BASIC DESIGN STUDY REPORT ON THE HORTICULTURAL DEVELOPMENT PROJECT IN THE KINGDOM OF NEPAL

FEBRUARY, 1985

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

In response to the request of His Majesty's Government of Nepal, the Government of Japan decided to conduct a study on the Basic Design of the Horticultural Development Project and entrusted the study to the Japan International Cooperation Agency (JICA). The JICA sent to Nepal a study team headed by Mr. Shichiro Tsuchiya, Head of Fourth Laboratory of Fruit Breeding, Division of Fruit Breeding, Fruit Tree Research Station, Ministry of Agriculture, Forestry & Fisheries, from September 13th to October 1st, 1984.

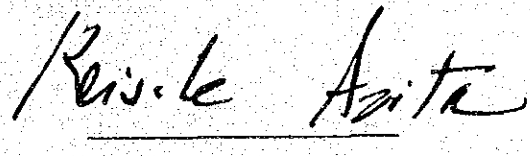
The team had discussions on the Project with the officials concerned of the Government of Nepal and conducted a field survey in the Kathmandu area.

After the team returned to Japan, further studies were made and the present report has been prepared.

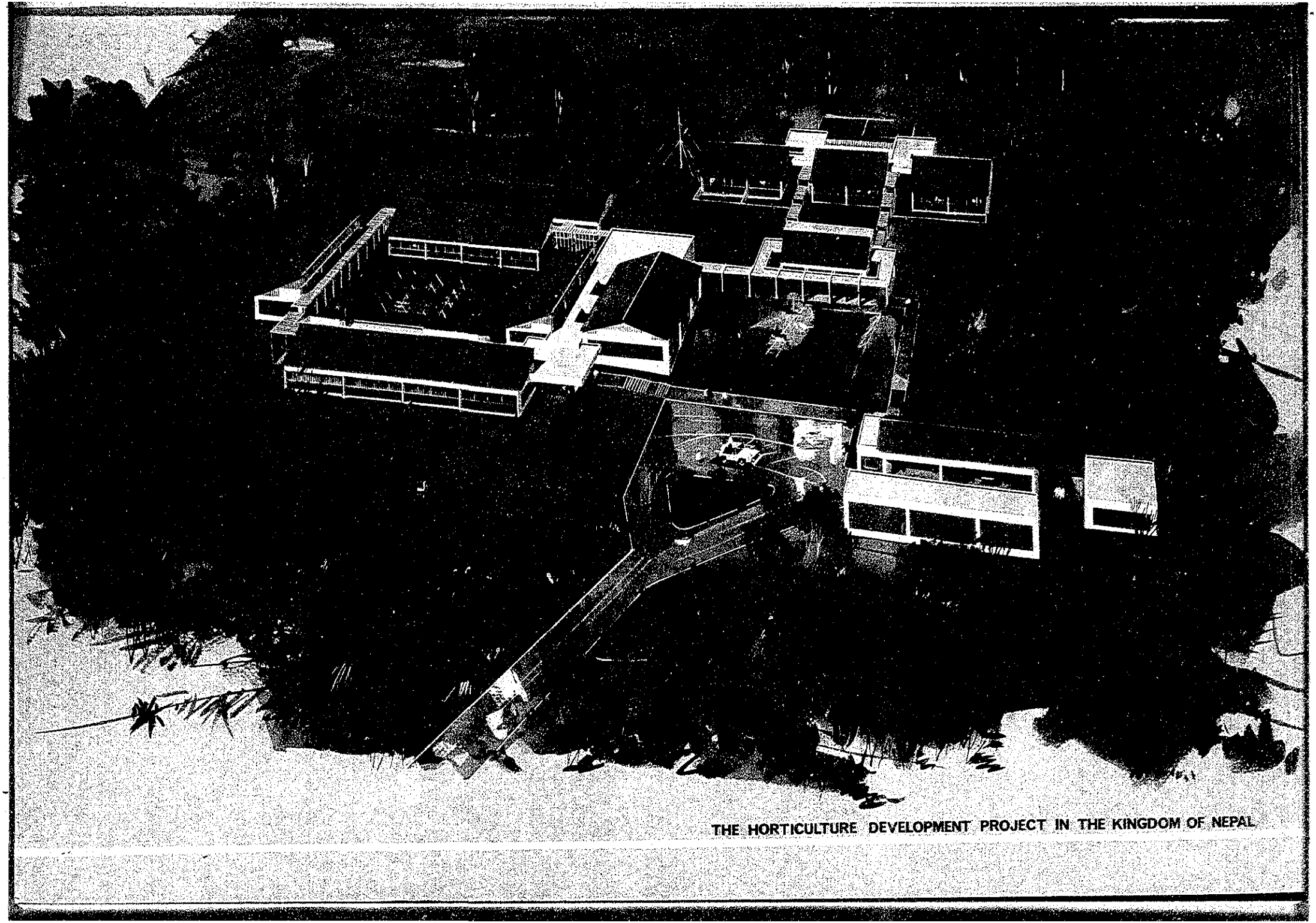
I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of His Majesty's Government of Nepal for their close cooperation extended to the team.

February, 1985

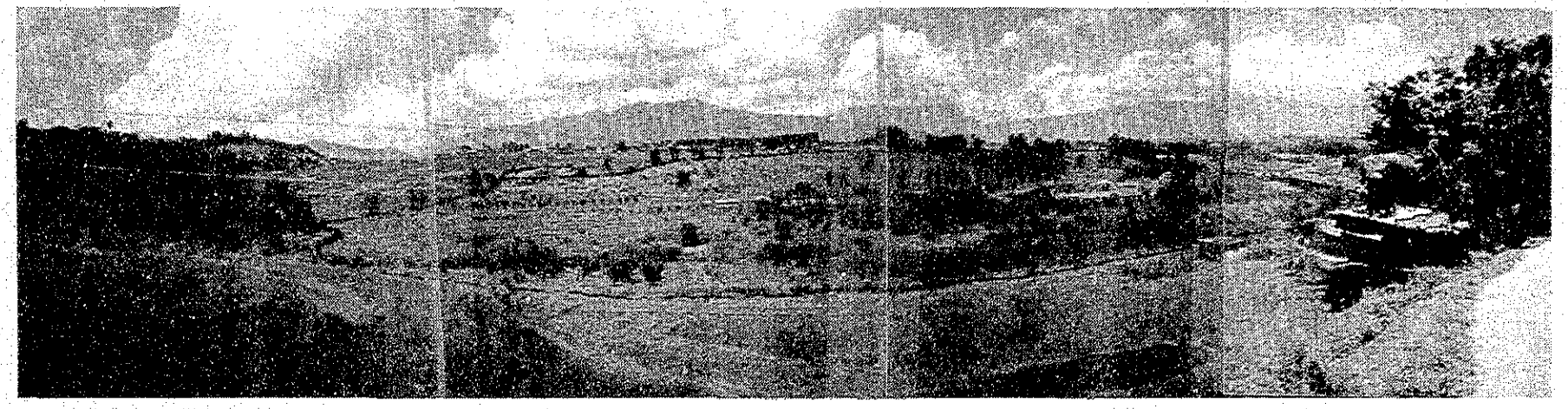


Keisuke Arita
President
Japan International Cooperation Agency



THE HORTICULTURE DEVELOPMENT PROJECT IN THE KINGDOM OF NEPAL

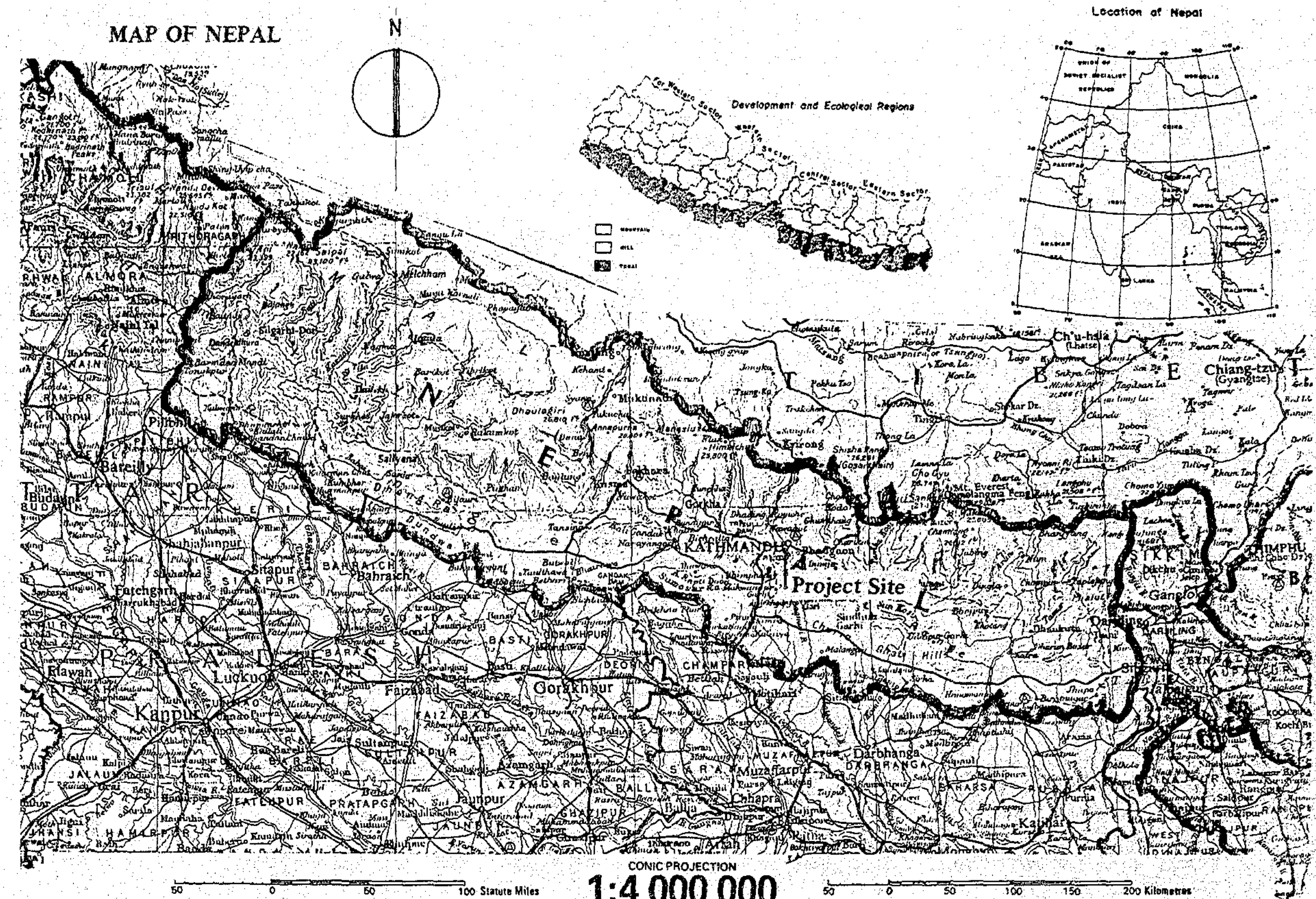
PHOTOGRAPHS OF THE PRESENT STATE OF PROJECT SITE



