The Demographic Transition of Yunnan Province and its Influence on the Ecological Environment since Bronze Age to Modern Times

Fan Zhang, Changbing Ye, and Haitao Lin

Yuxi Normal University, 653100, 134# Fenghuang Road, Yuxi City, China
*Email: drhtlin@yxnu.edu.cn

Abstract. Driven by the Industrial Revolution, the relationship between population and ecological environment is found an obvious brand new look as science technology takes part in human production and life as well as economic activities in modern times. It depicts a more distinct time characteristic than ever before. Consequently, the influence of Yunnan’s demographic transition on ecological environment is discussed under this period from two angles. One is demographic situation, and the other is human activities. The results showed that such negative impacts were undoubtedly caused by static demographic situation and dynamic human activities. And these impacts have become more profound with the development of science and technology.

1. Introduction

It was proved by literature analysis that the academia has reached a consensus on two points: (1) Population exerts a significant influence on the ecological environment; (2) Historical studies on the relationship between population and the ecological environment is conducive to “learning from history and facing up to the future”. Therefore, historical analysis of the relationship between population and ecological environment has yielded fruitful results. At present, researches on the ecological environment of Yunnan Province in historical periods are attracting so much attention [1]. However, there has been a lack of studies on the population and environment of Yunnan Province. Besides, those results mainly focus on the population-environment relationship since the Ming and Qing Dynasties, such as the relationship between population and cultivated land and soil erosion along the Fen River in the Qing Dynasty [2]; Influences of deforestation and reclamation around the lake caused by the rapid growth of population on the ecological environment in the Ming and Qing Dynasties [3]; Influences of population increase on vegetation, wild animals, land deterioration and water and soil loss in the West Liaohe River Basin in the Qing Dynasty. But the effects of population on environment under the influence of Industrial Revolution have been ignored. After the Industrial Revolution broke out, motivation for population activities became greatly different from that in ancient war times. Driven by science and technology, the relationship between population and ecological environment since modern times has possessed distinct features of the times. The scientific and technological progress as well as the development of the productive forces under the huge population pressure has become a double-edged sword,
making mankind’s ability to damage the ecological environment, just like their creativity, much stronger than that in any other period in history. Only in this period could be seen although inorganic fertilizer, brought about by scientific and technological advance, taking the place of human and animal excreta and plant ash, accelerates the crop production, it has also led to the ecological consequence of soil hardening. What is more, the “Effect of the Late Comer” peculiar to the late 20th century has caused developing countries including China new population and ecological environmental problems. Therefore, it is undoubtedly that research on this period has special historic significance. Besides, I have noticed that studies on population and environment seldom pay attention to the influences of population under the dynamic and static conditions on the ecological environment. By combining the dynamic and static aspects of demographic situation and human activities, this paper discusses the dynamic role of population in ecological environment, and meanwhile it sums up and expounds on the demographic changes and migration activity, analyzing the influence of the population of Yunnan Province on the ecological environment on human’s part since the modern times from the perspective of “demographic transition”. It is aimed to make up for the lack of researches on the population and ecological environment of Yunnan Province since the modern times by integrating the dynamic and static perspectives (Figure 1).

Figure 1. Yunnan Province of China and surrounding areas.

2. Methods
This part describes the generation of the model, initially natural and documentation record of Yunnan in the South-west and China, the generated environment and its change by human activity, as well as its influence to Society.

2.1. An Overview of the Demographic Transition of Yunnan Province Since Bronze Age to Qing Dynasty
In the previous study, the Asian monsoon system has determined the climate in South-east Asia. After the research to lake systems, ice cores and modern moisture sources, climate proxy records provide a relatively comprehensive picture about earlier times. The period of ca. 6 ka BP until around 2 ka BP is considered important for the human occupation of diverse
regions in China and neighboring countries. During the succeeding Bronze Age and succeeding Han Dynasty, in Yunnan Province of South-eastern China, major lakes as Dian Lake basin in the vicinity of the Provincial capital Kunming were also preferred for early settlements. Lowered groundwater levels enabled human cultures to settle at low-terrain sites. The local cultures adapted to climate deterioration and made use of extended arable land and intensified harvest of aquatic gastropods.[4] Yunnan Province has become a place where various immigrants gather since the Yuan-Ming-Qing Dynasties. As for the modes and ways immigrants entered Yunnan, each dynasty laid different emphases. In the Yuan Dynasty, it mainly involved military garrison, while in the Ming Dynasty, there was military garrison and administrative placement (including officials’ taking office, feudal official immigration, relegation and exile). In the Qing Dynasty, military garrison and natural migration and drifting were the primary modes [5]. When those immigrants contributed to the development of the economy of Yunnan, they also made the contradiction between human and land more prominent. Natural environment and the allocation of various resources changed quietly, resulting in an immeasurable ecological crisis. If we say the development of agriculture and animal husbandry during the period of Yuan-Ming-Qing Dynasties eases the population pressure of primitive agriculture and promotes the rapid growth of population, then the influence of population on environment on human’s part becomes troublesome. After the Industrial Revolution, driven by the advance of science and technology, the influence of population on the environment has entered a new stage.

