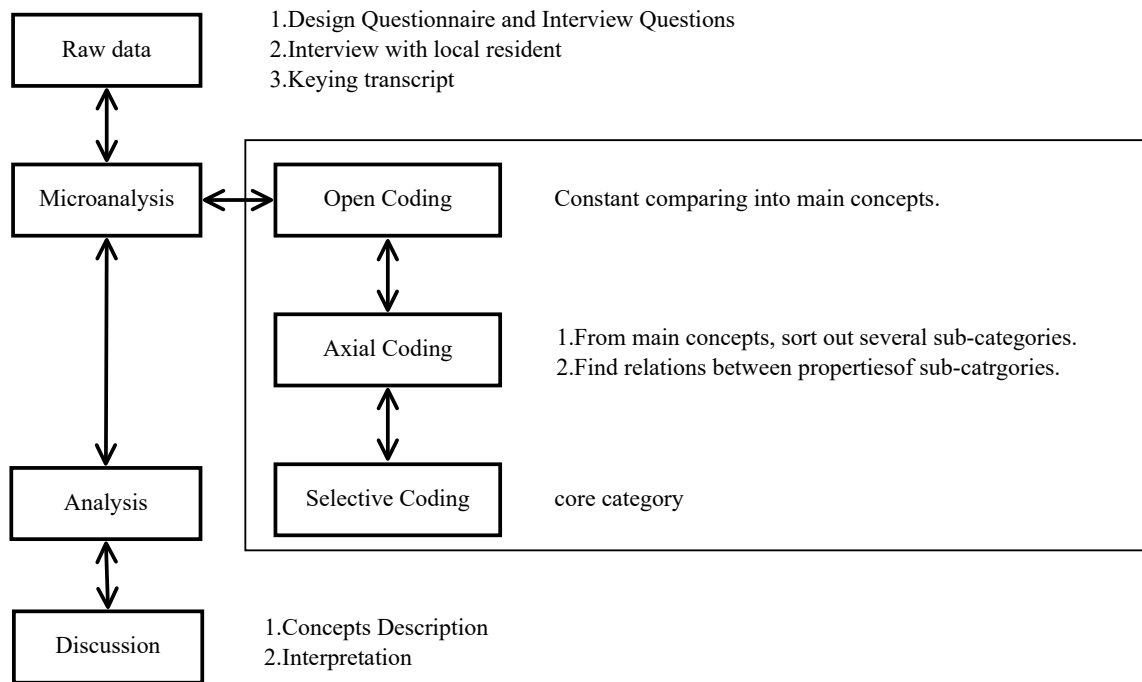


Fig. 1. Flow chart of this study.

2.2. Study Area

The research adopted in-depth interviews and field investigations for data collection. With intentional sampling, the interviewees were selected among residents of the study area between 50 and 80 years old. The interviews were carried out in August 2022, and a total of 6 people were interviewed (Table 1). According to the research purpose and geographical characteristics, environmental characteristics with flood disasters and frequent changes were selected as the research base. The study area includes Dukou Village, Gushi County, Xinyang City, and Henan Province, China. They are located at the junction of Henan and Anhui provinces, the northern part of Gushi County, and the intersection of East China and the Central Plains (Fig. 2). During the 450 years from the Ming and Qing Dynasties to the early days of the founding of New China, an average of 94 floodings in 100 years occurred in this regions. The topography of the basin is "high at both ends and low in the middle" and makes the Huai river become one of the most difficult rivers to manage in China. The study area is located in the middle section of the Huai River, which is prone to flooding. The most serious flood occurred in July 1968, when the floods broke levees, collapsed 82 houses, and inundated 16,105 ha [16]. We focused on flooding events that occurred during the period 1950–2021 (Fig. 3).

Table 1. Interviewees and their backgrounds.

