Report of the

UNITED NATIONS ENVIRONMENT PROGRAMME

Regional Advisory Team

Mission to the People's Republic of China

1 - 21 August 1978

UNEP Regional Office

For Asia and the Pacific

Bangkok, Thailand

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FOREWORD

There has always been a continuing interest in learning how the Government of the People's Republic of China has approached the problem of dealing with environment in the light of universal concern for ecological degradation resulting from man's activities. A number of UNEP missions have gone to China, some at the expressed invitation of the Government, to find out the latest conditions and activities relating to environment.

It was in late 1976 that the Director of the UNEP Regional Office was invited for an official visit, as a result of which it was mutually agreed that a Regional Advisory Team (three members) would visit China as a follow up of that mission.

After a series of consultations between the UNEP Regional Office and the Chinese Embassy in Bangkok, it was finally decided to have the mission visit take place from 1-21 August 1978.

ACKNOWLEDGEMENT

The UNEP ROAP mission members are very grateful for the warm reception and hospitality universally shown by the representatives of the Government of the People's Republic of China. All preparations had been meticulously arranged, and the schedules prepared were comprehensive and appropriate enabling the team to learn and benefit from the briefings and discussions that took place throughout the duration of the mission.

The names of all the officials who made our visit as fruitful and pleasant as possible would take far too long to list, but it would be appropriate to name just a few.

We are most grateful to Mr. Lu Tzu-po, Counsellor and Charge d'Affairs of the Chinese Embassy in Bangkok, Mr. Lin Hua, Second Secretary, and their staff for providing the much needed liaison with the national officials in Peking.

To Mr. Wang Shing-shieh, leading member, Environment Protection Office (EPO), State Council, and his staff we are thankful for the briefings on the general environmental policy currently being purused by China. We also want to express our appreciation to the officials of the Tachai Production Brigade who went out of their way to give us a very thorough introduction ot their activities in Tachai, the model for agricultural production in China today. To Mr. Chu Ching, Director of the Department of Animal Ecology, and Mr. Wang Sung, Director of the Department of Veterinary Taxonomy Academia Sinica Institute of Zoology, we are indebted for the briefing on wildlife and conservation. To Mr. Chang Tai-chung, leading member Director of the Environment Protection Office (EPO) of Honan Province and his staff, we owe special thanks for providing us with information on the administrative structure of a typical provincial EPO.

We would like to make a special acknowledgement to Mr. Liu Chu-te, teacher of Middle School No. 3 in Chengchow and his assistants who demonstrated the use of a portable solar cooker, which could find applications in many developing countries in the region.

We are likewise much obliged to Mr. Chin Huai-kang, Director of the EPO, Shanghai Special Municipality, who informed us of the organizational structure and activities of a municipal EPO.

Last but not least, we are most thankful for the company of Mr. Wang Chih-chia, Staff Member of the State Council EPO and Miss Chou Huei-fang, staff member-interpreter of the China International Travel Service, who accompanied us throughout the China trip and served as our guides, interpreters and liaison staff.

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PART ONE

1. Summary and Recommendations

1.1 General Impressions

The purposes for which the team visited China were accomplished and the current environmental practices observed. A most important impression that the team obtained was the great ferment of activity that China seems to be undergoing.

With the present leadership that includes men of pragmatic inclination, there is now more attention being paid to four modernizations (agriculture, industry, defense and science and technology) than used to be. The goal is to catch up with the developed countries by the end of the century. The environmental implications of this thrust are soon to be felt and officials in charge of environmental protection are fully aware of the situation.

We were allowed and even encouraged to ask questions all throughout the visit. It was of course understandable that there was some loss in the language translation both ways, and our impressions were thus under these limitations.

We observed the following, however, in our visits to the various places:

(a) People worked hard without any apparent compulsion - both in urban and rural areas.

(b) Honesty in general, a way of life as evidenced by the absence of any fences or iron grilles on homes and by the casual way hotel rooms are closed but unlocked while occupants are away.

(c) Bicycles are an important means of transport by both urban and rural dwellers. Motorised transport is mainly owned by communes.

(d) Trees are planted along streets, roads and canals and there is a vast national afforestation and reforestation programme being vigorously implemented.

(e) People tend to live simply and under self-discipline.

(f) Because manpower is the single greatest resource of the country, public works are oriented towards labour-intensive direction and techniques. It is not uncommon to see large number of men,

women and children all working together to build a road, dam or bridge using manual labour. Mass mobilization is a characteristic of development effort in China today.

(g) Sayings and slogans are in general used and served to motivate the masses towards achieving stated production goals.

(h) Because of the great numbers of pedestrians and bicycles, vehicles tend to use the horn very much and noise pollution appears to be an increasing problem.

(i) The Chinese people do not appear to covet the luxury consumer articles which they see with tourists and visitors.

(j) Use of natural and organic fertilizer is given greater emphasis and inorganic fertilizers employed only for additional soil enrichment. Thus compost piles and use of night soil are practiced on a large scale. We were told also there were some 40,000 biogas installations throughout the country.

(k) With the emergence of a new China today, the people have acquired a new sense of identity and are proud to have achieved a great deal of progress since 1950.

1.2 Environmental Philosophy and Policies

The theoretical framework upon which Chinese environmental efforts are based is best summed up in the now well-known 32-character policy, written in 8 groups of 4 ideographs each and translated roughly as follows:

(a) over-all planning (Chuan Mian Kwei Hua)

(b) rational allocation (of resources) (He Li Pu Chu)

(c) multipurpose utilization (Chung He Li Yung)

(d) conversion of the harmful into the beneficial (Hua Hai Wei Li)

(e) reliance on the masses (Yi Kao Chun Chung)

(f) universal participation (everybody takes part) (Ta Chia Tung Shou)

(g) in environmental protection (Pao Hu Huan Jing)

(h) for the benefit of the people (Zao Fu Jen Ming).

According to this policy, (1) masses are to be mobilized to do environment protection work through non-formal education and information dissemination; (2) errors and wrong practices are to be corrected and each factory and commune pays attention to environment protection work in unity, which is integrated into production work; (3) large factories are distributed and smaller ones centralized; (4) attention paid to preventive

measures prior to disposal of wastes into environment; (5) industry and agriculture harmonized and complementing each other; (6) improvement of processes to utilize waste products whether they be solid, liquid or gaseous; (7) change of toxic to non-toxic procedures or processes; (8) careful recycling to reduce or eliminate wastes; (9) purification or treatment processes to include physical, biochemical and engineering techniques; (10) rules and regulations for new factories and installation of pollution control equipment in existing ones; (11) design, construction and operation of factories and plants to include environmental protection and pollution control facilities failing which the government may withhold clearance or disapprove projects; and (12) laws and standards set up according to health and environmental needs. We felt that careful attention is being paid to environment and not merely lip-service.

Even the new constitution of China, adopted on 5 March 1978 contained this very explicit provision (article 11 of Chapter I) "The State protects the environment and natural resources and prevents and eliminates pollution and other hazards to the public."

Finally the new Chairman, to underscore this constitutional provision stated in his address at the First session of the National People's Congress on 2 February 1978:

> "The elimination of pollution and the protection of the environment are a major issue involving the people's health, an issue to which we must attach great importance. We must draw up regulations to protect the environment and make sure that related problems are satisfactorily solved."

1.3 Principal Environmental Activities

At the time of the visit the main pre-occupations of Chinese environmental protection officials may be classified under the following activities:

(a) Industrial pollution control through waste water treatment (primary settling, oil-water separation, activated sludge, ion-exchange, etc.) use of bag filters, cyclones and precipitators for air pollutants, recycling and appropriate industrial siting.

(b) Water conservancy to prevent floods and droughts, control soil erosion and insure domestic, industrial and agricultural (irrigation) supplies.

(c) Wise use of natural resources through product recycling and maximum use of waste products.

(d) Afforestation and urban tree planting to insure green belts and a steady and sustained supply of wood and timber.

(e) Universal production of biogas from human and animal wastes and conversion of agricultural wastes and residues to compost for farm soil application and enrichment, thereby minimizing the use of inorganic fertilizers.

(f) Conservation of energy supplies through the use of biogas and agricultural residues, not readily compostible, for domestic needs.

(g) Monitoring of environmental pollution through water and air sampling and analyses, especially in and around industrial areas.

(h) Provision of mass housing in rural and areas and of high-rise apartment type residences in urban and industrial areas.

1.4 Human Settlements and Human Health

Provision of housing is a top priority in China and housing projects are under continuous planning and construction. Various types of materials are used including stones (cut by hand using minimum tools), bricks and wood.

The housing sub-division in Shanghai is an excellent example of city efforts, with minimum state (national) assistance, to provide shelter to its people even if two families have to share a common kitchen and bath. The attraction of city or urban life has been reduced by rural housing projects and helped in the elimination of slums that are well-known throughout Asia.

In general, human settlements and housing sub-divisions are now planned and developed to be self-contained communities and include food stores, a medical center, several light industry or small-scale factories, kindergarten and primary school and sufficient premises for a playground and recreation center. Utilities and services - water, sewers and drains in urban areas and light are provided. In rural areas the construction of waste digesters for biogas production is actively encouraged.

Health services are augmented by use of medicinal herbs and even hospital grounds are encouraged to have its own herbs-producing gardens.

Acupuncture in combination with western surgical techniques is widely practiced and accepted.

1.5 Energy

Rural energy supplies for cooking and lighting come mostly from biogas and agricultural units such as corn stalks and firewood from waste lumber or cut trees. For as long as electrification has not reached these areas, there will be this dependence on such energy sources.

A source that is becoming increasingly important is the hydro-electric power plant of about 40 kw generating capacity utilizing a water-drop of not more than about 5 meters. These are spin-off projects from other large engineering projects such as the Red Flag Canal, along which have been constructed 19 such small generators.

Coal is another important energy source and China has a number of substantial deposits. It is used not only in heavy industries, but also in small-scale industries. To a limited extend, it is used for domestic purposes such as cooking, especially during winter, and in lime production in rural areas.

Energy conservation is also evidenced by an apparent strict adherence to a policy of minimizing use of headlights of gasoline and diesel driven cars, trucks, buses and similar vehicles. Car headlights were turned on quite late in the evening to the point of risking accidents especially with bicycles, push carts and various types of animal-driven transport.

1.6 Soil Conservation and Fertility

Traditionally land has been farmed in China for centuries and experience has taught the peasants how best to increase the productivity of agricultural lands. The most practicable and convenient way is the use of compost as a soil conditioner and applying inorganic fertilizer only marginally.

At almost all production brigades visited up to 1/3 of farm needs for organic fertilizers come from residues of biogas and 2/3 from compost piles. The present rate of application is about 900 kgs. of inorganic fertilizer (NPK), 75 tons of compost and 35 tons of bio-digester sludge per

hectare of farm land. The cost of a 10-cubic meter digester for a family of 5-6 people is only about US$14.00 and needs only local labor and readily available materials.

Farmers in China are now transforming even their mountainous or hilly lands into productive areas for growing crops. Gullies and ravines are being filled and reclaimed, hills leveled and dams built, as part of an integrated approach to flood prevention, irrigation, soil conservation and river control.

Chengchow which used to be a dusty city has been planted with more than 2 million trees and the Yellow River has been put under control through a series of embankment dykes that run up to 800 kms. in length. Yellow River is perhaps the most heavily silt-laden water in the world, averaging 37 kgs. of silt per cubic meter of water or about 37,000 ppm, although the figures can vary anywhere from 3,000 to 170,000 ppm. Because of this, it is also unique in that the river bed at its lower reaches is higher than the surrounding areas.

Afforestation and reforestation is now a major activity in China and is pursued down to the commune level in a determined effort at soil conservation and for other purposes.

1.7 Wildlife and Nature Reserves

China is very rich in wildlife and has reserved some 1.34 million sq. km. or 0.14% of its land as protected areas for conservation of endangered species.

Some of the protected and endangered species are:

(a) Giant Panda (Ailuropoda melanoleuca)
(b) Lesser Panda (Ailurus fulgens)
(c) Wolf (Canis lupus)
(d) Chinese tiger (Panthera tigris amoyensis)
(e) Amur leopard (Panthera pardus orientalis)
(f) Wild bactrian camel (Camelus bactrianus)
(g) Wild Yak (Bos mutus)
(h) Golden Takin (Budorcas taxicolor bedfordi)
(i) White-lipped deer (Cervus albirostris)

(j) Musk deer (Moschus moschi ferus)

(k) Chinese alligator (Alligator sinensis)

(l) Siberian crane (Grus leucogeranus)

(m) Japanese crane (Grus japonensis)

(n) Brown-eared pheasant (Crossoptilon mantchuricum)

(o) Japanese crested ibis (Nipponia nippon)

1.8 Recommendations

The trip to China was very enlightening and the team saw a great deal of the country. Some of their practices are worth emulating while others need perhaps some modification. Since the team has been repeatedly asked by the Chinese Authorities to offer and make suggestions in the light of our training, experience and observations elsewhere, we would like to make the following recommendations:

1.8.1 Strengthening Mutual Collaboration in Pollution Abatement

Throughout the mission, we repeatedly heard from the Chinese officials regarding their desire to learn more about the methodologies of pollution abatement in other countries. The paucity of information available to scientists is more conspicuous at the provincial level. Specific areas where information is lacking are inter alia:

(a) Pesticide management and control;

(b) Residue utilization in aluminium industry particularly on chemical recycling and "red mud" handling;

(c) Treatment of pulp and paper mill effluents.

UNEP may be of assistance by encouraging more Chinese participation in its programme particularly the Industry Programme. It is still not very common for Chinese scientists to establish direct contact with their counterparts through attending international meetings. Recently, a positive trend has been established where China has begun to depute specialists to participate in technical meetings of the Regional Commissions.

1.8.2 Roving Seminar-cum-Study Tour on Industry and Environment

China is rightfully proud of its success after liberation through self-reliance and hard struggle. In "Industry and Environment", there are still many aspects where China may gain from learning the experience from other countries, but at the same time, she has unquestionably demonstrated her ingenuity in residue utilization and pollution abatement. The approaches and experience in China can be beneficial to other developing countries.

The purpose of the roving seminar and study tour is to bring a selected group of high officials (director-generals and deputy director-generals in pollution control offices) from developing countries to observe the approach in Chinese pollution abatement. During the mission, seminar type exchange of opinions will be conducted at every city visited so that the Chinese host may at the same time benefit from such missions.

Suggested places to be visited are:

a) Peking - Discussion with State and Municipal Environmental Protection Office and the National Environmental Chemical Institute.

b) Shanghai - Industrial locations, automobile industry and chemical industry.

c) Tientsin - Light industry.

d) Taching - Petroleum and petrochemical industries.

e) Anshan - Iron and steel industries.

Study tour duration should not be more than 15 days.

Participants envisioned are high officials from pollution control or environmental agencies from developing countries, preferably not more than 15 persons.

The method of implementation will be roughly as follows: Prior to departure of the mission to China, the participants will be requested to submit a brief account of pollution abatement programme (at least one industry per city of visit) of their respective countries. At each city of visit, one full day session will be arranged for a seminar-session where each participant will present his experience so that a viable discussion and exchange of views on pollution management may be conducted. The host country will be requested to supply local experts who will participate in the discussions and introduce the participants to the Chinese environmental pollution abatement programme of each sector of industry.

1.8.3 Control of Soil Erosion Through Afforestation

The disparity in the extent of afforestation on mountains and hills of northern and of southern China, was reported to be due, in part, to the relatively shallow soils in the hills in the northern parts. Although this is a serious handicap, certain shrubs which do not require very deep

soils and have soil-holding propensities could be propagated, which in due course will add humus and gradually break up the shale and thereby add depth to the soil. In certain areas where the soil is deeper, hardy species of trees, mainly of the coniferous species could be propagated. The Taihang mountains, where we were told natural forests were destroyed in the pre-liberation period, are now being gradually afforested. In some parts 70% of the hillsides have been covered.

The propagation of rhododendron bushes on some of the hillsides may prove very beneficial and will at least prevent further soil erosion. Two very encouraging features noticed during the travel of the mission in the hilly terrain was the total lack of cattle grazing and of itinerant people cutting fuelwood, which are such great banes and the cause of so much environmental degradation in many developing countries in South Asia.

In the train journey between Canton and the Hong Kong border, it was noticed that hillsides were covered partially by plantations of tropical pines, and partially by plantations of two or three species of eucalyptus. In the plains areas the plantations were mostly of eucalyptus. Though both these types provided no canopy, there was relatively little undergrowth noticeable on the hillsides, particularly on those parts on which the eucalyptus grew. The lack of grass and other undergrowth was causing a certain amount of soil erosion and in some parts the soil lay exposed. Though eucalyptus are a very fast-growing species and a good source of fuelwood they do have certain inherent disadvantages which may be kept in view while propagating this family of trees in the future. The eucalyptus drain the sub-soil water to a greater extent than most other species of trees and what is more significant, they return no nutrients back into the soil. The oil from the leaves prevents grasses from growing underneath, and many eucalyptus plots, after the harvest of timber, have been found to be too impoverished for other economic exploitation, at least in the immediate future.

It would be ecologically much more appropriate if in the afforestation of hillsides the practice of monoculture is avoided as far as possible. It is an accepted fact that monoculture by simplifying the biotic community, reduces the fertility of the soil and impoverishes it in the long run. Since the primary objective of afforestation of the hillsides is not only the

propagation of a particular species of trees of commercial value, there should be no impediment to a heterogenous approach in afforestation in these areas. Along canals, roads, railways and the villages, monoculture would not have an adverse impact in view of floral diversity which already exists in the adjacent cultivated lands.

1.8.4 On Nature Conservation

(a) Need for survey of endangered flora and fauna

Investigations regarding status and distribution of the fauna and flora need to be carried out in detail, particularly of the rare and threatened animals. Some progress has been made in this direction, but much more needs to be done. It is suggested that the animals and birds of the first category, at least, should be made the first priority with regard to which detailed investigations should be initiated to ascertain their current status and distribution in the country. Similar investigations at least in some sample areas should also be carried out in respect of species of commercial or medicinal value such as the musk deer, the various elephus and sika deer taxa, and some of the fur-bearing animals currently being commercially exploited. In certain cases the ecology of these species need also to be studied. We were told in Shanghai that ecological research on some of the mustelids and marmots has been initiated.

Once the current status and distribution of the endangered species is ascertained, at least one or more protected areas for each such species should be created. As regards those endangered species which are currently protected in existing parks or sanctuaries, it may be ascertained whether the extant protected areas are ecologically viable and their management appropriate. Wherever possible at least two protected areas for each endangered species should exist.

The classifications of the protected animals and birds which had been carried out by the authorities of China is indeed a most commendable approach. However, since the classification was done in 1962 and the status of wildlife, particularly of the endangered species is not a static factor, a revision of such classification needs to be done based upon existing data and that which would be obtained from investigations which need to be carried out as mentioned above. The Chinese authorities themselves stated that such a review of classification is under consideration, and it is hoped

that this shall be initiated shortly. In this context, it may be appropriate to suggest that not only the larger mammals be included in the revised classified list, but also more birds than feature in the list today, as well as some of the rare plants, fish, reptiles, amphibiants, etc., which are in danger of extinction.

(b) Restrictions on hunting

We were informed that the people in the rural areas are allowed to shoot, trap or hunt in any other manner animals and birds that may occur in their area, except the animals which are protected under the classified list. Apparently, there are no restrictions upon hunting. This, of course, does not apply to the protected areas designated by the Government and it may also not apply to certain other areas. However, it was not possible to obtain any detailed information with regard to hunting rules and regulations prevalent in the various parts of the country.

(c) Policy review on wildlife trade

Another aspect of great importance would be to review the present policy on trade in wildlife, particularly with regard to export of wildlife and wildlife products. Certain restrictions and quotas have been imposed in the recent past on such export through Hong Kong. However, a large volume of trade in and export of wildlife and wildlife products is still carried on, including that in some endangered species. Commercial exploitation of wildlife is a viable proposition provided it does not lead to depletion of wild stocks and of course to the extinction of genetic resources. It is imperative, therefore, that a strict control may be enforced as to the species and products derived therefrom, that are actually to be exported, or in which trade within the country is to be permitted. This would require investigations as to the status of the species that are commercially exploited in the different provinces of the country, fixation of annual harvest quotas in different parts, and to careful physical checking of the exports to identify the taxa.

(d) Breeding in captivity

Some of the rare species of animals may have to be bred in captivity to ensure continued survival as a safeguard against their extinction in the wild. The Shanghai Zoo has already taken steps in this direction by segregating some of the rarest species like the Chinese alligator, the

lesser and the giant panda, two species of cranes and certain other animals to be reared in captivity in a special area away from the zoo. It may be appropriate to carry out this practice on a larger scale in other zoos and breeding centres. The captive breeding of such rare species should be done with a view to enable the re-introduction of the captive-bred stock in the wild habitat in the future, once the habitat is secure and the numbers in captivity are adequate. This would imply that the captive-bred stock is not domesticated or made unduly tame. One such animal which needs to be bred in captivity for future re-introduction into the wild is the Milu or Pere David's deer, as stated elsewhere in this report.

(e) Criteria on national parks and protected areas establishment

In the establishment of national parks and other protected areas the occurrence of endangered species should not be the sole deciding criteria, and the inclusion of representative and unique ecosystem and remnant natural forests, endangered plants and biotic communities, wetlands, lakes and rivers - or of some section of rivers - must also be duly considered.

(f) Investigations on low bird population

As noted elsewhere in this report, there is at present a very low bird population in China. If this is eventually shown to be due to toxic chemicals, it poses a very serious and significant ramification vis-a-vis human health in the country. Though the effects of such toxic chemicals may not be apparent on human beings at the present moment, the repercussions that they have had on the bird life may well be a precursor and an environmental hazard whose magnitude and effect will increase in the future. It is imperative that a detailed study be carried out as expeditiously as possible to determine the precise situation, and whether the conclusions drawn above are in fact valid.

(g) Training in wildlife conservation

The authorities in Peking informed us that the other great requirement in the field of nature conservation was training of in-service personnel in the methodology of wildlife management. This is another aspect which the government may well consider developing, since if these natural resources are to be harnessed and managed on a long-term basis,

adequate expertise must be imparted to the people in charge of the protected areas and of the breeding of rare species. Protection alone, crucially important though that may be, will not suffice. Management principles and practices combining indigenous experience, needs and practical application with up to date know-how and experience of other countries - a fusion in which the Chinese are past masters - need to be applied in the case of wildlife management as well. Side by side, education of the people to arouse their interest in the importance of nature conservation is another aspect that needs to be given attention. China has very rightly emphasized on the need of public participation and the communes and the production brigades exercise considerable authority in areas under their jurisdiction. If the significance of wildlife conservation and its economic importance to the people is highlighted, it would greatly facilitate the task of nature conservation and research. As for the protected areas, particularly those that would be set up in future, the active participation of the people of the surrounding areas should be obtained.

(h) Scientific management of wildlife resources

Perhaps, it would not be an over exaggeration to state that no people in the world depend so much upon wildlife resources both faunal and floral for medicinal, commercial and other usages as the Chinese. These natural resources, therefore, mean much more to China than to any other nation in the world, and it is essential, therefore, to the economic and social well-being of the country that these resources are scientifically managed. Those genetic resources that are facing extinction in the wild would have to be conserved in-situ in the wild, while in certain cases ex-situ conservation through artificial propagation and captive breeding may have to be resorted to, both to safeguard against extinction in the wild, as well as to supply the commercial demands. China is now fully conscious of the importance of her natural resources and is embarking upon a programme to manage these resources on a long-term basis. The highest priority has been accorded to those species which have been classified as "world treasures" - and China is one of the greatest custodious of such living world treasures. It is earnestly hoped that in her endeavour to conserve this heritage of mankind China will meet with all success, and that where necessary she will seek, and receive, full cooperation from all far-sighted peoples of the world.

2. Background of Present UNEP Mission

2.1 Previous UNEP Missions and Study Tours

A number of UNEP missions and tours have previously visited China. Those that are on record at the Regional Office are as follows:

1) Messrs. M.F. Strong, M.K. Tolba and V. Anghel: 22-28 September 1974.

2) Ernst F. Winter First UNEP Study Tour to the People's Republic of China on "Sand Dunes Stabilization and Afforestation" 17 August - 2 September 1975.

3) Ernst F. Winter First UNEP Study Tour to the People's Republic of China on "Schistosomiasis Control in China" 20 October - 18 November 1975.

4) Mr. R.B. Stedman and participants to Study Tour on Energy and Environment, 27 September - 16 October 1976.

5) Mr. C. Suriyakumaran, 26 September - 9 October 1976.

6) Messrs. C. Quintana, Y.K. Gurer, Wo Yen Lee and participants to the Human Settlements Study Tour (co-sponsored with UNHHSF) 15-25 September 1977.

7) Dr. A. Khosla, 17-24 June, 1978.

It was the official visit of the Regional Director, Regional Office of UNEP in late 1976 (which coincided, unfortunately, with the demise of Chairman Mao Tse-tung) that paved the way for the present mission.

2.2 Objectives of the Mission

As a follow up of the Regional Director's visit, the present mission had the following objectives.

(a) To observe and to benefit from the Chinese experience in relation to "Environment and Development", particularly the success of the application of the "unified planning" concept in its development process covering communes, industrial areas and urban settlements.

(b) To observe in detail the waste treatment and monitoring equipment already in use in China for their possible adaptation to other developing countries.

(c) To observe wildlife conservation and national parks management in China.

(d) To identify further areas for study tours/visits by officials from developing countries in this region.

(e) To use the benefit of the visit in the course of RAT activity functions in this region.

However, the itinerary was only made available to the Mission after it reached China. The planned travel and discussion programmes did not provide much opportunity to observe the waste treatment and monitoring equipment, neither did it arrange for discussions with the authorities on policy aspect as envisaged in (a) and (b). Since it was impossible to revise the schedule, it was felt that the Mission might also benefit from taking the opportunity to observe the environmental management programme of various industries to be visited.

2.3 Places and Offices Visited

The complete itinerary and listing of officials met are given in Annex 1 and Annex 2, respectively. All in all, there were visited five provinces (Kwantung, Shansi, Hopei, Honan and Chekiang); seven cities (Canton, Peking, Shihchiachuang, Chengchow, Shanghai, Anyang and Hangchow); four counties (Fangshan, Hsiyang, Huolo and Lingshien); three production brigades (Tachai, Huolu and Pai Chuang); three factories (General Petrochemical works, the Huapei Pharmaceutical Factory and Kwan Ming Electroplating); the famous Red Flag Canal, two of its power stations and aqueducts; a pumping station for flood control; several Exhibition Halls; a hospital; three zoos and a botanical garden, several kindergarten schools; a housing colony and a children's palace.

3. Human Settlements

3.1 Characteristics of Human Settlements in China

Being the biggest country in the world in terms of population with more than 80% of its people living in rural areas, China distinctly maintains a rural accent with peoples' communes serving as the basic production and administration units. During the three-week trip in which visits were arranged to selected locations both in cities and in rural communes, it could be observed that China seems to have succeeded in providing shelter and other basic human needs to its citizens. In the rural areas people look healthy and well-fed. Clothing, though non-presumptuous, is

ample and sufficient to suit the weather in different provinces. Housing conditions in rural communes, although simple, appear clean and adequate. Since a previous study tour on human settlements has visited China previously, the subsequent topics below will deal mainly with rural and semi-urban settlements.

3.2 Land Reform and Human Settlements in Rural Communes

In most other developing countries in South and Southeast Asia, the historical feudal systems have for generations propagated tenant farmers and absentee land ownerships. Although land reform programmes have been initiated in almost all of these countries, the prevailing conditions are far from encouraging. A recent report publish by FAO mentions that: "In Asia, quite often ten per cent of the land owners hold between 60 to 80 per cent of the land. Actual tillers continue as tenants or sharecroppers. Rents are generally about half of the gross product, despite regulatory legislation that stipulate farm rent at one-fourth to one fifth of production."

