Environment, Technology, and Society: 
Water Control in Shaoxing from the Tenth to the Eighteenth Centuries

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A thesis submitted for the Degree of Doctor of Philosophy at the Australian National University

April, 1995
STATEMENT

Except where acknowledged, the investigations described in this thesis are my own work.

It would have been impossible for me to complete this thesis without help from many people. Appreciation of thanks are due to everyone. However, special thanks are due to my supervisors, Professor Shiba Yoshikazu, who started me on the way and took a part in the formation of the thesis, and Mr. Takeshi Mizutani, who greatly enjoyed working with me. I am grateful for your valuable advice and encouragement.

I would like to express special thanks to my family, especially to my wife, De Li, and for her help in understanding and suggesting new subjects. She was extremely important for reproduction of this thesis.

Finally, I have been supported and encouraged by my family and friends. I am most grateful for their help and support in these years.

Dong Yang

April, 1995
Acknowledgements

My interest in water control in particular, and in Chinese environmental history in general, only crystallized when deciding on a topic for my thesis. This was to a great extent thanks to Mark Elvin who took me into this new and rapidly growing field.

It would have been impossible for me to complete this thesis without help from many others. All deserving of thanks are my supervisors, Mark Elvin, Colin Jeffcott and Shiba Yoshinobu, who commented on the organization of the thesis, the formation of arguments and the like. I have greatly enjoyed working in a friendly environment in which the understanding and encouragement of other people are of much benefit to academic pursuits. Among these, Lewis Mayo, Josephine Fox and Vicki Luker are most of all appreciated. Special thanks should go to Joan Kweck who has done an extremely important editing job on the thesis. I also would like to take this chance to thank Marion Weeks, and Oanh Collins for their help in numerous ways. I thank Robin Grau for her help in producing remote sensing images which are crucial for reproduction of the maps used in the thesis.

Finally, I have been and will be indebted much to my wife, Liu Li, who has given me substantial and emotional support in these years.
This thesis is about the transformation of the Shaoxing landscape through water control. Water control was the fundamental technological strategy by means of which the people of Shaoxing reshaped their physical environment to serve their economic needs, while adapting themselves to the new anthropogenic "nature" that resulted. Its focus is thus on the impact of environmental change resulting from the construction of storage reservoirs, drainage systems, and sea-walls in the low-lands, and from the extensive deforestation of the highlands between the tenth and eighteenth centuries. This impact interacted with social-political shifts, as in patterns of property rights and in the financial sources of water control.

The transformation of the landscape, particularly on the Shan-Gui plain, was primarily made in response to environmental processes, and the challenge of environmental change initially required confronting the problem of creating both the physical and the institutional structures for water control. The later construction of water-control systems was in a certain sense remedial. It was made necessary by the problems generated by the works constructed earlier, and hence was necessitated by environmental forces themselves set in motion by human action. The development of Shaoxing agriculture thus became locked into a pattern of interaction between humans and their environment, and was deprived of any easy alternatives later on when the dynamic potential of water control began to decline. This is perhaps a case of what may be called a "hydraulic trap", in which successful long-term physical and social engineering carries the price-tag of increasing immobility and over-commitment.
Measure Equivalents

The equivalents given below are standard approximations to Ming measures. The equivalents to the measures of other periods will be given at the footnotes where they are first referred to.

<table>
<thead>
<tr>
<th>Chinese measure equivalent</th>
<th>Approximate metric</th>
</tr>
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<tbody>
<tr>
<td>chi (foot)</td>
<td>0.32 meter</td>
</tr>
<tr>
<td>zhang (10 feet)</td>
<td>3.2 meters</td>
</tr>
<tr>
<td>li (150 zhang)</td>
<td>0.5 kilometer</td>
</tr>
<tr>
<td>xin (8 feet)</td>
<td>2.56 meters</td>
</tr>
<tr>
<td>fen (silver weight measure)</td>
<td>3.7 grams</td>
</tr>
<tr>
<td>liang (tael, 10 fen of silver)</td>
<td>37.30 grams</td>
</tr>
<tr>
<td>sheng (volume measure for grain)</td>
<td>1.0355 liters</td>
</tr>
<tr>
<td>dou (10 sheng)</td>
<td>10.355 liters</td>
</tr>
<tr>
<td>shi (10 dou)</td>
<td>103.55 liters</td>
</tr>
<tr>
<td>(the equivalent to dou, later on reduced to five dou)</td>
<td></td>
</tr>
<tr>
<td>mu (land area measure)</td>
<td>6.144 ares</td>
</tr>
<tr>
<td>qing (100 mu)</td>
<td>6.14 hectares</td>
</tr>
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Abbreviations Used in the Footnotes

BSZ (1225-27): Baoqing Siming zhi 寶慶四明志．
JGZ (1201-04): Jiatai Guiji zhi 嘉泰會稽志．
JSXZ (1804): Jiaqing Shanyin xian zhi 嘉慶山陰縣志．
MS: Ming shilu 明實錄．
NJZ: (1469): Ningbo jun zhi 宁波郡志．
JGQ: Jingye guile quanshu 經野規略全書．
QSZ (1736-95): Qianlong Shaoxing fuzhi 乾隆紹興府志．
SFZ (1588): Shaoxing fu zhi 紹興府志．
SFZ (1720): Shaoxing fu zhi 紹興府志．
SFZ (1793): Shaoxing fu zhi 紹興府志．
SSB: Simingtashan shuili beilan 四明他山水利備覽．
SCS: Siming congshu 四明叢書．
WSK: Weyan ge siku quanshu 文閑閣四庫全書．
XXZ (1681): Xiaoshan xianzhi 蕭山縣志．
XXZXG: Xiaoshan xianzhi gao 蕭山縣志稿．
ZTZ (1562): Zhejiang tong zhi 浙江通志．
ZTZ (1735): Zhejiang tong zhi 浙江通志．
ZXZ: Zhuji xian zhi 諸暨縣志．
ZDCS: Zhongguo difangzhi congshu 中國地方志叢書．
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Administrative Divisions in Shaoxing
From the Song to the Ming
Chapter 1: Introduction

Shaoxing is located to the south of Hangzhou Bay in Zhejiang province, southeastern China. It was given the present name in 1130. Before the seventeenth century, the name referred to a prefecture comprised eight counties. In the early Republican period, one of them, Xiaoshan, was separated and combined with Hangzhou which lies to the west across the Qiantang River. This study is concerned with the transformation of the landscape through the effects of water-control systems in the areas of the Puyang River (sometimes called the Wanjiang in the sources) in which four of the counties of Shaoxing, namely Zhuji, Xiaoshan, Shanyin, and Guiji, as well as the prefectural city of Shaoxing itself, were located.

It is commonly recognized that, by pre-modern standards, agriculture in Shaoxing in pre-modern times had attained a "high" level of development. Encouraged as well as pressed by rapid population growth, Shaoxing water control was the key contributory factor that ushered in the expansion of rice cultivation into the coastal wetlands, and also provided an effective traffic and communications network that facilitated the integration of the local economy and society into nation-wide markets and imperial politics.

The Shaoxing agricultural development can be seen from its distinctive landscape. In the upper part of the coastal region there are numerous reservoirs dotting the feet of hills to collect flood-waters off the mountains in the south. More striking is the coastal plain which is characterized by a network of dense drainage and traffic channels with numerous dikes and sluices. Its coasts are fringed with enormous sea-walls and river levees to protect the areas inland from tidal incursions from Hangzhou Bay. The present study is about the formation of this hydraulic landscape in Shaoxing.
Studies of water control seek generally to explicate two relationships of water control 1) with natural environmental processes and 2) with economic factors. The technical approach sees water control mainly as the technical means of human adaptation to and to some point, of controlling the natural environments; and hence its scope of concern is exclusively limited to the development of technical capacity to reduce environmental impact on humans. The economic approach considers water control a form of economic investment and hence only deals with the billing for the economic outcomes of water control.

This study is neither about the technical aspect of the Shaoxing water control, nor the role of water control in the development of Shaoxing agriculture as such. It instead looks at the interaction of both technical (hydraulic in Shaoxing's case) adaptation and socioeconomic consequences of human response to the change of environmental processes.

The hydraulic shaping of the Shaoxing landscape was a long process that started at least as early as the second century A.D. It was during the fifteenth and sixteenth centuries, as mentioned above, that the Shaoxing landscape was given the fundamental configuration as we see today, underlying the rapid transformations of economic growth later on. The Shaoxing landscape has thus had a rich history of man-made changes in its channel patterns, the re-shape of its coastlines, the highland vegetation situation, and also in the composition of the soils in lowland. Among the numerous factors contributing to the landscape formation, water control was the one deeply involved with environmental

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2 For example of such a research in the clearing of forest-land, see Repetto, R., "Accounting for Environmental Assets," Science American (June, 1992).
processes.

This study thus focuses on the course of water control in the low-lands and the extensive deforestation in highlands as joint contributors to the formation of the Shaoxing landscape. It takes account of environmental processes such as flood regimes, changing pattern of river current, and climate as the agents of the Shaoxing landscape history. It is to show that water-control works in turn requires constant commitment of local habitants in forms of technical, financial, and organizational input. The impact is too found in the area of human affairs, namely the shifts of financial sources and of organizational resources for water-control activities. Rather than seeing these changes as the response to the alteration of local society per se, it seeks the linkages of the former to the changes of environmental processes.

It thus argues that in Shaoxing’s case, human efforts alter the nature and forms of natural processes and hence create a new environment in which human activities are a critical element. The changed pattern of tidal action, and the increase of the siltation rate in lakes and drainage channels were ever perceived by contemporary members of the local elite as having human causes. Construction of later water-control works was to some point the patch-up work for ones constructed earlier, necessitated in turn by environmental forces themselves set in motion by human action. Set in such an over-controlled environment, the Shaoxing agriculture has to entrust its further development with the maintenance of what was accomplished before, no matter at what costs. The study explores thus the nature of the interaction, assuming that from the point of environmental history view, the case of the Shaoxing water-control stands little for human success in coping with environment.

Previous Studies and Their Implications
An observation is made of the previous critical theories concerning Chinese water control. It tries to identify the implications that the former studies of the Shaoxing water control particularly by Chinese and Japanese scholars have for this study.

Water control in Shaoxing from the tenth century to the eighteenth century is relatively well documented, which makes it a suitable case for examination against the already formulated frameworks embodied in previous studies. This examination is undertaken here with special regard to the determinants and effects of developments in technological sophistication as well as of simple spatial expansion.

K.A. Wittfogel in his book, *Oriental Despotism*, attempts to explicate the relationship of water control to ecological conditions. In his study, it is argued that water-control systems of pre-modern China may be grouped into categories established according to the types of technologies involved. Therefore variations in technology are correlated with the natural environment, particularly with different climatic patterns. Wittfogel argues, making a big intellectual leap in every sense, that Chinese water control was an environmentally determined technological adaptation that required centralized control by government. The Chinese social and political systems that developed in such ecological conditions were necessarily organized to perform suitable managerial functions. This necessarily gave them two fundamental characteristics: "hydraulic society" and "oriental despotism". The existence of one necessarily implied that of the other.

The latter part of Wittfogel's explanation has been discredited: it is now generally acknowledged as a misleading analysis of Chinese societal and political structure in particular, and that of other oriental nations in general. For a critique of Wittfogel's explanation based on the Chinese experiences, see D. Twitchett, "Some Remarks on Irrigation under the T'ang," T'ong pao 48 (1961); and for one based on the cases of other Asian societies, see E.R. Leach, "Hydraulic Society in Ceylon," *Past and Present* 15 (April 1959).
environmental causation of variations in hydraulic technology, still raises questions which are relevant to the discussion of the determinants of water-control development, and by extension, of agricultural development. There are, for instance, several studies, particularly by Chinese scholars, of Chinese agricultural development, which have emphasized the linkages of environmental processes, mostly in the form of climate alterations, with water control in south China.\(^4\)

It should be pointed out that these studies, including the useful parts of Wittfogel's work, are all to some extent tangential to an examination of the relationship of water control to changes in flood regimes. The latter is not solely a natural process but is closely related to human intervention in the form of water control.

Detailed study of Chinese water-control is in fact a field opened and still dominated by Japanese historians. Contemporary Japanese scholarship on Chinese water control, a body of writing with its own intellectual styles and traditions, has in general embraced multiple explanatory models. It has documented many alterations and events, and established analyses of the subjects.\(^5\)

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\(^5\) M. Elvin has outlined the heterogeneous multiplicity of Japanese studies in Chinese water control in Introduction to *Japanese Studies on the History of Water Control in China: A Selected Bibliography*, comp. by M. Elvin and H. Nishioka et al (Canberra: Australian National University; Tōkyō: The Center for East Asian Cultural Studies, 1994), a book which gives western scholars of Chinese history a useful index to what have been done by Japanese scholars regarding Chinese water control.
Some Japanese studies consider landscape transformation only as a result of the process of economic opening-up, particularly in the Yangzi valley from the tenth century on. These studies draw upon the documentary records concerning landscape change, the existence of which is to a great extent owed to the tradition of sharp observation on natural environment by members of the elite since late-imperial times (roughly defined as after the fourteenth century). Japanese scholars pay some attention to the increased severity of flooding, but they attribute it simply to over-reclaiming wetlands as some contemporaries perceived.

As far as the Shaoxing landscape transformation as a result of agricultural expansion is concerned, a massive work by Shiba Yoshinobu must be given attention, particularly as regards the relationship between the development of water control and the resulting problems of inland flooding in the Shan-Gui plain. In his account, the process of opening the plain falls in conformity with a pattern of agricultural expansion characteristic of most East Asian countries, namely having started from alluvial flats just at the feet of hills in early times, and then moving down to the lowland and ending up with the reclamation of extensive wetland along coats. Among various economic and social factors, the continuing increase of population, particularly the in-flow of migration

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7 Shiba Yoshinobu, Sōdai Kōnan keizai-shi no kenkyū [Studies in the economy of Jiangnan (Lower Yangtze) in the Song dynasty] (Tōkyō: 1988), the Latter Section, Chapter 3. The same account is also given other area in western Zhejiang, see his article, “Sōdai Sessei chihō no iden no hatten” [The development of Wei-tian in Chê-hsi during the Song Dynasty] Tōyō bunka kenkyūjo kiyō no. 40.
that peaked in the first half of the eleventh century is taken above all as the key factor. In his study, the environmental effects of opening the Shan-Gui plain under the Song are discussed, though tangentially. In order to reclaim extensive coastal wetlands in the plain, a massive sea wall was built up to disconnect the system of inland drainage from Hangzhou Bay. However, in consequence, Shaoxing suffered from frequent inland flooding and reduced efficiency of the drainage system. More than thirteen dams and sluices were constructed to regulate flooding waters in the plain, and the lower course of the Puyang River, which at the time cut through the Shan-Gui plain from the west and flooded the plain in the wet season, was diverted in the middle of fifteenth century. Shibam’s account on this sequence of events has provided fundamental basis for the analysis of this study.

There are many other Japanese studies particularly concerned with the interaction between water control and social and political processes. Of them, those produced earlier seem to have confined their analyses to Marxian as well as Hegelian oversimplified generalizations regarding Asian society. In their explanatory formulations, for instance, changes of water-control organizations are considered the mere reflection of alterations in the larger social and political contexts in which water-control activities were undertaken. Some contemporary Japanese studies still appear strongly associated with some Marxian concepts when they argue the probable causes of the decay and collapse of water-control systems in the Yangzi valley during the late Ming and early Qing in terms of changes and conflicts of class relations. The same account still holds its position in present-day studies by Chinese historians.


9 Hamashima Asutoshi, Mindai kônan nôson shakai no kenkyû [A
Quite recently, Japanese non-Marxian studies of water control, as a branch of Chinese socioeconomic history, have achieved a high standard. In their substantial investigations, a wide range of socioeconomic factors, such as demographic changes, agricultural expansion, urbanization development, and political events, are all taken into account to explain alterations in water-control systems both technical and organizational. However, the effects of environmental change - as a result of the interaction between water control per se and environmental change - are outside their concern and on some occasions, touched incidently and briefly.

In their ambitious recent study, "Man against the Sea: Natural and Anthropogenic Factors in the changing Morphology of Hangzhou Bay, circa 1000-1800", however, Mark Elvin and Ninghu Su focus on the part played by water control in the shaping of the southern coastline of inner Hangzhou Bay. Making use of historical records and data obtained from modern observational technologies, they explain changes in the sediment pattern and examine their effects. They link changes in the siltation pattern to the construction of sea-walls on the one hand, and to reservoirs and river locks built to control floods and facilitate agricultural reclamation, which affected sediment loads and the behavior of inland rivers, on the other.¹¹

Analytic Perspectives

The analytical framework of this work is derived from explanations of human interaction with the natural environment drawn from several disciplines. Most former studies of water control in pre-modern China are concerned with describing and documenting water control as a technological component of agricultural development, and are thus framed in terms of the production characteristics of traditional technologies.

The issue of landscape transformation has been treated in two different but related conventional disciplines: human geography, and economic history. They concern respectively different aspects.

In human geography, with which this study probably is most closely identified, the factors that are usually addressed as contributory to the formation of cultural landscapes are demographic movements, economic development, and changes in social organization. More recently, some human geographers have attempted to investigate linkages between the patterns of human use of various natural environments, on the one hand, and variations of social and political structures on the other. Yet others - showing, it must be said, little or no appreciation of the fact that most earlier landscapes have undergone major transformation as a result of extensive human intervention - are concerned with the way in which the “stability” of the so-called “natural” environment is disturbed, and environments are abused by modern people pursuing the logic of economic rationalism in the quest for “development”.


14 The conceptual treatment of this subject originated probably
These writers have on the whole paid little attention to how local inhabitants were driven to commit themselves to constant patterns of activity which transformed the environment in which they lived. Nor have they paid much attention to how this landscape transformation affected economic and social development.

This work does not attempt to reconstruct the whole historical process of Shaoxing’s landscape transformation in terms of human settlement and agricultural expansion. Rather, it is concerned only with its technological aspect. In other words, the formation of the Shaoxing landscape is here seen largely as the outcome of water control. Analogous patterns might be found with, for example, the introduction of new types of crops or improved plows that enabled crop cultivation to expand into new lands, and in consequence, brought some degree of change to the face of the earth.

The anthropological approach of the adaptation of human beings to various natural environments, including climatic shifts and different conditions of flora and fauna etc. is stimulating and instructive for my analytical formulations. It is proved by a host of case studies that technological and ecological strategies on which various societies rely for their existence and development are both facilitated as well as constrained by their own physical environment in human activities are a “constituent”.

in the 17th and 18th centuries, and it was much later on that it became a discipline based on empirical observation. G.P. Marsh is the one who broke into this ground with his work, Man and Nature or Physical Geography as Modified by Human Action (1864) and was followed by R.L. Sherlock (1922) in his analysis Man as a Geological Agent. This has now developed into a field attractive to scholars of other disciplines. See, for example, W.L. Thomas et al. in Man’s Role in Changing the Face of the Earth (International Symposium on Man's Role in Changing the Face of the Earth, Princeton, N.J. 1955).

15 Leach, for instance, states that: “Every anthropologist needs to start out by considering just how much of the culture with which he is faced can most readily be understood as a direct adaptation to the environmental context, including that part of the context which is man-made.” See his book, Pul Eliya, A Village in Ceylon: A Study of Land Kinship (London: Cambridge University Press, 1961), p. 306. The similar point is made by R.F. Ellen in his book, Natural Settlement and Ecology: An approach to the Environmental Relations of An Eastern Indonesian Community (The Hague: Martinus Nijhoff, 1978). In another
In environmental history, the linkage of human activities with environment is conceived as a double enquiry: first into "how humans have been affected by their natural environment through time and conversely, how they have affected that environment and with what results."16

Structure, Conclusion and Implication

In the succeeding seven chapters, the Shaoxing landscape transformation, thus alluded to, will be related in topics concerning the patterns of environmental change within various geographical sectors. The second chapter of this study briefs the history of Chinese water control to show that pre-modern Chinese economic landscape would have been profoundly different without massive construction of water-control works. This development is well documented in writings of members of the elite. The construction of water-control works, particularly in the south, is praised in glowing terms, and therefore led to the re-emergence of the believe in the human's ability of dominating natural world.

The third chapter details physiographic features and climate pattern of the Shaoxing area.

The fourth chapter shows lake construction and conservation in the upper river areas. The people of Shaoxing committed a great deal of their economic and social resources in these lake systems; and hence the local economy and society was largely determined by the success or failure of lake conservations. As documented in the sources, local book, Environment, Subsistence and System: The Ecology of Small-Scale Social Formations (London: Cambridge University Press, 1982), he discusses the interaction at the conceptual level. J.W. Bennett, also provides a case concerning the variations of land-use patterns accorded by different natural environments in the Saskatchewan plain of Canada since the eighteenth century in his work, Northern Plainsmen: Adaptive Strategy and Agrarian Life (Arlington Heights, IL: AHM Publishing, 1969). For his conceptual treatment, see The Ecological Transition: Cultural Anthropology and Human Adaptation (New York: Pergamon Press, 1976).

government worked as an organizer and one of major participant in lake construction and conservations to such a great extent that the Shaoxing case may provide new evidence for rebutting the conventional position that local governments always kept their hands off most of local administration affairs and left them with local elite.

Moving from the upper-stream areas down to the downstream areas, the fifth chapter documents the construction of several key hydraulic works, including a flood-storage reservoir, sea walls, the diversion of the Puyang River as well as their collateral works. It argues that these developments have not fended off nor reduced the influence of environmental processes, such as river behavior, flooding regimes and tidal invasions, to the point expected. Shaoxing has been locked in the constant massive commitment to constructing new hydraulic works and to maintaining old ones which all constituted a great drainage of what Shaoxing has gained.

The sixth chapter covers the history of the woodland destruction in the highlands. Since the late Song, some forests suffered from unrestricted commercial cutting; and others were uprooted for American crops later on. However, some forests in elite and religion estates were well preserved up to the fourteenth century. The extensive destruction did not take place until the Ming when the highland society began to decline and eventually collapsed. As a result, all large landholdings of monasteries and intellectual estates dissolved into peasant small holdings. This triggered extensive environmental abuse. The deforestation caused soil erosion which made great damage to hydraulic works in the lowlands.

The seventh chapter looks at shifts of the financial sources for water control. The development of water control in Shaoxing was not a pure derivative of human endeavours. Rather, water control as such demanded and resulted some institutional changes. The shifts of financial sources were made primarily in response to increased demands for financial input on the one hand, because of hydraulic expansion, and
on the other, because of the costs that mounted in maintaining old works as a result of changes in environmental processes. It was in consequence of this increase that reforms of the old financial contribution systems were locally devised or introduced from other regions for the search of new resources.

The eighth chapter covers the history of a lake in the meddle areas of the Puyang River. The lake was built in the early Song as a safeguarding device for extensive rice land around. Over the centuries, its hydraulic capacity dipped as a substantial part of its land was reclaimed into farming land. Great efforts were even made in vain to check the encroachment and to resume the lake to its earlier state. The decline of Xiang Lake’s technical capacity thus points further to the principal theme of this thesis that when water control in Shaoxing costs mounted, its potential declined.

Finally, the study reaches a conclusion. The development of the Shaoxing water control works as a “hydraulic trap”, a pattern of economic development in which the development of Shaoxing agriculture was exhausted and then deprived of any easy alternatives when the dynamic potential of water control began to decline but the costs of maintaining it increased.

The history of Chinese agriculture has been documented, and analyzed in many studies in terms of most of the concepts to be found in theories of pre-modern economic development. There is no doubt, however, among scholars of


18 For example, in her book, Agricultural Change and the Peasant Economy of South China (Harvard University Press, 1972), E.S. Rawski examines Chinese agricultural development between the Song and Ming, with emphasis on the part played by commercial development; for the development stimulated by population growth and commercialization, as well as accompanied by the opening of new frontiers in south, see Shiba’s work of 1988, and Markets in China during the Sung, Ming, and Ch’ing Periods, translated into English by W.A. Fujioka and M. Matsuda, (Tōkyō: 1960); for technological contribution to the agricultural development particularly before the 14th century, see M. Elvin, The Pattern of the Chinese Past (London: Eyre Methuen, and Stanford: 13
Chinese economic history, that technological progress constituted the basis for forms of agriculture that were in advance of those to be found in Europe before the fourteenth, or even the eighteenth, century. The relative backwardness of Chinese agriculture in later periods was closely related to the phenomenon of "economic development without technological change", the pattern into which the development of Chinese agriculture moved in the last centuries of the imperial period. This was characterized by a heavy reliance on "external" expansion in both production scale and overall size, closely linked with rapid population growth. This pattern took hold precisely because of the lack of fundamental technological progress, though there was unquestionably some "fine-turning" of existing technologies.


D.H. Perkins has investigated this shift in his book, Agricultural Development in China, 1368-1968 (Edinburgh University Press, 1969) which draws on statistical data culled from voluminous gazetteers and documents. For an overall view regarding the distinctions of these two patterns, see M. Elvin, The Pattern of the Chinese Past (London: Eyre Methuen, 1973).

For the explication of the distinctions of these two patterns, see M. Elvin, 1973. The historical contribution of technological progress to economic development is also approached in a comparison between China and (mostly western) Europe by J. Mokyr in his book, The Lever of Riches: Technological Creativity and Economic Progress (New York Oxford: Oxford University Press, 1990), pp. 218-19, 223-27. His argument is largely based on the shifts of the advance of technologies in China before the 14th century to western Europe afterwards and the resulting effects which this brought to economic development on the two sides of the Eurasian continent respectively in these two periods. He overstates the part that technological progress played in general economic development to such a degree that he rules out the contribution of factors such as population growth, expansion of arable land, increase in capital, and even a better climate for agriculture, which were not necessarily contingent upon technological progress, to the expansion of the economy. Thus, he makes an error by asserting that population growth and increase of gross output necessarily imply technological progress, which makes his assumption useless in explicating the pattern of Chinese economic history of after the 14th century. Another comparative study is by E.L. Jones, The European Miracle: Environments, Economies, and Geopolitics in the History of Europe and Asia (London: Cambridge University Press, 1981). He attributes the development of European economies and sociopolitical relations to the superiority of the technologies in control of the natural environment, or to the correct "technological and ecological strategy for solving the problem of declining efficiency" in Harris' words (cited by the author), p. 14. In fact these two works have been of much more use in
Chinese economic history, that technological progress constituted the basis for forms of agriculture that were in advance of those to be found in Europe before the fourteenth, or even the eighteenth, century. The relative backwardness of Chinese agriculture in later periods was closely related to the phenomenon of "economic development without technological change", the pattern into which the development of Chinese agriculture moved in the last centuries of the imperial period. This was characterized by a heavy reliance on "external" expansion in both production scale and overall size, closely linked with rapid population growth. This pattern took hold precisely because of the lack of fundamental technological progress, though there was unquestionably some "fine-turning" of existing technologies.


For the explication of the distinctions of these two patterns, see M. Elvin, 1973. The historical contribution of technological progress to economic development is also approached in a comparison between China and (mostly western) Europe by J. Mokyr in his book, *The Lever of Riches: Technological Creativity and Economic Progress* (New York: Oxford University Press, 1990), pp. 218-19, 223-27. His argument is largely based on the shifts of the advance of technologies in China before the 14th century to western Europe afterwards and the resulting effects which this brought to economic development on the two sides of the Eurasian continent respectively in these two periods. He overstates the part that technological progress played in general economic development to such a degree that he rules out the contribution of factors such as population growth, expansion of arable land, increase in capital, and even a better climate for agriculture, which were not necessarily contingent upon technological progress, to the expansion of the economy. Thus, he makes an error by asserting that population growth and increase of gross output necessarily imply technological progress, which makes his assumption useless in explicating the pattern of Chinese economic history of after the 14th century. Another comparative study is by E.L. Jones, *The European Miracle: Environments, Economies, and Geopolitics in the History of Europe and Asia* (London: Cambridge University Press, 1981). He attributes the development of European economies and sociopolitical relations to the superiority of the technologies in control of the natural environment, or to the correct "technological and ecological strategy for solving the problem of declining efficiency" in Harris' words (cited by the author), p. 14. In fact these two works have been of much more use in
In conformity with thus an overall pattern of traditional Chinese agricultural development, Shaoxing experienced the burgeoning of water-control construction, particularly in the coastal plain in the fifteenth century. A major example is the project of diverting the lower course of the Puyang River into the middle course of the Qiantang River. This was a hydraulically sound but environmentally unjustified project. It has been seen as aiming simply at reclaiming the extensive wetlands in the plain, something which was in fact incidentally made possible after the diversion. Its aim was rather to solve a more widespread problem, that of frequent flooding in the plain. In the following several decades, over thirteen hydraulic works were constructed to cope with the increased threats of flooding caused largely by the diversion and the reclamation of extensive wetland. Eventually, the Lock of Three Rivers 三江閘 was constructed at the Mouth of the Three Rivers on the eastern edge of the plain to safeguard the drainage and irrigation systems of the inland rivers from the influence of saline tidal incursions. Its construction brought into being an integrated hydraulic network in Shaoxing. All these developments suggest that water control in Shaoxing had by the time reached a new stage in hydraulic know-how and techniques of construction, and also in organizational and financial capacity.

Given that the formation of the Shaoxing hydraulic landscape implies the pattern of traditional Chinese agricultural history, the last, but not the least important, of the questions that this study is to raise is that the variation itself can be more fully delineated and explained by taking account of change in the quality of natural environments.

studies of world economic history than in that of Chinese economic history. This is a result of the oversimplification of their arguments: the spans of time and areas under the observation are too long and too large for them to be sensitive to the divergences, particularly on the Chinese side, between regions and over shorter periods.
Chapter 2: Hydraulic Dominance

Before my account of the concrete historical detail, I give here an overview of pre-modern Chinese water-control. It has been an agent of landscape transformation, or at least a force consciously used to control and to manipulate the natural environment for human purposes, a process which was accelerated particularly from the tenth century. My overview here is intended to serve simply as a conceptual and historical backdrop.

There is no doubt that pre-modern Chinese society and landscape would have been profoundly different without the impressive results actually achieved in the area of water control. Old legends such as those of the flood-tamer Yu give an implicit account of the position of water control in Chinese history: China was created, as a nation, in extensive engagements in control of water in various ways rather than in bloody battles against other rival groups of human-beings.

From the third century B.C., China became an empire that relied for its revenue primarily on sedentary agriculture. Since then, it experienced several geographical shifts of its core economic areas as agriculture expanded into new frontiers. These shifts were on some occasions followed by relocations of the political center even though these two spatial movements may or may not have entirely coincided. In Chinese agricultural development, water control played an indispensable role, particularly after the late sixth century when the economic importance of the south began to increase.

From the twelfth century onwards, the nation’s economic gravity shifted entirely to the Yangzi valley as a result of reclaiming extensive wetlands there. Water-control activities accordingly played a predominant part for lowland farming. This development is well documented in writings of members

1 Chi Ch'ao-ting, 1936.

of the elite, where the extensive construction of water-control works is praised in glowing terms. The boast is that "water follows the command of man" (shuicont ren zhihui 水從人指揮).

During the Ming, the development of water control peaked in term of premodern standards, and thus led to the formation of an environment that in successive periods, was found more difficult and more costly to control. By the 18th and 19th centuries, Chinese economy reached the point where to a great extent, its further development was largely restricted by such an over-controlled environment as such. Agricultural expansion underpinned by water control was, for example, always met by the increased disasters of flooding and drought. Disaster relieves thus constituted an ever greater drainage on local and national governments' revenues. On the other hand, the costs of maintaining the former hydraulic controlling set-up continued soaring.

Forms of Water-Control Technology

To explain the ways in which water control could transform not only a landscape, but also people's thinking about their relationship to environment, we should have an overview of the traditional hydraulic technologies that lay

1 Yang Wanli 楊萬里 (1127-1206), Chengzhai ji 誠齋集 [The collection of Chengzhai (Yang Wanli)], juan (vol.) 32.

1 Chen Qiaoyi 陳橋驿, "Gudai Jianhu xingfei yu Shan-Gui pingyuan nongtian shuili 古代畿輔興廢與山會平原農田水利" Dili xuebao 28.3 (Sept. 1962).


at the core of the agricultural developments.

Most hydraulic works in pre-modern China were multi-functional, being intended for flood and drainage control, as well as for water supply for agricultural and urban needs. They were also often used for communication purposes. Some, on the other hand, were built for defence, as in the cases of sea-walls.

Limiting our observation for the moment to flood control and agricultural irrigation, there are at least six types of technological structures to consider.

1 Riverine diversion networks

The simplified diagram below shows a riverine diversion network. Part of the river flow is diverted and then re-diverted to areas where irrigation water is needed. An artificial water network composed of extensive channels with numerous locks and sluices is thus linked to a river. Both irrigation and drainage are gravity-powered. Key features of this system are the diversion barrage and drainage channels. The water diverted into the channels is not necessarily drained back out to down-stream course of the river. The Dujiang Barrage 都江堰 on the Min River in Sichuan and the Mulan Barrage 木蘭陂 in Fujian are examples of this type.

When a network was originally designed to improve communication for military needs as well, a linkage channel was often dug between two river basins. This was the case with the Ling Channel 靳渠 in present-day Guangxi province, which was built originally for military expeditions of the further south in the Tong, linking the Xiang River 湘江 (running south-north) to the Li River 滇江 that flows north-south. In north China, most diversion networks with such linkages were constructed before the close of the Tang. They were intended to improve irrigation and to replenish soil fertility with river sediment, as in the case of the original Zheng Guo Channel 鄭國渠 and the Bai Channel 白渠 in the Guanzhong plain of Shaanxi. Such diversion channels can be found in the middle region of the Yellow River valley as well.
Barrage and reservoir systems

Barrage and reservoir systems are found where water sources are intermittent, coming basically from seasonal rainfall, and where the landscape is characterized by undulating topography. Accordingly, they are mostly found in the mountainous areas of eastern Zhejiang, Fujian and the upper and middle stream areas of the Pearl River in south China.1

The key feature of this system is an array of water catchment setups of varying size and shapes known in gazetteers as “water storage reservoirs” (beitang 蓄塘). They are situated at different altitudes and store water from higher catchment for farm-land below them. When there is excess water, it is drained out through drainage channels, in most cases to rivers or the sea. Irrigation and drainage are accomplished by gravity. In many cases, a reservoir system is a cascade system comprising more than one reservoir, feeding rivulets, drainage channels, dikes, sluices and other auxiliaries used to regulate floods.