No.	Code	Ages	Background and Interview Summary
1	M_1	80	He lives in Dukou Village and belongs to a relocated household. In 2001, he moved from the original Chenzuwan to the current Dukou Village following the policy. Before the relocation, he was a farmer and is still a farmer. In 1954, the family had to move to a place where there was no flood because the flood destroyed their farmland and damaged all their foods. In order to alleviate the flood damage, the villagers strengthened the river banks under the organization of the government, and at the same time, they excavated new drainage channels according to the terrain. When the flood receded, the original land appeared again, and they started a new life based on the new geographical environment after the flood. (20220801)
2	M_2	70	He lives in Dukou Village and belongs to a relocated household. He participated in the self-rescue and flood repair project after the flood in 1968. At that time, he was about 15 years old. He also participated in the construction of reservoirs, digging canals, and building dams when he was about 20 years old. He has experienced the entire process of Chenzuwan's completion, relocation, and return to the homeland. In the interview, he recalled the 1986 flood most clearly. He described that it had been raining for nearly a week, and the Huai River had risen above the warning line, flooding Chenzuwan and destroying farmland, villages, and schools. The government deployed many rescue workers and the army was involved in rescue activities. In the immediate aftermath of the disaster, the local government had medical workers treat injured villagers and disinfected flood-damaged villages to prevent infectious diseases. As far as he can recall, though, several subsequent floods were smaller than those in 1968. However, most villagers preferred to stay there because they thought the local water supply, ventilation, and transportation were more convenient. (20220807)
3	M_3	53	He lives in Dukou Village and belongs to a relocated household. Before the age of 25, he relied on farming land, raising livestock, and selling tofu to support his family in the countryside. He and his family also used to live in Chenzuwan, and before they moved, they grew vegetables, wheat, and rice in the depression next to the river bank and planted trees on the river bank. When the floods destroyed everything, his family moved to another village. His parents died the first and second year after the move because they were too old and unable to adapt to the new environment. When he moved, he needed to build a new house. Although the government supported him, he still needed to go to the city to earn more money, so he did not have enough time to live with his family. (20220815)
4	F_1	53	She originally lived in Laoguan, Anhui on the other side of the Huai River. She married and moved to Dukou Village at the age of 23. She could not remember the year of the flood but recalled that everyone was forced to sleep on the high banks of the river when it came. "At that time, there were floods on both sides of the banks," she says. "People drank water and discharged waste in the same river. No one cared if they got sick." People who live by the river for a long time learn to accumulate experience, and they judge whether there is a flood or not based on the rainfall and weather conditions in the summer. "In the summer, if it rains, people start hoarding food," she says. (20220820)
5	M_4	67	He lives in Dukou Village and belongs to a relocated household. He started working as a rural teacher in Dukou Village at the age of 23 and retired at the age of 60. He experienced the great flood of the Huai River in 1968 and several floods in 1970. He was 12 years old when the flood struck in 1968. His family had a small boat, and he and his family had to live on it until the flood ended. The floods damaged crops but did not change the landscape. When the floods subsided, people returned to the same areas to grow corn, wheat, and soybeans. People often did not have enough food when the flood came, and even without the flood, there was not much food until people started building canals and growing rice on a large scale. (20220822)
6	F_2	63	She lives in Dukou Village and belongs to a relocated household. She has been working as a full-time housewife at home. She also experienced the Huai river flood in 1968. During the interview with her, we learned that when the flood broke out, people around her went to live with other relatives. At the time of the flood, dead bodies were seen in the river. Even so, the local people still drank the water from the river. Surprisingly, though, people did not get sick. Canals were built later, so rice could be grown. Now she no longer lives in the original village, but in the interview with her, she said, "Although I left that place for more than ten years, sometimes I still dream of the original place, imagining myself walking by the river and planting rice in the river." (20220822)

Note: The age of the interviewees is the year according to the interview time. Based on the research ethics, the reporter uses the code name instead. Code F means female, and M means male.

