

SOIL SURVEY

REPUBLIC OF KOREA

SOIL SURVEY IN SANGJU GUN, GYEONGSANGBUG DO



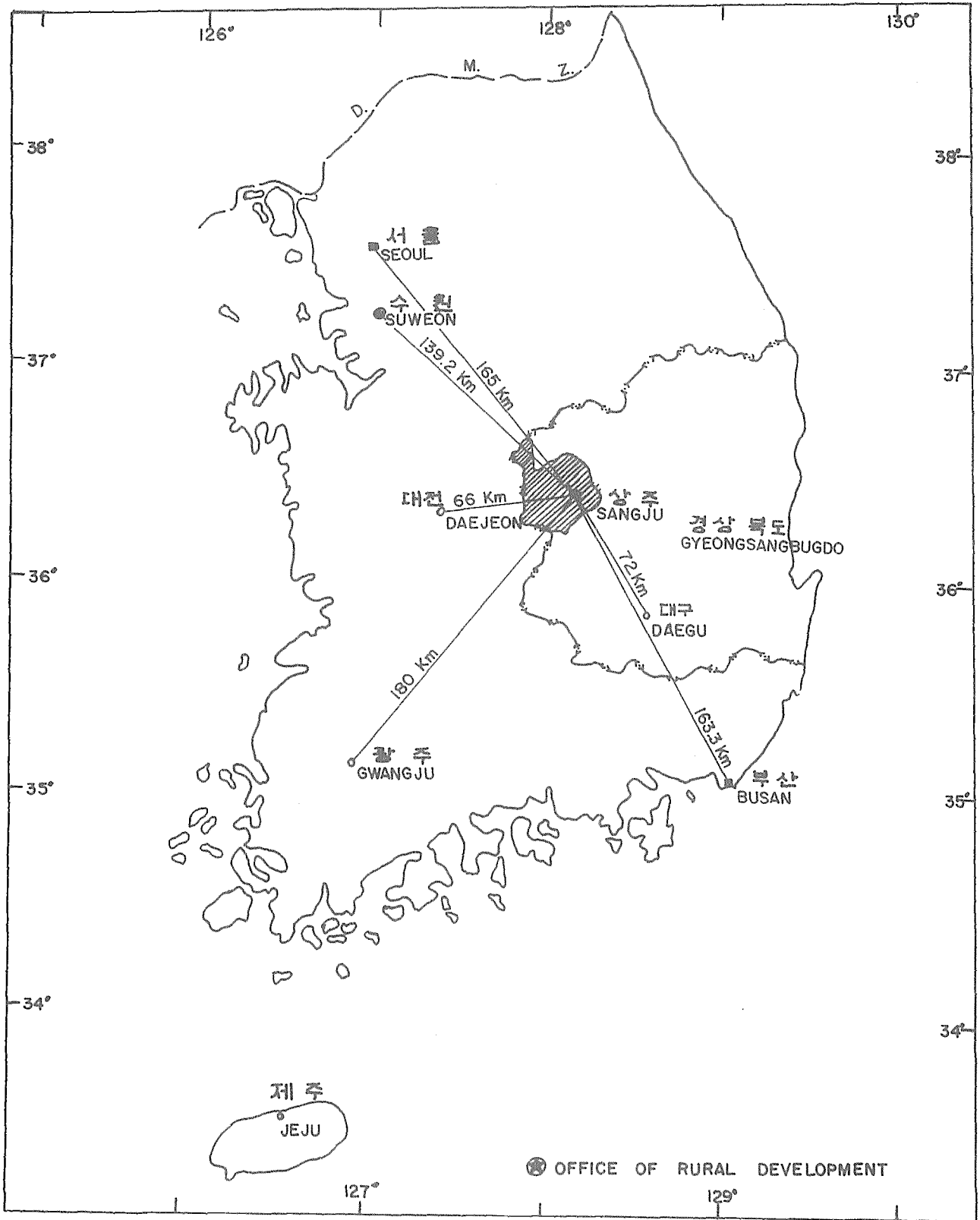
UNITED NATIONS DEVELOPMENT PROGRAMME
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS



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REPUBLIC OF KOREA

LOCATION MAP OF SANGJU GUN, GYEONGSANGBUKDO



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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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This technical report is one of a series of reports prepared during the course of the UNDP/SF project identified on the title page. The conclusions and recommendations given in the report are those considered appropriate at the time of its preparation. They may be modified in the light of further knowledge gained at subsequent stages of the project.

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FAO. Soil Survey, Republic of Korea. Soil survey in Sangju Gun, Gyeongsangbug Do. Rome, 1970. 88 p. 2 maps. AGL:SF/KOR 13, Technical Report 7.

ABSTRACT

This report describes soil survey activities in Sangju Gun which were part of the Korea Soil Survey conducted by the Government of the Republic of Korea with the assistance of the United Nations Special Fund 1/. The field work of the survey was done during the period from July 1967 to December 1968. The entire area of the Gun (125 928 hectares) was mapped in detail, including paddy lands, upland crop fields and forest lands. Together with the accompanying map, which is printed at a scale of 1:250 000, the report presents an inventory of soil and soil conditions in the surveyed area. Individual soils are described and laboratory data for representative profiles are given. The report includes soil descriptions and interpretations, and provides data and recommendations for specific land resource analysis and planning.

The basic information about the soils is interpreted for application to the various aspects of agriculture in the area, including land use adjustment, reclamation and development, increasing production, and the improvement and conservation of lands according to their capabilities. To show general land use potential the soils of the area are placed in seven land capability classes showing limitations and choices for practical use. The soils in each capability class are given, the suitability and limitations for cultivated crops and pasture are described, and management practices required for higher yields are suggested. About 19 600 hectares or 62 percent of the cultivated land is used for paddy rice. Management of the soils for paddy rice is discussed and the soils are placed in four paddy suitability groups, indicating progressively greater limitations in the use of the land for rice.

1/ The United Nations Special Fund and the Expanded Programme of Technical Assistance were merged to form the United Nations Development Programme on 1 January 1966.

Grateful acknowledgement is made of the keen interest and full support extended throughout the project towards the soil survey team by the Ministry of Agriculture and Forestry, the Government Cooperating Agency and by counterpart staff.

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LIST OF ABBREVIATIONS

cm	--	centimetre
ha	--	hectare
m	--	metre
mm	--	millimetre

Chapter 1

INTRODUCTION

The detailed soil survey described in this report began in July 1967 and was completed in December 1968. It formed part of the Korean Soil Survey conducted by the Government of the Republic of Korea with the assistance of the United Nations Special Fund ^{1/}. The Government cooperating agency was the Ministry of Agriculture and Forestry. The executing agency for the United Nations Special Fund was the Food and Agriculture Organization of the United Nations.

The purpose of the report is to provide basic soil information required for the development and management of the various aspects of Korean agriculture, including the reclamation and development of new lands for settlement, the improvement and conservation of lands according to their capabilities, the increasing of production, and overall economic development through appraisal of the soil resources.

For the Korea Soil Survey Project new research and new cartographic methods have been used in detailed soil surveys, by FAO soil experts and trained counterpart staff. The counterpart personnel were trained in techniques of soil survey, characterization, correlation, and classification by the FAO soil scientists before participating in the field.

This report is an inventory of research findings, in maps and in writing, of soil and soil conditions in Sangju Gun. It contains important information which will assist the Gun personnel, landowners and others, in the wise use of the land, whether it is for agriculture, forestry, urban development, building sites or recreational and other nonagricultural uses.

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^{1/} The United Nations Special Fund and the Expanded Programme of Technical Assistance were merged to form the United Nations Development Programme on 1 January 1966.

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The list of reports issued by the Soil Survey Project, including the present volume, is given below:

- Technical Report 1. The Soils of Korea (with map at scale 1:1 000 000)
- Technical Report 2. Soil Reconnaissance of Korea (with map at scale 1:250 000)
- Technical Report 3. Ulju Gun and Ulsan Si
- Technical Report 4. Gimhae Gun
- Technical Report 5. Dalseong Gun and Daegu Si
- Technical Report 6. Gwangsan Gun, Damyang Gun, and Gwangju Si
- Technical Report 7. Sangju Gun
- Technical Report 8. Pyeongchang Gun
- Technical Report 9. Gimje Gun
- Technical Report 10. Buyeo Gun

The individual detailed Soil Survey Reports (Technical Reports 3-10) are each accompanied by a detailed soil map at scale 1:250 000.

Chapter 2

GENERAL DESCRIPTION OF THE AREA

2.1 LOCATION

Sangju Gun is in the northwestern part of Gyeongsang Bug Do, one of the central provinces of the Republic of Korea (Map 1), between 127°47'5" and 128°20'3" east longitude, and 36°14'0", 36°39'1" north latitude. The area is bounded on the north by Myungyeong and Goesan Guns, on the west by Boeun and Ogcheon Guns, on the south by Yeongdong, Geumneung and Seongsan Guns, and on the east by Yecheon and Euseong Guns.

The surveyed area includes 125 928 ha and has a population of 251 634, according to the Yearbook of Statistics for 1967. Approximately 20 percent of the population lives in Sangju Eub.

2.2 PHYSIOGRAPHY, DRAINAGE AND GEOLOGY

Sangju Gun is mainly on the Mt. Sobaeg range and its offsets to the west. Slope ranges from moderate to very steep. The eastern part is along the Nagdong River and its tributaries. Near the river the land is mostly level to sloping.

The total area of the flooded plains and stream terraces is relatively small. The highest point, about 1 057 m, is on a summit of Cheonhwang in the northwestern part. In the west the elevation of the peaks ranges from 800 to 900 m.

Except for the west slope of the mountains in the west, the main streams flow eastward into the Nagdong River. These are the Eancheon, Bugcheon, and Namcheon creeks. Seogcheon and Sangcheon streams flow southwest, and Hwayang and Yongdae, northwest.

Nine geologic formations are in Sangju Gun (Table 1), made up of alluvium, fine grained rocks, and coarse grained rocks. Alluvium consists of material recently deposited on floodplains. The fine grained rocks, andesite porphyry and schist, are in the Silla rock series. The coarse grained are granite, and granite-gneiss of the Nagdong rock series and Daedong system. Roughly 80 percent of the surveyed area consists of the granite and granite-gneiss system. In distribution the sedimentary rocks are not extensive as compared with the igneous rocks, and are classified into the Silla series. Local areas of conglomerate, classified in the Nagdong rock series occur along the Nagdong river.

2.2.1 Parent Material

Parent material is the unconsolidated mass from which soil develops. So the area developed from residuum that weathered from underlying rocks, or from alluvium deposited by water.

The dominant underlying rocks include granite, granite-gneiss, shale, sandstone, and conglomerate. Granite and granite-gneiss are most extensive along the Nagdong river. Shale and conglomerate are also distributed there. The Sinjeong series is derived from these kinds of rocks. Soils of the Nagseo series are underlain mainly by schist. The Gwanag, Samgag, Taehwa and Songjeong series include the principal soils underlain by granite and granite-gneiss. The soils of the Habin series are the principal soils derived from shale and sandstone. About 8 percent of the soils is formed in alluvium.

Alluvial soils are mainly on river terraces, floodplains and bottom lands. Some of them are in narrow valleys in mountainous areas. Soils of the Banho, Jisan, Subug, Sindab and Jungdong series developed in alluvium and colluvium.

Table 1

ESTIMATED AREA OF KINDS OF ROCKS IN SANGJU GUN 1/

Geology	Area (ha)	Percentage (%)
Conglomerate	8 765	7.0
Shale and sandstone	2 810	2.2
Shale and conglomerate	333	0.3
Limestone	630	0.5
Granite system	34 420	27.3
Granite-gneiss	46 203	36.6
Andesite porphyry	15 110	12.0
Schist	6 510	5.2
Chert breccia and porphyry	200	0.2
Alluvium	10 947	8.7

1/ Geological Survey of Korea and the Geological Society of Korea; Geologic Map of Korea. 1956

2.3 WATER SUPPLY

Eight major streams, with a total length of about 58 km drain the Gun, and most farms have been developed along these water sources. The extent of well watered rice paddy is 8 373 ha. Principal soils in these paddies are Hamchang, Geugrag, Gyuan and Gangdong. Poorly watered rice paddy includes 6 882 ha, and soils are the Jisan, Jungdong, and Yongji series. The Geugrag and Gyuan are mainly furnished with irrigation water by the Gaeun, Gyeongdul, and Jungdeog reservoirs; Hamchang and Gangdong soils by farm ponds and dug wells. Jisan and Yongji soils depend largely on natural precipitation. Near the Nagdong river rice fields are provided with water from it.

2.4 CLIMATE

Sangju Gun has a continental climate with commonly an alternation of three cold days and four warm days. Winters are generally very cold, and summers very warm, especially July and August. Sangju Gun has no long record weather stations, but records from the Sangju agricultural-sericultural high school in Sangju Eup are representative of the area. A summary of temperature, precipitation, evaporation, and humidity data from the Sangju Gun annual report for the year 1966 is given in Table 2. Precipitation generally is very heavy in July, August and September, and very light in December, January and February. The annual average is about 1 300 mm. Annual snowfall is distributed from the first of January until the end of February. The humidity is nearly the same throughout the year.

Table 2
TEMPERATURE, PRECIPITATION, EVAPORATION
AND HUMIDITY ^{1/}

(1966)

Month	Temperature			Precipitation Average monthly mm	Humidity Average monthly %
	Average daily maximum °C	Average daily minimum °C	Average monthly °C		
January	-3.6	4.8	-6.4	4.55	86
February	-1.4	2.9	-3.9	27.0	87
March	5.7	10.4	2.4	53.27	76
April	2.6	16.9	8.0	96.0	77
May	20.8	26.4	12.6	17.99	73
June	23.2	28.2	17.1	153.7	64
July	26.3	32.0	22.4	235.1	82
August	26.7	32.1	23.6	112.8	87
September	20.7	25.3	14.7	183.5	78
October	14.5	22.3	7.2	26.0	79
November	6.4	11.0	3.4	90.3	85
December	-2.0	2.8	-4.5		90
Annual	11.65	17.92	8.05	1 000.21	80.33

^{1/} Statistical Yearbook of Sangju Gun, 1966.

2.5 AGRICULTURE

Farming is the most important enterprise in Sangju Gun, with about 30 percent of the total area devoted to it. Practically all of the remainder is wooded. Paddy rice is grown on about 19 643 ha, or 62 percent of the cultivated area of 31 761 ha. Most of the soils are loamy or sandy, and suitable for such crops as barley, soybean, vegetable, mulberry and tobacco.

Important soils for cultivation are in the Sangju, Baegsan, Banho, Geugrag, and Hamchang series. The soils of the Sangag need protection against erosion by planting trees such as acacia or alder. Apart from rice and barley the income is generally from the sale of tobacco, cocoons and persimmons. Barley is generally grown in the winter-spring on most farms, with about 60 percent of the paddy land area being used for this purpose.

Chapter 3

HOW THE SURVEY WAS MADE

This survey was made to learn what kinds of soils are in Sangju Gun, where they are located, and how they can be used. The entire soil landscape was observed including: steepness, length, and shape of slope; kinds of native plants or crops; kinds of rock; and many facts about the soils. Holes were made and profiles were observed at an average interval of about 200 m, depending on the nature of the landscape.

