EXECUTIVE SUMMARY

This is the second annual report of the Sustainable Agriculture Working Group to the CCICED. It is our pleasure to report on follow-up to past Council decisions, to present new findings and recommendations to the Council and to describe our proposed work plan for 1999.

In 1997 the SAWG recommended the establishment of demonstration projects on both grasslands and cultivated lands in northeast China to facilitate transfer and testing of available technologies for more efficient, profitable and environmentally sustainable agriculture. Further action was taken in 1998 on these recommendations, and the SAWG is hopeful that appropriate demonstrations will be funded and implemented in 1999.

In keeping with the grasslands development theme approved by Council in 1997 the SAWG organized a workshop in 1998 on grassland management and livestock production with particular emphasis on South China. It was conducted in close collaboration with the Ministry of Agriculture, Ministry of Science and Technology, State Environmental Protection Agency, Chinese Academy of Agricultural Sciences, Peking University and multi and bi-lateral development agencies active in China. The proceedings will be published shortly.

The principal activity of the SAWG in 1998 a field study tour to south China grasslands to complement the tour to the northeast grassland in 1997. There was extensive involvement of provincial and local officials. These and the northeast grasslands are considered the areas with the most development potential. Development of other arid and high altitude grasslands may be desirable for environmental and social reasons, but economic potential is limited.

The total area of grassland in south China is estimated at 5 million ha. About 70 % is considered available for future development. These grasslands are located primarily in mountainous terrain and include the 6 provinces related to the Yungui Plateau and all provinces in the south China sub-tropic region. Over 80 % of the total grassland area is considered to be undeveloped. The south China grasslands are characterized by high rainfall, high altitude, long growing seasons, and significant native plant species diversity. Water supplies are generally very good. Research has demonstrated good productivity for well-managed, improved grasslands.

The south China grasslands are faced with significant development constraints. Individual grassland areas tend to be relatively small and remote. Transportation and marketing infrastructure is poor. The grasslands are located at the headwaters of many streams, thus there are important environmental concerns to consider if and when livestock production potential, little has been done to assess other development options, such as eco-tourism and the production of high value, low weight or volume products like special wild mushrooms.
On average, the yield of natural grass in grasslands of the southwestern region is 2-3 times higher than that of northern region. The theoretical animal carrying capacity is 3.75 times higher than that of the North. Based on large scale experiments, the productivity of improved grassland in this region can be very high; every 2 mu of grassland can raise one sheep, same as that of hilly grassland in New Zealand.

In the Southwest, it is estimated that about 30% have been used intensively, 30% extensively, and 40% insufficiently. Currently, improved grassland in this area (including Hunan and Hubei provinces) is only 425,000 ha. If 80% of usable natural grassland are utilized and 30% of them (about 12 million ha) can be improve d, then an additional 1.3 billion kg of meat can be produced each year. If productivity of these improved and natural grasslands could be further increased, 1.9 billion kilograms of meat could be produced per year, and 9.5 billion kg of grain can be substituted, thus greatly reducing possible feed grain imports. This 9.5 billion kg of grain is equivalent to the output of 2.16 million ha of middle level cropland in the region, and there fore would greatly reduce the pressure on cropland resources.

The SAWG recommends

1. Detailed assessment of grassland resource inventories on a sub-regional basis to guide rational grassland development and to ensure environmental safeguards.

2. Increased investment in research to refine and adapt production systems to variations in the physical attributes of the south China landscape. A wide range of development options should be considered in the research program. International technology and experience with environmental impact assessment should be exploited to the extent possible. Demonstration projects funded internationally would be useful to test various technology options and technology transfer mechanisms.

3. Detailed analysis of the infrastructure investment needed to service alternative development options-land development, transportation, input supplies, machinery, education and health services, housing, livestock facilities, etc. Give the terrain and current development status, initial investment in infrastructure will be large to establish viable communities with good living standards, to achieve high productivity, and to ensure good environmental management.

4. Detailed assessment of market opportunities for meat, livestock products and other potential niche market commodities and services. Ability to compete with other sources in a market economy, needs to be assessed before large scale development proceeds.

5. A case study should be undertaken for the rapidly industrializing coastal region focusing on (a) the projected growth in demand for livestock products; (b) the preset domestic and overseas sources and costs of these products; (c) the potential cost of producing and delivering these products from the S. Highlands; and (d) the physical and economic constraints facing the S. Highlands in winning the coastal markets.

6. Evaluation of government regulations and policies pertaining to land tenure or user rights, rural education and technology transfer services, and environmental management that could play a vital role in the grassland development.
The main activities for the SAWG in 1999 will be implementation of demonstration projects in northeast and south China grasslands, organization of an International Workshop on Land Use and Sustainable Development in Loess Plateau, Beijing, May 17-18, 1999, and working group study tour and work session in the Loess Plateau area.