Wang Zhen 王祯 (1295-?), the author of the agricultural encyclopedia Nongshu 農書 (A book on agriculture), has a passage explaining the configuration of a reservoir cascade system.

As has been stated in agricultural books: "people in the south have a good knowledge of water control", and water-storage reservoirs sponsored by governments are

1 Morita Akira, Shindai suirishi kenkyū [Study on Water Control in the Qing Dynasty] (Tokyo: 1974), Chapters 4, 5, and "Water Control in Zhedong during the Late Ming" trans by M. Elvin and Tamura Keiko in East Asian History no.2 (December 1991).
found everywhere. The barrages standing on creeks (xihe 溪塹) and water-storage reservoirs (shuidang 水澇) built up by the people themselves are countless. The larger among them are able to irrigate hundreds of qing 個 of fields, and the smaller several tens of mu 坪 too. Since waters come from the upland areas, sluices are built on channels, ditches, and creek barrages to regulate the water flow. Culvert networks (jiandou 田 Buen) are also set up for drainage.

The following is a diagram illustrating the configuration of this system.

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Not every cascade system is necessarily composed of more than one reservoir with their command areas in succession below one another. It can include a single reservoir catchment system within which regularity of water flow is accomplished by the same process. That is, water is held in or drained out in the case of excess, then channelled deliberately into paddy fields and finally drained out of the system without passing to another reservoir. The configuration of the reservoir storage or cascade systems is geared to topographical features, and therefore displays a positive integration of human intervention with the natural environment.

A common alternative term for beitang or shuidang to refer to storage reservoirs is hu 湖, "lake", as found in the source materials of Shaoxing.

This technology may first appear in the Yanyzi valley because it was commonly used to reclaim extensive wetland there since the Han. The way in which the storage reservoirs worked is described in a Tang text:

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Mirror Lake 鏡湖 was built by the prefect, Ma Zhen 馬臻, in the Yonghe period of the Later Han Dynasty (A.D. 135-141). It is situated within the domain of two counties, Guiji and Shanyin, collecting water within its dikes. The level of the lake water is over a zhang 丈 higher than the fields which are alike a zhang higher than sea level. If water is short, the lake water will be used for irrigation; if it is too much, (people) will close all the sluices to the lake and drain water collected in the fields out to sea. Thus there has not been one year afflicted by disasters."

3 Diked enclosure systems

Where the continuous availability of water was never a problem but too much of it presented a threat to crops, enclosure dikes were built up to hold water out of farming fields. The terms used for these in gazetteers and government documents are wei 堍 or yu 圃 ("dike-enclosed polders"). Human power was needed in these systems. This was particularly so for drainage as the enclosed fields lay lower than the surrounding water level.

In some instances, small water ponds were dug in the middle of the enclosures to store water in case of droughts. As found in western Zhejiang, a dike-enclosed polder could be divided into several smaller enclosures by dikes between the fields.

Drainage, and irrigation in times of drought, were achieved through human powered pumping equipment such as pallet chain pumps known as "dragon's tail pumps" by farmers. Using this water-control technology, large areas of swamp and marsh were turned into arable land. However these human powered input and output systems were characterized by the need for high levels of labour by the farmers if drainage and irrigation was to be adequately handled.

Heavy labour by a great number of hands was thus always

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needed for the operation of the polder systems. The pumping equipment was also financially burdensome for commoners. In most cases, government assistance in the form of providing farmers with the equipment was vital in assuring continued good harvests from fields in the polders.¹

The configuration of the systems is shown in the following diagram.

4 Noria-and-flume systems powered by flowing water

Where the availability of rapid and steady water flows was ensured by perennial streams or creeks, water-lifting equipment such as water lift wheels furnished with bamboo tubes was installed to move irrigation water to higher lands. The adoption of this technology was usually limited to mountainous areas where creeks and streams are fed constantly by springs or melted snow. Its capacity was quite limited.

Sophistication of this technique led to the development of the noria. This is a huge wheel with pots mounted around its circumference in such a way that they pick up water as they reach the bottom of each revolution and pour it into a flume just after they reach the top.²

In addition to natural constraints, social and economic obstacles, such as the existence of "cheap" labor and the limited investment funds of individual farmers, worked to prevent this technology from spreading widely in pre-modern China.³

³ M. Elvin, 1975, pp. 105-06.
5 Defensive systems

The major works of a defensive type were levees, sea-walls and river embankments under the protection of which developed a vast wealth of farm fields that had earlier been subject to inundation by tides and floods.

Finally, well and underground channel irrigation can be added to our list. Both were of pronounced importance for cultivation in arid areas of north and northwest China.

These general technical categories are not ones that can only be delineated with modern hydraulic knowledge. Wang Zhen, for instance, identified them all according to the configuration of the works and their relationship to moving water, in approximately the same terms as I have done here.!!

Yang Wanli 杨万里 (1127-1206) described the power of water control to transform the landscape, as he witnessed it on a journey through Lishui 濒水 to his new office in Jiangsu, in a poem below:

On the dikes around the lake stand water gates.  
By them thousands of waves are depressed as soon as they are created.  
You can find red flowers spreading at the feet of the dike slopes like decorative trimmings,  
But you cannot see the traces of pile-up on the dikes.  
Whenever polder leaders are about to assemble polder people every year,  
The people come up spontaneously without being notified.  
Hundreds of thousands of shovels remove earth in a thousand bamboo scoops.  
People are singing working songs aloud and in chorus.  
Men never complain about the laboriousness of the work

by yelling at the sky.
A day of repairing the dikes will be remunerated by a year of repose.
When no rains dropped last June and July.
I stepped up to the heights to have an aerial view over the fields in the polder.
There was a host of rocks, slabs of stone and wood there,
People were building up polder dikes not city walls.
It seemed as if I might tell He Lian* not to recruit soldiers any more,
Contending for political hegemony couldn't be superior to plowing in spring.
The level of river water around the polder is higher than that inside.
The water in the polders flows through thousands of meandering ditches.
No one wonders that once the water sluices are set up,
Water follows the command of man.11

*A military general of the regional kingdom of Liu Song in Jiangnan before the Song.

The Concept of Relationship between Human and Water
This appreciation of way hydraulic technologies acted on the landscape is some measure of the emergence of a new concept on the relation between human and nature by the late Song period. In all probability this had its roots in the massive agricultural colonization of wetland and in effect, is an intellectual testimony to what might be termed "hydraulic dominance". It must thus be seen as in every sense divergent from what is considered the long-lasting and dominant Chinese preference for "a cooperative, harmonious relationship between nature and humanity". Rather, this text indicates the belief

11 The same as note 3.
in human’s supremacy over nature. Originated in the late Spring and Autumn periods, this belief casts no doubts on human’s success over the nature, as read in the source: “human is able to conquest the nature (the heaven)”, ren ding sheng tian 人定勝天, in a Song text. 11

A distinction is conventionally drawn between Western and Chinese perceptions of the position of humans in the ecological world. 14 The Chinese are seen as adaptive rather dominating. In fact, in documentary and literary sources, the transformation of many diverse landscapes by different regimes of water control is recorded in terms that demonstrate a high level of appreciation of the results of human intervention.

It is not only personalities and events on the national stage or in national institutions, that were seen as deserving qualified to be noticed and recorded. Attention was also given to the large number of men who qualified to take high degrees in the imperial examinations for government offices. But at the same time, local accomplishments, such as the establishment of water control, local specialization in some areas of craftsmanship and technology, and local religious institutions, were all considered as sources of local pride. They were all recorded, and classified into a hierarchy consisting of “climatic events, local advantages, and human endeavor” (tianshi, dili, renshi 天時,地利,人事). Although all three elements are employed metaphorically to explain the success of some areas rather than others in economic development and intellectual activities, human endeavors are always given the most important place. 15

15 In early times, this phrase, tianshi dili renshi 天時,地利,人事, was only used in general discussion of the principal elements of military action. Among those who applied it to agricultural production later on, readings varied regarding the relationship of human beings with the environmental factors summarized in the other two categories. It was, for instance, read in a number of cases as: “The seasons of Heaven are important, but geographical advantages are more so, and human cooperation is the most important” (天時不如地利，地利不如人和) (On some occasions, the last factor is phrased as “human wisdom, renmou 人
Over the centuries, water control has been used, as the major means, to transform natural landscape into farming fields; and its development created an environment which in contrast to what is conventionally considered the accomplishment facilitating agricultural development, required further human efforts to maintain its usefulness and therefore constituted the environmental restrictions on the latter's development. Also, its development contributed greatly to the emergence of the conception of human being in a significant place in the universal order. The following chapters will look at the first aspect, namely the course in which water control brought on the Shaoxing agricultural development the environmental restrictions.

The application of the phrase, given this interpretation, to water control is found in *Nongshu* (1956), p. 26. For the variations of the reading, see Li Bozhong, 1993.
Chapter 3: Environmental Necessity for Water Control

Landscape Layout

In the present day, the Puyang River flows south-north and feeds into the Qiantang River. Its main course now is 151 kms in length, cutting through three counties, with a catchment area of 3431 km². The entire area is composed of two kinds of physiographic features and hence ecological systems. The up-stream area is a narrow valley where the river is fed by waters that run off mountains by way of numerous ephemeral rivulets and perpetual water springs. Its terrain is characterized by a high gradient and extreme ruggedness. The area was once divided into three counties, Zhuji 諸暨, Pujiang 浦江 and Yiwu 義烏 (the latter two were within Quzhou 衢州 to the south of Zhuji). In a restricted sense, the upper-stream area of the Puyang River starts in the valleys within Zhuji. In the present course of the river, the river’s run-off finds its way from the heights of the Guiji mountains down to the open down-stream areas - 6 meters above mean sea-level - within a linear distance of less than thirty-eight kilometers from the middle of the river valley to the present debouchment of the Puyang River to the Qiantang River. The result is that it forms a torrent, particularly in the wet season.

The downstream area comprises the whole Shan-Gui plain 山會平原, a coastal plain of the elevation five meters high over the sea level. The Qiantang River is well known, throughout the nation, for its a high tide in the middle autumn, the highest tide in the world, which with the height of over three meters, pushes its way into the river channel up to the middle course and makes a rumbling sound heard sixteen kilometers away. Since very early times, people have come from all directions to watch this spectacular natural phenomenon. The power that this tide displays has been described as a popular subject in numerous poems. With the
relatively low elevation of the plain, the tides inevitably impose themselves great difficulties on the maintenance of the sea walls along the bay and of the river’s banks in the plain.

The plain is divided into two sections for the convenience of analysis: the eastern and western. In the present course of the Puyang River, the western section has become the down-stream reach of the river since its debouchment to the Qiantang River changed to the western edge of the plain. The eastern section constitutes a large proportion of the plain on which the lower Puyang (Qianqing 錢清) River cut through. From Song to Ming, the eastern plain was divided into two counties, Shanyin 山隴 and Guiji 會稽, and the prefectural capital, Shaoxing city, was located within Guiji.

Historically the Qianqing River was once the lower course of the Puyang River. In the middle fifteenth century when a waterway diversion project was completed, Puyang River was directed northwest into the Qiantang River. The former lost its lower course and its exit at the Mouth of the Three Rivers (Sanjiang kou 三江口) to Hangzhou Bay on the eastern edge of the plain. A lock, called Ma Creek Lock, was then built in the old waterway of the Puyang River. Now, it is only on the few occasions when the Puyang River flows too high, that the sluice can be lifted to allow a small portion of the water to flow through into the Qianqing River.

The plain’s landscape structure is presented in the following two maps. The first is a reproduction of a modern map with some modifications to illustrate the old course of the Qianqing River. The second is a satellite-image taken in the 1980. Through these two maps, we may obtain an overview of the Shaoxing landscape structure before we move into details later.
Landscape structure of the areas of the Puyang River.

Historical Climatic Pattern and Its Variations

The general climate pattern over Shaoxing can be described on two levels. First there is the general climate pattern, which is created by large-scale climate influences over the Yangzi valley. At the subregional level, the climate pattern is to be explained by topographic and atmospheric variations at regional or subregional levels.

Like much of China, the Yangzi valley is under the domination of a monsoon climate created by the alternation of two patterns. The first of these is the summer monsoon which originates in the moist, warm air-mass flows from Southeast Asia, the Australian region and the Indian Ocean. The second is the winter monsoon that consists of the dry, cold air-mass flows from the immense central Eurasian hinterland to the northwest of the heavily populated parts of the country. The main resulting feature of the monsoon climate is "the amplitude of annual variation for both temperature and precipitation". This is the most significant element of the climate pattern over China.

The seasonal variation in annual precipitation has very particular environmental consequences. In the Yangzi valley, uneven rainfall is marked by high concentration in the months of May and June. According to data from around the Shanghai area just to the north of Shaoxing, it is the usual pattern that some 37.3% of the annual precipitation falls during these two months. This is a period during which the two distinct air currents from the winter monsoon and the summer monsoon meet in the sky over the valley. The rains in this period are known as the "plum rains" (meiyu 梅雨) also "rotting rains" sometimes. The "plum rain" period - which usually coincides with the mature period of plums, hence the

1 As to the formation of the summer monsoon over the southern and southeastern China, see Y. Ding, Monsoons over China, (Dordrecht: Kluwer Academic Publisher, 1994), pp. 12-13.


3 Y. Ding, 1994, Table 4.2, p. 270.
name - is usually followed by spring floods (chuntao 春潮). As a result, during this period the Puyang River flows at a level that marks its peak annual discharge.  

The other rainy period, in the late autumn, probably results from the strong influence of air movements from the ocean. The distribution of rainfall for the year is illustrated in the following graph:

![Rainfall Graph]

On the other hand, the climate of Shaoxing is also characterized by great variation in the dates for the onset of rainy periods, and also in their duration. The resulting uncertainty makes it very hard to predict climate patterns in any given year, and this affects farming badly. A longer or shorter duration than usual, for example, of the period during which the two air blocks meet over the region may result in too much or too little spring rain. The outcome will often be floods or droughts. In 1866, Shaoxing fell victim to floods as a result of continuous rain for seven days. The vagaries of the climate are reflected in an old proverb found in the gazetteers of the Puyang River areas: "A drought is acknowledged when a bright moon is seen in the

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3. Huan Xuelie 華學烈, Preface for a 1866 reprinted book, Jingye guilu quanshu 經野規略全書 (The Complete Documents Relating to the Summary of Regulations for Managing the Countryside; hereafter: JGQ in all the footnotes), compiled by Liu Guangfu 劉光復 in 1603. Discussion of this work is in the next chapter.
clear sky for five nights in a row, but boats will be floating over land as soon as thunder is heard in the sky."

On the other hand, the general climate pattern over the Shaoxing region was not entirely independent of local topographic features. At the present time, in the Shaoxing area, annual precipitation averages between 1300 to 1800 cm. There are, however, subregional divisions that demonstrate how topographic differences can produce divergences from the mean. An important example is the mountainous areas, in which the precipitation is usually over 1800 cm. per year due to the higher altitude. In turn, this sometimes results in very rapid rates of rise in the water level of the upper Puyang River.

These climate pattern and physiographic features have given the present Puyang River torrential rates of flow as a characteristic pattern. Environmental conditions of this kind bespeak the necessity of water-control construction to ensure a stable environment in areas for permanent settlement and rice cultivation.

Our understanding of climatic patterns and their changes over historical times is quite limited to being largely descriptive rather than analytic. This is because the studies rely for their evidence almost entirely on documentary records which concern themselves only with devastating floods and droughts. What is more, two further features of the records make it difficult to construct a completely adequate record of the effects of climate. First, what was uppermost in the minds of the local officials who were ultimately responsible for the form in which the records were set down was the security of their posts or their prospects of promotion. Both were in theory conditional on preserving the stability of the local social and economic orders. This

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7五日明月天告旱，一聲雷動陸行舟. Cui Yunlong 崔雲龍, Preface written for the 1733 reprinting of JGQ; the original Preface (1603) to JGQ.

8 See note 2.

9 Zhejiangsheng dili jianzhi, p. 255.

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could drive them to lie to their superiors by under-reporting abnormal happenings and understating the severity of any resulting devastation in their jurisdictions.\textsuperscript{11} Second, the effects of climatic events recorded in the sources were not really external to the state of water-control systems. No system under such a climatic pattern was designed without a certain competence for coping with climatic vagaries. So a potentially damaging event—say, heavy rainfall which was capable of producing a flood in certain circumstances—would not necessarily cause consequences severe enough to arouse the concern of local governments and find their way into the records.

In this way, ascertaining and recording natural disasters that affected local economies were to some extent a matter of perception. This in turn could be determined by such factors as the level of hydraulic development, agricultural regimes, local social and economic institutions, and even the attitude of the observers. Thus, not all climatic abnormalities were recorded in contemporary sources, or when recorded, they were not evaluated in a manner that was consistent across space and time.

In the middle of Ming period, Shaoxing experienced rapid economic development in term of both population growth and the integration of local economies into nation-wide markets. It is evident that this development created the stimulus as well as pressure for the expansion of water control. The economic aspects of and forces for the development of water control in Shaoxing have been examined in other studies as noted earlier. It is impossible, as well as outside the scope of this study, to calculate the actual share of each factor in contributing to the formation of the Shaoxing landscape.

\textsuperscript{11} The underreporting was quite prevalent in Zhejiang under the Qing to the extent that it attracted the attention of some officials. See a memoir submitted to the throne by the Broad of Revenue in 1729 in \textit{ZTZ(1735)}, vol. 2, pp. 1447-8; also Ho Ping-ti, \textit{Studies on the Population of China, 1368-1953} (Harvard University Press, 1959), p. 227.
could drive them to lie to their superiors by under-reporting abnormal happenings and understating the severity of any resulting devastation in their jurisdictions. Second, the effects of climatic events recorded in the sources were not really external to the state of water-control systems. No system under such a climatic pattern was designed without a certain competence for coping with climatic vagaries. So a potentially damaging event - say, heavy rainfall which was capable of producing a flood in certain circumstances - would not necessarily cause consequences severe enough to arouse the concern of local governments and find their way into the records. In this way, ascertaining and recording natural disasters that affected local economies were to some extent a matter of perception. This in turn could be determined by such factors as the level of hydraulic development, agricultural regimes, local social and economic institutions, and even the attitude of the observers. Thus, not all climatic abnormalities were recorded in contemporary sources, or when recorded, they were not evaluated in a manner that was consistent across space and time.

In the middle of Ming period, Shaoxing experienced rapid economic development in terms of both population growth and the integration of local economies into nation-wide markets. It is evident that this development created the stimulus as well as pressure for the expansion of water control. The economic aspects of and forces for the development of water control in Shaoxing have been examined in other studies as noted earlier. It is impossible, as well as outside the scope of this study, to calculate the actual share of each factor in contributing to the formation of the Shaoxing landscape.

"The underreporting was quite prevalent in Zhejiang under the Qing to the extent that it attracted the attention of some officials. See a memoir submitted to the throne by the Broad of Revenue in 1729 in ZTZ(1735), vol. 2, pp. 1447-8; also Ho Ping-ti, Studies on the Population of China, 1368-1953 (Harvard University Press, 1959), p. 227."
However, climatic changes seem to have been liable in part for the development of water control. From the twelfth century onwards China saw an increase of the instability of its climatic regime, in accordance with a slight trend towards a world-wide weather pattern characterized as "secular climatic variations of smaller magnitude and shorter duration," or in other words, as "a deterioration of the climate toward a more continental regime." The high possibility of climatic fluctuation over China has been attested by meteorologists and historians. Their evidence is almost exclusively drawn from the "written data", namely the records referring to floods, droughts and other climate-determined disasters like locust plagues that they find from the voluminous gazetteers, yearbooks, diaries, county annals, and governmental documents of several hundred "observation sites" throughout China. The final outcomes have been incorporated into an atlas, which to some degree substantiates these two characteristics of the world climate pattern in the recent millennium.

As regards the measurement of annual precipitation in these special data, there are two indicatory systems adopted. One comprises five grades and it is applied to the Atlas, while a system of nine grades is adopted in other studies. The classifications of both systems are totally based upon descriptive observations made of droughts and floods as such as, well as their devastating consequences. The latter is classified under the five grade system. In this system Grade 1 refers to vast deluges described in the records as causing a high toll in term of the lives of people and domestic animals, and the destruction of large quantities of crops

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and property. Grade 2 is defined as spates caused either by sudden heavy rain, a prolonged wet season or by falls of rain outside of the right season, whose consequences are limited to a relatively small area or short duration. Under Grade 3, annual rainfall is normal and thus good harvests rather than famine are usually reported. As for Grade 4, a shortage of irrigation water is responsible for a harvest that is poor but not very severe. Grade 5 indicates the "big droughts" that are usually described in sources as in such terms as "not a drop of rain has fallen from April to August" and the "bottom of rivers and reservoirs being laid bare". The drought of Grade 5 were always followed by massive starvation.

The alternative system divides the range of gradations into nine grades. We adopt the first system in the following.

Furthermore, the climatic changes over these regions where the observation sites were set up are therefore able to be seen from the data. Unfortunately, there was no observation site set up in Shaoxing, nor have its written data been systematically collected and analyzed, and the results incorporated into the Atlas. Our evidence about climatic variation over Shaoxing is thus based on the estimations shown in the following table which is reproduced from data from two sites neighboring Shaoxing, to the north and west respectively.¹¹

<table>
<thead>
<tr>
<th>Regions</th>
<th>Precipitation Grades</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
</tr>
<tr>
<td>Hangzhou</td>
<td>30</td>
</tr>
<tr>
<td>Lake Tai Area</td>
<td>25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>55</strong></td>
</tr>
</tbody>
</table>

¹¹ The data of Hangzhou prefecture is reproduced from the Atlas. The data of the Lake Tai area are from "Cong taihu liuyu halao shiliao kan lishi qihou xinxi chuli,“ 從太湖流域旱澇史料看歷史氣候信息處理 [An approach to the datum analysis of historical climate information concerning floods and droughts in the Lake Tai basin] by Chen Jiaqi 陳家其 dili xuepao vol. 42, no.3, (Sept. 1987).
It appears that northern Zhejiang experienced a relatively pluvial period during the given period. Relative, that is, to the local observers' expectations. In fact, this wet climate was a result of the climatic fluctuation that probably began before tenth century and continued to into the nineteenth century. Based on the records of gazetteers, Chen Qiaoyi's research suggests that during 143 years in the Southern Song (1127-1278), Shaoxing had a wet climate, and hence suffered more from floods (38 counts), than droughts (16 counts). This climate continued into the Ming. This was followed by a dry climate in the following periods in which more droughts were recorded than floods in sources. Similar interpretation of this climatic fluctuation, but with different periodical divisions, also suggests that this region experienced more floods (one in every 1.3 years) in the Ming than in the Qing (one in 1.7 years). Speculation on the implication of any climatic change suggests that this presumed pluvial period may be interpreted differently. It could be seen as "a time of more frequent extremes" which only indicates changes in variability, or one that reflects a trend of change in the average climatic conditions by comparison with the early patterns. Being not necessarily associated with either of these two controversial questions, the above evidence suffices to indicate, though with uncertainty in some ways, that in relative terms, Shaoxing was under an unusually wet climate as were its neighboring areas in this period.

Manifesting itself significantly in the development of water control, the wet climate was of decisive importance as an environmental pressure, rather than an opportunity, compelling Shaoxing habitants to commit themselves increasingly to water control. This is a case of perhaps the most obvious

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16 Fang Zaihui et al., 1984, p. 90.
linkage between climate and men. It seems impossible so far to show precisely to what extent that the climatic stress was responsible for the development of water control in Shaoxing as opposed to the flood regimes and tidal influences as well as social and economic factors. It is reasonable to say that these factors in combination were all agents of change.
Chapter 4: The Upstream Area

In Shaoxing, reservoirs are referred to as hu 湖. This term is the literal equivalent of "lake" in English, but in Shaoxing dialect at least, it considerably means more than a sheet of water contained within land. What hu denotes in the context of Shaoxing water control refers to lake system, that is, a technical and institutional complex comprising a water-storage reservoir, feeder and drainage channels, dikes along the main drainage channel, and rice fields within the command areas as well as management structures. It is in terms of this local definition that hu is here rendered a "lake" rather than "reservoir" so as to bring out more than just its hydraulic functions. The latter term is used only to refer to water-storage tanks both human-made and natural, as a principal component of a lake system. On the other hand, the term "lake" conveys more or less the state of these lands before the water-storage systems were constructed, and also denotes the social boundaries of a lake-based community which are not implied in such hydraulic terminology as "reservoirs" and "water-storage tanks".

This chapter is particularly concerned with the development of lake systems in the late Ming, a period in which the Shaoxing water control reached the apex as noted in the previous chapter. There were numerous difficulties in maintaining these lake systems in operational condition. Some of them were imposed by natural forces such as the rapid rise of flood water due to the vagaries of weather, and the torrential flow of rivers caused by the steep gradient of the landscape. Others were related to human behavior such as encroachment on lake lands, and the poor repair of dikes due to the lack of or ineffectiveness of institutional structures. In Shaoxing, particularly in the late Ming, the development of the lake systems was to a great extent acted upon by the interactions of hydraulic
technology with natural processes on the one hand, and with sociopolitical factors, particularly governmental intervention into local water-control affairs, on the other. The evidence for the latter aspect goes against the conventional assumption that considers governmental involvement to have been minimized and the development of water control to have only been acted upon by economic and demographic movements.¹ A understanding of these interactions is therefore pursued in this chapter.

The principal source materials for this chapter are largely derived from the book, The Complete Documents Relating to the Summary of Regulations for Managing the Countryside, (Jingye guilu quanshu 經野規略全書) (hereafter The Complete Documents in the text below).¹ It is a mixture of documents concerned various disputes on the protection of the lakes, the assignment of responsibility for repairing dikes, official sanctions against behavior considered harmful to the operation of the lake systems, official survey data on dikes and the rice fields behind the dikes, plus four prefaces to an early Qing edition. The book was compiled by Liu Guangfu 劉光復, the county magistrate of Zhuji 諸暨 from 1598 to 1604. Some of the texts, however, refer back to earlier periods. It thus provides important and detailed information for our understanding of lake systems and their significance in


² The book comprises three volumes each containing one or two chapters. The pages are not paginated in a uniform order. The title of the book is abbreviated as JGQ wherever it is referred to in the footnotes below. The book was published first by in Liu Guangfu probably in Zhuji, and reprinted by some members of local gentry-scholars in 1733 and 1866.
Lake Construction

The upper reach area was characterized as a narrow valley in which the city of Zhuji county was located, as seen in the traditional illustrative map given below (and which is presented "upside-down"). The landscape was characterized by the numerous lakes which were set at the foot of mountains. These lakes fed into the Puyang River that served as the main drainage channel on the valley floor. They were all named, and according to the gazetteers and other sources, there were at least seventy-two lakes by the middle Ming.

Zhuji County from *Shaoxing fu zhi*, 1804 edition.

To a great extent this map conveys to us that these lakes were once swamps and marshes, and subject to seasonal flooding from water running down from the mountains. It is said that in earlier times, people constructed seventy-two lakes in mountain valleys. Flood waters running off mountains were thus regulated, and wetlands in the valley floor were reclaimed for settlements and rice paddies. The gazetteer
compiled in the Kangxi Reign (1662-1723) contains a text which provides us with an observation through contemporary eyes of the environmental conditions in earlier times against which local habitants had constructed these lakes in order to cope with floods:

Zhuji is situated where the mountains meet, and looks down upon the banks of the rivers and their confluence. For this reason, when there are sudden rains and a swift rise in the water-level, the currents of a multitude of torrents vie with each other for mastery.... These hydrological threats to Zhuji county arise from the lack of a means to drain the water, but there are also threats from a lack of supply of water. Everyone has long understood that, since drainage and supply functions are carried out in a mutually dependent fashion, it is difficult for them to be separated... It is for this reason that they have built enclosure-dikes (yu 圃) to form seventy-two lakes.¹

Information concerning how the Zhuji people in the earlier times constructed the lakes is rather scanty in the gazetteers. It appears that even the compilers of the late Ming and early Qing gazetteers did not know much about the early history of these lakes. Only two of them are mentioned in The Complete Documents as being constructed since the second century. The lake construction was continued into 1960s. But it was largely concentrated in mountains with the assistance of modern technology.

**Technical Components of Lake Systems**

In general the lake systems in the upper basin were distinguished from those in the lower reach area not only in

¹ Quoted from "Water Control in Zhedong during the Late Ming," Morita Akira's article, translated by M. Elvin & K. Tamura, East Asian History no. 2 (Dec. 1991), pp. 35-36.
function but also in configuration. Most of the lakes in the lower basin were created from depressions and served agriculture mostly as floodwater collection places and a means for water traffic. The irrigation function was met largely by taking water from south-north running channels which linked in creeks from hills to the south of the Shan-Gui plain. In the upper basin, a primary function of lakes can be understood from a Song text as followings:

Water barrage lakes (beihu 襄湖) exist everywhere within the boundaries of the prefectures of Ming 明 (Ningbo prefecture to the east of Shaoxing) and Yue 越 (the name of Shaoxing before 1131). [They] are all located higher in altitude than the farm fields, the latter lying higher than the rivers and seas. In times of drought, people let water flow down to irrigate the fields below, and in times of flood, excessive water in the fields is drained out to the river and sea. Hence, there are no worries about droughts and floods.

However, all lakes in the upper basin fell into two categories according to their topographical features. Those bordering on the Puyang River were designated as "flood drainage lakes in contact with the tides (yanjiang tongchao hu 沿江通潮湖)." A most important component of these lakes was entrenched dikes along the Puyang River which in the upper reach-area were characterized by the rapid rising of the water level once heavy rain had fallen in the mountains. Those lying at the immediate foot of mountains and not in direct communication with the Puyang River constituted the other kind. Depending on the topographic features and the elevation at which they were located, some of them were linked in succession by channels relaying the water of one

5 JGQ, volume 1, chapter 1, p. 14a.
to the next one below. The rapid deposition from water-borne sediment constituted the main problem for their operation.

The combined technological components of the lake system as a whole performed a variety of hydraulic functions, but they were maintained under different institutions. To understand the lake system operating as a whole, we need first give an account of the structures of the different components and the corresponding institutional set-up respectively.

Water-storage reservoirs or tanks, called dang 瀘 in Zhuji, constituted a crucial component of a lake system. Some reservoirs were enclosed by dikes which, called "inside dikes" (neigeng 内埂), were small in size compared with the defensive dikes along the Puyang River. Below a reservoir lay rice fields which were irrigated through sluices and drainage channels. Water from the reservoir's catchment was directed into the reservoir by artificial feeder ditches or natural rivulets. Most lakes were single reservoir cascade systems. One reservoir might or might not be linked to another one. Some reservoirs were located at different altitudes and connected by a diked channel meandering down the hillsides, forming a multi-reservoir cascade system. A layout such as this is described in The Complete Documents as followings: "a diked ditch (yonglie 堰埭) stretches among hills and connects up [to several water storage reservoirs] like a string of beads." According to the operational rules of a lake that were formulated by Liu Guangfu, when too much rain fell in the catchment areas, the reservoirs of higher altitude were not allowed to drain water to the lower lakes but only to drainage channels connecting directly to the Puyang River.

A lake was usually named either after its initial promoter's name or in accordance with its geographic features, while a reservoir was referred to only by the name of the lake with which it was associated. Some reservoirs supported a variety of aquatic plants and fish. The villages or

*JGQ, volume 1 chapter 2, p. 7.*
townships nearby them were therefore known for the particular aquatic plants they produced, such as lotus roots. The local government was much concerned with these reservoirs not only to assure the taxes from these aquatic products but also to assure the operational conditions of the whole lake system. From the government's point of view, all reservoirs fell into two categories in term of ownership. Most small reservoirs and all the large ones belonged to the government, or were claimed designated government possessions as "public reservoirs" (guan dang 官塘). In this sense they were pre-modern commons, being controlled and protected by rules formulated by local governments and freely open to all local habitants for fishing and the collecting of aquatic plants. The products collected there were all subject to light taxation by the government. There were some smaller ones that belonged to individuals and were referred so as to as "private reservoirs" (sidang 私塘) to be distinguished from the public ones.

In contrast, all farmlands below a reservoir belonged to individual farmers. According to land surveys, the outcomes of which were recorded the Shaoxing gazetteers, the territorial acreage of a county was usually broken down into the following categories: rice fields, dry lands (referring to cultivated lands not suitable for rice cultivation), mountains and hills, and rivers and reservoirs, as well as beaches and sandbars in some coastal counties.

The irrigation efficiency of these reservoirs is showed in the following table which compares the water surface of reservoirs to the area of the irrigated paddies in the upper basin. The data are drawn from the gazetteer of Zhejiang compiled in 1733, and they therefore reflect only the situation of the early Qing.
<table>
<thead>
<tr>
<th>Counties</th>
<th>Rice land</th>
<th>Reservoirs</th>
<th>Water surface as a % of area irrigated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pujiang</td>
<td>3154.23</td>
<td>172.27</td>
<td>5.5</td>
</tr>
<tr>
<td>Yiwu</td>
<td>4634.87</td>
<td>649.55</td>
<td>14.0</td>
</tr>
<tr>
<td>Zhuji</td>
<td>8139.94</td>
<td>306.49</td>
<td>3.8</td>
</tr>
</tbody>
</table>

Unit = qing 坡。7

The water level in these reservoirs fluctuated seasonally. Some lands around a reservoir were therefore intentionally reserved as the flood area to collect excess water in the wet season. In quite a few cases, farmers were allowed to cultivate these lands, and the proceedings from the taxes on the collection of reeds and other aquatic plants there were used to maintain the facilities of the lake.