Spacing was much closer in the highly productive paddy lands than in the hilly and mountainous areas. There stones, rock outcrops, gullies, and similar features are important indicators of kind of soil.

Comparisons were made among the profiles studied, and were compared with those in other areas where detailed soil surveys have been made. Soils were named and classified according to the soil classification system used in Korea and other countries.

Soils that have profiles almost alike make up a soil series. All of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each is named for a town or other geographic feature near the place where first observed and mapped.

Hwadong and Banho, for example are the names of two soil series in Sangju Gun. These would have essentially the same characteristics as the Hwadong and Banho mapped in other areas.

Soils of one series, however, can differ somewhat in texture of surface soil including the amount and size of coarse fragments, in slope, and in the amount of erosion that is evident. As these differences are important in the use and management of the soils, some of the soil series have been divided into mapping units based on slope and also upon the presence of rocks. Thus, there are sloping and moderately steep mapping units of Samgag soils with sandy loam surfaces as well as steep mapping units of Samgag soils with rocky sandy loam textures.

There is also another difference between the series and the mapping unit. The series includes a group of profiles that have a definite but limited range in their properties. The mapping unit, however, must include all of the important properties of the soils that are within the limits of the area shown on the map. Usually within a mapped area there are some profiles that resemble other series more than the series named in the mapping units. In mapping units such as Samgag rocky sandy loam, 30 to 60 percent slopes, the part of the area that is rock outcrops obviously does not have a profile. It would of course be most desirable to have a map with these areas of other soils and areas of rock outcrop shown in their true occurrence, but it is not practical.

Other areas of land which do not have developed soils are also shown on the soil map, but are given descriptive names, such as rock land, or riverwash, sandy and are called land types rather than soils.

Chapter 4

DESCRIPTION OF THE GENERAL SOIL MAP

4.1 INTRODUCTION

The general soil map, Map 2, shows the soil associations in the survey area. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil and it is named for the major. The soils in one association may occur in another, but in a different pattern.

This map is not suitable for planning the management of a farm or fields as the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics affecting management. Nine soil associations are shown on the general soil map. Of these, the Sangag-Sangju-Ibseog association is the largest, occupying about 54 percent of the Gun.

4.2 AREA 1. SANGAG-SANGJU-IBSEOG ASSOCIATION

Dominantly steep, but some areas of sloping in the valleys, somewhat excessively drained soils of the mountain areas.

This association covers about 52 percent of the Gun, mainly in the mountainous areas. Sangag soils make up about 80 percent, Sangju 10 percent, Ibseog 5 percent, and minor soils 5 percent. Sangag are sloping to steep, deep coarse sandy loam with low available moisture capacities. The Sangju, however, are deep and well drained, being found in the small valleys as alluvial fans. Ibseog soils are made up of coarse sand and fine gravel eroded from the Sangag areas, and deposited as alluvial fans in the stream valleys. The minor soils of this association are Banho and Jisan.

Most of this association has only a sparse cover of poorly shaped pine trees, but the Sangju and Ibseog are used for cropland. Erosion is a severe problem of the Sangag soils, for in addition to lowering the productivity of the upland soils, erosion deposits coarse sand and gravel on the lower lying soils. Productive vegetation, could be established on the eroding areas, though the cost would be high in relation to increased production. However, the benefits resulting from the lessening of deterioration through deposition of sand and fine gravel on the lower lying paddy lands, may far outweigh that.

4.3 AREA 2. GWANAG-TAEHWA-SEOGTO ASSOCIATION

Dominantly steep shallow soils, but some moderately deep and deep soils on lesser slopes.

This association covers about 6 percent of the Gun, with the principal area being found in the mountains in the northwest, with some smaller areas in the southeast.

The Gwanag soils, about 70 percent of the association, are mainly in the highest mountain areas; the Taehwa, about 15 percent, on the less sloping usually lower areas, and the Seogto, about 10 percent, in the high mountain valleys. Minor soils cover roughly 5 percent.

The Gwanag are shallow, with sandy loam texture, low available water holding capacity, and very droughty. The Taehwa are deeper, with loam to clay loam textures, and have desirable characteristics except for being sloping to steep. The Seogto, sloping and moderately steep, are very gravelly and cobbly.

This area is mainly suited for woodland, with some small areas suitable for pasture.

4.4 AREA 3. NAGSEO-SEOGTO ASSOCIATION

Steep and very steep shallow soils on high mountains with some sloping soils in the valleys.

The association covers about 8 percent of the Gun with most areas being in the southwest. Elevation ranges up to more than 500 m. Nagseo soils are dominant, covering about 75 percent of the area. These are steep and very steep, shallow gravelly loams. The Seogto are about 15 percent, and are sloping to moderately steep, deep, very gravelly and cobbly valley soils. Minor soils include the Banho and Yongji.

Practically all of the area is in woodland. Some areas of Seogto could be developed into pasture, but trees are best suited. With good treatment yields are apt to be only moderate, because of the droughty nature of these soils.

4.5 AREA 4. SINJEONG-HABIN-JANGWEON ASSOCIATION

Shallow to deep, sloping to steep soils developed over sandstone and shale.

This association covers about 7 percent of the Gun, mainly in the eastern part near the Nagdong river plain. The area is generally very severely eroded. The gullied Sinjeong soils are about 50 percent; the eroded, shallow Habin soils about 35; the Jangweon with a fragipan, about 10; and minor soils about 5 percent. Except for the small areas of Jangweon on the little valley slopes, only woodland and some pasture are suitable.

Active erosion also damages the paddy lands below by depositing coarse, infertile soil materials on them. The ditches of the irrigation and drainage systems there are filled with coarse sediment. Much tree planting, pasture establishment and other land treatment, is needed for the development of profitable uses.

4.6 AREA 5. SAMGAG-SONGJEONG ASSOCIATION

Gently sloping to moderately steep, well and excessively drained, clayey to sandy loam soils of the rolling hills.

This association covers about 4 percent of the Gun with the largest areas in the northeast near Hamchang and Gonggeom. The sandy loam Samgag soils are about 45 percent of the area; Songjeong, 40 percent, and minor soils, 15 percent.

This area is cropped to many kinds of vegetables, barley, and some tobacco, but erosion is a severe problem if annual cultivation is practiced. Forage and pasture crops are well suited, and high production could be obtained if the land were properly limed, fertilized and managed. These soils are also well suited for orchards, mulberry trees and similar crops. Practices such as contouring, strip cropping and terracing, help reduce erosion losses.

4.7 AREA 6. HAMCHANG-GEUGRAG-HWADONG ASSOCIATION

Nearly level to gently sloping, poorly and moderately well drained floodplain and low terrace soils.

This association is about 6 percent of the Gun, the main area being along the Namcheon and Seogcheon streams. The sandy and poorly drained Hamchang soils are usually adjacent to them and have about 40 percent of the area. The Geugrag, about 35 percent, are clayey, imperfectly drained and at slightly higher elevations than the floodplain. The Hwadong and Gongseong, about 15 percent of the area, are mainly gently sloping, with some sloping tracts well above the floodplain. Minor soils including the Hwabong cover about 10 percent.

This association is the most important for agriculture in Sangju Gun. Though the principal crop is rice, other crops are grown, and the response is good to management and fertilization. Hamchang soils are used only for rice because of their poor drainage, but the paddies on the other soils are usually also cropped to barley.

As practically this entire area is cropped, additional production must be obtained through such things as improvement of water supplies for irrigation, fertilization, and drainage.

4.8 AREA 7. SAMGJU-BAEGSAN-HWANGRYONG ASSOCIATION

Nearly level to moderately steep soils of the small stream valleys.

This association, in the better drained small valleys, covers about 9 percent of the Gun and is second in agricultural importance. The well drained loamy Baegsan soils are the most extensive, covering about 55 percent of the area; the Sangju soils, gravelly sandy loams, about 25 percent; the Hwangryong soils, well drained gravelly loamy sand adjacent to the streams, about 10 percent. Minor soils including Anyong, Bonryang, and Hoge comprise the remaining 10 percent.

A variety of crops, are grown including rice. Its yields are often low in many paddies because of a lack of water, and unless adequate sources are developed, crops other than rice may be the most profitable. The development of water supplies is costly in these areas because of the topography. The areas are long and narrow requiring the construction of many dikes for a relatively small amount of rice paddy.

4.9 AREA 8. JISAN-JANGWEON-YONGJI ASSOCIATION

Gently sloping to moderately steep, poorly drained to moderately well drained soils of the small valleys.

This association is about 4 percent and consists of small valleys in many sections of the Gun. The poorly drained, gently sloping to sloping, loamy Jisan soils, are most extensive, covering about 40 percent of the area. Yongji soils, somewhat better drained than the Jisan, but resembling them in other respects, make up about 30 percent, while the somewhat steeper Jangweon soils with fragipan horizons comprise about 10 percent. Minor soils including the Subug and Banho series are about 20 percent.

Rice is the principal crop on the Jisan and Yongji areas. This crop does well and yields are high in years of average to high rainfall. In drier years the lack of soil moisture often delays rice planting past the optimum date, with the result that the yields are low. The cost of developing a dependable irrigation system will be high as many dikes are required on the slopes in the narrow valleys characteristic of these soils. Because of the lack of water it may be more profitable to grow other crops in many places.

4.10 AREA 9. JUNG DONG--SINDAB ASSOCIATION

Nearly level, poorly to well drained sandy soils of river floodplains.

This association, about 4 percent of the Gun, is found in the Nagdong river valley and consists mainly of the poorly drained, very sandy Sindab soils. These are about 45 percent of the association, and the well drained sandy loam Jungdong soils about 35 percent. Minor soils including the Gyuan, Hagsan and Hamchang series, are about 20 percent.

The poorly drained areas are mainly planted to rice, and the better drained to a variety of crops. Mulberry trees are grown on some well drained very sandy soils.

The washing of sand into irrigation and drainage ditches is a severe problem. The wet areas, although not too suitable for rice production, would be very droughty if drained and are best left as they are. Improvement in this area is largely dependent on control of erosion on uplands, and preventing the accumulation of more sand.

Chapter 5

DESCRIPTION OF SOILS

5.1 INTRODUCTION

This section describes the soil series and mapping units of the Sangju Gun. With this are given detailed descriptions of a typical profile representing each series.

The soil series is described first, and then the mapping units of the series. Following the name of each mapping unit there is a symbol in parentheses, identifying the mapping unit on the detailed soil map.

To obtain full information on any one mapping unit, it is best to read first the description of the series which describes the general concept of the soil, and afterwards read the description of the mapping unit. This gives more detailed information about the area mapped, such as slope, presence of other soils, rock outcrops, and other factors affecting use.

Additional information about the use of the mapping units can be found in the discussions of Capability Units and Paddy Suitability Groups. Table 4 lists these groupings for each soil.

5.1.1 Classification of Soils

The classes in the current system are defined briefly in the following paragraphs.

(1) Order

Ten orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxosols, and Histosols. The properties used to differentiate the soil orders are mostly those that tend to give broad climatic groupings of soils. The exceptions, Entisols and Histosols, are in many different climates.

Ultisols are mineral soils that have distinct horizons and are commonly on old land surfaces. They contain a clay-enriched B horizon that has low base saturation.

Alfisols are soils containing a clay-enriched B horizon that has high base saturation.

Inceptisols are mineral soils in which horizons have definitely started to develop but which do not have clay-enriched B horizons. They generally are on young, but not recent land surfaces.

Entisols are young mineral soils that do not have genetic horizons or have only the beginning of such horizons.

Mollisols are mineral soils that have dark coloured surfaces with high organic matter content and high base saturation.

(2) Suborder

Each order is subdivided into suborders, primarily on the basis of soil characteristics that seem to produce classes having the greatest genetic similarity. The suborders have a narrower range of climate than the orders. The criteria for suborders chiefly reflect the presence or absence of waterlogging or soil differences resulting from the climate or vegetation. Those properties are mineralogy, chemistry, degree of gleying, soil moisture, texture, and the presence or absence of accumulated soluble material. The suborder is not shown in Table 3.

(3) Great group

Each suborder is divided into great groups on the basis of uniformity in the presence, absence, and arrangement of diagnostic horizons and features. The diagnostic horizons are those that contain alluvial clay, iron, and humus; or they are thick, dark coloured surface horizons; or horizons which have a pan that interferes with water movement or root development. The features are colours of dark brown and dark red that are associated with basic rocks; major differences in chemical composition; and wide differences in base saturation.

(4) Subgroup

The subgroups are subdivisions of the great groups and are defined in terms of reference to them. One of the subgroups represents the central concept of the great group, and others called intergrades, have properties of one great group that are dominant and also weakly expressed properties of another great group, suborder, or order. Subgroups may also be made where there is some soil property unlike that of the great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group.

(5) Families

Families are separated within a subgroup primarily on the basis of properties important to the growth of plants or to the behaviour of soils when used for engineering. Among the properties considered are texture, consistence, permeability, reaction, mineralogy, soil temperature, and thickness of horizons.

(6) Series

The series consists of a group of soils that formed in a particular kind of parent material and having a genetic horizon that, except for texture of surface soil, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are colour, structure, reaction, consistence, mineralogical and chemical composition.

5.2 ANYONG SERIES

The series consists of sloping to moderately steep, deep, well drained soils formed in colluvium derived from acid and intermediate crystalline materials. They are found on mountain footslopes, mainly in the southeast, and are members of the fine loamy family of Typic Hapludalfs.