In the Chinese experience, steps to land reform and commune development have been carefully planned and executed. Even before 1949, the main policy of the government in the liberated areas was to reform land holding system. Landlords were progressively eliminated and land divided among the millions of landless peasants. However, due to the enormous number of Chinese peasants, only small pieces of land could be equitably distributed. Agriculture on millions of small divided pieces of land did not prove to be productive nor economical. Hence a gradual shift to communes was initiated. The movement was started from small mutual aid teams among neighbours into simple cooperatives and finally to advanced cooperatives with the abolition of private ownership. Communes thus serve as the standard human settlement pattern in China nowadays.

3.3 Social Mobilization in Human Settlements

The integrity of commune settlements in China should be linked to the high degree of mass participation in governmental programmes. In achieving social and developmental goals, the government relies on social mobilization, self-reliance and hard struggle. These are unique characteristics which have served China for the past 30 years. Water resources

development may very well serve as an example. The Haiho River basin development in North China, encompasses a total area of 265,000 square kilometers with the population of 40 millions. Every year, one per cent of the population, or 400,000 people are voluntarily involved in the maintenance and expansion activities of this project. The strength of China economic development lies on the potential of this well disciplined and potent work force.

3.4 Stabilization of Rural-Urban Migration

Due to the imposed regulatory nature of human settlements, China has avoided one of the chronic problems facing other developing countries in Asia, namely the influx of immigrants into urban areas. To prevent such in-migration, China has promoted decentralization of industries. To ensure self-reliance and mass participation at the commune level, China emphasizes the development of comprehensive self-sustaining entities, to the extent possible, down to the commune level. Supplementing such an effort, industry has been dispersed, whenever appropriate, to the countryside. Each commune is encouraged to become self-reliant and interference with its internal working and programme by central authorities is reduced and this, in turn, encourages more participatory planning within the commune, percolating all the way down to the village team. In the case of farm mechanisation, for example, the government has encouraged the setting-up of repair and maintenance shop for farm equipments in communes whereas assembly plants are set up in counties while manufacturing plants are established at the provincial or state level.

3.5 Rural Energy Supply in Human Settlements

China now exports oil in significant quantities and some experts believe that it has the largest oil reserves in the world. It is generally considered that China now ranks third in the world as a coal producer. It is thus heartening to consider that the country still regards biogas as a renewable source of energy which should not be wasted. Since 1958, it has been a national policy to promote the use of biogas. It is reported that the total number of biogas in China has surpassed 4.3 millions. Biogas is mainly used for domestic cooking and lighting, while biogas tank residues are mixed with compost to serve as soil enricher and organic fertilizer. The standard biogas digestor is about 10 cubic meters in

volume for a household of 5-6 persons. The success in the promotion and application of biogas in China, perhaps could be attributed to its ability to reduce the cost. The plastic pipe and plastic joints are sometimes produced right at the communes. The mission was told that plastic pipe costs only 2.5 Yuan per 1 kg., while a biogas bulb costs only 1 Yuan each. The main raw materials are cement and lime, which are supplied at minimal cost to farmers. The total construction cost is only about 20 Yuan per unit of digestor. The low cost of investment and maintenance thus gives biogas the edge over the use of other sources of fuel such as coal. This experience has proved beyond doubt the practical value of utilizing biogas as a source of energy in rural settlements.

3.6 Role of Women

Women's rights have been put into full practice in China. During the mission to the communes and rural areas, it could be observed that women normally work side by side with their male counterparts in farms, workshops and generally in villages and settlements. Equal partnership between the sexes seem to be the rule rather than the exception.

4. Agriculture and Soil

4.1 Agricultural Progress

One of the greatest achievements of modern China, and in fact, one of the greatest achievements in the history of human endeavour, is the progress made in the last three decades in the field of agriculture in that country. Indeed, one of the features which the mission found to be most striking during its travels was a remarkable degree of uniformity in the crop situation in the various parts of the country. The crops were of course outstanding in the legendary Tachai commune, but the corn and other crops elsewhere were not much inferior. Anyone who is familiar with the vagaries of the climate and the havoc that it causes, resulting in marked differences in the status of agricultural produce in the different parts of the very same province in other countries of Asia, would be able to truly appreciate this success that the Chinese have been able to achieve. It bespeaks of the tremendous advances made in irrigation coverage, seed quality, fertilizer application, plant protection, soil conservation, and sheer human effort. Since, however, other UN reports have been made on

the agriculture in China, this report shall only mention certain salient features briefly, as observed by the mission.

Agriculture has been perhaps one of the greatest testing ground of the efficacy of the cooperative effort in China and it is perhaps the main aspect responsible for the evolution of the modern day People's Communes from the Mutual Aid Teams of the early 1950s. Not only have the communes been able to develop agricultural facilities such as water conservancy and irrigation networks, but have established substantially sophisticated industries that are ancillary to and necessary for agricultural production, e.g. tractor and other agricultural implements manufacture and maintenance, dairy production etc.

One of the greatest achievements has been the expansion of the irrigation networks. In the Red Star Commune near Peking, for instance, 1,400 electrically powered deep wells have been sunk, over 300 kms. of irrigation and drainage canals have been constructed, and the entire agricultural land of the commune is now under irrigation with the agricultural produce having increased 2½ times more than in the early days of the commune. Even the Dr. Norman Bethune Memorial Hospital in Shihchia-chuang, which is one of the leading hospitals in the region, regards agricultural production important enough to adopt a policy of raising outstanding crops of cereals and fruits on its extensive grounds. The Red Flag Canal which is discussed at some length elsewhere in this report, is at once a tribute to the Chinese skill and persistence as well as to the importance they attach to irrigation. The canal has of course entirely changed the living prospects and economic conditions of the entire region, previously one of the most backward and drought-affected areas in China.

In the hilly regions, the terracing of land is a noticeable feature, and in certain areas like Tachai the eroded gullies have been levelled and brought under the plough.

Afforestation to conserve soil and water is discussed elsewhere in this report and shall not be repeated here.

As regards plant protection, effective control has been achieved over pests and insecticide spraying of agricultural produce has been extensive. The mission noticed heavy dosages of insecticide spray in orchards. It is possible that insecticide and pesticide spraying may now be assuming

proportions serious enough to have environmental effects, and the current low bird populations in China may be a reflection of the situation, as discussed elsewhere in this report. This aspect needs to be investigated further.

Agricultural implements and tools, though not as sophisticated as are found in developed countries, are still far more advanced than are locally produced in most developing countries. What was of significance was the ready availability of these implements, the practicality and suitability of the designs to Chinese conditions and needs, and lastly, the presence of maintenance facilities on the spot.

Few countries utilize organic manure as extensively and comprehensively as is done in China, and one of the most noticeable features are the numerous and large compost heaps neatly set-up all over the countryside. With animal husbandry rapidly increasing and stall-feeding being the common practice - unlike in most South Asian countries - the animal "wastes" are effectively utilized and recycled for enhancing agricultural production. The residues of biogas production which has been a notable success in China, is one such example.

5. Industry and Environment in China

China today is determined to step forward and become a fully developed country, economically, and technologically, by the year 2000. In its drive to modernize the country by the end of this century, this country, the third plan for the development of science and technology was drawn up and approved by the first National Science Congress in March of this year. The plan covers the period of 1978-1985 and aims at the "four modernization": to approach or reach world's advanced levels of the 1970s in a number of important fields, to increase the number of scientific research and personnel to 800,000, to build a large number of up-to-date centers for scientific experimentation, and to complete a nationwide research network. Under the present guidelines for development, industry and agriculture take first priority, followed by sophisticated science and technology and basic theory.[1/] In the pursuit of this national

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1/ "Launching the Drive to Modernize Science" - Chou Pei Yuan, China Reconstruct, July 1978.

policy, slogans and posters can be seen throughout the country urging the people to struggle and work hard for the advancement of science and technology.

5.1 Industry Visits

China is one of the few countries in this region besides Japan, Australia and India, which possess a broad industrial base covering almost all sectors of industry. Rich in natural resources including minerals, China maintains a high potential for industrial development. In 1974, it produced 23 million tons of steel. In energy development, China now is the third largest coal producer in the world. In recent years, it has begun to export oil. The Taching oil field, which also serves as a pace-setter in Chinese industrial development, is one of the largest oil fields in the world. China also produces its own automobiles, generators, turbines, digital computers, satellites, etc., to name just a few. Almost every equipment and machine we saw is produced in China.

During this trip, perhaps due to logistical reason and also to time constraints, the mission was only shown selected and pre-arranged industries. However, valuable exchange of opinions at all levels: state, provincial and municipal, particularly with the Shanghai environmental officials, was most positive. The industries and industry-related exhibitions visited are listed as follows:

1) General Petrochemical Works, Peking

2) Huapei Medicine (pharmaceuticals/antibiotics) Shihchiachuang Factory (including the production of glucose from corn)

3) Tractor manufacturing and assembly plant, Linshien (Lin Xian) County, Honan Province

4) Shanghai Kwan Ming Electro-plating Factory

5) Industry exhibition in Shanghai

6) Hangchow silk and brocade factory

7) Various biogas production units.

5.2 Characteristics of China Industrial Pollution Abatement

The emphasis in industrial pollution abatement in China is the elimination of the three "wastes" namely, air, water and solid residues.

However, in the process, the precept is on reuse and recycling of wastes to utmost extent possible. Since all enterprises belong to the State, it is a national conduct that every agency concerned is responsible in protecting the environment from industrial pollution. In so doing, different alternatives suitable for different stages of industrial development are involved. For any new factory, environmental considerations are integrated throughout all stages of the project development, namely, planning, construction and operation. There were reported cases where pollution control facilities were installed prior to the completion of the factories themselves.

As for existing and old factories, the improvement of environmental conditions are gradually exerted through:

(a) Improvement of manufacturing process, such as the switch from process requiring toxic substances to other harmless processes, recycling of residue, etc.

(b) Multipurpose residue utilization through recovery of materials, recycling of effluents, utilization of residues for making construction materials such as bricks or for agricultural purposes such as fertilizer and irrigation water supply, etc.

(c) The treatment of the waste itself.

As mentioned earlier, the fact that all enterprises belong to the State adds to the degree of flexibility in pollution abatement. Economic constraints concerning abatement costs do not seem to be an impediment, as is happening in other countries with different social and administrative systems. Although national standards are still in the process of being developed, many factories have invested on pollution control and have been practicing residue recovery as a means of pollution abatement.

5.2.1 Kwan Ming Electro-plating Factory, Shanghai

The factory located on the outskirts of Shanghai, has invested more than 500,000 Yuan since 1970 in treating its residues. This effort now has proved to be beneficial. It is expected that the savings in terms of raw materials will compensate and cover the investment costs within three to four years period. Under the present pollution abatement programme, several improvement measures have been adopted viz:

1) In the past, up to three tons of sodium cyanide was utilized in the electro-plating process. In the attempt to prevent severe pollution from toxic substances, sodium cyanide now has been discontinued and cyanide-free process is introduced.

2) In the polishing workshop where plated products are polished prior to final shipment, pneumatic dust absorption equipment had been installed. The collected dust is passed through wire iron screen and burned daily. This process in itself reduces the amount of dust in the workshop and is effective in upkeeping the high standard of occupational health.

3) In the chromium plating process, lead cathode and chromic acid solution are employed. The gas vapours arising above the electro-plating tanks are conducted through a plastic screen which liquifies the chromium acid content. As a result, a 99% reduction in the chromium residue of the gas output is reported. Concurrently, the liquid waste from the electro-plating tanks is treated through a series of five ion-exchange columns. Sodium hydroxide (NaOH) is added to recover the chromic acid (H_2CrO_4). After treatment, almost no chromium can be traced in the liquid effluent. There is a recovery of up to 40% of chromium from the liquid wastes and 25% from the gas vapours while the rest is consumed in the electro-plating process. This principle applies equally well in the case of nickel. As for copper, research on its recovery is being conducted by the factory. (Please see details of the electro-plating process in the Appendix.)

5.2.2 General Petrochemical Plant, Peking

At this General Petrochemical Plant, the waste water is processed through sedimentation ponds where oil is segregated. It is then treated with aluminium chloride and sand filtration before being released for irrigation nearby crop fields. This waste water contains ammonia and nitrogen which serve as fertilizer input for sorghum and corn. A 10% increase in agricultural produce in adjacent grain fields was reported.

The sludge from the treatment ponds are now being used in brick making. However, due to the heavy metal content in the sludge, the management of this plant plans to disregard such a utilization. In the future, sludge will be buried in nearby fields.

The plant is also successful in its control of waste water quality. The oil content is decreased from 1,000 ppm. to less than 5 ppm., while the sulphur content decreased from 1,000 ppm. to 0.3 ppm.

5.2.3 Huapei Medicine (pharmaceuticals/antibiotics) Factory, Shihchiachuang

The main products of this plant are antibiotics such as streptomycin, pennicillin, chloromycin, starch, glucose from corn seeds, organic solvents like methanol, and ethanol, etc. In the past waste-water generated was used mainly for irrigation purposes, since it contained nutrient residues from fermentation. In recent years, through the plant's own research effort, it has succeeded in utilizing the RNA content of waste-water to create nucleotides, which can be used as anti-carcinogen and for hepatitis control. As a subsidiary product, glucose is already produced from corn seeds. In the process, the tips of corn seeds are heated and dehydrated to produce vegetable oil. The de-oiled residue can be utilized as animal feed.

5.2.4 Residue Utilization Through Composting

In China, there is simply no unused waste from agricultural residue. Stocks, leaves and other leftovers after harvesting serve as raw material for composting and biogas production. Since pork is a traditional source of meat in China, pig raising is promoted in most communes. The waste from pig pens and latrines are used as ingredients to biogas digestors and for composting. Large piles of composts are common sights everywhere in the rural areas. In composting, human and animal excreta are mixed with agricultural residue and mud. However, the stocks and leaves must be chopped to small pieces so that decomposition can take place within a specified time interval. The mixture then is left for an aerobic composting which may raise the internal temperature up to 60°C. The composting process increases the level of active nitrogen which serves as valuable source of fertilizer. As much as 7,500 kgs. of compost is applied to 1 mu of land (about 1/15 hectare), supplemented by another 750 kgs. of chemical fertilizer depending on the nature of crop and soil conditions.

Besides water conservancy, the improvement of soil fertility through the application of compost is regarded as one of the main

contributors to the success of agricultural development in China. The Chinese farmers are traditionally diligent, and the use of night soil directly as fertilizer has been practiced for generations. However, the now widespread use of composting not only produces enriched fertilizers from available agriculture residues, but it also increases the standard of environmental health through the eradication of fecal bacteria from the heat generated by the composting process.

5.3 Urban Industrial Siting

In development planning, China always emphasizes on the concept of "unified" planning, where the symbiotic nature of environment and development is receiving due attention. The long-term benefit of a project to the people seems to be the overriding factor. Large factories are allocated all over the country and serve as the pulling factor in industrial development. At the same time, small industries which existed in large numbers before liberation have been amalgamated into bigger groups.

In Shanghai, the Chinese experience in industrial siting was discussed. It is heartening to learn about the close working relationship between the City Planning Office and the Environment Protection Office of the Shanghai Municipality. Being the largest industrial complex of the country, and with the population of more than 10 million within its municipality, Shanghai has paid particular concern to environmental protection. Within its 6,100 km^2 territory, ten industrial zones have been delinated. The strategy is to develop small satellite towns on the outskirt of the city to promote full utilization of land and avoid congestion in the city proper. Incentives also are given to workers residing in the suburban areas in terms of larger housing compartments.

Some of the industrial zones are:

1) Ming Hang industrial zone for electrical machineries and chemicals

2) An Ting industrial zone for automobile production

3) Ke Ching industrial zone for chemical plants

4) Pao-Ching Son for petrochemicals

5) Pao Son for iron and steel industry

6) Ja Ting for industrial research and computer manufacturing.

The Environment Protection Office (EPO) assumes the final authority in approving the allocation of industrial factories. The present policy is to allow only non-polluting industries within the city proper. The other commendable effort is its interest in workers' welfare. At present, more than 14 million square meters of living quarters have been built. A two-bedroom shared kitchen and toilet apartment for four persons cost only 11 yuan per month (1US$ = 1.6 yuan) for both rental and utilities fee. This is equivalent to about 5 to 6% of the family's weekly income.

5.4 Environmental Pollution Control Mechanisms, Standards and Monitoring

Being the largest country in the world in terms of population, China depends on an effective bureaucratic machinery to carry out governmental functions. The Chinese Government structure dealing with the environment has been covered in previous reports. However, in order to understand the linkage between counterpart agencies at the State and the provincial levels, schematic presentations are illustrated in Figures 1 to 3.

It is worth noting that the provincial offices are rather autonomous in terms of financial commitment, which is also true in the cases of special municipalities and autonomous regions. The State Council provides directives and guidelines on environmental protection, but the details of programmes will be formulated at the provincial offices.

At the State level, the Environment Protection Office (EPO) also serves as the nodal agency in contacting international agencies and foreign bodies. Naturally, one of its major tasks is to coordinate various activities relating to the environment under different ministries. It also promotes environmental research through the Environmental Chemical Institute under the China Academy of Sciences.

The provincial and municipal set up gives high priority to research and monitoring. Normally, there are divisions on monitoring attached to the EPO. At the same time, there is a Provincial Scientific Committee under the Provincial Revolutionary Committee of every province. In Shanghai, which is the largest municipality in China, the EPO has the

FIGURE 1

Linkages between State and Counterpart Offices on Environmental Protection

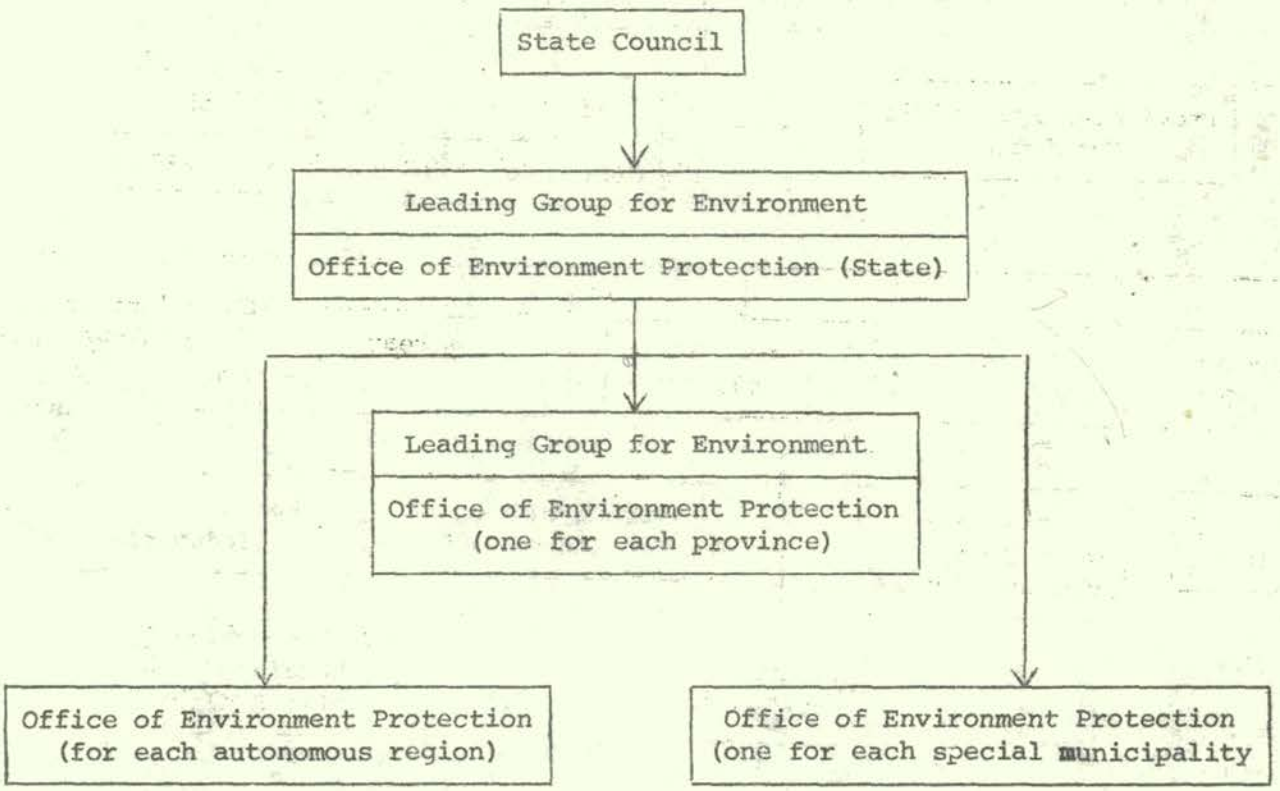


FIGURE 2

Schematic Governmental Set-up at Provincial Level
(same for municipalities and autonomous regions)

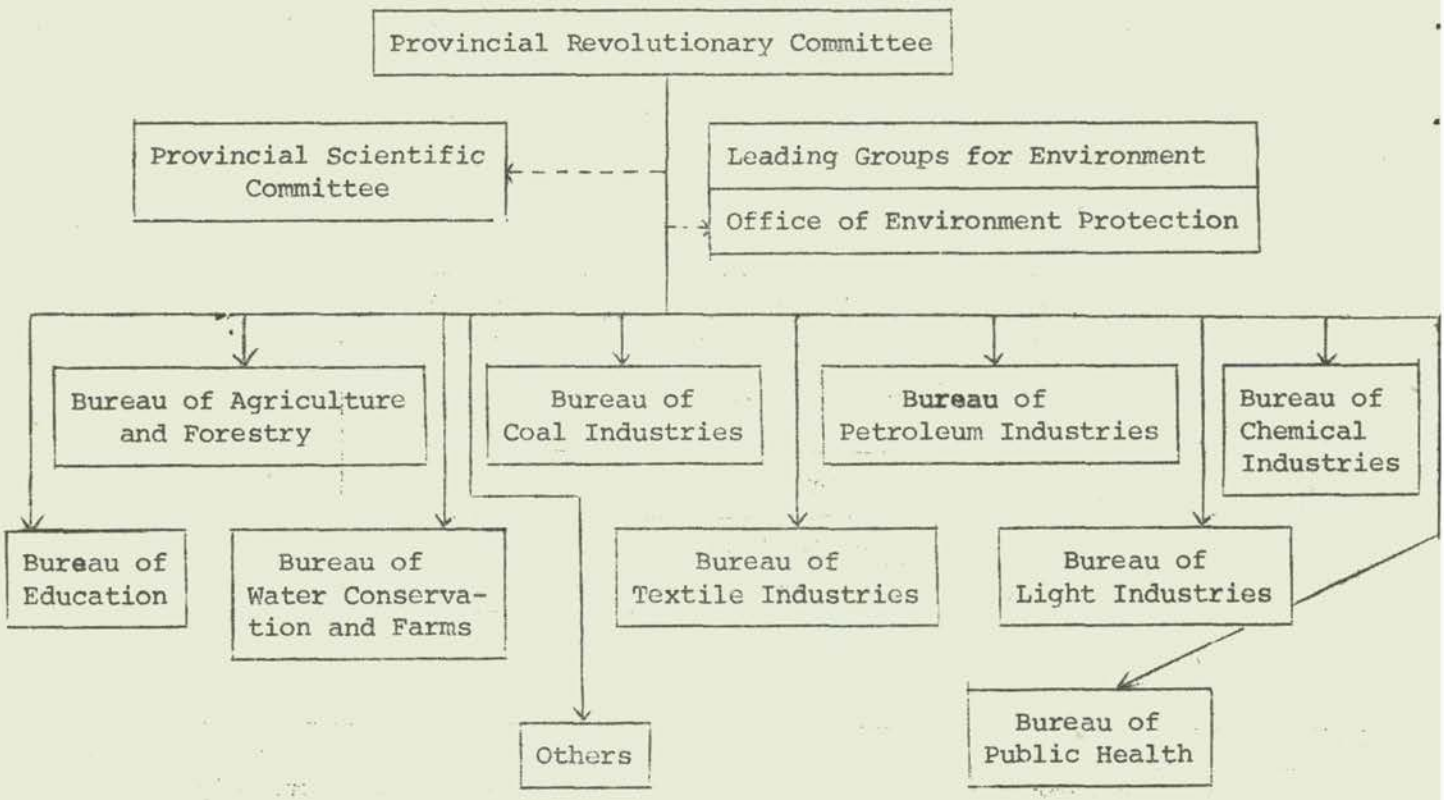
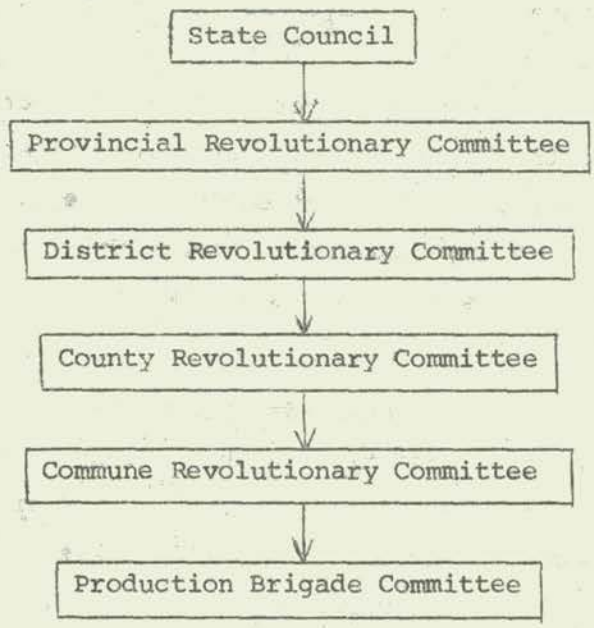


FIGURE 3

Vertical Line of Communities for the State down to do the Production Brigade



authority in approving the expansion of old industries. It gives special attention to the use of toxic materials such as mercury. The use of mercury must receive approval from both the responsible offices such as health or education, and from the EPO.

In Shanghai, monitoring for water and oil falls under the responsibility of districts. There are now 40 air monitoring stations and 20 water monitoring stations within the 80 kms. each of the Hwangpoo River.

At the provincial level, the intensity of environmental activities seem to vary from province to province. The thrust of activities is undoubtedly on industrial pollution control. In Chengchow province, we were told of a case where a pulp and paper mill was discharging its effluent untreated into the Yellow River. After investigation was conducted by the provincial EPO, a technical report depicting the situation was submitted directly to the Provincial Revolutionary Committee which became instrumental in imposing necessary changes in the production process of the mentioned plant.

Regarding environmental standards, the mission was told at different occasions that they are still in the process of being adopted. This applies to both State standard and provincial standard. On the technical side, the provincial authorities still look towards the guidance from the State, except perhaps major municipalities such as Shanghai. This may be due to the fact that like other countries in the world, environmental quality protection particularly in terms of industrial pollution control, is still relatively new to China. Most of the provincial offices were set up only in the early 1970s.

6. Afforestation in China

This subject matter has already been dealt with in considerable detail in reports prepared by FAO, UNEP and other agencies and, therefore, will be dealt with very briefly here, conveying some of the impressions of this mission vis-a-vis the approach and scope of afforestation in the areas visited.

6.1 Magnitude of the Problem

No nation in the history of mankind has undertaken the task of afforestation on so gigantic a scale as China has in the past quarter

century. At the time of liberation in 1949, the area under forests was assumed to be between 5 to 5.5 per cent of the surface of the country, or approximately 50 million hectares. The present forest area covers about 11 per cent which is approximately 105 million hectares. Richardson (1972) estimated that China had 80 million hectares of natural forests, while the remainder were man-made. Sixty per cent of the natural forests is in the northeast portion of the country within the coniferous and mixed coniferous/deciduous broadleaved zone, supplying a major portion of the national output of timber. Seventeen per cent of the forest is in the east and southeast, encompassing deciduous and mixed evergreen broadleaved tropical pines. Ten per cent is found in Southwest China, in Yunan, Tibet and parts of Szechwan, and Kwangsi Provinces consisting mainly of tropical evergreen and montane forests. The remainder lies in scattered pockets in the Northwest, South (including Hainan) and Central China (Kiangsi and Fukien). In 1974, the People's Liberation Army (PLA) is reported to have aerially sown nearly 700,000 hectares of forests as well as being engaged in ground afforestation. China has reported to have a regular annual plantation programme of approximately 5 million hectares of forests, and aerial seeding is being practiced.

