

Chapter 11

Research Cooperation between Chinese and American Geographers and its Significance in the Quest for Sustainable Development

Peijun Shi, Clifton W. Pannell and Tao Ye

11.1 Introduction

When comparing the geographies of China and the United States we note both countries are large, middle-latitude territories roughly the same size in area with a major ocean on the east and southeast flank. Yet there are key differences as China is enclosed on the southwest, west, and northwest by great mountains and basins. By contrast the U.S. has an ocean on its west which links it to Asia. These geographic realities have helped shaped the historical evolution of the two great countries. China is an ancient civilization and culture and today is on a rapid trajectory of economic growth and social change as it modernizes and urbanizes. It contains the world's largest population of 1.35 billion. The U.S. is a relatively young country with a population of 314 million and has an advanced economic and technical system, although today the country faces serious financial challenges owing to a recent period of excessive spending and inappropriate fiscal management.

China and the United States are the two largest economies in the world. China has the largest market in the world, while the United States has the most advanced technologies, which should provide very good conditions for Sino-US cooperation in science, technology and economy. The United States is among the countries with the largest per-capita energy consumption and exerts significant impact on global energy, environment and climate. China, perhaps the fastest growing economy, with

P. Shi (✉) · T. Ye

State Key Laboratory of Earth Surface Processes and Resource Ecology,
Beijing Normal University, No. 19, XinJieKouWai St., HaiDian District,
100875 Beijing, China
e-mail: spj@bnu.edu.cn

T. Ye

e-mail: yetao@bnu.edu.cn

C. W. Pannell

University of Georgia, 520 Cloverhurst Ave.
Athens, GA 30606 USA
e-mail: cpan@uga.edu

its huge population base, makes its total resource consumption, especially energy, rank top in the world. People are constantly concerned that China's rapid development will exhaust world resources and destroy the global environment. In different ways, China and the United States both exert substantial influence on global energy, environment and climate, and both are of critical importance to global sustainable development. How do geographic realities affect the outcomes of economic development and technologic change in these two countries that impact the environment, climate change and energy usage, and what are the contributions of geographers in each country to the study and resolution of on-going and future problems and challenges?

Since the formal establishment of China-US diplomatic relations in 1979, we have seen significant efforts developed to realize solid cooperation between China and the US for sustainability. At the government-to-government level, cooperation on environment, energy and climate issues are the most valuable in terms of sustainability, and also a significant part of the relationship between China and the US. Moreover, geographers from China and the US have been working on sustainability of environment and resources and other topics (Fan et al. 2003). However, as we shall see researchers and scholars in each country have employed varying methodologies and approaches derived from different academic and political traditions, although we now begin to see some evidence of the beginning of convergence especially among Chinese geographers who have completed their graduate education outside of China. In this chapter, the details of the cooperation at both government and academic levels shall be briefly summarized to discuss future efforts required.

11.2 Government-to-Government Cooperation

11.2.1 Cooperation in the Past

Since 1979 when the Sino-US diplomatic tie was formally established, some periodic characteristics emerged in Sino-US cooperation in fields like environment, energy and climate, which were closely related to the international political environment and the diplomatic background of the two countries. In general, the cooperation in the above fields can be divided into four main periods: the starting period of cooperation in the 1980s, the temporary suspension period in the 1990s, and the re-development period after "9·11" and the accelerated development in the Obama period.

11.2.1.1 1980s: the Starting of Cooperation

From the establishment of the Sino-US diplomatic tie to the end of the 1980s, the Sino-US relationship evolved successfully in various fields. After the *Third Plenary*

Session of the Eleventh Central Committee (1978), China determined to focus on economic construction, implement the policy of reform and opening-up and actively introduce foreign capital and advanced foreign technologies and equipment. In doing this, it was willing to cooperate with developed countries including the United States. During this period, the Sino-US relationship was normalized. On the other hand, the US government supported China's reform and opening-up, as the US realized the huge market potential in China and its economic and political benefits. The US invested heavily in China, provided advanced technologies and developed bilateral trade and an economic relationship.

During this period, the cooperation was mainly inter-governmental, and political interest surpassed economic interest. Both governments were very much enthused and actively created policy conditions for cooperation, reflected in the US government's relaxation of restriction on export of technologies to China and the Chinese government's active implementation of reform and opening-up to create conditions for Sino-US cooperation. During the warming-up period, cooperation projects were limited, at a smaller scale and less deep level. China was at the starting period of reform and opening-up; its environmental awareness and energy demands were limited and the extent of opening-up was not large. The US interest in China was more from strategic need, and cooperation in environmental protection was not a key issue in the Sino-US relationship.

Specific fields of cooperation between China and the US in terms of environmental protection in this period mainly included monitoring and control of air pollution, ozone protection and acid rain. There were several important pacts and agreements signed on environmental protection. In 1980, the first cooperation agreement on environmental protection technology was signed between China and the US. On February 5, 1980, the leading group of the environmental protection Office of the State Council of China and the US Environmental Protection Agency signed the Protocol on Technological Cooperation between China and the US in Environmental Protection, under which four appendixes were formed afterwards, involving environment and health, pollutant control, environmental change and impact and global environmental problem. Other agreements followed.

During this period, Sino-US energy cooperation was mainly concentrated in petrochemical energy such as coal, petroleum and natural gas, as well as hydropower generation and water resource utilization. Besides, China and the US also explored cooperation in peaceful utilization of nuclear technology. On August 28, 1979, China and the US signed the cooperation agreement on hydropower generation and water resource utilization. On March 15, 1980, the appendixes of cooperation agreement were signed in Beijing. On September 20, 1982, the Chinese government and the US government signed the cooperation agreement on hydropower generation and water resource utilization from 1982 to 1984. Several famous water conservancy and hydropower projects known to us now were included such as the *Three Gorges Dam* project. In 1985, the two countries signed an agreement on cooperation in peaceful utilization of nuclear energy. In May 1986, after the Sixth Meeting of the Sino-US Joint Economic Committee, the two parties signed two agreements to fund the feasibility study of two projects of disposal hazardous wastes in China

and power station turbine reconstruction. The signing of these agreements indicated the support of the two governments for promoting Sino-US energy cooperation.

11.2.1.2 1990s: Cooling Period

In early 1990s, due to dramatic changes in the world political situation, western countries like the US started to reassess their relationship with China, and the Sino-US relationship temporarily entered a low-ebb period. As a result, Sino-US cooperation in environmental protection was diminished, and many agreements signed earlier could not be implemented. The US projects and funds for environmental protection in China were gradually reduced, and for a time the US Environmental Protection Agency did not have a special fund for cooperation with China. Compared with corporations in other western countries, corporations in the US lost many commercial opportunities in the competition for the Chinese environmental protection market. However, by the late 1990s, China had successfully withstood the pressure and sanctions imposed by western countries and safeguarded its fundamental national interests. China and the US started to restore their cooperation in environmental protection. After all, Sino-US cooperation met both parties' interests; therefore, from 1994 to 1995, Sino-US cooperation was reinvigorated after a short period of suspension.

During this period, the cooperation areas were expanded based on the ones of the previous period. New cooperation highlights emerged besides the strengthening of cooperation in air pollution and river pollution, and new environmental policies. For example, legislation of emission trade in China gradually became an important part in Sino-US environmental cooperation. In terms of energy, besides strengthening of cooperation in petroleum, coal and natural gas, the utilization of clean energy, development of new energy and environmental protection became important elements in Sino-US energy cooperation.