Dikes (geng 柑) were another basic component of the lakes. As indicated previously, the Puyang River and its tributaries could rise suddenly. Dikes of various sizes stretched along rivers and streams to contain the river currents and they were all known as "outside dikes" (waigeng 外壩).

The maintenance of these dikes, particularly along the Puyang River, needed a great deal of attention and substantial input. This is shown by the example of a dike which was constructed at the point at which two waterways of the Puyang River joined. It was thus confronted with enormous river flow while at the same time it protected seven lakes lying behind it. In 1601, Liu Guangfu organized a project to rebuild the dike in stone. The dike was reinforced in a new manner: "its foundation is formed of pine stocks driven into the earth; the body of the dike is made up of large, broad rocks laid on top of the pine stock foundation. The gaps between these rocks are filled with rubble".8 The costs were

7 During the Qing, a qing amounted to 6.7 hectares. See G. Deng, Development versus Stagnation: Technological Continuity and Agricultural Progress in Pre-modern China (Westport, Conn.: Greenwood, 1993), p. xxv.
met by money levied on all farmers with land behind the dike, according to area of their fields. Not all dikes along the Puyang River were rebuilt in stone, but most were rebuilt in the new fashion during the early Qing. In 1728 Zhuji experienced several floods. Some dikes that lay at high and risky places were rebuilt in such a fashion. Farmers first removed loose earth on the top of the ground by digging deep trenches, and then laid stone blocks inside the trenches. After the dikes were ridged up, they drove in wooden stocks along the inside of the dikes to back them up in confronting the pressure from rapid water flow.9

On the basis of a thorough investigation, Liu Guangfu put forward a set of directives concerned with how to keep water-control facilities, particularly dikes, in good condition and how to save dikes in crisis. It consisted of twenty-one provisions which were put together and designated as "Matters that Concern the Future" (Shanhoushiyi 善後事宜).10 When the need to repair dikes arose, the government sent assignment orders to all dike leaders concerned, reminding them that it was time to work on the dikes. The warrants were usually issued to dike leaders to reinforce the dikes at the end of autumn when rainfall was rare, for instance; and in the summer when floods could occur at any moment, the warrants were sent to draw the dike leaders' attention to the need to be alert to the situation facing the dikes. These orders were written on a big wooden board. For the former matter, the boards were called the "boards for dike reinforcement" (jiagengpai 加埂牌), and for the latter, the "boards for dike saving" (jiugengpai 救埂牌). The following illustration shows people transporting materials for dike repair in a critical situation.

9 JGQ, volume 1, chapter 1, p. 10b.
9 SFZ (1793), vol. 2, p. 404.
10 JGQ, volume 1, chapter 2, p. 16-21.
This is found in the Complete Documents. The panel on the upper part is a dike-saving warrant and in the illustration below are two people carrying materials who are being hurried off their feet by a dike leader carrying an emergency lantern. At the bottom of the page is a technical directive on how to shore up a breached dike in an emergency. The warrant is rendered as follows.

Zhuji County: Warrant for preventing [floods] and Controlling Water

A warrant concerned with preventing floods and relieving flooding disasters in Zhuji county in Shaoxing Prefecture: The dike leader, labor-group heads, and farmers assigned to this lake are to have stake-timbers, bamboo and

\[\text{JGQ, volume 3. The text is quoted from M. Elvin and K. Tamura's translation of Morita's article with some modification.}\]
straw mats, and lanterns prepared. When there is a flood they are to go on patrol night and day. People shall be organized to provide each other mutual protection and assistance. If there is anyone who is lazy or neglectful in arousing the mass, so that they fail to cooperate, and a breach occurs as a result, the dike leader concerned shall report his name for pursuit and investigation. If a dike leader or labor-group head who has been assigned is neglectful and does not provide leadership, he too shall be punished without mercy. A warrant requiring to be despatched.

Listing:
Dike leader XXX Labor-group head XXX
Landowner XXX Landowner XXX
Landowner XXX Landowner XXX

The above possessing ..........fields, with dikes.

The above warrant commissions the dike leader concerned.

By Order

Received by the clerk for execution on the day, of the month, of the 31st year of the Wanli period.

In Zhuji, dikes were thus considered the most important components of lake systems so that Liu Guangfu paid more attention to them than to others. He spent three winters inspecting and surveying one hundred and sixty-one dikes in Zhuji. The survey data he compiled comprised the length of each dike and the acreage of the farm-fields behind it. On the basis of the survey, the responsibility for the regular maintenance of dikes was assigned to those who had farm fields behind them. All results were compiled into a pamphlet, designated as the figures derived from the measurement of the lake-dike lengths and the survey of land acreage in divided sections (zhangliang hugeng tianmu fenduanshu 丈量湖埂
It also contained a map indicating the location of these lakes and dikes, but more importantly, it included data on the preserved flood-lands such as their acreage, locations and their present situation.

In contrast to the upstream area, in the lower reach area, overflows were often caused by obstructed water drainage due to the siltation of river channels. Otherwise, the major problem was largely to do with dike reinforcement. Thus differences are accounted for by the different physiographic features on the two areas. In the case of the upper reach area, the rapid currents of the Puyang River scoured the river-bed and consequently created little or no siltation of water deposit even though the water was carrying a heavy load of sediment. At the same time, the river torrent itself imposed difficulties with the maintenance of dikes and caused many dike breaches and collapses.

Sluices (zha 閘) were set up on both reservoir dikes and ones along the rivers. Sluices, particularly on the reservoir dikes, were prone to filling-up from sediment. Their maintenance was so costly that some fields nearby were purchased by the government in order to provide the income needed.

Official channels and private culverts (guanli siyin 官瀦私瀦). Reservoirs were all connected with feeder channels and drainage channels. They were all considered the government's property. Certain activities involving channels were seen as potential threats that might lead to the disfunction of the channels. Encroachment by way of planting crops on the beds of drainage-channels (lihji 溥基) could lead to a reduction of the discharge capacity. Similarly, setting up screen-nets in the channels to catch fish could very likely impede water flow. Both practices were therefore prohibited by the official sanctions. In addition, setting up private culverts (siyin 私瀦) was restricted to those between fields and small channels. No culverts were allowed to be laid to drain off excess water from farm fields directly to rivers for such culverts.
could lead into dike breach when the river was flowing at a high water level. The duty of overseeing the construction of private culverts was assigned to dike leaders.

The Reserved Lands

In addition to encountering natural forces, lake systems in the upper reach area were also under threat from encroachment. The unsustainability of the lake systems drew up a great deal of attention from the local government and communities. There were rules and sanctions concerning the protection of lakes. They were the institutional components of lake systems that were formulated and put into force by the government.

In general, encroachment was considered opposed to a principal goal of water control, that is, to minimize the impact of natural hazards on agriculture rather than to increase yields. As a source indicates, Xie Lingyun 謝靈運 (385-433), a baron in Shaoxing, approached the prefect, Meng Ji 孟覔, with a request for the permission to reclaim the Huizhong Lake 回錦湖 in the east of the Guiji city. He was then rejected and told that the lake was being used for irrigation and therefore farmers all saw it a surety of farming. In the Song, encroachment was denounced by local governments as immoral conduct against public goods. Some wealth families and high rank officials thus gave up their intents to reclaim some lake-land into farming fields for fear that their conduct would affect badly the majority of the public; but illegal reclamation was never stopped.

In the Ming, encroachment became less morally restrictable; and people of all social strati could be found involved in it as population grew. Some local government even promoted lake reclamation to increase revenue. However, encroachment by individuals almost encountered fierce

12 SFZ (1588), vol. 2, p. 627.
oppositions from the public. The tension between conservators and encroachers went greater than ever before. Some local elite and magistrates were aware that water control should be first and most carried on to secure farming rather than to increase yields and thus came to argue their cases against lake encroachment. My sources indicate that it is in the middle Ming that the realization of these two different implications in water control was crystallized and taken in as the principle of water control by the public.13 The Complete Documents records numerous cases of lawsuits against lake encroachment, and contains several prosecutions lodged by dike leaders and even farmers. All these cases were argued to directly protect this principle.

On most occasions, encroachment took the form of either 1) converting the flood-lands around water-storage reservoirs (xidi 隙地) into paddies, 2) illegally claiming a reservoir as individual property, and thereby depriving other people of using it, and 3) installing fishing nets in the middle of discharge channels in such a way that they would impede water flow. Against encroachment of the first type, prosecutions were launched on the ground that the encroached land was government-owned and reserved for water control. Therefore, restoring it to what it was before was obviously in the interests of the government as well as the majority of the local population. Such disputes sometimes escalated into bloody violence, and some continued to be argued for years afterwards since it was difficult to return the encroached land back into flood-land. As noted earlier, Liu Guangfu organized a survey of every piece of flood-lands around all the lakes, (zhang xidi 丈隙地). The survey results were cataloged under the name of each lake and were printed out in the form of book which was kept by the government and local dike leaders. He then forwarded a detailed statement to the Shaoxing prefectural government requesting to be able to set up stern sanctions against any future encroachment.

13 SFZ (1588), vol. 2, p. 405.
In some spots where disputes had occurred due to the unclear demarcation of flood-lands from individual lands in former periods, boundary posts were installed to establish the lines. No one was allowed to reclaim any new lands created from floods. Liu's work earned him great appreciation from farmers and his survey records were reused to help solve disputes even in the Qing. This marked what we may consider an initial but significant movement towards the formation of water-control commons or public reserves in Zhuji. Such resources were never institutionally defined or preserved by governments in other counties, even within the Shaoxing region. With his extensive involvement in Zhuji water control, Liu Guangfu emerged as one of the significant identities of the public sphere that were engaged with the affairs of rural society.

Among the lawsuits recorded in the Complete Documents there are two cases referred to in detail which illustrate the functions of what we call public works in village society. The first case was lodged by residents the Houtang Lake 后塘湖. A water-storage reservoir of approximately fifty mu was located here with which all surrounding farmland was irrigated. From 1597, a farmer called Wang Neng 王能 had begun to reclaim the bottom land, turning it into farmland and pretending to lease it from an official household. This was a notorious means of illegal encroachment on reserved flood-lands and by implication, local common good. Such activities were quite pronounced in the Yangzi valley in the late Ming and Qing, and were condemned as "false tenure" (maodian 冒佃) by righteous local elites and government. This particular encroachment caused the failure of harvests around the lake in successive years. Using his personal connections, Wang Neng was able to persuade a dike leader, Wang Zun 王尊, not to report the matter to the county government. In the next year Liu Guangfu came to Zhuji to take the post of magistrate. As soon as he heard about the case lodged by residents around the lake, he reacted by taking a trip to
the lake area. On his journey he was met by "thousands of local residents kneeling in the road to implore relief from the mishap". After the case had been verified, he ordered the return of the reclaimed land back to water. Wang Neng as well as Wang Zun were convicted of encroaching on common property and both received forty heavy strokes. The official household involved was also obliged to withdraw its false claim of ownership over the reservoir. In addition, this case was reported to nine officials of higher authority who each gave it second consideration. As a result the two were both convicted of criminal action. Wang Neng was sentenced to being humiliated in public by wearing a neck-shackle and being paraded through all villages around the lake for thirty days; and both were finally exiled to the northern borders and had their land confiscated by the government.¹⁴

Another case was concerned with the deprivation of farmers' access to water by the seizure of streams and water tanks. The extract given below is the complaint submitted with the lawsuit. It relates the difficulties that commoners of a lake-based community encountered in dealing with a powerful family whom they were unable to restrain from encroaching, and gives the reasons why governmental intervention was required.

Complaint of Residents in the 64th Canton

On a certain day, the eighth month of the 32nd year of the Wanli period.

I, Huang Ting 黃廷 (residential number, 14), hereby lodge a complaint concerning the violation of official sanctions. By official prohibition no-one is allowed to set screen-nets across sluice-gates, or to erect stone stakes in the middle of channels connecting to lakes. All residents around the lake obey these prohibitions. It is only rich people such as, Yu Zhen 楊震 (residential number 62) and several others living around the Lake

¹⁴ JGQ, volume 1, chapter 2, pp. 41-44.
area who seize [benefit] by fishing and collecting water-grass in this government-owned lake. In collaboration with Bao Tao 保陶 (108) [dike leader?], they have set up screen-nets across most sluice-gates in order to catch fish for profit. This badly affects fishing in the lake. This complaint, passed through tithing head He Su 何溯, is hereby lodged with the county government together with our serious concern.

Huang Ting (14).\(^{15}\)

Yu Zhen was so unbridled in taking away other people's fishing benefits because his brother held a post in government elsewhere. By Liu Guangfu's judgement, Yu was, however, convicted of "incursion into public interests", and was subsequently sentenced to being lashed and fined. The money was used to have a stone stele set up on the lake dike, on which the prohibitions in question were inscribed.\(^{16}\) In Shaoxing, however, not all lakes were fortunate to be safeguarded from encroachment. Many of them shrank and some disappeared from encroachment that accelerated with the increase of siltation rate as well as with the yielding of the water-control principle to extensive encroachment. The history of Xiang Lake 湘湖 in Xiaoshan presents itself as a case of the failure in upholding the principle and its consequence as we will see later in Chapter 8.

The government involvement in local water control even extended into some technical areas, which in turn, enhanced its position not just a promoter but also as a manager. The following are the official prohibitions that were formulated by Liu Guangfu and promulgated to all farmers for them to obey.

1. The chopping and clearing of bamboo and trees that block the waterways must not be neglected.

\(^{15}\) JGQ, volume 1, chapter 2, p. 34.

\(^{16}\) JGQ, volume 1, chapter 1, p. 4b.

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2. Sluices must not be built without authorization. At times when it is (nonetheless) necessary to do so, they must be consolidated inside and out with stone slabs, and mishaps avoided by having a supervisor take care of them.

3. The flow of the river must not be obstructed as a result of building dikes or walled enclosures on the foreshores.

4. It is forbidden to encroach on the paths running along the tops of the dikes, or on the official roadways beside the east and west banks of the rivers, by erecting rough fences or planting thorns.

5. The collapse of dikes must not be instigated by the building of tile-firing kilns or latrines inside them.

6. It is forbidden to scrape material away from the foot of dikes, making them thinner, and leading to mishaps.

7. It is not allowed to plant vegetables, beans, mulberries, tallow-trees or fruit-trees on top of the dikes, so converting them into private property.

8. Unauthorized dikes are not to be erected on river foreshores or on flood-lands outside of official dikes that have been reported for taxation.

9. Tenants are not to be put on land purchased (by the government) for the purpose of serving as a passageway for water, nor on public burial grounds that have been recovered to effect the discharge of a debt, nor on any other land owned by the government.

10. It is forbidden to build houses in a manner that encroaches on constricted areas such as dike-paths and riverside roads.

11. Water may not be discharged from small water reserves through conduits into major lakes.

12. Catching fish by means of intercepting the current of streams and of lake drainage-channels with screen-nets is banned.
13. It is not allowed to construct fish harbors with stone slabs, as these create wave turbulence and cause dikes to collapse under the impact.

14. It is forbidden to encroach on either the beds of drainage-channels feeding into lakes or on the beds of run-off ditches for water outside the dikes.

15. Catching fish by spreading pocket-nets or installing screen-nets across the sluices and locks in the various lakes, and so causing the crops in the fields to be submerged, is forbidden.

16. Timber merchants are not to float rafts of wood to Three Rivers' Mouth (that is one on the middle course of the Qiangtang River) or other places on the river during the summer and autumn as this obstructs the water flow and causes flooding.

17. Encroaching on water stored in official lakes is not allowed.

18. It is not permitted to allow tenants on old riverbeds that have filled up with sediment, thereby encroaching on them.

19. Unauthorized reservoirs may not be excavated at the foot of dikes.

20. It is not permitted to catch fish by putting poison into the eastern or western rivers, or into mountain streams or lake drainage-channels anywhere in the county.

21. Shellfish are not to be gathered from the foot of the dikes by using a lance to scrape them into a 'foot-net' [bamboo basket]."
the Puyang waterway which had been reported to impede water currents and cause the overrun of the river. One such loop of ten kms. and another of thirteen kms. were eliminated by the efforts of more than three thousand laborers called up by Liu Guangfu. 18 The outcomes of these straightening projects were not well appreciated by all members of the elite particularly in the lower basin. Some of them in the lower reach areas noted that after the river course was straightened, the force of the river current increased. 19 This created more threats of breaches in dikes than ever before in the downstream areas, and thereby increased the costs of dike maintenance.

18 JGQ, volume 1, chapter 2, p. 27.
19 XXZG, vol. 1, pp. 233-34.
Moving the sight away from the upstream areas, we find the downstream areas comprising a coastal plain created by the withdrawal of the sea water from its most recent maximum about seven thousand years ago when it was a few meters higher than is today. To some point, the landscape in the downstream areas is characterized by the existence of inland drainage systems and the sea walls that differ from the lake systems in the upstream area not only in function but also in environmental settings and institutional configurations, as well as historical paths of development.

Illustrative Maps 1, 2, and 3 illustrate the shaping of the present plain from the early fifteenth century to 1980. By the close of the eighteenth century, the northern plain began to grow north into Hangzhou Bay. As a result the old shoreline that was enclosed by sea walls was left permanently inland. A century later, the big bend took already its present shape in the lower course of the present Qiantang River, which as a geographical feature has been presumed to have given the Qiantang River its other name, Zhejiang, (visually も, the zigzagged river). In the eighteenth century, the Qiantang River current flushed back to the original southern bank a few times probably as result of big floods from the upstream or tidal change due to the effect of typhoon, but it soon flowed back to north.
(Illustrative Map 1) The Shan-Gui Plain in the early 15th century.

(Illustrative Map 2) The Shan-Gui Plain at the close of the 18th century.
Various reasons have been put forward to explain the causes of the shift of the Qiantang River’s lower course or the formation of inner Hangzhou Bay. In the 1940s, for instance, some geologists asserted that the formation of inner Hangzhou Bay was likely to be accounted for by human activities particularly in Shaoxing. However, this held less attention from historians than from geologists at the time.

The present chapter is concerned with the construction of the inland drainage system and sea wall. Its focus is on the interactions between water control and natural processes, particularly river behavior and flooding regimes, the effects of which were responsible for the creation of the hydraulic landscape of the plain.

1 There has been some controversy over the origins of this name among historians and geographers. Zhu Tinghu 朱廷祜, for instance, holds that human intervention in the two sides of the Qiantang River, particularly by means of water control, was to a great extent responsible for the formation of the Qiantang River course. See "Qiantangjiang xiayou dizhi zhi yanjiu [A geological study of the lower Qiantang River reaches], Jianshe jikan 2: 2, 1948. I have not had access to this issue, but his argument is outlined in the article by Chen Qiaoyi as cited in the following note.

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Before the eighth century, most of the plain was a tract of wetland on which natural processes constantly displayed their forces: frequent tidal incursions from Hangzhou Bay created numerous lagoons and saline swamps in low-lying land bordering the bay, while the area further inland was cut through by creeks and rivers and hence subject to floods. Human activities in northern of the plain were limited to salt-production around lagoons and probably the planting of food crops within diked enclosures of small size.

The first hydraulic work on a large size was the creation of a reservoir system known as Mirror Lake (Jinghu 鏡湖) which was built in the second century. It took the shape of a pair of wings stretched out at the foot of hills in the south of the plain, collecting the waters which ran down from the hills and irrigating the fields below it.

At the time of construction, its circumference was 358 kilometers in length and the area of water surface 107 km.$^2$. At normal times it collected the waters of thirty-six creeks from the hills in the south. The prefect Ma Zhen 馬臻 initiated the project in A.D. 141. The lake was in fact constructed by assembling together a number of small and separated lakes that already existed earlier. Ma Zhen had a larger dike built to connect them up into the big lake and set several sluices on it to regulate the flow of lake water. The northern part of the lake’s command areas still suffered from the tides of Hangzhou Bay invading inland from the north edge of the plain and along the Qianqing (Puyang) River. In response, Ma Zhen also had a sluice built between two hills, a facility known as Yu Hill Lock (yushan doumen 玉山斗門) which functioned in association with the dikes along the Qianqing River and Hangzhou Bay.
As a consequence, nine thousand qing of land below the lake were assured of water supply during droughts and were free from the threat of floods and tidal incursion from the bay. In the periods that followed, this area developed into the center of economic activity and settlement for the whole Shaoxing region. The capital city of the Yue prefecture (Shaoxing) was sited on the area with the higher concentration of fertile paddies.

Some modifications were made to the lake system later on. Among them, the most significant change was the rebuilding of Yu Hill Lock under the aegis of Huang Fuzheng, the commissioner of the eastern Zhejiang circuit in 788. By the early twelfth century, the continued existence of Mirror Lake had fallen into jeopardy. It had silted up, and the newly risen lands been converted into farmland by farmers. A debate as to whether the lake should be dredged or abandoned arose among the local elite. However, as powerful local households who were anxious to obtain lake-bottom land due

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to its high fertility were involved in the process of encroachment on the lake, the reclamation went out of control. By the late Southern Song the lake was largely abandoned. Its physical structures were left firstly in disrepair and later in ruins, and its organizational structures disintegrated. Today what we know about its physical configuration is largely derived from written records in gazetteers as well as from its remnants in the form of small expanses of water on the old site.

There were several other water-control works built in the period after the Han. The Xixing Canal 西興運河 was dug under the aegis of He Xun 賀循 probably in the fourth century. It was approximately two hundred kms. in length cutting through the major part of the Shan-Gui plain from east to west. The canal was a combination of small channels that had existed earlier. It served as the only east-to-west waterway in the plain. The original purpose to dig the canal was to expand the command area of Mirror Lake. By the late sixth century, the Sui government began to use it as a traffic highway connecting the Qiantang River with the Caoe River in the east of the plain, and with Ningbo 寧波 later. It became important for transporting grain and troops because Ningbo had developed into an area of considerable economic significance since the fifth century. It thus became a section of the Canal which in most part was dug in the early seventh century. The responsibility for repairing the canal largely remained a task of solders probably up until the early Ming. After Mirror Lake was abandoned, water from the thirty-six creeks that flowed directly into the canal was redirected into the drainage channels running south-north direction below the canal. The canal was not primarily dug to solve the drainage problem caused the abandonment of Mirror Lake, nor did it act on the change of flood regimes that was accelerated in the plain later on. It contributed to the shaping of the Shaoxing landscape nothing more than giving a cross-cutting mark on the map as one who has read
through several centuries of the Shaoxing gazetteers would find.

Confrontations against Tides

With the expansion of reclamation further north in the periods that followed, the efforts of the habitants in Shaoxing inevitably came into confrontation with natural processes. Sea tides, for instance, were a problem very difficult to cope with. As noted above, the extensive lands in the north of the plain were still prone to the incursions of sea tides before the early eighteenth century. Along the northern edge of the plain lay an immense dike, known as the north-sea-wall (beihai tang 北海塘). Like Mirror Lake, the sea-wall was built by linking small and separated dikes that were constructed to protect salt-production fields in varying periods before the eighth century. The earliest dikes can be dated back to the first century B.C.\(^1\) This explains why the compilers of Ming gazetteers did not seem to have information concerning when the sea-wall was constructed, as it worked as an aggregate structure. Several walls had in fact existed in a row. They were not constructed in any consecutive order, nor in the same periods, with the order and dates of construction even varying between different sections. In some places a new wall was built outside the old one when the Qiantang River flowed away from the old one. Elsewhere a new one was built behind the old one as a result of collapses in the old wall after a south-flush of the Qiantang current. In the sources, they, however, are all generally referred to as "sea-walls" (haitang 海塘), with each section being named differently according to its topographical features or the name of the places where it was located.

The construction of the sea-wall brought significant change to the inland environment of the plain. Tidal incursions

\(^3\) Chen Qiacyi, 1962. p. 195.
were largely excluded, making it possible to reclaim the expanse of wetlands behind the wall. Its construction did not, however, provide the development of agriculture and other economic activities in the plain with a stable environment. The future of Shaoxing's development was thereupon plunged into constant and immediate confrontation with a tremendous natural force, that of the tides of Hangzhou Bay which are known nation-wide for their rampant power.

Then, the maintenance of the sea walls became costly, and thus constituted a ever greater imposition on the local economy as more and more breaches and breaks occurred as a result of the change of the tidal patterns. Thus, inhabitants of Shaoxing had to expend a considerable of what they obtained from rice paddies on maintaining the vital sea-wall. This can be seen from that fact that the Shaoxing people were rather conscious of these environment-imposed difficulties. From the eighth century on, massive and costly repairs to the sea-wall have been regarded as significant local events and thus documented in the various writings of Shaoxing history. In 726, a magistrate of Guiji county, Li Jun 李俊, organized massive repairs to the sections of the sea-wall in Shanyin and Guiji, known as the Shanyin-Guiji sea-wall (Shan-Gui haitang 山会海塘) or the "rear-sea" wall (hou haitang 後海塘) (Hangzhou Bay is sometimes referred to as the rear-sea by the local inhabitants of Shaoxing). The costs in terms of labor and money were very great. In successive periods breaches were frequently reported to local government. The funds needed to rebuild it were so great that the government appealed to the provincial government for aid. In 1214 it was again broken in several places and breached in others. Magistrate Zhao Yandan 趙彦淡 applied to the court for financial assistance. Ten hundred thousand strings of money and sixteen thousand shi 石 of rice were granted for rebuilding the collapsed wall in stone. In addition, the court also approved a diversion of several

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*SFZ (1720), p. 1638.*
thousand strings of money from Shaoxing's tax quota to the rebuilding project. After the wall was eventually rebuilt in stone, the government assigned 578 mu of paddy fields nearby the wall and 372 mu of hillside land which had been confiscated from Du Siji 張思济 in Zhuji to provide proceeds for future annual repairs.

Even so, the costs of the sea-wall repairs continued to increase. In 1271, sections in Xiaoshan were washed away by a fierce tide backed by a typhoon. The Shaoxing prefect applied to the court for support in rebuilding the collapsed wall in stone. He changed his mind later, and asked for aid in rebuilding it as an earth dike once he realized how high the estimated costs for stone work would be. After the new wall had been ridged, he had "numerous pine-tree stocks driven into ground as a protective screen standing outside the wall" and had a great number of willows planted on and behind the wall. It thus became known as the "ten thousand willow wall" (wanliuti), and soldiers stationed nearby were assigned to take care of it. There were a great number of wall breaches and collapses recorded in the gazetteer in the periods that followed. In the early Ming, the wall was reinforced with stone after a massive collapse following a big tide. Within a few years, it collapsed again, and a new wall was then built behind it. In 1496, the new wall too was broken by tides. In 1583, overflows pushed by a big tide were recorded as a result of another massive collapse.

On every occasion when an emergency occurred, laboring teams of thousands were called up from all counties in the prefecture. The Ming court approved the use of all grain stored in imperial granaries in Shaoxing to hire laborers in order to repair the broken wall. Even this was insufficient for the task. The prefectural government also went so far as to impose a levy of 0.8 tael in silver on each mu of paddies

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5 *SFZ* (1588), vol. 2, p. 332.
6 *SFZ* (1720), vol. 3, pp. 1641-42.
7 *SFZ* (1720), vol. 3, pp. 1641-44.
in Xiaoshan and three li on that in Shanyin and Guiji. Furthermore, a great portion of the support was given by the central government in cash. The total used in term of silver for the 1583 restoration amounted to two hundred thousand tael. There were many more relatively minor collapses and breaches that were only briefly mentioned or not recorded at all in the sources because their consequences and the costs of their restoration were not as great as others.

By the early Qing as the course of the Qiantang River shifted towards the northern shore of Hangzhou Bay, a large stretch of beach was left in the front of the sea-wall, and it seemed that the threat of tidal incursions had decreased. However, Qing gazetteers still record several disastrous breaches as the result of the sudden back-flush of Qiantang currents probably as a result of typhoons. From the middle Qing on, the river course no longer turned to move back towards the southern shore, and the tidal threats were therefore removed.

*Action upon and by Flood Regimes*

A further case of interaction between natural processes and inhabitants of Shaoxing has concerned with the current of the Qiantang River.

The Xiaoshan county is located in the western plain. A levee of huge size stretches along the shore of the Qiantang River following its bends. The levee has always been known as the Western-River Levee (*xijiang tang* 西江塘) to distinguish it from the sea-wall to the northeast. (Map 4)
Inland Drainage System in the Shan-Gui Plain in the middle Ming.

1 Sea wall. 2 Western River Levee. 3 Qi Hill Cut-through. 4 Ma Creek Dam. 5 Maoshan Dam. 6 Beima Sluice. 7 Biatuo Sluice. 8 Toujia Sluice. 9 Yu Hill Lock. 10 Zhe Woods Sluice. 11 Fishery Lake. 12 Lin Lake.

The levee counters the current of the Qiantang River, and hence protected a large stretch of land behind it, where the city of Xiaoshan county is situated and the majority of the Xiaoshan population have settled. The process of constructing the levee is little documented in the gazetteers. Like the sea wall, its construction was completed by linking up a number of small separate dikes built most probably for salt production before the twelfth century. Unlike the case of the sea wall, the threat to the sustainability of the levee came principally from the river's mighty current which constantly pounded it at the turning point of the Qiantang's S-shaped bend. This occurred particularly in the wet season between late summer and early autumn when the Qiantang River flowed at a high level. Even at normal times when the river level was low, the river flow caused constant erosion at the base of the levee. From an essay written by a Ming local degree-holder, Huang Jiugao 黃九皋, we can comprehend the critical location of the levee in the confrontations with floods, and the difficulties in making the levee sustainable:
(The Western-River Levee) lies just at the right side of the south-north bend (of the Qiantang River). The mighty current constantly pounds directly on the levee because it stands where the river course winds. This constitutes the first threat. The two banks of the large river [i.e. the mouth of the Qiantang River at the Hangzhou Bay] are separated from each other by a distance of eighteen li. The water surface there is open like the sea and therefore the river flows gently. The current never pounds on the north and south banks. But the upper river course is so narrow, less than a li in width, that it cannot contain flood water, and therefore the river finds it very difficult to discharge. This is a factor that makes it easy for the current of the upper river to become torrential and to overflow, constituting the second threat. Xiaoshan is situated in the low-lying land to the east of the river. To the southwest of the river are the eight prefectures of Hangzhou, Yuanzhou, Huizhou, Xinzhou, Jingzhou, Quanzhou, Wenzhou and Chuzhou (where the Qiantang originates and flows through). There are many lofty peaks and steep slopes to be found within these regions. When heavy rain continues to fall, waters from these mountains become torrential, like rain-water rushing down off a roof. At such times the river flows in a fierce fashion downwards the east where Xiaoshan lies. This rushing water is the third threat. Whenever the mountain waters pour in, causing the water level of the river to rise up to the top of the Western-River Levee, the levee reaches crisis point and can hardly withstand the forces. The situation worsens as long as water continues to come down from the mountains, and is most critical at those times when the morning or evening tides rise up from the sea, being pushed by easterly winds, like a range of mountains rushing rapidly inwards. If the tide
is small, the water level will fall as soon as the tide retreats. When a big tide rises and the water level of the river continues to rise due to flood-waters from the mountains constantly pouring down with no sign of end, the currents from the two directions come into confrontation with each other and make a tremendous sound. The levee can barely withstand this enormous force; and at this point, if there is no a place like the Dongting Lake to collect excess flood water, the collapse of the levee and the overflowing of inland are inevitable. This is the fourth threat.  

To sustain this tremendous current, the levee was necessarily constructed to a large scale: it was three zhang in height, the width of the base was five zhang and that of the top was halved. In addition, several critical sections were reinforced with big blocks of stone which were buttressed by a row of large wooden stocks driven into the ground behind the levee. Many trees were planted on the levee and some farmers set up their residences on it. Dike leaders were assigned to regularly inspect the situation and to organize periodic maintenance.  

Since the middle fifteenth century, the insustainability of the levee increased as a consequence of the diversion of the course of the Puyang River. This diversion was achieved after the Qixian Hill, also known as Qi Hill, in Xiaoshan was excavated through (Map 4). This diversion was made in response to the environmental problems caused by the construction of the sea-wall and the doing away with Mirror Lake. The completion of the diversion reduced the threat of flooding to the Shan-Gui plain and then was followed by the reclamation of extensive wetland along the old waterways of the lower Puyang River (the Qianqing River). However, it also caused by itself new environmental problems. Solving these new problems brought a new imposition to the already  

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8 XXZG vol. 1, p. 235.
enormous and upward spiral bill of the costs, such as money, efforts and organizational resources, for the interventions through water control. The Shaoxing local economy and society were thus locked in the interplay between human efforts and environmental processes. The case of the diversion and its effects sheds indeed some light on our understanding of the nature of the Shaoxing water control.

After the sea-wall was completed, the Shan-Gui plain was no longer in direct contact with Hangzhou Bay except when the sea-wall was broken. This separation, however, created many unexpected problems. One of these problems was related to flood drainage. As Mirror Lake filled up, and was reclaimed into rice paddies, there were no places left to collect the flood-waters of the thirty-six creeks running from the mountains to the south of the plain. In the wet season it was difficult to drain out excessive water through existing drainage outlets which included the Xixing canal and the old exit of the Puyang River. Both the fields that were formerly irrigated by the lake, and the land was reclaimed from the lake bottom suffered from inundation when heavy rains fell in the southern mountains.

In addition, before the diversion was completed, the Qianqing River emptied into Hangzhou Bay at its old exit on the eastern edge of the plain where it was met by the Caoe River also flowing south-to-north in the east of the plain. Accordingly, this place of flux place was and is now called “The Mouth of the Three Rivers”. The waterway of the lower Puyang (Qianqing) River was characterized by numerous bends and narrow channel that were prone to throw impediments in the way of the current and hence to cause flooding on the plain when the river flowed high in the wet season.