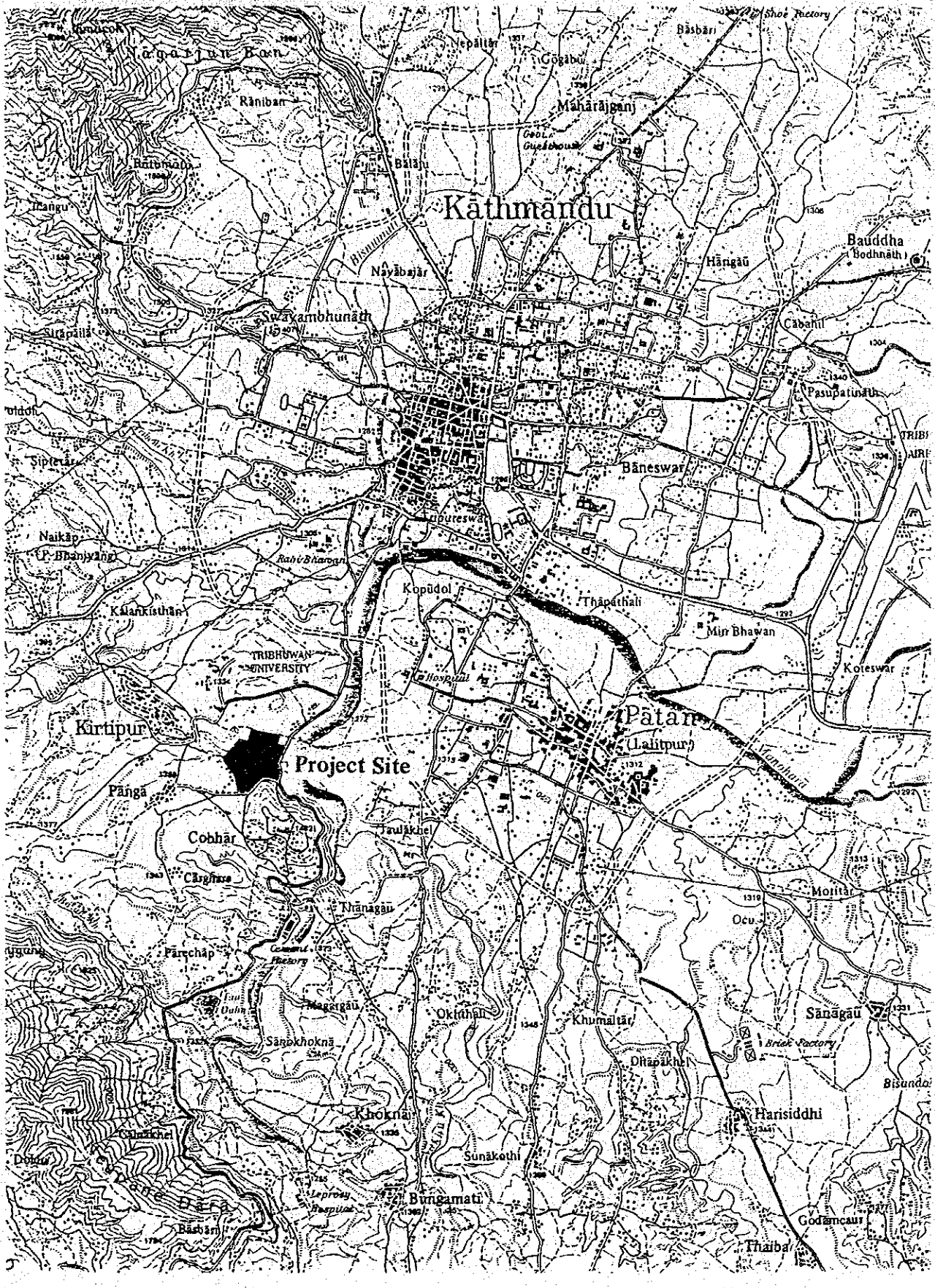
Whole View of the Project Site

Existing Glass Houses in the Horticulture Research Station

MAP OF NEPAL


N
Development and Ecological Regions
Far Western Sector
Western Sector
Central Sector
Eastern Sector
Location of Nepal
KATHMANDU
Project Site
Mt. Everest
Dhaulagiri
Annapurna
SIKKIM
THIMPHU
Chiang-tzu (Gyangtse)
Gorakhpur
Lucknow
Kanpur
Bareilly
Darbhanga
Muzaffarpur
Darjiling
Gangtok
TIBET
NEPAL
UTTAR PRADESH
CONIC PROJECTION
1:4 000 000
50 0 50 100 Statute Miles
50 0 50 100 150 200 Kilometres

LOCATION MAP OF THE PROJECT SITE



SUMMARY

SUMMARY

The Kingdom of Nepal is an inland country with the shape of strip extending from east to west, and is encompassed by China and India. It lies between in latitude 26° and 27° north and between in longitude 80° and 86° east, and has the territorial area of about 147,181 km^2. The land can be classified into the northern region of mountains, the central region of hills and the southern region of plains. The climatic conditions vary wildly from those of subtropical to temperate zone, to frigid zone and ice and snow-bound zone. The nation has a population of 15,022,839 (1981 census) of which 95% is engaged in agriculture.

The economy of Nepal depends on agriculture, the country's basic industry. However, the slowdown in the expansion of farmland development and in the growth of food grain productivity coupled with the recent rapid population growth are inflicting a serious blow on its economy. The attainment of a drastic increase in agricultural production, therefore, is the top priority policy in the Sixth Plan for the elimination of absolute poverty.

In the mountainous and hilly regions, surface soil is being washed away by the cutting of forest trees while the land is being further devided due to the current population growth. The increase in the agricultural production, as a result, is levelling off so that even the minimum subsistence level of food production can hardly be secured for the people of these regions.

In Nepal, such citrus fruits as Junar and Suntala have been produced since earlier times but there is no other noteworthy fruit tree to speak of, except pear, peach and chestnuts which are grown in the suburbs of Kathmandu in a small scale.

The Government of Nepal has formulated a mountain horticulture development plan to develop fruit gardening suited to each area with the

aim of raising the income of the farmers in the mountainous and hilly regions where the production of food grain is not suitable and of improving the nutritive condition of the people and conserving the soil of the mountainous regions, and has requested the Government of Japan for technical cooperation and grant aid for implementation of the said plan.

The Project, based on this request for the grant aid, aims to construct a Horticultural Development Center for research and experiment of pomiculture technology of citrus, grape and chestnuts which are considered the most promising of the products to be developed, and for training of horticultural extension workers (JT/JTA) and leader farmers to diffuse these techniques throughout the country.

By the implementation of the Project, pomiculture techniques suitable to each area of Nepal will be developed and 40 pomiculture technologists will be given training of these techniques each year to disseminate the techniques at each of the producing areas.

The construction site planned for this Center is within the compound of the Kirtipur Horticultural Research Station located 4 km south of Kathmandu, the capital city. The Kirtipur Horticultural Research Station was founded with the cooperation of India in 1962 and is the nucleus of Nepalese horticultural research stations. The site, including orchard, has the land of 20 ha, of which about 8 ha are available as the construction site for this Center.

The outline of the Project is as follows:

Horticultural Development Center

1. Buildings (total floor area about 3,120 m^2)

(1) Laboratory & Lecture Block (reinforced concrete, single-storied) office room, manager's room, meeting room, lecture hall, laboratory, research room, etc.
Floor area is approx. 1,580 m^2.

(2) Dormitory Block (reinforced concrete, single-storied) bedrooms, dining hall, kitchen, house-keeper's quarters, etc.
Floor area is approx. 700 m^2.

(3) Roofed connecting passage (wooden, single-storied).
Floor area is approx. 100 m^2.

(4) Workshop Block (reinforced concrete, single-storied) workshop, training space, garage, driver's room, electrical room, etc.
Floor area is approx. 420 m^2.

(5) Farm House Block (steel framed, single-storied) farm office, fruit storage, materials storage, working space, farm equipment and implement yard, etc.
Floor area is approx. 320 m^2.

2. Orchard Improvement

Size of orchard (total 3.25 ha)

Citrus	0.80 ha
Grape	1.60 ha
Chestnut	0.35 ha
Nursery of seedlings	0.50 ha

(1) Irrigation facilities

Water source : Existing borehole
Coverage : Citrus, grape, nursery plot, totalling 2.9 ha
System : Closed system water pipeline, ground surface stationary spray pipe type sprinkler

(2) Green house facilities

Glass house with a cooling facility	1
Glass house	1
Vinyl house	1

(3) Grapevine trellis

Of the 1.60 ha vineyard, grapevine trellis will be set up for 0.70 ha.

3. Equipment

(1) Pomiculture and breeding laboratory: 1 set
(2) Plant physiology and biochemistry laboratory: 1 set
(3) Soil science and fertilizer laboratory: 1 set
(4) Entomology laboratory: 1 set
(5) Plant pathology laboratory: 1 set
(6) Meteorological observation: 1 set
(7) Wireless radio unit: 1 set
(8) Vehicle: 5 units
(9) Training equipment: 1 set
(10) Farm machinery: 1 set

Construction equipment and materials necessary for execution of work will be planned for procurement within Nepal as much as possible, while those which can not be procured in Nepal or which are difficult to procure, with respect to quality and quantity, will be imported from Japan.

For the establishment of this Project six months are considered necessary for detailed design, cost estimation, tender and contract consummation, and another 12 months for procurement and transportation of equipment and materials and construction work, adding up to a total period of 18 months.

The Horticultural Development Center will belong to the Ministry of Agriculture, whose Department of Agriculture will be responsible for its operation. The annual operating expense of the Horticultural Development Center under this Project is estimated to be Rs 1,184 thousand (about US$ 69,000).

The benefits that would be accrued for the national economy by the Project are the production increment of fruits as a consequence of improved technical skill of the fruit producers by the establishment and diffusion of pomiculture technology suitable to Nepal, the prospective increase in the revenue of farm households, the attainment of self sufficiency and even exports of the fruits (currently being imported) would contribute to foreign currency earnings. The Project will also serve to improve the nutrition of the Nepalese people and to preserve the national land. Japan's grant aid for the Project would, therefore, be of great significance.

The following must be noted for the effective operation of the Horticultural Development Center:

- To create an extensive and cooperative relationship with departments and organizations of the Ministry of Agriculture having similar functions, and to implement dispatching of visiting researchers and lecturers as well as exchange of teaching materials and development data.
- The technical cooperation from Japan is necessary for the operation of this Center. The dispatching of experts on the production of citrus, grape and chestnuts, which are the object fruit trees to be grown particularly, and experts on farm machinery operation from Japan is desirable.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

CHAPTER 1 INTRODUCTION

The economy of Nepal depends on agriculture which is the country's basic industry. Nepal, which aims for self sufficiency in food, is suffering from a serious food crisis, and the slowdown in the expansion of farmland development and in food grain production coupled with rapid population growth are inflicting a serious blow on the economy. In the Sixth Plan (1980-1985), the basic policy is to eliminate absolute poverty, and to place top priority on the attainment of a drastic increase in agricultural production in an attempt to overcome this crisis.

In the mountainous and hilly regions, efforts are being made to convert even some steep slopes of the hills into farmland, but increase in the agricultural productivity in these regions is levelling off due to arable land being washed away by the cutting of forest trees and the subdivision of land holdings which is in progress due to population growth. The situation is that even the minimum subsistence level of food production can hardly be secured for the people of these regions.

With the aim of raising the farmers' income in the mountainous and hilly regions where production of food grains is not suitable, and of improving their nutritive conditions and preserving the national land in the mountainous regions, the Government of Nepal has formulated a mountain horticulture development project in order to develop pomiculture technology suitable to each area, and has requested the Government of Japan for technical cooperation and grant aid for implementation of the said Project.

In response to this request, the Government of Japan decided to carry out a study for the Project, and the Japan International Cooperation Agency dispatched a basic design study team headed by Mr. Shichiro Tsuchiya, the head of Fourth Laboratory of Fruit Breeding, Division of Fruit Breeding, Fruit Tree Research Station, Ministry of Agriculture, Forestry and Fisheries, from 13th September to 1st October,

1984 to study the proposed grant aid program. A preliminary study of the project-type technical cooperation was made in June, 1984 followed by another study during September-October concurrent with the study by the Basic Design Study Team, and the contents of these are now under review. The Basic Design Study Team has conferred on the contents of the request and the contents of the Project, confirmed the organizational setup for implementing the Project and surveyed the construction situation and other relevant matters. This report, which is based on the field survey, reviews the justification of the Project, develops the basic design and renders an overall evaluation of the Project.

With respect to the composition of the Study Team, Schedule of the Study and the Minutes of Discussions, the details are attached as "Appendix".

CHAPTER 2

PROJECT BACKGROUND

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2-1 General Conditions in Nepal

Nepal borders on China in the north, India in the south, east and west respectively. Its territorial land is about 147 thousand km^2, lying between in latitude 26° and 27° north and between in longitude 80° and 88° east. The country's population is about 15,023 thousands of which about 95% is engaged in agriculture. In terms of topography and climate, its national land can be divided into three parts: the central hilly region of which Kathmandu, the country's capital, is the center; the northern mountainous region including the Great Himalayan mountain group; and the subtropical southern plains commonly called the Terai plains. The country is a strip of land that extends in the east-west direction, and it has wildly differing climatic conditions that range from those of subtropical to temperate, to frigid and even ice and snow-bound zones.

Ethnically, various ethnic groups are commingled in a complicated way. Accordingly, not only the religion but life style, customs, language and culture are not uniform. This and the diversity of the climatic conditions which has been previously mentioned can not be disregarded in the discussion of the conditions on which the Nepalese agriculture was founded and its future prospects as they lie at the very basis of the subject.