2.2. The Period of the Republic of China
During the period of the Republic of China, there was population ups and downs in Yunnan Province, which was closely related to the social, economic and historical background of Yunnan at that time. The first stage: 1910-1932. In the early period of the Republic of China, revolutions like the Double Ninth Uprising in 1911 (September 9th, 1911, according to the lunar calendar), the Movement for Nation Protection and the Constitution Protection Movement succeeded in succession. Battles between warlords were basically pacified, and the society was relatively stable. The economy was developed to a certain degree. Besides, industrial and mineral industry gradually emerged, which promoted the thriving of the Yunnan-Vietnam Railway built in 1910. Thus, it sped up the migration of a large population. According to statistics, from 1910 to 1932, 11 main towns along the Yunnan-Vietnam Railway all witnessed a rapid increase of population except Jianshui, and the increase rates were all above 30%, while the average increase rate was 128.15%, much higher than China’s average growth rate of population of 11% during the corresponding period. In addition, when Burma Road was open to traffic, it served as the bridge linking the economies of the central region of Yunnan, southeast Yunnan and the western Yunnan and promoting the population migration of the areas along this road. The second stage: 1932-1936. According to the Yunnan Administration Record, in 1932, Yunnan Province had a population of 11,568,900. In 1936, the population reached 11,944,400 with a small increase. Researches show that during this period, the population of Yunnan remained about 12,000,000 or so and the average annual growth rate decreased by 0.07‰. The third stage: 1937-1945. During the Anti-Japanese War, large population moved to the west, which formed the fourth greatest population migration in Chinese history (according to the estimate of Feng Zuyi, the number of people moving to Yunnan, Guizhou and Sichuan was about 3 million, which is a conservative estimate. About one million of them settled in Yunnan and Guizhou). Since so many refugees from all over the country moved into Yunnan, its population showed a growth
trend. Taking Kunming as an example, in 1937, the population of Kunming increased rapidly to 205,900 from 142,700 in 1936 and the added 60,000 people mostly were refugees from other provinces. But at the same time, the war led to large quantities of deaths and separation in flight, resulting in the population decline. According to a rough estimate, Yunnan suffered a loss of population about one million during the eight-year Anti-Japanese War. The fourth stage: 1945-1948. In the early years after the war ended, as enterprises and schools that had moved to the west before returned to their original places and most of the immigrants from other provinces left Yunnan, returning to their native places, the population of Yunnan declined further. Afterwards, it gradually recovered. The fifth stage: 1949. The whole nation was liberated and the People’s Republic of China (PRC) was founded. A large number of people from other provinces went back to Yunnan again, making the population of Yunnan surge to 15,950,000, reaching the maximum in the period of the Republic of China.

2.3. Since the Founding of the PRC

Demographic change. Since the PRC was founded, social and economic development has promoted the significant and progressive increase of the population of Yunnan. During this period of more than fifty years from 1949 to 1990, the population of Yunnan increased from 15,950,000 to 36,070,000, more than twice the original number and the average annual increase was 402,400. Specifically, the fifty years could be divided into five stages according to the population growth rate, as shown in figure 2.