The US transnational corporations and organizations started to play a role in Sino-US cooperation in environmental protection and energy. Some large US investment companies started to invest in China and export advanced equipment to China. China's huge demands also became the focus of attention for US entrepreneurs, who saw a promising prospect in the extensive Chinese market. Economic globalization also had a complementary impact on Sino-US cooperation. China needed funds, technologies, advanced equipment and management abilities of the US, while the US needed China's market.

During this period, the Sino-US agreements on cooperation for environmental protection followed. Specifically, in March 1997, Premier *Li Peng* and the visiting US Vice President *Al Gore* co-presided over the "Sino-US Environment and Development Symposium" in Beijing. After the meeting, the Chinese National Planning Commission and the US Department of Energy signed the *Sino-US Proposal on Energy and Environmental Cooperation*. The main areas of this agreement were clean energy, urban air pollution control and electricity application in rural areas. Afterwards, the US Environmental Protection Association and the Chinese government

and research department cooperated to carry out the research on Chinese policy and legislation in emission trade. In April 1999, State Administration of Environmental Protection of China (SAEP) and the US Environmental Protection Agency (EPA) signed the intention for cooperation on “Feasibility Study on Reducing SO₂ Emission by Using the Market Mechanism in China”. In September 1999, EPA and the SEAP signed an agreement to carry out research and pilot work on total emission control and emission trade under the Sino-US cooperation framework. *Benxi* City and *Nantong* City in China were appointed as the first two pilot cities. Numerous other agreements including some related to the peaceful use of nuclear technology soon followed.

11.2.1.3 Post “9.11” Period: Strengthened Dialogue and Cooperation

In early 2000s, some changes took place in the Sino-US relationship. The Sino-US spy plane incident and the unilateral policy promoted by *George Bush Jr.* in the beginning of his administration led to another low ebb of Sino-US relations. However, the “9.11” incident in New York City occurred soon afterwards. China showed its understanding and support for the US anti-terrorist actions, and the US government finally came to realize that the largest threat to the US in the new millennium was terrorism instead of China. A closer Sino-US relationship was resumed. On the basis of bilateral cooperation, cooperation within a multi-lateral framework also started to be an important component in Sino-US cooperation, especially in terms of environmental cooperation. Meanwhile, the serious threats to international energy resources increased potential dangers of Sino-US competition for energy, and the intensified competition were not favorable for either country’s economic development. Therefore, China and the US both called for strengthening of dialogue and cooperation. During this period, China’s accession to the World Trade Organization further increased China’s opening-up, and its energy demand growth made China a great attraction for US enterprises. However, in terms of climate issues, former President *Bush* thought that the requirements of the *Kyoto Protocol* did harm to economic development in the US and thus the US withdrew from *the Kyoto Protocol*. No substantial progress was made in Sino-US cooperation in climate change.

The breadth and depth of Sino-US cooperation in environmental protection and energy were increased in the early twenty-first century. Changes also occurred in forms of cooperation, and the influence of non-governmental communication was gradually increasing. Sino-US cooperation in environmental protection and energy was developing rapidly and in good shape, with less and less influence from political factors. In April 2000, US Former Vice President *Al Gore* signed the *Sino-US Joint Communiqué on Cooperation in Environment and Development*, further promoting Sino-US communication and cooperation in energy, environment and development, including protecting global climate and bio-diversity. A number of specific agreements and communiqués followed which elaborated cooperation on energy usage and efficiency, hazardous wastes, and climate issues.

In terms of climate change, in June 2007, the Chinese government released China's National Plan for Coping with Climate Change for the first time, which gave a comprehensive description of China's position and policy in climate change, drawing extensive attention. In the "Eleventh Five-Year Plan", the Chinese government put forward the constraining indexes, i.e., the energy consumption per unit GDP would be reduced by about 20% during the period of the "Eleventh Five-Year Plan", and the total emission of main pollutants would be reduced by 10%. Meanwhile, the US call for changing passive climate policy and adopting more powerful measures to reduce greenhouse gas emission was increasing, and the concern with the issue of climate change in US society was also substantially rising.

The rapid warming of the issue of climate change made it more urgent for China to carry out international cooperation in climate change. This strong intention of international cooperation was reflected in the detailed list of technologies needed for coping with climate change in China's National Plan for Coping with Climate Change. The huge changes of the climate politics in the US, to some extent, also increased the US's intention to strengthen Sino-US cooperation in coping with climate. In terms of the US government, in the Sino-US strategic and economic dialogue started in 2006, the US would list energy and environment as one of the six key cooperation fields. In October 2007, the US Assistant Secretary of State Negroponte delivered a speech at the banquet of the US-Sino Relationship National Committee and listed climate change as one of the five global challenges with which the US should intensify cooperation with China.

In considering how Chinese and American geographers/climatologists and atmospheric scientists might cooperate successfully in research ventures, it would be useful to get the key national scientific organizations in each country to contact major departments and research centers to determine the nature and extent of current research on climate change. Further, surveys should be conducted to determine which units and researchers would like to do cooperative and comparative research on specific issues related to climate change both from an historical and contemporary perspectives in the U.S. and China. Such collaborative research could be encouraged and stimulated through research funding that would be specifically designated for the most significant research topics by funding agencies such as the National Science Foundation. An example of a research agenda and topic that would be of critical importance would be the ongoing study of carbon emissions in each country and how they affect other countries through the global atmospheric circulation system. Analysis could be undertaken at a variety of geographic scales ranging from the local to the regional to the global.

11.2.1.4 The Obama Era: Cooperation towards the Future

On January 20, 2009, *Obama* was elected the 44th US President, ushering the US into the Obama Age. Since the start of his administration, *Obama* put forward many guidelines in his election campaign and adopted many corresponding measures in his administration. The Obama government attached great importance to climate

change, new energy and green economy and vigorously advocated “*New Energy for America*” centering on developing clean energy, reducing energy consumption and improving energy efficiency. Several experts in energy and climate such as *Steven Chu* were appointed as high-ranking officials of the government. In the American Recovery and Reinvestment Act signed by *Obama* on February 17, 2009, 10% of the budget for economic reinvigoration was to be used in green energy projects. On June 26, 2009, the American Clean Energy and Security Act were released, aimed at reducing greenhouse gas emission in the US and reducing the US’s reliance on foreign oil.

In the Obama era, the Sino-US cooperation in environmental protection, energy and climate change was carried out in a comprehensive manner, and Sino-US cooperation entered a new historical period. In November 2009, during President Obama’s visit to China, the two parties formally signed the “*Memorandum of Understanding between the Chinese and American Governments on Strengthening Cooperation in Climate Change, Energy and Environment*”. The two parties reiterated that they would continue to promote the 10-year cooperation and announced agreement on an energy efficiency action plan under the 10-year cooperation framework. In Mid-May of 2010, the Sixth Meeting of the 10-Year Cooperation Joint Working Group was held, incorporating the relevant results of 10-Year Cooperation into the second round of Sino-US strategic and economic dialogue. During this period, besides energy cooperation in clean coal technology and coal bed gas development, there is potential for cooperation in fields such as energy conservation, energy efficiency improvement, renewable energy development, nuclear energy and potential technology as well as relevant standards, policies and economic incentive mechanisms.