Agriculture is the dominant industry, but because of the demand for improved living standard, imports of particularly apparel and industrial products have increased gradually. Its balance of trade, as a result, shows imports to greatly exceed exports (refer to Table 2-1). In exports, the ratio of its exports to India is large; and the ratio of its imports from India is also large. This is indication of its deep involvement with India from earlier times, partly due to their geographical proximity. (Refer to Tables 2-2 and 2-3). Lately, however, the ratio of imports from Japan is increasing. Particularly, the imports of auto-

mobile and motorcycle parts, spare parts for aircraft and tractor parts from Japan are largely accounted by which a relationship of greater intimacy is being established between the two countries.

Agriculture is the key sector which forms the foundation of the Nepal's economy. It accounts for 57% of GDP, 95% of employment and 80% of exports. Accordingly, an year of good or poor harvest in agricultural crops immediately reflects itself on the national economy. The economic development of the nation therefore is unthinkable without the development of its agriculture. With a population growth rate as high as 2.6% a year today, the food supply crisis is felt to be particularly acute in the hilly regions and the mountainous regions, and the need to offer employment opportunities to the surplus labor of the rural villages in these regions is also increasing.

Table 2-1 Trends in Foreign Trade

(units in million Rs.)

	Export (FOB)	Import (CIF)	Trade Balance
1979/80	1,150.5	3,480.1	-2,329.6
80/81	1,608.6	4,428.2	-2,819.6
81/82	1,491.5	4,930.2	-3,438.7
82/83	1,112.7	6,213.0	-5,100.3

Source: Nepal Rashtra Bank

Table 2-2 Principal Import Items (Excepting imports from India)

(units in million Rs.)

	1980/81	1981/82	1982/83
Petroleum and products	453.0 (24.0%)	374.4 (15.0%)	613.1 (17.9%)
Textile	359.7 (19.1%)	370.3 (15.4%)	229.3 (8.3%)
Cement	108.9 (5.7%)	182.3 (7.6%)	265.2 (7.4%)
Fertilizer	167.7 (8.9%)	161.1 (6.7%)	205.2 (5.7%)
Machinery and machine parts	153.5 (8.1%)	152.9 (6.4%)	188.2 (5.2%)
Transport equipment	158.3 (8.4%)	135.0 (5.6%)	181.2 (5.0%)

Note: Figures in parenthesis are the percentage ratios to total imports of Nepal (except from India)

Source: Trade Promotion Centre

Table 2-3 Principal Import Items from India

(units in million Rs.)

	1980/81	1981/82	1982/83
Food and live animals	473.6 (21.7%)	446.7 (17.8%)	186.0 (15.4%)
Manufactured good	655.1 (30.1%)	714.8 (32.1%)	416.5 (34.4%)
Machinery and transport equipment	399.7 (18.3%)	380.9 (17.8%)	226.7 (18.8%)

Note: Figures in parenthesis are the percentage ratios to total imports of Nepal

Source: Nepal Rashtra Bank

2-2 General Economic Situation and the Sixth Plan

General Economic Situation

There has been no change in the economic structure of Nepal in the past ten years. The per capita GDP in current prices (in the fiscal year 1981/82) is Rs 2,114. (US$165). The ratio of its labor force to the total population is merely 55% of which more than 95% is engaged in agriculture.

According to the economic survey report, GDP rose by 5.6% in the fiscal year 1980/81 and by 3.8% in the fiscal year 1981/82. In the fiscal year 1982/83, however, it recorded a minus growth of 1.3%, the major reason for it being the decline in agricultural production due to draught, despite the rise in industrial production during the same period.

The economic base is agriculture, and agricultural production accounts for 57% of GDP. The share of the manufacturing industry in GDP, on the other hand, is a mere 5%, and the sector provides employment to only 1% of the employed population.

Nepal sustains a chronic deficit in its balance of trade. Within a span of the last three years, its trade deficit increased by about three times from Rs 1,587.9 million in the fiscal year 1978/79 to Rs 5,130 million in the fiscal year 1982/83.

Traditionally, India was Nepal's biggest trading partner in both imports and exports; but since the early 1970s Nepal began to diversify its trading partners with the result that its share of exports to India in the fiscal year 1982/83 receded to 73.6%. Its shares of exports to other countries in the fiscal year 1982/83 were increased to 7.9% for West Germany, 2.3% for U.S.S.R., 1.5% for U.S.A., 5% for the United Kingdom, 3.4% for Italy and 1% for Japan respectively.

Hardly any change in the export pattern is recognizable for a long time now. The key export products are still agricultural produce and basic raw materials.

What supports the Nepalese balance of international payments position are foreign loans, grant aids and income from tourism.

The Sixth Plan

The Sixth Five Year Plan of Nepal began in the fiscal year 1980/81 and will end in the fiscal year 1984/85. The agricultural policy of the Sixth Five Year Plan mainly emphasizes an increase in agricultural production, expansion of employment, maintenance of grain exports and stable supply of raw materials to agriculture-related industries. The Five Year Plan aims for a 3.2% per annum rise in the principal agricultural products, of which the target growth rate for grain production is set at 2.8% a year and for cash crops, 3.9% a year.

Following the Sixth Five Year Plan, the gist of the Seventh Five Year Plan has been sanctioned by the National Assembly. The Seventh Five Year Plan gives the impression of merely carrying over the basic strategies of the previous five year plan, being centered mostly around policies for stepping up production of food, increasing employment opportunities and promoting exports.

Of particular interest is the emphasis being given to the development of systems for horticulture products (fruit trees and vegetables), livestock farming and fish breeding next to the production increase of grains as the agricultural policy of the Seventh Five Year Plan. The Seventh Five Year Plan not only attempts to increase the income of those in the mountainous and hilly region, to correct the income disparity between these people in the mountainous and hilly region and the farmers in the Terai plain region, to increase employment opportunities and to step up production of export products, but to realize and reflect the results of the horticultural research development implemented under the Sixth Plan to contribute to the improvement of the people's nutritive level of food intake.

Trends in Foreign Aid

Nepal has been the recipient of foreign aids for its development projects since 1951, and the amount that it has received in aid over the past 33 years (until the fiscal year 1982/83) has reached Rs 14,643.8 million.

At present (the fiscal year 1982/83), foreign aids, that consist of grant aids and loans, account for 52% of government expenditures and 75% of development funds. (Refer to Table 2-4)

The pattern of aid is three-quarters in grant aids and the rest in loans.

When bilateral aid and the aid from international organizations are compared, the former was the major source of fund until the fiscal year 1981/82, but in the fiscal year 1982/83, aid from international organizations came to account for a larger share. Of the total amount of foreign aid granted in the fiscal year 1982/83, the aid from international organizations accounted for 57% (which was 47% in 1981/82 and 45% in 1980/81). (Refer to Table 2-5)

Foreign aids for the various development projects of Nepal is mostly concentrated in such sectors as transport, power and communications. Since the road and communications networks were already considerably improved by the time the Fourth Five Year Plan was completed, the Fifth Five Year Plan allocated 33% of the total expenditures to agriculture with emphasis on agricultural production and development of domestic industries and small scale industries. However, the allocation of foreign aid did not coincide with the said national policy, and the fund from the foreign aids was allocated in accordance with the conventional development pattern. Lately, however, production projects began to be implemented with the aids of China, U.S.S.R. and ADB, although number and amount of such projects and foreign aids are still not enough for the development of Nepal's economy. (Refer to Table 2-6).

Table 2-4 Gross Government Expenditures, Foreign Aids and The Share of Foreign Aids

(Units in million Rps.)

Fiscal Year	Gross Government Expenditures (Current accounts & development expenditures)	Foreign Aid		Total	Share of Foreign Aids in Total Expenditures (%)	Share of Foreign Aids in Development Expenditures (%)
		Grants	Loans			
1975/76	1,913.36	392.61	167.32	559.93	23.9	37.2
1980/81	4,092.26	868.91	693.32	1,562.23	38.2	57.2
1981/82	5,361.31	993.30	729.88	1,723.18	32.1	46.2
1982/83	6,949.10	1,608.30	2,019.40	3,628.00	52.2	75.4

Source: (1) Foreign Aid Development in Nepal. (Oct. 1983)
(2) Economy Survey 1982/83.

Table 2-5 Amount of Foreign Aid by Type (on an Execution Basis)

(Units in million Rs.)

Fiscal Year	1979/80	1980/81	1981/82	1982/83
Bilateral	846.4	858.1	909.5	1,534.1
(Grants)	696.4	707.1	799.6	1,277.3
(Loans)	149.0	151.0	109.9	256.8
International Organizations	494.1	704.1	813.7	2,093.9
(Grants)	108.1	161.8	193.7	331.0
(Loans)	385.3	542.3	620.0	1,762.0
Total	1,340.5	1,562.2	1,723.2	3.628.0
(Grants)	805.6	868.9	993.3	1,608.3
(Loans)	534.9	693.3	729.9	2,019.7

Source: Economic Survey 1982/83.

Table 2-6 Foreign Aid to Projects in the Public Sector

Project/Enterprise	Donor Nation	Class of Trade
Basbari Leather & Shoe Factory	China	Foot wear and leather processing
Birganj Sugar Refinery	U.S.S.R.	Sugar & alcohol
Janakpur Tobacco Factory	U.S.S.R.	Cigarette
Harisidhi Brick & Tile Factory	China	Brick and tile
Bhaktapur Brick Factory	China	Brick
Hetauda Textile Mill	China	Cotton cloth
Hetauda Cement Mill	ADB loan	Cement
Nepal Metal Company	India	Fabricated lead
Bhrikuti Paper Mill	China	Paper
Lumbini Sugar Refinery	China	Sugar
Nepal Paper Mill	ADB loan	Paper

Source: Industrial Service Centre, Kathmandu

2-3 Prevalent State of Agriculture in Nepal

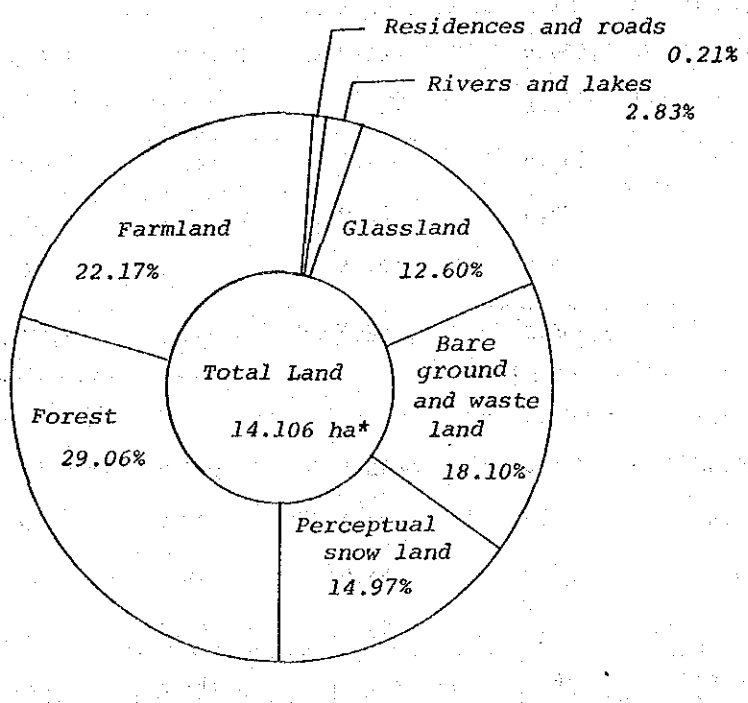
2-3-1 General Situation

1) Land Use and Crop Composition

As the land utilization in Nepal, 22.2% of total land in Nepal is cultivated farmland (3,130 thousand ha), 29.1% forest (4,100 thousand ha) and 12.7% grass land (1,760 thousand ha), whereas 18% is waste land or bare land (2,550 thousand ha) and 15% perpetual snow land (2,110 thousand ha) with the latter two which are unsuitable for cultivation accounting for one-third of the total national land.