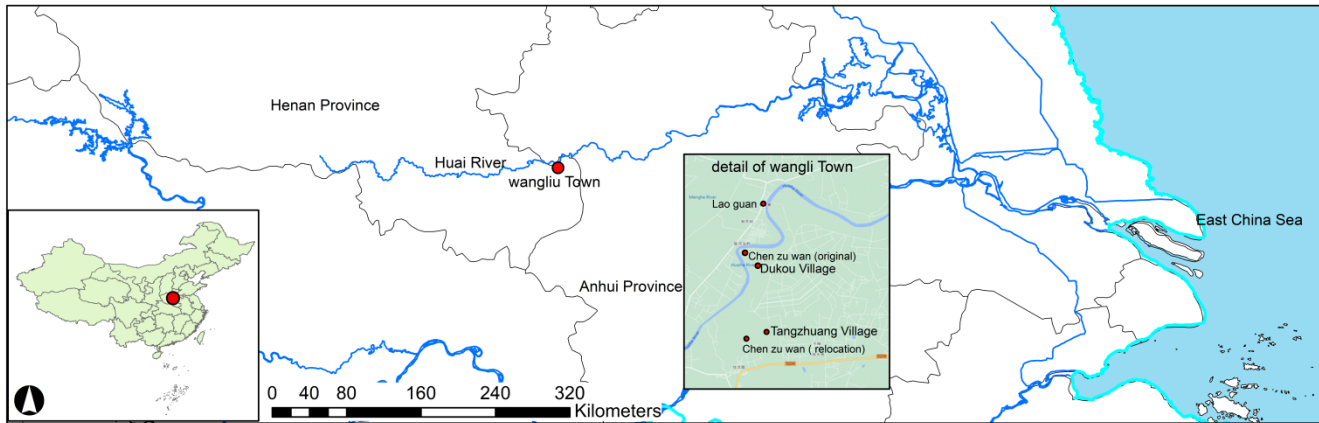


Fig. 2. Study location.

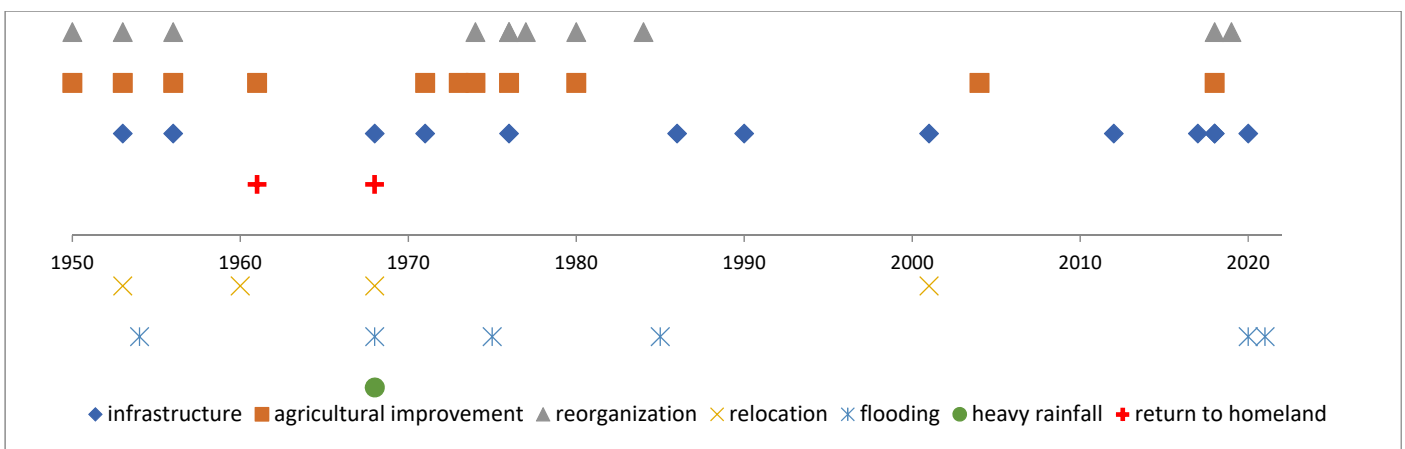


Fig. 3. Events in the study area during 1950–2021.

3. Results

3.1. Microanalysis and Open Coding

At the first stage, with the open coding, three sub-categories are defined: flood disaster, relocation and return to home, and environmental transformation. Floodings in 1954, 1968, 1985, and 2021 were used as the segmentation points of residents' memories because, during the interview, these four years are the years when the interviewees mentioned their memories of the flood. The memory segmentation point of residents, the intensity of flooding, the casualties and losses caused by the disaster, relocation and return to the homeland, post-disaster infrastructure and agricultural improvement, etc. remain in the memory of Huai River between two generations.