Table 3

SOIL SERIES CLASSIFIED ACCORDING TO THE CURRENT
AND PREVIOUS SYSTEMS OF CLASSIFICATION

Series	Current Classification			1938 Classification
	Family	Subgroup	Order	Great Soil Group
Anyong	Fine loamy	Typic Hapludalfs	Alfisols	Alluvial-Red Yellow Podzolic soils
Baegsan	Fine loamy	Dystric Fluventic Eutrochrepts	Inceptisols	Alluvial soils
Banho	Fine loamy	Dystric Fluventic Eutrochrepts	Inceptisols	Alluvial soils
Bonryang	Coarse loamy over sandy	Typic Udifluvents	Entisols	Alluvial soils
Cheongog	Fine clayey	Typic Rhodudults	Ultisols	Reddish-Brown Lateritic soils
Gangdong	Fine loamy over sandy	Fluventic Haplaquepts	Inceptisols	Low-Humic Gley soils
Geugrag	Fine clayey	Aeric Ochraqualfs	Alfisols	Red-Yellow Podzolic soils - Low-Humic Gley soils
Gongseong	Fine clayey	Aquic Hapludalfs	Alfisols	Red-Yellow Podzolic soils
Gwanag	Loamy skeletal	Lithic Dystrichrepts	Inceptisols	Lithosols
Gyuam	Coarse silty	Aquic Fluventic Eutrochrepts	Inceptisols	Alluvial soils
Habin	Coarse loamy	Lithic Eutrochrepts	Inceptisols	Lithosols
Hamchang	Coarse loamy	Typic Haplaquepts	Inceptisols	Low-Humic Gley - Alluvial soils
Hogye	Loamy skeletal	Fluventic Hapludolls	Mollisols	Alluvial soils

Table 3 (Cont'd)

Series	Current Classification			1938 Classification
	Family	Subgroup	Order	Great Soil Group
Hwabong	Sandy	Typic Udipsamments	Entisols	Alluvial soils
Hwadong	Fine clayey	Aquic Hapludulfs	Alfisols	Red-Yellow Podzolic soils
Hwangryong	Sandy skeletal	Typic Udipsamments	Entisols	Alluvial soils
Ibseog	Sandy skeletal	Typic Udipsamments	Entisols	Alluvial soils
Imog	Coarse loamy	Fluventic Hapludolls	Mollisols	Alluvial soils
Jangweon	Fine loamy	Typic Fragiochrepts	Inceptisols	Planosols
Jisan	Fine loamy	Fluventic Haplaquepts	Inceptisols	Low-Humic Gley soils
Jungdong	Coarse loamy	Typic Udifluvents	Entisols	Alluvial soils
Nagseo	Loamy skeletal	Lithic Dystrochrepts	Inceptisols	Lithosols
Samgag	Coarse loamy	Typic Dystrochrepts	Inceptisols	Lithosols
Sangju	Coarse loamy	Dystric Fluventic Eutrochrepts	Inceptisols	Alluvial soils
Seogto	Loamy skeletal	Dystric Fluventic Eutrochrepts	Inceptisols	Regosols
Seongsan	Coarse loamy	Dystric Fluventic Eutrochrepts	Inceptisols	Alluvial soils
Sindab	Sandy	Typic Psammaquents	Entisols	Alluvial soils
Sinheung	Fine loamy	Aeric Fluventic Haplaquepts	Inceptisols	Low-Humic Gley - Alluvial soils
Sinjeong	Fine loamy	Typic Dystrochrepts	Inceptisols	Lithosols
Songjeong	Fine loamy	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils
Subug	Coarse loamy over sandy skeletal	Fluventic Haplaquents	Entisols	Low-Humic Gley - Alluvial soils
Taehwa	Fine loamy	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils
Yongji	Fine loamy	Aquic Fluventic	Inceptisols	Alluvial - Red-Yellow Podzolic soils

The Ap horizon is 15 to 25 cm thick, and when not flooded is brown, dark brown, dark yellowish brown or pale brown gravelly loam or sandy loam. In rice paddy it is gray or grayish brown with mottles. The B horizon is yellowish brown, strong brown or dark yellowish brown gravelly to cobbly loam, clay loam or silty clay loam with clay cutans. The C horizon (not described in the typical profile) is yellowish brown, pale brown or brown very gravelly or very cobbly loam or clay loam.

The soils are commonly associated with the Jangweon, Seogto, and Baegsan. The last lacks clay cutans, and has less coarse fragments than the Anyong. The Seogto soils also lack clay B horizons, but are very gravelly to stony.

A typical profile follows.

Ap—0 to 10 cm; dark yellowish brown (10YR 4/4) cobbly sandy loam; weak, very fine and fine granular structure; friable, nonsticky, and nonplastic; common, fine yellow mica; few, fine gravel; many, fine and medium barley roots; abrupt, smooth boundary; pH 5.2.

Blt—10 to 25 cm; dark yellowish brown (10YR 4/4) gravelly sandy loam; weak, medium and coarse subangular blocky structure breaking easily to fine and medium granular; firm, slightly sticky, and slightly plastic; common, fine and medium pores; approximately 10 percent weathered granite gravel and cobbles; few, fine barley roots; gradual, smooth boundary; pH 5.8.

B2lt—25 to 50 cm; brown to dark brown (10YR 4/3) cobbly loam; moderate medium to coarse subangular blocky structure; firm, sticky, and slightly plastic; thin, discontinuous clay cutans; many, fine and very fine pores; approximately 15 percent slightly weathered granitic gravel and cobble; few, fine roots; clear, smooth boundary; pH 6.2.

B22t—50 to 90 cm; strong brown (7.5YR 5/6) cobbly loam; moderate, medium to coarse subangular blocky structure; few, discontinuous reddish brown (5YR 4/3) clay flows; few worm casts; firm, very sticky, and plastic; common, fine to medium pores; approximately 20 percent cobbles and stones; pH 5.0.

They are moderate in natural fertility and medium in organic matter. The available moisture capacity is moderate, as is permeability. Cation exchange capacity is medium and base saturation medium to high.

About 70 percent of the areas are in cultivated crops. Paddy rice has only a limited cultivation owing to the lack of water. The remaining land is in poor pine trees.

5.2.1 Anyong Cobbly Loam, 7 to 15 Percent Slopes (AnC)

The surface layer in many areas is free of cobbles because they have been removed by farmers for easier cultivation. Some areas have a clay loam surface layer and a subsoil with a dense compact horizon or fragipan. Also included are small areas of soils without coarse fragments. Otherwise, profiles are usually similar to that described for the series. Surface runoff is slow.

Cultivated crops and pasture are well suited, and paddy rice, moderately. Erosion is the chief management hazard, and cobble content another limiting factor.

Capability unit IIIe.
Paddy suitability group P3ac.

5.2.2 Anyong Cobbly Loam, 15 to 30 Percent Slopes (AnD)

Most areas have a profile similar to that described for the series. Many areas that have cobble free surface layers, and small areas with a silt loam surface layer are included, as are a few small areas of 30 to 40 percent slopes, small areas of soils with dense layers or fragipans, and some areas of stony soils.

Crops are limited because of the erosion hazard, but pasture and trees will do well. Erosion control is the main management problem.

Capability unit IVe.
Paddy suitability group P4ac.

5.3 BAEGSAN SERIES

The Baegsan series consists of gently sloping to moderately steep, deep, well drained soils formed in alluvium-colluvium washed from areas underlain by porphyry, granite, and granite-gneiss. These soils, usually on the concave colluvial slopes throughout the Gun, are members of the fine loamy family of Dystric Fluventic Eutrochrepts.

The areas that have not been used for paddy are brown to dark brown or yellowish brown loam, silt loam or clay loam throughout the profile. The paddy soils are grayish brown to dark grayish brown in the upper horizons. In some places they have a sandy loam substratum.

The Baegsan soils, commonly associated with the Yongji, Hwadong, Subug, Sangju, and Jisan soils, are finer-textured than the Sangju and better drained than the Yongji and Subug.

A typical profile follows.

Ap—0 to 5 cm; yellowish brown (10YR 5/4) and pale brown (10YR 6/3) silt loam; moderate, fine granular; friable; common, fine roots; abrupt, smooth boundary; pH 5.5.

A3—5 to 25 cm; light yellowish brown (10YR 6/4) silty clay loam with common, fine faint brown to dark brown (7.5YR 4/4) mottles; strong, medium platy; slightly firm; common, fine manganese concretion; pH 6.3.

B2—25 to 50 cm; yellowish brown (10YR 5/4) heavy loam with common, fine faint pale brown (10YR 6/3) mottles; moderate, very coarse prismatic; firm; pH 6.3.

B22—50 to 80 cm; yellowish brown (10YR 5/6) silt loam; common, fine faint strong brown (7.5YR 5/6) and yellowish red (5YR 5/6) mottles; strong brown (7.5YR 5/6) crushed; firm; pH 6.3.

B3—80 to 140 cm; pale brown (10YR 6/3) silt loam; firm; many, fine distinct strong brown (7.5YR 5/8) and yellowish brown (10YR 5/6); pH 6.0.

C—140 to 200+ cm; brown to dark brown (7.5YR 4/4) silty clay loam with common, medium faint pale brown (10YR 6/3) mottles; strong brown (7.5YR 5/6) crushed; weak blocky; firm; pH 6.0.

The Baegsan series are moderate in natural fertility, medium in organic matter, and are slightly to strongly acid. They have moderate permeability and medium available moisture capacity. Cation exchange capacity is medium, and base saturation high or medium.

Cultivated crops are usual, including paddy rice. Some mulberry fields and orchards have been established.

5.3.1 Baegsan Loam, 2 to 7 Percent Slopes (BeB)

The profile is usually much like that described for the series, and includes small areas of yellowish red clay loam, and silt loam or sandy loam throughout the profile.

Most crops commonly grown in the Gun do well, as does paddy rice if water is available. Erosion control is the main management problem when upland crops are cultivated.

Capability unit IIe.
Paddy suitability group P2ac.

5.3.2 Baegsan Loam, 7 to 15 Percent Slopes (BeC)

Profiles of this soil are similar to that described for the series, with some areas of the unit having silt loam, clay loam, or sandy loam textures.

The plough layer can be easily kept in good tilth. A wide range of crops, mulberry field and orchard are well suited. Paddy rice, if water is available, grows well. Erosion is the chief management hazard when upland crops are cultivated.

Capability unit IIIe
Paddy suitability group P3ac.

5.3.3 Baegsan Loam, 15 to 30 Percent Slopes (BeD)

Small rills are common and some shallow gullies but otherwise, the profile is similar to that described for the series. Some areas of silt loam, clay loam, or sandy loam textures are included.

Only a limited range of crops are suited, because of the steep slopes and erosion hazards. Most areas are well suited to pasture, mulberry or orchard. Erosion control is the main management problem.

Capability unit IVe.
Paddy suitability group P4ac.

5.4 BANHO SERIES

The series consists of gently sloping to sloping, deep, well drained, somewhat gravelly soils formed in colluvial material eroded from areas underlain by grayish brown and reddish brown shale, sandstone and conglomerate. These soils, mostly in local valleys and on alluvial fans mainly in the western part of the Gun, are members of the fine loamy family of Dystric Fluventic Eutrochrepts.

The surface layer is brown, dark brown, or dark yellowish brown gravelly loam or gravelly sandy loam 5 to 10 cm thick, but in the paddy soil ranges from grayish brown to dark grayish brown. The subsoil is yellowish brown, dark yellowish brown or strong brown gravelly loam or gravelly clay loam, and ranges from 60 to 80 cm in thickness. The C horizon is gravelly to very gravelly or cobbly sandy loam to loam.

The Banho are associated with the Sangju, Seogto, Yongji, and Anyong soils, contain less gravel than the Seogto, and are coarser, and lighter coloured than the Anyong. They differ from the Yongji in having better drainage and coarser substrata. The Sangju are free of gravel in the C horizon while the Banho are gravelly to very gravelly.

A typical profile follows.

Ap—0 to 5 cm; dark yellowish brown (10YR 4/4) sandy loam with some gravel; weak, fine and medium granular; friable; few, medium pores; common, fine roots; gradual, smooth boundary; pH 6.0.

A3—5 to 25 cm; dark yellowish brown (10YR 4/4) loam with some gravel; brown to dark brown (10YR 4/3) crushed; weak, coarse and very coarse platy breaking to blocky structure; friable; many, very fine and coarse pores; common, medium and coarse roots; abrupt, wavy boundary; pH 5.8.

B—25 to 55 cm; yellowish brown (10YR 5/6) loam with some gravel, medium and coarse subangular blocky structure; slightly firm; common, fine and coarse pores; few, fine coarse roots; abrupt, irregular boundary; pH 5.0.

C1—55 to 80 cm; yellowish brown (10YR 5/8) gravelly to cobbly sandy loam; massive; cobbles are granite-gneiss; few, fine and coarse pores; diffuse boundary; pH 5.0.

C2—80 to 120+ cm; yellowish brown (10YR 5/8) to dark yellowish brown (10YR 4/4); gravelly silty clay loam; massive; few, fine and coarse pores; gravels are granite-gneiss; pH 5.0.

The Banho are moderate in natural fertility, medium in organic matter, and are medium to strongly acid. Permeability is moderate, and available moisture capacity is medium. Cation exchange capacities are medium and base saturation high or medium.

Cultivated crops cover 80 percent while the rest is in paddy rice. Mulberry and persimmon grow in some places.

5.4.1 Banho Silt Loam, 2 to 7 Percent Slopes (BhB)

Most areas of this deep, well drained soil have profiles similar to that described for the series. In this unit are included patches that have a clay loam or silt loam surface layer, and small areas of greater slopes than the described range.

Mostly the land is well suited to crops commonly grown in the Gun, but paddy rice yields are usually low because sufficient water is not available. The main management problem is control of the moderate erosion.

Capability unit IIe.
Paddy suitability group P2ac.

5.4.2 Banho Silt Loam, 7 to 15 Percent Slopes (BhC)

Most areas have profiles similar to that described for the series. In this mapping unit are included small areas that have a yellowish brown clay loam surface layer, with greater slopes than the described range, and also Anyong and Yongji soils.

Cultivation is usually suited but paddy rice, because of the lack of irrigation water is not grown in some parts. Erosion is the chief management hazard.

Capability unit IIIe.
Paddy suitability group P3ac.

5.5 BONRYANG SERIES

The Bonryang series consisting of level to nearly level, deep, well drained soils, occurs on floodplains, mainly along the Nagdong river and its tributaries, and is a member of the coarse loamy over sandy nonacid family of Typic Udifluvents.

The soils are coarse sandy loam or loam over sand. Depth to sandy layer ranges from 70 to 100 cm. Natural colour is brown to dark brown or yellowish brown to dark yellowish brown, but when used for paddy is grayish brown to dark grayish brown. The sandy layer is yellowish brown or brownish yellow, and contains up to 30 percent of gravel and cobbles. These soils are commonly associated with the Hwangryong, Hwabong, Hagsan, and Hamchang soils.

A typical profile follows.

Ap--0 to 15 cm; brown to dark brown (10YR 4/3) sandy loam; weak, fine granular structure; few, fine pores; nonsticky and nonplastic; common, very fine and fine roots; plenty mica; clear, smooth boundary; pH 5.0.

C1--15 to 45 cm; yellowish brown (10YR 5/4) sandy loam (loam); friable, slightly sticky, and slightly plastic; few, fine and medium pores; few, fine roots; many mica; clear, smooth boundary; pH 6.0.

C2--45 to 85 cm; dark yellowish brown (10YR 4/4) sandy loam with few, medium faint mottles of pale brown (10YR 6/3), light yellowish brown (10YR 6/4) when crushed; massive; few, very fine and fine pores; few roots; abrupt, smooth boundary; pH 6.0.

IIC3--85 to 150+ cm; light yellowish brown (10YR 6/4) sand; single grain; loose; few roots; few pores; pH 6.0.

The Bonryang soils are moderate in natural fertility and low in organic matter. Available moisture capacity is low, and permeability rapid. Cation exchange capacity is low and base saturation high.

All of the area is in cultivated crops, with paddy rice occupying about 30 percent of the total.

5.5.1 Bonryang Sandy Loam, 0 to 2 Percent Slopes (Bo)

Most areas of this soil have profiles similar to the one described for the series, but included are small areas, with a surface layer of loamy sand, sand or coarse sand, and soils with sandy loam textures throughout.

This soil is suited to a wide range of crops, but because of the rapid permeability not to paddy rice. The low available moisture capacity and the need for flood control are the main management problems.

Capability unit IIs.
Paddy suitability group P4bc.