11.2.2 Problems and Challenges

Although China and the US achieved significant progress in government-to-government cooperation on environment, energy and climate change, problems and challenges have always been an important issue. There are still differences, obstacles and challenges for cooperation.

China and the US are two independent countries. Although we share a unique planet earth, the countries are different. Any government-to-government cooperation has to follow the national interest. If the cooperation is believed to be positive to national interest, it will be carried out. Otherwise, it will not, as China and the US are such different countries. The most critical issue is the divergence between socialism and capitalism, and the difference between a developing country and a developed country. For a worthwhile explanation, see the 1984 prefatory essay of Professor *Huang Bingwei*. The differences undermine mutual trust and consequently hamper the support from the US to China.

The disparity in ideology has always created difficulty in China-US cooperation, although the “Cold War” ended more than two decades ago. It is one of the fundamental approaches of North-to-South cooperation that the developed countries

provide international aid to developing countries. However, socialist countries were excluded from the list of benefit countries. Official aid provided to China by the US government is very modest in sharp contrast to the support from Japan and the EU. The influence of difference in ideology can also be observed by the change in the attitude of the US to China's need of cooperation induced by political events. In the 1980s, China started reforms and an opening policy and urgently needed funding and technology. As we have seen in an earlier section, China and the US started cooperating on environment and energy issues in this period. However, since 1989, the US enacted serious economic sanctions on China. The sanctions stopped the export from the US to China, particularly of high-tech products. The US opposed any proposal to provide China with loans by international financial institutions. Also, the peaceful utilization of nuclear energy in China was affected.

China's environmental problems have not always been used as a reason for cooperating with China by the US government. Frequently these environmental concerns have been used to convince outsiders that China is a serious threat to the global environment. Most developed countries finished the stage of rapid progress with severe environmental pollution and high resource consumption. Therefore, many people are concerned that the rapid development of China will produce considerable environmental pollution and consume a substantial amount of global resources causing serious challenge to the world. Some propose that the development of China should be restricted rather than helped with funds and technology to avoid environmental and resource problems. The environment diplomatic report of the US in 1997 claimed that in 1995 the consumption of coal, grain and meat in China had surpassed the US, and the green gas emissions from China were the second in the world. When President *Clinton* met Chairman *Jiang Zemin* in the mid-1990s, he claimed that the largest threat of China to the US was not military, but resulted from environmental problems. China was taking the place of the US and becoming the largest environmental polluter in the world. Americans believed that the carbon dioxide and sulfur dioxide emitted from Chinese factories could travel as far as the eastern Pacific and damage weather, atmosphere and climate of the US. Therefore, the US did have a sense about China's environmental problems, but the strategy was to blame, not to help.

In the energy field, China and the US have more conflicts. Due to the limited total stock of fossil fuels, China and the US as the two largest consumers in the world will inevitably meet in the energy market. The US is now the largest crude oil consumer, taking up 25% of the world's total consumption, with annual import of 500 million t. In past years, the US has been making great efforts to explore new and clean energy sources such as alcohol and bio-fuels to reduce its reliance on crude oil and imports. In year 2010, its import rate of crude oil dropped below 50%, which is the first time in 13 years. Of greater potential significance is the recent discovery and recovery of large reserves of shale gas in the US. This is natural gas trapped in shale formations that can now be released through a form of mining called hydraulic fracturing or "fracking." While the current amount of shale gas mined now accounts for about 35% of natural gas consumed in the US, the total production of natural gas is projected to rise by 44% by the year 2040, and the US is committed to a policy of energy independence in part based on its large reserves of natural gas and associated oil deposits (US Energy Information Administration 2012).

In contrast, China's dependency rate on imported oil increased from 47.2% in 2007 to 56.5% in 2011. Nevertheless, China's technology on clean and renewable energy sources is much less developed. *Kissinger* has his famous saying: "control oil and you control nations". In the twenty-first century, it is not the oil but the technology of clean and renewable energy that may determine the power of a country. Therefore, it would be extremely difficult for China to get the advanced technology from the US, due to the lack of trust and the fear of threat, although the action would benefit the planet earth.

There is also significant divergence between the perspectives to climate change of China and the US. As the top developed country, the US is leading its developed friends claiming that all countries should be treated equally and contribute to emission reduction according to the current emission level. The US quit the *Kyoto Protocol* with the excuse that large developing countries such as China and India should not be exempted from emission reduction. However, the developing countries believe that climate change is the result of cumulated carbon dioxide in the atmosphere mainly attributed to carbon emission by developed countries since the industrial revolution. In this sense, the developed group should be more responsible. Also, they are expected to provide developing countries with funds and technology to reduce emission in the development process. From Copenhagen in 2009 to Cancun in 2010, and to Durban in 2011, there has been no actual progress in climate consultation before the Rio + 10 conferences in 2012.

11.2.3 Future Perspectives

11.2.3.1 Cooperation: A Win-Win Game for China and the U.S.

With notable rapid economic development, China is suffering from the huge cost of eco-environment degradation, which also brings concern from other countries. In June 2005, the journal *Nature* published a famous paper "*China's environment in a globalizing world: How China and the rest of the world affect each other*" (Liu and Diamond 2005), indicating that if the consumption level of China reaches the standard of the developed countries, global resources consumption and environmental impact will be two times greater than the current (year 2005). At the closing part of the paper, the authors said

... In the past two decades, China has created an economic miracle. We hope that, over the next two decades, China can also create an environmental miracle and set a good example for other nations to achieve both socioeconomic and environmental sustainability. The outcome will affect not just China, but the entire world. (p. 1186)

Another famous article is from the *Guardian* (Watts 2005), saying that

In the nineteenth century, Britain and Europe taught the world how to produce. In the 20th, the US taught us how to consume. If China is to lead the world in the twenty-first century, it must teach us how to sustain. (Website <http://www.guardian.co.uk/world/2005/sep/20/china.jonathanwatts>)

As a rising and developing country facing serious issues related to global environmental change, China assumes great responsibility. Nevertheless, as a developing country with the largest population in the world, China faces the problems of limited resources and technology availability. Consequently, international cooperation with technical and financial support in environment and energy problems for China is needed, perhaps even essential. The demand for advanced technology makes China a huge market. Most of the environmental protection products and energy technology are below the international standard, and therefore considerable amount of products rely on import. In this sense, international cooperation is urgent for China.

Many of the major environmental policies, institutions and laws in China are from the developed countries, especially the US, based on their experience for success and lessons learned. Much of the terminology and underlying activities are also introduced from the US to China, e.g. *Environmental Impact Assessment*, *Emission Trading*, *Clean Production*, *Eco-compensation*, *Environmental-taxation*, etc.

China's huge demand in environment and energy brings the US opportunities. As the country with the most advanced science and technology in the world, the US has invested substantially in developing environment and energy products. These products have been sold to China and brought back profits. For instance, in China the cost of constructing a nuclear power plant is estimated to be 2 billion USD, of which half will be left to foreign investors because China does not possess full technology to finish the project. It is estimated that a 1 billion USD contract will bring 5,000–7,000 employment opportunities, most of which are in high-tech industries due to the complexity and intelligence-intensive nature of the project (Tremayne and Waal 1998).