“In the flood in 1968, when I was twelve years old, the whole dam was opened, and all the water on this side of the Huai River flowed to the other side. Not many people died in our Dukou village, but many people died in Huaibin and Shangwan” (M_4)

“I remember the flood in June 1968 most clearly. I was fifteen or sixteen years old that year. In June of that year, the middle and upper reaches of the Huai River had been raining for more than a week (we all commonly call it “seven days and eight nights”), and many people drowned.” (M_2)

“The worst memory is the flood in 1954 when the Huai River embankment was washed away by the flood. The villages inside the embankment seemed to be a vast ocean, the farmland was flooded, and people were forced to relocate.” (M_1)

“In the summer of 1985, Chenzuwan was hit by a tornado, some houses in Dukou Village collapsed, most of the trees were broken off, and crops were severely damaged.” (M_3)

“The flood in 2021 ruined our crops. The sesame I planted has been flooded, and the rice and other things have been flooded.” (F_2)

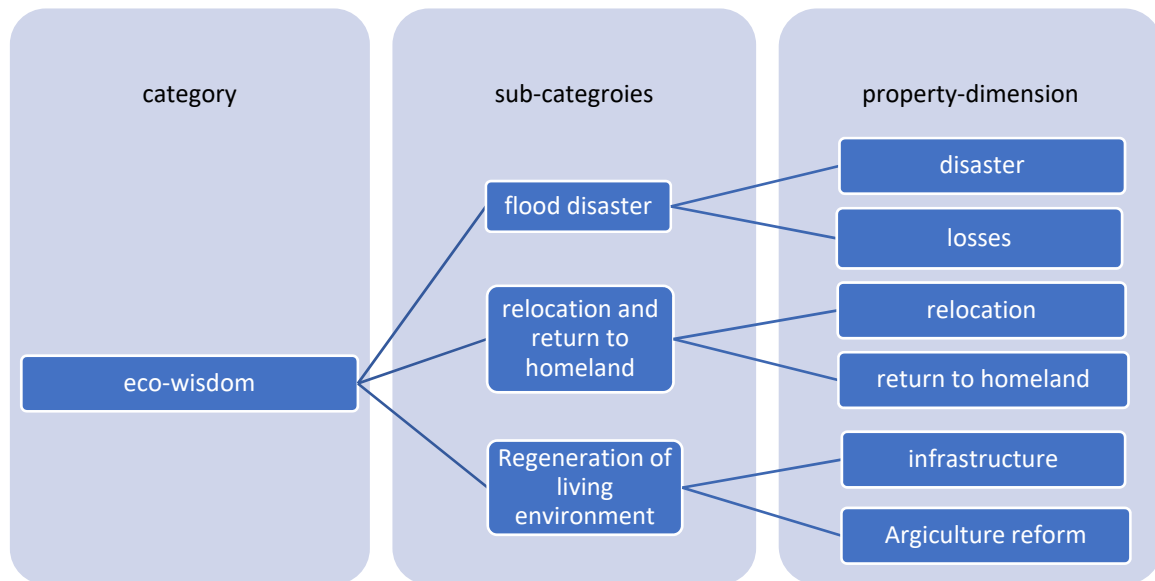


Fig. 4. Coding for text Analysis.

3.2. Axial Coding

3.2.1. First Sub-category: Flood Disaster

The first subcategory is flood disaster, which is composed of two dimensions: disaster and losses. Disaster includes danger, risk avoidance, and post-disaster recovery. Residents' disaster memory revolves around floods breaking through embankments: "when the Huai River embankment was washed away by the flood." (M_1), The dangers of flooding to the village are: "The embankment of the Huai River flooded or burst in many places, and the entire Chenzuwan became an isolated island" (M_2). "When faced with the flood at that time, the only response was passive avoidance, waiting for the flood to recede. Ordinary people could not do anything about this kind of disaster (M_1). At that time, no matter day or night, I slept and waited for the flood to go away" (F_1). "People abandoned the houses. Seeing that the water was rising, we had to go somewhere else, as the house was flooded"(F_2). "We survived the floods on the boat, and the flood water in our place was as deep as the armpit, and there was no way to live in the house"(M_3). "The length of flooding also deeply affected the livelihoods of residents. The flood lasted half a month, and it took half a month for the farmland to dry from the flood."(M_2)