![Figure 2. Population increase (ten thousand people) from 1949 to1990.](image)

Population increase (ten thousand people) from 1949 to1990. Phase one: 1950-1958. People were lifted out of the war, living and working in peace and contentment. Their living standards were greatly improved, which made the post-war compensatory fertility rise and increased the birth rate. The gradual popularization of medical services also inhibited the spread of various malignant infectious diseases, which contributed to the decline of death rate. Besides, as the country gave strong support to the construction of border areas, people from all walks of life moved into Yunnan on a large scale. The natural increase of native population and the immigration of foreign population created the first peak of the total sum increase of Yunnan's population since the Republic of China. The net growth of the total population reached 3,194,800. Phase two: 1959-1961. Due to the objective factors, such as the damage of national economy and natural disasters, and the subjective factors like population emigration, the growth trend of the population of Yunnan reversed seriously and there appeared negative growth. In these three years, the population decreased by 146,200. Phase three: 1962-1971. Since 1962, the national economy has gradually recovered and the compensatory fertility also peaked. Therefore, in this decade, the population of Yunnan reached the second peak of growth and the net increase of population totalled 6,298,300. The average annual increase of population was 629,800, the average annual growth rate reaching 3.16%, much higher than that at any other stage. The ten years of chaos resulted in the anarchic population fertility and the population development got out of control, which led to the irrational growth of population. Phase four: 1972-1982. After the ten-year turmoil, the government realized the seriousness of the irrational increase of population and thus began to carry out the Birth
Control Policy in the whole province in 1972. Therefore, the sharp increase of population was brought under control. During this period, the population had a total increase of 6,903,600. Although there was still a great net increase, the average annual growth decreased to some extent, compared with that in the previous period and the average annual growth rate also fell by a percentage point. The net increase of population during these two periods was so great that it made the population base of Yunnan Province huge. Phase five: 1983-1990. From 1982, various regions of Yunnan Province all formulated measures to control the population, which effectively controlled the rapid increase of population. In these 8 years, its net increase of population decreased to 4,418,900 and the population growth rate dropped to the ranking of 16 from the original 6 among various provinces of the country. The growth rate of the total population of Yunnan Province slowed down obviously, compared with that of the whole country. According to the fifth population census in 2000, the total population of Yunnan Province reached 42,879,000. In the late 2004, it totalled 43,756,000. When it came to the sixth population census in 2010, the total population of Yunnan reached 45,966,000. Compared with the fifth national population census, its population increased by 7.20% in ten years and the number of the total increased population was 3,087,000, the average annual increase reaching 309,000 . Compared with the first fifty years since the founding of the PRC, the rate of population increase slowed down in the decade between 2000 and 2010, but it still kept the growth trend. Population migration. The migration of population is one of the important factors of demographic change, which usually refers to the spatial movement of population between two areas. Such movement often involves the permanent or long-term change of place of residence of people who move out of a place and immigrate to another place, and it also involves the short-term change of the place of residence of people who move out of a place and immigrate to another place. Statistics of the fifth population census showed that the number of people involving migration (mainly refers to the inter-provincial migration) totaled about 1,164,400, of which the net immigration was about 820,900 people, ranking 8th in the national ranking of inter-provincial net immigration. Immigrants mainly concentrated in the eastern and central regions of Yunnan Province. Among the 16 cities, Kunming received the largest number of immigrants, who mainly came from Sichuan Province, while Nujiang received the fewest immigrants, which were mainly from the southwest area, and its immigrants from Sichuan, Chongqing and Guizhou accounted for the largest proportion. The number of emigrants was about 343,500 that mainly moved into Jiangsu, Zhejiang, Shandong, Guangdong and Sichuan, followed by Guizhou, Chongqing, Guangxi, Hunan, Henan, Anhui, Hebei and Shanxi. Figure 3 shows the population migration of Yunnan Province since the founding of the PRC.

Figure 3. Population migration of Yunnan Province since the founding of the PRC.
2.4. Influence of the Demographic Transition of Yunnan Province on the Ecological Environment

Population size. Researches show that population size is one of the main driving forces of the current ecological footprint. Population and the ecological environment change almost proportionately. Since the modern times, with the influx of immigrants and the increase of population, the land of Yunnan Province has been bearing the heavy burden of population. From the 1980s, the area of cultivated land per capita in Yunnan was less than 2 mu (1 mu=0.1647 acre), and in the 1990s, it approximated to one mu. The great demand for grain as well as the great economic needs made the conflict between population and the cultivated land increasingly prominent. High-yielding crops and commercial crops were widely planted in the mountainous areas of Yunnan, which exerted a great influence on the agriculture pattern and grain structure of its rural areas. Those crops planted in large areas were nibbling at the ecological environment of Yunnan. Donald Worster once came to the conclusion that specialization and the marketing system resulted in “the serious simplification of the biological species in the same area as well as their connections”. There is no doubt that the massive planting of corn and tobacco accelerates the exploitation and destruction of the mountain land, lowers the rate of vegetation coverage, leads to the loss of the ecological diversity of Yunnan and causes the deterioration of ecological environment to a certain extent. According to the research findings of Tong Yufen, the influence of the population change on environment is reflected in the multiplication and aggravation of the environmental consequences caused by human production mode and life-style and also in the stimulation of human activity modes through the pressure of population size. These two aspects suggest that quantity accumulation will bring about qualitative changes, and they also prove the idea put forward by the neoclassical economics that population increase will promote the development of technology and the reform of agriculture. The two points will undoubtedly further influence the ecological environment, causing a serious imbalance between social ecological system and the natural ecosystems.