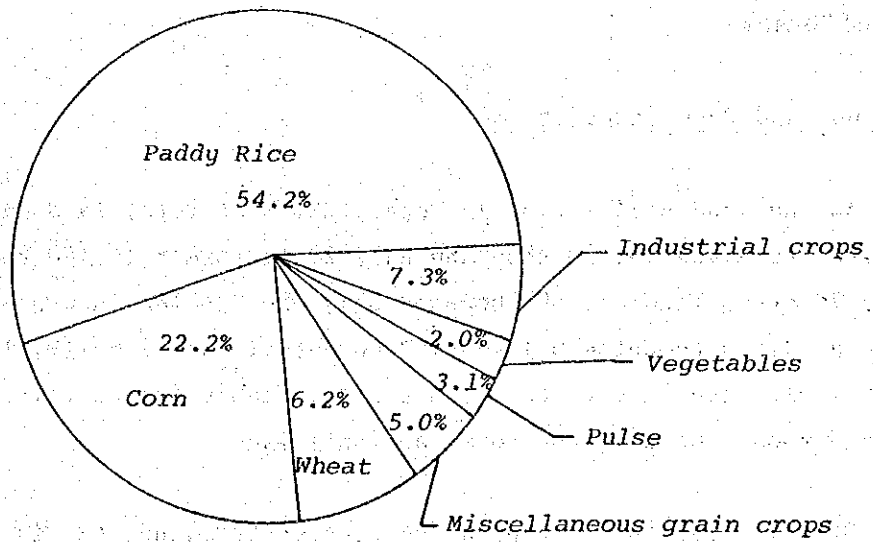
Of the 3,130 thousand ha of cultivated farmland, 62% is in Terai plain region and 38% in the mountainous and hilly region, and the farmlands that are being newly cultivated extend even to the steeply inclined terrain. (Refer to Fig. 2-1)

Fig. 2-1 Land Use in Nepal



Source: M.D. Joshi, Environment of Nepal (1981)
Unit: *million

Fig. 2-2 Ratios of Planted Area by Type of Crop



Source: Natural Envrionment and Crop Distribution in Nepal by K.B. RAJBHANDARY

Table 2-7 Production of Principal Agricultural Products

(Units in thousand tons)

Fiscal Year	1979/80	1980/81	1981/82	1982/83
Rice	2,059.9	2,464.3	2,560.1	1,832.6
Corn	553.8	742.9	751.5	718.2
Wheat	439.9	477.2	525.9	660.4
Barley	23.3	23.0	23.3	20.9
Millet	119.3	121.5	121.7	121.1
Total	3,196.2	3,828.9	3,982.5	3,353.2
Cash Crops				
Sugar Cane	384.4	483.4	590.0	638.3
Oil Seeds	61.9	77.1	79.1	69.4
Tabacco	55.0	54.9	48.2	66.6
Jute	67.5	59.3	42.7	31.1
White Potato	278.4	275.2	319.8	374.6

Source: Food & Agriculture Marketing Services Department.
Jute Development & Trading Corporation.

The production pattern of crops is overwhelmingly dominated by 50% share of paddy rice, followed by corn, wheat and then miscellaneous grain crops. In terms of planted area, it is no exaggeration to say that paddy rice and corn constitute the main diet in Nepal. (Refer to Fig. 2-2)

The grain production volume in Nepal is around 4,000 thousand tons a year. The fiscal year 1981/82 was year of poor crop with 3,221 thousand tons, but production is improving, though only slightly; for instance, the production volume of 3,934 thousand tons in the fiscal year 1980/81 increased to 4,302 thousand tons in the fiscal year 1982/83. The staple food of the Nepalese people is rice which accounts for 50 to 60% of total grain production, followed by corn (19-21%) and wheat (13-19%).

Pulse crops are indispensable as food in Nepal as in India. It is the main ingredient of the dal dishes and constitutes an important supply source of vegetable protein. There are many varieties of them, including climbing peas and beans.

Industrial crops occupy an important position as cash crops for foreign trade mainly with India and account for 7.3% of the total planted area. In cash crops, sugar cane is dominant, with a continuous increase in production during the five years from the fiscal year 1977/78 to the fiscal year 1982/83. The production of other cash crops of oil seeds, jute, potato and tobacco has fluctuated wildly in the last five years. (Refer to Table 2-7)

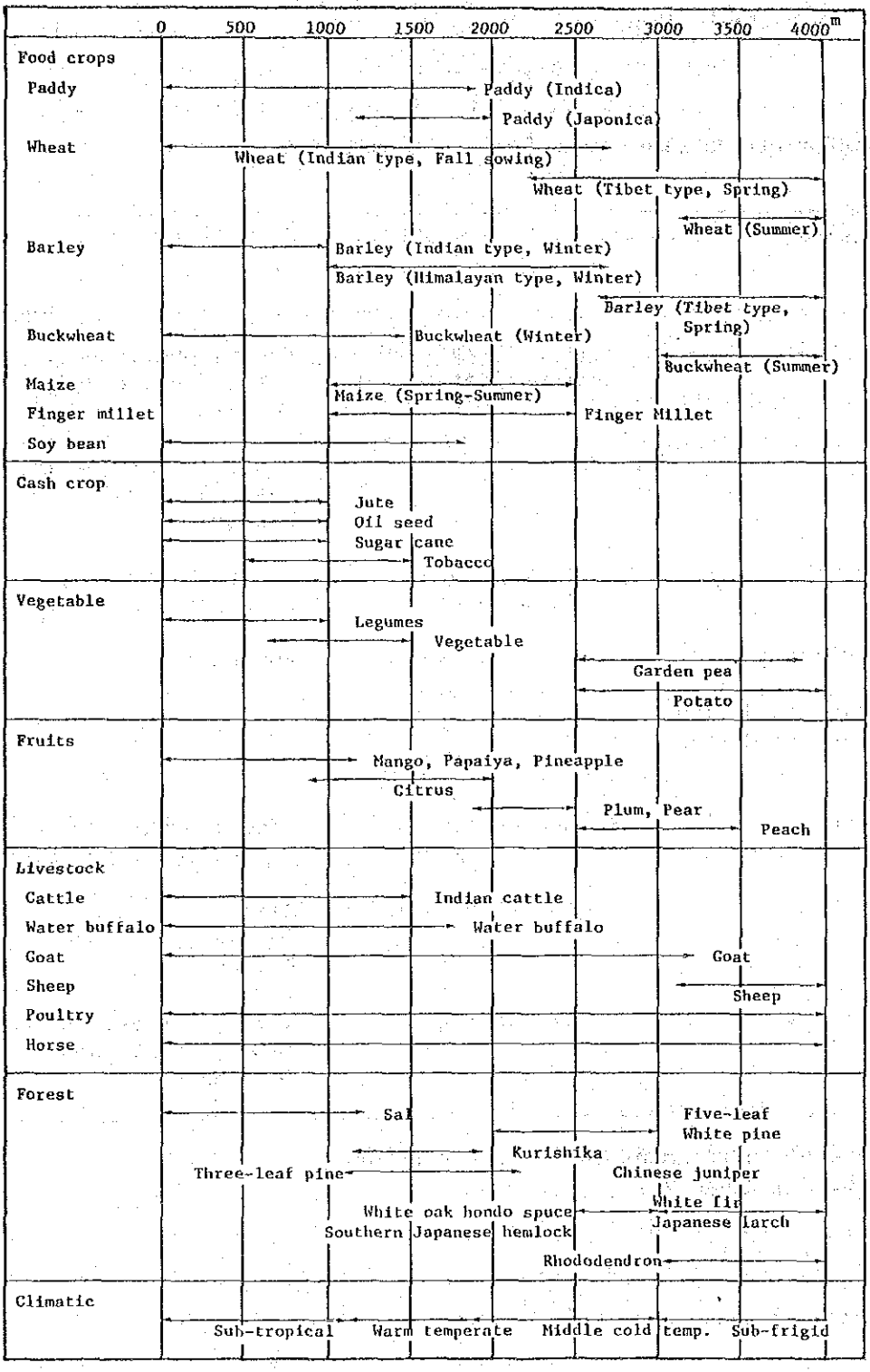
Commercial production of vegetables seems to be limited to the surroundings of Kathmandu and around other cities scattered throughout the country. The planted areas are not very large. However, every farm household has its own vegetable garden around the house for its own consumption, and if these are included in the statistical data, the area would actually be fairly large.

The planted varieties of vegetables are many, being as many as 104, but they are not extensively cultivated throughout the country; nor have they reached the stage of satisfying demand. The vegetables sold in

the Kathmandu market are only pumpkin and 20 to 30 varieties of root crops, which almost all of the other vegetables are imported from India. Cucumber and radish are cultivated almost in every part of the country.

Fruit trees are presumed to be cultivated on a land area of 36,470 ha. In the tropical regions including Terai, mango is mainly cultivated. Also, banana, papaya, litchii and guava are cultivated on a relatively large scale. Various citrus fruits are cultivated in the subtropical zone between the elevations of 300 m and 1,200 m above sea level, peach, pear, plum, apricot, pomegranate, etc. in the temperate zone between 1,200 m and 2,100 m in elevation and persimon and chestnut in the mountains of around 1,200 m in elevation. Also, apple, pear, hard fruits such as almond and walnut are cultivated in zones above 1,200 m in elevation; however, those which are on the market are mostly imported from India for the locally produced fruits are far from adequate to satisfy the Nepalese people's consumption of 20 kg per capita per annum. However, the cultivation of grape which was first introduced by a Japanese pomiculture expert quickly spread throughout the environs of Nepalgunj, and the cultivated area today is already 82 ha. (Refer to Table 2-8)

Table 2-8 Distribution of Crops and Livestock as Determined by Altitude and Climatic Variations



2) Soil Condition

There is not enough accumulation of data on classification of soil in Nepal, but in general, it is broadly classified into five major categories as in Table 2-9.

Table 2-9 Classification and Distribution of Soil and Crops Cultivated

Classification of Soil	Region	Cultivated Crops
1. Alluvial Soils	a. Eastern Terai and narrow river basins	Paddy, Sugarcane, Jute, Tobacco and Mustard
	b. Wester Terai	Paddy, Wheat, Barley Sugarcane, Potato and Mustard.
	c. Lower region of Eastern Terai	Paddy, Sugarcane, Jute and Tabacco
2. Sandy Boulder Soils (Generally mixed with ferruginous sand and clays.)	Inner Terai region	Forest Area
3. Lacustrine Soil with top clay soil	Kathmandu and Pokhara Valleys	Paddy, Wheat, Maize Potato and Vegetables
4. Diluvial Soil	Slope of the hills	Maize, Buckwheat Soyabean, Tea and Fruits
5. Glacial Soils	Himalayan regions	Wheat, Barley, Potato Beans, Fruits and Vegetables

Source: Natural Environment and Crop Distribution in Nepal by K.B. Rajbhandary.

The land in the southern area of Terai plains is consist of relatively new alluvial soils where the agricultural production is done in a large scale. The soil in Inner Terai area is sandy soil with much iron content, while the soil in Kathmandu and Pokhara Valley is the so-called lacustrine hydromorphic sediment. The soil of the hilly regions further north is alluvial soil formed in the Quaternary Period which is generally fairly strong in acidity and poor in fertility. (Refer to Fig. 2-3)

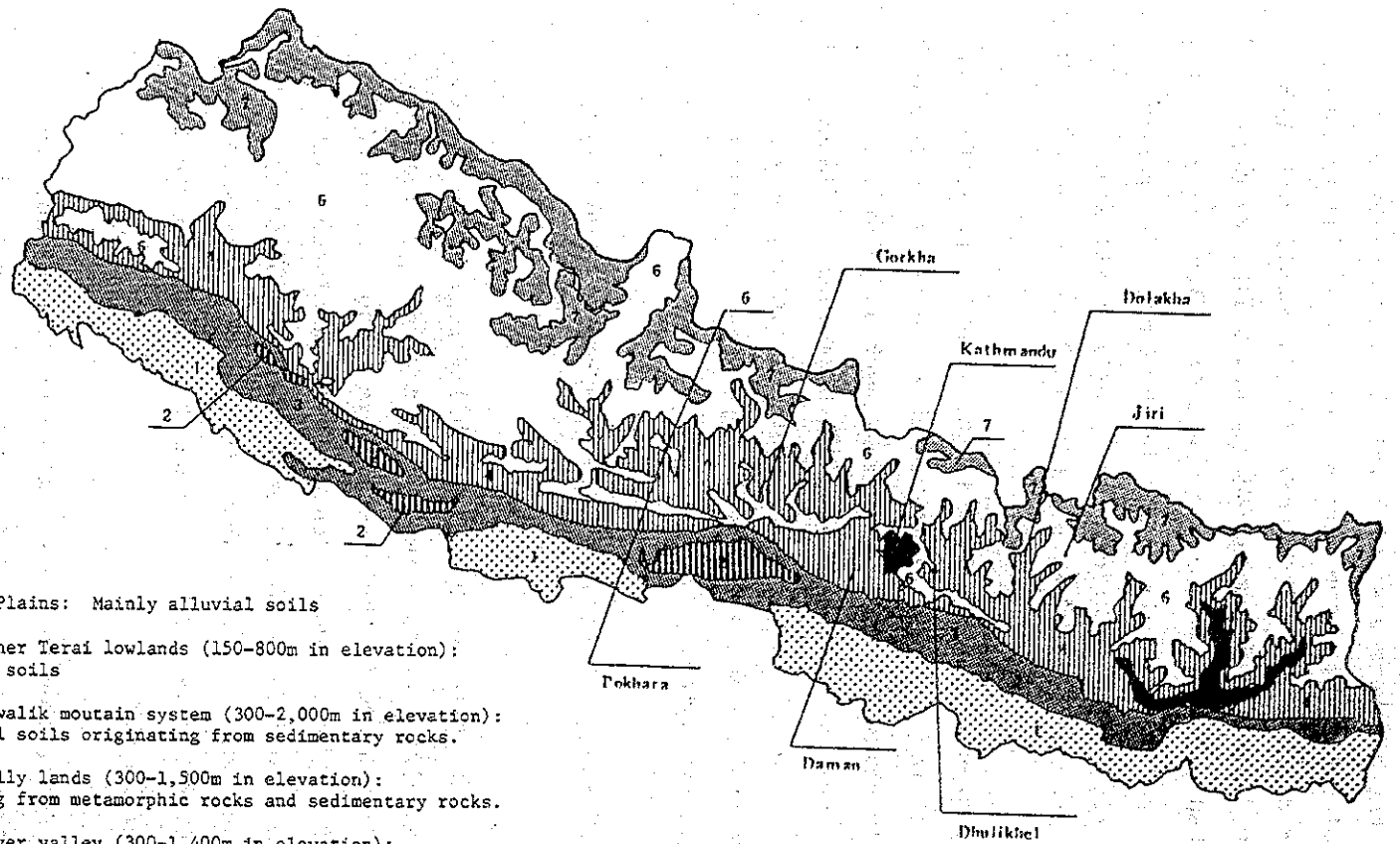
The most important as arable land is the alluvial soil that spreads over the entire area of Terai plains which is suited to cultivation of principal grain crops and some cash crops such as paddy rice, sugar cane, jute, tobacco, etc. The lacustrine hydromorphic sediment zones in the inland valleys are also suitable for cultivating many dry-field crops and vegetables and are next in importance to alluvial soils for agricultural development.