As we see above, on the one hand, China benefited from the international cooperation on environment and energy. Technology and funds have brought China significant progress in environmental protection and sustainability. On the other hand, the support to China is positive to the national interest of the US, because high tech exports win considerable revenue and employment opportunity. The cooperation on environment and energy is a win-win game for China and the US.

The continuing economic growth and development of China offers good opportunities to the U.S. and a fertile ground for collaborative research between American and Chinese geographers in examining the expanding trade relations between the two countries. This trade is based on the idea of comparative advantage in the factors of production and regional specialization of production. Both countries benefit from such trade at least theoretically. Economic geographers in both China and the U.S. are ideally suited to examine and analyze the various issues in this bilateral trade relationship to help determine the nature and mutual benefits of such trade. Moreover, the nature of global trade is a key factor in the continuing economic growth of both countries, and such analysis extends far beyond the bilateral trade between the two. Examples of the collaborative work of Chinese and American geographers on trade matters that extend to the global economy are available (Liu et al. 2009).

11.2.3.2 Cooperation for Planet Earth

The benefit of China-US cooperation on environment, energy and climate issues is far beyond the bilateral context. The process of global environment change and globalization make humans increasingly aware about the globalized environment problems, e.g. climate change, ozone destruction, land degradation, water pollution, desertification, and reduction in biodiversity. The world now is highly interconnected. Countries are closely linked to each other, not only in socioeconomic activities but also in environment and energy issues. Acid rain and dust storms may easily cross country borders. International rivers can easily induce drought in downstream countries if the upper stream is not well managed. Deforestation, desertification and industrialization can accelerate carbon emission and increase the uncertainty in future global climate. Also we see the impact of natural disasters is global. Examples are the impact of Iceland's volcano eruption and the 2011 eastern Japan great earthquake and tsunami.

The extent and damage such natural events cause indicate another area of potential cooperation for Chinese and American geographers. Geographers, with their interest and abilities to study and understand both natural and human-associated phenomena are in an excellent position to conduct research on the issue of disaster risk reduction. For many years Professor Gilbert White and his students have examined natural hazards and the behavior of humans in ignoring or diminishing the risks or dangers of such natural hazards. None of the problems can be solved by a single country, and international cooperation is needed. Sharing research findings and methodologies for analysis on hazards can begin the important goal of cross-national cooperation in disaster risk reduction. Sustainability issues are beyond races, nations, and ideology. China-US cooperation brings benefit to both China and the US. It also makes a great contribution to global sustainability and sets up a good example for other countries to follow.

11.2.3.3 Future Perspectives

There are problems and challenges, but there are also a number of achievements obtained in the past decades in China-US collaboration. In the current international environment, every country looks beyond its own borders for the sake of its national interest. Conflicts may result, but opportunities for collaboration always exist as long as there is common interest. Also, the divergence can always be resolved through bilateral and multilateral communication. With the increasing concern about the sustainability of our planet earth, we should be optimistic about the China-US cooperation on environment, energy and climate in the coming decade. China's development strategy, environmental protection policy and energy policy requires considerable input in related fields and industries. The environmental protection and energy technique market is booming, and it will continue to bring American companies lots of opportunities. The international community welcomes deepened China-US cooperation on environment and energy.

It is expected that more framework agreements will be signed between China and the US on environment, energy and climate issues, which will further strengthen the government-to-government cooperation. As indicated by China's Vice Premier *Wang Qishan*, China and the US have many points of common interest. China is the largest developing country in the world. It is at the stage of rapid economic development and structural change. Energy-efficient and environment-friendly technologies have huge market potential in China. The US is the largest developed country in the world. It has advanced technology and plenty of experience in energy efficiency, clean energy, and eco-environment protection. The relationship between China and the US on this matter is complementary. A series of agreements will be signed between the two largest countries in the future to further discuss how specific problems can be handled, e.g. greenhouse gases, water pollution, and sulfur-dioxide emission.

Cooperation is expected to have a broader context. Besides the traditional cooperation on greenhouse gases and pollution, several new fields are going to be incorporated in the collaboration framework. For instance, since 2004, China and the US began to discuss how to use an emission trade quota system to control emissions from the power industry and reach the national goal of emission-reduction.

In summary, as the two largest countries in the world, and the countries with the most energy consumption, China and the US are mutually dependent on environmental protection, energy and climate issues. The further cooperation between the two countries will definitely bring benefit to the people of both countries, and the entire globe.

11.3 Collaboration between China and U.S. Geographers

11.3.1 *Historical Perspective*

11.3.1.1 1949~1979: Early Collaborations

Although there had been some contact and communication between Chinese and American geographers prior to 1949, it was limited owing to the Second World War and the civil war in China which followed. While several geography departments were established in some of China's major universities during the 1920s, China's Institute of Geography was first organized in 1940 under the Academia Sinica (Hsieh 1959). The rupture in diplomatic relations between the People's Republic of China and the United States thereafter cut off scholarly and academic linkages, and the Cold War which followed the Korean War precluded virtually all contact between China and the United States for a number of years.

The reorganized Academia Sinica which included the Institute of Geography was moved to Beijing in 1953. This became the Chinese Academy of Sciences (CAS) designated as China's premier research agency and center. One of its Divisions, "*Earth Sciences*" included Geography. As Hsieh (1959) noted following this reorganization,

China has taken the Soviet Union as its model in the transformation of an agricultural country into an industrialized one. It recognizes that geography can play an important role in national construction in surveying the physical environment and natural resources and in the planning of development projects concerned with irrigation, land use, soil erosion, transportation and hydrography.

It is clear the focus of this Soviet-inspired “socialist” geography was mainly on various fields of physical geography as well as applied research that would serve the fundamental interests of the state and its people. It is also clear that this focus on physical geography and natural resources development allowed geography to take its place within the Chinese scientific establishment because it copied the Soviet model of geographic science. (Wu 1958; Huang 1984).

Yet human geography managed to survive through its metamorphosis and linkage to the natural environment and resource analysis. *Wu Chuanjun* (1958), for example, one of China’s leading economic geographers, indicated that the Soviet approach to geography was based on fieldwork, sound technical knowledge of the physical environment, and the interrelation of physical and economic geography (Wu 1958). In 1963 at the 3rd National Assembly of China’s Geographical Association, 343 papers were presented and focused on topics such as agricultural and physical regionalization, land use, water conservation, soil and land resources, agroclimate regions, agricultural mapping and climate cycles (The Third National Assembly, Annual Meeting of the Geographical Society of China 1964; Pannell 1980). In this period, other topics for Chinese geographers included water resources, river management, flood control, conservation, reclamation, and navigation (Chang 1975). On the other hand, studies on economic geography emphasized most heavily transportation, coal, petroleum, iron and steel, machines and cotton textiles, besides the farming of rice, wheat and cotton. The pattern of focus was appropriate since it was the period of China’s recovery and reconstruction after the war.

During this period, China was not open to western countries, and we can hardly find any study by Chinese geographers on foreign countries or even the global issues. On the other hand, the obstacle of diplomatic relationship also impeded the work of American geographers who were interested in mainland China. American geographer *Chang* (1975) made a survey of the studies of western geographers, including 100 books (monographs, or atlases) and 50 articles in American geographical journals. He found that about one third of these books were exclusively on China. The rest of the books paid attention to border issues, heavy industry, communes, minorities and local developments with respect to China. The journal articles were concentrated on the reappraisal of China’s resources foundation, progress made in transportation, redistribution of industries, urban growth, water resources and desert studies.