Before the cut-thought was completed, efforts at solving these drainage problems were made. Some fertile farming fields were abandoned to make a flood place, known by local residents as Lake Bi, in the middle course of the
Puyang River within Zhuji and bordering Xiaoshan in order to collect flood-waters from the Puyang as well as from its surrounding hills. Residents in the plain also built at least thirteen sluices and dams to control the flood-waters in the plain. A few were set on the Qianqing River’s waterway and others on the creeks and channels that linked south-north to the Qianqing River to prevent flood-waters from pouring in and overtopping the Qianqing river, a problem largely related to the disappearance of Mirror Lake. The linkage of the inland flooding with the reclamation of Mirror Lake was obviously perceived by contemporaries as seen from the following text:

Since Mirror Lake has been abandoned and the sea-wall built, the water from the West Small River flows down (into the Shanyin-Guiji plain) like water pouring into a bucket. There is only one sluice at Yu Hill [Yu Hill lock, also known as "the old lock" after its function and drainage area were taken over by the Lock of Three Rivers later on] to control floods. It is therefore impossible to drain off floodwater completely. The counties of Shanyin, Guiji and Xiaoshan are all suffering. People have built sluices and dams to control waters, such as these of Zhe Woods 柘林, Xingui 新靉, Biantuo 扁拖, Toujia 佗夾, New River 新河, Kan Hill 龲山, and Long Hill 長山 etc. They are thirteen in total, but they cannot contain the descending waters in the wet season. Several other sluices have thus been built on the river’s banks [the Western River Levee] such as the Gu Dam 顧壩 and Baiyang Outlet 白洋倉 in Shanyin, and Zhezhi 柘枝 and the New Dam 新壩 in Guiji. They all work well. In conjunction with the Puyang River configuration, several lakes have been constructed in the upstream reaches to contain floods. This is a matter that human beings are able to undertake... (However) the consequences

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9 SFZ (1588), vol. 2, p. 405.

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are still all determined by Heaven.\textsuperscript{11}

In the present day, the locations of these structures are still recognizable either by their physical remains or by the place names identified with them (see Map 4).

All the structures discussed above did not solve the problems but alleviated them. Together, their inadequacy was the justification for the diversion project. Shaoxing communities were thus pushed forward, though step by step, by both natural processes as well as the human-made environmental problems in the transformation of the plain landscape.

After the cut-through was completed, two dams, Maxi ba 麻溪塲 and Maoshan ba 茅山塲, were set in the old waterway close to the point of divergence and were later both rebuilt into two locks that only allow a trickle of the Puyang water to pass through and to flow into the Qianqing River. By so doing, the Puyang water was redirected northwestward and it joined the Qiantang River at a new debouchment in the middle section of the Qiantang. This indeed reduced, but did not do away with, the threat of floods to the Shan-Gui plain. In the periods that followed, the flow of the Qianqing River dwindled greatly, and hence many lagoons and wetlands associated with it in the plain were reclaimed into rice fields.

However, the diversion created its own problems particularly in Xiaoshan and Zhuji. Because of the diversion, the volume of the Qiantang River's run-off from the middle course downwards increased greatly. As a result a new threat to the Western-River Levee arose. This consequence was not unforeseen by contemporaries in the time shortly after the cut-through was completed. Huang Jiugao, for example, perceived such interaction as a result of the diversion in the following text:

\begin{quote}
In the Chenghua Reign, the Hon. Dai Hu, first came to administrate Shaoxing. He found that most paddies in
\end{quote}

\textsuperscript{10} SFZ (1793), vol. 2, p. 359.
Shanyin, Guiji, and Xiaoshan were all suffering from the Small River [the Qianqing] every year, and that there were many saline marshes and reedy grounds along the (Qianqing) river. They could be all reclaimed into rice paddies. He then made a survey of the surrounding topography, and found that there were some casual channels between the north of Lin Lake (Linpu 臨浦) and the south of Fishery Lake (Yupu 渔浦) through which small boats could pass. A small hill called Qixian Hill stood as a barrier in the passage. He then had it excavated through so as to rechannel the Pu River [the Puyang River] northwestward and to flow through Fishery Lake into the big river [the Qiantang River]. Since then the Pu River has joined the big river and both flow together in one waterway... Thus, those who live along the small river have been greatly benefited from its dwindling. The wetlands and reed grounds along the river have been all reclaimed into residential areas and rice fields. It must be said that these benefits do derive from the "merit" of the so-called Hon. Dai. However, the threat of overflowing of the western river [the Qiantang River] has thereby increased. 11

The conjunction of these two rivers was at the bend where the Western-River Levee was located. This conjoining not only increased the volume of the Qiantang run-off from its middle section but also changed the old pattern of its former flow against which the levee was originally set up. A great many whirlpools emerged as a result of this added influx. They tended to swirl around at the foot of the levee and scooped away at the levee's foundation day and night. The levee was thus exposed to the increased risk of collapses and breaches. This hydraulic effect was observed two centuries later by a member of the local elite, Zhou Zhimian 周之冕 who in 1666 described the change in the Qiantang River's current

at this bend. The outcome of his observation is recorded as follows:

The Western-River Levee stands to one side of the (Qiantang) river which sustains the flow of waters from Jing, Qun, Hui, Wu and Jiyang [Zhuji]. It is subject to collapse from floods. People in the past have discussed the critical situation with which the levee is faced. They have all expressed concern that there is no possible way to make the levee sustainable. What is responsible for this situation? The sea-wall is a crucial structure. However, it should not suffer damage because water [in Hangzhou Bay] rises very slowly with tides regardless of its being extensive. After the earth wall was rebuilt in stone, (people) there thought they would be free from worry about the wall all the time. However, the water of the western river runs rapidly like water rushing down off a roof. When it reaches the bend in its course, the current is thrown back and forth, and turns into a mass of torrential whirlpools revolving around and around. It has scooped up the riverbed and created a deep ditch of several xin 厘 in depth and several tens of xin in length along the front of the levee base. Even though many large rocks form tiers in front of the levee, they work no better than floating duckweed and fallen leaves in confronting the current. Even though the levee has been rebuilt in stone, it is nevertheless hard to predict what will happen to it in the near future.\footnote{XXZG, vol. 1, p. 241.}

The outcome that resulted from this change was to prove truly devastating. The frequency of levee breakages increased in the periods after the diversion. This can be seen in the increase in funds required for the rebuilding and repairing of the levee. In 1585, a magistrate of Xiaoshan, Liu Hui 劉會, requested the provincial government to distribute the
increased costs for the maintenance of the levee among neighboring counties. To justify his request, in his proposal he made special reference to an early practice of distributing the costs for constructing the sea-wall in Haiyan 海鹽 (to the north of the Hangzhou Bay) and also in a contemporary case for constructing the Lock of Three Rivers. By the same token, Huang Jiugao, one of his contemporaries, put a similar proposal to the provincial government. Huang, for his part, requested a subtraction from Xiaoshan's tax quota with which to support the maintenance of the levee. In addition, Huang overtly pointed out that Dai Hu was to blame for causing the insecurity of Xiaoshan agriculture by the diversion project that he sponsored.

There was a further case, namely, that of the construction of the Lock of Three Rivers (sanjiang zha 三江閘) at the old exit of the Qianqing River, which showed that the formation of the Shaoxing landscape was to great extent acted upon by the interaction of water control with environmental processes.

Although the cut-through diverted most of the Puyang River flow away, it solved only part of the drainage problem of the Shan-Gui plain. Waters pouring down from the thirty-six creeks were still capable of causing floods, particularly in the area in the center of the Shan-Gui plain that was reclaimed from Mirror Lake in the late Song. On many occasions farmers had to break the dikes along the Qianqing River to let water run out and also had to break the sea wall in order to allow flood waters to drain out into Hangzhou Bay and so save the lands that were reclaimed from wetlands behind the sea wall. But this, in turn, caused another problem. Because of the temporary outlets, water drained away so efficiently that so farm fields in the plain suffered from drought in the period following flooding. This cause-effect relationship was discerned by contemporaries. A Shanyin gazetteer accounted for the occurrence of these

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floods and droughts as being the result of the mistakes, namely, the reclaiming of Mirror Lake and the construction of the sea-wall in order to reclaim the large piece of land behind it. Xu Huang, an early-middle Ming native of Guiji described the causes of flood and drought he perceived as follows:

Shanyin, Guiji and Xiaoshan are the three counties that lie in the plain which measures a thousand li around. There are hundreds of creeks that pour into the plain. Since water drains away as fast as it runs down from the hills, the fertile land there suffers from droughts. When obstructed, the water of the thirty-six creeks overruns and the land becomes a vast flood plain. People drown in the water, not to mention suffering the destruction of their crops.

In addition to his human-made environmental problem, the tidal influence that invaded the plain from the open exit of the Qianqing River also created disasters. This problem drew great concern from local elites and government, but solutions were not to be found until a century later after the diversion was completed. According to the sources, the Shaoxing people simply attributed the emergence of the resolution to construct a river lock at the Mouth of the Three Rivers to the personal virtue of the Shaoxing prefect, Tang Shaoen. In fact this decision was much related to a factor. Upon arrival in Shaoxing in 1537 to take over the post, Tang was made aware of the sufferings of the local people and decided to build a river-lock as a final solution. However, when he spoke his opinion to local elders, most people just cast their doubts on the possibility to build a lock since the river bed around the mouth lacked the stone

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15 Quoted from M. Elvin & N. Su, 1993. For original text, see Cheng Mingjiu 程鳴久 comp. in 1702, Sanjiang zhawu quanzhu 三江閩務全書 [The Complete Documents of the Three Rivers’ Lock Administration], shang juan, p. 11.
ground for the foundation of such a large structure.\textsuperscript{16} It was only by chance that Tang Shaoen found an underground rock vein running across the river-channel "like a rocky pavement". Indeed, this finding revived his resolution which he had almost given up.\textsuperscript{17}

The lock was a stone-framed structure. It was made up of twenty-eight sluices, each one of which was named after one of the twenty-eight stellar mansions (xiu 宿). The construction technologies involved are described by M. Elvin and N. Su in their article as follows: "It was constructed between two hills that were joined by a natural stone pavement into which the huge stones of the lock's foundation were "mated" and caulked with a sort of paste made out of boiled millet stalks and lime or mortar (hui 灰). It was flanked to the north by an earth wall that was 4000 feet long and 400 feet broad, reinforced by iron and later bamboo in a fashion that the sources do not specify except to note that it was needed because the 'mud' (nao 潢) of which this barrier had been made proved 'unpredictable at first'. The flow of water was regulated by means of a double layer of wooden planking in each sluice."

This lock has served ever since as the cornerstone of Shaoxing's water-control network. The construction brought a show of great honor from local people towards Tang Shaoen, the promoter and engineer, both at that time and later on. Its construction has come to be evaluated as a great technological achievement in the history of pre-modern Chinese water-control. The process of the construction was inscribed at great length on stone tablets and copied repeatedly in local gazetteers and the essays of elites of several later generations. Its first all-around repair was carried out some fifty years later. The director of the repair project, Xiao Lianggen 蕭良干, the Shaoxing prefect of the time, was also given as much honor by local inhabitants as was Tang

\textsuperscript{16} Sanjiang zhawu quanshu, volume 1, p. 11.
\textsuperscript{17} Sanjiang zhawu quanshu, volume 1, p. 11.
Shaoen. Their images were worshipped together with others in shrines located near the lock.

The construction of the lock marked the coming into being of an integrated water control network in Shaoxing. It could be said that under the protection of water-control works, Shan-Gui plain was by and large spared much tidal and flooding havoc. This was a great achievement in many senses, but at the same time, Shaoxing was not totally freed from natural hazards. Long-standing problems relating to the development of water control remained or intensified, or else changed into other guises, and could not be actually eliminated.

Reclamation of Wetlands

Following as a consequence of the extensive construction of water-works facilities was the massive reclamation of low-lying lands in the plain. As noted above, before the Southern Song, reclamation was mostly confined to the flats at the foot of hills in the south part of the plain. The larger part was still characterized by numerous wetlands, the existence of which remained more or less in association with tides of Hangzhou Bay as well as the flood water of the Puyang River. Reclamation was less well documented in gazetteers and was less of a feature in local elites' writings than was the construction of water-control works. We do find that some places possessed names that derived from geographical features such as lakes and marshes which seem no longer to have existed at the time when these gazetteers were completed in the late Ming. In the west of the plain, for instance, there were two places still called Fishery Lake (yupu 漁浦) and Lin Lake (linpu 隨浦) up to the present-day. In fact they once used to be wetlands and were well-known, as two lakes, for their size and beauty, and were mentioned in many poems of the Tang and the Northern Song. Geographically they had originally been two lagoons of the Qiantang River, and in
The flood periods, they also functioned as a temporary exit of the Puyang River to the Qiantang River. After the early twelfth century the West-River Levee was first built between small hills, and then gradually stretched southwestwards, eventually shutting off all contact between Fishery Lake and the Qiantang River. As a result these lakes shrank and finally disappeared from the landscape of the plain by the time of probably the late thirteenth century. What then emerged at the bottom of the vanished lakes was rice paddies, villages, and commercial towns although some depressions were deliberately retained as water reservoirs. Examples are the White Horse Lake (baimahu 白馬湖) and the Xiang Lake (湘湖) (an artificial lake that I will turn to later). By then the whole Shan-Gui plain was sealed up like an huge diked enclosure except at the old exit of the Puyang River at the eastern edge of the plain and the ferry of the Xixing Canal on the West-River Levee which both remained open as exits to the Qiantang River. In addition, before the lower Puyang course was diverted in the middle fifteenth century, there were a number of small lakes in the west of the plain that were still in existence. As a result of the diversion, almost all of the Puyang river flow was redirected away from the area, and they then experienced the same fate as the above two lakes.

In the middle of the plain a massive reclamation was triggered after the Lock of Three Rivers was set up. Between the period after the Puyang River course had been diverted and before the Lock of Three Rivers had been built, there existed a large area between the sea-wall and the Qianqing River. As noted earlier, before the sea-wall was constructed, this area was subject to the influence of tides from Hangzhou Bay, making it a wetland characterized by numerous saline swamps and lagoons. After the sea-wall sealed off all contact with Hangzhou Bay, it was gradually reclaimed into farmland that was known as "sea land" (haitian 海田) in

18 XXZ (1681), vol. 5, pp. 172-73.
government tax records.

Water control meant more to Shaoxing farmers than just control of floods. It was also a means by which farmers could alter the implications of the location of their lands and their soil type. For example, by channelling fresh-water into saline swamps and thereby washing the soil that had once soaked in brine, they were able to make them suitable for rice growing. In addition, we read in a modern agriculture manual of Zhejiang that there is a sort of soil called "wet-field rice-soil" (shuidaotu 水稻土) which is in fact a man-made soil-type that is produced after land has been under very intensive rice cultivation for a certain time.

According to the taxation assessment system of the Ming, all farmland in Shaoxing fell officially into four grades (and a number of subgrades) based on land productivity. In the first grade were those lands reclaimed from the bottom of Mirror Lake, referred to as the "lake lands" hutian 湖田. These were the most productive rice fields in Shaoxing. Making up the second were the lands at foot of the southern hills (shantian 山田), which were in fact the oldest rice-fields in Shaoxing. The third category was the sea-lands. In the bottom grade were the lands in the middle area (zhongxiangtain 中鄉田) which were subject to immersion by salt water flowing in with tides through the old exit of the Qianqing River before the Lock of Three Rivers was built. After most of the Puyang River water was diverted into the Qiantang River, and the Lock of Three Rivers completed to prevent tides from flushing in, the Qianqing River was no longer a hazard to the plain at least at normal times. A large portion of the lands in the middle area was reclaimed and tamed, making it very suitable for rice growing. Within successive periods lands of this area became more and more productive, so much so that by the middle of the seventeenth century, their taxation assessment was upgraded to the second category, above that of the hill-lands and sea-lands.

In late Qing, due to other factors unrelated to water control, such as the construction of a railway across the land, this area became the one in which a dense population as well as highly productive rice fields were located, and this situation remains up to the present day.  

Additionally, the process of reclaiming the Shan-Gui plain was driven by a population increase in the region. According to gazetteers, between 1008-1016, Shanyin and Guiji counties (occupying the whole Shanyin-Guiji plain) had a population of 50,000. By 1201, the population was 102,000; in 1368-98, it reached 303,000; then 604,000 during the period 1522-66. By 1802, it had risen as far as 1,008,000. There is no question that the increase in new rice farmlands hardly kept pace with the population growth. By the early Qing land reclamation had already reached its limit. As indicated by a late Ming gazetteer, "all marginal lands that are close to water are all reclaimed now, and what little remains unfarmed is no more than small strips outside of rice fields."  

The case of Lake Bi in the upper area of the Puyang River illustrates the extreme that, ushered in and backed by water control construction, reclamation reached in the early seventeenth century. In contrast to Mirror Lake which disappeared as a result of sedimentation, Lake Bi was wiped out through intensive reclamation soon after the Puyang River course was diverted. Its disappearance triggered an intense dispute within and between communities as the lake was located on the border between Zhuji and Xiaoshan. From a geographic perspective, it lay between the upper-and down-stream reaches of the Puyang River, at the point where the river left the restricted mountain valleys and reached the western Shan-Gui plain. Lake Bi was originally created by turning a small water-logged depression into a flood-water storage reservoir of the Puyang River. The project was promoted by


21 SFZ (1588), vol. 6, p. 2442.
and completed under the aegis of the Xiaoshan magistrate, Cui Jiana 崔嘉納, in the period 1341-1367. Before the course of the Puyang River was diverted, the peak discharge of the Puyang River rushing down from Zhuji was impeded only by the bends in the Qianqing River on the plain. The lake was consequently built in the middle course of the Puyang in order to store flood-water which otherwise would have inundated farmland below in Xiaoshan. After the Puyang River was diverted, the lake lost its function as a flood-water regulator and immediately dwindled in size. By the early Jiajing period (1522-1567) a scramble for farmland from the lake-bottom land took place.

The disappearance of Lake Bi was responsible for a renewed vulnerability of the lake area to floods. Certain magistrates who were more concerned with the likely threat of floods than the needed increase of farmland perceived this potential vulnerability. One magistrate even sought to restore the lake, but his attempt came too late as it proved impossible to identify precisely which places were once under water. Accordingly he ordered that the fields at thirteen spots where there still exited small amounts of water fed by trickles be turned back into lakes. In 1535, another magistrate, Xu Kui 徐魁, made an inspection of the thirteen spots and then reversed the previous decision by allowing farmers to reclaim the lands into farm fields as government-owned land.22 In 1557, a magistrate sold off all these lands to local residents in an attempt to cover the costs of rebuilding the city of Shaoxing walls in response to the increasing threat of "Japanese pirate" attacks along the east China coast.23 With the granting of this official permission, an extensive reclamation proceeded. In the tenth month of 1598, when Liu Guangfu arrived in Zhuji, he found

22 JGQ, volume 1, chapter 2, p. 11.

23 For the action and the resulting social and political impact of Japanese pirates, see Kwan-wai So, Japanese Piracy in Ming China During the 16th Century (East Lansing: Michigan State University Press, 1975).
that the lake no longer existed. Some of the farmers lodged a request, appealing to him to preserve some depressions in the lake area for the purpose of storing excess water in the wet season. He responded by ordering those who had reclaimed land to restore it back into reservoirs. To confirm the public nature of these reservoirs, he erected several stone steles at these spots specifying that everyone had the right to fish and cut reeds in the reservoirs but no one was allowed to claim private ownership of them. It seems that his efforts did not bear the outcomes intended. Even while he still was in office, lawsuits concerning encroachment on these reservoirs occurred one after another.

While the struggle between the partisans of the reclamation and the restoration of the lake intensified among residents around the lake, another dispute was proceeding between Zhuji and Xiaoshan. The construction of the lake had been based on an agreement between the two counties that the tax quota of the land in Zhuji lost to the lake would be reassessed on the land that benefited in Xiaoshan. This was known as the "substitutative assessment" (daina 代納). As a result of the disfunction of the lake, more than forty-two thousand mu of farmland were reclaimed within it by residents around the lake. In the late Wanli period (1573-1619), Xiaoshan elites collectively submitted several requests to the prefectural government in order to persuade it of the need to remove this assessment. The following is one of these requests showing how tense social relation could be due to the extensive reclamation resulting from the development of water control:

Before the Chenghua Reign (1465-87) Qixian Hill and its surrounding areas in Xiaoshan were in connection with water [of the Qiantang River] from Jin and Qu 金衢 [the prefectures of Jinhua and Quzhou]. The water [of the

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24 JGQ, volume 1, chapter 1, p. 11.
25 XXZ (1662-1722), vol. 1, p. 405.
Puyang River] from Yuan and Ji (Yuanzhou and Zhuji counties) flowed through the Ma Stream (Maxi 麻溪) into a the river [the Qianqing River], and poured out of the Three-Rivers' Mouth at the end of the Qianqing River. Its flow snaked through many bends along its course and therefore did not discharge easily. Farming was badly affected by this. Lake Bi was located in Zhuji and bordered on Xiaoshan. The latter, as it were, borrowed the lake to collect the flood-waters, thereby reducing the force of [the Puyang River's] current. Farming [in Xiaoshan] has been therefore assured. Ever since then, Xiaoshan has paid the tax quota for Zhuji to the extent of about a thousand shi each year. According to prefectural gazetteers, the lake is designed to collect flood-waters, so the land on its bottom is not allowed to be reclaimed into farmland. In later periods, since our magistrate completed the cutting-through of Qixian Hill, the lake has no longer served to collect flood-waters and therefore Xiaoshan has no longer relied on it. From that time on, the lake began to be reclaimed into fertile fields, but Xiaoshan is still bearing the tax quota. During the Jiajing Reign (1522-66) [the period may be misstated here], a former magistrate, Lin 林, learned of this anomaly and tried to reverse it after discussing it thoroughly with the elders, but because he was soon transferred to a higher post elsewhere, his plan did not come into force. Around the time of the thirtieth year of the Wanli period [1602], Liu Guangfu, a magistrate of Zhuji, had some loops (qujian 曲澗) of the upper Puyang straightened since he knew that Qixian Hill had been already cut through. Since then, the Puyang River has poured in a more torrential fashion than ever before down into the Qiantang River through the debouchment at Fishery Lake. In consequence, two levees in Xiaoshan [i.e. the Western-River Levee] have come under threat from the rushing current, while the property of Zhuji
derived from the lake is forever free from the disaster of being inundated.

Lake Bi used to serve like a bucket into which the flood-waters poured, but now its water flushes immediately down to Xiaoshan like pouring into a gully. In the old days people who directly benefited [from the lake] were all happy to pay the substitution quota, but now no one is willing to do it any more. Moreover, as the lake has been reclaimed into farm-land, it should bear its own tax quota. It is not just to tax twice regardless of whether the people of Xiaoshan should or should not carry this substitution assessment. 11

In another proposal they made their argument by stressing that Zhuji was left free of floods due to the diversion, while Xiaoshan was left suffering. The West-River Levee was, for instance, left in a position vulnerable to the forceful currents of the Qiantang River as a result of the change in the pattern of the Qiantang flow. This made it difficult and costly to maintain the levee. Some members of Xiaoshan local elites simply ascribed the heavy burden of Xiaoshan tax quota, a phenomenon prevailing in the lower Yangzi valley generally in the Ming period, to this substitution. 27 They therefore made a claim on Zhuji for the costs spent annually on maintaining the levee. This was calculated in grain paid to laborers for the maintenance of the levee. No information concerning the result of this dispute is given in the gazetteers, but the fact that concerns us here is, however, that the lake was never restored.

The abandoning of Lake Bi to farmlands brought an end to the agricultural reclamation of large inland wetlands and lakes in Shaoxing. Since then, inland reclamation was limited to marginal lands along the Qianqing River and around lakes, which only made some tips for Shaoxing's agricultural expansion

26 XXZ (1662-1722), vol. 1, p. 431.
27 XXZ (1662-1722), vol. 1, p. 431.
and contributed little to the revenue increase. The technological capacity of water control for the expansion of rice fields seems to have been all but exhausted, and its renewal was not made possible until two factors occurred in the late Qing. These were, firstly, that accompanying a shift of the Qiantang River course further north, the land outside of the sea wall began to expand northward into Hangzhou Bay. Secondly, some new techniques and construction materials were introduced in the Yangzi valley, which included the use of cement-made large blocks, in substitution for stone ones, to protect the current from pounding directly on river banks. Then, the further expansion of the Shaoxing agriculture relied almost entirely on coastal reclamation. To elaborate on this development is outside the scope of this study. However, the case is referred to here for it helps us further identify the role that water control and the environmental processes in combination played in the process of the Shaoxing landscape transformation.
Chapter 6: The Highlands

Equally, Shaoxing experienced dramatic environmental change in its highlands that lie to the south of the coastal plain. The impact that the Shaoxing people brought in the highlands was however different from that they did in the lowlands. From the tenth century or probably earlier, the forests in the Shaoxing highlands began to decline. This trend continued through Yuan, and eventually led to the destruction of the woodlands by the seventeenth century. The outcome can be seen from a saying which originated in the late thirteenth century: "Shaoxing has hills but no woods, water but no fish, and men but no righteousness". By the middle seventeenth century most woodlands in this region had disappeared as a result of human exploitation.

Several factors accounted for the woodland destruction, but not all equally in the same way. The way and the periods in which different tracts of woodlands experienced the degeneration and the eventual destruction varied greatly. Forests in some localities fell victim to unrestricted exploitation in earlier times; that in others was uprooted

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1 This mocking pun was used first by the people of Hangzhou adjacent northwest to Shaoxing to characterize the notorious cunning of Shaoxing people. See J. Gernet, Daily Life in China on the Eve of the Mongol Invasion (London: G. Allen & Unwin, 1962), p. 247. It indicates that by that time, outsiders like the local people of Shaoxing had witnessed this environmental countenance of Shaoxing highlands.


The destruction of woodlands was obvious in the whole Yangzi valley. Since the late fourteenth century the region experienced severe shortages of timber and firewood for industrial use. Evidence particularly concerning shortages in the Ming and Qing periods is presented by Li Bozhong 李伯重 in his two articles, "Ming-Qing Jiangnan gongnong ye shengchan zhong de ranliao wenti" [Problems relating to fuels of industry and agriculture in the Jiangnan regions in the Ming and Qing periods], Zhongguo shehui jingji shi yanjiu 中國社會經濟史研究 vol. 4, (1984), pp. 34-49; and "Ming-Qing shiqi Jiangnan diqu de mucai wenti" [The problems of timber in the Jiangnan region in the Ming and Qing periods], Zhongguo shehui jingji shi yanjou 中國社會經濟史研究 vol. 1, (1986), pp. 86-96.
much later. While some forests were suffering from uncontrolled logging and fuel-collecting, others in adjacent private domains were well preserved up to the fourteenth century.

The destruction of woodlands was in no sense an intended goal of local inhabitants. Before the Ming, when people lived in the mountains, their activities and mountain settlement had little impact on the environmental stability within their own domains. The extensive destruction did not take place until the Ming when the highland society began to decline and eventually collapsed as a result of the dramatic social changes in lowlands.

It is as yet extremely difficult and next to impossible to reconstruct and describe the process and the rates of the Shaoxing highland environmental change in terms of the natural sciences in this chapter. Rather, taking account of the variations of human activities on the highland environment and of the resulting environmental effects, the present chapter focuses on the social aspect of the Shaoxing highland history. It looks at changes in the ways in which Shaoxing inhabitants made use of their highlands, and then investigates into the context in which these changes took place. Finally, it takes account of the environmental effects of the woodland destruction on water-control activities in the low land.

Destruction of Woodlands

Commercial exploitation

Beginning in the fourth century, and to the second half of the twelfth century, the Yangzi valley was the destination of southbound immigrants. Especially after the Song Court abandoned North China to the Jin regime and eventually moved its capital to Hangzhou, to the northwest of Shaoxing in 1127, this region saw another population displacement probably of largest size. Then, a rapid development of urbanization was followed. Hangzhou soon became the largest commercial center in the world in that epoch. Beginning with the political and demographic movements, the highlands of Shaoxing, like others around Hangzhou, felt the effects of the urbanization of lowland areas on their stock of natural resources. For
example, the soaring prices for construction timber inevitably stimulated extensive commercial logging; so did demands for firewood for domestic use and industries, such as the yellow-wine production, one of the Shaoxing’s nation-wide well-known specialties which boomed in this period. Many people were thus driven up into woods to make profits in commercial logging and fuel-collection. Commercial logging developed so widely that its outcomes drew up attention from some members of local elite. In Fangweng jiaxun 放翁家訓, the manual of family instructions, the author, Lu You 陸游 (1125-1210), a poet and native of Shanyin, expressed his denouncement on commercial logging. Resenting those who cut down trees planted in graveyards, in defiance of moral restraints, he told his descendants not to plant more than "a few tens of trees" around his tomb after he died. He claimed that in the centuries since trees had been planted near the tombs of his distant ancestors, "a dense forest sprawling up hills and down valleys" had developed. Unfortunately, "later generations have misbehaved by logging the trees for trade." By putting limits on the afforestation to be carried out around his own tomb, Lu You was anticipating that his descendants would not be tempted into "the unfilial behavior", and so would save the virtue of his family from being stained by profit-mindedness.

It may be a mistake to assume on the basis of this text that during the Song, the environmental damage that commercial logging caused to the highlands was not regarded as a problem so grave as that of the morality decline in the minds of the members of the elite. One of Lu's contemporaries, Wei Xian 魏巖, took notice of serious soil erosion in the Siming Mountain areas (Siming ta shan 四明他山, to the southeast of Shaoxing). In the following text, he related this environmental damage to the over-logging on steep hills:

The Siming Mountains... display the beauty of retreats amidst a thousand peaks. In the past, giant trees stood in dense forests; valleys stretching along the streams

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1 Chen Qiaoyi, 1965.

were covered by dense bamboo thickets. Although floodwaters could burst forth suddenly and flow down [the hillsides] rapidly, little soil was washed away because it was well fixed by the roots of trees. Accordingly, there was little sediment deposited by water, and dredging [channels and lakes] was quite easy. In recent years, however, as the price of timber has gone up, [people] carrying axes have been frequenting the mountains, [in search of timber]. Few hills have not been denuded, and all the bamboo thickets on the stream flats have also been slashed down. During the flood season, torrents rush down fiercely because there are no trees to intercept them. Because there is no turf covering the soil, the top soil is washed down with floods into the valleys... The deposit fills the beds of the creeks, so that old ferry wharfs are now on dry land.¹

Over-cutting took place mostly on non-privately owned hills. In other words, the access to the woods and bamboo thickets on these lands was open to the public but only on quite a few occasions, subject to government’s action. Some of local governments ever set up rules for regulating or bans against individual’s use. Seen in a poem, “Lamentation for Hills” (Minshan shi 間山詩), the author and also the magistrate of Guiji during the period of Jingyou (1034-37) under the Song prefaced with the words: “Fu Hill, or in other name, the Lying Dragon Hill (to the southeast of the Shaoxing city) has been a scenic place. When I came to take up my office (in the county) I found the bamboo thickets are all in poor shape, and only half left. I interrogated governmental clerks for answers, and was told that it was resulted from massive cutting of the former periods... I, therefore, proclaim a ban against wood-cutting.”² This was an aesthetics driven action, and hence was highly complimented by a well-known poet, Qin Guan 秦觀. However, on most occasions, government is found in a position in sharp contrast to this as we will see as follows.

¹ SSB, p. 22.
² JGZ (1201-04), p. 6296.
urbanization in the lowlands as a result of the population growth from the Song onward. As indicated by Chen Qiaoyi, in less than two hundred years, from 1011 to 1201, the population in Shanyin and Guiji increased as much 1.4 times.\(^7\) Immigrations fleeing from the war-torn north accounted partly for this growth. Yet the approximate growth rate remained in the times later on throughout the nation. The Shaoxing highland thus experienced ever greater pressure for fuel and timber. In the south Song, for instance, Shaoxing was well known for its paper industry as well as for wine industry. But in the Ming, the paper industry disappeared in local economy. By the Qing, the salt producers had to resort to sunlight to evaporate brine, rather than the old method that used wood fuel for energy.\(^7\)

**Ecological despotism**

In addition, the deforestation in the Shaoxing highlands was attributable to another factor. That is government policies which were exclusively concerned with extracting resources from the highlands, with irresponsible disregard to the stability of the highland environment. In fact, the occurrence of over-cutting in woodlands was largely related to a shift of government concerns about mountain resources. To a large extent, it is after the government released first and then abandoned control over highland resources, a process probably started from the fourth century, that commercial cutting in the Shaoxing highlands aggravated and eventually caused environmental damage to woodlands of free-access tracts.

Government intervention in the highland environment originated in earlier times. It varied according to the shifts of its objectives and hence had different outcomes. Feasibly, an overall view of the former government policy may facilitate our understanding of the present events. We will extend temporarily our focus back to earlier times and on a wider scope.

In 522 B.C., government control of woodlands was practised in a northeastern state, Qi 齊. Two departments were set in

\(^7\) Chen Qiaoyi, 1983, p. 4.

\(^7\) Chen Qiaoyi, 1965. p. 31.
charge, Henglu 衡露, of the management of mountain forests (probably for timber and mining) and the Yuhou 虞侯 of providing firewood for government use. In the meantime, thinkers of several schools - the best known to later times being the Confucian Mencius - appealed for official restriction on the use of woodland resources which were open to free use of everyone. In the early Han dynasty, at least some mountains were controlled by government as a source of state revenue, shanze zhi li 山澤之利. By the early third century B.C., two bureaucratic apparatuses were established to take charge of the management of mountain resources. One is known in government documents as the “Private Treasury of the Imperial Family” (shaofu 少府). Its functions originated much earlier but its name was inherited from the preceding Qin dynasty. This department took care of collecting the proceeds from the hunting grounds and lakes of the imperial family. The other department, the “Guardians of Waters” (shuiheng 水衡), was responsible for the production and trade of salt and coinage. It was merged in the state revenue ministry by 118 B.C.