According to Chairman Mao "Agriculture, forestry and animal husbandry are interdependent; none of them can be dispensed with and they should be put on equal footing". Thus the concept and approach of forestry is that of sectoral interdependence and multiple usage. The Ministry of Agriculture and Forestry determines the broad policy and approach in agriculture and forestry and coordinates the plans of various provinces. The provincial forestry bureaux coordinate the forestry activities within their areas of jurisdiction and the communes and production brigades play a major role in the mobilization of the people for afforestation activities. Article 3 of the Forest Regulation of 1963 states "Revolutionary Committee at the various levels must strengthen propaganda and education in order to promote forest consciousness and forest education and mobilize the masses to properly protect forests and trees."

6.2 Objectives

The objectives of the forest policies of China are indeed most significant. These are to cover the country with trees and to make the

land look like a garden; to adopt a "four-around afforestation" approach involving afforestation around houses, villages, roads, rivers and canals; and finally, to raise seedling for revolution implying raising of timber for defense and other national purposes. Great endeavours have been made with signal success in sand dune fixation, creation of shelter belts, river bank stabilization, dike consolidation, watershed management, fuelwood plantations and the branches from thinnings carried out in such plantations are used for domestic purposes. It is generally believed that the consumption of fuelwood is still three times the volume of all industrial wood utilization in the country. However, with the development of coal exploitation, this is expected to reduce.

6.3 Major Activities Undertaken

It is appropriate to summarize here some of the major activities undertaken in the various fields of forestry cited above. As regards shelter belts, one such shelter belt system in north China is 15,000 kms. long and 12 meters wide, while another is 13,000 kms. long. In 1961, 700,000 hectares of tree belts were planted in the northern provinces - in the Mongolian Autonomous Region and in the Kailunkiang, Kirin and Liaoning provinces. To contain the sand storm hazards from the Maosu desert 230,000 hectares of forests have been planted. 1.6 million hectares of shelter belts serve as a protection barrier around the Gobi desert. These activities have also involved the afforestation and stabilization of sand dunes. Some 130,000 hectares have had grass vegetation revived and 23,000 hectares of such dune areas have now been recovered for farming.

One of the most remarkable effort involving mass participation is the afforestation along roads, canals and railway lines. There is now scarcely any road, canal or rail tract without continuous avenues often consisting of several rows of trees. Trees also line the dikes and the embankments which contain the major rivers that have long been the cause of floods and misery. The New China News Agency reported in 1976 that such tree avenues have been established along 220,000 kms. of roads and 15,000 kms. of railway tracts in China. Each production brigade has undertaken a tree planting programme. The celebrated Tachai brigade has afforested 27 hectares of barren hills with 120,000 trees of which 40,000 are fruit bearing. The production brigades decide as to when the trees have to be cut for supplying local needs.

The Chinese recognize the importance of trees in the reduction of noise pollution and in absorbing harmful gases, and the large scale afforestation activities in the rural areas are matched by very vigorous plantation programmes in the urban areas. Peking, Canton and particularly Shanghai have undergone an intensive plantation programme. In Chengchow, the capital of Honan province, dust storms in the pre-liberation days used to deposit loess silt a meter deep, which used to turn the streets into a churning morass of mud in the rainy season. Over 3 million trees of over 100 species - mostly Chinese and Korean pines, boxwood, cinnamon, cypresses and willows - were planted in the area of 70 sq. km. of the city including 5,000 sand dunes which then existed around it. More trees were planted in the eastern parts of city since the prevailing dust-bearing winds were mostly from that direction. Now dust storms in Chengchow are a thing of the past.

Though it is difficult to quantify precisely the benefit of afforestation, especially in the indirect advantages thereby bestowed, the total contribution of afforestation is understood through the concept of attributality. The Forest Research Institute at Hailungkiang has calculated that:

1) Wind velocity has decreased by 20% on the leeward side
2) Evaporation of soil moisture has decreased by 10-30%
3) Relative humidity has increased by 5-10%, in some places up to 20%
4) Soil temperature has increased by 1°C - 2°C
5) Temperature fluctuations are smaller
6) Farm production overall has increased by 18% compared to normal years and 50% compared to "calamity" years.

In the afforestation programme, the mission was informed, the Yangtse Kiang River was regarded as the dividing line between north and south and different species of trees were planted in the two zones in keeping with climatic conditions. It was noticed that in the northern part of the country plantation work was mostly confined to the plains areas, and though a certain amount of afforestation was noticed in the mountain regions such as in the lower slopes of the Taihang mountains on the border of Shansi and Honan provinces, relatively little afforestation was being carried out in the hilly areas. Rocks and shale lay exposed in some

mountainous regions. Soil erosion and turbidity in rivers was noticeable in the mountains of Shansi province. On the other hand, much more afforestation on hillsides was noticeable in the southern parts of the country mainly around Hangchow and on the journey between Hangchow and Canton whilst flying over the mountainous region of Chekiang, Fukien and Kiangsi provinces. The authorities of the EPO of canton when questioned as to why there were much more afforestation in the mountains of southern China as compared to the mountains of northern China, gave the following very valid reasons for this disparity:

1) Greater rainfall in the southern provinces
2) Shallower soils on the mountains in northern China
3) More population in the southern provinces, which enabled greater mobilization of manpower resources for plantation work, and
4) The methodology and techniques of tree planting were more advanced in the south.

7. Wildlife of China

With a vast land-mass of varied topography and climatic conditions, China possesses faunal and floral diversity unsurpassed by any other country in the world. In the past, the pressure on the land by its vast populace has understandably had a very deleterious effect upon these natural resources of the nation. Vast montane tracts have been rendered devoid of tree growth, while all arable land and more had been brought under plough. Wild animals and birds have been assiduously pursued and rendered extinct over large tracts of the country. The state has understandably been very preoccupied with nation-building activities in the past 3 decades. However, it was quite apparent that China is now determined to conserve its wildlife as a natural resource on a long-term basis. At the UNEP Governing Council Meeting in May 1978, the Chinese delegation made a very forceful statement in the support of wildlife conservation, and made it evident that the country was determined to conserve its depleted wildlife resources in the years to come. Keeping in view the almost super-human efforts made by this nation in other fields, there is little doubt that if the present interest and commitment continue, China would be able to build back the severely reduced populations of its endangered species and to utilize a number of these for economic and other purposes.

Unfortunately, it was not possible to visit any natural forests or protected areas during our visit to China. Our information is, therefore, based upon discussions held with various authorities, especially with Dr. Chin, and with Mr. Wang Sung and Mr. Chu Ching of the Peking Institute of Zoology, Academia Sinica, as well as upon observations made during field trips, albeit mostly in inhabited areas.

7.1 Flora and Fauna in General

According to information given to us by the Chinese authorities the country has 30,000 species of "high grade" plants of which more than 25,000 species are seed plants. There are more than 1,500 species of wild birds and mammals. Thirty-five natural conservation areas of national parks have been established comprising 0.14 per cent of the total land area of the country. There are several kinds of natural conservation areas. The comprehensive types are those which protect wildlife and promote scientific research such as the Hua-Pin Natural Reserve in Guan-Shi Autonomous Region. Such reserves also exist in Kirin and Si-Chuan (Szechwon) provinces. The second category of natural reserves protect the treasured and rare plants, animals and birds such as the Wang-Lang and Wo-Long Reserves in Si-Chuan, and others in Kuangtung and Kangsu and Yunnan Provinces. The third category protects forests such as the Feng-Ling Natural Reserve in Hei-Long Jiang (Heilongkiang) Province which conserves forests of the Korean pine. The fourth category are those which protect water birds such as the Bird Island Reserve on Qing Hai province, safeguarding an important waterfowl breeding area. The fifth type of natural reserves protect snakes and there are special reserves on some islands for this purpose. There are also special reserves for the conservation of sites important from the viewpoint of historical heritage.

A factor which indeed was most striking was the remarkable lack of birds. Though, admittedly, no extensive natural forests or national parks were visited, we did travel by rail and road during our three week stay some thousands of miles of the country, from Peking in the north to the Hong Kong border in the south. Some mountainous areas and forest plantations were also visited, and there was no dearth of tree-cover with the vast tree-planting programmes that the Chinese have carried out in the past. Yet, during our entire trip we saw only 18 species of birds, and

with the exception of the house sparrows and the swallows, the total number of specimens of each of the other species seen were less than 10 in number. Furthermore, 7 of these 18 species were seen during the few hours we spent in the mountains of Hopei and Honan Provinces, a little removed from the fields. The most noticeable was the total lack of water birds despite the fact that it was the rainy season and vast tracts of water and marsh lands were seen. Even the immense mud flats of the Hwang Ho River were totally devoid of birds. Only one bird of prey, a high flying eagle of an unidentified specie was seen. Not a single ground-laying bird was observed, and despite thousands of acres of fruit orchards that were traversed and seen, not a single bird that is primarily fruit-eating was encountered. Chemical fertilizers are used in very limited quantities in China. On the other hand, compost is very widely relied upon and great quantities are applied. Composting should help birds since it leads to propagation of insect life and organisms which would benefit many AVIAN species. While it is possible that a large number of birds may have been hunted for food and decimation of populations may have been effected, it is not possible that such a drastic reduction of birds of all species including those which are not edible or not normally eaten, could have been so effectively carried out. Thus, though the population of birds may have suffered in the past when food supply for the human population was not adequate, this does not hold good today, and it appears that though hunting pressure may have succeeded in bringing down the population of many species of birds, it cannot be held responsible for the present situation. Significantly, the house sparrow against which a regular campaign for eradication was reported to have been carried out in the last decade, is still the most numerous bird today. Is it so because it mainly breeds and feeds in towns and villages? The swallows, too, nest in houses and, of course, feed on air-borne insects. On the other hand, the type of birds of which no representative specimens were seen, namely, the water birds, the birds of prey, the ground egg-laying bird and the fruit-eating birds are the ones that would be most affected with insecticide and pesticide spraying, and it could very well be the case that the bird population in China, perhaps already low due to over-exploitation, has been dramatically reduced still further or at least has not been allowed to make a recovery, and is almost reduced to the point of being non-existent in some parts in the case of many species of birds by massive dosages of chemicals used in agriculture.

Authorities at the Environment Office in Canton informed us that greater use of insecticides and pesticides has been carried out since 1964. The main agricultural pests are locusts and bacterial diseases of paddy. They stated that rice crops are sprayed two or three times. One highly toxic chemical, the English or generic name of which they were not sure of, was used, though the use of this particular chemical is now being reduced in favour of less toxic chemicals. The insect pests, they reported, are much less now, but the bird population is also much reduced than what it was 15 years ago, even though hunting pressure has not increased.

It may not be inappropriate at this juncture to mention some facts regarding the importance of birds. It is true that some species of aves do cause damage to agricultural crops and a number of species are edible and provide a source of protein. However, many bird species are beneficial to agriculture. They destroy agricultural pests and also assist in pollination. With the increase in the practice of monoculture of cereals over large tracts, man has upset the balance of nature by creating a super abundance of food and thereby fostering an unprecedented increase of insect populations. To control insects greater quantities of pesticides are employed which, though destroying the insects, also harmful to the birds which are, ironically, the greatest natural controllers of insect pests. The metabolism of birds bring much higher than of mammals, many an insect-eating bird consumes more than its own body weight in one day. A pair of rats can increase to 880 within a year, and yet the birds of prey such as the owls which primarily feed upon these rodents are amongst the most affected by pesticides.

7.2 Wildlife Classification

In 1962 regulations were made whereby protected animals were divided into two classes. "First class" animals are those which are precious, not only to China, but to the whole world and include rare and endemic animals and birds.

The second class animals are of two types, firstly, those whose economic value is high but whose numbers are low; and the second type are those whose economic value is high, but because their populations are also relatively high, they are categorized separately. There are at present 19 first-class animals and they are completely protected throughout the country.

A re-examination of the protective status of the various categories and species is under consideration, whereafter it is likely that certain animals may be added to the first-class animal list. The main problems in wildlife conservation, according to the authorities questioned, were the lack of adequate information regarding status and distribution of species, and the lack of training and public education. Research and investigation has started in certain areas and some institutions and universities are working in this field, together with the concerned provincial authorities. One specific example is in the Anhwei province for the Chinese alligator. The university students and the staff of the zoo have pooled their resources to investigate the status of the alligator. However, we were told that much more needs to be done in this field of research and inventory - making respect of other species in other parts of the country.

7.3 Endangered Animal Species

As regards the status of certain Red Data Book and other endangered species, only cursory information could be obtained. However, in view of the almost total lack of knowledge about these species at present, the information that was obtained is of some significance and is summarized below:

7.3.1 Giant Panda (Ailuropoda melanoleuca) Is an animal of the first-class category and is completely protected. The numbers are reported to be increasing in Si-Chuan (Szechwan) province. However, due to a recent earthquake in the Wang-Lang protected area which seriously damaged the habitat, a certain number of pandas are believed to have been killed. We were shown colour photographs of the animal taken in the wild in this reserve. Their status, on the whole, seems to be satisfactory and stable, if not improving. The Chinese seems to have adopted this animal and one finds it as a motif on a number of artifacts and everybody knows of and recognizes the Giant Panda. Eight specimens are kept in the Peking Zoo, about the same in the Shanghai Zoo and four in the Canton Zoo.

The authorities will have to exercise some caution in trapping them for zoos, as they do not breed well in captivity and all zoos in China are keen to have them, and in sizeable numbers as well. A report has just appeared in the New China News Agency that a mobile zoo which includes

Giant Pandas has taken to the streets of Shanghai, and several Panda skins were observed in the Canton Export Commodities Fair in the Spring of 1978 (IUCN/SSC Traffic Group, Newsletter No. 4).

7.3.2 Lesser Panda (Ailurus fulgens). The status of the animal was reported to be satisfactory. A number of skins with heads mounted were available for sale in a fur shop in Peking for 50 yuans each.

7.3.3 Wolf (Canis lupus). Local inhabitants reported the presence of a few stray wolves in the Tai Hong Mountains in southwestern Shansi province.

7.3.4 Chinese Tiger (Panthera tigris amoyensis). This is a second-class animal and is decreasing in numbers. Hunting of the tiger is not allowed but some man-eaters have been destroyed in the past. Pressure on the habitat is reported to be the main reason for the decline of this tiger. Wildlife experts whom we met in Shanghai had no recent reports of the animal though they had worked in the Fukien province, the main remaining stronghold of this tiger.

7.3.5 Siberian Tiger (Panthera tigris altaica). This is a first-class animal and are currently being enumerated. The population, however, is not yet known. The Changpai Shan (Mountain) Protected Area in Kirin province is set aside for the animal.

7.3.6 Amur Leopard (Panthera pardus orientalist). It is difficult to obtain precise information on this animal as it is not differentiated from the more common P. p. japonensis of Northern China. I was informed that the Amur Leopard is a first-class animal and is extremely rare. There is no protected area today for this leopard and its current status is not known. However, it is reported to be still surviving in Chinese territory. A number of leopard skins were on sale in fur shops and leopard skin coats were on offer for 2,100 Yuan.

7.3.7 Snow Leopard (Panthera uncia). Is a second class animal and its status is reported to be fairly satisfactory in some parts, while its numbers are reported to be rather low in other areas of the country. On the whole, however, it is not believed to be gravely endangered.

7.3.8 Przewalski's Horse (Equus przewalskii). During the UNEP mission to Gobi Desert in Mongolia last June, it had been reported to us that Przewalski's horse is now regarded to be extinct there. However, during

our stay, the Mongolian authorities reported that a small group of this wild horse has been seen in the Gobi on the border with China. Since the Przewalski's horse is often confused with the Kulan or wild ass (Equus hemionus) it cannot be said for certain whether the sighting was authentic or not. On questioning the experts in China, we were told that it is a first-class animal, but they did not know for sure whether it still survived in the country or not, and could not tell for certain as to when and where the last authentic sighting of this animal took place. No special expedition has yet been organized to find out the status of the wild horse, but one is being planned. If the Przewalski's horse is found to survive, a special area will be set up to protect it.

7.3.9 Asiatic Wild Ass (Equus hemionus). Is a second class animal in China and it is reported to be numerous in certain areas.

7.3.10 Wild Bactrian Camel (Camelus bactrianus). It was reported to be very rare in the Mongolian Autonomous Region of China. Being a first-class animal, it is fully protected.

7.3.11 Wild Yak (Bos mutus) is a second-class animal and is reported to be still widely distributed. However, it is often found with domestic yaks with which they breed and hence, it is difficult to know as to how much of the wild stock is genetically pure and truly wild. The wild population nonetheless is far from being extinct at present, and as there is no human pressure, there are no problems involved in protecting it.

7.3.12 Shensi or Golden Takin (Budorcas taxicolor bedfordi). The Golden Takin is a sub-specie which is confined to only one area, namely, the Great White Mountain in the Tsing Ling Mountain Range in southern Shensi province. However, during our questioning this animal was often confused with the Szechwan Takin (Budorcas taxicolor tibetana) which has a much wider distribution in Szechwan and other parts of China. The Takin is a first-class animal and is regarded as a treasured specie. It is completely protected, but there are no figures available as to the total numbers of the two sub-species. The populations were reported to be satisfactory and the animal in no danger of extinction. We were informed that takin flocks containing three to four hundred animals each have been seen.

7.3.13 White-Lipped or Thorold's Deer (Cervus albirostris). Its range extends from Central Tibet to Szech an and Kansu provinces. The animal belongs to the first-class category and is protected. Their numbers are reported to be increasing and there are protected areas for these deer in southern Kansu province. We saw 15 animals in the Shanghai Zoo, where they are breeding well. The antlers are off each year while in velvet.

7.3.14 Shou (Cervus elaphus wallichii). The status of this deer is not known and no class has yet been assigned to it.

7.3.15 Père David's Deer or Milu (Elaphurus davidanus). Specimens are now in the Peking and Canton Zoos. We specifically questioned the authorities as to what plans they had for this deer, and whether there was any proposal to introduce them in the wild, once their number in captivity increase, and were told that if it breeds well in captivity, it would perhaps be returned to its original home. As to where it would be re-introduced, they had not formulated any ideas as yet. At present, there are only three to four animals in the Peking Zoo and we saw one in the Canton Zoo. The return to the wild of Père David's deer would be one of the most significant events in the history of conservation, at least in the 20th Century. No animal which has disappeared in the wild for such a long duration has yet been successfully returned. Endeavour should, therefore, be made to offer all cooperation and assistance to the Government of China to enable them to build up a stock of these animals in captivity so that its release and propagation in the wild could become a possibility. As the specimens in captivity at present are very few, the authorities in China should endeavour to keep one or two captive-breeding herds to propagate the species in real earnest and then distribute pairs to select zoos when they have multiplied, rather than dissipate the existing low numbers by giving them to various zoos in ones and twos as appears to be the practice today.

7.3.16 M'Neill's Deer (Cervus canadensis macneilli). Regrettably I could obtain no information whatsoever about the status in the wild of this rare and little-known deer. There were four specimens in the Shanghai Zoo, two stags and a hind with a yearling born in the zoo.

7.3.17 Black Muntjac (Muntiacus crinifrous). This animal belongs to the first class category. In some areas the numbers are reported to be

decreasing while in others they are stable or even increasing. No protected area has yet been set aside for this muntjac. It is a principal prey for the Chinese tiger in the area where the habitats of the two coincide today. There was a pair in the Shanghai Zoo and a zoologist informed us that he had seen one last year in the Paitsi Shan (Mountains) on the tri-junction of Chekian, Anhwei and Kiangsi provinces.

All the sub-species of the sika deer in China belong to the second class category, but re-classification is under consideration at present as stated earlier. We made special effort to enquire about the status of the various sika sub-species during the meetings with the various authorities in Peking and in the field, especially in Shansi and Honan provinces.

7.3.18 North China Sika (Cervus nippon mandarinus). Their numbers in the wild are reported to be low, but there are conservation areas set aside for them in the Kirin province. The North China sika is being extensively bred for their antlers in deer farms and it is this sub-specie which is to be found in most farms, including the one visited in Tachai in Shansi province, also represented in most zoos.

7.3.19 South China Sika (Cervus nippon kcapschi). Their numbers are reported to be low and as yet, there is no protected area set aside for this sub-specie. We could not obtain any information of its status in the Kwangtung province and the Canton Zoo did not have a specimen.

7.3.20 The Shansi Sika (Cervus nippon grassianus). The authorities in Peking, Mr. Wang Sung and Mr. Chu Ching informed that their numbers are low and that there is as yet no conservation area for the animal. During the visit to the Tachai Commune, in the central portion of western Shansi province and to Lingsian on the borders of Shansi and Honan Provinces, we made pointed enquiries about the existence of this very rare and localized animal. We were told that natural forests have disappeared almost entirely over Shansi province and that the people had not heard of the existence of the deer anywhere in the area. A substantial piece of natural forest still survived about 60 kms. west of Tachai which held other species of animals including leopard, wild pig and wild goat (goral?), but no deer were reported in the forest. The deer farm in the commune, had obtained its animals from Peking and they belonged to the North China sika sub-specie. One maral stag had been obtained from a deer farm in southern Shansi province.

During our visit to Lingsian on the border of Honan and Shansi provinces just below the Tai Hang Shan (mountains) where the famous Red Flag Canal is, enquiries about the existence of the sika in the mountains were again made and we were told that none existed anywhere in the vicinity. The Tai Hang Shan (mountains) had been almost rendered void of tree growth in the past and only recently has any tree planting activity been started in this region. It would, therefore, appear that the Shansi sika is in all likelihood extinct, at least in the Shansi province, though it is possible that it may survive in some remote isolated areas either in Shansi or neighbouring provinces.

A most interesting fact was reported by Messrs. Wang Sung and Chu Ching that a new sub-specie of the sika deer has been found in the Szechwan province towards the end of the 1960s. The sub-specie has been named Cervus nippon szechwanensis, and has been described in an article published in Acta Zoologica Sinica. A special protected area called Norkey has been set aside for this animal in the Szechwan province, where a few hundred animals are to be found. Their numbers are believed to be increasing. Some animals had been caught and are being bred in a deer farm. The Norkey protected area is in the northern part of the Szechwan province. An attempt should be made to investigate the precise status and distribution of this deer and to give all protection possible to the animal and its remaining habitat.

7.3.21 Eld's deer (Cervus eldi siamensis). This sub-specie of eld's deer is found on Hainan island. Their numbers are few but a protected area has been set aside for it in the Tung Fang County on Hainan. A solitary female from Hainan was in the Canton Zoo. The status of the animal on the mainland of China could not be ascertained.

7.3.22 Chinese Water Deer (Hydropotes inermis). It is an animal of the second class. Population in some areas is reported to be satisfactory while in others the numbers are on the decline.

7.3.23 Chiru of Tibetan antelope (Pantholops hodgsoni). It belongs to the second class category and its conservation status is not reported to be critical or to cause any anxiety at present.

7.3.24 Tibetan gazelle or Goa (Procapra picticaudata). The animal is not as yet classed. Its status is reported to be satisfactory. However, we were informed that with the building of highways and other development projects in the valleys in the Tibet Autonomous Region the numbers of this gazelle are reported to be declining. This indeed is most likely. Unlike many of the other animals of the high uplands of Tibet the goa prefers the lower valley and takes to the high hills and slopes only reluctantly. Since these valleys are the ones in which human existence and other usage including domestic stock-grazing is practiced, the animal comes in conflict with man and it is for this reason that the population has decreased so drastically in Ladakh in India. The same situation could very well in in the Tibet Autonomous Region and unless some protected areas are set up in certain valleys, it is very likely that the already low population of this gazelle would decline still further.

7.3.25 Saiga antelope (Saiga tatarica mongolica). This sub-specie of the saiga antelope is very rare in China and is a first-class category animal. Its current status in the Mongolian Autonomous Region, however, could not be precisely ascertained.

7.3.26 Musk deer (Moschus moschiferus). The animal belongs to the second class category, and its status is reported to be satisfactory in many parts of the country. Five or six farms have been set up, but musk deer farming is still regarded as at an experimental stage and at present, there are no plans of increasing the number of farms. Several dozen musk deer are kept in each of the farms. The extraction of musk from the musk pod is done several times a year. A male produces at an average 40 gr. of musk during the course of a year. The Chinese authorities conveyed to us that the musk produced in these farms is far from being sufficient to meet with the needs and demand of the country itself, and there is no question of their being any surplus for export. This coincides with the view point of this writer that musk deer farming cannot in the conceivable future satisfy the demands of the market, and that increasing the supply of musk through such deer farming would only enhance its demand rather than meet it and thereby lower the market value of the raw commodity to an extent that would make it not worth the while for the musk deer poacher.

7.3.27 The Chinese Dolphin (Lipotes vexillifer). Very few exist now. The dolphin is not eaten, but its oil is used. It is frequently trapped in fishing nets. The animal belongs to the first class category and protected areas are being planned in a number of places, mainly on the Yangtse Kiang River.

Regrettably, it was not possible to obtain detailed information regarding the status of endangered bird species. Facts which were gleaned are summarized below.

7.4 Endangered Reptiles

7.4.1 Alligators

The Chinese alligator (Alligator sinensis), is one of the most unique crocodilians in the world being the only alligator to be found outside the new world. It is at once one of the most threatened, localised and least studied of the large reptiles of the world. Specific enquiries were made to determine its status. A protected area has been set up in the Anhwei province on the Yangtse Kiang River. It is a swamp just off the main river and in this area fishing has now been prohibited. The status of the alligator is currently not known as the protected area has been set up only recently. However, a joint effort by university students and zoo staff is currently underway to determine the status of the alligator. It is an animal of the first class and is completely protected. In the 4 hectare breeding station of "special" animals and birds in Shanghai, there are 20 alligators, some have bred in the past though not too readily, and one female had a clutch whilst we were there. The animals, reportedly had come from the Anhwei province. One alligator was in the Canton Zoo. It was conveyed to the Chinese authorities that if expertise is needed with regard to the breeding of the Chinese alligator in captivity, they may approach the Regional Office of UNEP and we would be in a position to provide the requisite know-how.

7.4.2 Turtles

Attempts were made to enquire about the status of turtles both fresh water and marine. We were informed that very few terrapins are caught in the rivers and lakes and very few breeding areas exist. As regards marine turtles, the muddy nature of the shores mostly precludes

the possibility of turtles breeding on the major portion of the Chinese coast line.

7.5 Endangered Bird Species

7.5.1 Cranes (Family gruidae)

No bird features so prominently in Chinese art as does the crane. All the eight species of cranes that occur in Asia are found in China and no other country possesses more species of this family. Five of these eight species are endangered.

The Great White or Siberian Crane (Grus leucogeranus) the largest bird in China after the Sarus crane and the rarest crane in the world, were reported on the Yangtse Kiang River during the winters some years ago, but have not been seen recently. However, detailed investigations do not appear to have been carried out and it is very likely that the birds still winter along the vast wetlands along the lower reaches of the Yangtse Kiang.

The Shanghai ornithologists and officials of the zoo there informed us that the Hooded Crane (Grus monacha) was occasionally seen on the Yangtse Kiang, as were a few specimens of the Japanese crane (Grus japonensis). The White-naped crane (Grus vipio) is more common and is seen each year on Lake Weishan, a long lake on the borders of the Shantung and Kiangsu provinces. Specimens of all the three species of cranes mentioned above are kept in the Shanghai Zoo where efforts are underway to breed them. No information regarding the current status and distribution of the more localized Black-necked crane (Grus nigricollis) could be elicited. One solitary specimen was seen in the Shanghai Zoo.