5.6 CHEONGOG SERIES

The Cheongog consists of steep, deep, well drained soils formed in materials that weathered from basic igneous rocks. Depth to hard rock is more than 1.5 m in most places. The series is a member of the fine clayey family of Typic Rhodudults.

The A horizon is reddish brown or yellowish red silty clay loam or clay loam; the B, red to dark red silty clay loam or clay loam; and the C, yellowish red, yellowish brown or reddish brown clay loam or loam. Coarse fragments of basic rock of variable colour are occasionally present. The solum is 100 to 150 cm thick.

A typical profile follows.

Ap—0 to 5 cm; reddish brown (5YR 4/4) silty clay loam; strong, fine, granular structure; sticky and plastic; few, fine pores; many, fine roots; abrupt, smooth boundary; pH 5.5

B21t—5 to 15 cm; dark red (2.5YR 3/6) silty clay with moderate very fine subangular blocky breaking to granular aggregated; very sticky and very plastic; few, fine pores; many fine roots; abrupt, smooth boundary; pH 4.5.

B22t—15 to 50 cm; red (2.5YR 4/6) silty clay loam; with moderate coarse subangular blocky structure; sticky and plastic; few, fine pores; common, fine roots; diffuse, broken boundary; pH 4.5.

B31t—50 to 90 cm; red (2.5YR 4/6), olive brown (2.5Y 4/4) clay loam; brown to dark brown (7.5YR 4/4) when crushed; massive; friable; patchy thin discontinuous clay cutans; diffuse, broken boundary; pH 5.0.

B32—90 to 130 cm; yellowish red (5YR 4/6) silty clay loam; friable; weak, medium blocky structure; few roots; few pores; clear, smooth boundary; pH 4.5.

C—130 to 170 cm; dark yellowish brown (10YR 4/4 70%), yellowish red (5YR 4/8 30%) clay loam; reddish brown (5YR 4/4) when crushed; massive; sticky and very plastic; pH 6.0.

The Cheongog soils are low in natural fertility and organic matter. Permeability is slow and the available water capacity medium to high. Cation exchange capacities are high and base saturation low. These soils have a deep root zone. The native trees are small pine.

About 90 percent is wooded, and the rest cleared for tobacco or similar crops.

5.6.1 Cheongog Bouldery Clay Loam, 30 to 60 Percent Slopes, Eroded (GbE2)

Boulders make up about 10 to 20 percent of this unit area, but apart from them, the profile is as described for the series, with some areas having a thinner one. A few small areas with slopes ranging from 15 to 30 percent, and some areas of a soil underlain by limestone are also included. This soil is not well suited to cultivation, but is to the woodland now growing. Barley and tobacco grow well but the steep slope makes erosion a serious hazard.

Capability unit VIe.

5.7 GANGDONG SERIES

The Gangdong series consists of gently sloping to sloping, deep, poorly drained soils formed in alluvium washed from nearby uplands underlain by granite, gneiss, and schist. These soils occur in the small valleys throughout the Gun, and are members of the coarse loamy over sandy nonacid family of Fluventic Haplaquepts.

The Ap horizon is grayish brown to dark grayish brown or very dark grayish brown loam or sandy loam, 5 to 10 cm thick. The B horizon is gray, dark gray or olive gray loam, and is usually stratified with thin clay loam or sandy loam layers. The C horizon is loamy sand to sand.

The Gangdong are associated with the Hamchang, Subug, and Jisan soils. The Hamchang are sandy loam throughout the profile, and are not underlain by loamy sand. The Gangdong soils are relatively coarser textured than the Jisan.

A typical profile follows.

Ap--0 to 5 cm; grayish brown (2.5Y 5/2) to dark grayish brown (2.5Y 4/2) loam with few coarse distinct dark gray (5Y 4/1) mottles; olive gray (5Y 5/2) when crushed; massive; many, fine to medium roots; abrupt, smooth boundary; pH 6.5.

Alg--5 to 25 cm; dark gray (5Y 4/1) loam with few, fine distinct olive brown (2.5Y 4/4) mottles; slightly sticky and plastic; structureless (massive); common, fine to medium roots; gradual, smooth boundary; pH 6.5.

Blg--25 to 40 cm; dark gray (5Y 4/1) loam with few, fine olive brown (2.5Y 4/4) mottles; massive; friable, slightly sticky, and plastic; few, fine pores; few, fine roots; clear, smooth boundary; pH 6.5.

B3g--40 to 70 cm; very dark gray (5Y 3/1) loam; massive; firm, very plastic, and very sticky; clear, smooth boundary; pH 6.5.

Cg--70 to 120+ cm; gray (5Y 5/1) sand and stratified loamy sand; structureless (single grain); nonsticky and nonplastic; pH 7.0.

The soils of Gangdong series are low to medium in natural fertility, medium in organic matter, and are slightly acid to neutral. They have rapid permeability and low to medium available moisture capacity. Cation exchange capacity is low to very low, and the base saturation high.

Because of the high groundwater table, all of the land is in rice paddy.

5.7.1 Gangdong Loam, 2 to 7 Percent Slopes (GdB)

The profiles of most areas are similar to that described for the series. With this soil are included small areas that have a clay loam or loamy sand surface layer, and a few small areas of less slope than the described range. Some parts have loamy textures throughout. Surface runoff is very slow.

This soil is suited to a wide range of crops if the high groundwater table is lowered. Paddy rice, a crop that grows well on this soil, is generally cultivated. The main management problem for crops other than rice, is to lower the water table.

Capability unit IIw.
Paddy suitability group P3ab.

5.7.2 Gangdong Loam, 7 to 15 Percent Slopes (GdC)

This deep, poorly drained soil has a profile as described for the series, but includes patches that have a sandy loam, sandy clay loam, or clay loam surface layer, small parts with greater slopes, and a few small areas of soils with loam or sandy loam textures throughout.

Good yields of most crops, if the high groundwater table is lowered, will be produced, but in its present condition it is well suited only to paddy rice. Crops other than rice are subject to droughtiness in the years of unfavourable rainfall because of the low available moisture capacity. The main management problem for crops other than rice is to control the groundwater table.

Capability unit IIIw.
Paddy suitability group P3ab.

5.8 GEUGRAG SERIES

Soils of the Geugrag series are level to nearly level, very deep, and imperfectly drained. They have formed in mixed alluvial materials, and are distributed chiefly in the eastern part of the Gun. This series is a member of the fine clayey family of Aeric Ochraqualfs.

The Ap horizon is silt loam or loam, but is silty clay loam or clay loam in the areas where the surface layer has been removed or disturbed by the rearrangement of farm land. Its colour ranges from dark gray to dark grayish brown with mottles of yellowish brown or olive brown. The B horizon is yellowish brown or dark yellowish brown, mottled with grayish brown or light gray, very sticky and very plastic silty clay loam or silty clay.

The Geugrag occur with the Hwadong, Gongseong and the Hamchang soils. The Hwadong are on higher elevations and are better drained than the Geugrag, while the Gongseong are redder and harder in consistence.

A typical profile follows.

Ap--0 to 5 cm; grayish brown (10YR 5/2) silt loam; few, fine distinct yellowish brown (10YR 5/6) mottles; pale brown (10YR 6/3) when crushed; structureless (massive); friable; few, fine discontinuous random vesicular pores; many, fine roots; clear, smooth boundary; pH 5.5.

Blg--15 to 25 cm; dark gray (5Y 4/1) silt loam; few, fine prominent strong brown mottles (7.5YR 5/6); olive gray (5Y 5/2) when crushed; massive; sticky and plastic; few, fine pores; common, fine roots; gradual, boundary; pH 6.0.

B2l--25 to 55 cm; yellowish brown (10YR 5/8) silty clay with many, medium, distinct light gray to gray (10YR 6/1) mottles; yellowish brown (10YR 5/6) when crushed; moderate, fine and medium subangular blocky structure; firm, very sticky, and very plastic; few, fine, common pores; few roots; gradual, smooth boundary; pH 6.0.

B22--55 to 90 cm; yellowish brown (10YR 5/8) silty clay; common, fine faint, light gray to gray (10YR 6/1) mottles; pale brown (10YR 6/3) when crushed; weak, blocky structure; firm, very sticky, and very plastic; many, very fine and coarse pores; gradual, smooth boundary; pH 6.0.

B3--90 to 120+ cm; light gray to gray (N/6) silt clay loam; common, fine, prominent yellowish brown (10YR 5/8), mottles; light olive brown (2.5Y 5/4) when crushed; massive; sticky and plastic; many pores; pH 6.0.

The Geugrag are moderately high in neutral fertility and medium in organic matter content. Permeability is very slow and available water capacity high. They are medium to strongly acid, and are high both in cation exchange capacity and in base saturation. Rice and barley grow well and are widely cultivated. Some limited depression areas are used only for paddy due to the high groundwater table.

5.8.1 Geugrag Silt Loam, 0 to 2 Percent Slopes (Gr)

Most areas have a profile as described for the series, but included are patches that have a silty clay loam or sandy loam surface layer, and small areas of Hwadong, Bonryang, and Hamchang.

The land is easily kept in good tilth, and most is in cultivated crops. It is suited to paddy rice, and a wide range of other crops if properly drained. There is no particular problem in growing rice, but drainage is required for most other crops.

Capability unit IIw.
Paddy suitability group P1.

5.9 GONGSEONG SERIES

Soils of the Gongseong series are gently sloping to sloping, deep and moderately well drained. They occur on alluvial-colluvial terrace positions, and the series is a member of the fine clayey family of Aquic Hapludalfs.

The Ap horizon is yellowish brown, dark brown, or dark yellowish brown loam clay loam or silty clay loam, except for tracts used for paddy rice which are grayish brown. The B2lt horizons are similar to the upper B horizon but have many light gray or light grayish brown mottles. The C horizons are brownish yellow or yellowish brown clay loam.

The Gongseong occur with the Hwadong, Jangweon, and the Geugrag soils. The Jangweon have a fragipan and are on mountain footslopes, while the Geugrag are less well drained than the Gongseong series and are on lower elevations. The Hwadong soils are yellowish brown, less clayey ranging from 35 to 45 percent clay.

A typical profile follows.

Ap--0 to 10 cm; yellowish brown (10YR 5/8) silty clay loam with weak, fine subangular blocky structure; friable, sticky, and plastic; clear, smooth boundary; pH 5.5.

B2lt--10 to 30 cm; yellowish red (5YR 4/8) and strong brown (7.5YR 5/6) silty clay; strong brown (7.5YR 5/6) crushed; strong, fine and medium angular blocky structure; very sticky and very plastic; continuous thin clay cutans; common, coarse black manganese mottling on ped faces; gradual, wavy boundary (13 to 20 cm thick); pH 5.0.

B22t--30 to 50 cm; strong brown (7.5YR 5/6) and yellowish red (5YR 5/6) silty clay; yellowish red (5YR 5/8) crushed; strong fine and medium angular blocky; firm; continuous thin clay cutans; medium black manganese concretions; very sticky and very plastic; clear, wavy boundary; pH 5.0.

B23t--50 to 80 cm; strong brown (7.5YR 5/6) and yellowish brown (10YR 5/8) silty clay with common, coarse faint light gray (10YR 7/1) mottles; strong brown (7.5YR 5/6) crushed; strong, medium and coarse angular blocky structure; patchy thin clay cutans; diffuse, irregular boundary; pH 5.0.

B3t--80 to 150 cm; light gray (10YR 7/1) clay with many, coarse, distinct strong brown (7.5YR 5/6) mottles; yellowish red (5YR 5/8) crushed; medium and coarse angular blocky structure; patchy, thin clay cutans; very sticky and very plastic; pH 5.0.

The Gongseong soils are moderate in natural fertility and medium in organic matter content. Permeability is very slow and the available water capacity high. These soils have a deep root zone, and are all cultivated to rice and other crops.

5.9.1 Gongseong Silty Clay Loam, 2 to 7 Percent Slopes (GsB)

Most areas have a profile similar to that described for the series. In areas of this soil are included patches that have a very fine sandy loam surface layer, and a few small areas with less clay. Runoff is slow.

There is suitability for a wide range of crops, with now about 30 percent used only for rice, and 70 percent cultivated for rice and winter barley.

Capability unit IIe.
Paddy suitability group P2ac.

5.9.2 Gongseong Silty Clay Loam, 7 to 15 Percent Slopes (GsC)

Profiles of most areas resemble the one described for the series. In areas mapped as this soil are included patches that have a fine sandy loam surface layer, a few small areas with less or greater slope than the described range, and small areas of Jangweon soils. Runoff is slow, and permeability very slow.

Most of the area is used for crops other than rice. Erosion is the main management hazard.

Capability unit IIIe.
Paddy suitability group P3ac.

5.10 GWANAG SERIES

The soils of the Gwanag series are steep, shallow, somewhat excessively drained, and occur on the mountainous areas in the northwestern part of the Gun, having formed in material weathered from granite or granite-gneiss. Depth to hard rock is 30 to 50 cm. This series is a member of the loamy skeletal family of Lithic Dystrichrepts.

The surface layer is loam or gravelly fine sandy loam that ranges from dark brown or dark yellowish brown. The B horizon is yellowish brown or dark yellowish brown, gravelly to very gravelly loam or fine sandy loam underlain by hard rock. Many fragments of granite, granite-gneiss or porphyry are on the surface, and rock outcrops are common. The Gwanag soils occur with the Nagseo, and Samgag series and rock land. The Nagseo soils are redder and have developed mainly from schist.

A typical profile follows.

Al--0 to 10 cm; dark yellowish brown (10YR 4/4) loam with strong, fine and very fine granular structure; friable, slightly sticky, and slightly plastic; few, fine pores; many, very fine and coarse roots; clear, smooth boundary; pH 5.5.

B--10 to 30 cm; yellowish brown (10YR 5/6) friable, very gravelly loam with weak blocky structure; sticky and plastic; common, fine roots; many angular blocky granite fragments; few pores; clear, smooth boundary; pH 5.0.

R--30+ cm; hard granite.

The Gwanag soils are low in natural fertility and medium to low in organic matter. Permeability is rapid, and the available moisture capacity very low. Cation exchange capacity is medium to low and base saturation low. The native trees were small pines, and oaks. Most areas are in forest, with some shrubs and small areas of wild grass.

5.10.1 Gwanag Rocky Sandy Loam, 30 to 60 Percent Slopes, Eroded (GnE2)

About 10 to 25 percent of this unit is rock outcrop. Profiles between the rocks are similar to that described for the series. In areas mapped as this soil are included patches having a sandy loam or clay loam surface layer, a few small areas with slopes ranging from 15 to 30 percent, and small areas of Seogto and Samgag soils. The total makes up less than 10 percent of this mapping unit.

About 10 percent of the area has been cleared for crops, such as potato, sweet potato, sorghum, millet and corn. But, generally, it is suitable only for woodland, but because of the unfavourable characteristics only low yields from that can be expected. In managing this soil the main concern is erosion control.

Capability unit VIIe.

5.11 GYUAM SERIES

The Gyuum series, consisting of deep to very deep, moderately well drained, moderately slowly permeable soils formed in recent alluvium on level to nearly level broad alluvial plains, is a member of the coarse silty family of Aquic Fluventic Eutrochrepts.