Finally, we wish to express our sorrow that Professor Li Bo passed away in May 1998. As an invited group member, Professor Li, with his wide expertise on China's grassland and exuberant enthusiasm for work, participated in the SAWG's workshop and field trip. He threw all his energy into China's grassland development and conservation cause and the group's work. We will cherish deeply the memory of Professor Li.

I. Introduction

This is the second annual report of the SAWG to the CCICED. The first report outlined terms of reference, identified priority topics for the working group and reported on the first field survey in north China in 1997 on the theme of grassland development. The second annual report continues on this theme with particular attention to south China grasslands development. These two regions had previously been identified by Chinese investigators as areas with significant potential for increased sustainable grassland livestock production.

1.1 China's agricultural development challenges

The conflict between increasing population and consumption level and decreasing cropland is getting serious. In addition, environmental deterioration caused by intensive agriculture together with unemployment and stagnation of economy in many rural areas are broadening the development dilemma.

Although China has made considerable progress in agriculture in recent years, particularly in grain production, its future agricultural production faces major challenges as well as opportunities. Firstly, population is still growing so that at least 300-400 million people will be added in the next 30 years. Consequently, the pressure on total demand for grain will continue for at least 30 years before the population attains its highest point, and that will be difficult to meet. Secondly, with increased incomes and transition to a market economy, the consumption pattern will continue to change dramatically. While demand in quantity increases, demand for better quality will also be increasing, characterized by rapid growth in demand for feed grains and brand name goods and new agricultural products. Thirdly, under the current agricultural practice and policy, agricultural growth is accompanied by increasingly negative environmental side effects. Shortages of cropland, water resources and environmental capacity are getting more severe. Finally, because of increasing global competition, major agricultural products, especially grain products in China are losing their comparative advantage, and may someday be imported in greater amounts.

Employment in rural areas and higher farmers' incomes are major issues for future agriculture development. To increase agricultural production and farmers' income, it is crucial to raise labor productivity as well as using more inputs, which, in turn, makes labor employment in rural area more difficult. In short, China's agriculture is entering a new era and new problems arise beyond food self-sufficiency. The task of sustainable agriculture development is extremely challenging. China's food supply and food security
cannot depend only on the limited cropland. We should pay more attention to grassland and livestock production.

1.2 Status of grassland livestock production in China

Greater emphasis on grass fed livestock production could help overcome the four challenges to agricultural development given above. Grassland production in China can alleviate pressure on cropland enhance food security, increase farmers' income, and reduce environmental degradation.

Since the reform policy in late 1970s, livestock production in China has been accelerating. The output of livestock products increased rapidly and successively from 1978 to 1996. Annual growth rate of meat, egg and milk exceeds 10%, which is much higher than that of cropland production growth. Consequently, livestock production per capita has increased rapidly. Meat and egg production per capita exceeds the world average level. In 1996, the value of livestock output accounted for 31.4 percent of total value of agriculture. Livestock production has become a vital component of the rural economy.

At present, meat production in China makes up 25% of that in the world, and 67% of Asia. As total livestock production increased, the structure of production also changed. The proportion of pork in total meat production decreased from over 90% in 1978 to 68% in 1996. However, livestock products are still dominated by grain-based pork, and it is 28% higher than the world average of 41% (in 1995). The proportion of grass-fed beef and mutton is only 12% in 1995, 21% lower than the world average. The development of livestock production, especially of meat production per capita and grassland livestock production, is far behind that of many developed countries.

The usable grassland area in China is twice that of cropland. Grassland livestock production has enormous potential and will play a more and more important role in agricultural development. There is significant potential to develop grassland and herbivorous livestock so as to adjust the structure of livestock production. Firstly, it is getting more difficult to increase food and feed grain production owing to limited cropland and low economic benefits of grain crops. Secondly, with the improvement of living standard, the consumption of livestock products is increasing, which currently leads to greater feed grain use. Thirdly, shortages of feed grain could result in major imports. Grassland development, however, can produce more meat, wool and milk products, and consequently alleviate the pressure on cropland. Moreover, grassland development can be cost-effective. If grassland is used sustainably, it can play an important role in improving ecosystem quality and increasing farmers' income, as well as promoting sustainable development of agriculture. However, grassland development also faces many challenges, such as grassland quality improvement, labor force education, market development, achieving appropriate economies of scale, and raising investment and infrastructure construction. Without appropriate response to these challenges grassland development is unlikely to succeed.