3) Agriculture in the Central Hilly Regions and Northern Mountainous Regions

Although the situation in the central hilly regions and northern mountainous regions differ by each small area according to altitude, topography and resource endowment, these regions as a whole accommodate two-thirds of the nation's total population on their farmlands which constitute one third of the total farmland of Nepal. The population density is 1,500 persons per 1 km^2 of arable land, or in other words, the cultivated area per household is only 0.4 ha which is much too small to attain self-sufficiency in food.

And, as the population in these regions still continues to grow, the land is continuing to be subdivided into even smaller lots. The principal crops are corn (36%), rice (26%), wheat (14%) and foxtail millet (11%). Land reclamation in the hilly regions had reached even the steeply inclined slopes of the mountains so that further expansion of farmland is almost impossible when future development is considered. It is therefore necessary to consider advancing into new areas related to improvements in farming technology, such as the systematic inducement of

Fig. 2-3 Soils in Nepal



1. Soils in Terai Plains: Mainly alluvial soils
2. Soils in the Inner Terai lowlands (150-800m in elevation): Mainly alluvial soils
3. Soils in the Siwalik moutain system (300-2,000m in elevation): Mainly colluvial soils originating from sedimentary rocks.
4. Soils in the hilly lands (300-1,500m in elevation): Soils orginating from metamorphic rocks and sedimentary rocks.
5. Soils in the river valley (300-1,400m in elevation): Soils of river terraces and alluvial area.
6. Soils in the mountainous lands (1,500-5,000m in elevation): Soils originating from igneous rocks and metamorphic rocks.
7. Soils in the Great Himalayas (1,500-8,000m in elevation): Mountain soil

Source: NEPAL, Atlas of Economic Development (1980)

domestic animals, the selection of appropriate varieties and qualities of crops, the input of fertilizers and insecticides and the diffusion of irrigation or into the area of agricultural products processing.

2-3-2 Administrative System

Administratively, the Kingdom of Nepal is divided into 14 zones and 75 districts. Each zone consists of four to five districts. (Refer to Fig. 2-4)

The Kingdom of Nepal today is under the reign of King Birendra Bir Bikram Shah Dev who rules the country through a council of ministers headed by a Prime Minister on the basis of Panchayet Democracy. There are 19 ministries headed by ministers who directly report to the Prime Minister. In addition, there are seven organizations which directly report to the King. (Refer to Fig. 2-5)

As for agriculture, the Ministry of Agriculture is headed by the Minister of Agriculture and it enforces all agricultural policies and administration. The Ministry of Agriculture consists of 3 departments, 1 laboratory and 7 corporation.

Fig. 2-4 Administrative Division of Nepal

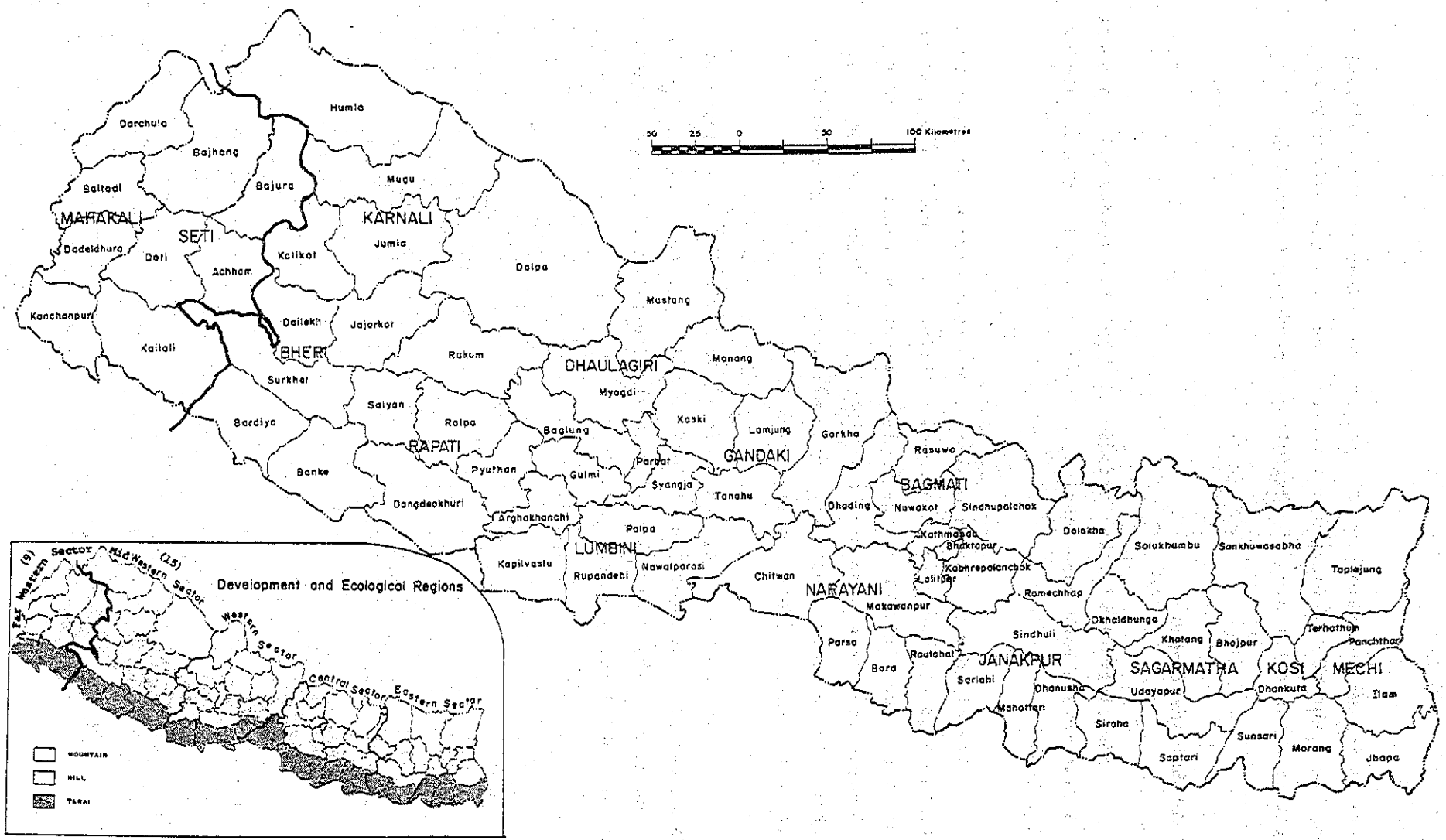
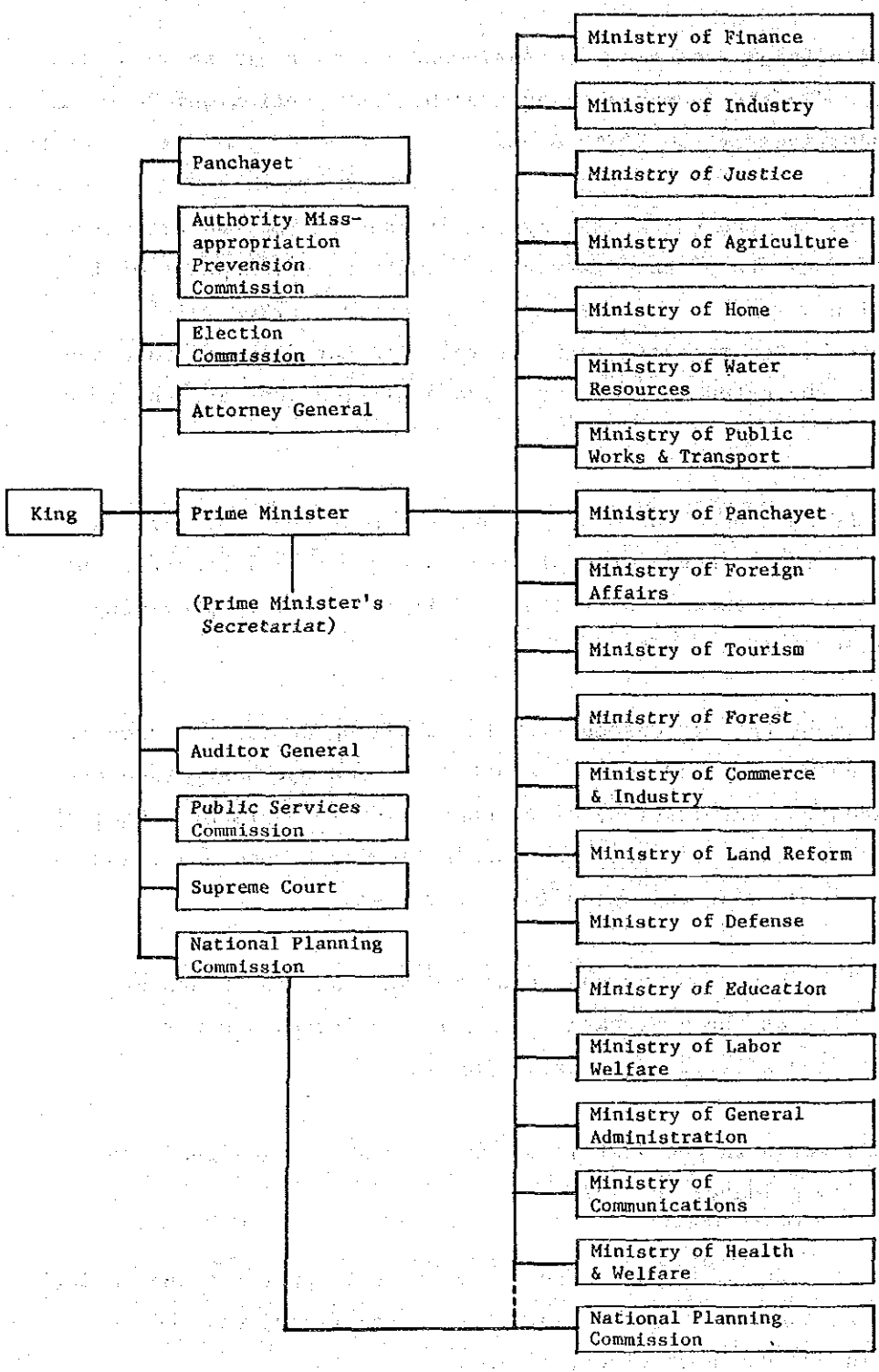


Fig. 2-5


King
Prime Minister
(Prime Minister's Secretariat)
Panchayet
Authority Miss-appropriation Prevension Commission
Election Commission
Attorney General
Auditor General
Public Services Commission
Supreme Court
National Planning Commission
Ministry of Finance
Ministry of Industry
Ministry of Justice
Ministry of Agriculture
Ministry of Home
Ministry of Water Resources
Ministry of Public Works & Transport
Ministry of Panchayet
Ministry of Foreign Affairs
Ministry of Tourism
Ministry of Forest
Ministry of Commerce & Industry
Ministry of Land Reform
Ministry of Defense
Ministry of Education
Ministry of Labor Welfare
Ministry of General Administration
Ministry of Communications
Ministry of Health & Welfare
National Planning Commission

2-3-3 Extension Services, Research and Education

1) Extension Services

Agricultural extension is considered important in this country for achieving a drastic increase in agricultural production which is the one of the objectives of the Sixth Plan.