Quality of the population. Yunnan is located in the special border area. The most direct consequences of economic poverty are poor education condition, shortage of talents and low population quality. Statistics of the three-time population census showed that in Yunnan, people at various education levels were all fewer than the national average level. According to the result of third population census, the number of people in Yunnan who received college education or above was 80,486. The number of its college graduates every 100,000 people ranked the last in the country. Besides, the number of undergraduates and enrolled students was 27,323. In the 1990s, illiterate and semiliterate people in the whole province of Yunnan accounted for 25.4% of its total population. One out of four people of Yunnan was illiterate or semiliterate. Therefore, even though Yunnan abounds in resources, its lack of talents and awareness of environmental protection and scientific exploitation has caused the secondary damage to the ecological environment due to the low population quality. For instance, although the exploitation and utilization rate of mineral resources in Yunnan is less than 1%, the imbalance of its ecological system and the environmental degradation could match that of other countries with mining rates of more than 30%. Up to now, in some areas of Yunnan, the “slash-and-burn” farming method is still adopted to destroy the forest for farmland, which has led to a series of consequences of environmental destruction, such as vegetation reduction and water and soil loss. Production mode. Yunnan is a province full of ethnic minorities. There are 55 ethnic minorities in the country, and 45 of them live in Yunnan, most of whom are nomadic people and shifting cultivation people with high mobility. Their traditional material production mode still has the habit of excessive exploitation, which seems to “drain the pond to catch the fish”, plundering
the ecological environment. The extensive exploitation and overloaded taking has made mankind’s ability to obtain resources from nature greatly exceed the nature’s multiplication and regeneration capacity and mankind’s ability to compensate for the consumption of nature. Besides, such a production mode is the outcome of a certain level of productive force and economic activities on a scale, making human activities in material production and the ecological environment keep a delicate balance. Once such a balance is broken by the development of productive forces and the expansion of the scale of economic activities, the occurrence of ecological crisis is unavoidable. The arrival of these immigrants is changing the local production mode and lifestyle, while the ecological environment is also responding to the production mode and lifestyle, which has caused ecological environment deterioration, with water and soil loss, ditches choked with silt, reduction of vegetation and frequent natural disasters. Furthermore, according to the analysis of the data of third population census, over 80% of the working population of Yunnan were engaged in agriculture. And its population concentrated in the east and the west was sparsely populated. Town population and non-agricultural population accounted for a small proportion, which more or less would exert a direct or indirect influence on the ecological environment. It is unnecessary to go into details here.

2.5. The Influence of Human Activities on the Ecological Environment

The population migration has sped up the rate of population increase of Yunnan. From 1936 to 1949, population density of Yunnan increased from the original 31 people per square kilometer to 41 per square kilometer. The overly rapid increase of population was bound to give rise to a series of related activities based on life and economic needs and at the cost of the ecological environment, such as the reclamation and cultivation of wasteland, water conservancy construction and development of the mining industry. The following part takes those three kinds of activities for example and expounds.