The authorities in Peking informed us that collecting of the eggs of cranes was completely banned. However, efforts should be made to locate the nesting areas of the Black-necked crane which is the most endangered of the cranes that breed in China, and to safeguard these areas.

Five species of cranes including four endangered ones frequent the lower basin of the Yangtse Kiang in winter, more than in any other area of equal size in the world. Consisting of a series of large lakes and wetlands, an attempt should be made to identify the precise wintering areas of these four rare species, particularly of the Siberian crane and those that may harbour more than one of the rare species. Protected areas should be established in such refuge.

7.5.2 Pheasants

China possesses the largest number of pheasant species and sub-species in the world. Only one is regarded to be endangered, the Brown-Eared pheasant (Crossoptilon Mantchuricum) which belongs to the first class category of animals. However, no protected area has been set aside for it so far. Other pheasant species have not yet been classed.

The eight sub-species of the Silver Pheasant (Lophura leucomelana) were reported to be safe and in parts quite abundant. They are breeding well in the zoos. As regarded the Reeve's pheasant (Syrmaticus reevesii), we were told that there are no recent reports from the wild, but occasional specimens are recorded from the Anhwei province. Cabot's Tragopan (Tragopan caboti) have been collected from the mountains of Fukien province in the past and have bred once in the Shanghai Zoo. The Chinese Tragopan (Tragopan temminckii) is abundant in the Kwangsi province, though it is confined to the high altitude areas there. It was conveyed to the authorities that a number of pheasant species have been successfully bred in various zoos and private collections all over the world, and if the authorities in China wished to obtain captive stock for rearing in China or for re-introduction into the wild, they may write to the Regional Office and we would be glad to put them in touch with the appropriate people and institutions. A few Brown-eared pheasants were seen in the Peking Zoo, but other pheasants are kept in the same cage and there seems little likelihood of their breeding. It is hoped that this specie as well as some of the other rare ones such as the Chinese and Sclater's monal (Lophophorus ehuysii and L. scalteri), the tragopans, Hume's Bar-tailed (Syrmaticus humiae) and Elliot's pheasant (S. ellioti) would be reared scientifically under captive conditions, and that they would be protected also in special areas in the wild.

7.5.3 Ibis and Storks

As regarded the very rare Japanese Crested Ibis (Nipponia nippon) the book of Mr. T.S. Cheng, China's Foremost Ornithologist, gives it a wide distribution in the country. The authorities in Peking, however, had not heard of any report recently, though they felt that there could well be some specimens in Shensi, Shansi and Honan provinces. Some specimens were collected in 1972-73 in the Tsingling Mountains. The ornithologists in Shanghai said they were only familiar with specimens in museums.

As regards the Oriental White Stork (Ciconia ciconia boyciana), it is reported to be found in Northeast China, but is not very common. There were a number of specimens in the Shanghai Zoo where special efforts are being made to breed it in captivity in the breeding centre for "special" animals. Eggs have been laid but have not hatched.

7.6 Deer Farming

Sika deer are mostly used in these farms. However, the elaphus species are also kept in deer farms in Northern China, and cervis unicolor in the farms in Canton (Kwangtung) province. Most of the farms are in the Kirin province in northern China. In the Szechwan province the recently discovered sub-species of sika, cervus nippon szechwanensis, is being utilized as mentioned earlier.

Realising that antlers would in the conceivable future continue to be a very important ingredient of Chinese medicinal systems, certain suggestions with regard to deer farming may not be out of place at this juncture. The propagation of deer in captivity should be on the basis of genetic purity and crossed-breeding of sub-species, as well as of course of the distinct species of deer, must be avoided. Since many of these taxa are seriously endangered in the wild and some may be completely extinct outside zoos and deer farms, it is imperative that the captive stock of such threatened species, such as may still exist in the deer farms, should be identified segregated and conserved as an important genetic resource. If any Shansi sika (cervus nippon grassianus) still survive in any deer farm, they should be grouped together and bred separately from the other sub-species of the sika deer. The same would apply to the South China sika (cervus nippon kopschi) and to the newly-found Szechwan sub-species of the sika deer. An effort should be made to set aside protected areas for such taxa endangered deer and groups from zoos and deer farms should be introduced in them. With the large scale tree-planting activity going on in most parts of China such an endeavour in the not too-distant future should not be a difficult proposition.

In the sawing of the deer horns, the operation should be carried out with as less distress to the stag as possible, and if feasible under local or other anaesthesia.

Though a large number of farms have come up in the country, the price is still 84 Yuan per 100 grams of sliced, dried deer horn in velvet. It is significant that while the prices of medicine in China has been reduced by 80% since the early 1950s, the price of deer horn still remains extremely high. No country in the world possesses as many species of deer as does China. It is imperative, therefore, that from the commercial point of view as well as of course from the point of view of nature conservation and preservation of genetic resources, that special attention should be given to the protection of deer species in the wild which ipso factor implies the conservation of their habitat.

LIST OF FIGURES

Part Two

PART TWO

BRIEF NOTES ON DISCUSSIONS AND INTERVIEWS WITH CHINESE OFFICIALS, 1-21 AUGUST 1978

1. National (State Council) Officials in Peking (afternoon of 3 August)

The team was warmly received by the State Council officials and welcomed to Peking in particular and China in general.

Since this was the first contact with Chinese officials the team leader extended on behalf of the group, their gratitude for the kind reception accorded. The purpose of the visit was explained, namely to observe and benefit from the Chinese experience in relation to environment and development, to observe rural waste treatment and handling practice and to learn about Chinese methods of wildlife conservation, protected areas management and commercial utilization of wildlife resources. The six priority subject areas of the UNEP Governing Council and the supporting measures were briefly mentioned. Our hosts were also informed of the team's interest in Chinese afforestation programmes and on how agricultural and agro-industrial residues were utilized.

Dr. Chin, Chief of Science and Technology Division, State Council Environment Protection Office replied that due to lack of time all the topics suggested for consideration could not be covered, but he would try to briefly highlight some of the more important Chinese environmental activities.

Prior to 1972, environmental protection was limited to water pollution control, but since then activities have been broadened in the light of the decisions at the Stockholm Conference on Human Environment which the Chinese actively participated in. About 1973, there was established the Environment Protection Office (EPO) Leading Group in the State Council, the highest executive organ of the Chinese Government. The main functions of the EPO are to:

(1) Organize and co-ordinate environmental protection work on a national level which can then be implemented at the provincial, district, county and commune level;

(2) Set up laws, rules, regulations and management methods;

(3) Perform educational and information dissemination work on environment protection;

(4) Monitor and promote environmental protection work.

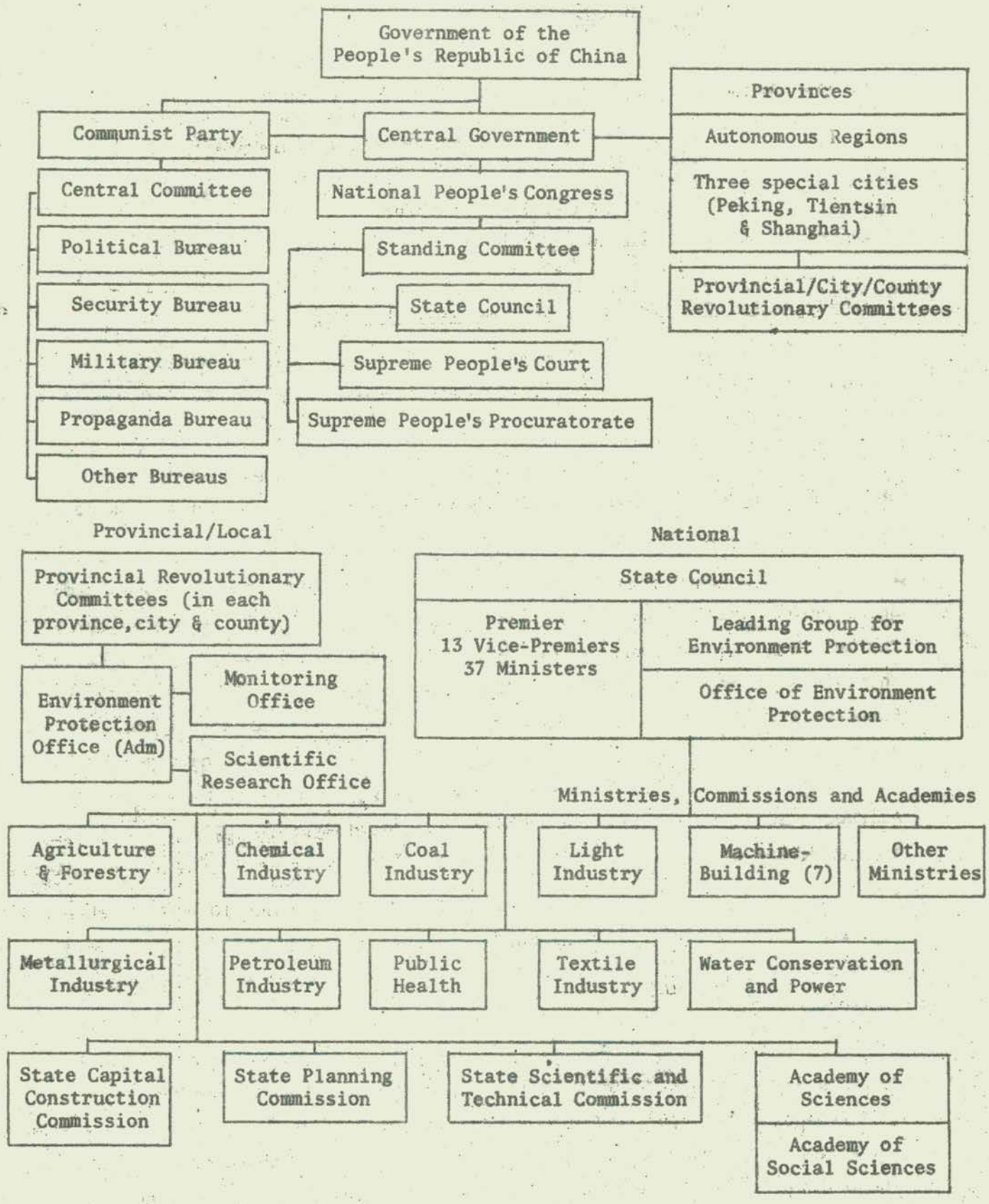
In every province, autonomous region, and special municipality under the central government, environmental protection offices have also been created. (There are 5 autonomous regions, 3 special municipalities - Peking, Tientsin and Shanghai - and 22 provinces including Taiwan. See Appendix for details.) In individual counties which are large or when it is deemed necessary, and in people's communes in rural areas, an EPO could also be established. In general, such an office consists of two components - the monitoring unit and the environment research unit.

Under the 1978 Constitution, there are some 23 ministries and 8 national or state commissions in the ministerial level as shown in the Appendix. In some ministries an EPO has been created, working in concert with the State Council EPOs. Each of the ministries have their own Environment Research Institutes. In addition, there are 4 other places where research on environmental matters is undertaken, namely (i) provincial and city administration, (ii) industry and large agricultural communes, (iii) Academia Sinica - Chinese Academy of Science, and (iv) universities and colleges under the Ministry of Education. The government structure pertaining to environment as could best be ascertained is indicated in Figure 1 on the next page.

There is an admitted lack of expertise and experience and Chinese officials have expressed a desire to learn from the advanced countries about their experiences in the field of environmental management, to avoid the pitfalls and mistakes that have been made previously.

Before ending the discussions, the correct focal point for environment was identified as:

The Director
Environment Protection Office of the State Council
Peking
Peoples' Republic of China



Many of these ministries have also Environment Protection Offices (EPO)

Figure 1

Government Structure Pertaining to Environment
(as of August 1978)

There is, however, a more direct focal point for IRS/PAC, namely:

The Environment Chemical Research Institute
China Academy of Sciences
Peking
Peoples' Republic of China

This was agreed on during the visit of Dr. A. Khosla a few weeks back.

2. General Petrochemical Works (morning of 4 August)

This petrochemical complex is located about 50 km. southwest of Peking. Its main raw material is crude oil coming from the Taching oil fields in northern China.

The top officials of the plant recognize and implement the 32-character Chinese policy on environment and control and prevent all three types of environmental pollution, air, water and solid wastes.

The complex is a large comprehensive petroleum enterprise, located on non-arable land and includes an oil refinery - the "East is Red Refinery". The complex also includes the (1) East Wind Chemical Factory, (2) the Victory Chemical Factory, (3) the Shukwang Chemical Factory, (4) the Shen Yang Factory, and (5) the Shenjin Factory. The complex maintains five service units: power plant, repair and maintenance shops, meter and instruments repair shop, factory environmental research laboratory and chemical machinery storage. It also maintains kindergarten and elementary school for children and part-time university classes for on-the-job technical training of workers.

The plant employs 37,000 workers of which about 10,000 are chemical construction workers, and was built in 1968. The whole complex is about 33 km^2 in area. About 38 per cent are women and 60 per cent are under 25 years of age.

About 7 million tons of crude oil from Taching are processed annually. Two main groups of products are the oils, including gasoline, kerosene, heavier oils and tars, and chemicals such as industrial gases, non-gas products and inorganic chemicals. Industrial gases include methane, ethane, butane and propane; non-gas products are synthetic fibres, resins, synthetic rubber, detergents and other organic compounds; and inorganic products include ammonia, nitric and hydrochloric acids, ammonium nitrate and similar fertilizers.

Also maintained by the complex are a chemical engineering design and research institute; a hospital and a network of clinics among the various factories in the complex.

The factory,according to the officials, fully treats all its liquid wastes. Its emissions are burned through flames in tall stacks and solid wastes are recycled or used as filling materials in the low lying areas. An oil-water separator recycles recovered oil from the treatment plant.

More information on the treatment of wastes in the plant was also mentioned in the section on "Industry and Environment" of this report.

3. Academia Sinica Officials (afternoon of 4 August)

Met with the officials deal with forestry and wildlife protection.

All over China there are some 35 national parks with a total area of some 1.34 million sq. km. or 0.14 percent of the country's land area. This park area is deemed to be small due to centuries of irrational exploitation by the former ruling classes. In old China, before the second World War and before liberation in 1949, many rivers, in particular the Yellow River caused destructive floods, mainly because of forest destruction and resulting loss of top soil.

After 1949 the masses were mobilized to plant trees. Afforestation and reforestation are now aimed at:

(1) Maintaining soil moisture;

(2) Protection of watershed and river basins;

(3) Providing sustainable source of firewood for rural use;

(4) Providing sanctuary and habitat for birds and other wildlife;

(5) Maintaining a steady source of timber;

(6) Helping absorb harmful atmospheric gases emanating from industrial emissions; and

(7) Helping maintain normal weather.

Afforestation work includes research and studies on species suitable to soil and as absorbers of certain undesirable gases, e.g. carbon monoxide. Trees suitable for growth in northern, southern and western China differ on account

of temperature, rainfall and soil. The Yangtze River is regarded as a dividing line between north and south China.

The State is also keen upon the protection of birds and wild animals. There are about 1,100 species of birds and about 400 species of wild animals. Herbs used in Chinese traditional medicine are now being cultivated and conserved.

An attempt was made to learn about the administrative set up and organization that deals with wildlife management. Wild animals are classified into first and second categories. The national parks are of five types. Details of all these are given in the relevant chapter of this report.

4. Red Star People's Commune (morning of 5 August)

This is the first people's commune visited by the UNEP team. It is located about 15 km. south of Peking. The commune representative explained in outline form, due to lack of time the organization of people's communes in general.

Before liberation in 1949 most peasants worked for landlords who owned the vast majority of arable lands.

The first step, under the direction of Chairman Mao was to organize the peasants, through their own initiative, but under the leadership of the communists party member, into mutual aid teams (MAT). It was obvious that both agricultural production and combating of natural disasters such as floods and droughts are best achieved collectively. Thus, after the land was re-distributed to families in proportion to the number of individuals, groups of 10-20 families started to share their draft animals, tools, seeds, and other means of agricultural production. Land was enlarged and all agricultural implements were considered MAT property.

To engage in large scale production, however, it soon became evident that MATs needed more skill, such as accountancy, marketing and distribution, and the need for an elementary co-operative (EC) soon became manifest. Accordingly, ECs were formed out of several MATs and this was a necessary first step on the road to socialism. An EC, however, was deemed only semi-socialistic since land still belonged to the families, and the product was divided according to the amount of land the family possessed. This resulted

in the first contradiction to the Marxist-Leninist principle of "from each according to his ability and to each according to his work".

The problem was thrown back to the people and after open and serious discussions under the leadership of the communist party, it was decided to organize the Advanced Agricultural Producers' Co-operative (AAPC), which also saw the end of land ownership by the family. Land was henceforth considered as belonging to the AAPC as a whole, and private ownership was therefore abolished. In 1957 Chairman Mao issued a call for the formation of people's communes (PC) from a group of AAPC. The following brief chronology shows the step by step evolution of peoples' communes:

Mutual aid teams (MAT)	- 1951
Elementary co-operatives (EC)	- 1954
Advanced agricultural producers' co-operative (AAPC)	- 1956
Peoples' Communes (PC)	- 1958

The Red Star People's Commune (RSPC) (also known as the Red Star China-Korea Friendship People's Commune to commemorate Chinese-Korea Friendship) was organized in 1958 out of 7 AAPC's. A people's commune which is considered as the basic production and accounting unit, on a national scale, is made up of management districts (MD), which is composed of production brigades (PB) which in turn are composed of production teams (PT). The Red Star People's Commune has 10 management or administrative districts, and 116 production brigades which serve as the basic units. The commune has no production teams, which in other communes are the basic units.

Food crops are mainly rice, winter wheat, and corn, but the RSPC also engages in forestry, animal husbandry, fishery and side occupations. Each year, the central government, through the provincial authorities, fixes the quota of production of each commune. Any surplus is sold to the State, but if the harvest is poor due to drought or natural disasters, the State may reduce the quota or even provide grain and food to the PC to ensure that basic needs of the people are met.

Agricultural wastes such as rice and corn stalks and husk and cobs are mixed with animal and human wastes to produce compost. Water pollution is thus eliminated and wastes converted into beneficial materials and returned to the soil to increase land productivity. Because there are no factories nearby

there is virtually no industrial pollution. Trees have been systematically planted and each house has a toilet where solids are collected for composting. Small amounts of chemical fertilizers and pesticides are also used. On an average 75,000 kg. or 75 tons of compost and 750 kg. of inorganic chemical fertilizer are used per hectare of land. Rice is produced at 50,000 kg. and two crops are harvested, one rice and one wheat crop. About 40-60 trees per person have been planted along streets, canals and the 17,000 households of the 83,000 people that inhabit and belong to the PC. The more common species of trees are poplar, pine and willow. Some trees are cut on the basis of age and utility need for buildings and furniture making. Sometimes the State also buys the lumber. Corn stalks are used and tree branches of fallen timber utilized to supplement domestic fuel needs. Charcoal is not used but coal from mines is supplied during winter.

RSPC, learning from the Tachai agricultural experience, has levelled and terraced fields, built irrigation and drainage facilities and constructed wells. As of 1978 there are 1,400 electrically powered deep wells, 77 pumping stations, 310 kms. of irrigation and drainage canals and all lands are now under irrigation. The 1977 grain production (rice, corn and winter wheat) is 5,000 tonnes and is 2.5 times more than the early commune days.

The commune now owns 166 big and medium-sized tractors (each of more than 20 hp), 492 hand tractors (of 12 hp) and 102 trucks. Ploughing, field levelling, sowing, threshing, winnowing and fodder and grain processing are now completely or semi-mechanized. The commune has also set up 18 factories, 9 dairies, 130 big and medium-sized pig farms and 8 Peking-duck farms. The factories produce goods needed for agricultural production. In 1977, 12,000 tonnes of fresh milk and 290,000 Peking-ducks were delivered to the State, and a total of more than 70,000 pigs were raised.

In education and medical care, RSPC has 12 high schools and 59 primary schools. Senior high school is universal. The commune has a hospital, the administrative/management districts have clinics and production brigades have health stations. Since 1969 a system of co-operative medicine has been in operation. A rough diagram of the RSPC administrative set up is as follows:

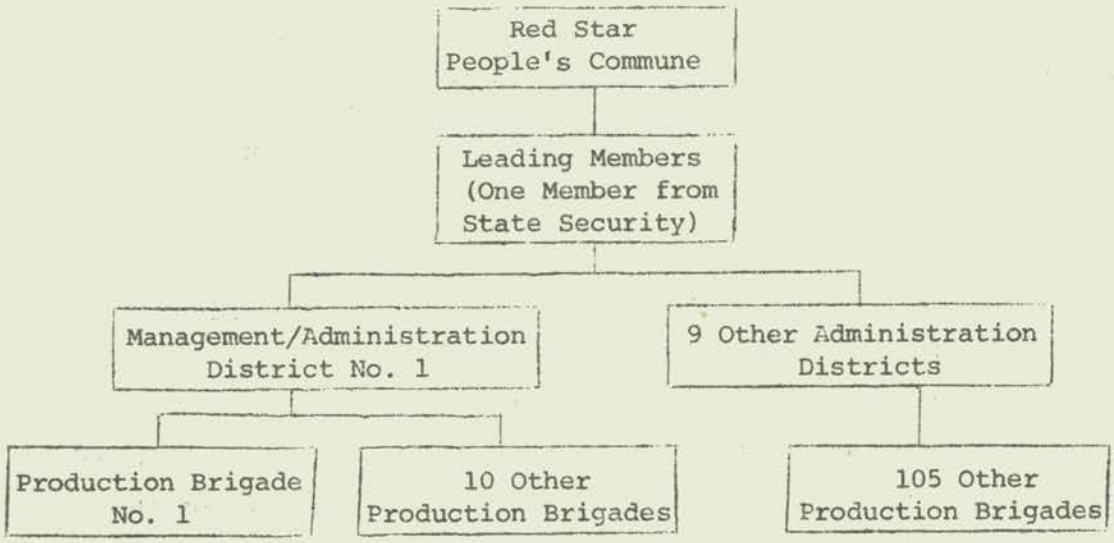


Figure 2: Organization Chart of the Red Star People's Commune.

In the afternoon of 5 August, the Peking Agricultural Exhibition Hall was visited. This is located on Donghuan Bei Road in the Chaoyang District of the city and portrays the progress in agriculture that has taken place in the country since 1950. There is a special section on Tachai but since this was to be visited, the details of the briefing will be included later.

A demonstration of the use of biogas for domestic lighting and cooking was presented. There was an interesting innovation showed - the use of biogas in combination with diesel oil to run an electric generator and to operate a water pump for irrigation. The optimum biogas/diesel oil ratio found was about 15 per cent to 85 per cent.

5. Tachai Production Brigade, Hsiyang County, Shansi Province (morning of 8 August)

In Hsiyang County, there are 20 people's communes and the Tachai People's Commune (TPC) is one of them. In turn, TPC has 19 production brigades and the UNEP team visited one of these, the famous Tachai Production Brigade (TPB). The TPB has 83 households with a total of over 450 people and some 56.4 hectares of land are now under cultivation. There are some 80 drought animals, cattle, horses and donkeys.

Before liberation Tachai was a poor and backward village with only 190 people in 60 households, none made of brick but utilizing wood and mud

with thatched roof. Some even lived in caves. There was no electricity and firewood was used for domestic cooking and heating.

After liberation people started to improve production through self-reliance and by early 1960s had terraced several hills surrounding the village.

In the 1963 rainy season (July-September) a severe flood hit the area after it had rained almost continuously for 7 days. As a result 97 per cent of the then existing houses were washed away and 80 per cent of the farmlands destroyed. The State offered to supply relief but this was turned down and the people, through self-reliance and hard struggle worked on the fields by day and repaired their homes and living quarters by night, creating a new Tachai village and surrounding farmland.

By 1970, the damaged buildings had been completely repaired and even enlarged. There were no more cave dwellings for the people and the farmlands have been put back into shape after moving some 20,000 cubic meters of earth.

Leadership in the brigade is entrusted to a management or administrative committee, chosen by the people for their experience, leadership qualities and willingness to work harder than the rest. This committee is made up of 15 people with only rudimentary classroom education but full of building construction and agricultural experience. There were no engineers nor detailed planning for terracing mountain sides, creating flat lands out of gullies and building the brick structures that now exist in the village. Instead, the people rely on experience, open discussions and actual work. Little brooks and streams were filled up and converted into streets in the village while gullies along hillsides were covered up and converted to terraced agricultural lands.

The people of Tachai rely almost exclusively on self-help. They refuse to receive any money from the government. Bricks for housing are made out of the clay available locally and fired using coal from a nearby coal field. Lime is manufactured on site out of readily available limestone which is piled on top of broken coal. When fired, the coal burns and drives of the carbon dioxide and lime results.

Terracing of mountain sides and filling up of gullies started as early as 1954 and from several failures, the people learned how to build

better terraces-dams. At first they merely put up a straight dam across a gully with shallow foundations. When this was washed away by rains, they made the dam thicker and the base deeper, but again this could not withstand the pressure from on-rushing waters. They finally constructed a concave shaped dam and this proved to be successful. (See Figure 3). Some of these dams are over 10 m. high. One gully was left undisturbed for demonstration purposes.

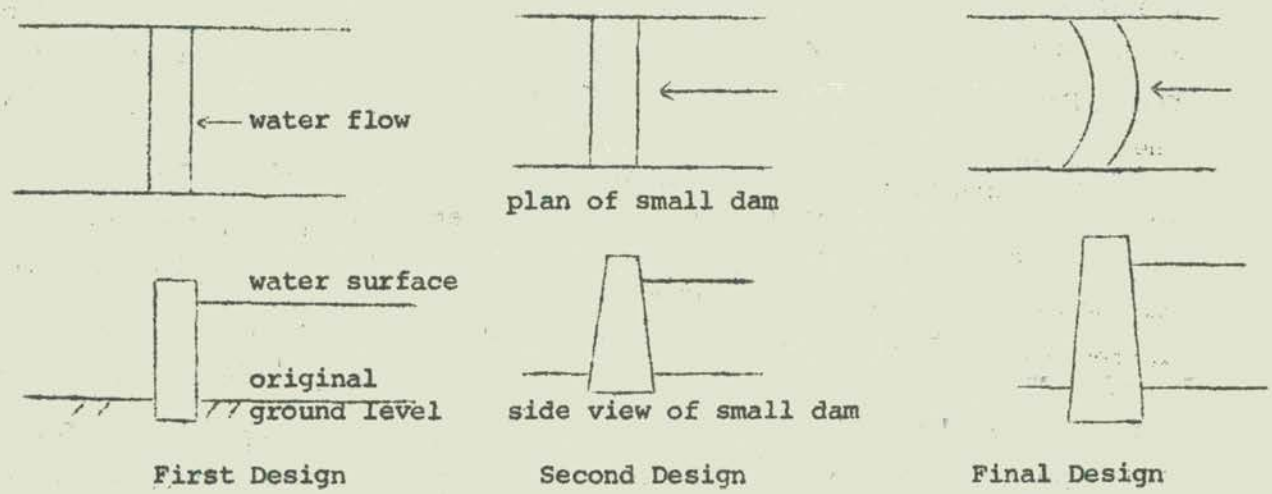


Figure 3: Evolution of Design of Small Dams in Tachai.

From the very beginning the people had to meet with problems - lack of manpower (in 1950s only 10 were able bodied men), absence of machines, and lack of experience. But gradually with self-reliance and hard struggle, the people overcome all these problems.

By 1971 they have accumulated several items of farm machinery and 9 hills have been levelled, the soil being used to fill up gullies. Thus where they had only 3 mou of land they now had 20 mou. Before 1965 there was no electricity, but by 1971 every household had a power connection. By 1975 several gullies have been filled and a 300 m. long hill was blasted and levelled. By 1977 the total land converted from gullies amounted to 50 mou. In that year, about 160,000 m^3 of land have been moved, 12,000 m^3 of rocks handled and 22,000 linear meters of dams and dykes constructed.