Jack Williams (1969) surveyed American geographers to assess their willingness to conduct research on China. According to Williams, among the approximately 4,000 geographers listed in the 1967 directory of the Association of American Geographers, only 65 expressed interest in mainland China. Furthermore, among the 26 geographers who gave first choice to China, only 6 of them published important studies on China (Table 11.1). As Williams (1969) indicated, the result

Table 11.1 Survey statistics (Williams 1969)

	Choice of China	Some knowledge of Chinese	Native Speakers
First	26	17	8
Second	27	11	6
Third	12	4	1
Total	65	32	15

... suggests a depressing lack of interest ... in a country that is inevitably destined to play a major role in world affairs despite the turmoil and disunity presently displayed, a country with one-quarter of the human race within its borders, with resources sufficient to make it a major economic force and certainly a country with one of the most enduring cultures ever created by man.

The reasons for the depressing lack, as Williams summarized, were the inaccessibility of China and the difficulty in learning Chinese language. Williams (2003) later provided an updated picture of the work of American geographers on China with an emphasis on those who are members of the China Geography Specialty Group (CGSG) of the Association of American Geographers. As he indicated the progress in the work being done in the last three decades is impressive, although the research agenda remains limited.

The period from 1966 to 1976 witnessed the Cultural Revolution in China. In this period, Chinese geographers were much less productive due to the domestic disorder. Yet some good scientific work in geography continued. Perhaps the best scholarly work in geography was seen in physical geography and its subfields of geomorphology and hydrology. While much geographic research had previously been done in regional classification of soils, mineral resources, and climate, in geomorphology and hydrology increasing emphasis was placed on process and analytical understanding of the mechanisms of geomorphic and hydrologic forces (Kikolski 1964; Stoddart 1978). Meanwhile work in cartography and related fields such as remote sensing lagged (Pannell 1980).

11.3.1.2 Post-1979 Era: Getting to Know and Work with Each Other

Knowing Each Other by Conferences Even before China and the US established formal diplomatic relations in 1979, mutual visits and cooperation between Chinese and American geographers had begun. In 1977 the first official visit of American geographers under the auspices of CAS took place (CAS, Institute of Geography 1977; Ma and Noble 1979; Ma 2007). A group of 10 American geographers spent 3 weeks in China and visited several university geography departments as well as research institutes doing geographic research. The following year, the Ohio Academy of Sciences sponsored a return visit of 10 of China's most senior and promising young geography scholars. CAS and university scholars in China presented briefings on the status of geographic research and study in China, and complementary field excursions and briefings on the latest geographic research in the US were

presented in return during the visit of the Chinese geographers to the United States in 1978. The highlight of the October, 1978 visit of the Chinese geographers was a meeting held at the Wingspread Conference Center of the Johnson Foundation in Racine Wisconsin. A number of leading American geographers convened for an exchange of ideas and information on the state of geographic research and scholarship in both countries. The importance of these initial meetings and exchanges cannot be overemphasized, as they soon led to a flow of graduate students from China as well as joint research activities and exchanges among a number of scholars and institutions (Ma and Noble 1979; Ma and Noble 1981; Ma 2007).

Soon thereafter, Chinese geographers started to participate in geography academic conferences held in the US. The most popular events are the Annual Meetings of American Association of Geography (AAG) and the International Geographical Union (IGU). The first formal report written by Chinese geographers regarding geography annual conferences was in 1981, by *Zhang Piyuan* (1982). It is the first introduction to Chinese Geographers about the AAG Annual conference, in which the conference structure, value of geography, and the latest trends in geographic scholarship were summarized. In the report, the author emphasized the trend of quantitative approaches and metrics in geographical research. Quantitative analysis in geographic scholarship emerged in the US in 1950s and accelerated in the 1960s, while Chinese geographers started such research in the 1980s and reached its climax in the 1990s. Later, the full text of the speech of Prof. *Ronald F. Abler* on AAG Annual Conference, 1987 was translated into Chinese and published in the Chinese journal *Human Geography* (Alber and Wang 1991). AAG events on 1994, 2010 and 2011 were also formally reported to Chinese geographers in journals (Zhou 1998; Zhao and Zhang 2010; Zhang and Chai 2011).

The settings of conference topics were always reported to introduce the latest trends in geographical research. Yet, participants were sensitive about the interest and scope of research presented at the AAG conference which made them feel anxious. For instance, in the report of the 1994 AAG event, Prof. *Yixing Zhou* (Zhou 1998) pointed out that the innovations in methodology (for example, the introduction and application of computers for geographical information systems (GIS) and digital cartography) were advancing geographical research in the US. Also, he found that topics and working groups such as cultural studies, social justice, geographical perspective of women, and human rights were completely strange to him as a geographer. These topics illustrate the divergence between the geographical scholarly emphases of China and the US which have not converged till now (e.g. social justice or human rights), or the frontiers of geography which were later introduced to and well developed in China (e.g. studies with GIS, and women's perspective).

Cooperation Platforms There are important platforms for Chinese and American geographers, which have played a significant role in promoting cooperation. The working group of AAG, CGSG aims to promote the study of the geography of China, including Taiwan, and to serve as a clearinghouse of information for persons interested in Chinese geography. It also seeks to increase contacts with Chinese geographers and encourage professional activities, including the development of collaborative

research projects. A report on some of the recent research activities of the CGSG and its members may be reviewed in the essay on the geography of China compiled for a major compendium of recent scholarship in American geography (Fan et al. 2003).

The working group began research on China as early as 1953. In 1973, the Committee on Chinese Geography (CCG) was formally established within the AAG structure, and *Rhoads Murphey* of the University of Michigan was elected to serve as the committee chair. In 1979, CGSG was established in Philadelphia and the CCG was formally terminated and merged into the CGSG.

The major activity of CGSG includes academic study and publication on China issues, journal publication, organizing panels for the annual AAG meetings and maintaining a newsletter to keep its members informed on their activities as well new publications and research projects. It also presents annual awards for the best student papers to encourage the younger generation in the geographical study on China.

Examples of Specific Projects Chinese and American geographers also carried out a substantial number of joint research projects. From 1981 to 1983, Chinese experts went to the United States to cooperate with US experts in doing research, with beneficial progress made in numerical value forecast and numerical value simulation experiments. In 1982 and 1983, experts of China and the US exchanged mutual visits several times and prepared cooperation plans in the climate area. Chinese scientists and US scientists held the Sino-US Climate Academic Symposia in Beijing, to discuss issues like climate research cooperation and put forward feasible measures. In 1987, the scope of cooperation of this project started to expand to research on annual tree rings, climate change and climate simulation. The Sino-US monsoon cooperation research carried out from 1983 to 1993 was highly effective. This project for atmospheric science cooperation was carried out with the US government with funding from the China Meteorological Administration and the National Natural Science Fund. China and the US carried out cooperation in terms of the formation mechanism of East Asian monsoon, the relationship between East Asian monsoon and Indian monsoon, monsoon and Chinese weather and climate, monsoon's low frequency vibration and inter-annual vibration characteristics, putting forward many new views, providing some basis for long-term forecast and cultivating a group of excellent climate study experts. In 1988, the two countries carried out Sino-US mesoscale meteorological cooperation and held three mesoscale meteorological academic symposia in 1988, 1990 and 1992. For more information, see the websites of the branches of the Institute for Atmospheric Physics (IAP, <http://cmsr.iap.ac.cn>) of the Chinese Academy of Sciences such as the Center for Monsoon Research.