(1) Land reclamation and cultivation. With the increase of population comes the demand for cultivated land. The reclamation and cultivation of wasteland is inseparable from the population increase. Due to the influence of population development, the course of land reclamation also presents the corresponding changes. During the period of the Republic of China, land development degree of Yunnan was very low. Taking 1932 for example, the area of cultivated land of Yunnan totaled 27,125,000 mu, but the total land area of the whole province was 598,259,000 mu. Therefore, the cultivated land area only accounted for 4.53% of the total land area. According to the estimate in 1938, the area of barren mountains and wasteland made up 89% of the mean value of the land area of various counties in the whole province. According to the statistics of the China Yearbook made in 1948 about the “cultivated land and farmers in various provinces” in 1946, the area of cultivated land per capita in Yunnan was 3.66 mu, which was not only lower than that of most other provinces in the country, but also lower than the national average number of 0.6 mu. After the PRC was founded in 1949, the area of cultivated land of the whole province was 33,915,000 mu. By the end of 1985, it was 41,648,700 mu, so in those 37 years, there was an increase of 7,734,000 mu in the area of cultivated land, increasing by 22.8%. The natural growth rate of population was 16% and the area of cultivated land per capita dropped to 1.2 mu from the original 2.12 mu. The population increase resulted in the reduction of cultivated land area per capita. The land’s increasing load of population caused a sharp conflict between the population and land. Therefore, the growing demand for cultivated land led to “reclamation of wasteland”. The so-called “reclamation of wasteland” was in fact the “deforestation”. 94% of the total land
area of Yunnan Province is mountain land, and most of them is steep sloping land cultivation, so in order to bring more land under cultivation, farmers have destroyed the forest and reclaimed wasteland. The process of reclaiming and cultivating wasteland is the course of removing grass and cutting down trees in essence, which resulted in the destruction of native vegetation, the constant reduction of forestry area and the serious shrink of the distribution range of animal and plant resources. Till the mid-1900s, forest coverage rate of Yunnan had declined to 50%. The damage of forest resources and the vegetation caused the mountain land to lose its ability to conserve water sources, fix the soil and protect the land. Therefore, geological disasters like water and soil loss, landslide and debris flow were inevitable. The related data show that Yunnan is one of provinces that have the most serious water and soil loss problem. The area of water loss and soil erosion in the whole province has reached 141,130,000 square kilometers and every year the amount of the soil lost totaled over 500 million tons. What is more, the lost soil is mostly the surface soil of high quality, which is suitable for cultivation and the plant growth, and it accounts for 10% of the total soil loss amount of the whole country. According to the Historical Data of the Weather Disasters of Yunnan Province, during the period of the Republic of China, flood happened 278 times in Yunnan, which is just the consequence of human being’s breaking the ecological balance.

(2) Water conservancy construction. The increasing population has made people “ask the barren land for grain”. Construction of water conservancy projects is the product of science and technology due to the "stimulation of mankind's activity mode". The reason is simple that it will promote the increasing reclamation and cultivation of mountainous land. Since the period of the Republic of China, water conservancy projects in Yunnan have mainly involved reclaiming farmland from lakes, dredging rivers at sea mouth, improving the Xian and Yun Lake, dredging Zhaolu River, and building the Lvfeng Dam and hydropower station as well as reservoir, etc. In the first reign year of the Republic of China, the first hydropower station was built in Yunnan, which was the first one in the country, marking the beginning of the urbanization and industrialization of Yunnan. Although water conservancy construction has played an important role in controlling the flood and improving the utilization of water resources, it has changed the state of being of water, land, creatures and the climatic environment, directly or indirectly damaged the original ecological environment and given rise to new water environmental problems. Hydropower station is the specific product of modernization. Since the Republic of China, the successive construction of hydropower station has posed a serious threat to creatures living in the water, and its existence has reduced the habitat of fishes, blocked the water channels in which fishes go upstream and destroyed their spawning grounds. The running of hydropower station even has resulted in a huge number of deaths of fish. Therefore, it has seriously affected the reproduction and survival of fishes and even resulted in the extinction of some fishes. After the founding of the PRC, large and middle-sized reservoirs and irrigation projects have been built. The construction not only resulted in the inundation of forest and grassland, extinction of plants, animal migration and species degeneration, but also changed the water temperature of the upper reaches, thus further influencing the water body density, dissolved oxygen, microorganism and aquatic organism. Besides, modern aquaculture has also caused serious ecological pollution to lakes and rivers of Yunnan Plateau. It has led to water body eutrophication, deterioration of water quality, loss of the diversity of species and a sharp decline of the number of native aquatic organisms. From the 1960s to 1990s, the reclamation of land from lakes, the permeation of chemical fertilizer and pesticides, and the direct discharge of waste water have resulted in the most serious pollution of water body of Yunnan Plateau around 2000. Water contamination of
the Tanglangchuan River, the Longchuan River, the Nanpan River, the Lu River, the Beipan River and the Panlong River reached V+, and the water quality of Yilong Lake reached V. Besides, water quality of the Dian Lake and the Xingyun Lake reached V-. Due to the discharge of a great amount of sewage, the Dian Lake has suffered serious water pollution. It has been found out that 72 kinds of organic pollutants exist in the lake, of which 12 could cause cancer and malformation. Thus they have done great harm to the health of the surrounding residents.