Currently, the three-tier system is adopted for the extension personnel. It consists of the district agricultural development officer (ADO), extension worker (JT) and assistant extension worker (JTA). In unorganized areas, the regional agricultural director (RAD) of each zone directly guides the extension workers. The qualifications and the roles of each are:

(1) An ADO must be a university graduate (four-year course) and registered as a gazetted officer in the Official Gazette. He maps out an extension program and implement it by providing guidance to JTs/JTAs.

(2) A JT must have graduated from the training school attached to the university and must be a SLC (a person who has passed the graduation examination) after completing 10 years of schooling, or a JTA who has passed the examination to become a JT, and is a nucleus of actual extension activities.

(3) A JTA is a person who has completed at least one month of training at the government training institute, and performs extension activities by assisting JT.

(4) A RAD works in the districts, where no ADO is assigned, to provide guidance to JTs/JTAs.

However, these JTs/JTAs are not quite yet competent due to lack of actual experiences in extension services on the field, and need to undergo more intensive in-service training.

Those of RAD, ADO or JT class usually understand English but most of those in the JTA class do not seem to understand it. 100 to 120 JTs/JTAs are employed each year.

Nepal is administratively divided into 5 development regions, 14 zones and 75 districts, and there are also about 4,000 villages, or panchayets (self-governing body of a village) with each panchayet being composed of a few to several wards.

The extension service organization in this country in principle adopts the unit of administrative division as a unit area for extension service coverage, and in accordance with the administrative system of the national government, structures the agricultural extension service system in the three levels of central, region and district and village.

The following points may be enumerated as the organizational characteristics of the extension service system of this country.

(1) At the central level, the extension service is directed and promoted by the Dept. of Agriculture, but the responsibility for its implementation and operation are shared between the respective deputy director general (D.D.G.) of the Agricultural Extension and Training, the Crop Research and Horticulture and Fisheries. The Agricultural Extension and Training Division controls and directs agricultural development and general extension works. The D.D.G. (Crop Research) and D.D.G. (Horticulture and Fisheries) oversee the major crop research stations, horticulture research stations and Fis-Farm respectively and play the role of promoting the diffusion of techniques mainly at the village level.

(2) At the regional level, RAD acts as go-between for the central government and field offices in each district, mainly bears the responsibility for preparation, adjustment and guidance of agricultural development program for each district under its jurisdiction and for supervision of its implementation as well as for provision of administrative support, supervision and

guidance to the general extension activities of the District Agricultural Development Offices (ADO) all in line with the central government's policy.

(3) At the district and village level, JT and JTA act extension services centered around ADO which is placed for each district.

The total number of villages in this country is about 4,000, and the average number of farm households is said to be in the range of 300 to 400 per village. Total number of the JT and JTA positions are 7,700. However, the actual number is said to be about less than 7,000. Accordingly, the area served per extension worker is six villages on average or in terms of the number of farm households, about 2,000 to 2,500 households.

2) Agricultural Research

Since the research and experiment institutions were established not very long ago, and also due to the small number of technical experts, the prevalent state is such that Nepal is limited in its ability to carry out any new experiment for practical application.

In the 1980's, however, greatly desired for the development of agriculture on the Terai plains are the promotion of a large scale irrigation project, the creation of superior varieties to match its newly improved environment; and also desired for the development of agriculture in the hilly and mountainous regions are the promotion of comprehensive stabilization measures for the progressive farmers, such as the development of new agricultural technologies to match the environmental improvements - such as the small scale irrigation and drainage works - , the construction of roads to connect the villages in the valleys, the installation of new storage and distribution facilities, the development of pomiculture and the stabilization of agricultural product prices.

The existing agricultural research and experiment institutions are as listed on Table 2-10.

Table 2-10 *Agricultural Experiment and Research Institutions*

HIS MAJESTY'S GOVERNMENT OF NEPAL
FRUITS FARMS/STATIONS

1. Temperate Farms/Stations:

1-1 Horticulture Farm; Daman, District Makwanpur
1-2 Horticulture Farm; Godavary, District Latipur
1-3 Horticulture Farm; Helambu, District Sindhupalchowk
1-4 Horticulture Farm; Darma, District Humla
1-5 Agricultural Station; Jiri, District Dolakha
1-6 Horticulture Farm; Jumla, District Jumla
1-7 Agriculture Farm; Kakani, District Nuwakot
1-8 Horticulture Research Station; Kirtipur, District Kathmandu
1-9 Agriculture Station; Marpha, District Mustang
1-10 Agriculture Farm; Dhunche, District Rasuwa
1-11 Horticulture Farm; Satbanj, District Baitadi
1-12 Horticulture Farm; Solukhumbu, District Solukhumbu

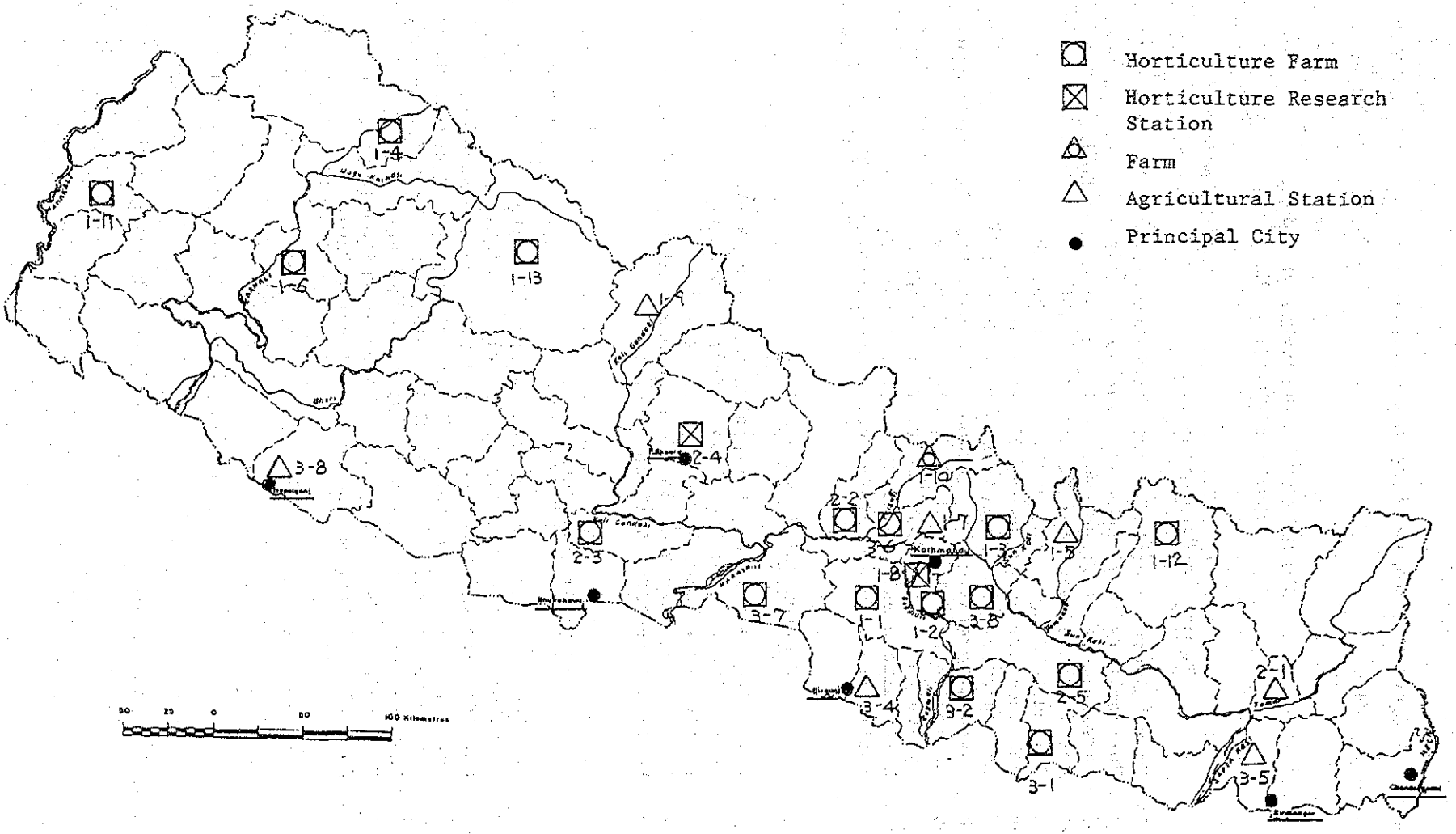
2. Subtropical Farms/Stations:

2-1 Agricultural Station; Paripatle, District Dhankuta
2-2 Horticulture Farm; Dhunibesi, District Dhading
2-3 Horticulture Farm; Tansen, District Palpa
2-4 Horticulture Research Station; Pokhara, District Kaski
2-5 Horticulture Farm; Dailekh District

3. Tropical Farms/Stations:

3-1 Horticulture Farm; Janakpur, District Dhanusha
3-2 Horticulture Farm; Nawalpur, District Sarlahi
3-3 Horticulture Farm; Panchkhal, District Kavrepalanchowk
3-4 Agricultural Station (Hort. Unit); Parwanipur, District Bara
3-5 Agricultural Station (Hort. Unit); Tarahara, District Sunsary
3-6 Horticulture Farm; Trishuli, District Nuwakot
3-7 Horticulture Farm; Yagyapuri, District Chitwan
3-8 Agricultural Station; Nepalgunj District Banke

Fig. 2-6 Location Map of Horticulture Farms, Horticulture Research Stations and Agricultural Experiment Stations



3) Outline of Agricultural Education

Considering the development of the Nepalese economy, the role played by agricultural education is extremely large. Agricultural education consists of the Institute of Agriculture and Animal Science (IAAS) under Tribhuwan University.

(1) IAAS

IAAS of Tribhuwan University located at Chitwan in the Western Region is the only Institute dedicated to agriculture training. The IAAS offers a course on general agricultural science including horticultural science, and about half of its graduates engaged in extension services are employed as ADOs. As the figures released by the Ministry of Education and Culture show, the number of new entrants to IAAS is increasing yearly.