The property damage included the death of people, the destruction of daily necessities, and the lack of food. "Food was swept away by floods, and many people starved to death" (M_1), "Not many people died in our Dukou village, but many people died in Huaibin and Shangwan" (M_4). "Houses, food, clothing, poultry, livestock, and other property were all washed away by the flood. Crops fail, schools destroyed by floods." (M_2).

From the interview, we found that the harm brought by the flood directly affects people's production and life. In the traditional human settlement environment, the natural environment plays a decisive role in people's choice of settlement. People choose to live near the Huai River because the environment meets the needs of traditional agricultural production in rural China. Therefore, when a flood breaks out, it destroys farmland, drown crops, wash away houses and schools, and put people's property and even lives at risk.

3.2.2. Second Sub-category: Relocation and Return to the Homeland

The second sub-category is the response of residents to the post-disaster environment. It mainly consists of relocation and returning home. There were four relocation records in Chenzuwan, all of which are policy-driven. "Relocation was also a policy issued by the superior. The whole village had been moved, and we only moved" (M_2). After the flood in 1954, the relocation began. "The three relocations between 1960 and 1968 were all due to flooding disasters, and all the members moved to live in Tangji Brigade and Dengwei Brigade respectively" (M_1). Only the relocation in 2001 was due to the start of the infrastructure construction of Chenzuwan. "We started to relocate in June 2001. The Chen (zhuwan) Da (gankao) Huai River Treatment Project was launched, and the entire Dukou Village was relocated to Tangzhuang Village... The population is about 1,900 people" (M_3).

There were two homecomings in 1961 and 1968, namely the independent homecoming in 1961 and the government leadership in 1968. "At the end of 1961, the displaced people voluntarily returned to their hometowns to live, and the production team allocated

0.03 ha of vegetable land to each of the population”(M_1). In the autumn(1968), under the leadership of the superiors, the post-disaster production self-rescue and restoration projects were carried out” (M_2).

When the flood broke out, people tended to follow their instinct to act -- "take shelter". People showed the behavior of "moving". People who have lived along the river for a long time know the horrors of flooding. Through generations of experience, people are consciously moving to higher embankments, temporarily moving to the homes of friends, or making residents relocations organized by the government. In short, when facing a flood, people are more willing to passively avoid it and return to the familiar land after the flood.

3.2.3. Third Sub-category: Environmental Transformation

The third sub-category is the environmental renovation, which consists of two parts: infrastructure construction and agricultural reform. “Water damage restoration projects were carried out to reinforce embankments and build farmland water conservancy construction” (M_1); “At the end of 1986, the mechanical irrigation water pumping station began to be converted into an electric water pumping station” (M_2). “In 1990, Chenzuwan started to build the embankment and expand the Huai Road by more than 19 kilometers” (M_3). Related projects for building quality of living were also conducted. “Concrete roads were built in front of every house” (F_2). Agricultural reform is to think about how to stabilize the food supply. “Machine irrigation and water pumping station were introduced to divert Huai water to irrigate farmland, increase grain yield per unit” (M_2). “The land was leveled for converting dry land to paddy fields, increasing the area of rice fields” (M_2). “When the land was allocated to each household, they started to build channels and grow rice” (M_4).

Whether it is the construction of infrastructure or agricultural improvement, it is based on the local natural environment. In the early days, local materials were used to stack river banks, and now floodwaters are introduced into farmland by building canals to reduce flood damage. In addition, crops such as wheat and corn in dry land are replaced with rice grown in paddy fields.