The A horizon is grayish brown to very dark grayish brown loam, fine sandy loam, or silt loam. The B horizons are brown to dark brown, dark grayish brown, yellowish brown, or strong brown with coarse silt loam, and are gravel-free. The Gyuum soils occur with the Seoggye, Jungdong, and Hamchang soils.

The Seoggye soils are sandy loam, Jungdong soils have fine sandy loam textures, and are better drained than the Gyuum, while the Hamchang are more poorly drained.

A typical profile follows.

Ap--0 to 4 cm; yellowish brown (10YR 5/6) loam with common, fine faint pale brown (10YR 6/3) mottles; yellowish brown (10YR 5/4) when crushed; massive; slightly sticky and nonplastic; many, fine white mica flakes; clear, wavy boundary (3 to 7 cm thick); pH 6.0.

A3g--4 to 25 cm; olive gray (5Y 5/2) loam with common, coarse, prominent strong brown (7.5YR 5/6) mottles; olive brown (2.5Y 4/4) when crushed; few, medium yellowish red (5YR 5/6) linings in root channel; slightly sticky and nonplastic; many white mica flakes; clear, smooth boundary; pH 6.5.

B1--25 to 35 cm; yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) silt loam with common, medium prominent light olive brown (2.5 4/4) mottles; strong brown (7.5YR 5/8) when crushed; few, medium black concretions; massive; slightly sticky and slightly plastic; clear, smooth boundary; pH 6.5.

B2--35 to 45 cm; strong brown (7.5YR 5/8) loamy very fine sand with few, medium prominent light olive brown (2.5Y 5/4) mottles; yellowish brown (10YR 5/8) when crushed; single grain; slightly sticky and nonplastic; abrupt, smooth boundary; pH 6.5.

B3--45 to 70 cm; strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) silt loam; common, coarse, prominent light olive brown (2.5Y 5/4) mottles; strong brown (7.5YR 5/8) when crushed; very weak, prismatic structure; common, very coarse very dark brown (10YR 2/2) concretions; sticky and plastic; gradual, wavy boundary (20 to 30 cm thick); pH 6.5.

C1--70 to 120 cm; yellowish brown (10YR 5/8) silt loam with common, medium prominent light yellowish brown (2.5Y 6/4) and few, light olive gray (5Y 6/2) mottle; massive; yellowish brown (10YR 5/6) when crushed; common, fine black concretions; common, fine white mica flakes; sticky and plastic; pH 6.5.

C2--120 to 130 cm; yellowish brown (10YR 5/6) silt loam; many, coarse distinct light olive gray (5Y 6/2) mottles; massive; light olive brown (2.5Y 5/4) when crushed; pH 6.5.

The Gyuan are slightly acid. Natural fertility and organic matter content are moderate to high, while available moisture capacity is high. All of the areas are in cultivated crops, paddy rice growing during summer and barley in winter.

5.11.1 Gyuan Silt Loam, 0 to 2 Percent Slopes (Gy)

Most areas have profiles similar to that described for the series. With this soil are included some areas that have a surface layer of grayish brown to dark grayish brown sandy loam or loamy sand. This soil, completely cultivated, is well suited to barley, wheat, and vegetables, and mostly is planted to paddy rice in the summer and barley during the winter. In some tracts of small extent additional drainage is required.

Capability unit I.
Paddy suitability group P2c.

5.12 HABIN SERIES

The Habin series consists of moderately steep to steep, shallow to very shallow, somewhat excessively drained soils developed in residuum weathered chiefly from red shale, fine grained sandstone, and conglomerate. Depth to hard rock ranges from 20 to 50 cm. These soils, mostly on the moderately to strongly dissected mountainous areas in the southwest part of the Gun, are members of the coarse loamy family of Lithic Eutrochrepts.

The A horizon is 10 to 20 cm thick, dark reddish brown, weak red or dusky red loam, fine sandy loam or silt loam. The B is reddish brown gravelly to very gravelly loam, silt loam or fine sandy loam over consolidated hard rock. Depth to the bedrock is 30 to 50 cm.

In the lower slopes the Habin are associated with the Sinjeong, but in the higher slopes they occur with the Nageo and Mudeung soils. The Mudeung and Nageo are over granite, gneiss, schist, and some porphyry, while the Habin overlies red shale. The Sinjeong are deeper than the Habin soils.

A typical profile follows.

A—0 to 10 cm; dark brown (10YR 3/3) silt loam; strong, fine granular; friable, slightly sticky, and slightly plastic; few, fine pores; some gravel consisting of fresh, red shale fragments; many very fine and coarse roots; clear, smooth boundary; pH 4.5.

B—10 to 30 cm; dark brown (7.5YR 3/2) very gravelly to cobbly silt loam; structureless (massive); friable, sticky, and plastic; few pores; very gravelly to cobbly, fresh red shale fragments; common, fine and medium roots; clear, smooth boundary; pH 5.5.

R—30+ cm; hard red shale.

The Habin are moderate in natural fertility, medium in organic matter, and are medium to strongly acid. They have very low available moisture capacity and moderate permeability. Cation exchange capacity is low, and base saturation commonly high.

About 60 percent is in poor pine forest with some oaks, while the rest is cropped.

5.12.1 Habin Rocky Loam, 15 to 30 Percent Slopes, Eroded (HbD2)

About 20 to 30 percent of this unit is rock outcrop, otherwise, the profile is similar to that described for the series. With this soil are included small areas that have a reddish brown gravelly clay loam surface layer, and a few small areas of deeper, gravelly soils.

Because of the erosion hazard and shallow soil depth, cultivated crops are not well suited. However, grassland and woodland are, but only low yields can be expected. At present, about 40 percent is used to grow barley, soybean, wheat, and buckwheat. A close-growing ground cover should be maintained to protect the soil.

Capability unit VIe.

5.12.2 Habin Rocky Loam, 30 to 60 Percent Slopes, Eroded (HbE2)

About 30 to 40 percent of the unit is rock outcrop, and most areas have a loam or fine gravelly loam surface layer. Otherwise, the profile is similar to that described for the series. With this soil are included small areas of a yellowish red or strong brown gravelly clay loam surface layer, some shallow gullies, a few small areas of greater slope than the described range, small areas of very rocky soil, deeper gravelly soils, and some shallow soils over porphyry.

Because of the erosion hazard and the shallow soil depth over hard bedrock, it can only be used for grassland or woodland, with no expectation of high yields. Erosion control is the main management hazard.

Capability unit VIe.

5.13 HAMCHANG SERIES

The Hamchang series, consisting of level to nearly level, deep, poorly drained soils formed in alluvium on depressed floodplains adjacent to stream channels, is a member of the coarse loamy nonacid family of Typic Haplaquepts.

Because of sedimentation of river channels the stream beds are higher than the floodplains, and water remains on the ground much of the time.

The surface layer is olive gray, grayish brown, gray or dark gray silt loam, loam, sandy loam, or loamy sand. The B horizon is gray, dark gray, olive gray, or very dark gray silt loam, loam or sandy loam. The C is dark gray to gray loam, fine sandy loam or sandy loam, and contains few fine gravel in some places. The Hamchang, occurring with the Sindab, Seogyee, and Sinheung, are finer textured than the Sindab and less well drained than the Seogyee and the Sinheung. They are strongly to medium acid, high in natural fertility, and medium in organic matter.

A typical profile follows.

Ap—0 to 15 cm; light olive brown (2.5Y 5/6) silt loam; common fine faint yellowish brown (10YR 5/6) mottles, light olive brown (2.5Y 5/4) crushed, weak, fine and coarse granular structure; friable, slightly sticky, and slightly plastic; few, fine pores; common, fine roots; gradual, smooth boundary; pH 5.0.

B1—15 to 30 cm; light olive gray (5Y 6/2) silt loam; many, medium to coarse faint yellowish brown (10YR 5/8) mottles; pale brown (10YR 6/3) crushed; sticky and plastic; common, very fine to fine pores; common, very fine to fine roots; gradual, wavy boundary; pH 5.5.

B21—30 to 40 cm; dark gray (10YR 4/1) silt loam; common, medium to coarse prominent dark yellowish brown (10YR 4/4) mottles; olive (5Y 4/3) crushed; massive; sticky and plastic; many, medium to coarse pores; many, coarse roots; diffuse, smooth boundary; pH 6.5.

B22g—40 to 60 cm; yellowish gray (10Y 5/1) silt loam; few, fine prominent dark yellowish brown (10YR 4/4) mottles; yellowish gray (10Y 5/1) crushed; massive; sticky and very plastic; few, fine pores; many medium roots; clear, smooth boundary; pH 6.3.

C1g—60 to 100 cm; gray (10Y 5/1) sandy loam; common, medium to coarse olive brown (2.5Y 4/4) (along the root channel) mottles, dark yellowish gray (10Y 4/2) crushed; massive; friable, slightly sticky, and plastic; light olive brown (2.5Y 5/6) very thin sand layer; few, very coarse pores; many coarse root channels; diffuse, smooth boundary; pH 6.0.

C2g—100 to 150 cm; olive gray (5Y 5/2) very fine sandy loam; structureless (massive); slightly sticky and slightly plastic; few pores; few roots; pH 6.5.

Available moisture capacity is moderate and permeability is moderate to rapid. Cation exchange capacity is low and base saturation high. Most areas are cultivated only to paddy rice.

5.13.1 Hamchang Silt Loam, 0 to 2 Percent Slopes (Hh)

This soil has a profile as described for the series. Some areas are included that have a loamy sand or sand surface layer, as are small areas of the Sindab, Sinheung and Seoggye soils. Because of the poor drainage and the high groundwater table only paddy rice does well. Drainage is required to grow other crops. The main management problems are flood control and drainage improvement.

Capability unit IIIw.
Paddy suitability group P3b.

5.13.2 Hamchang Soils, Sandy Loam Over Wash, 0 to 2 Percent Slopes (Ha)

This soil has about 20 to 50 cm of sandy loam, loamy sand, or sand over a profile similar to that typical of the series. It is usually adjacent to streams, from which flood waters have deposited sandy material, thus lowering productivity. Included are some areas with sand or loamy sand textures. Paddy rice is only moderately suited because of the low available moisture capacity, but it is cultivated due to the poor drainage and high groundwater table. Flood control and drainage are main management problems.

Capability unit IIIw.
Paddy suitability group P3b.

5.14 HOGYE SERIES

The Hogye series consists of deep, dark coloured, well drained, moderately permeable soils that formed in recent alluvium. These soils are found in nearly level to gently sloping, slightly elevated alluvial fans and small valleys in mountainous regions. The series is a member of the loamy skeletal family of Fluventic Hapludolls.

The A horizon is black, very dark gray, or very dark grayish brown gravelly sandy loam, gravelly loam, or gravelly silt loam. The B horizon is brown, dark brown, or dark yellowish brown gravelly sandy loam, gravelly loam or gravelly silt loam.

A typical profile follows.

A--0 to 50 cm; very dark brown (10YR 2/2) gravelly fine sandy loam; weak, very fine to fine subangular blocky breaking to granular structure; friable; pH 5.5.

B--50 to 150 cm; brown to dark brown (10YR 4/3) gravelly sandy loam; weak, medium angular blocky structure; slightly firm; 35 to 50 percent gravel with some cobbles.

The Hogye soils are slightly to medium acid, and are high in natural fertility and organic matter. Available moisture capacity is low to medium.

They are well suited to cultivation, and generally are planted to grain crops and vegetables. Chestnut trees, persimmon, and tobacco plants are growing in some places. Crops on these soils respond to good management.

5.14.1 Hogye Gravelly Loam, 2 to 7 Percent Slopes (HgB)

This permeable, alluvial soil occupies nearly level to gently sloping, alluvial fans and local valleys along the Oeseo stream. Most areas have a profile similar to that described for the series. With this soil are included a few small areas having a surface layer from which most gravel has been removed, some areas of sandy soils with and without gravel, and small areas that have a very gravelly to very cobbly loam or sandy loam surface layer. Some areas are nearly level.

Cultivation is generally to many kinds of crops with the exception of rice. Chestnut trees and persimmon are growing in some places, and a few tracts are planted to tobacco. The removal of stones from the plough layer will facilitate tillage and improve yields.

Capability unit IIs.
Paddy suitability group P4abc.

5.15 HWABONG SERIES

The Hwabong series, consisting of nearly level, deep, excessively drained soils formed in alluvium along the streams, are members of the sandy family of Typic Udipsamments.

These soils are yellowish brown to dark yellowish brown or brownish yellow loamy sand, sand or coarse sand, and are usually stratified with fine gravelly layers in the lower profile. In most places small gravel fragments are common on the surface.

The Hwabong, associated with the Hwangryong, Bonryang and Sindab soils, are coarser textured than the Bonryang, and are free, or have only small amounts of gravel. The Hwangryong contain much gravel, and the Sindab have poor drainage and a higher groundwater table.

A typical profile follows.

Ap—0 to 15 cm; dark yellowish brown (10YR 4/4) sand; single grain; many fine to coarse roots; clear, smooth boundary; pH 6.0.

Cl—15 to 25 cm; yellowish brown (10YR 5/8) loamy sand; single grain; common fine to coarse roots; abrupt, brokent boundary; pH 5.0.

Cl—25 to 40 cm; light olive brown (2.5Y 5/4) sandy loam with common, medium faint mottles of strong brown (7.5 YR 5/8), yellowish brown (10YR 5/6), when crushed; slightly sticky and nonplastic; very fine to fine pores; common, common medium roots; abrupt, smooth boundary; pH 4.7.

C2--40 to 120 cm; yellowish brown (10YR 5/6) sand with some fine gravel; single grain; diffuse, smooth boundary; pH 4.7.

The soils of the series are low both in natural fertility and organic matter. They have a low available moisture capacity and very rapid permeability. Cation exchange capacity is very low, and base saturation which is usually high may be low.

These soils are best suited to drought resistant crops.

5.15.1 Hwabong Loamy Sand, 0 to 2 Percent Slopes (Hw)

In this mapping unit are included some areas of a soil that have a very gravelly sandy loam surface layer and a sandy loam surface layer over sand, but otherwise the profiles are generally similar to that described for the series.

The soil is suitable for a limited range of crops, such as peanuts, melon, and watermelon. Poplar and mulberry trees can be grown well. The main management requirement is the selection of drought resistant crops. Other problems are flooding and the leaching of plant nutrients.

Capability unit IVs.
Paddy suitability group P4bc.

5.16 HWADONG SERIES

The series, consisting of gently sloping to sloping, deep, moderately well drained, permeable soils developed in alluvium, occupies slightly dissected low terraces and alluvial plains, and is a member of the fine clayey family of Aquic Hapludalfs.

The Hwadong soils used for growing rice have an A1 horizon of grayish brown to dark grayish brown, mottled yellowish brown or strong brown loam, silt loam or silty clay loam. Hwadong soils not used for growing rice have yellowish brown, brown, or strong brown surface layers. The upper B horizon is strong brown or yellowish brown silty clay loam or clay loam. Soils used for rice have gray colours in the upper B.

The lower B horizon of yellowish brown, or gray or light gray mottled loam or sandy clay loam, is sometimes stratified with sandy loam layers.

