



地理学报(英文版) 2001年第11卷第1期

On coordinated development of oasis and environment in arid area

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Abstract: Based upon the formation and evolution of oasis and the factors restricting the coordinated development of oasis economy and environment, this paper presents a goal of the development in coordination. It suggests that the sustainable survival and development of oasis could be ensured only if the oasis-desert and water source ecology are managed in a combined way to form a macro system. In light with the above mentioned, the approach to the development of economy and environment of oasis in arid area should depend upon the establishment of an oasis ecological and economic system, which suits the arid environment and promotes the efficiency of resource configuration, stabilizes economic increment and benefits ecological development.

On coordinated development of oasis and environment in arid area FU Xiao-feng, LI Zhe (Institute of Geographic Sciences and Natural Resources Research, CAS, Beijing 100101, China) 1 Formation and evolution of oasis Both physical environment and human activities influence the formation and evolution of oasis. Natural oasis is a kind of ecological landscape formed mainly by water without human intervention. Its prosperity and adversity primarily depends on the flow direction and discharge of a river. With the increment of intensity of human activities, however, great changes have taken place in oasis in arid area. The evolution of oasis has been transformed from the control by natural condition to that by human activities. There exist two antithetic processes for the formation and evolution of oasis. One is oasisification, in which the vegetation is widened, cover degree increased and biological productivity enhanced (as a result of an increase in water sources or water utilization rate). The other is desertification, an opposite process to the former, caused by climate desiccation, water sources declining, or land degradation by inappropriate utilization of human being. (What is affecting the formation and evolution of oasis is nothing but natural and human factors.) The change of natural factors has a wide influence over a long period; while the effects of human activities, although in local areas, are fast and profound. Humans enlarge oasis by improving irrigation system (digging channels and wells), fertilizing soil, cultivating crops and planting trees, coupled with which however is the increase in demand resulted from population growth. To meet the demands, humans utilize the natural resources in an inappropriate way that leads to the land salinization and desertification in addition to oasis degradation. It is mainly reflected in the following aspects. First, the decrease of water amount in the downstreams of rivers and the decline of oasis resulted from the increase in population, farmland areas and water requirements for daily life and irrigation. Second, salinization formed due to improper irrigation practices with high salinity in arid area. Third, devastation of vegetation on the edge of oasis because of wrong policies and humans' motivation for fuel and structural materials, endangering the survival of oasis. Fourth, the plundering exploitation by human plus the tough natural conditions leads to a failure in the exploration of oasis, even brings it into ruin. Fifth, wars and disasters caused the abandonment of reclaimed farmlands, thus causing land desertification and reduction and decline of oasis. The reasons for the lots of abandonment of oasis are complicated and various. Meanwhile, new oasis appeared constantly. The stability of oases depends on the guarantee of water sources. Water resources are the main factors that respond for the development and vicissitude of oasis, and the improvement of human productivity is the motivation of its development and evolution. 2 Factors restricting coordinated development of oasis and environment 2.1 Occlusion and ecological vulnerability of oasis restrain the formation and evolution of its economic system Oasis is an azonal landscape in a macroclimate and green island of arid area. The above two characteristics exert great impact on the development of oasis economy, even threaten its survival. 2.2 The discontinuity and singleness of oasis restrain its economic development In the vast arid

area, oases are divided into discontinuous plots. For instance, there are more than 50 small oases, some of which merely cover an area of several acres in Pishan county, Hetian and Xinjiang. Such a sporadic pattern leads undoubtedly to a restriction of production scale. The sporadic oases, therefore, can be united organically and developed a macro oasis system only if they are formed into a network. Most of the oases in which artificial irrigation is carried out are distributed in plains and are suitable for developing tractor-ploughed cultivation, large-scale crop pattern, and establishing special production bases. Similar natural condition produces an identical economic structure for oases forming a tendency of monoculture in terms of regional economy, and thus increasing the instability of economic system. In order to develop oasis economy, the frame of single economic structure should therefore be broken, new industries should be selected based on special production and single structure be transformed into multi-structure. In so doing, the pressure-proof and stability can be promoted.

2.3 The survival and development of oasis are restricted by the scarcity of water resources

Weak precipitation and strong evaporation lead to a deficit of water balance. A given plot of oasis requires a certain amount of water resources. Net evapotranspiration will increase with the expansion of oasis. Desertification of oasis will appear when the total evaporation of oasis is greater than the input of surface or ground water. Therefore, preservation of oasis should be taken as a prerequisite for its development and the establishment of oasis economic system should emphasize its depth instead of width. The scarcity of water in the course of oasis development is mainly due to the expansion of water consumption, irrational structure and undeveloped water utilization. Scarcity of resources is a very common phenomenon during the process of regional development, restrictions of resources, therefore, is inevitable, and the key problem is how to minimize it. Water-saving economic system will become a target of oasis economic structure, under the condition of scarcity of regional water resources.

2.4 The small-scale market and conventional idea restrict the transformation of oasis economy to an advanced level

Owing to the occlusion and discontinuity of oasis, oasis markets are basically limited to the interior of oasis. The small-scale markets lack a driving force to stimulate needs, hence less vigorous economy. In addition, the conventional occlusive ideology further helps a small and complete inferior economic system to take shape. The narrowness of oasis market itself requires that the oasis development should break its limitation, integrate the needs from outside the oasis, bring into play the advantages of resources, and provide its unique products and thorough process to the outside of oasis, thus promoting the communication between oasis and the outside.