3.3. Core Coding: Eco-Wisdom

From several flooding disasters to relocation and returning home, residents used adaptive methods to get along with nature. For example, to divert floodwaters, “There was an opening in the dam to let the water from one side of the dam flow to the other side” (M_1). Also, environmental awareness increased during flooding. “Looking at the weather, if it starts to rain for a day or two in a row and it does not stop in summer, you have to think that the flood is coming and start stocking up”(F_1). The land is transformed to strengthen the resilience of the environment to disasters. “Plant small saplings on the shore, and water will not drown the saplings”(M_4). “Near the Huai River, each house only planted trees, about five or six hundred meters”(F_1). Residents depend on the Huai River for their lives, and they eat, drink, farm and raise cattle in the same river. Even if the flood breaks through the dam where they live, the domestic wastewater is discharged into the Huai River, and the domestic water is also taken from the Huai River. Therefore, in the event of disasters, it is still a part of life. “When the flood came, the dead floated and passed us, and we still drank the water normally, and there was no disease or disaster at that time” (F_2).

Residents know that the flood must save their lives, which is the wisdom of survival. They also know that the flood will always recede. When the original earth reappears, it is the beginning of a new life. Residents understand the natural law of life and death from the flood and understand that human beings must consider nature as the center of ecological wisdom, so they start a new life based on the new geographical environment after the flood.

4. Discussion

4.1. Acceptance and Adaptation to Natural Disasters

During the 1950s and 1960s, there was no modern weather forecasting or warning system, so all the government was to send the army to fill the dam with sandbags to prevent it from breaking (M_4) or airdrop supplies after the disaster (F_2, M_2, M_4), distributed food (M_4), health and epidemic prevention (M_2), repaired the damage (M_1, M_2), and move(M_1, M_2). Residents responded to the disaster by accepting the policy. However, observing the relationship between residents and land, it is found that the actions of residents are expressed by the voluntary return to their hometown (M_1). As for environmental improvement, in the early 1950s, the land reclamation was done by manual works, and two new embankments were built by shoulder lifting, trolley pushing and pulling, ramming, and compaction. After the disaster, they received infrastructure and grew rice, wheat, or multigrain crops (M_2, M_4, F_2). On one's land or the banks of the river, people adapted to a way that was within their ability, such as planting trees (F_1, M_4). They read the flood signals from time to time and began to imitate nature in a compliant manner, including letting it flow with its tide and planting rice in ditches where the water flows (F_1, M_4).

The two floods in 1954 and 1968 brought great stimulation to the management of disaster from nature, especially the threat of death to the residents (F_1, M_4). Therefore, after the floods in 1968, the government took more measures such as infrastructure construction, agricultural improvement, and organizational adjustment. Then, the flood frequency of the Huai River was significantly reduced. On the other hand, the residents were more experienced in observing and interpreting the information on rainfall in order to store grain strain (F_1) and plant inundated trees (F_1, M_4) in the watershed area. For the management policy at that time and the resilience of the village, this was the way to survive. During this period, the response of residents to natural disasters is closer to the connotation of environmental philosophy, especially Lao Tzu (ca. 500 BC) in Chinese philosophy. Lao Tzu thought that strong things are easy to be broken, and the weak are not easy to survive, so take strong as a commandment: " Lǎo shì jiè gāngqiáng, róuruò shēng zhī tú " (Cui Yuan,77–143 AD). The message is that to survive, you must not be strong, like water to adapt to the environment [17]. The residents of Chenzuwan are with nature and nature-centered.

4.2. Survival Wisdom and Eco-Wisdom Leads to Sustainability

Human beings survive in the wilderness because they learn the wisdom of survival in the wilderness [18]. In order to survive, the residents along the Huai River developed observant survival wisdom such as observing the seasons and weather, the extent of the water area, the crops that could be grown, and the time when they could be grown. Being aware of the banks destroyed by the floods and the fertile soil brought by the floods, the residents replace wheat and corn in the dry land with rice grown in paddy fields. In the past floods, the residents combined the observed phenomena with the practice, accumulated ecological knowledge, and constantly tried to coexist with the flood in the area of the Huai River which is prone to flooding (Table 2).

Table 2. Survival wisdom and Eco-wisdom leads to sustainability.