1.3 SAWG activity

The SAWG maintains that livestock production and grassland management should be one of the highest priorities in realizing sustainable agriculture. To that end the SAWG
surveyed grassland development in North China and reported its findings to CCICED in 1997. In March 1998, SAWG held an "International Workshop on Grassland Management and Livestock Production in China". Experts and officials from both China (Chinese Academy of sciences, Chinese Academy of Agricultural Sciences, related ministries and commissions of the State and international organizations in Beijing) and abroad (Canada, Britain, USA, Australia, etc.) presented their valuable opinions and insights on grassland development and related issues. Proceedings of that workshop will be published. Afterwards, a field survey was made to typical South China Grassland including Nanshan Pasture located in Chengbu County, Hunan Province and Hongchiba Pasture in Wuxi County, Chongqing Municipality. Apart from the field survey, SAWG exchanged views with local officials and experts. Local leaders paid great attention to the survey and provided logistics and information. The news of both the workshop and field survey were broadly released by mass media.

The report is divided into five parts. The first part introduces challenges facing China's agriculture and the importance of grassland development. The second part analyses potentials and problems in grassland development in South China. The third part outlines 1998 recommendations to the CCICED. The fourth part reports on the status of SAWG activity on a number of general issues related to sustainable agriculture. The fifth part describes SAWG's work plan for 1999, Appendixes provide additional information including field trip report, group meeting minutes and workshop participants mailing list.

II. Development of grassland resources and livestock production in South China

Recent debates on food security show that integrated measures are needed to ensure food supply and to sustain agriculture development in China in the next century. Grasslands have significant potential for contributing to this development.

Among the major grasslands in China, those in the north and south are considered to have the most development potential. Grassland development would provide livestock products, not only to contribute more to China's food supply, but also to the development of local economies and maintenance of ecosystem quality.

The result of SAWG's field survey on Northern grassland in 1997 shows that some of the Northern grasslands are severely degraded and need more careful management and protection. In order to use grassland sustainably, more investment is needed in grassland improvement where water and soil conditions are suitable. Transportation, processing, and marketing infrastructure need careful planning and greater investment. Education and technology transfer need to be improved. The policies related to land management and control need to be reformed.

SAWG's 1998 field survey concentrated on examining the potential of South China's grassland. The findings and conclusions are given below.

2.1 Importance of grassland development

The potential meat and wool output on grassland in South China is equivalent to that of New Zealand. Given the strategic importance of the Southern grassland to the local economy, the development of Southern grassland would help the local government to
accelerate poverty alleviation in mountainous areas, and alleviate the pressure on other grassland and cultivated agriculture.

2.1.1 Potentials for establishing a grassland livestock production base in South China

The total land area of the 13 provinces and regions in South China is 2.9 billion mu, of which cropland is 511 million mu (13.1%). Total grassland is 980 million mu, of which some 700 million mu are suitable for livestock production (17.0% of the total land area, and 1.4 times the cropland area). Much of the grassland area is fragmental which makes it difficult to develop economically. Those grasslands exceeding 10000 mu in size make up about 20 percent of the usable area (See Table 1 in Appendix A for more detail). At present, only a small portion of grassland near villages and towns are used for livestock production, large scale grasslands in remote areas have yet to be developed. Due to ecological fragility and poor infrastructure, some hill sand slopes are difficult to use. It is estimated that the real area of usable grassland in South China is about 400-500 million mu, and about 200 million mu of grassland could be developed easily in the medium term.

South China is located in a subtropical humid area and is characterized with adequate supply of water and heat, long growth period, high productivity and infrequent natural disasters. The precipitation ranges between 1100-1800mm. Vegetation is green all year round. According to investigation by the Ministry of Agriculture, natural grassland produces 500-800kg of hay per mu, with total production of 50 billion kg annually, which is higher than that of Northern grassland. The potential animal carrying capacity of Southern grassland is equivalent to that of the North. The yield of improved grassland is 3 times higher with good management than that of natural grassland. In addition, the risk of grassland production in South China is lower than that in the North due to less frequent disasters like drought, snow and rodents.

Improvements in grassland productivity were critical factors behind New Zealand’s success as a producer and exporter of lamb meat and wool. The productivity of improved grassland in South China is as high as that of New Zealand. Moreover, the area of Southern grassland is five times that of New Zealand. The gap in yield and export of livestock products between China and New Zealand reflects the potential of grassland development in China. High-quality grass and good breeds of animals have been introduced to South China. If more attention is given to grassland development in South China, with more investment and better management, it could become the second largest livestock production area in China. The area Could be established as a meat and wool production base with output levels similar to that of New Zealand. It could be an important contributor to food security, wool supply, and possibly to export earnings.

2.1.2. Promoting local economic development and poverty alleviation in mountainous areas

Southern grasslands are mainly located in mountainous areas, where the local economy is less developed with poor communication. Total poverty population is over 2.1 million, accounting for 26.5% of the national total.