Of the total arable land about 3/4 produces only 1 crop a year (corn or maize) but in the remaining fourth they could produce 2 crops a year, the second being wheat, millet or sorghum. Both organic and inorganic fertilizers are used. Compost from the brigade is applied at the rate of 7,500 kg. per

mou of land. Likewise 20 kg. of inorganic (NPK) mixed fertilizer and 30 kg. of phosphates are also applied. Underground drainage and irrigation pipes totalling 600 m. have been built.

Other than agriculture, the brigade also undertakes afforestation, animal husbandry, fisheries, deer-farming and side occupations. Already they have some 300 heads of pigs in 2 pig farms and 40,000 fruit trees have been planted. Fruit trees include apples, walnuts, grapes, dates, parsimmons, pears and peaches. They also have murlberry trees (14,000 trees) to feed their silkworm industry, pines and cypress and willow on top of Tiger Hill. The 1977 fruit harvest was 60,000 kg.

Wheat and rice straws, corn stalks and waste fodder are used to mop up big sties and cattle barns, collected and mixed with more agricultural wastes and converted to compost for later application to the fields.

Seed selection is done scientifically through experimentation and comes from within the village. According to the local officials, pesticides are seldom used but if there is a felt need they use lime and sulfur sprays. Pests apparently are minimal due to weather and habitat conditions.

In 1977, total grain yield was 492 tons, a 17.3 per cent increase over 1976 and 10 times the pre '49 yield. Grain sale to the State totalled 235 tons.

Tachai people merged the brigades' tiny plots into larger ones and razed dozens of hilltops to fill up gullies to form 27 hectares of small man-made plains. They have also designed, with help from other government departments, several 10 hp. crawler tractors specially suited for these hillsides and filled-up gullies. They now have 90 agricultural machines with a combined total of 465 hp. so that 80 per cent of the field work is now done by machines. Field sprayers and dusters of insecticides are also mechanized as are threshing and processing of farm produce. There are sprinklers for irrigating over half of the fields, and bulldozers, ditch diggers and tampers (pulsators) are use in field capital construction. Special machines are now being tested for sowing, cultivation, harvesting, forestry planting and animal husbandry.

The success of Tachai lies partly on their application of scientific methods and on an eight point policy:

1. Deep plowing and soil improvement
2. Use of fertilizers
3. Water conservancy
4. Seed selection
5. Close planting
6. Plant protection
7. Field management
8. Improvement of tools and implements.

Afforested are 27 hectares of barren hillsides with 120,000 trees, of which 40,000 are fruit trees. In 1977 the total output of fruits and nuts was 70,700 kilos a 54 per cent increase over 1976, the brigade has now 400 animals include 80 draft and over 200 hogs. There has also been built over 900 new brickhouses with an average of more than 2 rooms per person.

A co-operative medical service has been established and a secondary school set up. Those injured at work and families of workers killed accidentally are given compensation while the old and infirm receive pensions.

Acreage of winter wheat is now 13.3 hectares compared to 8.7 in 1976. A 10-year plan of filling up 7 gullies and the terracing of 8 ridges was finished in 9 years.

The leading member of the Tachai Production Brigade, Mr. Chen Yung-Kwei who spearheaded the work in the village, is now one of thirteen vice-premiers of the State Council.

It was in 1967 that 2 major irrigation canals were built about 7 km. long, partly underground. Water is taken from Kuotrang Reservoir in the plains and pumped to hill top reservoirs and these works were finished in 1974. Another canal system is 22 km. long, pumping water to Yangchapo reservoir on the hill top from which water flows by gravity to the terraced farm lands.

One reservoir visited, holding 10,000 m^3 of water, 40 meters in diameter and 8 m. deep, and can irrigate 40 mou of land.

Altogether there are 6 water ponds on hilltops all used for irrigation. Drinking water for the people comes from underground sources in another village 700 meters away, which has a better water quality.

One aqueduct, the longest in Tachai, is 120 m. long, 23 meters high but took only 4 months to finish April-July 1974. Present homes were built in 1975.

Some statistics on Tachai (1 jin = 0.5 kg.; 1 mou = $\frac{1}{15}$ ha.)

Year	Grain yield in jin per mou	Total grain output, jin	Supplied to State, jin
1953	24	203,280	45,000
1964	808	570,890	245,000
1976	1,120	838,691	330,000
1977	1,370	983,000	470,000

Before 1949 land was owned by a few rich families as shown by the statistics.

	Rich land owners	Middle class peasants	Poor peasants
Land owned (mou)	480	176	144
(%)	60	22	18
Families (No.)	4	12	48
(%)	6	19	75

Comparative Statistics

	1953	1976
Family income ¥/year from grain	220	23,000
from animal husbandry	200	40,000
from sideline occupation	38	46,000
Total income of Tachai Production Brigade	17,672	208,938
Value of labour (¥/work point)	0.30	1.50
Income/cap/yr (Yuan)	43.40	175

Cost of management steadily decreased as follows:

1955 - 0.45%; 1967 - 0.18%; 1976 - 0.09%

6. Hu Tou Shan or Tiger Head Hill Deer Farm in Tachai Commune (afternoon of 8 August)

Antlers of deer have long been used in Chinese medicine to cure numerous diseases, and are accredited with a number of health-giving properties.

This organic commodity is rich in albumin, hormones, calcium phosphate, calcium carbonate and phosphorus. It is sold in either a liquid form consisting of extracts from antlers, deer cartilage and tendons which are added to food, or consumed orally, or sliced thin and kept in wine for a few days before the wine is consumed. The Chinese medical literature records that deer antlers are a valuable tonic for physical debility, and modern pharmaceutical research in China shows that deer antlers contain properties which promote metabolism, invigorate blood vessel function, increase resistance to disease, promote the healing of ulcers and wounds, and is effective in the treatment of cardiac weaknesses and neurasthenia.

The antlers which deer stags grow in successive years are fast-growing living tissues consisting of nerves, blood vessels, calcium and other chemicals covered with a membrane of velvety hair. When the maximum growth is attained the nerves and blood vessels die, the velvet membrane peels off, and the antlers attain what is called a "hard" stage. After the rutting season the antlers are shed, to grow again prior to the next rutting season. However, the Chinese believe that the antlers contain the maximum medicinal qualities when they are in the "velvet" stage, which necessitates the sawing off of the antlers whilst they are still a living tissue.

The dry strips of "velvet" antlers were being sold at the rate of 84 Yuan a 100 gr. Export of deer horn product is handled by the China National Native Produce and Animal Bi-products Import and Export Corporation. At the present moment a very large number of deer farms have sprung up all over the country and produce deer horns for medicinal purposes. One such farm visited was on the Tiger Head Hill in Tachai Commune, Shansi province. This farm has been established in 1975 with 50 heads of deer being bought from the Peking Medicine Company. At the time of visit there were 103 deer, 54 stags adult and immature, 22 adult hinds and 27 female yearlings and fawns. The farm also raises oxen, horses, bees and black chickens which are used for medicinal purposes.

Deer were bought at the rate of 800 Yuan for a stag and 500 Yuan approximately for a deer hind. The specie was the North China sika originally from Manchuria. The one maral stag locally called Malu, has been bought from a deer farm in Rungchuan district in Southern Shansi province.

The antlers start to grow in April, and after 60 to 70 days whilst the horns are still in velvet the stag is driven into a special metal trap in which a semi-circular plate is pressed upon the withers of the animal to hold down the deer and prevent it from thrashing about. The antlers are then sawn off and inch or two above the pedicle. Since there is some bleeding, medicine is appled to stop it and to heal the wound, and after 15 days many of the stags start growing antlers again. In such instances after another 60 days the antlers are sawn off for the second time in the year. The average age of a stag is 15 years, but the maximum size of horn is attained during the age 6 to 9 years. During this age a pair of horn cut for the first time during the growing season weighs approximately 2.5 to 3 kgs. when fresh. When dried, however, they weigh 0.8 to 0.9 kgs. per pair at an average. The horns require 20 days to dry, whereafter they are sold to the Sian County Medicine Company. A kilogram of dried horn sells at 880 Yuan if the horn has 3 tines (branches). If the horn has 2 tines (branches) which is regarded as of higher quality, it sells 1,360 Yuan per kg. Each of these two categories of two-tine and three-horns are further divided into three sub-categories for purposes of commercial grading of horns.

The average cost of maintenance per head of deer is 80 Yuan, including feeding, maintenance of the farm, cost of labour etc. Last year the Hu Tou Shan deer farm earned 24,000 Yuan while the expenditure was only 8,000 Yuan. The deer are not slaughtered but when they die of natural causes the flesh and bones are dried and sold for medicinal purposes to the Sian Medicine Company. The dried flesh sells for 40 Yuan a kilo while the bones sell for about 10 Yuan per kilo. The skin is not used for any medicinal purpose.

7. Office of the Haiho River Basin Control Works (morning of 9 August)

The Haiho River System basin drains an area of some 265,000 sq. km. and is an important natural resource of the country. Actually there are 10 separate rivers emptying into the Po Hai, or inland sea in the northeastern coastline of China that compose what is known as the Haiho River System. These are:

1. Haihó River with two main tributaries
   a) Tsuya River
   b) Taching River

2. Changsin River with two tributaries
   a) Wei River
   b) Changcho River
3. Yungting River
4. Tu Liu Chen River
5. Nan Pai River
6. Ma Yi River
7. Derhuishin River
8. Tu Heh River
9. Yi Hue River
10. Tsuya-shin Channel, a man-made canal

Between 1368 and 1948, according to historial records, 387 floods and 407 droughts have hit the river system bringing death, misery and hardships for the people. Tsientsin, the second largest city in China used to be flooded by the main Haiho River during heavy rains.

Construction work in harnessing the controlling the Haiho River complex started in November 1963. Up to 1977 the following impressive statistics on work accomplished may be cited:

Number of reservoirs and dams, big and medium	80
Number of small dams and impoundments	1,500
Number of pumping wells	560,000
Total length of irrigation canals	176 km.
Number of pumping stations	1,115
Number of main canals	34
Number of branches of canals	218
Bridges, total linear meters	50,000
Total earth moved, cubic meters	110 million
Total length of protective dykes along river	4,300 km.

During the construction period, mass mobilization which is a distinguished characteristic of Chinese development, was fully employed. Up to half a million workers mainly from communes within the Haiho River basin took part in the construction work. Individual spirit for social development has been evidently demonstrated which is perhaps unmatched in any other country.

Most of the reservoirs and dams constructed are multi-purpose types, that is for flood control, fishery development, power generation, irrigation

and water supply. In a few instances two reservoirs in series were constructed as in the case of the Kawnang (upstream) and the Hwang Penchang (downstream) reservoir, to mitigate the effects of flooding after a specially heavy rainfall.

Other structures designed to prevent flooding include pumping stations, dykes and canals linking up small branches of the numerous tributaries of the rivers named above. As a result not only were floods prevented and now a thing of the past but also the economy has diversified to include animal husbandry, sideline occupations and fisheries. In 1974, the income of 46 counties and cities in the basin has increased 90% over that of 1964 figures, and the grain out put per mou of land is now an average 400 jin in 4 counties and cities, and up to 800 jin in 6 other counties and cities. In forestry the 1974 production was 136% higher than 1964 and in piggeries the income is 88% higher.

It is reported that during the construction of the whole complex, the local people sometimes had to use their own bodies in trying to plug any breach in the dykes to prevent further damage. Workers had to live in tents at the construction site and even the armed forces helped in the gigantic effort.

In the Shihchiachuang area within the basin at least 910,000 mou of land is now under irrigated cultivation, with the 1975 grain output at 732 jin per mou. An additional of 400,000 mou can be potentially irrigated in the near future.

In Chunghua County just below the Great Wall, two production brigades (Sipo and Shashi) succeeded in increasing the per mou production from 400 jin in 1957 to 1,500 jin in 1975. At the Chinglong County, mountain area where there are 5 rivers forming part of the Haiho River basin, there are now 79 large and 33 small power stations. Under construction is an 11,000 megawatt hydro station.

More work is scheduled and when finished in 20 to 50 years, the fiver will be fully under control. At that time they expect production to be 5-10 times present figures and they envision a water storage capacity of some 980 million to 1,820 million cubic meters and a power generating capacity of 55,000 megawatts. Fully protected from floods and disasters will be some 60,000 sq. km. of land.

8. Huolu County (suburb of Shihchiachuang) Marsh Gas Plant (morning of 10 August)

The UNEP team was warmly welcomed by the officials of Huolu County which is located east of Taihang mountains and west of the Haiho plains. The county covers 650 km^2 of area and has 280,000 people.

In 1974 the county started promoting the extensive use of marsh gas (biogas) in the various rural communes of the county. The agricultural production averages 400 kg. or 800 jin per mou of land in 1974. By 1977 this has increased to 425 and this year they are expecting an additional increase of 50 kg. per mou. Although the first marsh gas plant was successfully put up only in 1973, in 1977 there were already some 40,000 marsh gas installations in 70% of the county, showing its wide acceptability and use. All over China, it is reported that there are more than 4.3 million units in operation.

In the briefing given by the county officials, the following data and information were recorded. The advantages of marsh gas use are:

1. It is a new source of energy and can be used in farms, schools, communes.

2. Agricultural wastes are utilized and converted into compost for application back to the land as an important soil conditioner.

3. Use of electricity and firewood as domestic energy source is diminished.

4. Biogas is not a pollutive energy source.

5. There is an overall improvement of the environment as a result of improved health and sanitation.

6. Biogas tank residues are utilized as a field soil conditioner.

In an average household of 6 people, about 10 cubic meters of marsh gas (m.g.) can be produced and this could be used 6 to 7 months of the year for cooking. In winter, because of comparatively low gas production, firewood and coal are still needed and used as supplements.

Current practice shows that marsh gas residues serve up to 1/3 of farm needs for organic soil conditioner. The remaining 2/3 comes from compost. The production brigades estimates that in 1977 about250,000 kgs. of corn stalks

have been converted to compost. This is then applied at a rate of 2.5 m^3 per mou of land. About 60 kg. of inorganic fertilizer is applied per mou and only ammonia nitrogen (60 kg^3/mou) and phosphates (120 kg/mou) are used, at an average cost of ¥ 0.50/kg. of ammonia and ¼ 0.14/kg. of phosphates. The Huolo County production brigade has, in all, 256 marsh gas tanks from which could be produced annually about 2,000 tons of soil conditioner.

The advantage of the Chinese biogas design is its fixed top. The digester itself is divided into components which maintain continuous gas pressure. At the end of the plastic pipe which is normally connected to a biogas stove or a biogas lamp, a simplified manometer is attached to serve as a pressure gauge.

To make a 10 m^3 marsh gas tank installation, the following materials are needed:

	Approx. Cost
1 ton of lime	¥ 14.0
100 kg. of cement	¥ 4.6
Sufficient length of ½" plastic pipe connections to houses	¥ 4.0
Mud, about 7-8 tons, locally available	-
Total:	¥ 22.6

Total cost is thus less than ¥ 25 which will purchase about a ton of coal.

In the county exhibition hall, the following information was collected on biogas production.

a. At the end of 1976, there were some 40,000 biogas plants in the county covering 70% of the rural households.

b. One cubic meter of biogas is equivalent to the energy needed to:

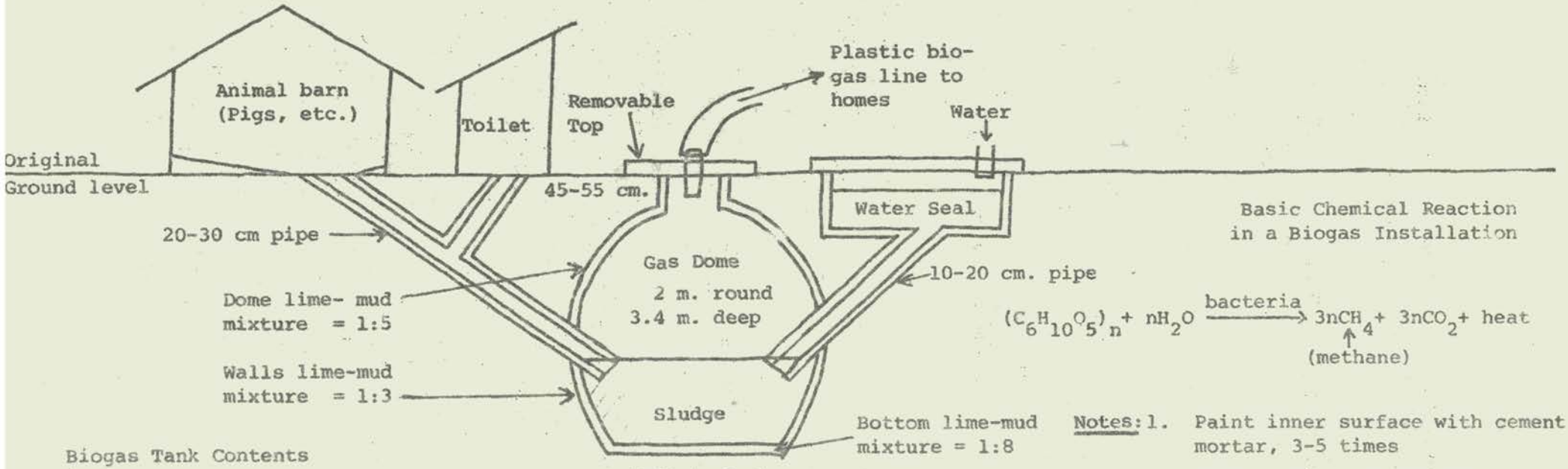
(1) cook 3 meals for 5-6 people;

(2) light a 60-watt bulb for 21 hours (or equal to 1.25 kw-hr of electrical energy)

(3) run an average truck for 2.8 km.

The Honan Provincial Revolutionary Committee, in a formal meeting, decided to promote wide spread utilization of biogas.

A diagram of a typical biogas installation and notes for its construction and maintenance are given in Figure 4 on the next page.



Basic Chemical Reaction in a Biogas Installation

$$(C_6H_{10}O_5)_n + nH_2O \xrightarrow{\text{bacteria}} 3nCH_4 + 3nCO_2 + \text{heat}$$

(CH_4 = methane)

Biogas Tank Contents

A.	Fermenting materials	- 8-10%
	Human wastes	- 10%
	Animal Wastes	- 20%
	Corn Stalks, etc.	- 70%
B.	Water	- 90-92%

(Stir and add water and fermenting materials frequently and regularly)

Bill of Materials for a 10 m^3 Biogas Tank

1 ton of lime (CaO)
100 kg of cement
7-8 tons of mud
Sufficient length ½" plastic tubing

Notes:
1. Paint inner surface with cement mortar, 3-5 times
2. After finishing construction, allow 4-5 days before use
3. Biogas production after 4-5 days
4. Rectangular tank would be 3.5 m by 1.8 m. wide by 1.6 m. deep
5. Construction to be water tight to prevent gas leaks
6. Suitable temperature 8° - 55°C
7. C/N Radio = 25 to 1
8. pH = 7-8.5

Figure 4

Diagram of a typical
Chinese Rural Marsh
Gas (Biogas) Installation

About 3,500 technicians from all over the county have been trained for biogas installation and use. Some operational and management practices to insure good biogas production are as follows:

1. At the end of autumn or at the beginning of winter, the biogas compartment or tank should be emptied entirely and a fresh set of materials put in.

2. The gas pipe should be buried at least 0.50 m. deep to avoid weather effects.

3. During inspection or maintenance, test for the presence of poisonous but odourless gases is carried out as a safety precaution. A live rabbit may be slowly lowered in a cage for this purpose.

4. A lighted flame is never used when inside the biogas compartment; instead a flashlight is employed.

5. When lighting a stove or lamp using biogas, the match is first lighted before turning the spigot, tap or switch.

6. Storing of combustible materials near biogas plastic outlets or taps is avoided.

7. Exits and entrances to the tank compartment are covered to prevent animals and small children from falling in.

Upon chemical analysis, the residue or sludge from the biogas compartment, which is a very useful organic fertilizer (soil conditioner) like compost, was found to contain the following NPK values.

N - 450-500 ppm (.05%)
P - 15 ppm (.0015%)
K - 2500 ppm (.25%)

It is obvious that the NPK values are very much lower than inorganic fertilizers but the residue contains valuable humus-like materials which contain organic matter and increases the moisture holding capacity of the soil. (Hence, the term soil conditioner, rather than fertilizer).

Research has also shown that pathogenic (disease-causing) bacteria can survive up to 17 days in the soil or polluted waters, but in a biogas tank they die within 30 hours. Ova of parasitic worms have been shown to die (95%) in 10 hours within the compartment. A research group continuously monitors

soil when biogas residues are applied. Sludge or biogas residue is superior to ordinary compost in N & K as a soil conditioner, as shown by the following comparative soil analysis of NPK values:

NPK	Use of sludge alone	Use of compost alone
Nitrogen	140 ppm	93 ppm
Phosphorus	31.2 ppm	33.5 ppm
Potassium	212 ppm	156 ppm

Before leaving the county, three typical peasants' homes using biogas were visited and its actual use and application observed. Plastic cross-connectors were being produced right in the commune, using a small electrically-run machine. Plastic tubing, however, were supplied from elsewhere, together with the lime and cement used in the construction of the tank. Labour is provided by the local residents.

9. Hopei Provincial Environment Protection Office
(early afternoon of 10 August)

It was in September 1973, a year after the Stockholm Conference, that a National Conference on Environment Protection held in Peking, decided to establish in each province, autonomous region and special municipality, an Environment Protection Office (EPO).

Hopei Province contains ten districts and nine cities as follows: (8 cities are on same level as districts)

Districts	Cities
1. Shihchiachuang	1. Shihchiachuang
2. Pao Ting	2. Pao Ting
3. Tangshan	3. Tangshan
4. Handan	4. Handan
5. Hsing Tai	5. Hsing Tai
6. Changchow	6. Changchow
7. Cheng Te	7. Cheng Te
8. Changchakuo	8. Changchakuo
9. Hengshui	9. Ching Huang Tao
10. Long Fang	

There are also a total of 140 counties and 5 of the biggest are Huai Lai, Anshin, Mancheng, Hsong Hsien and Gao Yang. Huolo (which was visited in the morning) is a small county just outside the city of Shihchiachuang.

It was in 1974-75 that the EPOs were established in all 10 districts and 9 cities. In addition 12 counties have also done so (the larger and industrial areas). There is also a plan to establish monitoring station and research units in each city and district.

Actually the main work of a provincial EPO is coordination and administration. Scientific activities are just starting and engineering work is expected to follow later, particularly design, construction and operation of waste treatment plants. This is in pursuance of the national policy to take into account environmental pollution control right from the very beginning of an industrial plant's conception.

In Hopei province there are three large water bodies that are threatened with severe environmental pollution from industries located nearby. These are:

a. Kwanting Reservoir
b. Pai Yang Tan Lake
c. Po Hai-Huang Hai Region.

Because the Kwanting Reservoir is the main water supply source for the capital city of Shihchiachuang (of Hopei Province) control of its pollution is deemed very important.

The largest lake in the province, Pai Yang Tan, is an important fishing resource. The lake supplies fishery needs not only of Hopei but also of Peking and Tientsin. It is reported that the water pollution has already reduced catches. The more important factories deemed contributing to pollution are pulp and paper mills, chemicals and textile mills. Attempts are now under progress to recover chemicals from the black liquor of pulp mills and to give biochemical treatment of acid wastes. The EPO of the province monitors the lake water quality and plans to set up a network of stations. The public health research institute, in turn, checks the fish for specific pollutants.

The inland sea, Po Hai, is an important source of fish and prawns, but recent catches have also reportedly decreased. The sea is also a recreational area. Factories located around the sea are now required to treat the liquid wastes before disposal. The national or central government has committed to provide funds for the control of coastal pollution, and there is close cooperation among the leading groups of Liaoning, Hopei, Shantung provinces and Tientsin, all bordering this inland sea.

The night-soil of the city of Shihchiachuang is sent to nearby rural production brigades for processing into compost or conversion into biogas.

10. Huapei Medicine (Pharmaceuticals/Antibiotics) Factory (late afternoon of 10 August)

On behalf of the management and workers of the factory, we were welcomed by Mr. Chao Hsien-shin, Vice-leader of the factory and other officials.

Established in early 1950, the factory has now been in operation for 20 years. Although its main products are antibiotics (penicillin, streptomycin, chloromycin), the plant also produces organic solvents (acetone, methanol, ethanol, butanol), urea products (nucleotides, sorbitol), corn starch and glucose, and glass were including TV tubes and ampoules. Aluminum plates and some rubber products are also manufactured. There are some 7,300 workers in the several associated factories located nearby, about 42% of whom are women. There is also a kindergarten, elementary and middle school and technical university for workers; clinics and recreational services. Day care centers and available for new-born infants of workers.

The main seed for the penicillin line of antibiotics comes from Penicilium chrysogelum and was originally imported. Basically, penicillin is manufactured by growing this seed in fermentation tanks with glucose as the main growth medium.

Other additives used in these tanks are peanut oil, corn steep liquor and ammonium nitrate. The penicillin extract is then vacuum filtered to remove the mycelium which goes to the sorbitol plant. The liquid extract is then treated with butanol acetate and other solvents to produce the pure penicillin powder.

Daily production is about 600,000 vials of powdered streptomycin, 500,000 vials of liquid streptomycin, and 600,000 ampoules of penicillin. A portion of these antibiotics is exported to the U.S. which, we were told, re-exports these to other countries including the Philippines. Steam heat is used in all their sterilization procedures. The factory is fully mechanized but not automated.

Formerly, the major wastes of the factory - the mycelium residue after extraction of the penicillin active portions - are used only as fertilizer/soil conditioner like compost. Later, after studies showed

feasibility of further utilization, the mycelium-containing wastes, which contains RNA, are used in the manufacture of sodium nucleotides. This is done by soaking the mycelium in sodium hydroxide, filtered, cooled and acidified to Ph 2.3. Then an enzyme-phosphorus diacetylase - is added and the nucleotides produced are separated by an ion-exchange and elution process and concentrated. The resin salts and halogens are removed using activated carbon and the filtrate is sterilized and filtered for placement in ampoules. Nucleotides are now used as tonic during recovery from certain diseases such as hepatitis and cardiac diseases. However, it causes a slight rise in the white blood cells after use and this must be considered in the clinical treatment of the disease.

Another product of the plant, in addition to nucleotides, is sorbitol and vitamin C (ascorbic acid) manufactured from glucose by adding hydrogen at 80 kg/cm^2 pressure and using an ion-exchange process. Glucose, in turn, is manufactured from corn starch and is also used in the fermentation tanks for penicillin manufacture.

In its glucose plant the factory uses corn as raw material, stored in silos holding 600 tonnes of grain. About 200 tonnes of corn is used daily. The corn kernels are first soaked in water and the starch separated. Corn starch is then extracted for corn oil and subsequently hydrolyzed in tanks to form glucose. Through ion-exchange and activated carbon the raw glucose in decolorized and refined into white granulated powder for use in penicillin manufacture. The waste waters from the hydrolysis are dried and used as additives for animal feeds.

11. People's Liberation Army (PLA) Medical Hospital (also known as the Dr. Norman Bethune Memorial for International Peace Hospital) (morning of 11 August)

The original hospital was built in 1937 in the Wuhan Mountains. It has grown over the last 40 years from the original clinic with only a dozen medical doctors and nurses. It was named in 1940 after the famous Canadian doctor, Dr. N. Bethune who came to China in 1938 and died while serving as medical officer in November of the following year. It was also in 1940 that two Indian doctors, Dr. Kotnis and Dr. Basu came to work in China, the former becoming the first director of this hospital.