(3) Development of the Mining Industry. Yunnan is famous for nonferrous metals. As far back as the late period of the Shang Dynasty, copper smelting industry appeared in areas of Yunnan, which was the beginning of mining and metallurgical industry of Yunnan. Abundant mineral resources are the major driving force of its economic development, which naturally attracted a large number of immigrants who entered Yunnan for "gold washing". In the early period of the Republic of China, namely the 25 years (1912-1937) from the founding of the Republic of China till the outbreak of the Anti-Japanese War, tin industry rose sharply in Yunnan Province. At that time, Gejiu possessed hundreds of private Changjian (tin ore factory). The average annual output of tin reached 7,000 to 8,000 tons, and the tin produced by those Changjian accounted for 90% of the total amount of tin of Gejiu. Besides, Dian Copper Industry also recovered and developed to some extent. After the founding of the PRC, metallurgical industry of Yunnan Province gained further development. In 1990, the output of steel of the whole province totaled 803,500 tons, 2,000 times from the rate in 1949. The output of ten kinds of nonferrous metals reached 207,500 tons (including central enterprises in Yunnan), over 170 times more than that in 1949. In 1990, total industrial output value made up about 20% of the total output value of the heavy industry of the whole province. Mining and metallurgy is a double-edged sword to Yunnan. When bringing about prosperity to Yunnan, it also caused great damage to Yunnan's ecological environment. Although abundant in mineral resources, Yunnan had to face the environmental and geological problems, of which mine geological disasters were the most serious. They mainly included seven categories, namely landslide, collapse, debris flow, ground collapse, surface crack, surface subsidence and mineral pit water gush. In addition, during the process of smelting copper, the produced off-gas contained harmful gas of sulfide and chloride. When they liquefied and fell on the ground, it would cause death of vegetation. It made the slop surface of mountains lose protection, and it further gave rise to water and soil loss, which thus provided solid substances for the occurrence of debris flow. After mining and obtaining the mine, in the course of crushing and rinsing, some of the hazardous substances in the mineral aggregate entered the water. Those of strong toxicity would directly burned the grain seedlings and those of slight toxicity deposited in the plants. After people ate them, it would cause far-reaching and serious consequences. If they were directly poured into the local rivers and exceeded a certain limit, natural water bodies like rivers could not achieve the self-cleaning, which would definitely lead to ecological disasters. Yunnan is a province full of mountains, and the area of mountain land accounts for about 80% of the total land area. Mountain land vegetation deterioration brought about by the development of mining industry is bound to lead to water and soil loss, and then cause disasters like landslip, debris flow and even landslide. The exploitation of Dian copper has reduced the forest coverage rate by 20%. Since the founding the PRC, the times, scale and harm of the outbreak of debris flow have been far beyond those in any period of the history.