In terms of geography, most of the grassland resources in south China are in the southwest provinces. In the meantime, grassland hills and slopes in the South are
mainly scattered in the following area: Wulinshan, Qinbasan, Deliangshan, Nan lin, Hengduanshan, and part of Yungui Plateau, especially border areas of Yunnan, Guangxi, Sichuan, Hubei, and Hunan provinces, surrounding Guizhou Province. There are more than 130 nationally recognized poor counties within this area.

The resources of silage and agricultural products or by-products are rich in Southwest China because of the relatively developed crop production in the area. Meanwhile, 30% of the grassland are inter-mingled with cropland and woodland which provides opportunity to combine livestock and grain production to complement resource advantages. Southwest China has the biggest Karst plateau-hilly region in the world, limestone is spread widely, mountains are abundant with little soil cover, croplands are dispersed, therefore the resources to develop rape-growing industry and forestry are limited.

More than 20 minorities such as Miao, Yi, Tujia, Buyi, Dong, and others reside in the area. the population of minorities is dominant in the community. Socio-economic development in these areas lags behind the national rate. Rural development is also poor in these areas. Problems related to topography, and resource endowments present extreme difficulties for poverty alleviation. The State Development Planning Commission recognizes that poverty alleviation in these areas is far more difficult than that of Loess Plateau region.

Development of southern grassland could be an efficient way of reducing poverty in the poor mountainous areas. Grassland development could reduce intensive use of slope lands for crop cultivation and control soil erosion given sound animal husbandry. After nearly 15-years of research, development and demonstration, new grass species combinations and domestic animal species have been selected in the area. A model for management, service and technical support for the development of southern grassland has been developed.

2.1.3 Conservation of ecosystem

More than 90% of the Southern grassland are scattered in middle and west parts of the south. This means that most of them are in the following regions: the upper and middle reaches of the Yangtze River, Zhujinang River, Hanshui River, and some inland water systems, which are ecologically important protective zones. These regions mainly contain limestone and yellow-red soil and have fragile ecosystems. Increasing population with limited land resources resulted in intensive use of slope lands, which caused serious degradation of forest and grassland, and eventually soil erosion. Furthermore, it is difficult to regenerate vegetation after the soil has been washed away.

The degradation of Southern grassland also threatens the ecosystem at the lower reaches. Soil erosion in upper reaches has led to siltation of lakes and rivers in lower reaches, such as the Xiangjiang River, Yangtze River, Dongtinglake, Zhujiang River etc. The Southern yellow-re soil area is the second most serious region of soil erosion next to Loess Plateau. Grassland development could help prevent further soil erosion and protect topsoil. Such activity needs little investment and can be cost-effective in a short time. Such development can help to regenerate vegetation and conserve the ecosystem, but it could also lead to further damage of the ecosystem if not used rationally.
2.1.4 Research information in the Southwest

Commencing in 1980, concerned ministries of the Chinese Government established several demonstration areas in southwestern region for improving grassland and introducing animals, optimizing a management model and studying integrated development of grassland production. These have achieved much by providing scientific evidence and experience on production potential.

On average, the yield of natural grass in grasslands of southwestern region is 2-3 times higher than that of northern region. The theoretical animal carrying capacity is 3.75 times higher than that of the North. Based on large scale experiments, the productivity of improved grassland in this region can be very high; every 2 mu of grassland can raise one sheep, the same as that of hilly grassland in New Zealand.

In the Southwest, it is estimated that about 30% have been used intensively, 30% extensively, and 40% insufficiently. Currently, improved grassland in this area (including Hunan and Hubei provinces) is 425 thousand ha. If 80% of usable natural grassland is utilized and 30% of them (about 12 million ha.) can be improved, then an additional 1.3 billion kg of meat can be produced each year. If productivity of these improved and natural grasslands could be further increased, 1.9 billion kilograms of meat could be produced per year, and 9.5 billion kg of grain can be substituted greatly limiting possible feed grain imports. This 9.5 billion kg of grain is equivalent to the output of 2.16 million ha of middle level cropland in the region, and therefore would greatly reduce the pressure on cropland resources.

In conclusion, grassland development in South China especially the Southwest is important to the development of the local economy and to the protection of the environment.

2.2 Constraints on grassland development

Low quality grass species in natural grassland, the small size of many grassland areas and fragile ecosystem are natural constraints for grassland development. Underdeveloped market, poor infrastructure, low investment, and inconsistent development policy and technology transfer system are economic constraints for grassland development in the Southwest.