The Hwadong are associated with the Geugrag, Gongseong, and Baegsan soils, the second having some gray colours. The Gongseong are more slowly permeable and have more clay in the B horizon than the Hwadong. The Baegsan are better drained, coarser textured and lack the clayey B horizon of the Hwadong.

A typical profile follows.

Ap--0 to 10 cm; grayish brown (2.5Y 5/2) silt loam with common fine prominent yellowish brown (10YR 5/8) mottles, light olive brown (2.5Y 5/4) crushed; massive; sticky and plastic; many fine roots; clear, smooth boundary; pH 5.5.

A1--10 to 18 cm; dark olive gray (5Y 3/2) loam with common, moderate coarse prominent yellowish red (5YR 4/6) mottles; olive (5Y 5/3) crushed; sticky and very plastic; massive; common fine roots; clear, smooth boundary; pH 6.0.

B1—18 to 30 cm; olive (5Y 5/3) loam with common, fine, distinct strong brown (7.5YR 5/8) mottles; olive brown (2.5Y 4/4) crushed; sticky and plastic; weak, fine coarse subangular blocky structure; few roots; abrupt, smooth boundary; pH 6.0.

B21t—30 to 50 cm; gray (N5/), grayish brown (2.5Y 5/2) loam with few, fine, prominent, strong brown (7.5YR 5/8) mottles; brown (10YR 5/3) crushed; moderate, fine and coarse subangular blocky structure; sticky and plastic; gradual, smooth boundary; pH 6.0.

B22t—50 to 80 cm; strong brown (7.5YR 5/8) silty clay loam; yellowish brown (10YR 5/6) crushed; very coarse, prismatic breaking to angular blocky structure; sticky and very plastic; gradual, smooth boundary; pH 6.0.

B23t—80 to 120 cm; yellowish brown (10YR 5/8) clay loam with common, medium distinct light gray (10YR 7/1) mottles; yellowish brown (10YR 5/6) crushed; moderate, coarse prismatic structure; sticky and very plastic; pH 6.0.

The Hwadong are medium to strongly acid, moderate in natural fertility, and medium in organic matter. Available moisture capacity is high. Cation exchange capacity and base saturation are high. Rice and barley are usually cultivated.

5.16.1 Hwadong Silty Clay Loam, 2 to 7 Percent Slopes (HdB)

Profiles of most areas are similar to that described for the series, but included are small areas of soils with more gray colours, some soils with loam or silt loam textures, and some areas that have a loam, clay loam, silty clay loam or sandy loam surface layer.

The soil is mostly planted to paddy rice in the summer and barley during the winter, and crop yields are moderately high. Response to added lime or fertilizer is good. The main management concern is erosion control.

Capability unit IIe.
Paddy suitability group P2ac.

5.16.2 Hwadong Silty Clay Loam, 7 to 15 Percent Slopes (HdC)

Most areas have profiles similar to that described for the series, with some places having a subsoil of gravelly clay loam. In this unit are also included small tracts of soils with clay, some small areas with silt loam to loam textures, and some areas with clay loam or loam surface layers.

Paddy rice and winter barley in a two-crop-a-year cropping system are usual, and response to added lime and fertilizer, good. Erosion control is the main management problem.

Capability unit IIIe.
Paddy suitability group P3ac.

5.17 HWANGRYONG SERIES

The Hwangryong series, consisting of nearly level, deep, very gravelly, excessively drained soils formed in alluvium on the floodplain along the streams, are members of the loamy skeletal family of Typic Udipsamments.

The Ap horizon is usually yellowish brown to dark yellowish brown gravelly sandy loam, coarse sand, or loamy sand, and ranges from 5 to 15 cm in thickness. It is grayish brown or dark grayish brown in the rice paddies. The C horizon is yellowish brown to dark yellowish brown, or brownish yellow gravelly to very gravelly, or cobbly to very cobbly sandy loam, loamy sand or coarse sand.

The Hwangryong occur commonly with the Hwabong and Bonryang series and the riverwash land type. The Hwabong are free of coarse fragments, and the Bonryang are finer textured than the Hwangryong.

A typical profile follows.

Ap--0 to 10 cm; yellowish brown (10YR 5/6) gravelly sandy loam with moderate, very fine to fine granular structure; friable; few, very fine to fine discontinuous random inped vesicular pores; many very fine to fine living roots; clear, smooth boundary; pH 4.5.

C1--10 to 25 cm; dark yellowish brown (10YR 4/4) gravelly sandy loam with structureless (massive); friable, slightly sticky, and nonplastic; many, very fine and fine discontinuous exped dendritic vesicular pores; many fine living roots; clear, smooth boundary; pH 4.5.

C2--25 to 35 cm; yellowish brown (10YR 5/8) very gravelly sandy loam with structureless (massive); friable, slightly sticky and slightly plastic; pores and roots same as in layer above; abrupt, smooth boundary; pH 5.0.

C3--35 to 100 cm; yellowish brown (10YR 5/6) very gravelly to cobbly coarse sand, about 40 percent coarse fragments; structureless (single grain); few pores; few roots; pH 4.7.

The soils are low in natural fertility, medium in organic matter, and are neutral to medium acid. They have very low available moisture capacities and very rapid permeability. Cation exchange capacity is very low, and base saturation, usually high, may be low. Cultivated crops are general, with some small areas planted to paddy rice. Mulberry fields and orchards of apple and pear have been established on some land.

5.17.1 Hwangryong Sandy Loam, 0 to 2 Percent Slopes (Hk)

Most areas have a profile as described for the series, but many pieces of gravel and cobbles have been removed from rice paddy and buried. Small areas of greater slopes than the described range are included.

This soil is poorly suited to most crops, but melon, watermelon, wheat and some other vegetables do well. Major management problems are low available moisture capacity, flood control, and the leaching of plant nutrients.

Capability unit IVs.
Paddy suitability group P4bc

5.18 IBSEOG SERIES

The Ibseog series, consisting of gently sloping to sloping, deep, excessively drained soils formed in alluvium, are composed of crystals of minerals in coarse grained granite or gneiss that were eroded from adjacent higher Sangag soils. The series is a member of the sandy skeletal family of Typic Udipsamments. The Ap horizon is dark yellowish brown to very pale brown fine gravelly loamy coarse sand or sand. The C horizon is yellowish brown to strong brown fine gravelly coarse sand. The gravel ranges from 2 to 5 mm in size.

The Ibseog soils are fine gravelly coarse, while the Hwabong are mainly coarse, sand.

A typical profile follows.

Ap--0 to 5 cm; yellowish brown (10YR 5/6) moist very fine gravelly coarse sand; single grain; loose; few, fine roots; pH 4.5.

C--5 to 120+ cm; strong brown (7.5YR 5/6) fine gravelly coarse sand; structureless (single grain); few roots; pH 6.0.

They are low in natural fertility and organic matter content. Permeability is very rapid, and available moisture capacity very low. Cation exchange capacity is very low, and base saturation is variable but usually high.

Most areas are in cultivated crops other than paddy rice, while mulberry, chestnut, and persimmon also grow in some parts. Tobacco is grown in the highly elevated western areas.

5.18.1 Ibseog Fine Gravelly Loamy Coarse Sand, 2 to 7 Percent Slopes (IbB)

Most areas have profiles similar to that described for the series, but included are small areas with a sandy loam or loam surface layer and with sandy loam textures. Water enters and passes through the soil at a very rapid rate.

Crops other than rice are mostly grown, but do badly because of the very low available moisture capacity. Mulberry, chestnut, and persimmon are grown in some areas, and tobacco, peanuts, and similar crops do well. Leaching of plant nutrients and low fertility are other management problems.

Capability unit IVs.
Paddy suitability group P4abc.

5.18.2 Ibseog Fine Gravelly, Loamy Coarse Sand, 7 to 15 Percent Slopes (IbC)

Most areas have profiles similar to that described for the series. In this soil are included small areas that have a sandy loam surface layer, some areas that have greater slopes than the described range, and a few small areas of soils with sandy loam textures.

This soil is poorly suited to most crops, but is cultivated, mainly in tobacco and peanuts. Major management problems are to lessen the effects of droughtiness, leaching, and low fertility.

Capability unit IVs.
Paddy suitability group P4abc.

5.19 IMOGE SERIES

The Imog series, consisting of gently sloping, dark coloured, deep, well drained soils formed in alluvium washed from nearby uplands, occur on small alluvial fans and footslopes throughout the Gun, and are members of the coarse loamy family of Fluventic Hapludolls.

The A horizon is dark brown to very dark brown fine gravelly sandy loam, sandy loam or loam. The C is dark yellowish brown or brown to dark brown gravelly sandy loam to gravelly loamy sand.

The Imog, occurring commonly with the Hogye, Sangju, and Bonryang soils, are less gravelly than the Hogye, and darker coloured than the Sangju and Bonryang.

A typical profile follows.

A1--0 to 55 cm; very dark brown (10YR 2/2) sandy loam; weak, coarse blocky structure; friable; common, medium, expd, tubular pores; about 10 percent fine gravel; few fine and medium roots; clear, smooth boundary; pH 5.5.

C1--55 to 95 cm; dark yellowish brown (10YR 3/4) sandy loam; structureless (massive); friable; few fine roots; clear smooth boundary; pH 5.5.

C2--95 to 125 cm; brown to dark brown (7.5YR 4/2) gravelly loamy sand; structureless (single grain); loose; pH 5.0.

The soils of the series are moderately high in natural fertility, high in organic matter, and are medium to strongly acid. The available moisture capacity is low to moderate and permeability is rapid. Cation exchange capacity is low to medium and base saturation high.

Most of the areas are in cultivated crops and mulberry fields.

5.19.1 Imog Sandy Loam, 2 to 7 Percent Slopes (ImB)

Many areas have up to 30 cm of light coloured fine gravelly sandy loam over the typical profile. Otherwise, this soil has a profile like that typical for the series. A few small areas of less slopes than the described range, and very small tracts of very gravelly soils, are also included.

Most crops commonly grown in the Gun will do well, but paddy rice because of the rapid permeability which allows a high water loss will not. All of the areas are now in cultivated crops other than rice. Erosion control is the main management problem.

Capability unit IIs.
Paddy suitability group P4abc.

5.20 JANGWEON SERIES

The Jangweon series consists of gently sloping to moderately steep, shallow to moderately deep, well drained soils formed in alluvium-colluvium washed from areas underlain by fine textured igneous rocks and shale. These soils have a compact horizon known as a fragipan at depth of 30 to 50 cm, and are members of the fine loamy family of Typic Fragiochrepts.

The Ap horizon is brown to dark brown or dark yellowish brown gravelly loam, gravelly sandy loam or sandy loam in the cultivated areas, but is mostly pale brown in the woodland area, and mottled grayish brown in rice paddy. The thickness of the A and B horizons overlying the hard fragipan ranges from 20 to 50 cm. The Bx horizon is yellowish brown or brownish yellow loam or sandy loam mottled with pale brown and light yellowish brown. Its consistence is very hard to extremely hard. The C horizon is pale brown or yellowish brown loam, cobbly loam, or sandy loam.

The Jangweon occurs commonly with the Seogto, Anyong, and Gongseong soils, but none of these have its compact fragipan layers.

A typical profile follows.

Ap—0 to 5 cm; brown to dark brown (10YR 4/3) sandy loam; moderate, fine granular structure; friable; few, fine pores; common, fine roots; gradual, smooth boundary; pH 5.0.

A3—5 to 20 cm; dark yellowish brown (10YR 4/4: moist) sandy loam with weak, coarse granular structure; slightly firm; medium pores; few, fine quartz fragments; few, fine grass roots; abrupt, smooth boundary; pH 5.3.

B1—20 to 35 cm; brown (10YR 5/3) to dark brown (10YR 3/3) sandy loam with moderate fine and medium platy structure; patchy thin clay cutans; many fine and medium pores; few fine roots; clear, smooth boundary; pH 6.0.

B21X—35 to 55 cm; yellowish brown (10YR 5/4) and dark yellowish brown (10YR 3/4) loam; moderate coarse prismatic breaking to medium to coarse platy structure; extremely hard; thin continuous clay cutans on prisms; few, medium pores; few, fine quartz gravel; clear, smooth boundary; pH 6.2.

B22X—55 to 110 cm; yellowish brown (10YR 5/8) loam; moderate coarse prismatic breaking to strong medium and coarse platy structure; continuous dark brown (7.5YR 3/4) thin clay cutans; pores as above; pH 5.8.

B3—110 to 150+ cm; yellowish brown (10YR 5/4) loam; pH 5.5.

The Jangweon are moderately low in natural fertility, low in organic matter, and are medium to strongly acid. They have medium cation exchange capacities and low base saturation. Permeability is very slow, and the available moisture capacity is medium or low. The rooting zone is shallow.

About 70 percent of the area is in cultivated crops, and the rest in poor pine forest. Paddy rice is grown on some very small tracts.

5.20.1 Jangweon Gravelly Loam, 2 to 7 Percent Slopes (JwB)

Most of the soil has a profile similar to that described for the series, but included are small tracts that have a clay loam surface layer. The Gongseong soils may also be found in a few small areas in this unit. The surface runoff is very slow.

Most crops are suited but the shallow soil depth over the hard fragipan is a limiting factor, except with shallow-rooted crops like pasture. Cultivated crops including some paddy rice are general. Erosion control is the main management problem.

Capability unit IIIe.
Paddy suitability group P3ac.

5.20.2 Jangweon Gravelly Loam, 7 to 15 Percent Slopes (JwC)

The profile is as described for the series, with small patches that have a clay loam surface layer being included. The Seogto, Anyong, and Gongseong soils also may be found in a few small areas. The surface runoff is slow, and permeability is very slow.

Only a narrow range of crops is possible as the shallow soil depth, strong slopes, and erosion hazard limit its use. Shallow rooted crops like pasture are better suited than cultivated crops. Some small areas of paddy rice are now grown. Erosion is the chief management hazard.

Capability unit IVe.
Paddy suitability group P4ac.

5.20.3 Jangweon Gravelly Loam, 15 to 30 Percent Slopes (JwD)

Most areas have a profile much like that described for the series. Small tracts are included that have clay loam or gravelly to cobbly clay loam surface layer, a few small areas of greater slopes, and small patches of Anyong, Seogto, and Taehwa soils.

About half is cultivated to the narrow range of crops possible and the other half is wooded. Erosion control is the main management problem.

Capability unit IVe.
Paddy suitability group P4ac.

5.21 JISAN SERIES

The Jisan series, consisting of gently sloping to sloping, deep, imperfectly or poorly drained soils formed in alluvium on small valleys throughout the Gun, are members of the fine loamy nonacid family of Fluventic Haplaquepts. Depth to coarse material is more than one meter.

The Ap horizon is light olive brown, grayish brown, olive gray or dark grayish brown loam to silt loam mottled with brown and yellowish brown. The subsoil is grayish brown, dark grayish brown or gray, mottled with yellowish brown and strong brown. Its texture is loam or clay loam. The C horizon is grayish brown sandy loam or gravelly coarse sandy loam.

The Jisan resemble the Gangdong, Yongji and Subug soils, but the Yongji soils are better drained, and the Gangdong and Subug soils are coarser textured than them.