3 Target of the coordinated development of oasis and environment

Oasis, characterized by the serried surface vegetation cover and the centralized development and exploitation, has a relatively definite border. The water resources, being the most deficit resource in arid area, is the focal and key factor restricting the development of oasis, hence the development and utilization of water resources has become the base of oasis economy and ecological rehabilitation. The existence of the natural border restricts to certain degree the communication between oasis and its surroundings. As a result, the cohesion of oasis as unification is inevitably intensified, thus leading the oasis social and economic development to the "small and complete" occlusion. However, the restriction of natural border will be weakening with the improvement of social productivity, especially communication and transportation technology, socio-economic system and new concentration will be formed through closely connected oases.

3.1 Controlling population growth and improving population quality

The increase of population will endanger the limited resources and cause crisis survival. The low efficiency in the application of resources caused by poor quality of population will further decline the carrying capacity of resources. The coordination between human itself and substance reproduction is the premise of coordinated and sustainable development of economy and environment.

3.2 Strengthening the management of water resources

Water resource management includes the construction of water conservancy projects, overcoming of the temporal and spatial imbalance in water resource distribution, adjustment of economic activity in light of the regional conditions, establishment of corresponding regulations. All these mean to improve the efficiency of water resource utilization.

3.3 Breaking the conventional pattern of natural economy of oases and constructing modern oasis economic system

3.4 Attaching importance to the oasis environmental preservation

Given the ecological vulnerability of oasis, protection of its habitat must be well taken into consideration in terms of oasis' development, production, and management. Because of the weak capability of biological decomposition in arid area and small environmental capacity, a pursuit in the eco-economy is an inevitable choice to the development of oasis economy.

3.5 Emphasizing the preservation of desert ecology of areas surrounding oasis and that of water sources ecology

The desert vegetation growing on the edge of oasis is its first barrier. The ecological preservation of water source is vital to the self-restraint and provision. The sustainable survival and development of oasis could be ensured only if the oasis-desert and water source ecology are integrated. In a word, the ecological-economic oasis is the target of development of oasis in arid area.

4 Establishment of sustainable oasis eco-economic system

4.1 Oasis macro system

As a special zone of arid area, oasis unites its water source and its surrounding desert an

d forms an interactive system. On the basis of oasis macro system, the approach to the development of economy and environment of oasis in arid area depends upon the establishment of an oasis ecological and economic system, which suits the arid environment and promotes the efficiency of resource configuration, stabilizes economic increment and benefits its ecological development. Given the difference between regional natural resources and socio-economy, the formations of oasis eco-economic system vary, however, their common characteristics lie in the optimized economic structure, benign ecological circulation, and efficient utilization of limited resources. High efficiency and coordination are the marrow of sustainable oasis eco-economic system. High efficiency means that as little input as possible gains as much output as possible. Coordination means the harmony between man and land, between development of oasis economy and environment, and between development of different industries. High efficiency is built upon the introduction and popularization of advanced technologies that subsequently raise the levels of economic development in a continuous manner. Harmony reflects the coordinated development of environment, society and economy on the basis of beneficial ecological development of the interior of the oasis, its water source and its desert, that is to say on the basis of the coordinated development of oasis ecosystem, mountain ecosystem and desert ecosystem.

4.2 Sustainable oasis eco-economic system

- 1) Maintaining resources for the survival and development of oasis
- 2) Beneficial ecological development The sustainable economic system not only improves the beneficial ecological circulation of the interior of the oasis, but also avoids the depravation of mountainous water source ecosystem and desert ecosystem of the surrounding oases. The construction of water self-restraint forests, oasis protective forests, and so on, serves as the basic safeguards of the beneficial development of oasis. Meanwhile, low pollution is also of importance in alleviating the ecological pressure of oasis and its surrounding desert areas.
- 3) Open economy The opening of economy includes the following three aspects: (1) opening of demand. A full utilization of markets both in and outside the region is required of the regional work division. The regional advantages can be exerted and reciprocal profits obtained only with markets opened. (2) Opening of technology. A good use of advanced technology to improve the productivity and competitiveness of products is the fundamental force driving the regional sustainable economic development. (3) Opening of resources utilization. The resources utilization will be maximized if the cooperation of different areas is reinforced.
- 4) Long-term stable economic growth The economic growth is one of the goals pursued in any economic activities. The improvement of people's living condition will be possible only if the velocity of economic growth is greater than that of population growth. Realizing long-term stable national economic growth is one of the major areas the establishment of oasis economic system aims at.
- 5) Forming coordinated industrial structures and their gradual advancement When the economy develops to certain stages, its industrial structures will manifest some characteristics. Corresponding industrial structures have to be considered to coordinate their development for different periods of oasis economy. The high-level industrial structure is a long process which varies in accordance with the changes of economic development, and which shows phases in order. The alteration of industrial structures is of different characteristics in different regions due to the discrepancy in the level of economic development and phase, but their common ground is that there exists a close relationship between industrial structures and their velocities and profits. Therefore, formation of coordinated industrial structures and their gradual advancement is the core in the establishment of sustainable oasis economic system. In conclusion, the beneficial ecological circulation, long-term stable economic growth, coordination and high-level economic structures, the sustainable utilization of resources, adherence to the opening policies, developing of regional advantages and pushing regional division of work and cooperation are the major connotations of establishing a sustainable economic system.

References

关键词: oasis; development; environment; arid area