2.2.1 Natural constraints

(1) The quality of natural grassland in the Southwest is low though with high output. The proportion of legumes is less than 1%, and most of the dominant species are coarse grasses with poor palatability. Consequently, the crude protein content and digestibility is about half, lower than that of northern grassland. replacement of natural grasses through better grazing management or re-seeding is therefore considered the main choice for grassland development in southwestern region.

(2) Grassland areas larger than 10 thousand mu in size account for 45% of the total area in southwestern region. Areas larger than 50 thousand mu account for only 11% of the total. The intermediate grasslands between forests or farms cover about 30% of the
total. Small areas of grassland limit the prospect to establish large-scale livestock farming, but could be suitable for sheep and dairying for local markets.

(3) About 74% of grassland in the Southwest is located in mountains and plateaus with elevation over 800 meters. About 31% is located in Karst region. Steep slope, complicated landform and poor soil texture are the main characteristics in this area. Taking Guizhou Province as an example, 50% of the grassland has slopes over 25°, so conditions are more suitable for sheep than cattle because of the risk of hoof induced soil erosion. Furthermore, 40% of the grassland has very shallow soils, and about 17% is on slopes which are almost naked.

These conditions of landform and vegetation can lead to degeneration of grassland and soil erosion if they are not used properly. It is reported that 20-30% of southwestern grassland have problems with soil erosion. Thus, the key to develop grassland is to use it carefully.

2.2.2 Economic and social constraints

(1) Market development is incomplete, and market potential has yet to be developed. Market mechanisms are important factors in the development of the local economy and improvement of farmers' living standards. But market development in this area is still at the primary stage. The gap between developed regions and the Southwest is large, though in recent years rural seasonal markets have developed very quickly in number and trading volume.

With the development of a market economy, marketing and pricing have a guiding effect on grassland development. Although grassland development in the Southwest has some favorable physical conditions, there is a need to develop a comprehensive marketing system. This will require initiatives from government and private investors at the national, provincial and local level.

Obtaining a greater market share is a challenge for grassland development in southern region. The market competitiveness of the products produced in this region is weak compared with its southeastern counterparts due to its less-favorable geographical and natural conditions. Products also face the challenge of many famous domestic and overseas alternatives.

In terms of its production and marketing, grassland development in southern region is at the primary stage. It is characterized by selling fresh and live products. It is important to gradually establish a production base and to create its own famous brands. In the process of developing its own marketing system, it is also important to expand the marketing to areas like Hong Kong and Macao and southwestern Asia. For this purpose, competitive quality and price are essential.

(2) Policy and technical support systems and low investment limit development of grassland in Southwestern Region

The pace of grassland development in southwestern region has been slow because of historical reason. Exploiting grassland resources has not been a part of the basic
strategy in many areas of this region. Lack of consistent policy causes serious problems on grassland development.

Lack of technical knowledge by individual farmers also poses difficulty in the development of grasslands. Local peasants have insufficient education and training. Many technical problems have yet to be solved, such as the selection and establishment of improved grassland, management of grassland, grass storage under high temperature and humidity etc., though good progress has been made in localities.

(3) The grassland contracting system is not well implemented

The SAWG found that the contracting system has not been well implemented in the southern grasslands. Unclear land ownership/user rights of grasslands have become restricting factors for further grassland development in the south. In Hounchiba of Chongqing Municipality for example, peasants who were interviewed thought that they would invest more in the grassland if they could have longer user rights.

(4) The scale of grassland development is small

Grassland development in the south is still at the primary stage. Input use and productivity are low. It is difficult to increase the production scale of Nanshan Pasture of Hunan Province, though eleven counties have been appointed as the base for grassland development by the State Development Planning Commission and Ministry of Agriculture. Thirty-nine demonstration of integrated grassland development have been conducted during the seventh and eighth "Five Year Plan". Good grass species, livestock species and the extension of modern management technology for grassland are available. The model of household grazing and raising animals has not been changed much. Poor natural condition restricts the growth of production scale. On the other hand, the traditional production model is the dominant type given that the state and collectives have little ability to input on the big scale.

(5) Infrastructure and communication

Generally speaking, the infrastructure for grassland development in South China is poorly developed, even though great improvements have been made in highway and hydroelectric facilities construction following implementation of a policy called "alleviate poverty through development" and "providing work instead of aid".

Communication is a major constraint for grassland development in South China. Progress of railway and motorway construction is slow and the distance is long. It usually takes several days to travel from the production area to the nearest major cities. The transport situation within counties is also unsatisfactory. Consequently, the successful development of grasslands will require large investments in communication and transportation infrastructure.

Insufficient energy supply leads to low quality production and poor living standard. Though hydro-electric resources are abundant in the area, its regional economy is still backward because of its high elevation and difficult access. Energy supply for grassland development could meet the demand through several small scale hydropower plants in
the area. Drinking water is not readily accessible. Production and living conditions are extremely poor in the large scale grasslands on mountain flat surface above 1200m.