A typical profile follows.

Ap—0 to 10 cm; light olive brown (2.5Y 5/4) loam with few fine mottles of yellowish brown (10YR 5/8); moderate, very fine to fine granular structure; friable and slightly sticky; brown (10YR 5/3) when crushed; few, fine pores; many, very fine roots; clear, smooth boundary; pH 5.0.

A3—10 to 25 cm; pale brown (10YR 6/3) loam with common, fine and coarse faint mottles of yellowish brown (10YR 5/6); weak, coarse subangular blocky structure; firm; brown (10YR 5/3) when crushed; platy aggregates when first broken; common, fine and medium pores; common, fine roots; clear boundary.

B21g—25 to 50 cm; grayish brown (10YR 5/2) loam with common, coarse faint mottles of yellowish brown (10YR 5/4); moderate, fine to medium angular blocky structure; brown (10YR 5/3), when crushed; common, fine and medium pores; common fine roots; gradual, irregular boundary (15 to 20 cm thick); pH 5.5.

B22g—50 to 90 cm; gray (10YR 5/1) loam with common, faint mottles of dark yellowish brown (10YR 4/4); strong coarse prismatic structure, brown (10YR 5/3) when crushed, breaking to subangular blocky; firm; continuous thick gray coatings on prisms; common, fine and medium pores; few roots; gradual, smooth boundary; pH 6.2.

The soils are moderate in natural fertility, medium in organic matter content and are strongly acid to neutral. They have a moderate permeability and moderate to high available moisture capacity. Cation exchange capacity is medium, and base saturation high.

About 70 percent of the land is cultivated only to paddy rice each year, but the remaining 30 percent is planted to paddy rice in the summer and barley during the winter.

5.21.1 Jisan Loam, 2 to 7 Percent Slopes (JiB)

Most areas have profiles as described for the series, but included are some areas that have a clay loam surface layer, small tracts of better drained soils, and soils with sandy loam textures.

This soil is well suited to most crops given that an adequate drainage system were installed, but at present only paddy rice will do well. About 10 percent is cultivated to barley in the winter after the harvest of that crop. Drainage is the main management problem.

Capability unit IIw.
Paddy suitability group P2a.

5.21.2 Jisan Loam, 7 to 15 Percent Slopes (JiC)

Profiles are similar to that described for the series, but included are some tracts that have clay loam or sandy loam surface layers, a few small areas of better drained soils, and soils with sandy loam textures. Some ground of this unit is moderately steep.

Most areas are suited to a wide range of crops including rice, if a drainage system is established. But, at present, only paddy rice can be grown well because of the high water table. In a few small areas barley is grown after rice. The major management requirement is drainage.

Capability unit IIIe.
Paddy suitability group P3a.

5.22 JUNG DONG SERIES

The Jungdong series consists of nearly level, deep, well drained soils formed in alluvium. These, in the floodplain along the Nagdong river in the eastern part of the Gun, are members of the coarse loamy acid family of Typic Udifluvents.

The A horizon is yellowish brown to dark yellowish brown fine sandy loam, but in tracts of rice paddy its colour ranges from dark gray to dark grayish brown. The C horizon is yellowish brown or pale brown fine sandy loam or sandy loam with common white mica flakes.

The Jungdong occur commonly with the Bonryang, Gyum, and Hwabong soils. The Hwabong have a sand or loamy sand texture, and the Bonryang, sand or loamy sand in the lower horizons. The Gyum soils have silty textures and some gray colours in the lower subsoil.

A typical profile follows.

Ap--0 to 10 cm; dark yellowish brown (10YR 4/4) fine sandy loam; weak, fine granular structure; friable, slightly sticky, nonplastic; few, fine pores; many fine roots; common, fine white mica; clear smooth boundary; pH 5.0.

C1--10 to 25 cm; dark yellowish brown (10YR 4/4) fine sandy loam; weak, granular structure; friable, slightly sticky; few fine and coarse pores; many fine roots; common, fine white mica; abrupt, smooth boundary; pH 5.0.

C2--25 to 40 cm; yellowish brown (10YR 5/6) fine sandy loam; structureless (massive); slightly sticky and nonplastic; few, fine pores; common, fine and medium roots; common fine mica; abrupt, smooth boundary; pH 4.7.

C3--40 to 100 cm; yellowish brown (10YR 5/4) and pale brown (10YR 6/3) fine sandy loam; yellowish brown (10YR 5/6) crushed; structureless (massive); friable, slightly sticky, and slightly plastic; few fine pores.

C4--100 to 170 cm; pale brown (10YR 6/3) fine sandy loam; common, coarse distinct strong brown (7.5YR 5/6) mottles, yellowish brown (10YR 5/6) crushed; massive; slightly sticky and slightly plastic; few, fine to medium tubular pores; pH 6.5.

The soils of the series are moderate in natural fertility, medium in organic matter, and slightly to strongly acid. They have a moderately rapid permeability and low available moisture capacity. Cation exchange capacity is low, and the base saturation medium to high.

Most areas are in cultivated crops, with some in rice paddy. Mulberry fields have been established in a few places.

5.22.1 Jungdong Fine Sandy Loam, 0 to 2 Percent Slopes (Jd)

The profiles of the soil are similar to the one described as typical for the series. Small areas with sand, loamy sand or silt loam textures, are included.

The plough layer is easily kept in good tilth. Crops grow well in most years, but yields are apt to be low after seasons of low rainfall. Paddy rice is poorly suited because of the rapid permeability. Most of the areas are subject to overflow, and flood control along with leaching are the main management problems.

Capability unit IIs.
Paddy suitability group P4bc.

5.23 NAGSEO SERIES

These soils, moderately steep to very steep, shallow, and somewhat excessively drained, have formed in materials weathered from schist and gneiss, and are in mountainous areas in the southern part of the Gun. Depth to consolidated hard rock ranges from 20 to 50 cm. The series is a member of the loamy skeletal family of Lithic Dystrichrepts.

Where eroded, the A horizon is yellowish red, but where only slightly eroded is brown to reddish brown. Its texture is gravelly loam or gravelly silt loam. The C horizon is red to yellowish red or reddish brown very gravelly loam or silt loam. Hard rock is less than 50 cm from the surface.

The Samgag are coarser textured and have paler colours and more deeply weathered saprolite than the Nagseo, which are over hard rock.

A typical profile follows.

A--0 to 10 cm; yellowish red (5YR 4/8), strong brown (7.5YR 5/6), gravelly loam; friable, sticky, and plastic; weak, fine granular structure; few, fine pores; common, fine grass and tree roots; abrupt, clear boundary.

B--10 to 30 cm; red (2.5YR 4/6) gravelly loam (gravelly content 80%) gravel is flat angular schist; few, fine roots; abrupt, irregular boundary.

R--30+ cm; hard schist.

The soils are low in natural fertility, medium in organic matter, and are medium to strongly acid. Available water capacity is low, and permeability is moderate. Cation exchange capacity and base saturation are low.

Forest of pine, oak with an understory of shrubs, or grassland, predominate. A few small areas are cultivated to such crops as barley, buckwheat, and potato.

5.23.1 Nagseo Rocky Loam, 15 to 30 Percent Slopes, Eroded (NsD2)

About 10 to 20 percent of the unit area is rock outcrops, and profiles of the soil between are similar to that described for the series. A few small areas that have a gravelly clay loam or gravelly fine sandy loam surface layer, and small areas of deeper soils with rock at 100 to 150 cm, are included.

The root zone is shallow and available water capacity low. The soil is poorly suited to cultivation because of the shallow soil depth, but suitable for woodland although yields would be low. A small acreage is cultivated for crops. Erosion control is the major management problem.

Capability unit VIe.

5.23.2 Nagseo Rocky Loam, 30 to 60 Percent Slopes, Eroded (NsE2)

Rock outcrops make up about 20 to 40 percent of this unit area, and severely eroded spots and rills are common. Otherwise, most areas between rocks have profiles which are like that described for the series. In areas mapped as this soil are included small tracts that have a gravelly fine sandy loam surface layer, small areas of Gwanag soils or miscellaneous rock land, and thicker soils with hard rock at 100 to 150 cm. A few areas may have slopes ranging from 15 to 30 percent.

The root zone of this soil is very shallow, and runoff rapid. Cultivation, because of steepness and the shallow depth over hard rock is unsuitable. Forest predominates giving low yields. The main management problem is erosion control.

Capability unit VIIe.

5.23.3 Nagseo Rocky Loam, 60 to 100 Percent Slopes, Eroded (NsF2)

This mapping unit has rock outcrops which are about 50 to 75 percent of the area. Severely eroded spots, rills and shallow gullies are common. Otherwise, the profiles are generally as described for the series with small areas having a gravelly fine sandy loam surface layer, being included.

The root zone of this soil is very shallow, and runoff very rapid. Most areas are in forest, but yields would be low even if well managed. Erosion control is a major problem.

Capability unit VIIe.

5.23.4 Nagseo Rocky Loam, 60 to 100 Percent Slopes, Severely Eroded (NsF3)

This land type consists of extremely eroded areas that have many rills, and gullies, and rock outcrops which cover about 50 to 75 percent. Fresh parent material is exposed in many places by severe erosion. Otherwise the soil profile is generally similar to that described for the series. In this unit are included small areas of very rocky soils.

Runoff is very rapid. Forest, with some areas idle, is general and suitable. Erosion control is a severe problem.

Capability unit VIIe.

5.24 RIVERWASH, COBBLY (RC)

This unit, found along the Namcheon, Bugcheon, Eancheon, Seogcheon, Geumsangcheon streams and their tributaries, is more than 90 percent in round gravel and cobbles, sometimes mixed with sand materials. It is associated with sandy skeletal soil, and is not suitable for agricultural purposes.

Capability unit VIII.

5.24.1 Riverwash, Sandy (RS)

This unit, mainly along the Namcheon, Pugcheon, Nagdong rivers and their tributaries, is more than 90 percent mixed coarse to fine sand. It is associated with recent alluvial soils.

These sandy materials have a very adverse effect on the agricultural value of good soils when deposited over them during floods, and dykes are commonly constructed along the large rivers to protect the arable land.

Capability unit VIII.

5.25 ROCK LAND (RL)

This unit consists of rock outcrop and talus in steep mountainous regions. It is mainly in the west side of Sangju Gun. The rocks are granite, and granite-gneiss, with some schist. Vegetation is poor, with some pines growing between rocks.

Capability unit VIII.

5.26 SAMGAG SERIES

The Samgag series, consisting of sloping to steep, excessively drained soils, mainly of granite or granite-gneiss saprolite, are members of the coarse loamy family of Typic Dystrachrepts.

A typical profile follows.

A1--0 to 10 cm; yellowish brown (10YR 5/8) loam; weak, fine granular structure; friable; clear, smooth boundary; pH 5.0.

B--10 to 80 cm; strong brown (7.5YR 5/6) sandy loam with few yellowish red (5YR 5/8) mottles; massive; friable; gradual, smooth boundary; pH 5.0.

C--80 to 150+ cm; yellowish brown (10YR 5/6) saprolite; massive; pH 6.0.

The A horizon is dark yellowish brown, yellowish brown, or brownish yellow loam or sandy loam. The B is strong brown, yellowish brown, or yellowish red sandy loam or coarse loam. The C is sandy loam, loam, or loamy sand saprolite with paler colours than the B horizon.

The Sangag are low in organic matter content and moderately low in natural fertility. Permeability is rapid, and available water capacity low. The root zone is deep with pine and oak trees, bush clover, some shrubs, and native grasses growing. Some sloping areas are used for crops, such as barley, melon, sesame, apple, and pear. Crops respond well to applications of manure, lime and fertilizer.

5.26.1 Sangag Sandy Loam, 7 to 15 Percent Slopes, Eroded (SgC2)

This soil is yellowish brown or brownish yellow loamy sand or coarse sandy loam with much grit and mica. In areas mapped as this soil are included small areas with fine sandy loam or loam textures, small areas with slopes ranging from two to seven percent, small areas with heavy loam subsoil, and areas of soils of shallow to hard rock. Occasionally tillage extends into the saprolite.

Organic matter content is low and natural fertility moderately low. Water enters and passes through at a rapid rate, and available water capacity is low. Most of the area is used for barley, melon, sesame, some vegetables, and apple or pear orchards. All crops commonly grown in the Gun produce average yields with the use of lime and manure. Erosion is the main management hazard.

Capability unit IIIe.

5.26.2 Sangag Sandy Loam, 15 to 30 Percent Slopes, Eroded (SgD2)

Most areas have a profile similar to that described in the series. However, some areas have sand or loamy sand textures, and these have a very low available moisture capacity and are droughty.

In this soil are included small areas that have some stones on the surface, small areas or rock outcrops, and areas of shallow soils. Runoff is medium.

Roughly 70 percent of the land is cleared and planted to crops and orchards. Tobacco is cultivated in the high mountainous regions of the western part. The rest is in pine trees. Unless management is good, crop yields are below average. The main management concerns are improving fertility, and increasing water available to the plants.

Capability unit IVe.

5.26.3 Sangag Sandy Loam, 15 to 30 Percent Slopes, Severely Eroded (SgD3)

Most areas have a profile similar to that described in the series, but in many places shallow gullies and rills are eroding the soil. Some areas have loamy sand or sand textures, and these have a very low available moisture capacity, tending to be very droughty. Small tracts that have a stony surface as well as some areas of rock outcrop, and small areas of soils shallow to hard rock, are included.

Pine trees are general, and cropping is not practical because of the severe erosion hazard. Shallow root zone and low fertility are also limiting factors. With good management moderate yields of pasture and woodland products can be obtained.

Capability unit VIe.

5.26.4 Sangag Rocky Sandy Loam, 30 to 60 Percent Slopes, Eroded (SmE2)

Bed rock is exposed on 5 to 30 percent of the area. Most other areas have a profile similar to that described for the series. Small rills and a few shallow gullies are present. Also included are a few small areas with slopes ranging from 60 to 100 percent. Some areas have sand or loamy sand textures and very low available moisture capacities. These areas tend to be droughty. Organic matter content is low and natural fertility is moderately low. Runoff is rapid to very rapid.

Most of this soil, unsuitable for crops because of steepness and the erosion hazard, is in pine and oak.

Capability unit VIe.

5.26.5 Sangag Rocky Sandy Loam, 30 to 60 Percent Slopes, Severely Eroded (SmE3)

Most areas have a profile similar to that described in the series, but from 5 to 30 percent of the area may be exposures of bedrock. Shallow or deep gullies and rills are common. In areas mapped as this soil are included small tracts that have coarse sand or gravelly coarse sand textures throughout, (these soils have a very low available moisture capacity and are droughty) a few small areas with slopes ranging from 60 to 100 percent, and small areas of shallow soils.

Most of this soil is in pines, oaks, acacias, bush clovers, and some shrubs. It is not well suited for crops, because of steepness and erosion hazard. With good management, moderate yields of woodland products may be obtained.

Capability unit VIIe.