By the early Han, the government monopoly of mining, and salt boiling and trade were severely criticized by some Confucian scholars. They denounced this policy of "struggling with people for profits" (yu min zheng li 與民爭利). The tension between those who favored the monopoly and those who opposed it developed to such an extent that a debate was held in the front of the Emperor Wu in 141 B.C. The arguments of both sides were recorded in a book, known to later generations as The Debates on Salt and Iron (Yantielun 鹽鐵論). Those who opposed the policy referred back to an old tradition of unrestricted access to mountains and wetlands while their opponents emphasized the two objectives of the government control over mountains, that is, to increase

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2 Cefu yuan gui 刁府元龜, juan 6, p. 5892.

3 For an English version, see Discourses on Salt and Iron: A Debate on State Control of Commerce and Industry in Ancient China, chapters I-XXVIII, translated by E.M. Gale, with Introduction, and notes (Taipei).
state revenue and to restrict non-farming activities. Included in the list of non-farming activities were mining by individuals, rare plant and animal hunting, and salt boiling and tree cutting.

The latter who promoted government control were Legalists. Their political formulation obviously favored the government’s interests over those of society. Their arguments appealed to the emperor, and hence their thoughts were incorporated into government policy. The control over mountain resources of economic values was epitomized into an elliptical phrase, “encouraging farming and suppressing commercial activity (zhong nong yi shang 重農抑商)”. The outcome of this debate was resorted in order to justify government intervention in many aspects of social and economic life throughout the imperial times.

The triumph of Legalists in the debate contributed to the enhancement of the control policy. However, the policy did not last into post-Han periods. In A.D. 317, the Emperor Jinyuan ordered a lifting of the ban on collecting natural products from mountains and marshes (shi shanze zhi jin 弛山澤之禁). In correspondence with this change, toll stations, quechang 堡場, were set up at the outlets of mountains in order to tax all "taxable products from mountains", shanchang quehuo 山場催貨. This is known in the sources as "taxing mountains (products)", queshan 權山. It fell into disuse later. But by the eleventh month of 471 when China disunified between the north and south, it was restored in the north, with some minor modifications, by Emperor Xiaowen of the Northern Wei. In the Tang, the taxes from mountain products became a regular source of government revenue.

The shift of government policy of mountain resources from direct control in the earlier periods to assessment and taxation later can be seen in the following text. It was written by the Administrator of the Hezhong Circuit, (Hezhong yin 河中尹), Jiang Shidu 姜師度, to criticize the current policy of taxing mountain products in the middle Tang.

State revenue from mountains and waters was achieved

11 Cefu yuangui juan 6, p. 5894, 5896.
12 Cefu yuangui juan 6, p. 5894.
[through the monopolization of mountain resources] in the past, but now it is drawn from poor farmers. For the state, the gains from mountains and waters could be great as long as the people live by farming. The gains are quite few if drawn from poor farmers who have given up farming. On this consideration, there were once official wardens (yuheng 廬衡) in charge of supervising the use of [mountain] resources and of enforcing market regulations (qingzhong 輕重 literally, lightening and weighting; i.e. official manipulation and control of prices). These wardens formulated rules that specified the times for [mountains and lakes] to be shut from and be open for use (jinfa you shi 禁發有時). In the first instance, this practice encouraged people to stick to farming. Secondly, it assured the state of sufficient revenue. 14

Under the Tang, the types of mountain products that were subject to taxation were increased to include forest products, such as charcoal and tea. 15 By the Song times, the mountain taxes had assumed an important source of state revenue, being a supplemental to the taxes on agriculture. This is reflected in the abundant records found in Song sources concerning taxation of mountain products at toll stations and markets.

The above taxing policy was primarily set to increase revenue. Government had no intent of and interest in restricting over-exploitation of highland resources in these localities that used be accessible with seasonal official permission. My sources indicate earlier that by the early Southern Song, commercial logging ran so fierce first in these formerly government-controlled areas in Shaoxing that it upset members of local elite like Lu You and Wei Xian.

On various occasions, the measure of indirect control was even given up. When an area was struck by a natural

14 Cefu yuangui juan 6, p. 5896.

disaster, for instance, the government often called off all taxes on grain as well as on non-agricultural products within the disaster-stricken area as a measure of disaster relief. In the early Yuan, the Yangzi valley was reported to be suffering from floods, and as a consequence, rice prices soared. An imperial edict was issued. Mountains, lakes and marshes were ordered to open free for food collection to people. 16 In the second month of 1277, in response to a request for relief from floods around the Hangzhou area, the Yuan court decreed exemption of all taxes both due and in arrears to each county within the disaster area. In addition, it ordered that all products from forests in mountains and lakes be free of tax except for logs of huge size and rare flowers and trees. 17 It specified that once a good harvest arrived, all these taxes were to be restored. Those who took advantage of misfortunes to make profits would render themselves liable to official punishment. As indicated by the sources, the measure was probably still in use in post Yuan periods. 18

Government interference in the property rights was also responsible for deforestation in some private woodlands. The interference varied in forms, depending on the problems that the government attempted to solve. For example, when the government exhausted its relief reserves for a disaster that persisted unexpectedly long, it sought sources of relief from the private sector. My sources indicate that such "resorting" took on a compulsory form. In the early 12th century, for instance, in southern Zhejiang, a magistrate, Xuan Wen 宣問, ordered all private non-agricultural lands, including woodlands and reed-grounds, to be opened to everyone's free use as a disaster relief measure. Anyone who had temporarily fled their disaster-ridden area was allowed to collect whatever was available in these lands. 19 Such a policy led to environmental abuse by the owners who promptly

16 Yuan dianzhang [The code of the Yuan], volume, 2. (not paginated).
17 ZTZ (1564)], vol. 2, p. 1426.
18 See Tu Long 屠隆 (who lived in the late Ming period), "Huangzheng kao," 荒政考 in Yu Sen 俞森, ed., Huangzheng congshu 荒政叢書 (1690), p.35.
19 Dong Wei 董火胃, Jiuhuang huomin shu 救荒活民書 in WSK, no. 662. p. 289.
cut down all trees and gathered everything of economic value from their reed grounds and woods before they handed over the lands to refugees. On the other hand, damage was also done by the free riders who carried no responsibility for their action. The mandatory leasing provoked inevitably the owners' resistance. Thus, some members of local elite suggested that the government give the owners money as rent for this period of time.¹¹ This event was entered in a disaster-relief manual circulated in the late Ming and early Qing periods; hence it was applied in other areas later on.¹²

In addition, heavy tax of hill-lands, shandi 山地, also led to the destruction of woodlands in Shaoxing. According to the Shaoxing gazetteer of 1588, there were no direct taxes on hill-lands in Sheng county 嵊縣, a mountain county among six counties in the prefecture, in the Yuan.¹³ Shortly after the Ming was established as a national regime, the government started to assess taxes and labor levies on the basis of holdings of non-agricultural lands. However, "mountain tax was very light in the early Ming" (guochu shanfu shengqing 頒初山賦甚輕). As indicated by the Shaoxing gazetteer of 1588, the money levy was "five wen per mu and the labor levy one adult per hundred mu".¹⁴

By the middle Ming, however, the tax of hill-lands increased. In Sheng county, for example, onerous hill-land tax that was assessed according to the area of their holdings of rice paddies, regardless of how many hill-lands one had.¹⁵ There was no equivalent of this unique way of assessment found elsewhere. As a result, many farmers tried to escape the tax by various means, such as falsely transferring ownership of their hill-lands to persons who had tax-exemption privileges. Others who could not manage so simply abandoned their hill-lands entirely.¹⁶ It is very possible that before

¹¹ Dong Wei, p. 289.
¹² Dong Wei, p. 24. For the circulation of his manual outside the original locality in the Song, see Robert P. Hymes and Conrad Schirokauer eds., Ordering the World: Approaches to State and Society in Sung Dynasty China (Berkely: The University of California Press, 1993), p. 283.
¹³ SFZ (1588), vol. 6, p. 2542.
¹⁵ SFZ (1588), vol. 6, p. 2542.
the owners gave up control over their hill-lands, they carried out a depletive extraction of all economically valuable resources in these lands. After that the lands were thrown waste (paohuang 拋荒)．

The change in the methods of surveying hill-lands also indicates the increased government concern of taxing private hill-lands. Previously, survey measurement in many parts of Zhejiang was conventionally based on the distance which the voice of a man's shouting from the top of a hill was able to reach. On many other occasions, "area survey is never applied in private transaction of hills." This is an indication that hill-lands were of insignificance in local tax assessment. By the middle Ming, as a result of the increase in tax assessment on hill-lands, a relatively precise method to survey the hill areas (liang shan 量山) was formulated by Zhang Jian 張鑑, a magistrate of Guiji in 1547. All hills were numbered and classified according to their topographical configurations into five categories which were named after the traditional five-phase elements, that is metal, wood, water, fire and earth． Different survey measures and tools were applied to the hills under the various categories. The survey results were entered in land registers and kept by the treasurer of the county government.

Moreover, the insatiable demands of the government for woodland products were also responsible for the degradation of the Shaoxing highland environment. For example, as a result of the increase in alarms over "Japanese" pirate attacks in eastern coastal regions during the mid-Ming, a great number of watch towers were built on sea-front hills． There was a campaign of building walled-city in Shaoxing as in other prefectures affected. To fire the bricks needed for

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11 SFZ (1588), vol. 3, p. 1148-49.
12 SFZ (1588), vol. 6, p. 2539.
The growing of American crops

By the late sixteenth century, the introduction of new American crops to Shaoxing resulted in emergence of the mountain farm which in turn caused environmental damage of different form to the highlands. Not only were trees cut down but wild plants on the hill slopes were also removed in order to cultivate the new crops.

According to documentary records, mountain farming in Shaoxing can be traced back as early as the fourth century. But in those times, it was limited to a small scale, and was confined to the gentle slopes on foothills close to lowlands. The crops planted then were millet (su 米), hemp (ma 麻) and indigo (dian 靛). Farmers who "lived in mountains and planted dye-plants" were therefore known to the lowland people as "indigo households" (dianhu, jingmin 靛户 / 菁民). Rice was by its virtue a lowland crop. Before the late sixteenth century, rice cultivation was exclusively carried out on the basin floor and in some terraced fields where springs supplied the irrigation water.

It is until the late sixteenth century when American crops, such as maize, sweet potatoes and peanuts etc., were introduced to the Yangzi valley that the extensive reclamation of hillsides for food crops did not occur. In contrast to rice and other lowland crops, these American crops were

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1 ZTZ (1564), vol. 1, p. 201.
2 Xiong Renlin 熊人霖, Nanrong ji 南榮集, vol. 12.
3 Chen Qiaoyi, 1965.
rather well-suited to mountain conditions. They needed much less water and human care after being sowed, and their growth required no particular topography nor types of soils. Encouraged by the availability of these imported crops, many farmers began to move up into the highlands and support themselves by planting these crops on hillsides.

By now, mountain farming also made it possible for others to settle in the mountains for a long time to engage in mining and quarrying. These mountain dwellers fed themselves while mining and quarrying by planting the new world crops. Their activities caused serious damage to the surrounding environment, such as landslides the removal of vegetation. The result was the provoking of disputes and even conflicts between the mountain dwellers and the inhabitants of the lowlands.

With this technological innovation of highland farming, the mountain population increased dramatically. Most of them were immigrants of two neighbouring provinces, first from Fujian and then from Jiangxi.

By the early Qing the local government had carried out several censuses of the mountain population for taxation purposes. Several magistrates were praised by the higher authorities when they found numerous unregistered people living in mountains. The government strengthened its control over these mountain residents. A mountain police force was formed; and the tithing system introduced into the highlands.

Then, what followed the extensive highland farming was the devastating environmental effects on hillsides as well as in the lowlands. The following text indicates:

Because these crops are planted on hill slopes, soils

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11 SFZ (1588), vol. 5, p. 5147. Also see the report to the throne much later by Zhejiang governor, Li Wei 李德, in Qing dai zhupi yuzhi 清代諸批御旨, p. 194:63; SFZ (1588), vol. 2, p. 418.

12 Fu Yiling 傅衣凌, "Ming-Qing tudi suoyou zhi xia de dizhu yu nongmin 明清土地所有制下的地主與農民" in Kazuko Ono Min-Shinjidai no seiiji to shakai [The politics and society in the Ming and Qing times] (Kyoto: 1983).

13 SFZ (1588), vol. 3, pp. 2438, 2588.

14 See the reports submitted to the court by Li Wei in 1727 in WSK no.180, p. 194.
are loosened and hence, stones easily come up to the surface. Every time a heavy rain falls, stones roll down with the torrents and fill up valley creeks. Since the Jiaqing period (1796-1820), creeks and lakes have suffered from the piling-up of sediment and stones until they are no longer able to contain water. This is then followed by troubles. Maize planting on the hill slopes will fail within ten years, and the land will become no longer fit for bamboo and trees. All advantage seem to be exhausted and what is left there is only nuisance.38

By the turn of the eighteenth and nineteenth centuries, the effects of these disasters on lowland farming developed to such an extent that the provincial governor, Ruan Yuan 阮元, calculated the balance between the income from taxing the mountain farms and the loss to government revenue due to the disasters caused by hill-slope reclamation. He then proclaimed a ban on the planting of these crops, particularly maize and sweet potatoes, in mountain areas throughout Zhejiang. However, this measure proved too little and came too late, it did not create the outcomes intended. Shortly, he lifted the ban himself.39 This is because some officials considered that this measure would provoke these mountain population: once the means for them to live there was removed, they would resort to a more dangerous one, - rebellion - to make a living.40

The Contrast with Pre-Ming Times under an Estate Economy

If the above events were taken to represent the whole environmental history of the Shaoxing highlands, there would be some serious omissions in our picture. In contrast to what happened in these woodlands of open access, the forests in the domains of literati and monastic estates were well preserved up to the fourteenth century. A full understanding

38 Quoted from Chen Qiaoyi's article in 1983. The original text is found in Guangxu Yuhang xianzhi 光緒余杭縣志, juan 38.
39 Chen Qiaoyi, 1965.
40 Chen Qiaoyi, 1983.
of the long-term processes of environmental change in Shaoxing thus requires an inquiry into the highland society of the pre-Ming times, and its fate from the Ming on.

Since the fourth century, a “taste for landscape” had developed among intellectual members of the elite, particularly in the Yangzi valley. Shaoxing, together with its neighboring regions, was renowned for the beauty of its mountains and creeks. It accordingly attracted many scholar-officials and famous literati from other parts of China to establish estates and take up residence in the mountains. This further enhanced Shaoxing's reputation among wealthy scholars and retired officials as a place for living the good life in the highlands.

It is possible that the fame of Shaoxing derived first from certain celebrities who were born there and were well-known for their life in the mountains, such as Xie Lingyun, a well known landscape poet, and many others in later periods. With the attainment of this reputation, Shaoxing attracted and absorbed people from all over China. For example, Wang Xizhi, the famous poet and calligrapher, and a native of Shandong, moved to Shaoxing as soon as he resigned from bureaucratic life. This occurred shortly after the Jin court had fled the war-torn north and resited its capital in Jiankang (present-day Nanjing), leading to the first large-scale population displacement in Chinese history.

Many colleagues of Wang Xizhi followed in his footsteps. After moving up to the mountains, they threw themselves into the construction of montane estates (shanzhuang). Their preference of highland life is seen by the practice that some literati who lived in the mountains adopted literary names (hao) that included the common suffix "mountain person" (shanren) to indicate the nature of their mountain settlement. The following text indicates the tendency toward such estate construction and reflects the structure of a typical mountain estate:

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42 JGZ (1201-04), vol. 3, p. 6319.
He Yin served the Jin regime (479-501) as a chancellor. Being of the opinion that the mountains in Yue (Shaoxing) contained many immortals and had unique qualities, he desired to live there. He subsequently sold his residence, and resigned from his post in order to settle down at Ruoye Hill [to the south of Shaoxing city]... He built a courtyard for his studio named the Forest-Formed Garden (Lincheng yuan 林成園), and a small cottage under a cliff. He lives there still. He opens the gate each morning and closes it each evening. None of his servant boys (tongpu 童仆) is allowed in.  

Most montane estates contained a diversity of natural elements and therefore incorporated natural resources of more than one sort. The physical layout of montane estates of this kind can be seen from one of Xie Lingyun’s landscape prose-poem, “Living in the hills” (Shanjufu 山居賦), which describes the diversity of the elements embraced in his estate. His latifundium bordered on a few counties and was laid out in congruence with various topographic features. The estate construction combined with appreciation of the beauty of country landscape in the "art of landscape-gardening". The niche that these montane estates created in the highlands was integrated with the surrounding environment. Lakes were dug in the mountain valleys and trees were planted on slopes. The elite settlement did not give rise to instability of the surrounding environment.

From the Jin dynasty to the Song, certain mountains in the Shaoxing area, specially the Simingta Mountains 四明他山,

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43 SFZ (1588), vol. 2, p. 506.


45 J.D. Frodsham, 1967, vol. 1, pp. 66-67. A text notices an event. Xie’s brother, Huilian 惠連 led his men out and cut a short way through dense forests in his domain. Their sudden appearance on the other side of hill made the magistrate consider them as mountain robbers (shanzei 山賊). SFZ (1588), vol. 8, p. 2944.

were well-known for the many Taoistic hermits who lived there and for the great number of Buddhist establishments to be found there. Examples of the former were Xie Fuzhai 謝敷齋 and Du Jingchan 杜京產 who were the most noted in the Jin, and Tao Hongjing 陶弘景 (452-536), a native of Huayang in Jiangsu and also a prominent Taoist. The highland way of life they lived was characterized by having plenty of leisure time to spend on non-economic activities. The activities of these mountain dwellers were largely limited to intellectual and spiritual fulfillment rather than economic pursuits. Tao Hongjing, for example, lived in the mountains as a hermit for many years and was known nation-wide to his contemporaries and later generations as Hermit Tao 陶隱居 for his mountain life and his full commitment to studying local herbs. His work remained quite influential in medical research even in later times.

During the Song period, the highland settlement of intellectual elite continued and in some aspects, developed in the Shaoxing highlands. This can be seen from the following cases.

Yan Tong 言通 was a native of Wu 吳 [southern Jiangsu

Murakami Yoshimi, "Rikuchō no teien" [The gardens in the southern regimes]. Kodaigaku, 4 (1955): pp. 41-60. In the Tang, planting trees was undertaken under the estate economy as reflected in a poem by Bai Juyi 白居易:

Spring seems to come late to the eastern slope,
What are trees there like?
...
I take my bondservants (nupu 奴仆) there every day.
They swing their hoes to dig the ditches,
Some pile up earth at the foot of the trees,
And water those that need watering.
Small trees are still a few inches high,
But big trees already several feet tall.


Huang Zongxi, vol. 2, juan 2, p. 5a; juan 5, p. 6b.

and northern Zhejiang]... He appreciated the beauty of the mountains and creeks [in Shaoxing]. He then moved to the south of the [Shaoxing] city in the second year of the Xianchun period (1266) and lived there like a native of Shanyin for the rest of his life.  

Another text refers to Fan Jun 范俊, a native of Pujiang county. He built a cottage on Xiang Hill 香山 in the Song. In a poem that he wrote, his appreciation of living in a hilly environment was expressed in the tone of a surprised observer:

Mountains lie behind (the cottage) like screens, and clouds encompass it like fences. Pavilions stand atop the hills, And ripples of water surround it. Nobody else has found the beauty of this place, I cannot help but wonder about the uniqueness of the master's (zhuren 主人) conduct.  

The life that the Song intellectual elite lived in the mountains was different from the hermit life of their counterparts of the former times. They set up private academies (shuyuan 書院) referred to as “elite schools” (jingshe 精舍) in the sources. This was perhaps provoked by the burgeoning of Buddhistic institutes in mountains, and then became such a nation-wide trend. Academies served as the center of intellectual pursuit. Zhu Xi 朱熹, for instance, visited a number of mountain academies and gave lectures (jianghui 講會) there. He pointed out that at the time, “Confucians like to live in forests in mountains and give lectures in leisure hours.” Hence, he concluded his

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10 SFZ (1588), vol. 7, p. 2639.
11 ETZ (1564), vol. 1, p. 320.
12 This term was used as an alternative to shuyuan probably first by Zhu Xi in “Wuyi jingshe zayong” [An essay on the jingshe in the Wuyi mountains], in Zhu zi quanshu 朱子全書 [The complete works of Zhu Xi], in WSK no. 721, p. 788. In later times, the term was commonly used to refer to private academies as opposed to schools. See Sheng Longxi 盛朗西, Zhongguo shuyuan zhidu 中國書院制度 [The regulations of Chinese academies] (Shanghai: Zhonghua shuiji, 1934), p. 40.
13 Sheng Longxi, 1934, p. 21.
14 Zhu zi quanshu, p. 786.
observation, after he visited *Wuyi jingshe* (Wuyi Academy) probably in Fujian, by asserting that “Elite schools are all situated in the places where are beyond easy reach.” (深不可极者，即精舍之所在也) Those he visited also included the Academy at White Deer Cave (*Bailutong shuyuan* 白鹿洞書院) in Jiangxi, and the Academy of Stone Drum Tower (*Shigulou shuyuan* 石鼓樓書院) in Hunan.

Two traditional drawings below show this geographical feature of the academies in the Shaoxing highlands. The first is Orchid Pavilion (*lan ting* 蘭亭) which was originally Wang Xizhi’s residence and later became the site of an academy not only for calligraphers but also literati and Confucian scholars. The second is the Academy on Ji Hill (*Jishan shuyuan* 稽山書院) which was built between 1241 and 1252 and soon became noted nation-wide.

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**Orchid Pavilion from *Jiaqin Shanyin xian zhi*.**

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The Academy on Ji Hill from *Shaoxing fu zhi, 1720.*
These academies were founded by wealthy households or scholars and sometimes by the government. They boarded a number of students. In the gazetteers of Ming and Qing times numerous names of such buildings were entered mistakenly under the category of "schools". A text in the gazetteer of Guiji compiled between 1201-1204 conveys that an academy supported itself with the income from its own landholdings:

During the Song, He 何 (the personal name is missing here) lived in the western side of hill where there were waterfalls running down from springs. He built studios and hostels for an academy. He also built a small cottage under the cliffs. He then opened two qing of rice fields at the foot of the hills and liked taking strolls around with his students for recreation.

As recorded in the sources, academies were numerous in the mountains throughout Zhejiang, and the course peaked in the Southern Song. The source attributes this Song development to the in-migration of intellectual elite from the north. The existence of these intellectual establishments in the highlands characterized the nature of the highland society. However, the question of their economic activities, though it has sometimes been raised incidentally. It remains unexamined.

11 Zhu zi quanshu, p. 43.
12 JGZ (1201-04), vol. 10, p. 2298.
13 In Ming and Qing sources, most academies and private estates are all placed in the section of "historic sites". See, ZTZ (1526), vol. 1, pp. 213, 262, 359-60; vol. 2, pp. 206, 213, 262, 303, 391, 394, 399, 400, 402, 433, 469, 473, 621.
14 ZTZ (1526), vol. 1, p. 206.
In addition to these private retreats set up by those who wanted to enjoy an elite style of highland life, there were religious establishments in the mountains which also functioned as social and economic institutions, and which developed their own systems of highland resource conservation.

The history of Buddhist monasteries and estates set up in the Shaoxing highlands as in other regions traces back to the fourth century. The number of religious estates recorded in gazetteer references is much greater than secular ones discussed above.

In the repertoire of the functions of religious estates, economic pursuits assumed a significant role. In Shaoxing as in its neighboring regions, many monasteries were originally set on highlands in earlier times; some expended their landholding down to plains in the Song when they were able to muster enough manpower and technologies to reclaim wetlands for rice cultivation. Most these hill-lands were originally given as donations by imperial nobilities, high officials and eminent families. The landed properties of many large monasteries in the Song comprised farmland, gardens, orchards, woods, pastures and the margins like sandbars outside sea walls and wetlands. The composition of monastery landholdings in Shaoxing indicates the diversity of monastic economic activities in the Song. The table on the next page shows the landholdings of some monasteries in the Siming and other mountains and the dates that they were donated. These landholdings were recorded in gazetteers under two categories, namely, fields (tian) and hill-lands (shan). The list is far from being exhaustive since there were many more monasteries which are not included in this list. All monasteries

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62 Ibid. p. 118.

63 As pointed out by Jaceques Gernet as a phenomenon found throughout China in pre-Song times, there were several sources from which monasteries acquired hill-lands. Of them, imperial bestowal and private donation were the important ones. See his book, Buddhism in Chinese Society: An Economic History from the Fifth to the Tenth Centuries (an English version of Les Aspects économiques du bouddhisme dans la société chinoise du V au Xe siècle), trans. by Franciscus Verellen (New York: Columbia University Press, 1995). p. 120, 137.

owned rice fields; but rather a few probably of some ones had no hill-lands at all. Some were founded by merchants and therefore relied fully for their material living on productive lands.  

The table below lists the composition of monastery landholdings.

<table>
<thead>
<tr>
<th>Monastery Name and location</th>
<th>Date built</th>
<th>Fields in Mu</th>
<th>Date given</th>
<th>Hill-lands in Mu</th>
<th>Date given</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jingde (景德寺) Heaven Boy’s Hill</td>
<td>300-01</td>
<td>3,284</td>
<td>1008-16</td>
<td>18,950</td>
<td>1008-16</td>
</tr>
<tr>
<td>Guangli (廣利寺) King Asoka’s Hill</td>
<td>405</td>
<td>3,895</td>
<td>1024</td>
<td>12,050</td>
<td>1024</td>
</tr>
<tr>
<td>Zhenxiang (真象寺) Golden Top Hill</td>
<td>766</td>
<td>332</td>
<td>1064</td>
<td>4,220</td>
<td>1064</td>
</tr>
<tr>
<td>Husheng (護聖寺) Damai Hill</td>
<td>785-804</td>
<td>172</td>
<td>1174-89</td>
<td>25,040</td>
<td>1174-89</td>
</tr>
<tr>
<td>Baofu (保福寺) Damei Hill</td>
<td>797</td>
<td>725</td>
<td>1190</td>
<td>25,042</td>
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<tr>
<td>Yansheng (延聖寺) Changxu Hill</td>
<td>889</td>
<td>556</td>
<td>1040</td>
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</tr>
<tr>
<td>Chongguo (崇果寺) Banku Hill</td>
<td>946</td>
<td>196</td>
<td>1012</td>
<td>1,120</td>
<td>1012</td>
</tr>
<tr>
<td>Chongfu (崇福寺) Five Peaks Hill</td>
<td>963</td>
<td>270</td>
<td>1011</td>
<td>680</td>
<td>1011</td>
</tr>
<tr>
<td>Fuchang (福倡寺) East Hill</td>
<td>892</td>
<td>435</td>
<td>1111</td>
<td>1,820</td>
<td>1111</td>
</tr>
<tr>
<td>Huizhao (惠照寺) Inscription Hill</td>
<td>986</td>
<td>270</td>
<td>1086</td>
<td>2,300</td>
<td>1086</td>
</tr>
</tbody>
</table>

Source: Baoqin Guiji xuzhi 寶慶會稽續志, in Song-Yuan difang zhi 宋元地方志 37 zhong no 7. pp. 5166-75.

Almost all of them inclined indiscriminately to augmentation of landholdings. Some monasteries with hundreds of monks achieved this objective by means of purchase with...
the money donated. Thus, they had strong influence in local society by virtue not only of the religious intercessory services they offered local people but also because of their large holdings in land."

A monastery usually rented out its rice fields to peasants and kept hill-lands under its own control to supply itself with fuel and construction materials for building maintenance. No wood was allowed to be collected by outsiders in their woodlands." My source records such a case. In 1037, the Renzhong Emperor had dream in which he visited the Longsheng Monastery 隆聖寺 which was built in 886 on Xuedou Hill 雪竈山 and had 1787 mu of rice fields and 7300 mu of hill-lands by the year 1001. As a result, he granted to the monastery golden cloak and declared a ban on collecting fire-wood and other mountain products (jin qiaocai 禁樵采) within the monastic woods." The government protection of monastic woods are also found in the sources of other regions." This policy constituted a sharp contrast to its attitude to the extensive common lands, and hence resulted in different environmental consequences in these two sections of highlands. This may explain the phenomenon that hills around prominent religious establishments have been all well wooded.

The Collapse of Highland Society and Environmental Effects

Extensive deforestation in the Shaoxing highlands was closely related to the collapse of the montane estates, a concomitance of dissolution of large consolidated landholdings. Started in the thirteenth century, large holdings began to decline throughout China and ultimately gave way to almost universal peasant small-holdings." The decline and collapse of highland institutions were multi-faceted and involved with several different courses.

In Shaoxing, few highland estates, particularly the


"Huang Zongxi, vol. 4, juan 2, p. 5a; juan 5, p. 6b.
secular ones, survived this profound social and economic transition. The sources show that most of the academies located in the Shaoxing highlands were abandoned. This can be seen in gazetteer entries in the category of “historic sites” (guji 古蹟). Many members of Ming local elite witnessed many rubble sites in the mountains. Probably out of personal emotion, they tried to trace up the names of founders and the set-up dates for these ruined buildings. In their gazetteers, the section of “historic sites” is featured by a number of the entries on buildings broken into "gardens/parks" (yuan 院/苑), "studios" (zhai 齋), "gardens" (yuan 園) "halls" (tang 廳), "storied buildings" (lou 樓) "pavilions" (ge 閘), "residences/cottages" (chuang 廳/軒), and "inns" (guan 館). In fact, the classification reflects merely the arbitrary nature of these authors/compilers’ imaginations on the different functions of these buildings. However some comments and notes of these entries reveal indeed that by the middle Ming, most rural academy buildings were abandoned.

Unfortunately, too little is documented in the gazetteers, at least in those for the Shaoxing areas, about how these secular montane estates declined and finally were wiped off the maps of the Shaoxing highlands. One piece of information found in the writing of Mao Qiling 毛奇齡, a native of Shaoxing who lived in the early Qing, refers back to a Ming text. Mao request to provincial authority in order to re-establish the property rights of the memorial shrines dedicated to Wang Yangming 王陽明 in Hangzhou. In his reference, the text says: “In the seventh year of the Wanli reign (1579) some court officials approached the throne with a request to destroy all buildings of private academies in the empire.”11 In much possibility, this text may refer to Zhang Juzheng 張居正 who ordered the close-out of all academies in

11 This was first pointed out by M. Elvin in 1973. Also see P.J. Golas, “Rural China in the Song,” Journal of Asian Studies 39: 2 (1980). It by no means follows that large landholdings all vanished. In the periods of the early Ming and Qing, there were some imperial nobilities and eminent families who held more land than their Song precursors. Nor were Ming and Qing large landholdings were comparable to their Song counterparts in that the former were parcelled out to free peasants rather than run under the consolidated control as manorial demesnes.

the year.

In pre-Ming times, the rise and fall of private academies coincided to a great extent with the dynastic cycle. However, it is under the Ming that doing away with private academies was related to the emergence of public schools in the lowlands. These lowland schools were financed and managed by local governments, and in some cases by local communities, as a local public facility, with the aim of producing candidates for the examinations for public service. In addition, the government of the later Ming period actively sought to bring the more independent private academies under its control. The change resulted in the decline of private academies, and consequently led to the dissolution of their landholdings. On the other hand, the public schools followed to emerge in great number and mostly in urban areas.

The decline of Buddhist monastic estates in the Shaoxing highlands was accounted for by different causes. Of them, one had its origin in quite early times, but only brought out significant consequence in the Ming.

As a government policy originated in the Tang, all monks were exempted from labor service, and monastery lands from taxes. These privileges remained legally in force under the Song and Yuan. As a result, many farmers who could not pay their taxes converted themselves into professional ecclesiastics or signed their farms over to monastery estates in early periods. This trend was more pronounced in the Song than ever before. The government was aware that state revenue was to decrease unless official restrictions on the number of monasteries were proclaimed. The throne decreed in the second month of 986 that from then on, no requests for the construction of new monasteries should be allowed. In the ninth month of 1028, Li Ji 李及, a court official, approached the throne with the purpose of restricting the expansion of the monastic population:

11 Sheng Longxi, 1934, p. 11, 21.
14 Quan Song Wen 全宋文 (Chengdu, 1988), vol. 2, p. 432.
In recent years, there have been too many people who have converted themselves into Buddhists; some desperados and criminals change their names and mingle amongst the monks in order to escape official investigation. [I] request that all who want to resign from civilian life must give their names to local governments before they are registered in a monastery.76

However, this policy was found a futile attempt. The Song, in fact, saw the flourishing of religious foundations and activity throughout China. According to a Song Guiji gazetteer, the number of monasteries in the five counties of Shaoxing is counted: 66 in Shangyu, 41 in Shanyin, 102 in Sheng Xian, 101 in Xiaoshan, and 42 in Xinchang.77 Some of these monasteries were quite large, with more than two hundred monks.78

Because the military expenditures ran on the high side as a result of confrontation with nomadic peoples in the north, the Song government resorted to the unwonted but never innovative means to make up its budgets by selling ordination certificates (dudie度牒).79 This encouraged the burgeoning of monasteries and accelerated the expansion of the monk population. In the Shaoxing period (1131-62), a Song magistrate, Dong Wei, for example, criticized this policy by pointing out the consequences: "the massive selling of certificates will lead to the complete loss of all labor-service men (dudie guangxing rending sangjin度牒廣行，人丁喪盡)."80

76 Ibid. vol. 3, p. 730.

77 JGZ (1201-04), vol. 10, pp. 6261-95.


79 This policy was initiated by Tang government to relieve fiscal problems resulting from increased military expenditure in the suppression of the An Lushan rebellion. J. Gernet, 1995. p. 53; Kenneth Ch'en, 1956; Yuan Zheng, "Liang Song dudie kao兩宋度牒考," [Investigation into ordination certifications in the Song periods] Zhongguo shehui jingji shi jikan 中國社會經濟史集刊 7:1 (June, 1944), pp. 41-104, and 7:2 (July, 1945), pp. 1-78.
This phenomenon persisted into the Ming. Ordinances of restricting the monastic population were also proclaimed by the Ming government. The number of monasteries was not allowed to exceed forty in a prefecture, thirty in a sub-prefecture, and twenty a single county (though slight differences in the number are found in different regions). It is unlikely to be a coincidence that the Ming oppressive policy was promoted by and put implacably into force by Ming Taizu, the founder of the dynasty. He had been sent to a Buddhist monastery at his teenage age by his family as a result of the starvation in his hometown. This was a miserable time for him.