Livestock management in South China is different from that in the North. It is usually based on fixed herding instead of nomadic pastoralism, and requires higher production and living standards. Thus it may be difficult to attract farmers and technicians to live and work in the Southern highlands before the necessary production and living facilities are constructed. Thus, infrastructure construction should be the first priority in the development of grassland resources in South China. The scale and speed of grassland development are very much dependent on the improvement of infrastructure. This should be a long-term program for both the central and local governments.

2.3 Competitive advantage and main area of development

2.3.1 Searching for competitive advantage

While the physical production potential for grassland livestock is large and markets are growing, competitiveness of the sector is weak. Major changes are needed in the grassland livestock sector if it is to respond to the new market-oriented economy. New concepts and management models based on market response should be created. Diversifying the rural economic structure should also be an integral part of development.

Increases in per capita income induce changes in food consumption pattern. This also means that direct consumption of staple food (rice & wheat) will be replaced by increased direct consumption of meat and dairy products and indirect consumption of feed grains. The need for meat or more protein products will be a gradual trend. It seems inevitable that wider commodity choices arising from livestock production will be needed to meet diversified demand for food. However, as China is to join the World Trade Organization, China’s agriculture will be faced with world competition. It is important to note that given current management efficiency and technical know how, Chinese agriculture will not show any competitive advantage despite its great market potential. It is important to recognize this situation so that proper measures can be taken to increase the competitiveness of Chinese agriculture.

2.3.2 Main area for grassland development in South China

Southwestern region as well as Hunan and Hubei provinces can be regarded as the most important grassland development areas. Firstly, the usable grassland in these areas makes up 87% of the total in the South, where water and heat conditions for herbage growth are superb and production potential is large. The theoretical animal carrying capacity surpasses that of the north. Secondly, the area has its own potential markets for grassland products and others in the rapidly industrializing coastal zone. Thirdly, the area has the basic technological knowledge required. Finally, from a poverty alleviation point of view, it is urgent to develop the area and to increase both food supply and households income. One other important factor is that such development can maintain a good ecological environment.

III. Recommendations
Although there are great production and market potentials in grassland areas in south China, there is currently no competitive advantage in both production and marketing. Grassland livestock production should therefore be regarded as an important economic activity in the development process. Favorable regional development policies are needed for further progress. Market development is one key area of development. General guidance on medium- and long-term regional economic development needs to be formulated by regional and local government. Speeding up the process of grassland improvement, strengthening infrastructure construction and improving mechanization are all necessary components of development. Grassland development requires access to investment capital. Measures need to be taken to attract financial and human capital resources.

3.1 Policy framework for southern grassland development

Regional and industrial policies that can facilitate the development of southern grassland livestock production are essential. Such policies need to clarify grassland property rights and user rights. It is important to develop a credit service system. Meanwhile, quality control and inspection systems should be re-enforced to ensure competitiveness of the commodities and raise consumer demand. Marketing information and analysis will become extremely important in the whole process. Clarifying the responsibilities, rights and benefits between the central and local governments, companies and participating households are necessary steps before full-scale development projects are implemented. Involving individual households in the policy-making process and management system will help to ensure smooth grassland development.

3.2 Sustainability of grassland and specialized production zones

Unitary medium-and long-term development plans need to be formulated for the rational and efficient use of southern grassland resources. At the same time, attention should to be paid to environmental conservation. Large-scale livestock production in the area needs to be distributed rationally. Systematic developments of related industries, such as feed industry, processing industry, as well as the marketing chain are integral parts of development. Physical, social and economic conditions and differences in living habits of domestic animal species should be considered in establishing special production scale and regional specialized markets should be the principles for grassland development.

The present situation indicates that development of grassland livestock production is very slow. To a large extent, it is based on natural grassland. In order to accelerate the development process, it is important to improve natural grasslands.

3.3 Infrastructure needs

Currently, the basic communication network in southwestern area has been established which ensures information exchange between major cities and county towns. However, road access to major cities from mountain grassland is very poor. As this is critical to the development of southwestern grassland, it is important to improve road condition. Given the fact of ample water supply, it may be efficient to build small water and electricity plants in mountain areas to meet the energy demand for grassland development. In addition, infrastructure including lodging, livestock shelter, feed storage, human and livestock water facility, etc. is needed.
3.4 Investment

Investment needs associated with grassland development are large. It is suggested that the increase in investment in the southern grassland should not only come from the central and local governments, but also from private companies and individual household or international agencies.