This hospital served both Hopei and Shansi provinces during the 8 years China was at war with Japan. During this period more than 1 million patients were treated, of which some 70,000 wounded civilians and soldiers were hospitalized. After the war the hospital was expanded and now has 7 other branches. As late as 1948, it was still located in the mountains but moved to its present location that year. Rapid development and expansion came in 1954.

At present the hospital has a capacity of 800 beds and it has 9 major departments - general medicine (including neurology, dermatology, cardiology and renology), surgery (general and thoracic), obstetrics/gynecology, EENT (eye, ear, nose and throat, including dental), pediatrics, pathology, geriatrics, physio-therapy and laboratory/X-ray.

It has also the usual complement of hospital services such as out-patient department (500 patients daily average), emergency room, pharmacy-dispensary, blood bank and dental clinic.

It is a teaching hospital but it also undertakes scientific research on both western and traditional Chinese medicine. Although it is primarily an army hospital, it treats local civilians as well. Several mobile teams are sent out to rural areas, and the hospital helps train the so-called bare-foot doctors or para-medical personnel who perform routine physicians' work and minor surgery in rural areas. Acupuncture is used both in anasthesia and in treatment. Part of the hospital grounds are used to grow corn, vegetables, fruit trees, poultry, pigs and dairy to supply the needs of the hospital.

The acupuncture ward had several patients with needles applied to them and in one instance an ultra-sonic electronic device was attached to the needles. Myxobustion, the application of a glass suction cup to an area of skin suffering from some pain, is also widely practiced. It was claimed that whereas "western" type of medicine has 60% cure success, the Chinese "traditional" medicine combined with western (herbal/electronic) can produce up to 91% cure rate.

One patient suffering from gallstones, we were told, did not need any surgery (as usually done in western medical practice) but application of Chinese herbal medicine dissolved the gallstones and the characteristic jaundice (yellowing of the inner eyelids) disappeared. For patients suffering

from first and second degree burns, a liquid Chinese herbal medicine is applied over the affected area, but third degree burns would need a skin graft.

A visit to the hospital herbarium was very interesting. Various herbs were being grown and harvested by the hospital staff and processed for use of the doctors. More than 500 herbs are grown. Some of those with identification were:

1. Chelidnium majus L.
2. Chrysanthemum cinera riaefolium Bocc.
3. Sylvia splendans Sella
4. Ocimum basilicum L.
5. Atractilus lancea
6. Phytolacca acinosa
7. Bupleurum chinense
8. Dianthus chinensis L.
9. Lilium brownii
10. Aster tataricus

The total hospital grounds cover some 46 hectares and the existing staff number 800, of which about 200 are medical doctors.

An Exhibition Hall featuring the history of the hospital was also visited. Details of the work of Dr. N. Bethune and Dr. C. Kotnis were explained.

12. Lingshien (Lin Xian) County and the Red Flag Canal (morning of 12 August)

Lingshien is a mountainous county covering 2046 km^2. It has 15 people's communes, 487 production brigades and 3946 production teams. Total county population is 700,000. About 890,000 mou of land (59,000 hectares) is cultivated. Because of the large population on a small area, this county was relatively poor. There used to be a drought 9 out of 10 years and even drinking water had to be fetched from, as far away as 10 kms., during the dry season. It was for this reason that many people emigrated to other places.

In 1953 the county leaders started to plan and implement water conservancy projects which became fully operational by 1969. There were three periods that characterize the peoples efforts, namely:

a. The period of digging wells and small size canals and reservoirs to conduct and store rain water during the rainy season for domestic supply and irrigation (1944-1953)

b. Construction of medium size reservoirs and canals (1953-1960)

c. The period construction of the 1,500 kms. long Red Flag Canal (1960-1969).

The Red Flag Canal (RFC) has a main canal 70 kms. long built around the slopes of Taihung Mountains and three sub-canals that go over the area of Lingshien county. In addition there are 5 big irrigation canals and 590 medium and small size canals. The entire length of the RFC is 1500 km. and took 40 million man days of work during which 16.4 million cubic meters of earth was moved. The project entailed cutting through 1250 hill tops, drilling 180 tunnels with a total length of 24 kms, and erecting 160 aqueducts with a total length of 6.5 kms. Associated structures include some 385 reservoirs of various sizes, 1300 pump well, 760 drainage and pumping stations and 33,000 wells. Altogether the cost of the project amounted to 47 million yuan of which only 21.6% came from the state and the rest from local resources. We were told that only two lives were lost during the mammoth project.

During the construction extremely difficult problems were faced. Workers had to be suspended by ropes from above the cliffs and manually bore holes, using hammer and steel chisels, for insertion of explosives. The most difficult portion was the construction of the Youth Tunnel which goes through the Taihung Mountains, and measures 650 meters long, 6.2 meters wide and 5.0 meters high. Aqueducts across gullies and rivers also demanded skilled construction techniques and in many cases it serves three purposes - to carry road traffic on top, conduct the water for irrigation and diverts the flood waters to flow through the river bed below. These aqueducts were all built without mechanical equipment nor reinforced concrete - only rocks, manually shaped into blocks and carried by men. Women and even children have been utilized.

An interesting construction technique employed was in the drilling of the Droufang aqueduct-tunnel (subcanal No. 3) which was 4 kg long. The underlying rock was very hard and water seepage caused many cave-ins. The technique used was to drill 34 vertical tunnels down to the proposed tunnel level along the 4 kilometers length of tunnel and to proceed tunnelling in opposite directions after reaching the required depth. In this manner, more men could be utilized and work could proceed in 68 places instead of only at the two ends of the main tunnel. This is shown in the attached Figure 5. Seven of the 34 vertical tunnels are now used as pumping stations and the team visited one of them, the deepest one, about 62 m. A reservoir measuring 90 m. long by 60 m. wide by 8.5 m. deep and holding 49,000 m^3 was constructed at the top of the hill to serve as drinking water and irrigation source. It is serviced by this pumping station.

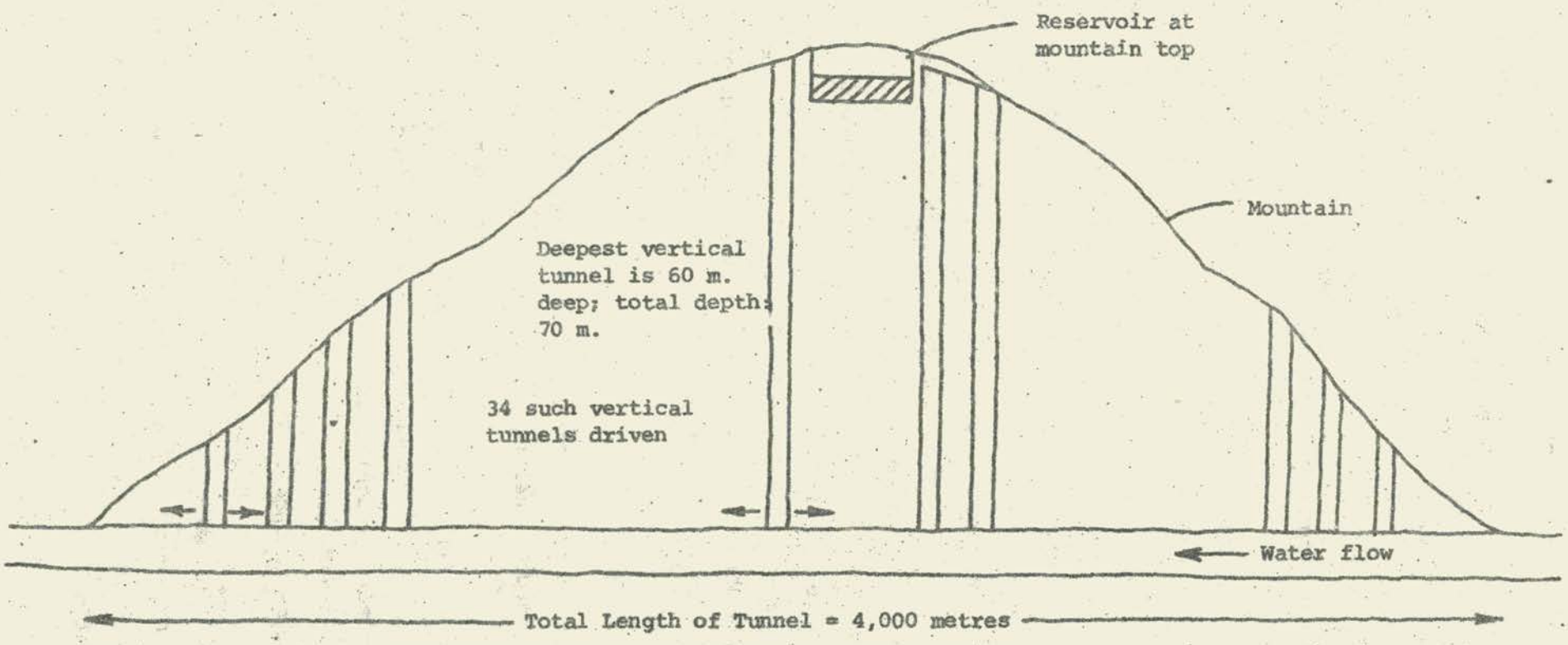


Figure 5. Sketch diagram showing technique of construction of the Droufang Tunnel of the Red Flag Canal

The total land irrigated increased 50-fold from only 12,000 mou to 600,000 mou (800 and 40,000 has. respectively) and the problem of water supply, is now considered to be solved. Many houses of members of the production brigades now have running water. Living standards have improved considerably. As a result of the irrigation water availability, the per mou yield is now 350 jin, while formerly it was 50 jin only (4.35 and 0.75T/ha respectively). Before the project Lingshien county was not even self-sufficient in grain and the state has to supply about 10,000 tonnes of grain annually. Now the county has an annual supplies of 30,000 tonnes of grain.

The availability of water led to the production of electricity in the rural areas. There are now 45 big and medium size hydro-power stations with a total installed capacity of 15,000 kw. In addition there are 20 small hydro-power plants one with a capacity of 250 kw. and 19 with a capacity of 40 kw. each.

The presence of water and electricity also promoted communications. There are now 1,000 km of highways within the country, 200 km of which are asphalted. Majority of communication production brigades now have highways connections. Afforestation has also been promoted with water availability together with animal husbandry and side-line occupation. Each production brigade has orchards with apples, pears, and other fruit trees and the total production for 1977 was 160 tons. On both sides of road are rows and rows of trees.

The construction of the RFC is regarded by the rest of China as an outstanding achievement. Nearly 200 sections of the canal are near mountain tops and at least 50 sections are located at elevations of 200 meters in the mointain areas, along some portions of the canal.

13. Small Tractor Factory (late morning of 12 August)

The factory is named Tung Fang Hong and was originally established in 1948 when the poor peasants expressed the need for small tractors for agricultural use. In 1954-5 people organized the factory into a cooperative and in 1958, it was further expanded by the State to help the farmers. Now there are over 500 workers with 140 machines and instruments, 65 per cent of which were constructed by the workers themselves. Main products are harvesters, threshers, tractors of 12 hp. only, and air compressors. There are 6

workshops and such auxiliaries as maintenance and repair shops, installation and assembly shops and a testing area.

Production of tractors, which costs a commune 2300 yuan, has been increasing as shown below:

1975	- 300 units	1977	- 1700 units
1976	- 700 units	1978	- 1900 units (forecast)

The nearby county of Anyang is also serviced by this factory and in turn, Anyang supplies it with tyres, diesel machines, and engines.

A typical procedure for ordering a tractor is as follows. If the Tachai Production Brigade (TPB), for example, wants to buy a tractor, it sends a request to the Local (county) Planning Agency (LPA) through the leading member in charge. The LPA collects these requests from all nearby communes and production brigades and compiles the number of tractors needed. The LPA then directs the factory to produce the required number. Once delivered to the county, the units are sent to the local requesting offices. The LPA "buys" the units and "sells" them to the requisitioning office or commune.

The 12-hp. tractors uses about 1 kg/h of diesel oil which sells only for 0.35 Yuan per kilo.

14. Tree Planting/Dust Control Programme in Chengchow City (morning of 14 August)

Chengchow, capital city of Honan province is located close to the southern bank of the Yellow River. It covers an area of 1,700 sq. km. and has a population of 1.7 million. An ancient city with a history of 3,000 years, it was the place where workers of the Peking-Hankow railway held a meeting on 1 February 1923 to inaugurate their General Trade Union. A strike was called on 4 February. On 7 February a massacre of workers took place, and to commemorate this event, a twin-tower 17-storey monument was erected at the spot.

Before 1949, the city was insufficiently lighted, roads were uneven, telephone lines out of repair and during dust storms the streets were covered with layers of dust two or more feet high. After reconstruction began in 1950, the city has wide paved roads on both sides of which are planted trees of more than 100 species. More than 3 million trees have been planted since 1966.

15. Demonstration of a Solar Cooker and Small Tractor Supercharger (late morning of 14 August)

The teacher in charge of the solar cooker, Mr. Liu Chu-te demonstrated the actual use, under a bright sun. Beef was stewed and eggs prepared. The cooking was done in a few minutes showing the feasibility of the device.

The type-7509 light-focussing box or solar cooker was first made with success by the Chengchow Middle School No. 3 in 1975. In design, it consists of a collapsible wooden box, on adjustable stands, with its inner reflecting surface taking the curvature of the effective part of a paraboloid of revolution. Its mathematical equation was learned to be $x^2 + y^2 = 4\ az$, where a, the focal distance, is 88.7 cm., z being in the vertical direction. The sunlight is focussed by the 792 pieces of small plane mirrors pasted or glued within the device at a point about 850 mm. over the box, thus forming an incandescent light source, the temperature of which may reach even above 600°C. This enables the device to be used for any kind of cooking purposes such as steaming dough (making bread), cooking noodles, boiling vegetables, frying eggs, etc. With a total light-collecting area of about one sq. m., the solar cooker is equivalent to an electric oven of 1 kw. in heat energy.

The special features of this solar cooker are as follows:

a. Due to the unusual design of the curved surface, the cooker is highly efficient. Unlike other conventional sunlight cookers, this one is designed so that both the focus and the shadows of the cooking utensils do not fall upon the center of the collecting surface.

b. Because the light-reflecting surface is composed of a lot of small pieces of 5.2 x 2.5 cm^2 flat mirrors, they are easily obtainable from glass store cuttings or trimmings or from broken mirrors. The cooker has a high reflection, it is low in cost and of rugged construction. Its reliability has been proven in more than three years of actual use. In case some mirror pieces are broken or damaged, they will not affect the use of the cooker and could be easily replaced.

c. The cooker may be folded into a portable box measuring 60 cm. x 96 cm. x 11 cm. which makes it convenient for transportation or storage. The whole set only weights about 15 kilos.

d. Any two sets of cooker of the same type may be used in combination by installing them on a specially made support thus doubling the heat energy and increasing the efficiency.

e. A typical record of the solar cooker is given hereunder.

Month	Use/Application	Duration	Temp.	Wind
July	Boiling 4.5 catties (2.25 kgs.) of water	28 min.	31°C	Grade 2
Sept.	Cooking 2 catties (1 kg.) of rice	28 min.	30°C	Grade 2
Feb.	Frying one dish of meat pieces	6 min.	-5°C	Grade 1
Feb.	Cooking one catty (0.5 kg.) of vermicelli	8 min.	0°C	Grade 1

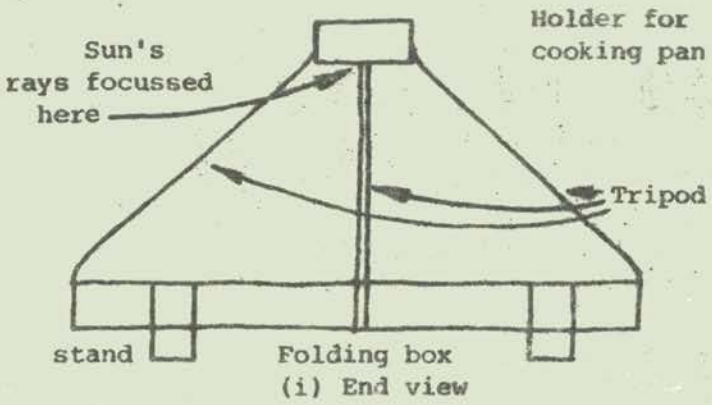
Note: Grade 1 wind velocity not more than about 20 kmp; Grade 2, more than 20 kph.

They were very interested to know about other countries' experiences in solar energy utilization and we promised to send them some literature on solar energy utilization for domestic purposes in India.

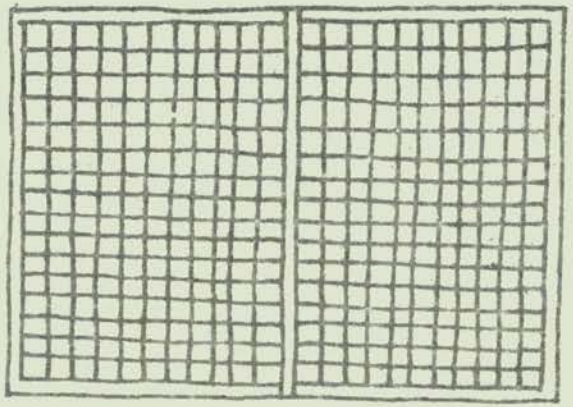
According to Mr. Liu, a few Chinese villages are already using this solar cooker model, of which about 100 units have already been produced. Cost is less than 20 Yuan. The authorities showed interest in obtaining information about the use of solar energy for practical purposes in other countries. On return of the mission to Bangkok literature on the use of solar energy in India was forwarded to the authorities concerned in Chengchow.

Next demonstration was a 12-hp tractor diesel "supercharger" which appeared to be an enlarged pre-heated air chamber added before the air intake of the engine. It is claimed to produce a 30% increase in power from the rated 12 to 16 hp. and at the same time reduce the diesel oil consumption. Without the device, the tractor normally uses 10 kgs. of diesel to plow one mou of land, but with the supercharger it uses only 9 to 9.5 kgs. of oil to do the same work.

Figure 6 shows the diagramatic sketch of the solar cooker and the tractor supercharger.

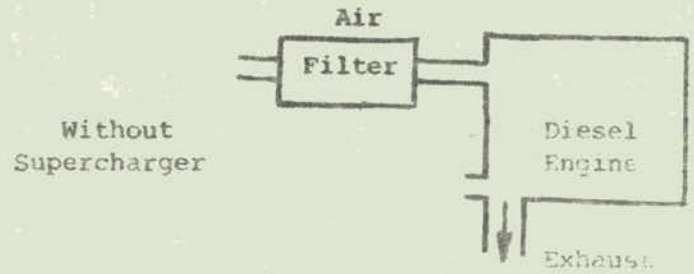


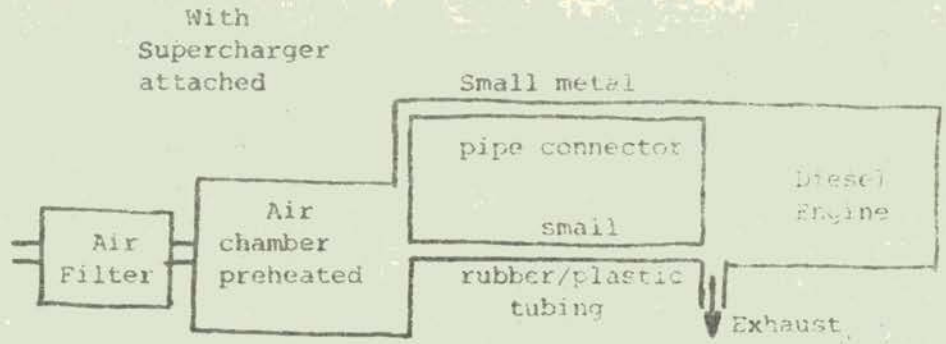
(i) End view



(ii) Top View

(a) Folding portable solar cooker with parabolic cross-section consisting of 790 small plane glass mirrors 52x25 mm.





(b) Supercharger for small diesel engine

Figure 6. Diagramatic sketch of (a) solar cooker and (b) small tractor supercharger in use in Chengchow, Honan

16. Yellow River Control and Conservation Office
(early afternoon of 14 August)

The briefing was divided into 4 parts and each is discussed below.

A. The Yellow River Basin

The total length of this river is 5,464 km. from Tsinghai near Tibetan border to Po Hai inland sea. It has 40 major branches and drains a total watershed of some 752,000 km^2, of which 200,000 sq. km. (20 million hectares) is farmland. The basin population is estimated at 110 million.

The total river length may be conveniently divided into 3 sections:

1. The upstream portion from the source near Kyaring Lake in Tsinghai province up to Tokoto near Huhehot in Inner Mongolia. This section of the river passes through high mountains, ravines, and pasture lands and its waters are clear.

2. Middle section from Tokoto to Chengchow area. Here the river passes through loess geologic forms and causes severe erosion leading to high yellowish turbidity of the water, which gives the river its name.

3. Lower portion from Chengchow to the mouth. In this section of the river, the water unloads its cargo of silt and the river bed is actually higher than the surrounding grounds. This part, the Chinese call the "suspended river".

The total descent of the river is some 4300 meters, from the source to the mouth. Main crops grown in the basin are corn, wheat, millet, cotton, sesame seeds. The area is rich in deposits of coal, petroleum, iron ore, bauxite (aluminium) and copper. A number of large cities are located along the river, such as Sining (Tsinghai), Lanchow (Kansu), Yinchwan (Ningsia-hui), Paotao (Inner Mongolia), Sian (Shensi), Chengchow (Honan) and Tsinan (Shantung).

Within the basin, there have been found more than 100,000 ancient and historical relics of which 3,000 are signs and symbols in script on tortoise shells, proving that the basin has been populated for the least 4 to 5 thousand years. Irrigation canals date back 2,000 years to the Shang and Yin dynasties. In a later period, Sui dynasty (581-618 AD), more canals were constructed and during the Tang dynasty (618-907 AD) the river was used extensively for grain transport. It was, however, only during the later part of the Ming dynasty (1368-1644) that river gaging started.

B. Disasters Caused by the Yellow River

Although the river is a major source of livelihood for the people through transport, irrigation and water supply, it has also been the cause of severe disasters in the form of floods and droughts. One of the most severe droughts came in 1942 when almost 3 million died of hunger in Luoyang due to failure of crops caused by the drought. People ate tree bark and grass to survive. The plains in the middle and lower sections of the river are the largest loess plateau in the world (430,000 km^2) and has been continuously eroded. Silt deposition is estimated at 1.6 billion tons a year. The lower portion of the river covering a drainage area of 240,000 km^2 had some 1059 dyke breaches and the stream in this section has changed its course some 9 times in recorded history (602 BC, 132 BC, 11 AD, 1048, 1060, 1193, 1288, 1855 and 1938).

Period	No. of Years	No. of Breaches	Average Duration Between Breaches
221 BC - 229 AD	450	15	26 years
1368 - 1911	543	936	9 months
1912 - 1949	37	108	4 months
1950 - present	28	0	-

The above statistics show that up to 1949 the interval between major floodings caused by dyke breaches have shortened, a fact which implied more frequent occurrence. After finishing the work began in 1949, there have been no flooding since.

C. Methods Used in Controlling the River

Because the river bed is from 4-7 meters higher than the surrounding ground, higher dykes are continuously built to prevent flooding. More than 800 kms. of dykes have been built. A network of gaging stations has been set up to measure flows especially during the rainy season from July to September. To control flooding, in addition to dykes along the river a series of dams in the central and upper reaches of the river have also been constructed to conserve the water (for domestic and industrial supply and irrigation) and to prevent flooding below. Low places in the basin were also deliberately selected and used as flood-retarding areas. Finally the river bed in the lower reaches has been periodically dredged and the dredge spoils utilised to

increase the height of the dykes. In 1958, there was a severe threat of flood when the Yellow River was flowing at a rate of 22,000 m^3 per second. But 2 million people were mobilized to reinforce and protect the dykes from being broken.

The amount of silt caused by the Yellow River is the highest in the world as shown by the following comparative tabulation:

Name of River	Silt load, kg/m^3 (ppm x 1,000)
Yangtze	0.43
Nile	1.6
Amur	2.3
Colorado	16.6
Yellow River	37.6

It has been estimated that the amount of silt deposited by the Yellow River, if piled 1 m. high and 1 m. wide, will go around the world 27 times. Actually the silt load of 37.6 kg/m^3 is an average one since the figure ranges from a low of 3 to a high of 172.

Fortunately only one-quarter is deposited in the lower reaches of the river, the remiaining 3/4 being carried out in to the sea.

To insure further control of floods and prevent droughts, the following steps have also been taken:

a. terracing plateaus and mountain sides to prevent rapid erosion of the loess.

b. construction of dams across small streams that are tributaries to major branches of the main river.

c. reclamation of deforested areas and some agricultural lands for tree replanting.

d. planting of trees and grass on mountain slopes to reduce soil erosion.

e. construction of impoundments for irrigation and hydropower stations.

In the Yellow River basin, there are some 190 pumping stations to utilize its water for irrigation. As a result there has been an increase of more than double in agricultural production from 1965-1975 as follows:

	kg/ha grain output	Total grain production, tonnes
1965	1,500	108,000
1975	3,720	213,000

About 4 million hectares are now under irrigation and some 121 artificial lakes and reservoirs conserve water. There are also 6 power dams, each with about 2,000 megawatt capacity.

At Huayuankon People's Commune, where a dyke was deliberately blown up in 1938 to slow down the advance of the Japanese military forces during the war, the soil was water-logged for 9 years and became alkaline. Five pumping stations were built for irrigation and drainage to wash out the soil alkalinity.

At Sanmenshang Gorge Dam, built in 1958-60, the storage capacity was reduced by 50% after only 4 years (in 1964) because of the heavy silt content of the impounded water. To remedy the situation two tunnels were dug to allow the deposited silt to flow downstream. Designed to generate 1,200 megawatts, the hydroplant now has only a capacity of 250 megawatts.

Another dam constructed (1964-74) was the Liuchiahsia Hydropower Station, 800 meters long and 140 meters high and designed to develop 1,200 megawatts of electricity.

17. Pai Chuang Production Brigade (late afternoon of 14 August)

This production brigade is situated about 10 km, east of central Chengchow. It is a small one with only 105 households and a population of 618. Its arable land is barely 41 hectares of which about 27 is planted to corn, the main crop. The soil is sandy and the farm yield before 1950 was only about 600 kg. per hectare. In addition there were floods, droughts and insect pests. After improvement of agricultural practices the production is now (1977) 13,500 kg. per hectare, an increase of more than twenty-fold. Apart from corn, rice, wheat and millet are also grown.

Some 84 biogas plants are now in use since 1975. After these have been installed, there was reported a general improvement in the living conditions of the people - wastes were taken care of and spread of common enteric diseases, such as ascariasis, was controlled. Moreover, the use of coal and firewood has been minimized. For each household about 1 ton of coal per year is saved by using biogas as domestic fuel. Malaria has also

disappeared after 5 years of campaign by the people against the disease-transmitting mosquitoes.

The average size of a family biogas plant is 16 m^3. About 2,500 kg. of material is available twice a month from each tank for application to the farmlands. The material is used as soil conditioner/fertilizer at the rate of 2,500 kg. per mou or 4 kg. per m^2 of land. Compost, on the other hand, has to be applied at a rate of 15 kg. per sq. meter. Both compost and biogas tank solids (sludge) are spread evenly and plowed into soil before the crops are planted. The production brigade now has 6 tractors, one electric generator of 75 kw. capacity and 3 trucks (55, 50 and 40 hp. respectively). It has a grain reserve of 200 tonnes, Yuan 700,000 of accumulated funds, and provides 275 kg. ration of grain per person per year.

A brief visit and inspection trip was conducted after the briefing. Seen and observed were typical commune homes with biogas plant (pigsty and toilet connected to a chamber), cattle and hog barns, compost piles and an orchard with various fruit trees.