11.3.2 Problems, Challenges and Opportunities

There are obstacles and challenges for geographer-to-geographer cooperation between China and the US beyond the diplomatic and political issues. The largest discrepancy is in the field, focus and scope of study. As known to us, although

geographical research covers a wide range of topics in both China and the US, their main foci are different. American geographers are more concerned about human issues in their study and concentrate on the human-environment relationship. They have both advanced physical geography and human geography, but the latter has always been dominant. In contrast, most Chinese geographers concentrate on physical geographical research. They prefer to discuss human-environment relationship from the angle of the natural environment, but less from the perspective of human agency. Human geography in China lagged in the early socialist years. In the US, geography is often regarded as a social or human science, although it has frequently been described as an earth science (National Research Council 1965). This varies by departments, although it is true that the number of human geographers far outnumbers the physical geographers. In China, geography is viewed as a natural science (Wu et al. 1984).

The discrepancy has its historical cause. During the period of 1949–1979, geographical study in China was deeply influenced by that of the Soviet Union. At the beginning, Chinese geographers had limited knowledge of human geography, from theory to methodology. Human geography in China started its rapid development only after the reform and opening. The cooperation between Chinese geographers and foreign scholars also contributed to the process.

Second, geography in China is a discipline with specific goals. Geographical research is expected to provide useful knowledge and analysis for policy-making and to produce social value. During the past six decades, Chinese geographers have been making contributions to the development of China, whose projects and findings were directed at national needs (Lu and Cai 2001; Wu 1981). Therefore, its focus was on a national scope, with concentration on natural resources assessment and agricultural development in the 1950s and 1960s (Zhao, 1981). Since the 1980s, many geographers were involved in large national projects, mainly working on physical geographical study, e.g. the *Three-Gorge Dam* construction, dust storms and grain-to-green policy. Consequently, many publications on land resources, land utilization, environmental protection, regional planning as well as natural disaster reduction were seen in journals (mainly Chinese).

The scope of geographical study clearly indicated the bias of Chinese geographers for physical geography. China is a country with highly centralized power. In this sense, Chinese geographers prefer macroscopic and top-down approaches, in which physical processes and patterns are essentially important, while human dimensions are less essential. When providing consultancy to the government, the perspectives of Chinese geographers are typically focused more on the natural aspects, and the scale of analysis is generally at the national or regional level.

While these varying perspectives have limited research collaboration in the past, as Chinese geographers have expanded their studies in recent years to include a greater focus on various subfields of economic and urban geography, there appears to be increasing opportunity for collaborative study. Examples would be work in transportation, tourism, trade, urbanization and urban social and economic studies (Liu et al. 2009; Cai and Chan 2009). China's dynamic economic growth has led to rapid migration of rural people to urban areas which in turn has created an urgent

need for new policies and solutions to emerging new social and economic problems and concerns (Han and Pannell 1999). Chinese and western geographers have frequently interacted and collaborated to study these problems and issues and to provide additional expertise that can be useful for policy planners in China (Chan and Zhang 1999; Fan and Sun 2008; Zheng et al. 2008; Li et al. 2009).

One of the most positive trends since the 1980s is the large number of Chinese students and scholars who have come out of China for graduate education in Hong Kong, North America, Europe, and Australia. Many of these young and now middle-aged scholars have completed their graduate education and assumed important faculty or research positions in major universities or research institutes in China or remained in their host countries. See for example the work of George Lin at the University of Hong Kong (Lin 1997) and Kam Wing Chan at the University of Washington (Chan 2009). With their expanded perspectives on the nature of contemporary geography, these scholars have assumed an increasingly important role in defining the academic and intellectual trajectory of geography in China today. Those Chinese scholars that have elected to pursue academic careers outside China often maintain close contact with their friends and former classmates in China and increasingly share in collaborative research projects (Li and Wei 2010). In this way, it seems clear that there has been a growing focus on the importance of human agency in geographic research among some scholars in China. It is likely that this trend will grow stronger as the power of geographic methodologies such as GIS, digital cartography and various spatial statistics is recognized for analysis of economic and social problems in the arena of applied scholarship and knowledge (Veeck et al. 1995; Yu and Wei 2003; Tang and Pannell 2009).

Recent trends in geographic scholarship indicate the persistence of some divergence of scholarly work and perspectives between China and the US, although there is growing evidence of limited convergence as better understanding and appreciation of the value of human geography research grows in China. This is clearly seen in the examples cited above of extensive recent collaborative work among geographers in China and those in the U.S.

11.3.3 Future Perspective

11.3.3.1 Common Interest, Obligation, and Duty in Sustainable Development

As stated before, geography is a discipline that seeks to facilitate the activities and practices of human beings in their quest for dealing harmoniously and productively with the challenges and opportunities of natural environments. This is true for Chinese and American geographers (Wu et al. 2008; “Rediscovering Geography:” Patricia Gober’s speech on 1994 AAG Annual Conference). Since the 1970s, international geographical research has been switching from the nature-dominated environmental change to human-dominated environmental change (Messerli et al. 2000; National Research Council 1997). Geographers have been increasingly concerned

about participating in programs regarding global issues and sustainability of natural environments for the proper and long-term use of future generations. Consequently they have rarely been so motivated to support national and government policy-making (Lu and Cai 2001). When sustainability comes as a global challenge, Chinese and American geographers share a common outlook. Right after the 1992 Rio conference on sustainable development, seminal articles were published in *Annals of the Association of American Geographers* (Wilbanks 1994) and *Acta Geographica Sinica* (Zhang et al. 1994; Huang 1996). In the twenty-first century, we believe Chinese and American geographers will cooperate even more closely on this topic.

11.3.3.2 Strategic Directions for Geographical Research in the Twenty-First Century

In 2010, the US National Research Council (NRC) released the report—*Understanding the Changing Planet: Strategic Directions for the Geographical Sciences* (NRC 2010), providing geographers a stepping stone for launching discussions about the strategic issues facing the planet and geography as a discipline (Sui 2011). In the report, 11 strategic directions in 4 groups were listed (Table 11.2).

The 11 directions listed above in Table 11.2 cover a wide range of research fields and topics. Directions in group A are mainly about human-environment relationship, emphasizing human impact to the natural environment and the vulnerability of human-environment system. Although the title of group B uses the word sustainability, it is mainly about demographic issues, population and health. While geographers in China have not engaged in these matters, it is clear there are great opportunities for geographers in China to expand their research agendas once they seek competency in geographic training for doing research on demographic, social, and medical/epidemiological issues. A good example of where such geographic research would assist in solving a serious threat is the potential use of geographic tools such as GIS and analysis in tracking an exploding epidemic such as occurred in China and Hong Kong during the SARS outbreak. See, for example, the recent collaborative studies of Li and Wei (2010) and Zheng et al. (2008). These are very important areas of geographic research in the United States and have significant roles for applied policy making as well as achieving a sustainable society and future for all citizens. Group C is mainly about social, economic and political issues, in geographic perspective, and their impacts on sustainability. Group D is about technological issues.