Slow economic progress in southwestern China has limited local government financial support to grassland development. However, if governments recognize the strategic importance of grassland development to the whole economy, it is important for them to create a favorable environment for outside investors. Attracting outside funds to develop roads and basic infrastructure should be integrated into a unitary agricultural development plan. Grassland development will also help the local governments provide services. At the same time, more job opportunities will be created and higher income can be anticipated. This will help the government to alleviate poverty.

Suitable organizational models need to be developed which can involve not only companies, but also households into the investment and management systems. To bridge the gap between scattered small individual household production and big modern market, integrated models like "company + households" or "company + production bases + households" are practical for grassland development.

Regional disparity between the east and west is characterized by fast economic growth in the east and much slower economic progress in the west. It will be very useful to encourage collaboration between the east and the west. By so doing, the west could provide the east with cheap raw materials and commodities. At the same time, both financial and human capital could be complemented.

Credit service plays an important role in the development process, Experience in some areas show that access to capital is one of the most serious constraints to economic progress. Apart from government formal credit schemes provided by financial institutions, there is need to meet various kinds of financial demand.

3.5 "Promoting Livestock Production with S & T"

The strategy of "promoting livestock production with science and technology" should be implemented. Science and technology are the driving force for future economic development in southwestern grassland areas. In order to increase the market competitiveness of grassland livestock products, increasing resource use efficiency will be important. Furthermore, future development of the grassland livestock industry will require new and advanced technologies both to raise productivity and lower and negative environmental impacts. Current production also faces unsolved technical problems. All these depend on greater progress in science and technology.

Implementing demonstration projects, conducting experiments on grass and animal improvement are essential steps of grassland development. Technical training of local leaders and farmers, and improvements in environmental education are also important.

IV. General Issues in Sustainable Agriculture
In developing its work plan and defining its priorities the SAWG chose a two-pronged approach. One relates to annual international workshops and study tours on specific issues or development opportunities and the other to general issues which the SAWG wishes to address over the life of the working group.

Proceedings of the 1997 workshop have been published by China Environment Science press under the title "Challenges and Opportunities for Sustainable Agriculture in China". This workshop assisted the SAWG in developing priorities for its own activities. Proceedings of the "1998 International Workshop on Grassland Management and livestock Production in China", will be published in the near future.

Findings and recommendations arising from the workshops and study tours are contained in the 1997 and this annual report. The focus on grassland livestock production reflects the SAWG's views that this sector has not received adequate attention in China and that there is enormous potential for sustainable increases in food and fiber output from this source.

4.1 Land resource inventories

A recent UNDP publication entitled, China Agriculture and Food Security Resource Book: A Compendium of Donor Activities (1994-1997) describes a current FAO project funded by Italy related to the Chinese Agricultural Census (p. 78). At completion in 1999 it is expected that "China will have the first definitive picture of the structure of China' s agricultural production sector and have the necessary data and tools for planning and policy decisions in this sector of the economy". As information becomes available from this project, the SAWG will assess it's adequacy with respect to land resource management and sustainability issues, such as estimates of cultivated and grassland areas for major agro-ecological zones and loss of land to urban and industrial uses. The work plan for 1999 will address land management issues directly as the SAWG conducts a workshop and field tour to address sustainability and development options in the Loess Plateau region.

4.2 Livestock industry development

The SAWG has focused its efforts in 1997 and 1998 on the potential for sustainable increased livestock production from grasslands. Growing food demand, changing food preferences, rising consumer incomes and imminent changes in trading relationships all point to a need and opportunity for substantial future growth in meat and livestock product output. The SAWG has given particular attention to development potential in north and south China grasslands and has made appropriate recommendations to the CCICED to assist this industry growth. Recommendations have been made for specific demonstration projects, but, to date, funding agencies have not been confirmed.

4.3 Integration of information

A large number of international organizations, country development agencies, foundations and internal Chinese institutions are involved in some aspects of agricultural development-rural education, poverty alleviation, research and demonstration projects, joint venture livestock projects. The SAWG developed a bibliography of these projects to aid its work on policy advice and demonstration project proposals. The UNDP
compendium complements this work and will facilitate continuing efforts by the SAWG to exploit Chinese and international sources of information in support of sustainable agriculture development in China.

4.4 Technology transfer

Several studies of agricultural extension and rural education in China have concluded that these services are inadequate to properly serve a dynamic industry that is responsive to market signals and environmental imperatives. One such study authored by Liu Yonggong of CAU is entitled "Institutional and Policy Reform of China's Rural Extension in the Transition Towards Market Economy." Professor Liu describes and extension system in the planned economy with:

- top-down approach
- complex multi-level network-national, provincial, prefecture and county
- focus on grain production
- administrative approach to technology delivery

According to Prof. Liu, transformation of the extension system in a market-oriented economy faces numerous challenges, including:

- limited knowledge and decision making skills of farmers
- lack of market information
- integration and coordination of services of national and regional institutions
- qualifications of extension staff for effective service in a market economy
- decentralization of planning procedures to include participation of target beneficiaries
- continuation of administrative intervention
- private sector funding and delivery of some technology transfer services.