However, some innovative measures were found in Ming period. The monk population was, for example, no longer to be exempted from labor services. If a family that had less than three male adults sent one of them into a monastery, or if a male adult between sixteen and sixty converted himself into a monk, they would be jailed for a month. If a monastery accepted illegal ordinations, its buildings would be destroyed. The oppression provoked resistance of monasteries; the conflict persisted until the sixteenth century.

Local Ming governments were, on the one hand, characterized for relatively higher levels of the involvement in local public works, such as water control, local schools, foundling houses, public cemeteries, etc. On the other, they were determined to prevent as much as possible monasteries from developing into rivals. Restricting monastic landholdings was thus taken for granted in order to increase local revenue. In Shaoxing, as in other regions, this policy took coercive forms. One case is documented in the gazetteer of Lishui county (south of Shaoxing: known as Yiwu county from the Ming on). The land of a monastery was confiscated by the government and given to a school in the Yuan. Later the monastery claimed it back, but in the mid-Ming, the government ordered its return to a public school. A case in

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"Dong Wei, p. 265.
" R. Huang, 1974, p. 33.
" R. Huang, 1974, p. 185.

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Hangzhou may serve as a footnote indicating the development of this course. The general gazetteer of Zhejiang compiled in 1735 refers to a text of the former period. In 1509, a prefect of Hangzhou, Yang Mengying 楊孟瑛, restored West Lake to its earlier size. This restoration project destroyed 3,481 mu of rice fields and reed land which had been illegally reclaimed from the bottom of the lake by residents around the lake in earlier times. He then shifted the tax quota of these lands, more than 931 shi of rice, to a monastery's lands and to other lands that had not been subjected to taxation before. This course was found in the other regions throughout the Yangzi valley.

As a result, many monasteries lost their landholdings and hence had to live on public funds collected from their "parish" or on cash donations of individuals. Many others did not survive these stressful circumstances. The survivals were quite few, and were mostly the large monasteries with woodlands to supply themselves with firewood and building materials. As the gazetteer of the Shanyin county compiled in the Jiaqing period (1796-1820) indicated, numerous monastery buildings were taken over by civilian residences (wei minju suo qin 為民居所侵占) during the Ming and Qing periods, and their lands fell into the hands of individual farmers. What happened to the Tianyi Monastery 天衣寺 in Shanyin exemplifies this change. The monastery was built in 418 by a monk, Tanyi 羅賢. It was burned down and rebuilt many times before the Song. It owned a large amount of lands in the Song. By 1558 when the monastery organization disintegrated for reasons that are not indicated by the gazetteer, "all its buildings fell to ruin", and the landholdings were dissolved. The


"ZTZ (1735), vol. 1, p. 1105.


"T. Brook, Praying for Power: Buddhism and the Formation of Gentry Society in Late-Ming China (Harvard University Press, 1993), pp. 113, 163.

"JSXZ (1804), vol. 4, p. 948.
decline of Buddhist foundations was so pronounced that in the late Ming when Shen Mingchen 沈明臣 travelled in the Siming mountains, he was surprised while seeing so many monastic buildings lying in ruins. As soon as monastic control fell into disorder, their former woodlands deteriorated into what we know as open-access resources which were under control of nobody and therefore liable to ecological destruction. A temple gazetteer points out, for instance, that once the Zhao Hill Monastery in Hangzhou had sold its hill-lands to the laities, all the forests on the slopes were uprooted for some purpose that unfortunately is not mentioned by the source.

Recent scholarship suggests a change in the nature of Buddhist foundations between Song and Ming. Most of the Tang and Song monasteries were virtually private institutions in that they provided almost exclusive prominent families and lineages with intercessory services. Ming monasteries, in the contrast, delivered the services to a the whole local society. Paradoxically, while Ming monasteries shifted to serve a bigger rural population, their economic activities and accordingly sources of incomes lessened. After their landholdings had disintegrated as described above, many of them lived only on public funds collected in their "service areas", and on individual donations. In effect, they had become no more than one of various public facilities of local society.

These analyses lead to the conclusion that from the late Song, the old highland society in Shaoxing began to decline and by the Ming, collapsed eventually. Then, the woodland that had been well protected within private domains were all exposed to economic exploitation as population grew rapidly in the lowland. The economic opening of the Shaoxing highlands took place on an unprecedented large scale. As a result, this was followed by the extensive environmental 

"Huang Zongxi, vol. 54.

" This can be seen from the prevalence of cloisters (gongde yuan 功德院) set up by imperial nobilities and high officials in order to improve their religious virtue. See K.Ch’en, 1964, p. 273.


" T. Brook, 1993, pp.173, 193, 258.
abuse, all the woodlands being left at the mercy of eager timber cutters first and then land seekers.

Scourges in the Lowlands

The degradation of the Shaoxing highland environment inevitably had environmental consequences on the lowlands. This impact took many forms. As noted earlier, by the late Song, soil erosion due to over-cutting had occurred, and then was followed by rapid deposition of water-borne sediment in channels and water-storage lakes. Many gazetteers indicate that some islands, known as "growing sand and deposited earth" (zhangsha fengni 漲沙 封泥), arose in the middle of lakes as a result of the piling-up of sediment. River channels became shallow and their water-carrying capacity decreased. In Hangzhou, the government hired farmers to clear West Lake every a few years. The costs for such clearance were made up by selling the silt to farmers as fertilizer (maifeng qian 萨封錢). However, not all lakes were cared for by the government in this way. Some lakes lessened in their water surface after the land created from siltation had been converted into farming fields, a practice that was condemned as "lake robbery" (daohu 盜湖) by local governments and members of the elite.

To cope with the rapid sedimentation, some technical solutions were sought. Sluices were set on the feeder channels. When water ran through the sluices, silt was intercepted by the sluice boards. In the dry season when water stopped flowing, it was possible to remove the sediment collected at the foot of the sluice boards. With such innovative device, the siltation in the lakes was expected to be decreased. In the gazetteers, these sluices are referred to as "sediment-returning sluices (huisha zha 適沙閘)". In addition, the government bought some fields near these sluices to provide rent in order to pay for dredging the deposited sediment and maintaining the sluices. These lands were called "dredging-sediment fields" (taosha tian 掃沙田). The farmers who cultivated them were assigned the task of regularly dredging the channels and looking after the sluices. The government also formulated regulations regarding labor allocation for large-scale clearance of the lakes.

ZTZ (1564), vol. 2, p. 580.
The environmental degradation triggered social tensions and even conflicts between and within local communities in the lowlands. In Shaoxing, most lakes were built in conformity with topographical features. A lake was made up of several components, including water-storage reservoirs, feeder and drainage channels, dikes, and flood lands. The last consisted of swamps and marshes around lakes, and sandbars along channels. They were subject to inundation in the wet season. These lands were reserved as commons in that they were, on the one hand, a component of water-control works, and on the other hand, available for everyone's use if there was something of economic value there. Some of them were wetlands and open for collection of reeds and other aquatic plants, and hence subject to payment of a light tax. Crops with a short growing season were allowed to be planted on these lands; their rents were used for repairs of the water-control works. Permanent conversion into farmlands was not allowed.

The government claimed ownership over these lands; so did local communities on some occasions. However, the demarcations of these commons were largely determined by the boundaries of the privately owned lands nearby and around. Only the latter were entered in official land-registers according to their location and acreage in accordance to tax quota. Probably related to the increase in the importance of these flood lands in local water control in the Ming, local government began to "survey these marginal land" (zhang xidi 丈隙地). A massive survey was conducted by Liu Guangfu, a magistrate of Zhuji, in 1602. The results were recorded in a book.

Because of the physical and social nature of flood-lands as commons, it was difficult for either local communities or the government to protect them from individual encroachment. The temptation to convert these lands into rice-fields was related to the comparatively fertility of soil. On many occasions when the physical boundaries were done away with by floods, farmers took advantage of this chance to extend their fields into nearby floodland. More often than not, the gazetteers indicate that when powerful households were involved in such illegal encroachment, large tracts of the

"JGQ, volume 1, chapter 2, p. 30.

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flood-lands were covertly reclaimed into farmland. In this way, water control-works often lost much of their working capacity.

The number of disastrous floods and other calamities increased in the late Imperial period. Climatic change may or may not be one of the factors. However, some of these disasters were in fact man-made. The human causes of disasters were even discerned by local officials. In 1793 when Zhuji was suffering from floods, the magistrate, according to what he observed, drew the following conclusion about the cause of the floods:

Zhuji is a place where all the waters meet from mountain valleys stretching hundreds of miles among the Tiantai Mountains 天台, Siming and Douwu 寶婺. It is only the Qianqing River that drains these waters. In the county as a whole, seventy-two lakes have been constructed to collect the water. Thus there has been no threat of flooding to worry people any more. With the passage of years, people have gradually reclaimed the seventy-two lakes to farmland. When there are heavy rains in the mountains, the water all gathers in these lakes. All the crops growing in the lake areas suffer. However, this disaster is not caused by natural flooding, but from the fact that people should not have reclaimed the lake-bottom as farmlands.'

In another report, he denounced local officials for allowing all these reclaimed lands to be registered. Obviously, governmental concern was limited to the security of its interests in the lowlands, and little related to the environment of the highlands. To some point, the government did not integrate its interests in these two environments which were geographically distinct but ecologically related into a rationale was responsible for instability of the agricultural regime of the lowlands. By the turn of the eighteenth century, A decade later, this relationship between the over-exploitation of highlands and the disastrous consequences in lowland was fully understood by local elite and some

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13 QSZ (1736-95), vol. 1, p. 404. 120
government officials throughout the province, as we can easily find in their requests and proclamations to control the use of the highland resources. However, that the environmental abuse persisted into the whole next century should be accounted for not by lacking the intention of control but by the lack of power to control. On some occasions, the control was even found to have come too late and too little to cope with the situation that involved a big population using highlands for their subsistence."

Moreover, the encroachment on flood-lands triggered tense relationships between those who were affected and the encroachers. The encroachment was so pronounced throughout the Shaoxing areas that some morality-bound members of the elite came out to condemn this behavior. They related two common forms of encroachment directly as a crime. The first was the "stealing type" referring to purposely planting wetland plants in the flood-lands to catch more deposit from water flow so that "the perpetrators" could later convert the newly created lands into rice fields. The second was the covert reclamation of lake-bottom lands by constructing enclosure dikes to separate these lands from the main body of water." The gazetteers record numerous lawsuits lodged by farmers against encroachment by local strong-men who were charged for "lake robbery". Some disputes even turned to bloody violence."

Some historians of Chinese society have recognized that fact that organizational and physical structures of water-control experienced substantial changes, particularly in the middle Ming. However, their attempt of finding out these changes is confined within social scope. Underlying their views is the idea that changes in water control, whether in the form of physical decay, or organizational rearrangements,

" Thanks to Ann Osborne who gave me a copy of two proclamations, (1) Yanjin ganshan zuoshi 規禁散山鑿石 (2) Jin pengmin shi 禁濫民示, by Ruan Yuan (阮原) in 1802, which indicate that government control of the highland use in west Zhejiang did not come until the close of the 18th century.

" Zhen Gong 曾敏 (1019-83), "Yuezhou Jianhu tuxu 越州鑿湖圖序" in ZTZ (1564), vol. 4 p.4491; Wang Shipeng 王士朋 (11 n.d.-?), "Jianhu shuo shuo" 鑿湖說 in ZTZ (1564), vol. 4, p. 4608.

are best understood as a result of an intensified competition between the mass of the populace for subsistence and the powerful for profits. The competition went so high that local governments found themselves unable to restrain the tendency in such an atomized rural society. This proposition needs qualification before it can be applied to the case of water control, a major public undertaking, in Shaoxing. A body of literature concerning cases elsewhere and in different times has shown that changes in the physical and social configurations of water control throughout the world are related to numerous factors ranging through population fluctuation, changes in crops, introduction of new irrigation techniques, transformations of the local social fabric, shifts in local government’s role and interests to long-term climate change. Extensive encroachment of marginal lands also took place in other parts of Zhejiang and in other provinces. In Shaoxing, one of its origins is, however, detectable in the destruction of woodlands.

There is no doubt that most, if not all, environmental changes in the last millennium have had human causes. In the case of Shaoxing, the differentiations between the human impact on the highlands in each of the two periods (pre-Ming

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101 T.F. Glick presents the following case: as a result of urbanization and the shift of cropping patterns in Valencia in medieval Spain, dramatic changes took place in the irrigation systems which had survived a variety of cultures, not to mention numerous political regimes. See his book, Irrigation and Society in Medieval Valencia (Harvard University Press, 1970) For the effects of alterations in larger social context on water control communities in western Zhejiang, see Atsutoshi Hamashima 1982, chapters 2, 3.

102 K.W. Butzer shows that the readjustments of irrigation systems in the Nile delta were made in response to changes of ecological, particularly climatic, conditions that caused the descent of water level of the Nile river. See his book, Early Hydraulic Civilization in Egypt: A Study in Cultural Ecology (University of Chicago Press, 1976).

and Ming-Qing) are so noticeable as to bespeak two distinct patterns of Shaoxing people's use of their highland environment. The shift from one to the other coincided with China’s entry of a transitional period which began in the late Song and extended in almost all aspects of social and economic life into the late Ming.

The shift from one to the other coincided with China’s entry of a transitional period which began in the late Song and extended in almost all aspects of social and economic life into the late Ming.
Chapter 7: Financial Sources

The preceding chapter has showed that the development of water control in Shaoxing was not a pure derivative of human endeavours, but largely resulted from the interaction between water control and change of natural processes. To uphold the interventions meant for the people of Shaoxing the increased demands, and costs as see some occasions, for input in forms of labour and funds as well as organizational skills in this "collective venture". These demands mounted almost always in the wake of, and on some occasions simultaneously with, the completion of a significant water-control work. To meet these ever greater demands and more costs, several shifts of financial sources for water control were made for the search of new sources; and reforms of the old financial contribution systems were locally devised or introduced from other regions. The present chapter documents the course of these shifts and analyzes the causes behind them.

Outside Sources

Before the Ming, government contributions in forms of labour, grain and money constituted the major sources of financial input in local water-control activities. This in turn strengthened the pre-Ming government’s position in controlling local society. Since the Song, government gradually put an end to some governmental sources such as the employment of armies for regular labour supply; and others trickled less and less with the decrease of the governmental direct input.

The Song government, for instance, assumed a dominant role in support of local hydraulic construction. It funded exclusively all large projects which involved a great number of labourers and needed a wealth of material in a limited
time. As initiated in the Tang, the troops in lieu of corvée labour were used as the major source of labour supply. Although on some occasions, local labour forces were mobilized in slack seasons, the number was limited. Some magistrates were quite aware — as held as an orthodox doctrine — that heavy levies would exhaust the farmers and disturb their work in farming (laomin 勞民). Compared with the labour provided by troops, labour levies from farmers were therefore of little significance in water control. Since the Song, a village-based labour contribution system emerged originally to manage matters concerning labour contributions for the maintenance of small facilities used only by farmers for irrigation and transportation; but in the Ming, it was dramatically turned to meet the demands for local labour supply in large projects. To this change, I will turn later. However, almost all large projects and works for flood control and large scale transportation were taken care by provincial or even central governments.

The large number of troops stationed in the Shaoxing area particularly facilitated this kind of imperial input in Shaoxing water control. Most of them posted near waterways or behind the sea walls. Some of them were especially assigned to carry out water-control construction, and therefore referred to as "dike troops (yan ying 堤營)", and "river-protection troops (hanjiang ying 悍江營)", with a slight variation in the designation in Hangzhou where they were called "dredging troops (liaoqian jun 撩淺軍)", "river-dike repair troops (xiujiang sijun 修江司軍)" and "lake-dredging soldiers (liaohu bin 撩湖兵)". Prisoners, too, were occasionally used for the construction and repair of seawalls and river levees. On a few occasions, when the need for ever great labour supply could not be met by troops, "vagrants" (youmin 游民) were hired with funds (gongtang 公帑) provided by the Board of Works or the Ministry of Revenue on request.

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1 JGZ (1201–04), vol. 4, p. 4.
2 ZTZ(1735), vol. 1, pp. 1096, 1160, 1228.

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for emergency situations.¹

In Shaoxing, as in other areas of the Yangzi valley, local governments below the prefectural level had only limited funds at their disposal, less than a quarter of the annual revenue they collected from the villagers.² Magistrates were hard pressed for funds for local public works unless they requested assistance from the outside. The grounds for these requests varied in different situations. When waterways and the lakes that were connected to traffic channels became shallow with accumulated sediment, for instance, which affected the passing-through of tax-grain traffic, abundant funds could be easily acquired at the request of the local government, and troops assigned to where they were required.

Innovations were made in the Song period in the use of other funds for water control. An example may be found in a nearby prefecture. In 1030 Fan Zhongyan 范仲淹, then the prefect in Suzhou 蘇州, distributed famine relief grain as payment to hire farmers for the rebuilding and modification of water-control works. This innovative policy was soon introduced throughout the Yangzi valley and continued into the Qing period, even keeping its original title of "substituting work for relief (yigong daizhen 以工代振)". Some important modifications to sluices and dikes were accomplished in this fashion in the early Song. Farmers who worked on water-control projects were all paid by the government in either kind or money.

Not all aid was derived from outside the relevant local government area. Some local tax revenue was retained. This was known as "deducting from the grain tribute in order to distribute relief (jiecao sanzhen 截漕散振)".³ On some occasions, the retained funds even included "silver collected together for convoying to the capital" (gangyin 綱銀) with

¹ ZTZ(1735), vol. 1, p. 1097.
³ ZTZ(1735), vol. 1, p. 1100.
approval of the central government. But still, they were imperial input in that the locality was not able to ensure their availability at all.

Additionally, making loans of grain and money from the ever-normal granaries (changping cang 常平倉) in the area was another temporary alternative measure. In theory, ever-normal granaries were a government controlled mechanism over markets. Control was achieved over grain price levels by purchasing grain at the "normal" price when the price was falling due to a great bulk of grain flowing into the markets after a good harvest. It was sold at a lower price when the harvest failed, or between harvests, when the market price tended to rise. Additionally, the grain in granaries was used for disaster relief and loaned to troops when the need occurred.

There were several granaries in Shaoxing. They were not local facilities, but functioned, as they did right down until the Qing dynasty, largely as the imperial state's charity agency. In the early Song period, loans for water control were normally not included in their functional agenda, as the regulations prescribed that "the rice in the granaries can be used for nothing but disaster relief." In a few cases special loans were made, but restrictive conditions were imposed regarding the way and the time to repay, and interest was required. In 1096 such loans were legitimized as an institutional source for local water control by Wang Anshi 王安石 in his reform programs implemented throughout the nation. In Shaoxing, the clearing of the Rear Lake (houpu 後浦) in Guiji county was completed largely with funds loaned by the prefectural government. These comprised three thousand strings of money from the ever-normal granaries and three thousand hu 斛 of grain from the community granaries (yicang 義倉, set up in villages by the farmers), both with

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There are few systematic studies of the functions and administrative structure of ever-normal granaries in the pre-Ming periods. For a reference to its counterpart in the Qing, see Pierre-Étienne Will, Bureaucracy and Famine in Eighth-Century China, translated into English by E. Forster (Stanford, California: Stanford University Press, 1990), pp. 182-197.
the approval of the prefect, Jiang Shi 饒市。A similar case involved Zhu Xi when he was serving in the office of Qu prefecture 衢州 (to the south of Shaoxing). When the ever-normal granaries failed to supply enough rice or money to meet the demands for dredging rivers, partly because of the frequent arrears of repayment by the military the community granaries were asked to make up the deficiency。'

It is probable that the geographic location and economic status of Shaoxing facilitated the extensive involvement of the state in water control. As noted earlier, Shaoxing was linked to Hangzhou by the Xixing canal. The southern Song court moved its capital to Hangzhou, to the northwest of Shaoxing across the Qiantang River. Shaoxing's geographic proximity to the national capital and economic center attracted numerous immigrants from all parts of the nation. The population of Shaoxing increased greatly in accordance with the growth of its economic and political importance in this period. A great number of soldiers were stationed there. Under such circumstances, the central government's concern for water control in Shaoxing increased.

Compared with the labour supply provided from the outside, the contribution by local government was much less significant. The involvement of local government in water control was restricted by the limited sources at its disposal. Often the availability of these funds was a matter of particular situations in the local government unit concerned. For example, in 1267, the prefect of Yanzhou 廣州 (to the southwest of Shaoxing), Qian Wenshi 錢聞詩, used up all the rents from thirty-six government houses for clearing a lake, an outlay amounting to a thousand strings of cash。' In other cases, the government collected the proceeds from reed grounds, marshes, and flood lands within lakes and between river banks in which some cash crops with short-growing
seasons could be planted between flood periods. Local sources of this kind in the Song were never sufficient to support large projects. Thus on many occasions the local government had to cut its expenses on local public works, including water-control activities.

Local Sources

Imperial supports persisted through the Yuan until early Ming, a period when the development of Shaoxing water control was at its apex. The change first took place in the social composition of the state’s contributions. The imperial input decreased and by the mid-fifteenth century, was entirely replaced by national conscription. The latter falls in the category of the state’s input in that these labour forces were more often than not assigned to the places far from their conscription localities. Probably from the late Song, local governments had some control over the labour forces conscripted locally for water control; and gradually the local conscription prevailed and eventually replaced the national labour conscription in the Yangzi valley at latest by the middle Ming. In the following periods, changes continued to occur; and by the late Ming, cash payment eventually replaced labour conscription for water control. Meanwhile, In conformity with the latter development, local government also made great efforts to tap irregular sources for funds that were insufficiently met by official local contribution systems. The rest of this chapter concerns the course of these shifts.

The change in the sources of finance toward much higher levels of local input was to a great extent made practically possible by changes in the forms and composition of the funds which came to be used. Thus, before we proceed any further into the matter, we need to look at these changes. The change in the forms of input was related, not so much to the development of water control techniques themselves, but
to the transformation of the local labour-service system which was a component of a political campaign that took place throughout the nation.

As soon as the Ming was founded as a national regime in the fourteenth century, the Ming government launched a campaign to increase state control of rural society. To facilitate government intervention in the countryside, a unified labour-conscription system was set up. It comprised two categories of conscription: "regular duty (zhengchai 正差)" which was subdivided into four subcategories, and "miscellaneous corvée (zafan 雜泛)" including all levies for extra-bureaucratic activities. This labour-service system functioned on the basis of the village tithing system. All rural adult men were subject to state-imposed conscription, which met the needs for local labour forces for a wide range of purposes, including both imperial undertakings such as the courier service and the transporting of tax grain to the capital, and local public works like repairs to city walls and the maintenance of water-control works and roads. Under this system, levied labour was the major form of local input in the construction of local public works including water control.

This system persisted probably until the middle of the sixteenth century, when most of the labour services were commuted into payment, first in food and then in money, as a result of commercial development. The commutation probably began with part of the miscellaneous corvée; then it extended to the regular duties. Later on monetary commutation even extended to land tax that had traditionally been levied in kind. In this tendency, the Yangzi valley took the lead, due to its high level of commercialization and agricultural development. For example, land tax collected in silver in Shaoxing amounted to eighty-two per cent of the total revenue in the late Ming even though there were other taxes.

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It seems that the monetary commutation of the labour contribution to water control had a late Song origin in the Shaoxing area. In the upper Puyang River basin, the evidence found dates back to 1184. However, it was limited to the contributions of the well-to-do or upper-grade households (i.e. the leadership section) that were asked by the government to carry more responsibility than others.

By the middle Ming, the budgets of most hydraulic projects were calculated in cash-payment. Quotas were allocated among farmers according to their landholdings. The majority of the labour corps - conscripted or hired - were paid with the money levied from the farmers. If there was any surplus after the project was completed, it was usually used to purchase fields which were then assigned to provide proceeds from their rents to cover the costs of future repairs. A levy of this kind was made only when large projects were envisaged. On many occasions an advance of money was made at the request of the magistrate from the tax payments that were supposed to be delivered to the provincial or national capital; and the repayment was distributed over several years' arrears, with the approval of the higher authorities. In many cases, the dues could be cancelled if the area was reported to be suffering from natural disasters by the time to pay.

In the late Ming, this monetary commutation was not limited to the official labour conscription. In Xiaoshan, it was also applied to two categories of the rural population for the maintenance of the Western-River Levee. Those who lived near the levee made an agreement with others who lived far from it, by which a generally applicable labour contribution was required for regular repairs. According to the agreement, the former were specified to do the actual work of the latter, and had therefore to be paid in money. This cooperation

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11 R. Huang, 1974, pp. 95, 125.
12 Song Huiyao, shihuoj, shuilipian.
was vulnerable to conspiracy by those responsible for the work: they colluded with government clerks to request more repair work than was actually needed. They lined their pockets while just muddling through the jobs they were contracted to do. When a number of dike breaches occurred due to the poor maintenance, magistrates and local elites began to consider this agreement, called "contractual responsibility" (baoyi 包役), as a fraud. They laid the blame on these contractual dike repairers, condemning them as "tricksters" from near the sea walls (jintang jianmin 近塘奸民). To prohibit this fraudulent practice, the government ordered that all commuted labour contributions be collected in money at the government-prescribed rates. Then, trustworthy scholar-gentry were to be charged both with collecting the money and using it hire the labourers needed, in the expectation that "the tricksters could no longer have their own way" in profiting themselves, and that the river dikes would remain in good condition for years.

Similar monetary commutation was also practised for privately organized works within lake-based communities. All the fields under a lake system were required by the communities to bear the costs of regular dredging and dike repairs. The quota on each mu varied from one community to another.

Now, let us return to my main argument. The change in financial sources was to a great degree the result of an increased demand for the input, as well as the disappearance of funds supplied from the central government. The increase resulted first from the need to maintain existing structures. This can be seen from the great sensitivity that the magistrates and members of local gentry showed in regard to the division of the costs for the rebuilding of the sea walls and other large projects among the counties concerned. For example, the costs of constructing the Lock of the Three Rivers’ Mouth and the rebuilding of the sea-wall in stone

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were officially allocated to Shanyin, Guiji and Xiaoshan, in which the majority of the rice fields were under the protection of these structures. A range of agreements was reached regarding the distribution of the costs. The assessment of the size of the contribution from each county was made according to the incidence of damage caused by breaches of the sea wall throughout the county.

In 1684, hearing that the Western-River Levee had collapsed due to an enormous flood, the prefect took a trip to the spot to investigate the damage and to assess the funds needed for rebuilding. On his return to the prefectural capital, he called the well-known scholar-gentry in these counties to a meeting in the city temple to discuss the matter of cost distribution. An agreement was made after uneasy negotiation. Xiaoshan was required to bear half of the total costs, which amounted to six thousand liang (taels) of silver. The rest was assigned equally between Shanyin and Guiji.11 Similar assessments, but differently apportioned, were also made in 1687, 1693, 1704 and 1715. The same was true with projects to rebuild other structures. This practice is known in the documents as "cooperative repair" (xiexiu 協修) or "mutual assistance" (xieji 協濟). From the nineteenth century on, all households were required to pay "water tax" (shui shui 水稅), which was combined into annual tax payment and became an important source of local water-control funds.12 It is in some possibility that the water-control tax had its roots in the above levies for the projects.

Related to the increased demand of financial input from local society, tense relations and disputes occurred between and within communities. In many cases, the disputes were carried on by members of the scholar-gentry who concerned themselves strongly with the local interests in their own counties. We have noted, for example, the dispute regarding

the reassessment of the tax quota from Xiaoshan back to Zhuji after Lake Bi had been reclaimed into rice fields (see Chapter 4).

Another such case comes from the late sixteenth and early seventeenth centuries. Ren Sanzhai 任三宅, a member of the gentry of Xiaoshan, filed a request to the prefectural government to reduce the Xiaoshan contribution to the sea-wall on the grounds that Xiaoshan was already bearing too much of the costs of the maintenance of the Western-River Levee, since the Puyang River course had been changed. The request was not accepted by the government, even though it continued to make appeals for assistance to the Xiaoshan scholar-gentry in general. The claim for reassessment continued into the late eighteenth century. I have not found any clear indication of the outcome.

In the Ming and the Qing gazetteers of Shaoxing prefecture, there are texts eulogizing officials whose individual commitment to water control was considered an indispensable contribution and thus worthy of being remembered to later generations. Most noteworthy are three figures: Ma Zhen of the Later Han, Tang Shaoen of the middle Ming (Chapter 3) and Yu Qing 俞卿 of the early Qing. Following an old tradition that the worship of images was the ultimate manner in which people could renew their commemoration of those whom they revered, a shrine was built for them. Local inhabitants addressed them as "the three masters" (sangong 三公) on all relevant occasions. In fact the first two won this honor from the Shaoxing inhabitants because of the construction of Mirror Lake by Ma, and the Lock of the Three Rivers' Mouth by Tang respectively. Yu Qing, in contrast, was remembered not for construction of any structures but rather for his complete commitment to preserving the source of the funds for sea-wall maintenance. His achievement was inscribed on a stone tablet, "the stele inscription concerning Yu Qing" (Yu Qing beiji 俞卿碑記), which stood in the front of the shrine. The inscription was later copied into the gazetteers.
The case of Yu Qing provides evidence on how the increase in the need for water-control funds caused social tension among local inhabitants, who were unavoidably involved in water control. Under the taxation assessment of the early Qing, the Shan-Gui plain had been zoned into three parts. Behind the sea wall were 93,467 mu of land, known as the "river land" (江田 jiangtian, i.e., the sea land of the Ming, referred to in Chapter 4); its tax assessment was the lowest because its soil was relatively unproductive. In the middle of the plain was the "middle-districts' land", (zhongxiang tian 中鄉田). It was the most productive land in the plain in the early Qing. To the south of it and at the feet of the southern mountains was the "mountain land" (shantian 山田) that had been the first to be reclaimed in the history of the Shaoxing landscape. According to the government prescription, the "river land" was free from taxes, and in return the holders of the land were all assigned the responsibility of regular maintenance of the sea wall and were therefore known as "sea-wall repair households (zhitang huahu 值塘花戶)". This policy was probably instituted in the late sixteenth century, and its implementation was based on the system of sea-wall leaders (tangzhang 塘長). The records of the responsibility assignment to households were known as the "books of the sea-wall repair duties" (zhitang zhi ce 值塘之冊) and were kept by sea-wall leaders.

By the early Qing, this system had fallen into disorder. There were probably two reasons for this. First was the change in the Qiantang's main flow. From the middle Ming on, the Qiantang changed its course to the north twice in a fairly suddenly fashion (between 1639-35, and between 1760-80), and formed the configuration to be seen on the present-day map. Accordingly, its currents ran away from the southern coast, and the sea-wall therefore lay ashore at most times of the year, subject to damage by river water and tides only in the case of sudden rises of the water level caused by typhoons, big tides, or flood water from the upper stream.
Second, the disorder in the system was probably related to the transition of powers between the Ming and Qing, a period when the newly founded Qing regime had not established firm control in the villages. The Shanghai area experienced similar kinds of problems for this reason.17

In 1672, the Qing government campaign for re-establishing rural administrative units was introduced into Shaoxing. According to the government stipulations, a new unit designated as li 里 (a substitute for the du 都 or tu 圃 of the Yuan dynasty at the same level) was established. The division of li 里 was entirely determined by farming area instead of by the number of residences, as had been the case in the earlier period. One li 里 was composed of three thousand mu 亩 of farmland.18 The new division served as a tax collection unit.

After this rearrangement, some powerful families shifted the registration of their landholdings out of this area to the middle-district land in order to avoid providing contributions for sea-wall repairs. Additionally, some small landholders also tried to achieve the same result by bribing land registrars or by selling out their holdings. The total of the land which was re-registered in other places came to over 19,000 mu. Accordingly, these were all known as "[tax] evasion fields" (guibi zhi tian 謊避之田). In the eighth month of 1713, when the Qiantang current rushed back towards the south coast as a result of tidal change, the sea-wall was broken in several places. On the second day of the eleventh month, when Yu Qing arrived in Shaoxing as prefect, he was involved in the restoration of the physical and institutional structure of the sea-wall.

He first made several trips to inspect the damage situation, consulted masons in order to make an estimate of the needed expenditure for rebuilding some high-risk sections in stone, and then heard the elders' suggestions on funds and their sources that were immediately available. He used

17 M. Elvin, 1977.
18 SF2 (1588), vol. 6, p. 1661.
all the government's savings derived from fines and confiscations of the property of lawbreakers, and also contributed part of his personal income to fill the budget. But the funds were still inadequate. He thus determined to restore the previous responsibility system for sea-wall maintenance.

The restoration of the responsibility system proved much more difficult than that of the physical structure. The contributory sources had decreased due to the evasion of their obligation for providing money and labour by the owners of approximately one-fourth of the river land. And the records of the responsibility assignments had been lost, which made it impossible to identify the farmers' responsibility.

When he spoke of his restoration program to some members of the local elite and elders, they were stunned, and considered it too ambitious to produce the results he envisaged. But he was not discouraged by the difficulties facing him. After careful investigation of all the problems involved, he proceeded with his plan. With the assistance of the local elite, he first notified local inhabitants of his resolution to restore the old system, in "A poster concerning the restoring of the river land back to the river" (Jiangtian gui jiang gaoshi 江田歸江告示).