18. Mang Shan Pumping Station (morning of 15 August)

The pumping station is located at southern bank of Yellow River about 15 km. north of Chengchow City. It lifts water at two stages: 33 meters and then 53 meters, and has a pumping capacity of 60 million m^3 a year. The project includes 40 kms. of canal passing through 6 tunnels, 2 aqueducts and 2 silt-precipitating pools. It is a multi-purpose conservation project utilizing the Yellow River water for use in watering about 6,700 hectares of farmland along the canals, and for domestic and industrial use in the city. Its construction took 28 months from July 1970 to October 1972, requiring a total of 4 million man-days and cost 7.6 million Yuan. Construction was done mainly by manual labor and about 4.2 million m^3 of earth and stone were moved.

A big problem is the heavy siltation caused by the silt-laden waters of the Yellow River. A settling tank is provided to insure that water that enters the pumps are silt-free. A reservoir at the first stage must be cleaned up periodically and the silt and sand revolved are used to fill up valleys and gullies.

At this pumping station, the Yellow River flows with a minimum of less than 200 m^3 per second in summer and a maximum of 20,000 m^3 per second during

the flood season. The pumps normally operate year-round. Operation is suspended usually during the flood season when the silt content is very high. This period is then used for repair, maintenance and the desilting of reservoirs and settling ponds.

When the pumping station is not in operation, Chengchow gets its water from the small Chialu River, a branch of the Huai River. The city uses about 400,000 m^3 of water a day on the average. Some factories in the city use ground water for their operations; but discharge their wastes into the Chialu River. A thermal plant causes the water temperature to rise a bit whereas a chemical factory discharges some mercury-containing (Hg) wastes. However, the factory has recently started recycling Hg wastes and only the supernatant or treated wastes are allowed to enter the sewer system. To control air pollution, some smoke arresters and movable loading grates in coal-fired boilers are used. A factory using cyanide (CN) in its electroplanting operations has changed to non-toxic substances or has added neutralizers to destroy the CN radical. Gradually, the use of Hg and CN has been reduced and the target is their complete elimination or substitution with non-toxic chemicals. Dust collected by the cyclones, smoke reducers, filters and precipitators are recycled into bricks or hollow-blocks for use in the construction industry.

19. Honan Province Environment Protection Office (late morning of 15 August)

The Honan provincial EPO is organized along the lines indicated in Figure 7 on the next page and is similar to others in the 21 provinces in China. It is planned to have a staff of 50 in each province within the next 3-5 years. At present there are only about 15 members of the staff and no specialists are available, only technicians. Even the State Council Research Institution has only 20-30 staff although they plan to have 150 staff in the future.

The monitoring office now has a staff of 20, but there are plans to increase it to 50. Apart from the provincial and country level offices, there are also several district level offices for environment protection even on a marginal basis. Some cities, e.g. Chengchow, are directly under the provincial EPO. The district's EPO activities are limited to monitoring and administration. The size of the organization depends on the local situation, e.g. a place with more industries to monitor will have a bigger staff. Honan

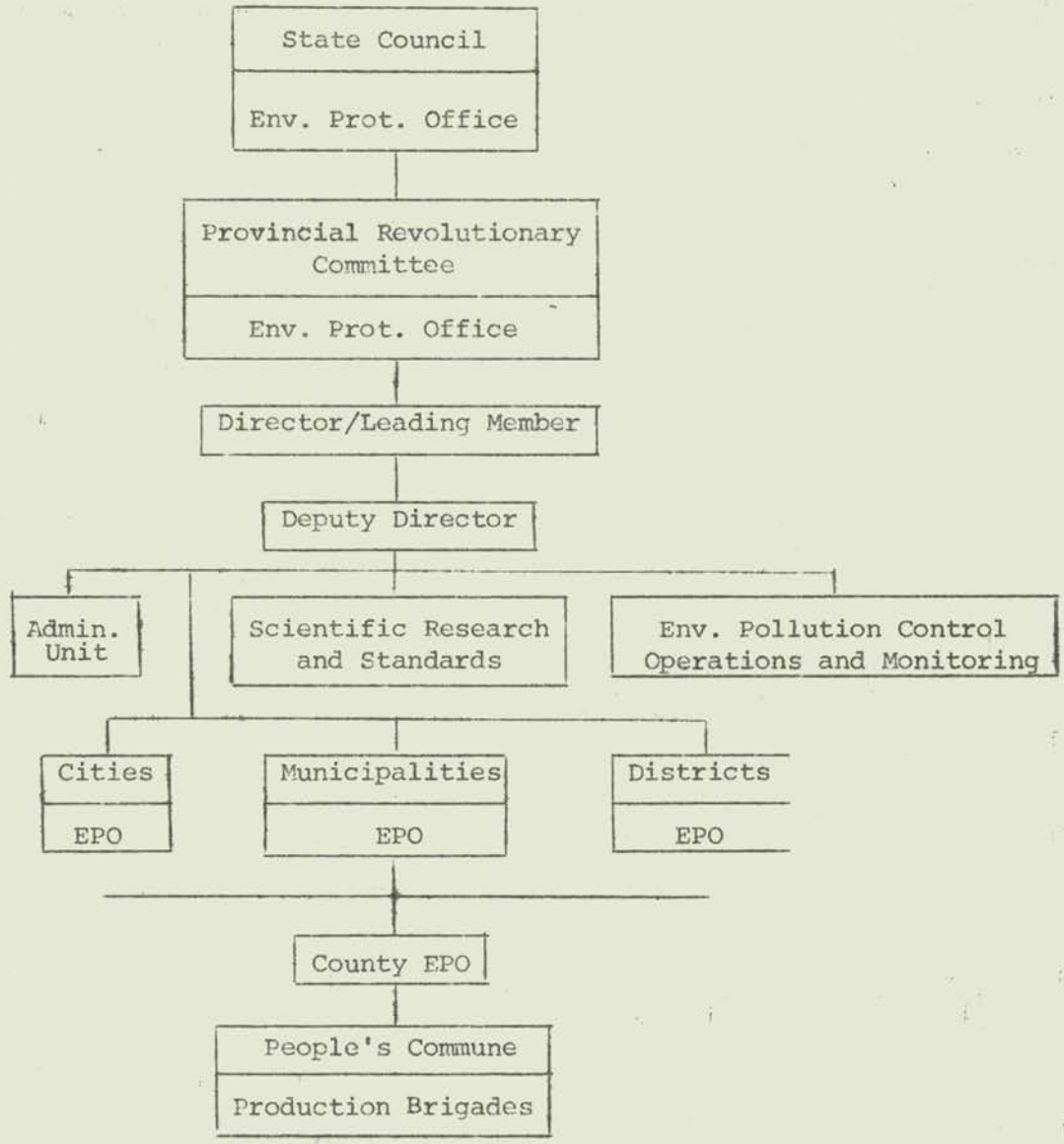


Figure 7 Organizational Chart of Honan Province Environment Protection Office.

province has tentatively established discharge standards for industries, but unfortunately these were not available. The standards set limits to certain specific substances and if the limits are reached or exceeded, the industry is required to treat the wastes prior to discharge into sewers or nearby body of water. Older factories set up before the promulgation of standards and without pollution control are given time to comply with the regulations so that these factories do not discharge substances that exceed the prescribed limits. Serious pollution near scenic tourist areas and discharge of harmful substances like mercury, are dealt with immediately and adequate measures taken to control and abate pollution. Yi Chuan Paper Mills, for example, near Loyang City was discharging black liquor causing severe water pollution, near the famous Longmen Grottoes, a favorite tourist place south of the city. A decision was taken immediately to stop the mill operations and to institute remedial measures like putting up holding ponds or lagoons. Paucity of funds is also a major problem in putting up pollution control works. New factories and enterprises (planned after 1975) have to have pollution control facilities built in and should include these during the entire process of design, construction and operation of the enterprise.

Details of particular rules and regulations concerning these procedures are to be issued later. A needed pre-requisite for approval of plans and specification must be the provision of such pollution control works. For example, a boiler using coal as fuel must have a movable grating for uniform combustion and insure deposition of ashes at the bottom; or a supercharger may be required to reduce diesel engine smoke emission; or a paper mill using the soda process may be asked to use the less polluting sulfite process. Problems encountered in combating environmental pollution caused by industries, other than lack of funds, are:

a. limited availability or use of appropriate pollution control devices;

b. existing technology not applicable;

c. new technology not yet available or feasible; e.g. in pesticide manufacture, how to get rid or recycle phenols from waste products.

Current environmental protection activities in Honan province are, in addition to industrial pollution control, limited to water conservancy, agricultural products recycling, control and prevention of flooding by the

Yellow River, afforestation of mountain areas and urban tree planting, and biogas and solar energy application in rural areas.

20. Workers Village on Fangkua Lung (Squash Lane)
Chapei District, Shanghai City (Morning of 16 August)

This workers' village consists of 35 blocks of 5-storey buildings is located in Tienmu Street near Tatung Road. It contains 1830 households with a total resident population of 7,500. The housing village is self-contained and has a food store, a medical center, two small scale processing workshops run by the neighborhood, a kindergarten and a primary school. Before the war, the area was an undrained wasteland and life for the residents was very miserable. In 1941 poor people in the city congregated in the area and built mud and mat shacks. After liberation in 1949 the poor people gradually improved their standards of living by securing jobs and in 1952, they pulled down their shacks to build a tile and straw-roof huts with running water. In 1963 the state allocated funds and construction of the concrete buildings forming a housing village started. By 1965 most of the buildings were completed at a cost of about 80 Yuan per sq. m. of floor area. The first batch of tenants moved in on 16 July 1964.

At the time of the visit, about 200 retired workers also lived in the housing area and they give free lectures to the younger generations and work part-time for working couples. The two enterprises in the housing village consist of a shop that assembles electrical relays for the communications industry, and another one assembling spare parts of still cameras.

As a reminder of the past, the village has retained in a corner of the compound a sample of the previous mud and mat shack and the tile and thatch-roof hut. It had a marker which reads "Guendilung in which Fangkua lane working people lived". Guendilung is Chinese for mat huts and Fangkua lane refers to the local name for the area as it was then called. At that time there were many squash (fangkua) plants that seemed to thrive very well in that area.

A typical apartment in the housing area has two bedrooms housing 4 or 5 people. Two apartments share a common kitchen and toilet/bath facilities. Rental is only 5 Yuan per month, but services such as running water, electricity and gas may add another 6 Yuan a month. Rice price throughout the city are

controlled and stable at 33 fen per kilo. Prices of vegetables, meat and fish vary according to season. Vegetables may only cost from 4 fen (units) to 10 fen per kilo.

A 5-storey building in the compound may have up to 100 families but some buildings are smaller and can only accommodate 40 families. A typical home was visited and the grandmother, a Mrs. Chou, was interviewed briefly. She and 3 other persons (a daughter; her husband and a child) occupy a two room flat with 22 sq. m. area.

The buildings were built by the Shanghai City Construction Bureau. A Residents Committee (RC), elected by all the people in each building of the housing village supervises the maintenance and collects the rent for the apartments.

Shanghai is the largest city in China, and possibly the whole world, with a population (1977) of about 11.5 million. The Greater Shanghai area, also known as the Shanghai Municipality, consists of the city proper and 10 counties, namely,

Chungming	Shanghai
Chiating	Sungkiang
Paoshan	Nanhui
Chingpu	Chinshan
Chuansha	Fenghsien

Shanghai city proper which is outside Shanghai county, in turn, is divided into 10 districts as follows:

Chapei	Whangpoo
Puto	Luwan
Changning	Nanshih
Hsuhui	Hungkow
Chingan	Yangpu

The city proper covers an area of only 140 km^2 and is therefore very densely populated. It has also over 9,000 factories and industrial enterprises.

Each of the 10 city districts has its own housing project. A management sub-bureau is responsible for the upkeep and maintenance of the buildings and apartments.

A Shanghai resident can own a house but not land. Those in the professions and senior government officials live in bigger apartments or even

individual homes but the rentals are much higher. No dogs are allowed in the city proper, but few cats to deter rats are permitted.

There is free medical treatment for workers and tenants in the building even after retirement, though there is a charge of 5 to 10 fen as registration fee each time one consults the clinic.

Newer homes and apartment buildings that are being built now have individual toilets, baths and kitchens.

21. Kwan Ming Electroplating Factory on Hungkow District, Shanghai (afternoon of 16 August)

The main products of the factory located at Talien Road are electroplated parts of sports gear, musical instruments, certain small machinery parts and small items - rivets, handles, etc. Electroplating is for anti-corrosion and heat resistance. The factory has a staff of 220, a third of which are women and a third are below 25 years.

Prior to 1965, the factory used to produce mainly mirrors, but after that time, it was converted to an electroplating plant. Worker safety and environment has recently been emphasized, particularly since the operations required the use of 3 types of strong acids (sulfuric, nitric, and hydrochloric), two strong bases (sodium and potassium hydroxide) and other strong chemicals such as chromic acid and sodium cyanide (Na CN). When the factory was small, wastes containing some of these chemicals were discharged into a nearby stream, but with increased production and increased discharge of effluents, the factory felt the need for waste treatment and recovery of the spent chemicals. The factory location was also shifted from inside the city proper to the nearby suburbs which were later designated an industrial area. At the old location the factory did not have any facilities for expansion nor waste treatment and in 1970, the decision to transfer was made. Formerly Na CN was used and about 3 tons per month was required, but this practice is now abandoned.

The treatment of wastes was undertaken under the initiative of the factory management and the Light Industry Bureau of the Shanghai EPO in collaboration with the Chemical Engineering Institute and the Second Designing Institute of the First Ministry of Machine Building of the government. A treatment scheme for a composite sample of the wastes was studied on a laboratory scale. Next the scheme was tried on a bench model and when it worked,

a medium size prototype was installed. Results of these tests were then used in the final design of the waste water treatment plant.

Waste gases in the plant contain as high as 1.4 mg. of chromium (Cr) per cubic meter of air. A plastic micro-screen was used to filter the air in the factory and the Cr content was reduced to 0.006 mg/m^3, a removal of 99.99%. The Cr is then reprocessed and, we were told, up to 25% is recovered. In the waste water, chemical treatment to recover Cr proved to be both difficult and expensive. Eventually, after tests by the research institutions and trying out various chemicals, the use of ion exchange resins proved to be the most feasible technically and economically. The Shanghai Resin Factory manufacturers supply the needed resins out of locally available materials. An acid or a base is used to regenerate the ion-saturated resins and up to 40% of the Cr is recovered and recycled. The plant thus recovers Cr 25% from gases and 40% from the effluents.

Polishing of the electroplated metal is the other operation that cause air pollution since it produces dust particles containing chromium. A vacuum system is used to which the polishing machines and grinding wheels are connected. The ducts of the system lead to a corrugated wire screen which collects the accumulated particles. These are burned and from the ashes, Cr is recovered. Coal used in the boiler is subjected to a 2-step burning process (preheating prior to actual combustion) to reduce coal dust emission.

Wastes containing copper, the first metal used before nickel and chrome in the electroplating process, are still under study for its recovery. Likewise reduction of noise pollution and recovery of acids and bases employed in the plant are under study. All the cotton polisher-grinding machines in the polishing section are connected to the vacuum duct system. At the power room which provides the suction blowers, a corrugated iron wire screen absorbs the dust particles collected. After working hours, properly masked workers sweep the collected dusts, mostly cotton lint from the grinders containing nickel and chromium metal are burned. About 20-30 kgs of dusts are collected daily.

At the electroplating section, the following computerized steps take place:

1. Cleaning of the metal to be electroplated, especially of oil;

2. Acid washing (hydrochloric);

3. Copper electroplating - electrolytic copper as one electrode in sulfuric acid; 3 contacts each lasting 5 minutes or a total of 15 minutes;

4. Nickel electroplating - electrolytic nickel as one electrode in a nickel sulfate solution; also 3 contacts at 5 minutes or 15 minutes total;

5. Chromium electroplating - electrolytic lead electrode in chromic acid solution; one contact lasting 7 minutes. The treated metal is then washed in water twice, the wash water being recycled for recovery of the Cr. The product is finally washed in clean water twice.

Direct current of 12 volts is used in the plating process. Air over the electroplating section is sucked through a separate duct system and bubbled into clear water reducing the Cr content from 1.7 mg. to 0.006 mg. per cubic meter/air as noted earlier.

The waste water treatment unit consists of 9 columns of resins. The first two columns contain hydrogen zeolite, a synthetic resin designed to remove hardness (calcium and magnesium) by the ion-exchange process. When the resin columns become saturated, as indicated by its color, it is regenerated by passing through hydrochloric acid (HCl).

The next two resin columns are designed to remove the nickel. Incoming effluents from the factory contain from 80-100 ppm nickel but this is reduced to 0 after passage through the column.

Columns numbered 5 to 9, connected in series, are used to remove the chromium. The efficiency is close to 100% since the reduction is from a concentration of 30-40 ppm Cr. in the incoming line to nil at the outlet.

The following simplified reactions of the ion-exchange resins are noted:

(a) Removal of chromium (sodium-based resin for Cr removal)

$$Cr + NaR \longrightarrow CrR + Na^{+}$$

(b) Removal of nickel (sodium-based resin for nickel removal)

$$Ni + NaR \longrightarrow NiR + Na^{+}$$

(c) Removal of Ca/Mg (hydrogen zeolites)

$Ca/Mg + HZ \longrightarrow Ca/MgZ + H^+$

(d) Regeneration of resin columns (Ni/Cr removal) by NaOH

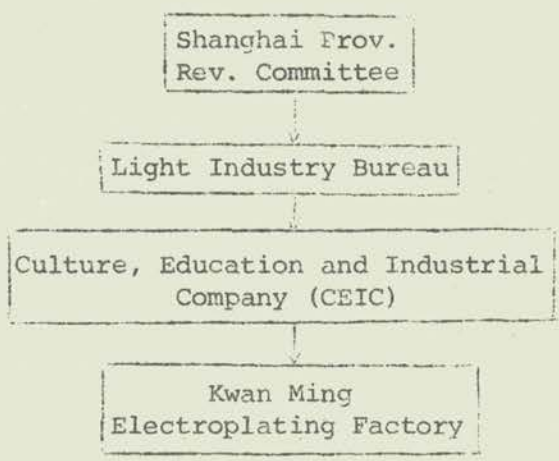
NiR (or CrR) $+ NaOH \longrightarrow NaR +$ Cr/Ni hydroxide.

(e) Regeneration of hydrogen zeolite by HCl

$Ca/MgZ + HCl \longrightarrow HZ +$ Ca/Mg Chloride.

The total capital cost of the air/water pollution control plant amounted to half a million yuan and is expected to be recovered in 3-4 years as a result of savings in recovered metal. The chemicals used per month when operating at maximum capacities are: 1 ton of chromic acid, 1 ton of electrolytic nickel and 2 tons of electrolytic copper.

An approximate organizational chart of the factory management is outlined below:



This company sets up quota according to present conditions, available equipment, existing manpower and needs of state and local industries. The factory discusses among its own management and workers if it can produce the suggested quota and the decision is forwarded back to CEIC for final action.

22. Shanghai Industrial Exhibition Hall (morning of 17 August)

The building built in 1971, occupies 10,000 m^2 of exhibition space and has some 4,000 product displays at one time. Products shown include those from heavy and light industry, textiles, instruments. There is, e.g. a 300 megawatt turbine generator delivering 18,000 v., 3 phase, 50 cps. a.c. current of 13,320 amperes at 3,000 rpm, 98.6% efficiency at 0.85 power factor; a boilet capable of producing 1,000 tons of steam per hour; boring, drilling

and milling machines and heavy duty turning lathes; screw making machines and grinding machines.

A section deals with the chemical industry: rubber products, fertilizers, pesticides; petrochemicals such as plastics (PVC and poly-ethylene); pharmaceuticals (anti-biotics and traditional Chinese herbs): phosphorescent powders for TV picture tubes. Another section exhibits metallurgical products such as copper, ferro-alloys, stainless steels hi-temp alloys with titanium and zirconium produced from ores found in China.

The Shanghai passenger car plant produces 10 models which are used all over the country. Shanghai also makes trucks such as 2 tons, 4, 15 and 32 tons capacity. Other products are buses and minibuses which are very popular in China.

Agricultural machines are also manufactured - combines (cut, thresh, and winnow), uprooter, transplanter and cutter for rice harvesting and weed removal. Tractors up to 50 hp. are produced to accelerate agricultural production. Special machines such as plane passengers staircase are also manufactured.

As an industrial center, Shanghai also produces transister radios, television sets, record players, electric computers and calculators, cameras, watches, thermos bottles, bicycles, sewing machines, ball pens, sporting goods (balls, racquets, etc.) and textiles products.

23. Shanghai Environment Protection Officials (late morning 17 August)

A meeting with a select number of officials was held to learn about the Shanghai EPO operations. Contacted were Mr. Wang Sen Chen, City Planning Office, and Head, Comprehensive Planning Department; Mr. Wu Yin Shan, Member and Head, Scientific and Research Section, EPO of Shanghai; and Mr. Wang Chen Wei, Chief of Science and Technology Unit, Shanghai Municipality Revolutionary Committee.

Mr. Wang briefly described the importance of Shanghai as the most populous and industrialized port city in China. As such they consider environmental protection work important and intend to integrate it into the planning function of the city, in particular the siting of specific industries and the treatment of solid, liquid and gaseous wastes on a national basis within the framework of the city planning process. Shanghai has a population

of over 10 million covering area of 6,100 km^2. The city proper has 5.3 million inhabitants and pollution problems are sometimes severe. The municipal government is determined to pursue the economic development and hence the need for rational city planning but taking into account as well the protection and improvement of the environment.

At the city suburbs there are more than 10 industrial areas. Transportation has been improved in order to insure rapid movement of the people, especially workers. New buildings have been constructed, totalling more than 14 million square meters of area to house these workers. Several new bridges have been built to span the Whampoo River and there are also plans to extend or improve existing sewerage and waste treatment facilities. Streets have been broadened and trees of various species have been planted. However, they realize that there is no unlimited expansion in a physical sense and they plan to locate new factories in different areas to develop new town centers. No large factories are now allowed within the city limits, and in areas where they are admitted, management must provide pollution control facilities and adequate housing for the workers. A new town, Minghang, 32 km from the city proper, has been planned and built by the Shanghai City Planning Office. This new urban area has a total population of about 60,000 and contains 30 big and small factories, serviced by 40,000 industrial workers. This industrial city manufactures electrical machinery and chemicals and it is still under completion and limited expansion using the unified city planning concept. All factories treat their wastes before disposing it to the environment. Highways to and from this new city have also been planted with trees. There is also domestic sewage treatment

In addition there are 12 similar industrial areas like Minghang near Shanghai. Among these are Anting which build automobiles, Soong Chiang, cameras, meters and other light industries; Tingshan, chemical workers; Paosan, steel and iron complex, and Shaching, hardware processing and computers. All in all, these industrial sites contain more than 200 factories with a worker population of 200,000 and a total population of 400,000.

The planning office has re-arranged industrial areas according to function and type of products manufactured in order to cut down pollution and combine pollution control workers wherever possible. Existing factories within city limits which would require very expensive pollution control works will be transferred to the suburbs or new industrial towns and the vacated

to be used for housing or green parks. Previously agricultural areas are now under planning for new towns with basic services being provided including water, electric power gas and telephones. Workers are given incentives of lower rent in such new areas to decongest the central district of the city.

Mr. Wu of the Scientific and Research Section, informed us that old factories are trying their best to control their environmental pollution, but newly built factories are required to put up treatment works. New factories have to be cleared through the Environment Protection Office which has now been given the power to clear the plans prior to final approval for setting up such factories.

Effluents of such factories must fall within the national and the Shanghai standards. Exchange of views were held on the limits that the central or national government and Shanghai had adopted. We were informed that they have prepared tentative standards but unfortunately this could not be made available to us since it has not yet been approved. Emission standards to control or limit air pollution includes such parameters as SO_2, CO, NH_3, NO_x and oxidants including CO_3. The water pollution standards deal with BOD, heavy metals, such as mercury cadmium and lead, total solids, chemical oxygen demand or COD, pH, nutrients (NPK) and pesticides.

Each of the 10 urban districts of Shanghai City has a monitoring system and for the entire city, there are a total of 40 air monitoring stations. However, there are less than 20 water sampling points to monitor water pollution.

24. Shanghai Zoo (afternoon of 17 August)

The team was warmly received by the zoo director,who on a previous request, asked two scientists to meet with us during the discussions. The zoo has an area of 75 hectares and was established in 1954. There are more than 280 species of animals and the zoo management officials are still improving the collection. Chinese alligators and certain other rare species of fauna are reared and bred separately. Among the more important species in the zoo are the giant and lesser Panda, golden-haired monkey, pheasants, cranes and deer. The 8 species of cranes, either reside in or visit China. Three of the rarest cranes visit the lower reaches of Yangtze River in winter. These are the Japanese crane (Grus japononsis), the hooded crane (Grus monochu), and the rarest of all, the Great White Crane (Grus leucogeranus).

25. Youth Palace (morning of 18 August)

This is a huge building with ample premises built by the State to house the more talented children in the city. The place contains several sections such as atheletics (which include boxing, fencing and table-tennis); ballet dancing; voice culture; music including piano and two-stringed violin called erhu; arts including sketching, paper cutting, pencil painting; and hobbies section which includes the model building of boats, airplanes, cars and servicing of radio/TV sets.

26. Hangchow Silk and Brocade Factory (morning of 19 August)

This factory is 50 years old and produces silk products of various types including picture embroidery. Before 1949, this was a small factory containing 17 hand looms and serviced by 40 workers only. After liberation, it has been expanded gradually so that at present there are now 1,800 workers and staff of which half are women. The factory has 350 electric looms that can produce a variety of products including table cloth, bedspreads and matress covers. The looms can produce 16-colored textiles, with 1,000 different types of products. The 1978 production quota is 2.25 million meters. The four major workshops are designing, spinning, weaving and quality control. In addition, the factory has a canteen, nursery, medical clinic and dormitory.

Raw material comes from the silk industries nearby. Artificial silk is also made from bamboo and certain special types of woods. Raw material hanks (skein of thread) both real, artificial and combined silk are used. About 600 of the products are real silk and only a very small portion is cotton. In the future, they plan to computerize the designing department. Raw silk is produced in people's communes by cultivation of the silk worm which feed on mulberry tree (Morus alba), and there is a Silk Research Institute in the city. Unfortunately, we were not able to visit this institute. One silk worm is capable of producing as much as 1 km. of silk thread as maximum. On the average, however, one hank comes from the output of 6-7 cocoons for total of 1 km. of thread. Temperature is a major factor. Normally 3 crops of cocoons are harvested a year, but using scientific methods this can be increased to 4 times a year.

The dead cocoons are either used for animal and fish feed or converted into compost.

27. Hangchow Municipality Botanical Gardens (afternoon of 19 August)

A very quick visit was made to this botanical garden where we learned of the species of trees that China uses in planting their major streets and avenues. We were informed that the specific trees commonly planted along the wide city streets of modern China are the following:

willows	-	Salix babylonica
poplars	-	Populus tomentosa, P. canadensis
plane tree	-	Platanus hispanica
locust tree	-	Firmiana simplexus
eucalyptus	-	Globulus regnans.

In addition, there are some 130 species of Bambusa (bamboos) in China, more than half of which are cultured-varieties, 3 species of firs, 3 of cypresses and 20 of pines.

The gardens cover an area of 223 hectares and may be divided into 2 portions, an experimental area which we visited and the larger area where various species numbering some 3,200 are grown. In the premises they have 1,290 species of medicinal herbs alone.

28. Hangchow West Lake (Morning of 20 August)

A leisurely boat ride was arranged by our hosts. Perhaps the most significant fact worth noting is the use of battery-operated boats for use by tourists (mostly foreigners). The objective is two-fold: to reduce oil/gasoline pollution of the lake waters and to eliminate the noise. As a result our ride was smooth, clean and silent in a boat large enough to accommodate 8 people. We were told that there are two larger boats, seating 25-30, that will soon also convert to storage battery powered motor and use of oil/gas engines will be banned eventually.