A recent analysis by the China-EU Center for Agricultural Technology contained similar observations.

The World Bank is currently funding a large project on Agricultural Support Services to:

(1) strengthen agriculture, animal husbandry, animal and plant quarantine management capability;

(2) reorganize crop and livestock extension system from national to county level;

(3) improve extension services;
(4) reorganize seed centers to separate their production from certification and regulation roles and promote seed commercialization;

(5) strengthen veterinary and preventive animal health service, establish a well coordinated national breed improvement program and strengthen pharmaceutical and feed quality control; and

(6) promote cost recovery for services.

The project is scheduled for completion in 1999. This project indicates Chinese government concerns about the need for improvements in agricultural extension and technology transfer services. There is no apparent need for further activity by the SAWG on this topic at this time.

V. Work Plan for 1999

The main elements of the SAWG work plan for 1999 are as follows:

5.1 Implementation of demonstration projects

(1) Land management practices in northeast China

Dryland cereal and oilseed cropping practices in this area are not sustainable. After only 40 years of cultivation soils have already lost at least 30% of their organic matter and associated benefits to soil quality and productivity, through inappropriate ploughing techniques.

Based on observations of the soil and landscape conditions in eastern Inner Mongolia there appears to be an opportunity to increase crop productivity by 50 to 100 percent by using more efficient and intensive cropping systems and sustainable land management practices. Experience and scientific evidence from the Canadian prairies and the northern great plains of the United States with very similar climate and soil conditions have documented the serious soil degradation implications and productivity losses associated with poor land management practices. Good technology is available to address productivity and sustainability concerns.

The SAWG will implement field scale demonstrations of land management practices and appropriate machinery that have proven successful in addressing productivity and sustainability problems in physically similar situations elsewhere in the world.

(2) Grassland management in northeast China

The northeast China grasslands are considered one of the grassland ecological zones with significant potential for increased sustainable livestock production. Demand for meat and livestock products is increasing due to continued population growth and rising consumer incomes. But, land degradation is serious, grassland productivity is low, biological diversity is deteriorating, production levels and quality of meat and livestock products are low and marketing infrastructure is weak. Research and extension support for grassland management is limited and education level of rural residents is low.
Government policies pertaining to land user rights and property transfer are not conducive to long term investment in sustainable land management practices.

Research in China, North America, Australia and elsewhere has proven that output levels higher and more sustainable than those currently obtained are achievable. Experience in similar environments in market-oriented economies has demonstrated economic viability and environmental sustainability of good grassland management practices.

The SAWG expects to implement demonstrations of sustainable grassland management technologies in northeast China. These will include water harvesting, land control, grazing management, testing of grassland improvement technologies and winter management of animal herds/flocks. Technologies appropriate to local natural conditions and traditions/culture will be assessed.

A companion analysis of marketing infrastructure needs to enable livestock producers in north China to service distant meat and livestock product markets may be undertaken.

(3) Grassland Development in South China

South China grassland development opportunities and constraints are described in Section III and Annex A of this report. Demonstration/applied research/training projects will be proposed and, hopefully, funded and implemented to assist in evaluation and testing of various technology options related to grassland management, livestock production and other development opportunities.

5.2 International workshop

The SAWG will organize and International Workshop on Land Use and sustainable Development in Loess Plateau. The workshop will be held in Beijing, May 17-18, 1999. The State Council has recently approved the National Ecological Construction Project (NECP) proposed by the State Development Planning Committee. The Government of China intends "to rehabilitate the Northwest with clean rivers and green mountains". The SAWG will examine the environmental impact of current agricultural practices and policies and proposed large projects like the NECP and make recommendations pertaining to sustainable agricultural development in the Loess Plateau. The workshop will bring significant Chinese and international expertise and advice to bear on economic, environmental and social issues.

5.3 SAWG field tour of loess plateau region, May 19-29, 1999

Information and advice received at the international workshop will be supplemented by a working group field tour and subsequent work session. The SAWG will be supplemented by appropriate invited experts and local officials. The expected output from this activity is policy and demonstration project recommendations for submission to the 1999 CCICED annual meeting.

5.4 General issues in sustainable agriculture
The SAWG will continue to address issues in agricultural sustainability as they pertain to the working group's specific focus in 1999, i.e., the Loess Plateau, and as they apply generally to agricultural development in China. These issues include land and water resource management, livestock production, education and technology transfer, marketing and agricultural systems.