Following the responsibility system used for the maintenance of the Western-River Levee in Xiaoshan, he divided the whole sea-wall into three categories according to geographical location, relating the categories to possible threats from the Qiantang's currents. The first contained sections that required little care, the second those that needed some regular maintenance, and the third those that required constant watch and maintenance. The regular maintenance was assigned equally among those who had landholdings in the river land. The assessments were entered in a new land register. The notice rendered below shows that the maintenance of the sea-wall was burdensome to farmers so that tense
From now on, the fields, whether recently or previously registered, should all carry responsibility for sea-wall maintenance. No one will be allowed to have his fields registered as supplementary to his main holdings in the middle-districts' land... Now all fields are to bear the responsibility. So when a breach happens in the sea-wall, everyone is responsible for (the restoration). Though this is an old system, it is not one-sided or unequal. If you do not want to keep it, I, as a government official, will not spare my energy to show you that it is best to serve [the sea-wall]. However, there are some people who have their fields in this land and who consider it right to avoid carrying the responsibility through trickery. They are persons lacking any sense of the common good... All of them, whether supported by local tithing leaders or local strong men, or bullies, should be given severe punishment.  

The reconstruction of the physical sea-wall structures was carried out as the result of the success in restoring its institutional structure. More importantly, the total cost spent in the reconstruction of the wall was five times more than that spent in constructing the Lock of the Three Rivers’ Mouth. To cover excess expenditure, an additional tax was imposed on all paddy-fields in Shanyin, Guiji, and Xiaoshan.

Individual Contributions
With the increased demands for funds to maintain some facilities that were left at peril as a result of the change of environmental processes, individual contributions outside the official levying systems increased and became an important

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19 SFZ (1588), vol. 6, pp.1658-60.
supplementary source later on.

In the sixth month of 1502, the Western-River Levee was breached. An official in the central government who was a native of Xiaoshan and on leave at that moment, volunteered to carry the financial costs for rebuilding the breached levee. Then, other official households followed the example he set. On the occasion of rebuilding the Western-River Levee in the early Qing, the total assessment was twelve thousand liang of silver and it was divided among three counties.

When the governor-general of Fujian (1679-84), Yao Qisheng 姚啓聖, a native of Guiji, learned that his hometown was suffering from floods, he determined to cover all the expenses himself. When his contribution arrived, the project had however already begun. He wrote the assistant governor of Zhejiang to stop levying money from farmers and to have all the money already collected returned to them. He then entrusted his brother, Yao Qihuan 姚啓鳳, with the money and asked him to supervise the project. The levee was rebuilt in stone at a cost of twelve thousand liang. Local residents named this section of the levee the Mr. Yao's Dike (yaogongtī 姚公堤) to honor his contribution.

This contribution seems excessively big, at least in terms of Yao's income from office. There is no information concerning the formal income of provincial governor-generals in the Qing, but there is that for county magistrates and prefectures. According to a study, the regular or nominal salaries of prefectures averaged eighty liang a year. In fact, magistrates' income was, to a significant extent, made up of informal incomes. This largely comprised percentages of various fees levied from extra expenditures, including those for entertaining a superior who was to come for an inspection of, or to pass by, the county, as well as from the compulsory contributions required by the provincial treasurer to replenish the provincial coffers when they had run short. The proportion of these supplementary incomes to
the salaries of prefects varied from one province to another, being six hundred liang a year in Zhili at the bottom and one thousand and six hundred in Guangxi at the top. The gap increased at the county level: four hundred at the minimum and over two thousand at the maximum: because all county magistrates were logically asked to pay more for extra expenditures due to their lower position in the bureaucratic hierarchy. There may have been less or no salary supplementary officially allotted to officials above prefectural levels. Thus, on the basis of eighty liang of silver being the average formal annual income of prefects, his contribution appears enormously big. Probably, this was one that combined all contributions from him, his clan and other sources and all were put together under his name. Records of the similar practice have been found elsewhere in Zhejiang.

In honor of this benevolence as well as to encourage many others to follow them, these donors’ names were recorded in the local gazetteers. This was considered highly as an honour which would preserve their memory in history, and for honours of this kind members of the local elite were prepared to involved themselves extensively in local public works during the late Ming and early Qing.

Another form of private contribution was made in land, or money with which to buy land, in order to provide an income for maintenance of water-control facilities. For example, to ensure a regular source of funds for the maintenance of the Lock of the Three Rivers’ Mouth, a donation of ninety-two mu of rice fields and a tract of reed ground was given by local residents, and thirty mu by the prefect, Xiao Lianggan. The rents, collected in money,

\[ T’ung-Tsu Ch’ü, 1962, pp. 22-23. \]

\[ For example, more than forty-two thousand taels were needed according to the estimation for a project to dredge the West Lake in Hangzhou in 1725. When the request was heard by the salt distribution commissioner, Wang Jun, a native of Hangzhou, he personally covered a big portion of the sum needed. See, ZTZ(1735), vol. 1, p. 1101. \]
were used for the lock, so these fields were known as "lock lands" (zhatian 鬧田). These individual contributions were made at the will of the donors themselves, and constituted an irregular source outside the local government’s control.

All the dike leaders who had fields in lakes were officially exempted from regular labour service in dike repairing and from making the contributions of materials assigned to all others according to their landholdings in the lake. The financial burden of water-control administration was distributed among all other households. 22

From the middle Ming on, local gentry-scholars began to involve extensively in local administrative and social affairs as a leadership group. By the late Ming, this tendency was very advanced. As a result, some new sources were drawn on for local water control.

The following is a notice about fundraise for dredging a channel in Zhuji. The text is followed by a list of names of members of the scholar-gentry whose status is especially indicated by the literary names following their surnames. The date of this notice is not given, though it seems that it was made in the late Qing or early Republican period. Nor do we know the status of Yu Wanjiang 余浣江 who drew up and circulated the notice. But it seems clear that the notice was not issued by the government because Yu was obviously a native of Zhuji as identified from his given name which was after another name of the Puyang River, the Wanjiang 浣江.

A notice with reverence on the matters of dredging rivers and banning timber logging in mountains
As far as water control in Zhuji is concerned, the lake fields and hill land, which are related to the people's livelihood, have suffered from floods and droughts for years in succession. Besides the loss of crops that have been inundated and washed away, and the failure of harvests with not a single grain, no less than two

22 JGQ, volume 3, chapter 2, p. 12.
million [wen] have been spent on repairing the breached dikes in the first to the fourth year of [reign-period not specified]. People seem not to be able to endure this [cost], as you know.

The government has sent us river dredging machines (kaiheji 開河機). In order to collect funds for hiring labour, we intend to hold a meeting in the city temple on the first of the ninth month to discuss setting up an administrative board to undertake the project (shejukaiban 設局開辦) Everyone is required to attend on time. Notice is hereby given."

Among the individual contributions there were some donations made by well-to-do households. In the case of the sea-wall repair, when funds ran short, voluntary contributions were called for by the local gentry from the populace (juanzi canxiu yuanjin leshu 捐資參修遠近樂輸) to make up the needs." For example, there were donations made by merchants' guilds for dredging a channel. Yet such generosity was limited to water-traffic channels which were considered to be crucial for commercial activity. Small donations, which usually comprised a few mu of land or an equivalent amount of money, were more obviously oriented to facilitating daily activities. They were specified as donations for the building of a sluice, bridge, or ferry.

**The Proportionately Equitable Allocating System**

From the late Ming on, at relatively low levels of expenditure, rather multifarious sources are found. For small works in the lake systems, labour contributions from households were still the principle input, and only some of the households were required to contribute. In contrast to the labour forces levied or hired by the local government in

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" The text is attached to JGQ and is not paginated.

" Ibid.

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earlier times, and then by rural scholar-gentry managers from the late Ming onwards, this labour contribution was assigned to households according to their landholdings. They fulfilled all their assignments themselves alone.

The old system was called the "land bordering system" (tiantou zhi 田頭制). Under this system, only those households whose fields happened to be adjacent to water were required to reinforce the full length of the dike that crossed the fields, regardless of how long it was. This was also known as "reinforcement by each household alone" (aimen fenzhu 挨門分筑).

By the beginning of the seventeenth century, this system was replaced by a new system which emphasized the equalization of contributions among the whole populace. Under the equitable allocation system, more households than ever before were made immediately liable to the contribution. This change was most obvious in lake-based communities, particularly in Zhuji. Most of my information concerning it is drawn from The Complete Documents.

Before Liu Guangfu arrived in Zhuji in 1598, even the tiantou zhi was not in full usage, as there had been other manners of dealing with the division of the responsibility for repairing lake dikes. When Liu took up the magistrate's office, he was faced by difficulties in restoring lake facilities which were poorly maintained because most lake communities had fallen into chaos. He considered it a priority to establish a unified system under which all farmers would be liable for the maintenance of lake dikes. His reform scheme proceeded with a survey of dikes and the fields behind each of the dikes. After two months of intensive work, the survey concluded with a book containing all the details concerning the length of all the dikes with their designations, configuration and topographical features, and the area of the fields behind each dike. The total length of 162 dikes surveyed was 76,817 zhang and under their protection was farmland of approximately 223,718 mu.
Responsibility for the maintenance of the dikes was assigned to each household in proportion to the area of their landholdings. The length of a dike was divided by the number of mu of land that lay behind it. Each household was assigned to repair a certain length of this dike depending on how many mu of farmland they had behind it. Records of the divisions are given in great detail in The Complete Documents. This manner of division was known as lümu zhanggeng, fenduan peizhu 履畝丈埂 分段培筑, literally "surveying farmland and measuring the length of the dikes in order to allocate the dikes in sections for maintenance".\(^{11}\)

With the wide range of the ratios of dike-length to farmland between lake-systems, the length of the dikes for whose maintenance a given area of farmland was assigned responsibility differed greatly, ranging from 6.5 zhang per mu in one lake to 0.08 zhang in another. The households thus bore responsibility in very unequal amounts. In some places, if all the fields behind a small dike belonged to a single household, the household was required to reinforce the dike. This was the legacy of the tiantou zhi, but it was described as "self-maintenance" (zizuo 自做) and was limited to the dikes of small size. These households were still obliged to meet other levies, such as providing materials and labour in emergencies to save and rebuild collapsed dikes in other places; and their performance was subject to supervision by their dike leaders.

By order of Liu Guangfu, the outline of the division of responsibility was printed in the form of handbooks and issued to all the dike leaders, and to the county government clerks who were ordered to travel around from time to time to inspect the dikes and urge the dike leaders to fulfil their duties.\(^{11}\)

Another component of this equally allocated responsibility was to keep the waterways between channel banks clear by

\(^{11}\) JGQ, volume 1, chapter 2, p. 8.

\(^{12}\) JGQ, volume 1, chapter 2, 12.
removing all trees and weeds, since they tended to obstruct the flow of water, and at worst, to stop the river flow.

As regards a household that owned too many fields for its members to carry out its assignments, a solution was devised. The owner was allowed to hire someone else, most often his tenants, to carry out the work for him. If a landlord required his tenants to fulfil his duties, he was to pay his tenants money or provide them with food for the period when they were working so as to meet his obligations. This practice was recorded in gazetteers under the title "landlords providing food and tenants labour (yeshi dianli)." Its operation and origins are discussed below.

Equitable allocation was introduced into Shaoxing by the local government, starting in the Lake Tai region, in the late sixteenth century. Tracing its origin may shed some light on how the development of water-control interlocked with the social context as well as promoting its transformation. We have therefore to turn our attention to Changshu around Lake Tai, Jiangsu, where the system was first formulated and then disseminated.

Before the late sixteenth century, the tiantou zhi still prevailed in the Yangzi valley. Jin Zao 金藻, private secretary to Yao Wenhao 姚文灝 (1455-1504), the prefect of Huzhou and the author of Zhexi shuili shu 浙西水利書 [Water control in western Zhejiang], related the merits of the tiantou zhi over the equitable allocation in the following conversation:

A. It would not be reasonable to [have people] repair all the dikes and drainage channels along their fields by themselves. Some of their fields stretch along drainage channels, while some border on the channels at the ends of the fields, and others are not adjacent to...
the channels at all. If we follow your method [the tiantou zhi], the land of the first kind will be burdened with too much labour [for dike repairs], the second will be burdened with a demand for [proportionately] little, and no labour at all will be required for the third. Is this to be considered equitable?

B. [represents the author himself] If person A has to go over to cultivate person B's fields and person C goes to repair the dikes in person D's fields, they won't have the intention of doing it well, and it will be impossible to reward those who work assiduously and to punish those who are lazy. The fields that don't border on channels will suffer from having no drainage outlets when floods occur and from having no irrigation water in drought times, and it is difficult to ship fertilizer in [through waterways] to these fields and to carry harvests out. Most of those who own these fields are poor. It is, however, easy to irrigate those fields that either lie along or near the channels in times of drought, and to drain off excessive water in times of floods; fertilizer is easily carried in and harvests out. Those who own these fields are all the well-to-do and influential households. The tiantou zhi is therefore good to the poor who have poor fields but are assured of their living, and the wealthy cannot avoid [contributing] nor can they remain idle [in their duties]. Under this system, those who reinforce the dikes or dredge the waterways will be rewarded, and those who leave the waterways to become silted up and shallow or neglect to repair the dikes will find no way to escape the punishment for their guilt."

The later prevalence of the equitable allocation system

over the tiantou zhi cannot be ascribed just to a demand for more equalized allocation for the sake of political principle. In effect it emerged as an rearrangement of duties in order to get more of the local populace, that is small landholders whose number had increased greatly, under the liability of maintaining water-control facilities.

Closely related to the increase of small landholdings was the dissolution of large landholdings that had accelerated since the sixteenth century, as noted in the previous chapter. The link is that the eventual predominance of equitable allocation over the tiantou zhi was partly a response to, and facilitated by, the increase of small landholdings, under which the old tiantou zhi was impractical and hence unworkable.

The evidence for this development in Shaoxing is largely derived from the findings of Tanaka Kazushige in his article concerning the income of a prominent clan corporation, the Lai clan in Xiaoshan." His study is based on the clan's account book, which covers a period from the late Ming to the early Qing. The Lai family originally came from He'nan province, in north China, under the Southern Song. In the fifth generation it moved south to the Long-River Township 長河鎮 of Xiaoshan. In the seventh generation it started to split into several branches, which lived apart from one another in different parts of Xiaoshan. By the late Qing the Lai's had become a well-organized association of landowners: not only did most of its members own farmland, but the clan as a whole also controlled about six hundred mu of land to provide an income for the collective facilities within the clan. These landholdings comprised more than two hundred plots, scattered in twenty-one places over Xiaoshan. All the income from these fields was managed by the clan organization. This can be seen from the account books, which carry detailed statistics of the annual income from these fields,

and the expenditures on collective activities, from 1682 down to 1813.

With the highly fragmented and scattered landholdings characteristic of late Imperial and Republican China, it was impossible for those who had several plots of fields that were scattered around to carry out by themselves their responsibility for repairing dikes and for dredging channels as they had done under the *tiantou zhi*. This was the case with the Lai clan organization. All the branches of the clan had settled separately, and their landholdings, including the commonly owned clan land, were affiliated to several different water-control systems. Although the clan was well known in Xiaoshan for its wealth and for the cohesion of its organization, and hence was quite influential in local affairs, and in spite of the fact that the clan organization was also extensively concerned with the common good within their clan community, it never involved itself as a corporation in water-control activities. As seen from the account book, the money used for such activities as local defence and the control of locusts, floods, and criminals, that were undertaken by local government outside the clan organization, took up only twenty per cent of its annual expenditure; and most of it was paid in the form of cash contributions. As soon as the money was paid out, the clan was no longer able to control the use of it. This may explain why clan organizations in Shaoxing, as in other areas in the Yangzi valley, were little concerned with local water control, and scarcely provided any organizational foundation for water-control activities.

On the other hand, the high fragmentation and scattering of landholdings reflected frequent changes in land ownership. The local governments found that the official land registers were always out-of-date, and hence needed an over-all revision every few decades. For example, in Zhuji after Liu Guangfu, Cui Yucang 崔雨蒤 organized a land survey in 1732, Zhang Debiao 張德標 in 1800, and Hua Xuelie 華學烈 in 1867. Such
was also the case in Xiaoshan where the list of surveys was longer since the average interval between any two surveys was shorter.\textsuperscript{11}

The equitable allocation system was thus devised in response to these changes in rural society in order to maintain on the one hand constant supply of funds for water control, and on the other to tap more sources for its development.

\textbf{The Yeshi Dianli}

The \textit{yeshi dianli} was an important component of the equitable allocation system. More noteworthy, it was a reform of the old pattern of cost division in water control between landlords and tenants in the Yangzi valley, both of whom relied heavily on water control for their economic well-being. The reform was devised to ensure, or at least to facilitate searching for, wider financial sources for water control projects.

According to studies by Asutoshi Hamashima, in the Song some members of the local elite and government officers had suggested equitable allocation of the costs of dredging drainage channels among all landholders concerned, but the practice prevailing in villages had remained the \textit{tiandou zhi}. This was to a great extent due to the existence of large landholdings, especially in the case of those lands that were close to drainage channels, and therefore found it easy to carry fertilizer into the lands and bring harvests out. By the late Ming, absenteeism became so pronounced that it brought uncertainty to the financial resources of water control. Thus, the equitable allocation system came to replace the old \textit{tiandou zhi} as noted above.

With the \textit{yeshi dian li}, landlords were required by local government to provide their tenants with food or grain

\textsuperscript{11} The 1866 Prefaces to JGQ.

\textsuperscript{12} K. Schoppa, 1989, pp. 13-16.

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as the payment for the work their tenants did in dredging channels or repairing dikes, and tenants provide their labour. This system was in effect devised by the local government as part of a new policy aiming at abolishing the exemption from contributing to water control for those who were originally free of providing all labour services for government as well as for local works.

To interpret the sociopolitical implications of this reform is not the aim here. However, as indicated in Asutoshi's studies, in the late Ming contributions to water control in the form of labour and money became so burdensome that it led to tense relations between landlords and tenants. This change, however, had its origins in the relatively increased demand for financial input in water control, which is hard directly perceived from economic indicators such as going-up of food prices and labour wages.

The yenishi dianli reform was introduced to Shaoxing from Changshu where it was probably devised by the magistrate, Geng Ju, in 1601. In a sense it was a trade-off between labour providers and buyers on the basis of a contract the terms of which were formulated by the local government.

All the tenants who worked for their landlords under this sort of contractual system were organized by dike leaders and village elites. The difficulties which were found in carrying out the system were mainly concerned with the payment procedure. It was this with which government intervention was mostly concerned. There may have been regional variations in respect of the way in which landlords paid their tenants with food, and of the means by which local governments supervised the deal. In Changshu, a key component was the payment voucher that was issued by the

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\(^{33}\) For a detailed discussion of the origins, application, and social results of the yenishi dianli around the Lake Tai area, see Asutoshi Hamashima, “Gyôshoku denriki-kô” [An investigation into the yenishi dianli], Tôyôshi kenkyû, vol, 30 (1980), pp. 119-153.

government. The following passage is translated from a voucher which gives some rather convincing detail about the active part played by the government in maintaining labour contributions to water control. The original copy of the voucher is found in *The complete documents concerning water control in Changshu county (Changshuxian shuili quan shu 常熟縣水利全書)* compiled by Geng Ju himself in 1604.

Food Payment Warrant for Tenant's Work

In the matter of greatly promoting water control in Changshu county in order to ensure sufficient [revenue] for the state and abundant [food] for the people: There is no doubt that the government relies on tax payment for its revenue, and landlords on rents from tenants' work in the fields. Landlords and tenants are dependent on each other as they are bound as a whole to the weal and woe that affect all. As a county magistrate, I am obliged to urge people to dredge waterways and to ridge dikes. However, the government is not able to fund all these projects. No matter whether it is easy or difficult to complete a project, landlords should be obliged to provide their tenants and hired labourers with the food for their work (*gongshi* 工食). Although [landowners] will have to pay a little more for each project [than before], the resulting benefits for the future will be countless. In our county, there have been some landlords who pay their tenants in such a fashion. However, there are also those who care too much about [their individual costs] and thus treat people [tenants?] badly. Therefore, this voucher is issued [to tenants]: When a landlord is assigned the responsibility of dredging one *zhang* of waterway, he ought to provide his tenants with a certain amount of rice to have them carry out this assignment for him. This also applies to the building up of dikes. A mediator (*gongzheng* 公証)\(^\text{11}\) will fill in

\(^{11}\) As indicated by Xu Guangqi in *Nongzheng quanshu*, the mediation
the vouchers with the details and sign on the bottom. The vouchers that tenants hold should be cashed for the amount [of rice] specified by their landlords and the latter will keep the vouchers as the proof [that they have already paid]. If a landlord is found to discount, put off, or reject the payment, or even to insult and assault the tenants, his tenants should return the vouchers immediately to the mediator who will put them together in a dossier and send it to the county government. When the day to pay rents comes up, these tenants will be allowed to deduct double their delayed payment of rice from their rents. In case [a tenant] fails to meet the deadline for the work as a result of his laziness, he should be severely warned, and forced to do double the work originally assigned. No mercy should be given him.

Listing:
Mediator of ... District
Landlord X who is responsible for dredging waterway X of X Zhang, should, by the agreement, provide X shi of rice as work-remuneration per zhang, and also for augmenting dikes of X Zhang, should, by the agreement, provide X shi of rice as the work-remuneration per zhang.

The total amount of rice X should be paid to tenant XX.

Document Number:
By order of the Changshu county government
Issued on the...day, of the...month, of ... year of the Wanli period

This reform broadened the source for financial input was usually assigned to grain captains (liangzhang 樂長) who were originally responsible for tax-grain collection in villages and delivery to the capital. See Xu Guangqi, Nongshu, p. 300. As for the role of grain captains in the villages, see Liang Fangzhong 梁方仲, Mingdai liangzheng zhi 明代糧長制 (Shanghai: 1957).

Xu Guangqi, p. 298.
into water control in the sense that the two major social
groups in the villages were charged to provide what they
were respectively able to contribute to water control. It
was designed not only to solve the problem of cost allocation
among the villagers but also to mitigate the pressure on
governmental funds from the need for water control projects.
Thus, it was easy to spread the system to other places. For
example, Xu Guangqi reproduced the payment voucher just
quoted into his book, *Nongzheng quanshu* 農政全書, which was
widely circulated in the Yangzi valley soon after being
published in the middle of the sixteenth century. 17

It was introduced to Shaoxing, probably by Liu Guangfu,
almost as soon as it was applied in Changshu. In a government
notice, "Hutian shiyi 湖田事宜 [How to deal with matters
concerning the lake-fields]", Liu sets out the necessity for
carrying out yeshi dianli in Zhuji as follows:

Tenants and landlords should all obey the prescriptions
that concern the contribution of labour by tenants and
[food] payment by landlords... Wealthy people have no
compassion for the hardship of their tenants, and take
for granted that those who work their land should carry
the costs [for water control] themselves. Poor people,
though they consider dike repairs important, worry that
they cannot provide themselves with the food for their
work. Both [groups] shift [the responsibility] onto
each other. This leads to procrastination over the
work. Both landlords and tenants are concerned about
their harvests. If the harvests are inundated, neither
will obtain anything. Hence [landlords] should be obliged
to assume their responsibility for dike repairs according
to the prescriptions.

One *mu* of farmland should provide food for a
labourer. Every winter, dike leaders are to organize

cp.5.
all labourers into groups, led by group heads, to reinforce the dikes assigned to them. While tenants are working on the dikes, landlords ought to give them a fen 分 of silver a day or reduce rents by five sheng 斛 of rice per mu as payment to the tenants. If each mu is required to support two labourers, [the owner] should give two fen of silver. If three labourers or more, the landlord should employ other labourers. If everyone obeys this rule, there won't be the worry that everyone will not act but watch when dikes encounter an emergency. There will be no trouble in finding out those who evade doing their duty and those who delay work.18

In the areas around Lake Tai, the development of the yeshi dianli was later responsible for the emergence of a conscripted labour force that completed dredging waterways and repairing dikes according to contracts with landowners.19 But in Shaoxing, no evidence for such a development has yet been found.

Temporary Levies

There were non-institutional sources which were made use of only in particular situations. When an emergency occurred due to the collapse of a dike, for instance, materials and tools including bamboo mats, pine and bamboo trunks, wood planks, hoes, bamboo baskets, and ropes were needed immediately. Dike leaders and labour group heads were called to collect and stockpile them. To meet these needs through a levy in kind was a nuisance for both farmers and for the dike leaders. A reform was initiated by residents of the White Tower Lake (bai tahu 白塔湖) in Zhuji. Instead of collecting what was needed in kind, each mu of farmland was

18 JGQ, volume 2, chapter 1, pp. 6-7.
obliged to furnish half a sheng of unhusked rice. The need for materials was then met through purchasing it at the markets with the money from the sale of the rice. After a project had been accomplished, the remainder of the funds were lent out at interest, which would be saved for future expenditure for dike repairs."

There were special costs involved in some works. A certain amount of farmland was destroyed because massive amounts of earth were removed from it to reinforce dikes, or because a new dike was built across it. Before Liu Guangfu arrived, no payment was made to those who happened to have fields that either had deep pits excavated in them to provide earth for dike reinforcement, or were confiscated for new dike constructions. This practice, which had been known as “sacrificing the small to save the big” (juan xiao yi quanda), was eliminated by Liu Guangfu on the ground that some small landholders who were thus to lose their fields, still carried their tax quota, and would therefore go into bankruptcy. He therefore ordered that from then on all farmland removed for the sake of dike reinforcement and construction should be paid for either in money according to the current market price for land, or by providing land created by floods in other places."

**Government Lands**

Other financial sources were derived from fields which were set aside to provide proceeds for the maintenance of water-control facilities. In Shaoxing most of this land was owned by the local government. Such landholdings constituted a funding source, and therefore make it hard to see the government involvement in water control at the village level as an “external” intervention. It was, rather, a component of administrative input. On most, though not all, occasions,

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" JGQ, volume 2, chapter 1, p. 10.
" JGQ, volume 2, chapter 1, p. 8.
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to construct such installations as dikes, waterways and reservoirs took up a certain amount of land and needed great amounts of money or labour. Before a water-control community was formed, or when it still lacked the organizational and financial ability to undertake these projects independently, the support of the local government was necessarily sought. Government intervened in a double role, both as a big contributor and as the supervisor. More often than not, the distinction tended to be obscured, for instance, by the role of its "involvement-in-arbitration" in local disputes related to water control. According to the evidence from the cases in Zhuji, this dual character of the government worked out as described below.

A. The government asserted its ownership and control over nearly all such installations as water-storage reservoirs (guandang 官塘), lakes (guanhu 官湖), waterways, channels (guanli 官利), rivers (guanhe 官河), flood land along riverbeds, and the lake foreshore (guantan 官灘). When Liu Guangfu engineered four projects which were designed to eliminate four loops on the Puyang River course, the land through which the new river course was cutting was, for instance, all purchased by the government from private hands. The abandoned river courses were therefore specified by the government as not to be used until they had naturally silted up so as to be reclaimed into farmland. They then became government land and were rented out to provide proceeds for water-control. The government even leased out the land which was engendered as the result of floods at the feet of hills, and by siltation at river loops and in reservoirs. All the rents were specified as water-control funds. If there was surplus from the budget, it was lent out at regular interest.

There were a lot legal disputes against encroachment committed by influential households, the government always claimed ownership of the land under dispute in order to force the encroacher out. If it was impossible to restore the land back to its previous state, it was assigned as
special land to provide income for maintenance of water-control facilities.

B. To keep the installations in operational condition, the government also purchased farmland from farmers who happened to have fields near the installations concerned, and then re-leased the fields to them. Since massive repairs were undertaken only at intervals of every few years, the rents were collected and lent out at interest between the repairs. The task of collecting the rents was assigned to the dike leaders. This type of funds was usually made for sluices and dikes which were quite vulnerable to floods and therefore needed more regular care than others.

The following table that is based on the data provided by the *Complete Documents* shows the difference in the amount of government land dedicated to water control and to other public facilities in seven lakes during the seven-year period when Liu Guangfu held the magistrate’s office in Zhuji.

<table>
<thead>
<tr>
<th>Lakes</th>
<th>water control</th>
<th>Religion^a</th>
<th>Ferries</th>
<th>Bridges</th>
<th>Steles^b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dalu</td>
<td>173.09</td>
<td>19.97</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Xu</td>
<td>23.54</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beita</td>
<td>70.21</td>
<td>1.45</td>
<td>9.68</td>
<td>7.55</td>
<td>2</td>
</tr>
<tr>
<td>Zhugong</td>
<td>37.84</td>
<td>3.24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lishan</td>
<td>2.97</td>
<td>9.31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gao</td>
<td>10.95</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Meichi 9.37

^a: ceremonial facilities.

^b: In Zhuji, most official rules and regulations were inscribed on stone steles. The land on which they were erected belonged to the government. On some occasions, the steles were roofed under pavilions, known as "stéle pavillons (bei ting 碑亭)". The government provided the land and expenses for building and maintaining the
pavilions and steles.

The figures are derived from data from the land survey in The Complete Documents. In the data, there is other government land in many other lakes, but it is too scattered to put it in the above table according to the location of each of the lakes concerned. It amounts to 513.7 mu of rice fields and 111.7 mu of dry fields.

The differences between income from government land for local public works and the government's revenue are many. In several instances, as the source indicates, once a piece of farmland was purchased by the government and leased to farmers, all its rents were used only for specified purposes, ranging from the maintenance and reconstruction of hydraulic installations to local education. It remains a question worth an enquiry whether the lands were or were not exempted from national taxes. Farmers assigned to work these fields were designated as sluice-men (zhafu 閘夫), or ferry-men (dufu 渡夫), or other titles depending on what structures they were taking care of. Unlike the postmen and craftsmen who were conscripted in rotation by the government and assigned official land to provide them with service payment, these men provided the services which met strictly local needs. Their service may be seen as local public service in the sense that it differed from, if not replaced, the labour services conscripted by the government among all male adults.

Some former studies attempted to link the shifts of the late Ming water-control contribution systems in the Yangzi valley, with a focus in the west Zhejiang around south part of Lake Tai, largely to the softening of the relations between landlords and their tenants which started in the fourth century, and became quite pronounced in following two centuries.42 This chapter argues that the change and increases

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41 Hamashima Asutoshi, 1982; and "Mindai kōnan no suiri no ichi-kōsatsu" [The investigation of water control in the Jiangnan area during in the Ming], Tōyō bunka kenkyūjo kiyō no. 47, pp. 1-62; "The Organization of Water Control in the Kiangnan Delt in the Ming Period, "Acta Asiatica vol. 38 (1980), pp. 69-92; "Gyō-shoku ten-ryoku kō,
of financial sources for water control were thus in response to the increased demands for input on the one hand, because of hydraulic expansion, and on the other, because of the costs that mounted in maintaining old works as a result of changes of environmental processes. The Shaoxing local economy and society had thus to commit themselves constantly to water control which was acted upon by the interplay of human efforts and natural environment even though the costs of maintaining it increased.

Chapter 8: Efficiency Decline

As mentioned earlier in Chapter 4, many lakes shrank and some were entirely reclaimed into farming land, particularly in the Ming when population pressure on arable land increased greatly. In fact, illegal encroachment on lake land is found as early as a lake was built. The building of the lake was originally promoted to safeguard the majority of farmers' interest. This was achieved at expense of some individual's farming land and of wishes for reclaiming more land. It was ever more difficult to uphold this principle in the facing of the increasing demand for farming land later on as population grew. Thus, many water-control works lost some their technical capacity they had reached before. The present chapter presents a case of the efficiency decline in Xiang Lake which in what may be loosely described as "premodern" terms, had reached its limit in technological sophistication and capacity before the Ming. While the residents of Shaoxing were making substantial efforts to maintain the physical set-up of water control and for it as a whole to function at the level of performance intended, the efficiency of some facilities particularly lake systems dipped with the shrinking of the lakes' size from reclamation. The decline of Xiang Lake’s technical capacity points to further the principal theme of the present thesis that when water control costs mounted, its potential began to decline.

The story of Xiang Lake is told by Keith Schoppa in his book, Xiang Lake: Nine Centuries of Chinese Life. The lake's doom in the great reduction of its size and the loss of its hydraulic function from the twelfth to the present centuries was caused, according to his account, by some misbehaviour of bad local elite as well as the completion of the Qi Hill diversion and of the Three Rivers' Lock.¹ He considers the development of the former the evidence of the decline, or

the lack in the Ming times, of the public domain in Chinese local society. He additionally attributes the unrestricted encroachment to a traditional social and cultural context in which "personal standing and relations rather than impersonal law were decisive in attaining social and political goals"." Thus, the shrinking of the lake's size is taken to indicate the decline of traditional values.

The lake's story is retold in this chapter as the base of my source-materials never extends beyond Schoppa's. But the focus of my concern is on the decline of its technical capacity as a hydraulic work rather than the change of the residents' community around the lake.

Lake Construction

Xiang Lake was located two kilometers away from the Western River Levee in the western plain. It was located between two hills running parallel in a northeast-southwest direction, which sandwiched the low-lying land between like two natural dikes. Farmers raised earthen dikes across the low-lying land, bridging the ends of the hills, and thus created a reservoir to store spring water and collect water from the hills, which otherwise would have run away as soon as the rains had stopped. The lake covered an acreage of 37,000 mu with a circumference of eighty li when it was first built in the Song. It supplied water for 147,000 mu of rice fields lying below, in nine townships. Its topographical layout and function tally with the overall characterization of lake systems in the Shaoxing gazetteers: "The altitude of the lakes is higher than that of the fields; the fields, too, are located at an altitude higher than sea level. Under these circumstances, farmers are able to channel water to the fields from the lakes in times of drought and to drain water off the fields to the sea when the rainfall is too

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With the construction of Xiang Lake, the area in which the capital city of Xiaoshan is situated was largely protected from the impact of fluctuations in the weather and became the most productive area in Xiaoshan as well as in Shaoxing.