Theme	Methods	Subject	Phenomenon	Knowledge	Practice	Sustainable Outcomes
Survival wisdom	observe	weather	days of rain	flooding	store food, move it to the boat	survive and reproduce
		season	summer	rainy season	temporarily leave	security
Ecological wisdom	observe	line of watershed	washed out bank	flooded area	plant trees to fix sand banks	maintenance of topography
		crops	crops soaked in water and rotted	Water resistant plants	converted to rice	stable food supply

The attitude of residents towards flooding disasters caused by heavy rainfall was passivity. The only initiative is to be alerted, and they can be saved by stocking up on food or leaving the area for survival. Residents can just wait for the flood to occur and go away, and the adaptive behavior without resistance also protects the Huai River to a certain extent. The residents regard their hometown and the Huai River to be the same. As long as the Huai River is there, the hometown is still there. Just as in the book "Eco-Wisdom", "Survival wisdom comes from the adaptation of organisms to the environment, so survival wisdom is essentially eco-wisdom. Adaptation to the environment is the most primitive and profound source of all wisdom" [1]. The survival wisdom in the flood is the ecological wisdom of the residents along the Huai River.

Only the residents know how to maintain the sustainability of this environment. In agricultural reform, the residents planted easy-to-survive plants, such as willows and poplars to resist floods and maintain water and soil. In the open space beside the Huai River, the purification effect of plants makes the river water clean and clear, and the thinning of trees can also increase the small income of the family. The residents along the Huai River survived in the environment with the most primitive life attitude and governance methods. Although the village was located on the convex bank of the most vulnerable river, no trees were cut down and no sand was sold for money. The pristine terrain was maintained most gently for a long time.

The Chinese philosopher Lao-tze emphasized that the TianDau (a regular pattern of Nature) was naturally inaction. The way of humanity must follow the TianDau, conform to nature, and practice inaction for "doing nothing but do anything". Doing Nothing means not refraining from activity contrary to Nature, that is, not being stubborn enough to violate the nature of things or not forcing what it is not suitable for [18]. The residents' disaster-free consciousness also comes from the sustainability brought by residents' subconscious protection of the environment.

5. Conclusions

We collected testimonies about the disasters caused by the floods of the Huai River. Text analysis and coding showed that in the process of previous disasters, relocation, return to their hometown, and regeneration of the living environment, the residents accept, adapt, and use plants to improve the land to currently advocating the sustainable practice. The term eco-intelligence does not need to be separated into two parts: "ecological" and "wisdom". The ecological wisdom in this study refers to the wisdom of people living in a fixed ecological environment. The article on Ecological Wisdom showed that *survival wisdom comes from the adaptation of organisms to the environment, so survival wisdom is essentially ecological wisdom* [1]. People live on the banks of the Huaihe River, and the flood forms a part of the ecology. Choosing to live close to the river means having a clear understanding of the flood of the Huai river and even unconditionally accepting the existence of elements of the environment that are not conducive to survival. The ecological wisdom reflected by people's relocation and return lies in that people always accept reality as a part of the ecology, and at the same time, they gradually find the appropriate living conditions by consciously adapting to the ecology in the flood. With the rapid economic development and the rapid loss of natural resources at present, this study shows how to return to the basics and the result reminds us that in natural disasters, we can learn the most primitive ecological wisdom for survival.

Author Contributions: Conceptualization, S.-C. T. and X.-J. Z.; methodology, S.-C. T.; software, S.-C. T.; validation, Z.Z., X.-J. Z.; formal analysis, S.-C. T.; investigation, X.-J. Z.; resources, X.-J. Z.; data curation, X.-J. Z.; writing—original draft preparation, S.-C. T. and X.-J. Z.; writing—review and editing, S.-C. T. and X.-J. Z.; visualization, S.-C. T.; supervision, S.-C. T. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by a scientific research start-up fund of Jimei University, China, grant number Q2022014; and Research on the sustainable development model of humanistic Jimei global tourism planning Xiamen Federation of Social Sciences [2022] No. B28, and by the 2021 Fujian Provincial Federation of Social Sciences Doctoral Support Project for research on; and Fujian's all-area tourism ecological planning from the perspective of rural revitalization (FJ2021BF047); and Landscape Planning and Design (2021 Ideological and political reform boutique) (4431/C150534).

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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