The lake, apart from being a tourist attraction, also seems as an anglers recreation since it is stocked with game fish.

29. Canton Zoo (afternoon of 20 August)

A late visit to the Canton Zoo was arranged to enable the team to see the rare Chinese alligator, Père David's deer are other rare species. Their famous orchid farm was also briefly visited before departure.

Annex 1

Mission to the People's Republic of China

1 - 21 August 1978

Itinerary

31 July 1978, Monday

Morning - Departure from Bangkok to Hong Kong via TG 610

Afternoon - Final arrangements with China Travel Service, 2nd Floor Alpha Building, Peking Road, Kowloon, re travel to Shumchun and Canton entry point to China

1 August, Tuesday

Morning - Departure from Kowloon Railroad Station for China border, Entry formalities at Shumchun, train trip to Canton

Afternoon - Arrival at the Tungfang Hotel and visit to Memorial Park to the Martyrs of the Canton Uprising

2 August, Wednesday

Morning - Discussions with the Provincial Government Environment Protection Agency official; visit to the Paiyun Mountains and Yuehsiu Park

Afternoon - Departure by air for Peking via flight CA 132

3 August, Thursday

Morning - Visit to the Great Wall of China, Badaling Town

Afternoon - Discussions with the National Environment Protection Officials

Evening - Dinner given by Mr. Wang Shing Chieh, Chief, State Council Environment Protection Agency

4 August, Friday

Morning - Visit to the General Petrochemical Works, Fangshan Country

Afternoon - Discussions with officials of Academia Sinica, in charge of zoology wildlife and forestry

5 August, Saturday

Morning - Visit to the Red Star People's Commune

Afternoon - Visit to the Agricultural Exhibition

6 August, Sunday

Morning - Visit to the chairman Mao memorial Hall and the Palace Museum

Afternoon - Visit to the Summer Palace and City Zoo

7 August, Monday

Morning - Departure by rail from Peking to Yangchuan (Yangquan), Shansi province

Evening - Arrival at Yangchuan Railway Station, proceed to Tachai (Dazhai)

8 August, Tuesday

Morning - Visit to the Tiger Head Hill and surrounding corn areas, water reservoirs

Afternoon - Visit to the Deer Farm; Hsiyang Country Exhibition Hall in Tachai

Evening - Attendance at a movie showing on Tachai Production Brigade

9 August, Wednesday

Morning - Departure by rail for Shihchiachuang, Hopei Province

Afternoon - Exhibition Hall: Taming the Haiho River complex; visit to Kindergarten and show with Japanese students

10 August, Thursday

Morning - Visit Huolu county marsh gas installations; briefing by local officials

Afternoon - Discussions with the Provincial Environment Protection Office authority; visit to Huapei Pharmaceutical Plant

11 August, Friday

Morning - Visit to the People's Liberation Army medical hospital also known Dr. N. Bethune Memorial International Peace Hospital; discussion with officials of Haiho Harnessing Headquarters, Hopei province

Afternoon - Departure by rail for Anyang and Lingshien, Honan Province

12 August, Saturday

Morning - Briefing on programme in Lingshien; visit to the Lingshien Exhibition Hall and to the small tractor factory

Afternoon - Visit to the Red Flag Canal, 40 km. away, pumping station

12 August, Saturday (Cont.)

Evening - Viewing of movies on the Red Flag Canal

13 August, Sunday

Morning - Visit to small hydro power plants on a branch of the Red Flag Canal, apple orchard, bridge aqueduct, commune marsh gas installation; departure for Anyang

Afternoon - Departure by rail for Chengchow, capital of Honan Province

Evening - Dinner given by the Honan Province EPO Director

14 August, Monday

Morning - Briefing on tree planting and Dust Control Programme in Chengchow City; visit to the solar cooker and small tractor super-charger demonstration.

Afternoon - Visit to the exhibition on the control and utilization of Yellow River; visit to the Pai Chung Production Brigade, Suburb of Chengchow

15 August, Tuesday

Morning - Visit to the Mang shan Pumping Station on the Yellow River (Hwang Ho), briefing by Honan Province EPO officials

Afternoon - Departure by air from Chengchow to Shanghai, short briefing by the Shanghai Environment Protection Office (EPO)

Evening - Dinner given by the Director, Shanghai EPO

16 August, Wednesday

Morning - Visit to the Workers' village on Tienmu Street near Tatung Road, Shanghai

Afternoon - Visit to the site of the First National Congress of the Communist Party of China, and to the Kwan Ming Electro-plating Factory

17 August, Thursday

Morning - Visit to the shanghai industrial Exhibition, main discussions with EPO officials

Afternoon - Visit to the zoo and discussions with wildlife scientists

18 August, Friday

Morning - Visit to the Children Palace

Afternoon - Visit to the Friendship Store

Evening - Departure by rail for Hangchow, capital of Chekiang province

19 August, Saturday

Morning - Visit to the Hangchow silk factory

Afternoon - Visit to the historic Buddhist temples and Hangchow Municipality Botanical Gardens

Evening - Dinner hosted by the Provincial and city EPO authorities

20 August, Sunday

Morning - Visit to the West Lake and environs

Afternoon - Departure by air for Canton via flight CA 181, visit to the city zoo and orchid farm

Evening - Dinner hosted by Provincial EPO authorities

21 August, Monday

Morning - Departure by rail from Canton to Hong Kong

22 August, Tuesday

- Departure for Bangkok

Annex 2

Mission to People's Republic of China
1-21 August 1978

List of Officials Met

(Names of places in parenthesis
are the accepted Chinese spelling)

A. Canton (Guangzhou), capital of Kwantung province (inward trip)

1. Mrs. Li Ya-Yien, Environment Protection Officer, Kwantung Provincial Revolutionary Committee

2. Mr. Huang Pei-Hsing, Interpreter and Staff member, China International Travel Service (CITS), Canton Branch

B. Peking (Beijing), national capital and a special municipality directly under the Central Government

(a) City

3. Mr. Wang Chih-chia, Staff Member, Environment Protection Office, State Council

4. Miss Chou Huei Fang, Staff member and interpreter, CITS
(Mr. Wang & Miss Chou accompanied the UNEP team during the mission)

5. Dr. Chin Chien-Ming, Chief, Science & Technology Division, State Council Environment Protection Office (SCEPO)

6. Mr. Wang Shing Shieh, Leading Member, SCEPO

7. Mr. Chu Ping-yi, Leading Member, Asia/Africa/Latin America Division, CITS

(b) Fangshan County

8. Mr. Shao Tzuo-Hsi, Vice-General Engineer and Director, Department of Multiple Utilization, General Petro Chemical Works (GPW), Fangshan County

9. Mrs. Hsiao Yu-ching, Engineer, GPW

10. Mrs. Li Kwei-yin, Office Reception Staff, GPW

11. Mr. Liu Wei-chen, Engineer, "The East is Red" Oil Refinery

(c) Academia Sinica

12. Mr. Chu Ching, Director, Department of Animal Ecology, Institute of Zoology, Academia Sinica (IZ, AS)

13. Mr. Wang Sung, Director, Department of Veterinary Taxonomy, IZ, AS

(d) Agriculture Exhibition Hall

14. Mr. Hsiang Tao, Chief "Learn from Tachai" Unit, Agriculture Exhibition Hall

(e) Red Star Peoples Commune (RSPC)

15. Miss Chou Huei-Li, Leading Member, Commune Office, RSPC

16. Mr. Chih Yung-Hsi, Leading Member, RSPC Production Brigade

C. Hsiyang County/Tachai, Shansi (Shanxi) Province

17. Mr. Chia Ru-ko, Vice-director, Reception Office, Tachai Production Brigade (TPB)

18. Mr. Chia Lai-hen, Vice Leader, TPB

19. Miss Lin Ping, Senior Staff, Exhibition Hall of Hsiyang County

20. Miss Shao Ching-hua, Staff Demonstrator, Exhibition Hall, Hsiyang County

21. Miss Mao Hei-mei, Staff Demonstrator

D. Shihchiachuang (Shijiazhuang), capital of Hopei (Hebei) Province

(a) City

22. Mr. Yu Zi-lin, Vice-Director, Provincial Environment Protection Office, (PEPO)

23. Mr. Li Ping-Hua, Leading membe Marsh Gas Office, PEPO

24. Mr. Sun Tao, Staff member, PEPO

25. Mr. Wu Yan Ko, Staff member CITS, Shihchiachuang branch

(b) Huolu County Production Brigade

26. Mr. Yan Chang Hai, Vice-director, County Revoluntionary Committee (CRC)

27. Mr. sen Hai Chen, Leading member, Pai Chican, Production Brigade

28. Mr. Wu Shun Tien, Senior official, CRC

(c) Huapei Pharmaceutical Co. Factory

29. Mr. Chao Hsien-Shin, Vice-Leader of Factory

30. Mr. Yi Kwang-peng, Production Section Leader and Engineer

31. Mr. Chi Kwon-chiang, Factory Technician

(d) PLA International Peace Hospital, memorial to Dr. Norman Bethune

32. Mrs. Li Yun-lai, Vice-Director of hospital

(e) Haiho Harnessing Headquarters, Hebei Province

33. Mr. Hu Feng-ling, Cadre Haiho Harnessing Headquarters (HHH)

34. Mr. Tong Kuang Chien, Engineer, HHH

E. Lingshien (Lin Xian) County

(a) County

35. Mr. Lu Sheh-yu, Staff Member, CITS Anyang Branch

36. Mr. Chan Tung-Sheng, Leader, Lin Xian County sub-branch of CITS

(b) Tung Fang Hung Machinery Factory

37. Mr. Lee Man-chang, Chairman, Factory Revolutionary Committee

F. Chengchow (Zhengzhou) capital of Honan (Henan) Province

(a) EPO and CITS officials

38. Mr. Chang Tai-chung, First Leading Member (director) Provincial EPO

39. Mr. Li Tao-ting, Vice-director Provincial EPO

40. Mr. Li Yue-gao, Manager, Chengchow Office of CITS

41. Mr. Lin Lai-chang, Staff Member, Chengchow Office of CITS

42. Mr. OW Hung, Interpreter, CITS

(b) Solar cooker and tractor super-charger demonstration

43. Mr. Liu Chu-te, Teacher, Senior Middle School No.3, Chengchow

44. Mr. Chen Ho Kwei, Municipal Officer for EPO, Chengchow

45. Mr. Wang Kwang Sheng, Demonstrator of super-charger model

(c) Exhibition Hall on Harnessing the Yellow River

46. Mr. Hsue Pin, Commentator/in charge

(d) Pai Chuang Production Brigade of Chi Cheng People's Commune, Chengchow suburb

47. Mr. Pai Wen-shin, Member, Revolutionary Committee of brigade

48. Mr. Pai Shi-chuan, Leader of Production Brigade

49. Miss Chao Gai-shiu, Vice-Leader of Production Brigade

(e) Many Shan Pumping Station

50. Mr. Lee Hsin-Ling, Leading Member, Pumping station

G. Shanghai, special municipality directly under central government

(a) Shanghai Municipality Environment Protection Office

51. Mr. Chin Huai-Kang, Director, Shanghai Environment Protection Office

52. Mr. Wu Yin-shan, Member and Section Leader, Scientific Research Section of Shanghai EPO

53. Mr. Ku shu-hsin, Staff Member, Shanghai Environment Protection Office

54. Miss Ku Yueh-ping, Staff Member Shanghai EPO

55. Mr. Cheng Yuong-ning, Staff Member, Shanghai branch of CITS

56. Miss Pao Chih-fung, Staff Member Interpreter, Shanghai branch of CITS

(b) Workers Village Housing on Tienmu St. near Tatung Road

57. Mrs. Chun Tung-yin, Leading Member, Residential Committee of Village Housing (RCVH)

58. Mrs. Lee Feng-yin, Member, RCVH

59. Mr. Weng Fu-ching, retired worker, former rickshaw driver for 27 years, and member, RCVH

(c) Memorial of First National Congress of Communist Party of China, No. 76 Hsingyeh Road

60. Mr. Hsu Cheng-chu, Staff Member of Memorial Site

(d) Kwan Ming Electroplating Factory, Hungkow District, Talien Road

61. Mr. Yu chen-ching, Leading member of factory

62. Mr. Wu shun-shan, Engineer in charge of operations

(e) Industry Exhibition Hall

63. Mr. Wang Tung-mou, Staff Member for visitors

(f) Shanghai Zoo

64. Mr. Wang Tao, Director

65. Mr. chen Ke-li, Vice-Director

66. Prof. Chou Ben-hsiang, Secretary-General of Shanghai Zoological Association and Director, Biology Department, Shanghai Teacher's University

(f) Shanghai Zoo (Cont.)

67. Prof. Hwang Wen-hsu, Director, Shanghai Zoological Association and Staff member, Biology Department, Fu Dan University

68. Mr. Sheng Ho-lin, Teacher and Scientist, Shanghai Teachers' University and Recipient of Special Honor 1978 National Conference on Science (held in Peking)

(g) Children's Palace

69. Mrs. Chen Gen-di, Staff Member for visitors

H. Hangchow (Hangzhou) capital of Chekiang (Zhejiang) Province

(a) Environment Protection Office

70. Mr. Sun Tien-ru, Director, Chekiang Provincial EPO

71. Mr. Chu Tan, Director, Hangchow EPO

72. Mr. Pao Lai-ta, Staff Member, Provincial EPO

73. Miss Chang Ko-lee, Interpreter, CITS

(b) Hangchow Silk Factory

74. Mrs. Shen Gen-hua, Staff Member, Reception Office

(c) Hangchow Municipality Botanical Gardens

75. Mr. Chang Shao-yao, Engineer-botanist

76. Mrs. Chiang Mei-chen, Technician

I. Canton (on return trip)

(a) Environment Protection Office (EPO)

77. Mr. Hou Hsia-chin, Vice-Director, Kwantung Provincial Revolutionary Committee EPO

78. Mr. Shu Chen-tung, Vice-Director, Kwantung Provincial Revolutionary Committee EPO

79. Mr. Tung Gan-wei, Deputy Division Leader, Sicence and Technology, Provincial EPO

80. Mrs. Lee Ya-yien, Environment Protection Officer, Provincial EPO

81. Mr. Hwang Chih-min, Staff member, Provincial EPO

82. Mr. Chao Feng-lin, Director, Canton Municipality EPO

(b) CITS

83. Mr. Huang Pei-Hsing, Interpreter and Staff Member, Canton branch CITS

(c) Canton Zoo

84. Mr. Ko Yung-shu, Vice-director of Zoo and in charge Afforestation Bureau

Capsule Data on the People's Republic of China (1978)

A. General

1. Total land area - 9.597 million sq.km.

   Land boundary - over 20,000 km. (with Vietnam, Laos, Burma, India, Bhutan, Sikkim, Nepal, Afghanistan, Pakistan, USSR and N. Korea)

   Coastline - over 14,000 km. (along Po Hai, Yellow Sea, East and South China Sea)

2. Total population, 1977 (est.) - 820 million, 33% under 15

3. Currency is Renminbi and monetary unit is Yuan

   US$1.00 = ¥1.67 (1978)
   1 Yuan = 10 Jiao
   1 Jiao = 10 fen coins are 1, 2 and 5 fen

4. Some 54 minority nationalities, the 12 most numerous being

   a. Mandarin (Han), (94%)
   b. Mongolian
   c. Hui
   d. Tibetan (Zang)
   e. Uighur
   f. Miao
   g. Yi
   h. Chuang
   i. Puyi
   j. Korean
   k. Kazakh
   l. Tai

5. Major religions (not encouraged, atheism propagated)

   a. Confucianism
   b. Buddhism
   c. Taoism
   d. Islam

6. Principal rivers (1500 rivers have basins greater than 1000 sq.km.

   a. Yangtze Kiang - 5,800 km. (1.8 million sq.km. basin)
   b. Yellow or Hwang - 3,600 km.
   c. Pearl or Hungshui-Si - 1,500 km.
   d. Heilung
   e. Talim
   f. Yalutsangpo
   g. Huaiho
   h. Haiho

7. Major lakes

   a. Poyang
   b. Tungting
   c. Taihu
   d. Hungtse
   e. Chinghai (Salt Lake)

8. Land use: 11% cultivated; 8% forest; 13% pasture

   Topography: mountains 33%, plateaux 26%, basins 19%, plains 12%, hills 10%

9. Climate: Varied, ranging from tropical in the south, temperate in the middle and north and frigid zones in the high mountains regions near the Himalaya. Rainfall varies from 1500 mm to 50 mm in deserts and arid zones.

B. Socio-Economic Indicators

1. Average annual population growth - 1.6%

2. Vital statistics:

Birth rate	- 27 per 1,000
Death rate	- 10 per 1,000
Life expectancy at birth	- 62

3. Workforce - 450 million (60% agriculture, 20% mining)

4. Est. 1977 GNP - $320 billion (US$380 per capita)

5. Principal Imports

Raw Materials and Food	- 65%
Plant and Capital Equipment	- 30%
Manufactured Consumer Goods	
Petroleum	

6. Principal Exports

Raw Materials and Food	- 61%
Manufactured Goods	- 25%

C. Political subdivisions and Administrative Structure

1. The People's Republic of china was proclaimed as a socialist country by Chairman Mao Tse-Tung on 1 October 1949

2. Special Municipalities, their areas and populations

   a. Peking, 17,800 sq.km., 7.6 million, is also the national capital

   b. Shanghai, 5,800 sq.km. and 10.8 million, birth place of the Communist Party of China and site of the First Communist Party Congress, 6 July, 1921

   c. Tientsin, 11,000 sq.km. and 6.3 million, major industrial and port city.

3. Autonomous Regions and capitals (est. 1970 pop.)

a.	Inner Mongolia	- Huhehot	(700,000)
b.	Kwangsi chuang	- Nanning	(375,000)
c.	Ninghsia hui	- Yinchuang	(175,000)
d.	Sinkiang - Uighur	- Urumchi	(500,000)
e.	Tibet	- Lhasa	(175,000)

4. Provinces and capitals (est. 1970 pop. in 1000)

1. Anhwei - Hofei (400)
2. Chekiang - Hangchow (1100)
3. Chinghai - Sining (250)
4. Fukien - Foochow (900)
5. Heilungkiang - Harbin (2750)
6. Honan - Chengchow (1700)
7. Hopeh - Shihchiachuang (1500)
8. Hunan - Changsha (850)
9. Hupeh - Wuhan (4250)
10. Kansu - Lanchow (1500)
11. Kiangsi - Nanchang (900)
12. Kiangsu - Nanking (2000)
13. Kirin - Chang chun (1500)
14. Kwantung - Canton (2300)
15. Kweichow - Kweiyang (1500)
16. Liaoning - Mukden (3750)
17. Shansi - Taiyuan (2725)
18. Shantung - Tsinan (1500)
19. Shensi - Sian (1900)
20. Szechwan - Chengtu (2000)
21. Taiwan - Taipeh (1604)
22. Yunnan - Kunming (1700)

5. Over 2,000 counties in the whole country.

6. National People's Congresses held at Peking since 1949

First: 15-22 September 1954

Second: 13-25 April 1959

Third: 21-28 December 1964

Fourth: 13-17 January 1975

Fifth: 26 February - 5 March 1978 (1 Chairman, 2 Vice-Chairmen, 1 Secretary-general, 175 Members)

7. Communist Party Congresses held since 1921

First: 6 July 1921, 12 representatives out of 70 members, Shanghai

Second: July 1922, Shanghai

Third: June 1923, Canton

Fourth: January 1925, Shanghai

Fifth: April 1927, Wuhan

Sixth: June 1928, Moscow

Seventh: April 1945, Yenan

Eighth: 15 September 1956, Peking

Ninth: April 1969, Peking

Tenth: 19 August 1973, Peking

Eleventh: 12-18 August 1977, Peking (35 million members, 1978)

8. Ministries of Government (as approved 5 March 1978)

1. Agriculture and Forestry
2. Chemical Industry
3. Civil Affairs
4. Coal Industry
5. Commerce
6. Communications
7. Culture
8. Economic Relation with Foreign Countries
9. Education
10. Finance
11. Foreign Affairs
12. Foreign Trade
13. Light Industry
14. Machine Building (7 ministers)
15. Metallurgical Industry
16. National Defense
17. Petroleum Industry
18. Posts and Telecommunication
19. Public Health
20. Public Security
21. Railways
22. Textile Industry
23. Water Conservancy and Power

In addition there are also Ministers for

24. State Capital Construction Commission
25. State Economic Commission
26. State Nationalities Affairs Commission
27. State Physical Culture and Sports Commission
28. State Planning Commission
29. State Scientific and Technology Commission
30. People's Bank of China
31. All China Fed. of Supply and Marketing Cooperatives

9. The State Council, the highest organ of state administration, is presently composed of:

   One Chairman - Hua Kuo-Feng

   13 Vice-chairmen - led by Teng Hsiao-Peng, and

   37 Ministers listed above

10. There is also a Supreme People's Court and a Supreme People's Procuratorate

D. Selected cities and their industries or characteristics

1.	Anshan, Liaoning	- Iron and steel works, chemicals, electric power and transmission, transportation and vehicle repair work
2.	Canton, Kwantung	- Textiles, sugar refining, cement, ship building, paper mills, Export Commodities Fair
3.	Changchun, Kirin	- Cars, trucks, locomotives, tractors, electric motors, tools, chemicals, textiles, cement
4.	Changsha, Hunan	- Non-ferrous metals, electric equipment, iron and steel, tools, cement, archaeological and historical sites
5.	Changshan, Hopei	- Coal, ceramics, iron and steel, cement, locomotives, refractory materials, electric power, textiles, pharmaceuticals
6.	Chungking, Szechwan	- Iron, steel, machinery, chemicals, sugar refining, fertilizers
7.	Dairen (Luta), Liaoning	- Machine-building, steel, chemicals, cement, locomotives, metallurgy, textiles, light industries, ship building
8.	Foochow, Fukien	- Chemicals
9.	Fushun, Liaoning	- Coal, petroleum, electric power, machine building, chemicals, light industry
10.	Hangchow, Chekiang	- Light industries, silk brocade, hot springs, tea
11.	Harbin, Heilungkiang	- Food processing, electrical motors, bearings, machinery
12.	Kirin, Kirin	- Basic chemicals, power industries
13.	Kweilin, Kwangsi Chuang A.R.	- Machine plants, textiles, rubber plants, pharmaceuticals, grotesque caves
14.	Lanchow, Kansu	- Oil refinery, cement, chemicals
15.	Mukden/Anshan, Liaoning	- Iron and steel, machinery, chemicals, tools, ball bearings, electrical equipment
16.	Nanchang, Kiangsi	- Aircraft, historical site
17.	Paotow, Inner Mongolia A.R.	- Iron and steel works

18. Peking/Tsientsin, Hopei - Iron and steel, machinery, cement, chemicals, textiles, handicraft, carpets

19. Sian, shensi - Textiles, cement, electric equipment, historical sites

20. Shanghai/Nanking, Kiangsu - Ship building, textiles, iron and steel, machinery, tools, food processing, chemicals, paper, cement

21. Shihchiachuang, Hopei - Textiles, chemical machine-building, light industry

22. Soochow, Kiangsu - Manufacturing, light industries, basic industries, cultural spots.

23. Tainan/Kaochung, Taiwan - Machinery, oil refinery, non-ferrous metals, sugar refinery

24. Taipeh, Taiwan - Machinery, chemicals, textiles, ship building

25. Taiyuan, Shansi - Iron and steel, machinery, cement, chemicals

26. Tsinan, Shantung - Metallurgy, machine-building, chemicals, textiles, hot springs resorts

27. Tsingtao, Shantung - Textiles, tires, locomotives, health and summer resorts

28. Urumchi, Sin Kiang A.R. - Cement, agricultural machinery

29. Yangchuan, Shansi - Coal, machine-building, electric power, chemicals

30. Wuhan, Hupei - Iron and steel, machinery, cement, chemicals

Model for Industry: Taching Production Brigade in Harbin County, Heilungkiang Province

E. Major Agricultural Products: Cereals (rice in south, wheat, millet, and corn in the north and west, soya beans, sorghum and wheat in northeast)

Livestock, Soy beans, Tobacco, Cotton
Fruits (apple, pear, walnut, peach, grape, parsimmons)

Model for agriculture: Tachai Production Brigade in Hsiyang County, Shansi Province

F. Principal Minerals and Significant Fossil Fuels

Metallic - Bauxite (aluminum), copper, iron, mercury, manganese, lead, antimony, tin, tungsten, zinc, silver, gold, mangnesium, sodium, fluorspar, molybdenum, uranium, jade

Non metallic - Asbestos, gypsum, talc

Fuels - Coal, petroleum, natural gas

G. Wildlife (animals and birds) of special significance

Animals

1. Giant Panda (Ailuropoda melanoleuca). Endemic to China.
2. Wild Yak (Bos mutus). Very large wild bovid found in Tibet. Rare.
3. Golden Takin (Bodorcas Taxicolor bedfordi). Endemic to China with a very restricted range.
4. Chinese Alligator (Alligator Sinensis)
5. Thorold's or White-lipped dear (Cervus albirostris). Endemic and rare.
6. M' Neill's Deer (Cervus canadensis macneilli). Endemic and rare.

Birds

7. The Great White or Siberian Crane (Grus Leucogeranus)
   The eastern population of this rarest Asiatic crane winters in China
8. The Black-necked Crane (Grus nigricollis)
   Breeds in china. A very rare and comparatively localized crane.

H. Special measurement units used in China

1 mou (area of land)	= 0.07 (1/15) hectare	= 0.167 acre
1 chih	= 0.33 metre	= 1.09 ft
1 li	= 0.5 km	= 0.31 mile
1 sheng	= 1 litre	= 0.22 imp. gallon
1 jin or catty	= 0.5 kg	= 1.10 lbs
1 picul	= 50 kg	= 110 lbs

I. Sketch of Chinese Dynasties

Period	Dynasty	Seat of Capital	Province
c. 2100-1600 BC	Hsia		
c. 1600-1100 BC	Shang (Yin)	Yin, near Anyang	Honan
c. 1100- 771 BC	Western Chou		
770 - 476 BC	Spring & Autumn period	Loyang	Honan
475 - 221 BC	Warring States period	Loyang	Honan
221 - 207 BC	Chin	Loyang	Honan
206BC- 220 AD	Han	Loyang	Honan
206BC- 24 AD	Western Han	Loyang	Honan
25 - 220 AD	Eastern Han	Loyang	Honan
220 - 265	Three Kingdoms	Loyang	Honan
220 - 265	Wei	Kai Feng	Honan
221 - 263	Shu Han	Sheng Tu	Szechwan

Period	Dynasty	Seat of Capital	Province
222 - 280	Wu	near Nanking	Kiangsu
265 - 420	Tsin		
265 - 316	Western Tsin		
317 - 420	Eastern Tsin		
420 - 581	Southern & Northern		
420 - 479	Sung		
479 - 502	Tsi		
502 - 557	Liang		
557 - 589	Chen		
386 - 534	Northern Wei		
534 - 550	Eastern Wei		
535 - 556	Western Wei		
550 - 577	Northern Tsi		
557 - 581	Northern Chou		
581 - 618	Sui		
618 - 907	Tang	Sian	Shensi
907 - 960	Five Dynasties		
907 - 923	Liang		
923 - 936	Tang		
936 - 940	Tsin		
947 - 950	Han		
951 - 960	Chou		
960 - 1279	Sung	Peking	Hopei
960 - 1127	Northern Sung		
1127 - 1179	Southern Sung	Hangchow	Chekiang
916 - 1125	Liao		
1124 - 1211	Western Liao		
1038 - 1227	Western Hsia		
1115 - 1234	Kin	Shenyang (Mukden)	Liaoning
1271 - 1368	Yuan		
1368 - 1644	Ming	Peking	Hopei
1644 - 1911	Ching	Peking & Shenyang	Hopei

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