3. Results
In the early years after the founding of the PRC, in order to change the poor and backward economic condition of Yunnan, the country organized a series of activities, such as exploration, exploitation and development and massive migration. Since the Third Plenary Session of the 11th Central Committee of the Chinese Communist Party, with the development of socialist commodity economy, Yunnan Province, located in the border area, has also witnessed considerable population migration, due to various factors including left-over problem of history and policy support of the country. The population migration could be attributed to four aspects: (1) Migration of military personnel. On the one hand, in the early post-liberation days, cadres and the Chinese People's Liberation Army (PLA) moved southward and moved into Yunnan. According to the statistics of the Organization Department of the Provincial Party Committee in 1956, the number of those immigrants was about 7,000. After entering Yunnan Province, most of them became middle-level and senior leaders and settled down. On the other hand, military personnel of the Kuomintang army who revolted and surrendered as well as those prisoners of war were sent away from Yunnan. According to the related information and data including the roster of the PLA Yunnan Military Region, in the early years after the liberation, the number of the military and administrative personnel of Kuomintang lingering in Yunnan reached up to 30,000, and a large proportion of them were from other provinces. They received travelling expenses and were sent back to their hometowns, which resulted in a large-scale emigration. (2) Migration due to construction supporting of border areas. It mainly involved immigration, which included two aspects: Farmers from Hunan who immigrated to Yunnan to reclaim the wasteland and support the border area. According to the statistics, only in the two years of 1956 and 1960, about 30,000 people from Liling and Qidong of Hunan Province moved into dozens of farms of Yunnan Province, such as Simao and Honghe, but there was a certain rate of return migration among those immigrants. For instance, from 1960 to 1962, more than 6,000 immigrants initatively returned to their native places or did not return to Yunnan after a long leave. Besides, the immigration was partly caused by the inland cities’ support to the construction of border areas. According to the statistics, in 1965, over 6,000 youth students from various big cities of the country, such as Shanghai, Tianjin, Wuhan and Chongqing, who had not graduated from middle school or high school, voluntarily moved into Yunnan to support the construction of border area. (3) The migration of educated youth and students (including immigration and emigration). During the Great Cultural Revolution, educated youths from other provinces were rusticated to Yunnan, but later they returned. According to statistics, in the 11 years from 1968 to 1978, Yunnan placed more than 300,000 rusticated educated youths. What is more, students who were natives of Yunnan moved out because they went to school in other provinces, but at the same time, there were also people who were assigned to Kunming and thus resettled there. From 1977 to 1983, native students of Yunnan Province were admitted to universities in the Southwestern China, East China and South China, which resulted in a certain scale of immigration. Meanwhile, according to the statistics of the Assignment Office of the Education Department of Yunnan Province, by 1984, the number of college graduates from other provinces who were assigned to Yunnan had reached up to 3,000. IV. The emigration resulting from natural disasters or other objective factors. Most of these people moved out of Yunnan and resettled in various places of Sichuan Province. Besides, some of them moved into Burma (about 10,000 people).

4. Discussion
The model results indicate that the Cyclone Lahar was a significant event that generated waves up to 18 m at the height of the storm. The cyclone moved west-northwestwards over the central Bay of Bengal. A better understanding of wave characteristics due to the Cyclone Lahar on the near shore of Andaman and Nicobar Islands was achieved from this particular study, which is very important for these Islands that are vulnerable to natural disasters like tsunamis and cyclones. Numerical modelling techniques can be used as a better tool for making enhanced strategies for disaster risk reduction and control specifically in the era of changing climate.

5. Conclusions
The relationship between population and environment is an old topic, from the pessimistic theory put forward by Malthus at the end of the 18th century that population increase would definitely exceed the growth of materials, to its opposite optimistic viewpoint proposed by the neoclassical economics in the 20th century that the increase of population could promote the expansion of the environmental capacity. The internal relationship between population resources and the ecological environment and their influences are a rather complicated question. There are many factors influencing the environmental transition. Population is an important factor restricting the safety of the ecological environment and it works through mankind’s social activities. In the long human history, natural factors and human activities constantly interweave and interact with each other, which has led to the constant change of the ecological environment. In a certain specific time series, it will present the multi-layered complicated relations of driving, feeding back, intensifying, responding and magnifying. Such kind of relations cannot be simply defined as the causal relationship between them. Therefore, the argumentation of this paper, based on the obtained data, just gives a presentation of the demographic situation and the migration of Yunnan Province as well as its relationship with the ecological environment from Bronze Age to modern times in terms of the course and relevance, instead of simply concluding and summarizing their causal relationship.

Acknowledgements
Funding Statement: Project of Philosophy and Social Science Planning In Yunnan Province (YB2020066).

References
[1] Bai Y J 2014 A case analysis of the emigration from the mountainous areas of Yunnan Province and the changes of the environment---a historical investigation centering on the Yanhe Village in Chahe Town of Eshan County Journal of Baoshan University 2014(3) 1-9,22
[2] Yan D D, Wünnemann B and Jiang Z L 2020 Hydrological variations of a lake-catchment and human interaction during the last 6 ka in Yunnan, China Journal of Hydrology 2020(587) 124932
[3] He Y L, Liu X F, Zhang L Y and Tian E 2010 The Yunnan-Vietnam railway and the changes of the population of the main cities and towns of Yunnan since the modern times Areal Research and Development 2010(3) 67-72
[4] Sun F H, Sun D Q and Hu Yi, et al 2013 The change pattern of the pressure of China's population on the ecological environment: 1990~2010 Demographic Research 2013(5) 103-13
[5] Yang J C 2013 Tradition, evolution and reconstruction: a discussion on the population and eco-culture of peoples in the southwest mountainous regions *Ecological Economy Review* **2013** 173-84