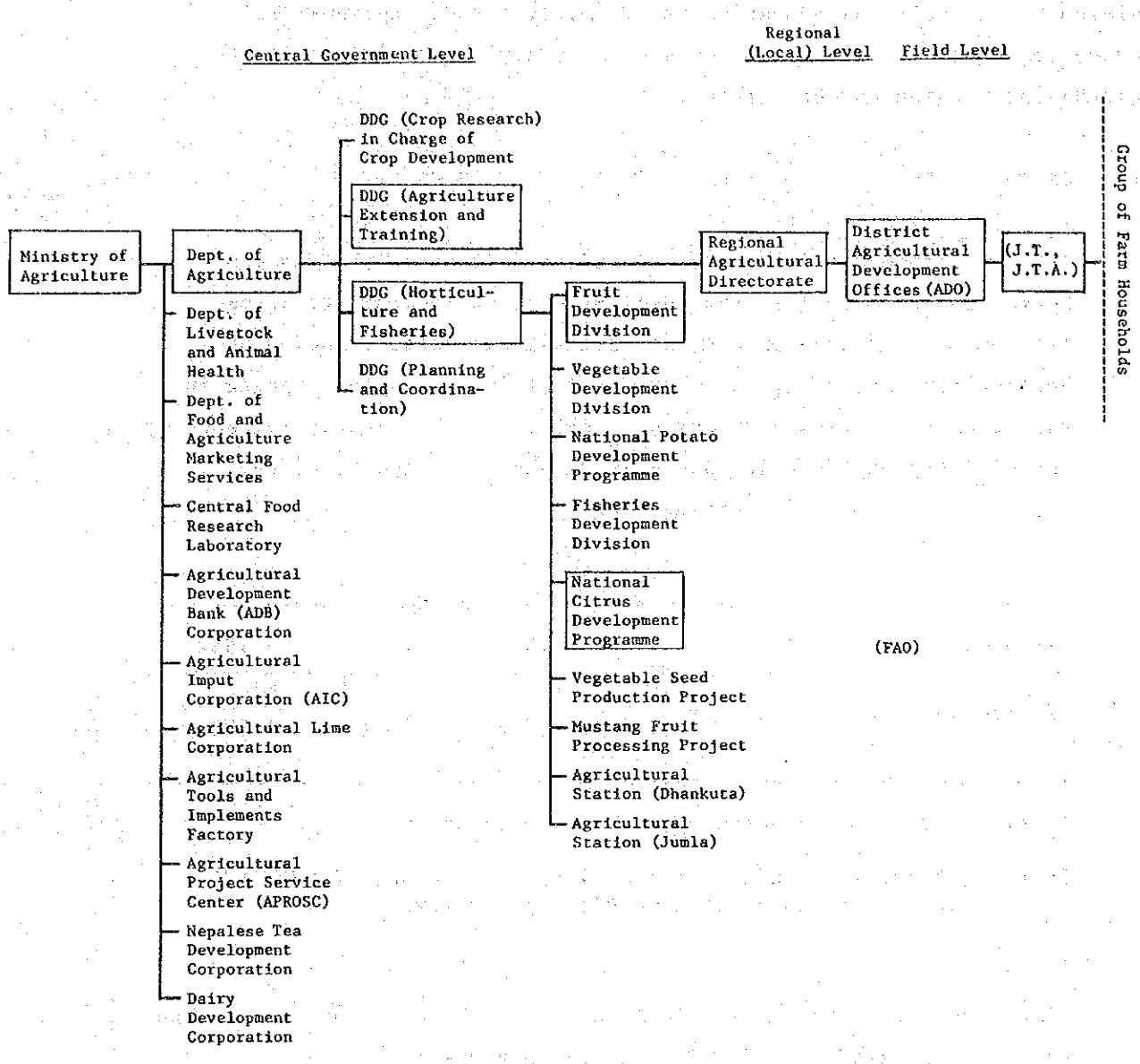
Fiscal Year	1978	1979	1980	1981	1982
No. of enrollees to IAAS	874	1,094	1,040	923 (9)	1,322 (16)

Note: Figures in parentheses are female students.

Source: Educational Statistics of Nepal at a glance (1978-1982)
H.M.G. Ministry of Education and Culture

IAAS gives training for middle level technicians (JT/JTA). It sends out about 30 graduates as JTs and JTAs every year.

Fig. 2-7 Organization of Ministry of Agriculture



2-3-4 Development Plan

The development plan in its initial stage was promoted with major emphasis on transportation which was considered to be the basis for economic development. However, ever since the Third Plan, a considerable amount of fund came to be invested in agriculture upon the recognition that it was agriculture that was the mainstay that supports the Nepalese economy.

The agricultural policy of the Sixth Plan places major emphasis on increase of agricultural production, expansion of employment, maintenance of grain exports and stable supply of raw materials to the agriculture-related industries, and the Plan, under which development projects have been implemented, is already about to enter its last year.

Expansion of field crop production is realizable by the introduction and extension of modern agricultural techniques such as breeding of improved varieties and application of chemical fertilizers, but also necessary for its agricultural development program, besides these technical matters which directly support production, are the improvements in basic conditions, and these are found incorporated as the central items of plan. For instance, as a measure to improve the knowledge of the farmers and inspire their willingness to work, it provides for technical training and organizational reform of the extension service system. The plan also refers to the need for a detailed investigation and review to establish the optimum scale of operational holdings per farm household that matches the climate and the its location instead of simply applying a uniform system of land ownership reformations since productivity differs greatly depending on the particular area and the crops cultivated.

The fund lending system for the petty farmers who lack the financial resources is one of the characteristics of the agricultural development program of the Government of Nepal, and the system is gradually taking effect.

In the Sixth Plan, 30% of the nation's development budget is allocated to the agricultural development program, of which about one third is applied to the agricultural sector and about a half to the irrigation sector. The major development projects are the Second Phase Mahakali Development Project, the production program for the existing cultivated land, and the agricultural research and extension program, the Sunsari Morang Irrigation Project, the Mahakali Irrigation Project.

The major development projects under foreign aid are as follows:

(1) Pokhara Regional Agricultural Training Service Center - West Germany

Technical training and services in agriculture in general are offered to the farmers in Pokhara Region.

(2) Janakpur Agricultural Development Project (JADP) - Japan

The project covers a total of five districts as its project areas, three in the southern Terai plains and two in the intermediate mountainous region, and under this project, Japan has implemented the construction of regional development centers and extension farms, groundwater irrigation by means of deep and shallow wells for model villages, and training of farmers and extension workers in new techniques to match the new improvements in environment, etc.

(3) Swiss Agricultural Technology Assistance (SATA) - Switzerland

The Swiss program mainly centers around the construction of a mountain livestock industry improvement center in a certain district in the northern mountainous region. It is also cooperating in the opening of the road for transport and connection to the mountainous region and in the construction of a primary school in a remote area.

(4) Integrated Cereals Project (ICP) - U.S.A.

It involves the technical cooperation to the central experiment stations for major crops located at seven places throughout the country. At present, it is also cooperating in the construction of a laboratory block, experimental farm for practical application as well as other facilities mainly at Parwanipur Paddy Research Station; in the training of technicians for research and experiment; in the mini-kit program (a program to distribute packages that contain seeds of superior varieties and fertilizers with instructions to farmers to have them cooperate in local trial cultivation); and also in the training of farmers and extension workers in techniques and extension work.

The implementation of the foregoing regional agricultural development programs of international dimensions are contributing to the modernization of the development bases in the local regions which had been neglected heretofore, and serve for the remote regions in the extreme west, the development and extension bases of this country at the regional level are now considered to be in good shape in terms of facilities and equipment. However, facility improvement and the assignment of technical personnel for the extension offices, extension farms, seed and seedling producing farms of villages have not been touched yet. There is practically no new technique that has yet penetrated the terminal end of the extension organization or any results of experiments in practical application that had been diffused among the extension farms of the villages.

2-4 National Horticulture Development Program

2-4-1 General Situation of Horticulture

Nepal has natural conditions favorable to the growth of fruit trees so that fruits have been cultivated since ancient times. However, those have never been cultivated by the farmers as commercial agricultural products but only for their own consumption and for their village. The per capita fruit consumption in Nepal is said to be about 20.2 kg per year.

Various factors are conceivable as reasons why large scale orchards have never been developed in the past, but the foremost reason may be the fact that the country had been long closed to foreigners. There was hardly any road until 1951 or any other means of access to the cities so that the movement of people and flow of commodities were quite limited. Secondly, because fruits are easily damaged when handled and transported in bulk, no one produced in a large scale as commercial merchandise.

As a result, fruits were never cultivated in large quantities as marketable products. What are produced are only a tropical and sub-tropical fruits. The reason that a few number of orchards did exist was only because fruits were necessary for religious and social events and not because there was any economic demand for them.

In the hilly and mountainous regions between 900 to 1,500 m in elevation, a citrus called "suntala", which is a fruit of the same kind as mandarin or tangerine orange, is produced in large quantities. It has been produced since ancient times at Illam, Dhankuta, Bhojpur, Sindhuli, Pokhara and Dailekh, and because of its excellent quality and superior commercial value, its cultivation has been rapidly expanded lately.

Another Nepalese citrus is the "junar". This one is genealogically called Citrus sinensis of Mosumhi Genus and is an original local variety of Nepal. It is very sweet and juicy and compares quite well with any other orange in the world. At present, it is being pro-

duced on a limited scale in a part of Dhankuta, Bhojpur, Sindhuli and Ramechhap. Also, citrus fruits such as lemon (Citrus limon and Citrus jambhili), Kagzilime (Citrus auran tifolia), Pummelo or Shaddock (Citrus grandis), Sweet lime (Citrus limetoides), Citron (Citrus medica), Bitter orange (Citrus aurantiun) and Kumguat (Fortunella japonica) are cultivated in the gardens of homes in all of Nepal to be eaten daily or as an offering at festivals. Since suntala and junar are both excellent in quality, those are quite exportable to foreign markets. Those are therefore quite valuable as the main fruits to be developed. Regarding grape, the Government of Nepal intends to develop it as a newly introduced fruit and to expand its producing areas in Manang and Mustan to increase the planting of varieties for wine as a step toward winery production in Nepal. For the time being, however, it plans to extend the cultivation of table varieties such as Olympia, Cambell, Delaware, and Kyoho in the Banke and Berdia areas. Incidentally, the place of origin for European grapes is said to be Trans-Caucasus. Grapes in Japan were first introduced from China, but they were of European varieties. However, the varieties of grape improved in Japan are adaptable to the climatic conditions in Nepal and are expected to play the leading role in the horticulture development program in Nepal.

2-4-2 Horticulture Development Program

In Nepal, citrus fruits such as junar and suntala are main fruits. And now, the Government has mapped out a horticulture development program to develop the mountainous and hilly regions which are unsuitable for cereal cultivation in accordance with the foregoing objectives of the Sixth Plan.

The Government expects to gain large benefits from this program as an initial input to create the favorable effects subsequently - namely to give the farmers in the mountainous and hilly regions a new means by which to earn cash and thus correct the regional income disparity; to recover the national land that has been devastated by the cutting of forest trees; and to contribute to improving the people's nutrition.

Horticultural crops, particularly fruit trees have larger leaf areas by comparison to other crops, so that the ratio of ground surface covered by leaves, twigs and branches is larger.

This is an advantage because when their leaves, twigs and branches naturally fall and accumulate on the ground and their nutrients begin to circulate in the soils, they would improve micrometeorology and prevent erosion by rain and wind by virtue of improved organic growth environment.

Regarding improvement of the people's nutrition: - Nepal today is one of the countries with the highest disease ratio and the poorest nutritive conditions in Asia and the people's life expectancy is therefore short. (Refer to Table 2-11). As a result of efforts to improve nutrition and public hygiene, the life expectancy of infants was extended from 37 years in 1960 to 45 years by 1977, and the child death rate was also reduced from 200/1,000 to 154/1,000. But, the nutrition level is declining again coupled with excessive population. It is because of the fact that horticulture development is now in the limelight, since increased production of fruits is believed to contribute greatly toward improvement in nutrition level of the Nepalese people.

Table 2-11 Health Indicators: Selected Countries a/

Country	Life Expectancy at Birth (Years)	Child Death Rate /b	Population per Physician	Percentage of Population with Access to Safe Water	Calorie Supply as % of Requirement /c
Nepal	45	23	38,700	9	95 /d
Bangladesh	47	23	11,400	53	92
Burma	52	15	5,400	17	103
India	51	18	3,100	33	89
Pakistan	51	17	3,800	29	93
Sri Lanka	69	2	6,200	20	91
Average, 37 lowest-income countries	50	19	10,300	28	91

Source: World Development Report, 1979 (World Bank), Annex Tables 21 and 22.

Note: /a Selected years, 1974-77.

/b Number of deaths per thousand per year among children aged 1 to 4.

/c Calories available as a percentage of calories required for normal levels of activity and health given the age, sex, and weight distribution of the population and the environmental temperature.

/d Table I-3 indicates a calorie surplus in the Terai; hence, for the 60% of the Nepalese population living in the Hills and Mountains, the calories supply as a percentage of requirements is substantially lower than 95%.

For the Terai plains which belong to the tropical zone, Nepal has requested EEC for its cooperation in a tropical horticulture development project. As for the mountainous regions, Nepal has requested Japan for its cooperation in a temperate pomiculture development project, in the hope of not only meeting domestic demand but earning foreign currency by producing exportable products.

The objectives of horticulture development projects are as follows:

1) Map out and implement programs to produce fruits at suitable places in the northern mountainous region.

2) Expand the production scale of seedlings to cope with the growing demand of fruit tree growers.

3) Develop facilities for the training of horticulture extension workers, technicians and leading growers.

4) Establish a distribution center for horticultural products in towns.

5) Develop and improve each infrastructure of the producing area of horticultural products in order to implement the fruit production program efficiently.

6) Construct facilities for fruit processing.

The foregoing development projects are, for example, improvement of the Sarlahi Horticulture Farm; establishment of the Kirtipur Horticultural Development Center; improvement of the Kirtipur Horticulture Research Station; construction of marketing facility; aid for production of seedlings; aid for construction of roads for transport from producing area; provision of vehicles for transport of products; aid for construction of irrigation systems. Among the above projects, the project for establishment of the Kirtipur Horticultural Development Center has been requested to Japan for its aid by Nepal.