At the beginning of 2000s, Chinese geographers also had wide discussions on the future development of geographical research, particularly research in China. Here we list the strategic directions summarized by representative Chinese geographers (Zheng and Chen 2001), Table 11.3.

As we see from Table 11.2 and 11.3, there are some fields and interests in common between Chinese and American geographers. Human-environment relationship is still the core of geographical research and the key to sustainable development. The focus on global environmental change, carrying capacity of key natural resources and ecological systems, and technological advance in geographical information and its impact all serve the goal of discussing human-environment relationship.

Table 11.2 Strategic directions for the geographical sciences according to the NRC report (National Research Council 2010)

A. How to understand and respond to environmental change

1. How are we changing the physical environment of Earth's surface?
2. How can we best preserve biological diversity and protect endangered ecosystems?
3. How are climate and other environmental changes affecting the vulnerabilities of coupled human–environment systems?

B. How to promote sustainability

4. Where and how will 10 billion people live?
5. How will we sustainably feed everyone in the coming decade and beyond?
6. How does where we live affect our health?

C. How to recognize and cope with the rapid spatial reorganization of economy and society

7. How is the movement of people, goods, and ideas changing the world?
8. How is economic globalization affecting inequality?
9. How are geopolitical shifts influencing peace and stability?

D. How to leverage technological change for the benefit of society and environment:

10. How might we better observe, analyze, and visualize a changing world?
11. What are the societal implications of citizen mapping and mapping citizens?

Nevertheless, the difference between geographical study in China and in the US can still be observed from the directions and ideas listed above. Chinese geographers typically approach research from the perspective of physical geography. Among the topics listed in Table 11.3 for China, 70% were selected from the perspective of the natural environment. This has changed little since the statement of then president of the Geographical Society of China, Professor *Huang Bingwei*, in 1984 when he averred “*It is estimated that no less than 70% of the work belongs to physical geography and its various branches.*” In contrast, 10 out of the 11 strategic directions in Table 11.2 for the US were drawn from the perspective of human agency. The difference could be attributed to the historical development of geographical study in China in the socialist period with its derivation from the Soviet model of geographical scholarship with its strong focus on physical geography and natural resources. American geographers have mainly focused on human dimensions. As stated before, the difference is a challenge for collaboration and cooperation of Chinese and American geographers going forward.

11.4 Conclusions

11.4.1 Global Perspective

China and the US have so many similarities in geographical conditions. Due to historical reasons, the development of China and the US is not balanced. The US is the most developed country with the most advanced technology. China is the developing country with the largest population and potential human capital. They are

Table 11.3 Disciplinary frontiers of geographical research in China (Zheng and Chen 2001)

Comprehensive study on the processes and spatial patterns of the terrestrial surface
Geophysical processes in water resource cycling
Land evolution (soil generating and land degradation)
Bio-geo-chemical processes and its health impact
Holistic research of natural regional systems
Global environmental change and regional responses
Palaeogeographical environment change of Holocene, particularly the last 2,000 years
Integrated study on polar region, alpine region and cryosphere
Land use/land cover change and its driving forces
Global environmental change and its impact on environmentally-vulnerable regions
Adaptation strategies to global environmental change
Natural resources and ecosystem reconstruction
Allocation and sustainable use of key natural resources (water and land)
Ecological and environmental service evaluation
Integrated study on eco-environmentally vulnerable regions
Sustainable regional development, Mechanism of human-environment relationship
Human settlement and urbanization
The impact of human factors on natural environment
Coupled human-environment system dynamics
Geo-informatics and strategies of digital Earth research

also different in ideology, the difference between capitalism and socialism, which sometimes brings the two countries into conflict.

Yet the conflict may have less to do with ideology than with the rapidly growing economic and military power of China during its so-called “rise to power” and the resulting idea of a “power transition” with the United States (Lai 2011). Such a power transition raises the spectra of a serious challenge to American security interests both in the western Pacific region and globally. Nevertheless, both China and the US are facing similar environmental protection, energy shortage and climate change problems. Those problems force both countries to come and discuss the solutions. The pursuit of a sustainable planet goes far beyond country boundaries, racial differences, and ideological divergence, making long term cooperation between the two countries desirable and possible.

11.4.2 Joint Responsibility for the Future of Planet Earth

There are significant historical episodes of cooperation between China and the US geographers, which can be traced back to early twentieth century. China and the US cooperation on soil-water conservation started as early as 1920s. American geographer Walter Clay Lowdermilk once helped Chinese people handle matters of desertification and environmental governance. Advanced soil conservation technology was introduced to China from the US, while experiences accumulated by Chinese people were brought back to the US. The cooperation among geographers from the two countries significantly promoted modern and contemporary development of

geography in China. Nevertheless, due to the deep impact of the Soviet Union, there was limited human geography research in China before the opening and reform (Wu 1958; Huang 1984). Consequently, physical geography has been leading China's geographical study for decades. In contrast, geographical research in the US pays much more attention to the human dimension, and therefore the cooperation was muted.

In the last two decades, cooperation between Chinese and US geographers has increased. Global sustainable challenges such as environmental problems, energy problems and climate change issues bring geographers together. In addition, as China's economy continues to grow rapidly and as the country shifts from an agricultural society to an urban-based economy and society, many new problems emerge. These present a number of new opportunities that are appropriate for geographical analysis as China reorganizes its spatial system and economy, modernizes and builds its cities, towns and urban infrastructure, and creates new transport systems and means of communication. It is here that geography as both a physical and human science can expand its horizons, as a new generation of geographers in China pursues new avenues of research in the service of creating a more just, sustainable, and livable environment and society for all of China's citizens. Geographers in the United States will no doubt be delighted to assist our Chinese colleagues in pursuing these new research agendas through collaboration and cooperation as well as in assisting in the continuing education of China's geographers who seek access to and understanding of the most recent trends and methodologies in American geography. As contemporary geographers on both sides, we are obligated and responsible to promote further cooperation in geographical research, for the well-being of the people of both China and the US, and the rest of the world.

References

- Alber, R. F., & Wang, Z. H. (1991). What shall we say? To whom shall we speak? *Human Geography*, 2, 16–23, 66–72.
- Cai, F., & Chan, K. W. (2009). The global economic crisis and unemployment in China. *Eurasian Geography & Economics*, 50(5), 513–532.
- CAS, Institute of Geography. (1977, Aug 12). *Oral presentations to the Ohio academy of science geography Delegation at the Institute of Geography*. Beijing.
- Chan, K. W., & Zhang, L. (1999). The Hukou system and rural-urban migration in China: Processes and changes. *China Quarterly*, 160, 818–855.
- Chan, K. W. (2009). The Chinese Hukou system at 50. *Eurasian geography and economics*, 50(2), 197–221.
- Chang, K. S. (1975). The geography of contemporary China: Inventory and prospect. *The Professional Geographer*, 27(1), 2–6.
- Fan, C. C., Ma, L. J. C., Pannell, C. W., & Tan, K. C. (2003). Geography of China. In G. Gaile & C. Willmott (Eds.), *Geography in America at the dawn of the 21st century* (pp. 668–678). Oxford: Oxford University Press.
- Fan, C., & Sun, M. J. (2008). Regional inequality in China, 1978–2006. *Eurasian Geography and Economics*, 49(1), 1–20.
- Han, S. S., & Pannell, C. W. (1999). The Geography of privatization in China. *Economic Geography*, 75(3), 272–296.