In fact the creation of Xiang Lake was not only a process of preventing the disastrous effects of climatic fluctuation. There were social and economic factors involved as well. In earlier times, the lake-bottom land was under rice cultivation. In the Xining period (1068-1078), a proposal to turn this area into a water-regulating reservoir in accordance with the surrounding physiographic layout was made to the Song court by Yin Qing and other local residents. The land carried a certain tax quota at that moment, so to turn it into a reservoir first of all implied to the government the loss of tax revenue from the land. It was also a matter of concern for those who had landholdings in this area. The Song court nonetheless approved the request; but such an approval bore no compulsory force. It allowed the local inhabitants to make the final decision at

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The county government then convened a few meetings of the local elite, including elders and wealthy families, to find solutions acceptable to all the populace. The attempt failed, because no agreement could be reached about how to handle the tax quota, and probably because these landowners were reluctant to give up their fields to the lake. The action that gave effect to the proposal did not take place until 1112 when Yang Shi 楊時 took up the post of magistrate in Xiaoshan. He re-activated the proposal by calling upon the elders (qilao 老者) to discuss it. It seems that the government was much concerned with preserving the tax quota from the land. A solution was finally suggested to local residents. A tax quota was assessed on all the fields that were supposed to draw water from the lake. Each mu was assigned a quota of 0.75 shi of rice; the total amounted approximately to 107.5 shi and was called by farmers “the equal share of tax-grain for the lake” junbao humi 均包湖米.

The lake was finally built, but problem of equitable distribution of irrigation water persisted throughout the lake’s history. Disputes often occurred among the farmers about water supply, particularly in the seasons when a supply of water was desperately needed for the growth of the rice crops. Some disputes turned into bloody violence. In 1132, the magistrate, Zhao Shanji 趙善濟, called a meeting of all the dike leaders and "upper households" (the well-to-do in the Song dynasty). As a result, they formulated a scheme for the equitable distribution of water. The way of measuring water taken from these irrigation outlets is documented in the gazetteer. In practice farmers allotted

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1. XXZG, vol. 1, p. 287.
2. During the Song, a shi amounted to 0.6185 shi in the Ming. See G. Deng, 1993, p. XXV.
4. XXZG, vol. 1, p. 287.
5. This measurement system consisted of these divisions: lǐ 里, hào 毫, sì 斯, hu 忽, miao 秒 (sometimes chao 拙). It seems to have been one of the local measurement systems such as that used for grain-tax,

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water by checking the time water was allowed to flow through each outlet. To begin with, the lake's eighteen outlets were built up in accordance with official criteria, being five Chinese feet in width, three in depth from the water surface down, and with the two sides being lined by stone blocks, and the bottom also paved by stone blocks to prevent the water current from wearing it deeper and wider. Farmers set the rotation at which these outlets could be opened in turn and the duration of time for which each outlet could be open. The order of rotation was determined according to the altitudes of the fields, from the higher to the lower. 9 In addition, water could only be drawn in the period that began three days after the lunar calendar's Beginning of Autumn (liqiu 立秋) and ended three days after White Dew (bailu 白露), the middle-day of the ninth month,10 which was, according to local farming practice, the period by which rice crops must be ensured sufficient water supply because rainfall diminished thereafter. These were all known to local residents as “the prescriptions of the channel” (quze 水則). To reinforce them, the government set corporal punishments for water pilferage: arm-cutting for illegally opening outlets, and toe-cutting for setting up private culverts through dikes to steal water.

There must have been some disruptions of the institutional setup in the several decades that followed. In the Chunji period (1174 -1189), the magistrate, Gu Chung 高宗, restored them to what they had been.

which ranged from shi 石, dou 斗, sheng 升, he 合, shao 勺, chao 抄, zuo 撮, gui 圭, su 萁, li 粒, shu 穀, kan 角, bi 扉. As the grain-tax measurement system, there might be some reasons for the use of this water-measurement system. As early as the northern Song, the court had decreed to abolish all the units below he. See, Songhuiyao jigu 先唐要籍【the Collection of the Selected Documents in the Song】shiho 70:3; and also Liu Daoyuan 劉道元, Liangsong tianfu zhidu 先宋田賦制度【the Systems of land taxes and labor service】(Shanghai, 1931), p. 94. However, they persisted in local tax assessment records even in the Qing as we frequently read in gazetteers. The Qing government also tried in vain to dissolve them.

Lake Protection

The lake's history was characterized by a tense relationship between lake encroachers and lake protectors, and occasional conflict. A considerable amount of the land of the lake bottom was reclaimed as farmland due to extensive encroachment, particularly when local strongmen involved themselves in this activity.

In 1119, some magnate households (haomin 豪民), for instance, asked permission to reclaim some lake-bottom land for rice fields. The government called a meeting of all wealthy households to discuss this request. The debate must have been too fierce to reach an agreement between those who favored this request and those who opposed it. It was a coincidence that a severe drought occurred in the period that followed the debate: all the rivers “ran dry in the autumn”. Only the crops in the fields irrigated by the lake were scarcely affected, and a good harvest in this area was not a problem. This event thus totally destroyed the footing of those who had favored reclaiming the lake-lands.

The fertile land outside the lake dikes tempted other people apart from these wealthy households. In 1166, a lake resident (humin 湖民), Xu Yanming 徐彦明, in collaboration with a prefect, Wang Qu 王璩, overtly reclaimed some of the lake shores as rice fields, with the claim that the land was the property of Wang, and Xu himself was a tenant of the land. This practice was condemned by Mao Qiling as jixian 計獻, equivalent to xianna 獻納, a term referring to the practice of encroaching on lands reserved for public usage, like flood-land outside lake dikes or sea walls, on the pretext of renting from official households, or school or temple estates. This was quite pronounced, especially in the Yangzi valley in the Song. When Zhao Shanji discovered the trick, he spoke vigorously to the throne in favor of preserving the lake on an occasion when he was called in the

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court. With the help of a vice-minister of the Ministry of Revenue, his appeal for the intervention of higher authority to save the lake was vigorously acted on by the Shaoxing prefect, Shi Hao who gave out severe punishment to Xu and Wong for their misbehaviour. The reclaimed land was returned to the lake.

Not only the wealthy households, but farmers also were induced to encroach, though on a smaller scale. They enclosed small bays around the lake with bamboo-woven screens to raise fish, and then planted water weeds as fertilizer for vegetable gardens. The government decreed that whenever residents discovered infringements of this sort, they were allowed to send to the encroachers the government for criminal conviction (jiefu duanzui). In 1214, Guo Yuanming took up the post of magistrate. He was approached by some residents with the accusation that some farmers had encroached on the lake by building dikes along the feet of the eastern and western hills. Accordingly, he went out to investigate. A dispute occurred when some farmers claimed that the fields they had enclosed did not belong to the lake but to the hills. Faced with the fact that there had been no clearly defined boundaries of the lake before, Guo seemed to be at a loss in making a decision. His fifteen-year-old son told him one day that it was easy to tell the lake land from the hill land by checking the color of the soil in the reclaimed land. The hill soil should be yellow, and the lake siltation greenish and light. He therefore resolved to clear up the boundaries of the lake, and had the enclosed land restored to the lake. To curb further enclosing, he had a notice issued to the public that the boundaries between the lake and the hills would be drawn by a golden line, namely the border between the two kinds of soil. All the lands with greenish soil were declared to belong to the lake; anyone who reclaimed them would be considered a lawbreaker, and automatically incur
criminal charges. There were, however, some farmers who still tried another way in order to reclaim the lake land. They dumped hill soil into the lake and built houses on the land they created. Guo was at first bewildered. But after his son suggested he should return there and dig up the soil, he finally discovered the truth. Then he had the houses destroyed and these farmers exiled to the northern borders.

Paying respect to the past has been considered one China's traditions. This may be seen from bureaucratic behavior. To start a new policy, officials tended to recall old institutions and practice relevant to asserting the present one. In 1378 after the Ming was established as a national regime, a magistrate, Zhang Mou, was determined to restore the lake system which had been left in disorganization during the transition between the Yuan and the Ming. He made great efforts to find the old operation manual, "The Regulations of Water Allocation (Junshui yueshu ji)" that had been revived by Gu Chong in 1185, and then discarded in the time of political unrest later. He then had it reprinted with a new preface he wrote. To show his firm commitment to restoration of the lake system, he had a stone table set up in the court of the county government, on which the regulations newly revived called "Irrigation Charter of Xiang Lake" (xianghu shuili tuji), with an illustrative map also drawn by Gu Chong, were inscribed. He also had a public shrine built on a dike to commemorate four magistrates: Yang Shi, the creator of the lake; Zhao Shanqi, who risked his office to expose the misbehavior of an official to higher authority to protect the lake's integrity, and initiated operating rules for it; Gu Chong, who restored and revived the regulations; and Guo Yuanming, for his impressive commitment to the clearing of the lake while facing unprecedented difficulties in a period when many other lakes around the

12 IXXZG, vol. 1, 293-94.
county disappeared due to massive reclamation. Local residents came to the shrine, twice a year and offered their "thanksgivings" by placing in front of these images various local specialities. This ceremonial activity was carried out into the Qing; but the number of the worshipped images was reduced to three perhaps because their contributions were confused in their memories, as the location of the shrine was changed more than once.  

In addition, a traditional way of using the written records for social adjustment was employed. In histories, poems, stele inscriptions and even local legends, only those who were considered moral models were recorded, while those condemned as villains were purposely left out. Most records concerning the lake's history refer frequently to two persons who protected the integrity of the lake at the cost of their own lives: He Shunbin 何舜賓 and his son, He Jing 何竟. He Shunbin used to be a censor in Nanjing and Huguang, but he lost his position due to his personality, too straightforward to be tolerable to some higher levels officials. He returned home from exile in Guangxi in 1498. He began to carry out the instruction that was left by his mentor, Wei Wenjin 魏文靖, also a retired official, who was much concerned with the lake's integrity once he arrived home, but died before He Shunbin came back from exile. Discovering the extensive encroachment that had been conducted by a lineage leader, Sun Quan 孫全, with the connivance of an incumbent magistrate, Zou Lu 鄭魯, He Shunbin, in no hesitancy, sent a memorial to the court about the situation. However, to win a case against an alliance of a locally powerful man and an official required more than promptness and a heart of integrity. He was framed by Zou Lu for stealing an official seal in order to send the memorial, as well as for his illegally returning home without official pardon. In addition, one of He's students was also falsely charged with robbing the graves of other households for treasures. This charge

11 K. Schoppa, 1989, p. 27.
was used by Zou Lu to discredit He’s reputation. As a result, He was found guilty and exiled again. On the way to the place of exile, he was murdered by the men of Zou Lu and Sun Quan. His son, He Jing, fled with his mother to the home of his father’s friend in Changshu in Jiangsu, with whom He Shunbin had built friendship when they both passed the civil service examination in the same year and both served on the Board of Punishments.\footnote{K. Schoppa, 1989, p. 50.}

One day, after they had been in hiding there for eight months, He Jing heard that Zou Lu was going to leave his position in Xiaoshan and be transferred to Shanxi with a promotion. With a scheme thoroughly planned, he and his fellow kinsmen ambushed Zou Lu and his escort on the dike of Xiang Lake. The bloody battle ended as promptly as it had begun. He Jing captured Zou Lu, and the group took him to the court in Hangzhou to file prosecution against him for the collusion with the lake encroacher as well as for the murder of He’s father. The court, after hearing this case, sent several officials to investigate the truth.

Then, a reassessment was made of the judgement in He Shunbin’s case. Zou Lu was found guilty of connivance in the encroachment on the lake and of the murder of He Shunbin, and was thus sentenced to death. On the other hand, He Jing was found guilty of assaulting on imperial officer, and was sentenced to death as well. Then, a succeeding magistrate, Yang Duo 楊鐸, resumed 1772 mu of land which had been reclaimed by the lineages of Sun and Wu as well as by some commoners, and destroyed all the brick kilns and houses built on the lake land. To prevent further encroachment, he set up a stele on the lake dike on which the inscription was cut to warn any future encroachers, as follows: "No encroachment on the lake land; no renting of the lake land; no pilferage of water; no fishing nets to be allowed to be set up outside dikes and across waterways; no plants to be cultivated in the lake to catch siltation. Those who infringe the above
rules will be certainly sentenced to death or exiled to the northeast borders."

In the writings of local literati, the contest in which the He’s both lost their lives was considered a glorious manifestation of the lake’s spirit that was incarnated in a military captain, a native of Shaoxing, who died for his loyalty to his military lord and then was buried on the top of a hill beside the lake. It was said that the spirit had saved lake residents from several misfortunes in the past.

In the Zhengde period (1506-1521), coinciding in some ways with the preceding case, an official on leave from the Board of Works, (who were commonly referred to as xiangguan/xianghuan in the sources,) Zhang Ding 張濬, who was a student of He Shunbin, and an official of the Board of Justice, Fu Xia 富紱, lodged a case against the encroachment by Sun Zhaowu 孫肇武, one of the descendants of the Sun lineage. Probably because they still held their official titles, their request immediately caught the attention of a regional commissioner, Xu Tingguang 許廷光. The latter responded by sending out his deputy, Ding Qi 丁沂, to investigate the case. No resistance from the encroachers occurred, and all the reclaimed land was immediately restored to its former state. Ding additionally had a public notice posted, in

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16 XXZG, vol. 1, p. 296.


18 Used at first in ancient times, the term referred to the canton chief in Song times. See B.E. McKnight, 1971, p. 209; Hoshi Ayao, 1976, p. 83. According to Gu Yanwu and elites of the late Qing, it also referred, as a general category, to all village officials who were selected from and by local residents according to their qualifications in wealth and behavior, and who were subject to the government's dismissal at the request of the locals. See, Chen Zhi 陳熾 (who lived in late 19th century) Yong shu [The book of the unwavering mean] in Wuxu bianfa 戊戌變法 [Reforms in 1898], comp. by Zhonggou shixue hui (Shanghai, 1953), vol. 1, pp. 234-35. The difference between periods is obviously slight in theory. In general it refers to influential persons of a certain social status, including gentry-scholars and officials on leave or at retirement in their home. On some occasions it was used in particular to address the latter, meaning literally "resident officials". See Mori Masao, "The Gentry in the Ming: An Outline of the Relations between the Shih-ta-fu and Local Society," Acta Asiatica: Bulletin of the Institute of Eastern Culture No.38, (1980), pp. 35, 47; and Hamashima, 1982, pp. 233, 235.
which the contribution of He's family in that conflict was reasserted, and warnings against any potential encroachment were laid out. He also destroyed some small-scale enclosures.

The lake’s history provides, however, a case demonstrating the active role that the government played in the formation and safeguarding of community institutions.

Daily management of the lake system was undertaken by dike leaders (tangzhang 塘長), a system which was part of the Song government’s control in the villages. The position of dike leader was filled in rotation by the well-to-do households who acted on behalf of the government in the villages. Their duties ranged from organizing regular maintenance, inspecting the dikes, catching encroachers and water pilferers, and keeping information in flowing between the government and local residents. Tough punishments might be imposed on those dike leaders who were found delinquent in their duties or who collaborated with lawbreakers. Such systems survived into the middle Ming, as showed in the following text:

All the lake dikes are to be divided, under the direction of the assistant magistrate, into nine sections, and the responsibility for management is assigned to the nine townships respectively. Each township provides two able-men as the lake leaders, who are from the well-to-do households and behave virtuously. A dike leader is to be responsible for taking care of a dike. When he discovers someone farming in the lake land or illegally taking water, he has authority to capture the rule-breakers and to take them to the county government...

In accordance with the precedent prescriptions of the Zhengtong period (1436-1449), anyone, whether local bullies (tucao 土豪) or deceitful peasants (jianmin 奸民), who illegally build [private] dikes to enclose lake land for over two months and show no willingness to return it to the lake, will be considered guilty and exiled to the northeastern borders, and the case shall...
be reported to higher authority afterwards. If a dike leader connives at the encroachment of a local bully for a share of the profits, he will be convicted of the same crime as the encroacher, and accordingly sent into exile once his action is discovered by other residents and proved true by officials. All dike leaders are not required to perform any labor services. In consideration of the hard-work they do, the positions will be reassigned to another dike leaders within two years."

In the meantime, the magistrate was required to make trips out at intervals to inspect the dike situation and the performance of the lake leaders at intervals. Failure to do so would incurred punishment as well.

To a great extent the integrity of the lake and the lake organization was determined by governmental intervention in rural society.

The size of Xiang Lake shrank greatly due to the encroachment conducted by two powerful lineages in the middle of the Jiajing period (1522-1567). The Sun lineage emerged again as one of its descendants gained a position in the central government. The lineage thus built a bridge across the lake at its narrowest point under the pretext of facilitating "public traffic". In fact the bridge made it particularly easy to cross the lake for the lineages of Sun and Wu, which lived across the lake from each other and had recently made a conjugal tie. The magistrate of that time "did not dare to speak a word for the lake" for fear of the Sun lineage's rising power. But he made a pretext for his acquiescence, saying that "the bridge is built right where the lake is naturally divided into upper and lower parts, where water flows out to the south and north. In the period that followed, many small bays around the lake were enclosed to form fish-pools. Houses and ancestral shrines were built on the more elevated lake land, and a great number of

" XXZG, vol. 1, p. 298.
private kilns were built, which used siltation of the lake. The bridge was, however, considered a visible stigma that debased the lake’s nature as the foundation of local public welfare. As condemned by Mao Qiling with great resentment later, the bridge was an overt inroad on common interests. This period was therefore considered a dark time in the lake’s history by Mao Qiling.

Gentry Administration

By the late Ming, gentry-scholars raised to leadership in local public works. The gentry-scholars’ participation in water control was an alternative to collaborative management of conscripted dike leaders and government clerks. The former system was declining due to leadership corruption, a point that is showed in the following text which was attached to an indictment lodged by some gentry-scholars in 1786.

On our knees, we sincerely request a thorough investigation of those who have broken the rules, who have left the dikes in poor repair, and who have bribed clerks or used their connections to take water illegally using water-pumps or private culverts. They, no matter who they are government clerks or local vermin (du 鬚), ought to be thoroughly investigated, and (other) people should be notified that according to the sanctions against lake encroachment, all those who are once accused will expose themselves to the criminal sentence of exile. The same will happen to those dike leaders and government underlings (xuli 賢吏) who are prosecuted. As for the officials who have perverted the laws to


11 According to M. Elvin, the earliest record concerning the actual participation of the gentry and scholars (shen-shih) in local public actions dates back to 1684 and is limited to Shanghai, but the phenomenon might have occurred earlier elsewhere. See M. Elvin, 1977, p. 463.
help [the above persons] or take graft from the spoils, and are derelict in their duties, [it is a matter of] the stern state to which reverence is owed, on which we, scholars, (shusheng 書生) are not allowed to make comments.11

As a consequence of this request, a team comprised of several gentry-scholars and an assistant magistrate was formed to investigate the lake’s situation, both physical and organizational. Thirty-three illegal culverts and water-taking outlets were found, some of them camouflaged by sharing the names of official outlets and others physically hidden from sight. Forty private water-pumps were discovered. All these illegal facilities were then destroyed.

In the seventh month of the same year, more than twelve basic-level degree holders (shengyuan 生員) jointly launched a lawsuit against an “irrigation clerk” (shuili ya 水利衙),23 Kai Jing 懷經, a dike leader and a township leader (zongjia 總甲) who were delinquent in their responsibilities. This lawsuit was intended to have them dismissed from their posts in the end:

On our knees, we request to have the clerk, dike leader, and township leader put into police custody for a thorough interrogation. The graft and evildoing they have committed should be measured against the law.


23 It seems that a distinction in ways of addressing government clerks developed between officials and local gentry-scholars in Qing times. In gentry-scholars' writings, the clerks are called by informal terms such as ya 衙, xu 薛, yi 役, and li 賴 which usually expressed dislike of the persons addressed. In communications of the government with the public such as court judgements, official notices, and the like, clerks were usually referred to by the formal and neutral term, "administrators" (dianshi 典史), which in the Ming refers to jail-wardens, and sometimes to the county treasurer, zhubu dianshi 主簿典史. But in the Qing, it was used to refer to all clerks in charge of specified duties, prefixed with other words, such as shuili dianshi 水利典史 for irrigation administrator. See Hoshi Ayao, 1976, p. 308. Usually in cases of the denunciation of clerks, the informal terms were used as alternatives to the formal one by the gentry-scholars.
without exception. [The case] should be used to show the public that the government cares about public welfare, and that the benefits of water control are certainly delivered to them.14

In the late eighteenth century the gentry took on a new role as managers and engineers of projects (shendong/dongshi 纥董/董事). A primary distinction between gentry managers and dike leaders under the conscript system is, as pointed out by Elvin, that the former provided local society with "their service as professional organizers".25 On most occasions, a degree holder was selected from the public as a director or supervisor for the construction or repair of water-control works. A management committee was formed consisting of those gentry-scholars who promoted the project and advanced or donated part of the money needed for the project. In some cases their donation constituted the major source of funds for dike repairs and sluice modification.

On the other hand, the authority of the managerial gentry was recognized and backed up by the government due to their intimate knowledge of local affairs, and their substantial technical knowledge ranging from pre-evaluation and fund raising to engineering and directing projects.

In 1796, for instance, Yu Shida 於士達, with several other degree holders, made a trip around the lake to inspect the situation. Then, they petitioned the provincial government for an advance of a thousand taels, that amounted to five years' annual repair expenditure, for an extensive repair of the lake dikes and outlets, with the suggestion that the money could be derived from a deduction from the county's annual tax quota. His knowledge of the lake's physical conditions and social environment is reflected in his book, A Summary of the Investigation of Xiang Lake in Xiaoshan County (Xiaoshang Xianhu Kaolue 蕭湖湖考略). Like many

14 XXZG, vol. 1, p. 306.
others, Yu expressed his distrust of governmental underlings for their lack of real commitment to local public welfare. As a result of the investigation, the project was contracted to a body of gentry-scholars including Yu himself. According to the agreement signed, the government lent them the money on condition that they would have to bear all the responsibilities including organizing labourers, and engineering, and would guarantee (jujie 具結) the good operational condition of the lake system for five years. After this term expired, the responsibility for lake maintenance would be handed over to the government.

This plan was in effect designed to prevent the further involvement of government underlings who had lined their pockets on lake repair projects before.16 Their efforts brought about the outcomes expected. Within less than a month, the dikes were greatly reinforced. Several dikes were reinforced with stone blocks laid down in a gentle slope known as the "water-glacis" (tanshui 坦水) to prevent waves from eroding the dikes. In succeeding years, there were a few more dike repair projects undertaken by gentry managers in the same fashion, which are described in the gazetteers as "following the precedent of the first year of the Jiaqing period (1796) (yuanzhao jiaqing yuannian chengan 援照嘉慶元年成案)".17 In the ninth month of 1846, Zhang Baikui 張百揆, with other gentry-scholars, made a request for an advance of the funds for maintaining the Western River Levee, in order to rebuild some dikes that had been ruined in the floods of the previous year. The same happened in 1866. The government even relied on the administration of gentry-scholars in emergencies. On the eighth of the fourth month in 1880, the magistrate, Gong Jin 龔謹, requested his superior for permission to rebuild outlets destroyed by a flood, also "following the precedent of the Jiaqing Reign" by entrusting several gentry of integrity with this restoration project.

16 XXZG, vol. 1, p. 318.
At the close of the nineteenth century, massive reclamation occurred throughout China at the appeal of the central government "for extending agriculture and raising education". In Xiaoshan, a reclaiming corporation (kenwu gongsi 塑務公司) was set up under the auspices of local gentry-scholars. In the beginning of this century, the foreshore lands of Xiang Lake (zhangtu 漲塗/tudi 塗地) grew to 4,635 mu, mostly in the lower part of Xiang Lake, and some land rose to two or three Chinese feet above the water, probably due to the drop of water level. In 1905, a local degree holder, Huang Yuanshou 黃元壽, asked the General Board of Agriculture, Industry, Commerce and Mining (nong gong shang kuang zongju 農工商礦總局) for a permit to reclaim land. Notified of this request, a member of the urban gentry, Sun Shoukang 孫壽康, with great anxiety, immediately assembled several other gentry-scholars and elders to request the government to reject Huang's demand. The dispute soon drew the attention of the Provincial Administration Commission (buzheng si 布政司) which, after consulting with the bureau, dispatched a commissioner to investigate the lake's situation with the assistance of the county government. The official assigned to this proceeded with a documentary study of the lake's history, and held several meetings with the elders. A heated debate broke out between those in favor and those opposed at the meetings. No information is given concerning the decision-making process. What we know through the sources is that a perpetual ban (yongjin 永禁) on any land reclamation in the lake was declared by the government as a result. By the beginning of this century, the lake shrank to one third of its Song size and even smaller after 1949.

It might be feasible to consider the gradual reclamation of the lake's land the case of releasing the local economy from the heavy reliance upon the performance of the lake system. However, Xiaoshan has been little free from its responsibility for as well as from the reliance on the whole water-control system in Shaoxing. Particularly, the diversion
of the Puyang River imposed threat to the Western River’s levee, Xiaoshan has been thus left in a position more vulnerable to the flood of a big river, the Qiantang River.

Over the centuries, inhabitants of Xiaoshan have taken pride in Shaoting being called the “land of waters” translating to both by Chinese and by outsiders. This reputation marks a recognition of the unique relation of Shaoting with water, both in the way they water dominates the Shaoting landscape, and thus in Shaoting’s remarkable achievements in water control that are, nevertheless, a local metaphor that describes Shaoting’s land, particularly in the Shaan-Gui plain, as a "一项大水下流的土壤." This image carries the implication that the Shaoting suffers on threats of floods and drought, a view echoed above two metaphors illustrate that have a real and documented in this study. That is, if any change can be attributed for another, the development of water control must be seen as a failure for the formation of the present Shaoting landscape.

During my field trip to Shaoting, I found that is the Shaan-Gui plain there are three pavilions standing on the top of three hills. These were once considered the points from which the sea view could be seen and are therefore commonly known as Shaoting’s "looking-pavilions" (designated by many 亭). The positioning of these hills form a line which runs northeast to southwest and cutting through the Shaoting plain from the East of the Qili mountains through to the Old Lock of Three Rivers. This northeast alignment coincides with the trend of the dikes in which the pavilions were built. In fact they were built to commemorate the three major hydraulic works which, in a certain sense, date back to the landscape of the Shaan-Gui plain.

Historically, they were all erected near the same basic plan at different periods, but they have now been left far from the sea. The oldest pavilion is the one standing on top of a small hill just south of the site of the remains of Miracol.
Conclusion

Over the centuries, inhabitants of Shaoxing have taken pride in Shaoxing being called the "land of waters" shuixiang 水鄉, both by themselves and by outsiders. This reputation marks a recognition of the unique relation of Shaoxing with water, both in the way that water dominates the Shaoxing landscape, and also in Shaoxing’s remarkable achievements in water control. There is, moreover, a local metaphor that describes Shaoxing’s land, particularly in the Shan-Gui plain, as a "lotus leaf" floating on water. This image carries the implication that Shaoxing suffers no threats of floods and drought. To some extent these two metaphors illustrate what I have argued and documented in this study. That is, if any change can be a fulcrum for another, the development of water control must be seen as a fulcrum for the formation of the present Shaoxing landscape.

During my field-trip to Shaoxing, I found that in the Shan-Gui plain there are three pavilions standing on the tops of three hills. These were once considered the points from which the sea (in Hangzhou Bay) should be best viewed, and are therefore commonly known as the "sea-viewing pavilions" (wanghai ting 望海亭). The positioning of these hills forms them into a line which runs northward, hence also seawards, cutting through the Shan-Gui plain from the feet of the Guiji mountains through to the old Lock of Three Rivers. This seaward arrangement coincides with the order of the dates in which the pavilions were built. In fact they were built in commemoration of the three major hydraulic works which, in a certain sense, gave form to the landscape of the Shan-Gui plain.

Historically, they were all located near the water-front in different periods, but they have now been left far from the sea. The oldest pavilion is the one standing on top of a small hill just south of the site of the remains of Mirror
Lake. This hill used to be in the middle of the lake when the lake was in existence. In fact what viewers could see from this pavilion at that time was not the sea but the waters of the lake (though it was described in literary terms as a "sea [hai 海]" to bring out its extensiveness). The second pavilion is on the top of one of the two hills between which the Yu Hill Lock, also known as to local inhabitants as the "old lock", was built in the late eighth century. The lock has now been replaced by a bridge, but the pavilion still remains. The third pavilion stands on the southern side of the Lock of the Three Rivers, more than forty kilometers northeast from the first one. It was built shortly after the lock was completed. Gazing east from this point now, one can see not the sea but a new modern lock standing four kilometers away at the exit of the Qianqing River into the bay. The old lock has no longer functioned as a water regulator since it was changed into a bridge in 1972; its function has been taken over by the new lock.

In fact, the construction of each pavilion marked the advance of the man-made landscape, proceeding from the alluvial fans at the feet of the Guiji Mountains into the extensive saline wetlands bordering on southern Hangzhou Bay. As a consequence of the development of water control, Hangzhou Bay has experienced, and is still experiencing, many changes to its southern shoreline. In a sense, these pavilions represent visible markers of the history of the plain over the last millennium.

The Shaoxing landscape has had a rich history of varied man-made transformations that took place on the lowlands as well as in the uplands. That is to say, it has seen changes in its channel patterns, the shape of its coastlines, its vegetation, the types of its land and the composition of its soils. Among the numerous factors contributing to these
variations, water control was the only man-made one deeply involved with environmental processes. The variations of tidal action and the increase of the siltation rate in lakes and drainage channels were perceived even by contemporary members of the local elite as having human causes. Construction of later water-control works was in some sense patch-up work for ones constructed earlier, necessitated in turn by environmental forces themselves set in motion by human action. The development of Shaoxing agriculture was locked into this pattern of interaction between humans and their environment. The impact of the natural environment (which includes the climate, though our discussion here has been limited to hydrographic processes) on Shaoxing agriculture can hardly be understood unless the nature and effects of water control in Shaoxing are addressed.

It is uncertain to what extent, if at all, the rise and fall of dynasties and associated population fluctuations may be associated with the periodic development of Shaoxing water control. Answers to this question are perhaps difficult to demonstrate from the evidence available now. One might certainly argue, though, on the basis of the cases presented in this study, that the conventional economic approach - little concerned with effects of environmental changes on human activities in the economic arena, and focussing mostly on the human side - is inadequate because it fails to take into account the events analyzed here.

In the long term of Chinese historical development, the period of the mid- to late Ming marks a decisive stage. By then, the technological capacity of water control to effect an expansion of rice fields had already been all but exhausted. Nearly all large-scale wetlands had already been converted into farmland. At the same time, all dry lands capable of being easily made into paddy fields of higher output had similarly been converted. However, the costs - certainly the absolute costs, though less certainly the costs relative to population and product - of constructing,
maintaining and reconstructing such hydraulic works increased greatly, and this tendency continued into the Qing.

The construction and maintenance of hydraulic works requires a considerable input of financial support. From the late Song onwards, several changes in the sources of funds and labour supply occurred, and some innovations were introduced in the way in which costs were distributed at the local level. This was promoted by the need to search for new sources on the one hand, and on the other by the need to maintain old sources that had dwindled, or had been stopped altogether, as a result of changes in rural society.

In Shaoxing, as in the Lake Tai area, the period of middle to late Ming was one which saw impressive hydraulic expansion, resulting in the creation of an integrated network of water control. As a concomitant, the period saw the occurrence of many local reforms designed to increase the supply of money and labour. Among these were the yeshi dianli, and the system of household responsibilities as a substitute for the tiantou zhi. These various changes indicate the scale of the problems posed by the need for funds and labour as input into water-control activities. The reforms and innovations alleviated the organizational and financial stress in the short term. But the long-term problems remained intractable, as demonstrated by the frequent occurrence of land surveys, and of reforms aimed at increasing the supply of money and labour for the maintenance of dikes during the late Ming and early Qing.

Water control produced an impact that cut deeply not just into the physical landscape but also into the social landscape as well. Shaoxing has a social history of considerable depth in time, and one that in substance comprises great variations in local organizations, intellectual traditions, and material culture. Our understanding of the many layers of this depth is considerably enhanced by exploring the nature of water-control activities, with its multiple changes over time.
In Shaoxing, water control developed - especially after the Ming - mainly as a local public undertaking. There were of course certain non-local aspects such as the transport canal, but most water control works were locally undertaken and managed, and served the need of the local inhabitants for defence against floods and provision of the infrastructure for general food production. These works were of great concern to the local government, which involved itself, in some cases extensively, in local water-control activities as it did in other local public works. Such involvement was more than justified in order to ensure its revenue resources and to preserve social order.

The safeguarding of hydraulic facilities from private encroachment was central on the agenda of government operations. Encroachment of this kind was an overt violation of community authority, and its increasing occurrence demonstrates the limits to the capacities of community water-control organizations.

Nevertheless at the same time the tendency to such encroachment had its roots in, and accordingly developed largely in conformity with, environmental processes. For example, the emergence of new lands around lakes or between river banks as a result of heavy siltation after flooding was more often than not followed by extensive encroachment. More noticeably, the extensive deforestation that took place on the Shaoxing highlands after the late Song caused soil erosion which brought damage to water-control facilities by making lakes shallower and silting up drainage channels. In response to the increased rate of siltation, massive clearance of lakes and dredging of drainage channels was called for either by the government or by local communities. These activities were then followed by campaigns aimed at reinforcing community authority. It seems logical to say that the functioning of water-control organizations was largely determined by the technological requirements of water control, and many of the characteristics of these organizations were
derived from the interaction of water-control projects with the natural environment, in addition to local social and political circumstances.

The development of Shaoxing agriculture thus was thus caught in the hydraulic trap, and deprived of any easy alternatives later on when the dynamic potential of water control began to decline. Hence, any successful long-term physical and social engineering thus always carries the price-tag of increasing immobility and over-commitment.
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