The horticulture development projects are as follows:

1) Sarlahi Horticulture Farm

Sarlahi Horticulture Farm is in the Sarlahi district of Janakpur zone.

In order to promote the tropical horticulture development program, the Ministry of Agriculture has requested EEC for aid in the establishment of a development center and the construction of training facilities. It is also reviewing whether to specifically request EEC for technical cooperation in order to amplify and strengthen the functions of these facilities.

2) Kirtipur Horticulture Research Station

The Kirtipur Horticulture Research Station, consisting of horticulture research facilities, equipment and an orchard, was constructed on the present site in 1962 with the aid of the Indian Government and it has performed its functions since then as the development center of pomiculture technology for the entire country of Nepal and has been operated as the culturing technique training institute for growers. After 25 years of use, however, the Station is no longer functioning as it used to. The laboratory wing is already dilapidated, and water supply and electrical wiring are inadequate.

The Station offers short term training courses on horticulture (Refer to Table 4-1) by the use of the library and the fields of the Station, but the facilities and equipment for them are inadequate so that the contents of the courses are quite poor. Also, due to a shortage of technical staff, it is hampered in its activities of extending technology to the growers in the producing area.

3) Kirtipur Horticultural Development Center

The Ministry of Agriculture has planned the establishment of a horticultural development center in the compounds of the Kirtipur Horticulture Research Station to select suitable fruits, develop and establish cultivating techniques and carry out training to enhance quality of fruit tree technicians concerning the sub-tropical fruit trees (mainly grape and chestnut), and had requested Japan for its assistance. This center is to function as the technological development center of tropical fruit trees for the mountainous and hilly regions and also as the center for guidance in extension in pomiculture technology and it is also planned to

establish sub-center(s) for this Center. At the same time, the Center will give training of the developed techniques to the extension workers and leading growers and will also give travelling guidance periodically for technology expansion. It is planned that the Government of Japan will provide technical cooperation to this Project.

4) Horticulture Service Center

As pointed out in Par. 2-3-3, the section on extension services, research and education, ADO, JT and JTA are jointly working for extension of horticultural development, but due to immature technology and lack of headquarters for in-service practical training, the extension services for the participating grower are be fully carried out. As a solution, Nepal is considering the establishment of new horticulture technology centers in the producing areas in order to improve the various support systems for the horticulture production plan.

In order to provide effective technical guidance to the growers, each service center will be established for about 500 ha of orchard or vegetable producing area, and experienced JT will be assigned to each center to supervise the implementation of the program and offer effective technical service to the participating growers. The technical center will also provide the necessary agricultural inputs and credit at the necessary time to support the distribution of products. According to plan, the building of each center will have office accommodations for JT, a meeting room and a storeroom for agricultural inputs and implements.

The center will have dual functions. One is the foregoing production technology services and the other is guidance in such matters as the means to harvest and process in a short period at harvesting time, or to assure that equitable remuneration for production can be secured without fail.

The development plan for each kind of fruit is as follows:

1) Junar

It is a high quality citrus produced in Sindhuli and Ramechap areas and with a high potential for export. The planted area of 540 ha as of 1982/83 will be expanded to 3,200 ha by 1987/88.

2) Suntala

It is a citrus of high commercial value that has long been cultivated in the hilly regions. The planted area will be expanded to 1,000 ha by 1987/88 while efforts will also be made to extend the cultivating techniques to enhance its quality.

3) Grape

Grape is a newly introduced crop in Nepal, but because the western region is suited for cultivating it, trial cultivation has been started since two years ago at Banke and Bardia in the Terai plains and also at Manang in the hilly region.

* Banke, Bardia : Table grape, target for 1987/88 250 ha
* Manang : Grape for wine, target for 1987/88 120 ha

4) Chestnut

An improved variety will be planted on 200 ha of hilly land of the Kathmandu Valley by 1987/88.

5) Fruits in the Kathmandu Valley

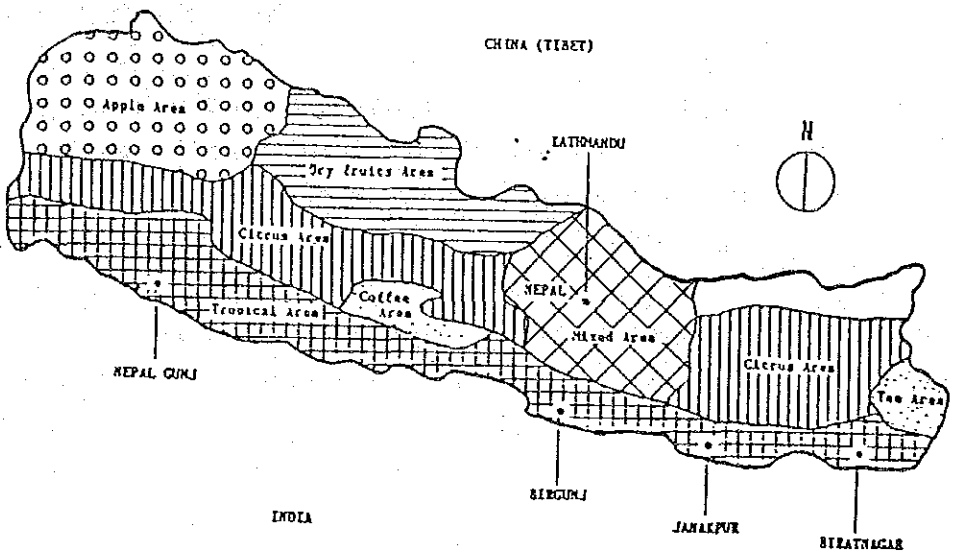
Kathmandu Valley is suited for growing pear, peach, plum and apricot. These fruits which are being imported from India now will be cultivated on 1,500 ha of land by 1987/88.

6) Vegetables

As demand for vegetables is rising in the town areas, various kinds of vegetables will be cultivated where suitable to each kind to meet demand.

Kathmandu Valley	500 ha
Dhading area	250 ha
Nuwakot area	850 ha
Kavrepalanchok	400 ha
	2,000 ha

Fig. 2-8 Distribution Map of Fruit Producing Areas



CHAPTER 3

PROJECT SITE

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3-1 Location of Project Site

The site planned for construction of the horticultural development center is located within the Ministry of Agriculture's Horticulture Research Station in Kirtipur which is about 4 km away toward the south from the center of Kathmandu, the capital city of Nepal.

Its surroundings have not been urbanized yet, and only a few private houses are spotted along the arterial road.

On the north side of the Horticulture Research Station, the campus of the Tribhuwan University lies in the large extent, and on the south side across the public road the Bagmati River flows. From the south to the west side beyond the villages and towns of Chobar, Panga and Kirtipur, there are mountains such as Bhanjyang, Campademi, Bhasmesmar that stand as high as between 1,800 m to 2,500 m above sea level.

The Horticulture Research Station has the land of about 20 ha of which 12.25 ha is now used as orchard, 4.0 ha as nursery of seedlings and 3.77 ha as road, waterway and building site. In the orchard, peach, apple, grape, plum, chestnut, walnut, mandarine orange, pear, etc. are grown, and their growth conditions are satisfactory except in part.

Of the 20 ha, about 8 ha can be used for the Horticultural Development Center. With the university campus on its north, the place is on the whole quiet farm area, and is considered to be a reasonable site for constructing the Horticultural Development Center.

The bus service is the means of traffic from Kathmandu to the Horticulture Research Station, but it can not be depended on as the buses are always crowded.

3-2 General Conditions

3-2-1 Natural Conditions

1) Topography

A small stream flows from the town area of Kirtipur through the center of the site of the Horticulture Research Station and into the Bagmati River. The topography gently declines toward the small stream and, as a whole, forms a conical depression that opens on the side of the Bagmati River in the east. The site commands a fine view of the east. The construction site is situated at the high edge of the north-west side of the conical depression. This area was once used as an orchard, but it had been earmarked as the site for this Center later as plant growth condition was poor by lack of water during the dry season and the land had low utility-value as the orchard without any irrigation facility.

2) Geology

According to the survey conducted by the Soil Science Division of the Ministry of Agriculture, the soil of this area consists of clay or clay mixed with silt, and forms a layer of such constituent as thick as 30 m to 40 m. For a visual investigation, test pits at six locations were dug 1.5 m deep from the ground surface on the field and resulted the soil to be all permeable clay of which mechanics can not be claimed to be very firm. Empirically judging, the soil bearing capacity is considered to be in the range of 8 ton/m^2 to 10 ton/m^2.

The underground water level is fairly low during the dry season but it rises to the ground surface during the rainy season. As water paddyfield exists on the west side of the site and at a level higher than the site, adequate care must be taken in designing the drainage of the site for the rainy season.

3) Meteorology

The Kathmandu Valley has a continental type monsoon climate with a clear division between the rainy season and the dry season.

Annual mean temperature is 24.6°C, and maximum temperature and minimum temperature are 32.9°C (in May) and -1.0°C (in December) respectively.

Humidity ranges between 50% and 95%, with the annual mean humidity being 75%.

Annual precipitation is about 1,200 mm of which 80% is concentrated in the rainy season from mid-June to mid-September. There is hardly any rainfall between December and February. Thunders occur during the rainy season but there has been no record of damages due to thunderbolts. None of the buildings, therefore, are equipped with a lightening conductor. The wind blows from west to east throughout the year. Being a valley, the wind velocity is not very high so that no special consideration with respect to wind force is necessary in the building planning.

As the area is located on the Eurasian earthquake belt, many earthquakes have been recorded in the past. Among others, the 1834 and 1934 earthquakes are recorded to have inflicted heavy damages. A seismic considerations are therefore necessary in the building planning.

3-2-2 State of Infrastructure Development

1) Power

At present, an 11 kV overhead distribution line of NEC (Nepal Electricity Corporation) is laid along the public road on the east of the Horticulture Research Station from where it is led into the Horticulture Research Station after stepping down the voltage to 220 V by a pole transformer.

The Center may receive its power supply from the same distribution line or from the other line laid overhead in the north of the proposed Project site.

According to NEC, voltage fluctuation in the range of approximately ±5% is often recognized during the dusk to evening hours which coincides with the peak consumption hours. Planned black-out occurs at the time of construction or repair, lasting from eight to ten hours each time.

2) Telephone

The city line is laid by the use of power distribution poles. One city line has already been drawn into the Horticulture Research Station, but the circuit still has enough room to allow the installation of one more line or so if applied for. The Telephone Corporation is planning the expansion of its facilities to be completed three years from now, so that new lines will be more easily installed afterward.

3) Communication Facilities

Most of the communication networks in Nepal are connected by wireless radio stations. The wire telephone is connected only among Kavhrepalanchok, Lalitpur, Bhaktapur, Nuwakot and Bara.

Kathmandu is directly connected to the wireless networks throughout the country by HF radio, and Nepalgunj has a CB exchange system with which it can directly communicate with Kathmandu. However, there is no radio connection at all between Kirtipur and Sindhuli, and radio communication with Nepalgunj is virtually impossible. It is therefore necessary to install a new radio communication system that can be used for communicating guidance or instructions with respect to demonstration farms in the said places.

4) Water Supply

As for city water, a storage tank (180 thousand gallons) is installed near the town area of Kirtipur City, and a water treatment plant is located adjacent to the Horticulture Research Station. The two are connected by a 9" pipe buried along the small stream which flows through the center of the site. The Horticulture Research Station receives its water directly from this 9" water pipe, but at present, water supply is restricted to one hour from eight o'clock to nine o'clock in the morning. An ordinary private house, therefore, overcomes the inconveniences of poor water supply by installing a water receiving tank (capacity of around 1 m^3). As the water quality is poor, it is filtered for drinking use.

As for well water, two boreholes were drilled at the Horticulture Research Station in the past, but one was abandoned midways when it began to spout butane gas. The other was drilled to the depth of 700 ft to 800 ft and it is welling out spontaneously now, but the water is not being used as the water quality is not potable due to odor and turbidity.

5) Drainage

Sewage facilities, to which sanitary sewage and miscellaneous waste water can be discharged, exist only in some part of the center of Kathmandu City, and there is none around the Horticulture Research Station. The Horticulture Research Station allows its sanitary sewage to seep into the ground while its miscellaneous waste water is discharged via the drain ditches around the orchard into the small stream that flows through the center of the site.

6) Fuel

Generally, firewood is used as fuel, but the devastation of national land due to felling of forests has become an issue lately which is one of the Government's headaches now. Oil, gas and electricity are being diffused to replace firewood, but since these costs are high compared to firewood, the diffusion rate is still low. Gas is LPG imported from India.