- Hsieh, C. M. (1959). The status of geography in communist China. *Geographical Review*, 49, 535–551.
- Huang, B. W. (1984). Preface. In *Geography in China* (p. 2). Beijing: Science Press.
- Huang, B. W. (1996). On earth system science and sustainable development strategy (1). *Acta Geographica Sinica*, 51(4), 350–354.
- Kikolski, B. (1964). Contemporary research in physical geography in the Chinese people's republic. *Annals of the Association of American Geographers*, 54, 139–154.
- Lai, D. (2011). *The United States and China in power transition*. Strategic studies Institute. Carlisle: U.S. Army War College.
- Li, Y. R., & Wei, Y. H. D. (2010). A spatial temporal analysis of health care and mortality inequalities in China. *Eurasian Geography & Economics*, 51(6), 767–787.
- Li, Z. H., Ma, L. J. C., & Xue, D. S. (2009) An African enclave in China: The making of a transnational Urban space. *Eurasian Geography & Economics*, 50(6), 699–719.
- Lin, G. C. S. (1997). *Red capitalism in South China*. Vancouver: University of British Columbia Press.
- Liu, J., & Diamond, J. (2005). How China and the rest of the world affect each other. *Nature*, 435(7046), 1179–1186. doi:10.1038/4351179a.
- Liu, W. D., Pannell, C. W., & Liu, H. G. (2009). The global economic crisis and China's foreign trade. *Eurasian Geography & Economics*, 50(5), 497–512.
- Lu, D., & Cai, Y. L. (2001). Geography in China: As sciences change direction. *Advance in Earth Sciences*, 16(5), 467–472.
- Ma, L. J. C. (2007). Building the first bridge of contact: A personal account of the 1977–1978 exchange program between American and Chinese Geographers. In *The 30th year of Sino-US Geography exchange*. Nanjing: Institute of Geography, CAS, Nanjing Institute of Limnology and Natural Resources.
- Ma, L. J. C., & Noble, A. (1979). Recent developments in Chinese geographic research. *Geographical Review*, 69(1), 63–78.
- Ma, L. J. C., & Noble, A. (Eds.). (1981). *The environment: Chinese and American views*. New York: Published for the Ohio Academy of Sciences by Methuen and Co.
- Messerli, B., Grosjean, M., Hofer, T., et al. (2000). From nature- dominated to human-dominated environmental changes. *IGU Bulletin*, 50(1), 23–38.
- National Research Council (NRC). (1965). *The science of Geography*. Washington, DC: National Academy Press.
- National Research Council (NRC). (1997). *Rediscovering geography: New relevance for science and society*. Washington, DC: National Academy Press.
- National Research Council (NRC). (2010). *Understanding the changing planet: Strategic directions for the geographical sciences*. Washington, DC: National Academies Press.
- Pannell, C. W. (1980). Geography. In Leo Orleans (ed.), *Science in contemporary China* (pp. 167–187). Stanford: Stanford University Press.
- Stoddart, D. R. (1978). Geomorphology in China. *Progress in Physical Geography*, 2, 187–236.
- Sui, D. Z. (2011). Introduction: Strategic directions for the geographical sciences in the next decade. *The Professional Geographer*, 63(3), 305–309.
- Tang, Y. B., & Pannell, C. W. (2009). A hybrid approach to land use and cover classification. *GI Science and Remote Sensing*, 46(4), 365–387.
- The Third National Assembly and Aid to Agriculture, Comprehensive Scientific Annual Meeting of the Geographical Society of China. (1964). *Acta Geographica Sinica*, 30(1), 78–84.
- Tremayne, B., & Waal, P. (1998). Business opportunities for foreign firms related to China's environment. *The China Quarterly*, 156, 1029.
- U.S. Energy Information Administration. (2012). Energy in brief, what is shale gas and why is it important? <http://eia.gov/energy-in-brief/article/about-shale-gas.cfm>.
- Veeck, G., Li, Z., & Gao, L. (1995). Terrace construction and productivity on loessal soils in Zhongyang county, Shanxi province, PRC. *Annals of the Association of American Geographers*, 85(3), 450–467.

- Watts, J. (2005). The railway across the roof of the world. *The Guardian*, Tuesday 20 September 2005. <http://www.guardian.co.uk/world/2005/sep/20/china.jonathanwatts>. Accessed 18 July 2012.
- Wilbanks, T. J. (1994). Sustainable development in geographic perspective. *Annals of the Association of American Geographers*, 84(4), 541–556.
- Williams, J. F. (1969). American geographers and China. *The Professional Geographer*, 21(5), 354–357.
- Williams, J. F. (2003). Geographers and China. *Issues and Studies*, 38(4), 39(1), 217–247.
- Wu, C. J. (1958). The geographical organization and new trends of development in geography in the USSR. *Acta Geographica Sinica*, 24(4), 438–456.
- Wu, C. J. (1981). Delineation of China's agricultural regions. In C. W. Pannell & C. L. Salter (Eds.), *The China geographer; No. 11* (pp. 27–40). Boulder: Westview Press.
- Wu, C. J., Wang, N. L., Lin, C., & Zhao, S. Q. (1984). Geography in China. In *The geographical association of China*. Beijing: Science Press.
- Wu, D. T., Wu, Q. X., Liu, R. W., & Song, J. P. (2008). Comparative study on the development venation of geography in China and America during the past hundred years—based on the statistical analysis of *Acta Geographica Sinica* and *Annals of the Association of American Geographers*. *Advances in Earth Science*, 23(6), 553–561.
- Yu, D. L., & Wei, Y. H. D. (2003). Analyzing regional inequality in post-mao china in a GIS environment. *Eurasian Geography and Economics*, 44(8), 514–534.
- Zhang, G. Y., & Chai, Y. W. (2011). The 2011 AAG annual conference was held in seattle. *Geographical Research*, 30(5), 963–964.
- Zhang, P. Y. (1982). On the annual conference of association of American geographers. *Geographical Research*, 1(3), 89–90.
- Zhang, S., Zhang, P. Y., & Wang, E. Y. (1994). Sustainable development and geography. *Acta Geographica Sinica*, 49(2), 97–106.
- Zhao, S. Q. (1981). Transforming wilderness into farmland; An evaluation of natural conditions for agricultural development in Heilongjiang Province. In C. W. Pannell & C. L. Salter (Eds.), *The China Geographer; No. 11* (pp. 41–57). Boulder: Westview Press.
- Zhao, X., & Zhang, G. Y. (2010). Chinese scholars participating the 2010 AAG Annual Conference. *Acta Geographica Sinica*, 65(7), 891–893.
- Zheng, D., & Chen, S. P. (2001). Progress and disciplinary frontiers of geographical research. *Advance in Earth Sciences*, 16(5), 599–606.
- Zheng, S. Q., Long, F. J., Fan, C. C., & Gu, Y. Z. (2008). Urban villages in China: A survey of migrant settlements in Beijing. *Eurasian Geography & Economics*, 50(4), 425–446.
- Zhou, Y. X. (1998). On the new directions of geographical research in the US from observations on the 1994 AAG Annual Conference. *Economic Geography*, 18(4), 16–18.