5.26.6 Sangag Rocky Soils 30 to 60 Percent Slopes, Gullied (SmE4)

This soil consists of extremely eroded areas in which there are many gullies. Between them are small areas of soil with a profile similar to that described for the series. Some areas are still eroding, and some have been stabilized. Other areas are coarse sand to fine gravelly sand or loamy sand. This soil is low in organic matter content and natural fertility. The land, in forest or idle, is not suitable for crops. Erosion is the chief hazard and will continue so, unless it is checked, either by plant growth, or engineering structures.

Capability unit VIIe.

5.27 SANGJU SERIES

The Sangju series, consisting of gently sloping to moderately steep, deep, well drained soils developed in alluvium on footslopes and fans throughout the Gun, is a member of the coarse loamy family of Dystric Fluventic Entrochrepts.

The A horizon is pale brown, brown to dark brown or dark yellowish brown sandy loam to fine gravelly sandy loam, 10 to 20 cm thick. But, in the paddy land, it is grayish brown to dark grayish brown, and mottled with yellowish brown. The B horizon is dark yellowish brown, yellowish brown, or brown sandy loam or coarse sandy loam, and may have strata of loamy sand.

The Sangju are associated with the Banho, Baegsan, Yongji, and Ibseog soils. The Ibseog are coarser, and the Yongji finer, than the Sangju. This series generally occupies the slopes below the Samgag.

A typical profile follows.

Ap—0 to 10 cm; pale brown (10YR 6/3) dry, dark yellowish brown (10YR 4/4) moist fine gravelly sandy loam; weak, fine granular structure; friable; few very fine to fine pores; common fine roots; clear, smooth boundary; pH 4.5.

Al—10 to 20 cm; dark yellowish brown (10YR 4/4) fine gravelly coarse sandy loam; massive; friable; common, very fine to fine pores; common, very fine to fine roots; gradual, smooth boundary; pH 4.6.

B—20 to 60 cm; brown to dark brown (7.5YR 4/4) coarse sandy loam; massive; slightly firm, sticky, and plastic; many fine and medium pores; few very fine roots; clear, smooth boundary; pH 5.7.

Cl—60 to 75 cm; dark yellowish brown (10YR 4/4) loamy coarse sand; single grained; loose, sticky, and plastic; few pores; few roots; clear, smooth boundary; pH 5.9.

C2—75 to 110 cm; dark brown (10YR 3/3) fine gravelly coarse sandy loam; massive; firm, sticky, and plastic; common, fine and medium pores; very few, roots; clear, smooth boundary; pH 6.1.

C3—110 to 150 cm; light yellowish brown (10YR 6/4) fine gravelly loam; firm, sticky, and plastic; few, medium pores; some cobbles; very few roots; pH 6.1.

The soils of the Sangju series are moderate in natural fertility, medium in organic matter, and are slightly to very strongly acid. They have a low available moisture capacity and moderately rapid permeability. Cation exchange capacity is low, and base saturation high.

Most areas are in cultivated crops including paddy rice. Mulberry, persimmon, chestnut, and jujube trees are growing in some areas.

5.27.1 Sangju Fine Gravelly Sandy Loam, 2 to 7 Percent Slopes (SuB)

Most areas have profiles similar to that described for the series. With this soil are included some areas with gravel-free sandy loam surface layers, small areas having surface layer of gravelly loam, and a few small areas with heavy loam and silt loam textures. The surface runoff is slow.

This soil is well suited to most crops commonly grown in the Gun, but poorly suited to paddy rice because of the moderately rapid permeability which permits much water loss. Leaching of plant nutrients and low available moisture capacity are the main management problems.

Capability unit IIs.
Paddy suitability group P4abc.

5.27.2 Sangju Fine Gravelly Sandy Loam, 7 to 15 Percent Slopes (SuC)

Most areas have profiles similar to that described for the series. A few small areas with two to seven percent slopes are included in this unit, as are patches with heavy loam or silt loam texture.

The surface runoff is slow. Generally the soil is suited to cultivation, but crop yields are apt to be low in seasons of low rainfall. It is poorly suited to paddy rice with the little planted producing poor yields. The main management problems are the reduction of leaching of plant nutrients, and erosion control.

Capability unit IIIe.
Paddy suitability group P4abc.

5.27.3 Sangju Fine Gravelly Sandy Loam, 15 to 30 Percent Slopes (SuD)

Most areas have somewhat coarser textures than the typical profile described for the series. Some areas have gravel-free sandy loam or fine gravelly loam textures. In this unit are included small areas with greater slopes than the described range, and a few small areas of soils with a dense layer or fragipan.

The soil is poorly suited to cultivation because of the strong slopes and erosion hazard, but it is moderately well suited to most crops if this is well controlled. Erosion and low available moisture capacity are the main management problems.

Capability unit IVe.
Paddy suitability group P4abc.

5.28 SEOGTO SERIES

The Seogto series consists of sloping to moderately steep, deep, well drained, moderately permeable soils formed in colluvium originating from areas underlain by granite and granite-gneiss. These soils, on mountain footslopes, are members of the loamy skeletal family of Dystric Fluventic Eutrochrepts.

The Ap horizons are brown, dark brown, dark yellowish brown, or yellowish brown loam or sandy loam, and usually contain gravel, cobbles, and a few stones. The B horizons are yellowish brown, brown or strong brown loam or sandy loam with 35 to 50 percent gravel and cobbles. The C are similar to the B but have more pale colours. The Seogto are below Gwanag soils, and stony colluvial land, in the landscape. They are often above the Hogye. The shallow Gwanag soils developed from residuum, while the Seogto are derived from transported materials. The Banho have fewer coarse fragments than the Seogto, and the Hogye are darker.

A typical profile follows.

Ap—0 to 14 cm; dark brown (10YR 3/3) gravelly sandy loam; granular structure; friable; clear, wavy boundary (13 to 20 cm thick); pH 4.5.

B21—14 to 35 cm; yellowish brown (10YR 5/4) gravelly to cobbly sandy loam; massive; friable, sticky, and plastic; diffuse, broken boundary; pH 5.0.

B22—35 to 70 cm; brown to dark brown (10YR 4/3) very gravelly to cobbly sandy loam; massive; friable, slightly sticky, and nonplastic; clear, broken boundary; pH 6.0.

C—70 to 100 cm; brown (10YR 5/3) very gravelly to very cobbly sandy loam.

These soils are medium to strongly acid, medium in natural fertility and organic matter. Available moisture capacity is low to medium, and response to fertilization is good. About 60 percent is cultivated for crops such as barley, soybean, sesame, and red pepper. The rest is wooded, with chestnut and persimmon growing in some places.

5.28.1 Seogto Gravelly Loam, 7 to 15 Percent Slopes (StC)

This deep, well drained soil occupies sloping, slightly dissected mountain foot-slopes. Most areas have profiles that are similar to that described for the series. In areas mapped as this soil are included small tracts of less gravelly and dark coloured soils. Nearly all land is cultivated for crops such as barley, soybean, sesame and red pepper. The main management problems are erosion and excess gravel.

Capability unit IIIe.
Paddy suitability group P4abc.

5.28.2 Seogto Gravelly Loam, 15 to 30 Percent Slopes (StD)

This deep, well drained soil occupies moderately steep, moderately dissected mountain footslopes. Most areas have a shallower and more stony surface layer than that described for the series, but it is otherwise similar. In this unit are included some eroded and small tracts of Gwanag soils and stony colluvial lands. About 60 percent is in forest and the rest is cultivated to barley, soybean, sesame, and red pepper.

In some places, chestnut and persimmon trees are grown. The main management concern is removal of stones from the plough layer, and raising of the low fertility. Erosion hazard is severe and careful management is required for its control. Bench terracing and contouring will help in cultivated fields.

Capability unit IVe.
Paddy suitability group P4abc.

5.29 SEONGSAN SERIES

The Seongsan soils are gently sloping to sloping, moderately deep to deep, and well drained. They are on alluvial and colluvial slopes formed in material weathered mainly from conglomerate, and are members of the coarse loamy family of Dystric Fluventic Entrochrepts.

The Ap horizon is yellowish brown to dark yellowish brown loam or sandy loam 10 to 20 cm thick. The B2 horizons are yellowish red sandy loam or loam. The C horizon is strong brown or yellowish brown sandy loam, gravelly sandy loam or sand. The Seongsan soils occur with the Sinjeong, Songjeong, and Baegsan series. The Baegsan are finer textured, and have yellowish brown colours, while the Songjeong and Sinjeong are developed from residuum. The Seongsan formed in transported material, and occupy slopes below the latter two.

A typical profile follows.

Ap1—0 to 15 cm; yellowish brown (10YR 5/6) sandy loam with weak, fine granular structure; friable, slightly sticky, and nonplastic; few fine pores; many very fine and fine roots; clear, smooth boundary; pH 5.0.

B21—15 to 20 cm; yellowish brown (10YR 5/8) fine sandy loam with few, fine, prominent mottles of yellowish red (5YR 4/6), strong brown (7.5YR 5/6) when crushed; massive; friable, slightly sticky, and slightly plastic; many fine to medium pores; common very fine to fine roots; common fine, white mica; gradual, smooth boundary; pH 6.0.

B22—20 to 45 cm; yellowish red (5YR 5/8) very fine sandy loam massive; friable, slightly sticky, and slightly plastic; few fine to coarse pores; few mica; few fine roots; diffuse, smooth boundary; pH 6.0.

B23—45 to 80 cm; strong brown (7.5YR 5/6) very fine sandy loam; massive; friable, slightly sticky and slightly plastic; few fine to coarse pores; thick stratified sandy layer; clear, smooth boundary; pH 5.5.

C2—80 to 100+ cm; yellowish brown (10YR 5/4) fine gravelly sand; pH 6.0.

The Seongsan are moderate in natural fertility and medium in organic matter. Permeability is moderately rapid to rapid, and the available moisture capacity low. Cation exchange capacity is low and base saturation medium or high. These soils have a deep root zone, and most areas are used for crops like barley, soybean, sesame, and red pepper.

5.29.1 Seongsan Sandy Loam, 2 to 7 Percent Slopes (SzB)

The soil profile in most places is similar to that described for the series. In areas mapped as this soil are included patches that have a silt loam surface layer, and a few small areas of Baegsan soils.

Runoff is slow. This soil is suited to cultivated crops, but poorly suited to paddy rice because of the low available moisture capacity. The main management requirement is erosion control and the selection of drought resistant crops.

Capability unit IIs.
Paddy suitability group P4abc.

5.29.2 Seongsan Sandy Loam, 7 to 15 Percent Slopes (SzC)

This is a moderately deep soil that washed mainly from conglomerate and some granite. Most areas have profiles similar to that described for the series. In areas mapped as this soil are included patches that have a silt loam or clay loam surface layer, a few small tracts with slopes ranging from 15 to 30 percent, and small areas of Baegsan and Songjeong soils.

Runoff is slow. It is well suited to cultivated crops, but most areas are poorly suited to paddy rice. Erosion control and selection of drought resistant crops are the major management problems.

Capability unit IIIe.
Paddy suitability group P4abc.

5.30 SINDAB SERIES

The Sindab series consists of level to nearly level, deep, poorly drained soils formed in alluvium on the floodplains along the streams. This series is a member of the sandy family of Typic Psammaquents.

The surface layer is olive brown, grayish brown or gray to dark gray loamy coarse sand to coarse sand, or coarse sandy loam. The C horizon is loamy coarse sand to coarse sand, and contains some gravel in places. It begins at depth of 20 to 50 cm below the surface.

The Sindab commonly occur with the Hamchang soils and are sand or loamy sand in texture, while the Hamchang are sandy loam.

A typical profile follows.

Ap—0 to 12 cm; olive brown (2.5Y 4/4) coarse sand; structureless (single grain); friable; common, faint coarse mottles of grayish brown, light olive brown (2.5Y 5/4) when crushed; common fine grass roots; gradual, smooth boundary; pH 6.5.

Clg—12 to 40 cm; olive gray (5Y 4/2) coarse sand; structureless (single grain); loose, nonsticky and nonplastic; few fine grass roots; clear, smooth boundary; pH 6.0.

C2g—40 to 80 cm; light olive gray (5Y 6/2) coarse sand; structureless (single grain); loose, nonsticky and nonplastic; pH 6.5.

C3g—80 to 120+ cm; dark olive (5Y 3/2) coarse sand; structureless (single grain); loose, nonsticky and nonplastic.

The Sindab are strongly to medium acid. Natural fertility is low, and organic matter content medium. Available moisture capacity is very low, and permeability rapid. Cation exchange capacity is low, and base saturation medium to high. Most places are cultivated only to paddy rice.

5.30.1 Sindab Sandy Loam, 0 to 2 Percent Slopes (Sn)

This deep, poorly drained, rapidly permeable soil occupies small tracts of depressed areas near the river sides. Included are small areas of somewhat better drained soil.

Only a limited range of crops are suited because of the poor drainage and high groundwater table. All of the areas are in paddy, and are planted only to rice. The response to fertilization is poor because of coarse texture. The main management problems are flood control and to minimize effects produced by leaching of crop nutrients.

Capability unit IVw.
Paddy suitability group P3b.

5.31 SINHEUNG SERIES

The Sinheung series consists of deep imperfectly drained soils, formed in material washed from adjacent uplands, and deposited in level to nearly level depressions along drainage ways. This series is a member of the fine loamy, nonacid family of Aeric Fluventic Haplaquepts.

The Ap horizons are dark gray to very dark grayish brown loam or silt loam. The B horizon is gray to very dark gray mottled with dark yellowish brown or yellowish brown loam silt loam or clay loam. The C horizon is yellowish brown or dark yellowish brown mottled grayish brown or dark grayish brown loam or sandy loam. The Sinheung occur with the Hamchang, Geugrag, and Hagseung soils.

A typical profile follows.

Ap—0 to 12 cm; dark gray (5Y 4/1) silt loam with few, medium, distinct dark yellowish brown (10YR 4/4) mottles; massive; friable, nonsticky, and nonplastic; abrupt, smooth boundary; pH 5.0.

B21g—12 to 23 cm; dark red (2.5YR 3/6) loam with common, medium prominent gray to dark gray (5Y 5/1 to 4/1) mottles; weak, very coarse prismatic structure; friable, slightly sticky, and nonplastic; dark gray (5Y 4/1) when crushed; common, medium black or very dark brown manganese mottles; abrupt, smooth boundary; pH 5.0.

B22g—23 to 48 cm; dark gray (10YR 4/1) loam with common faint dark grayish brown (10YR 4/2) mottles; weak, coarse medium platy structure; friable, slightly sticky, and slightly plastic; dark brown (10YR 3/3) crushed; clear, smooth boundary; pH 5.5.

B23g—48 to 60 cm; dark grayish brown (10YR 4/2) silt loam with many medium to coarse prominent dark gray (N4/) mottles; weak, coarse medium subangular blocky structure; slightly firm, sticky, and plastic; brown to dark brown (10YR 4/3) crushed; clear, smooth boundary; pH 6.0.

B3g—60 to 83 cm; dark gray to gray (10YR 4/1 - 5/1) heavy loam with many medium to coarse distinct dark yellowish brown (10YR 3/4) mottles; weak, coarse and medium subangular blocky structure; slightly firm, sticky, and plastic; dark grayish brown (10YR 4/2) when crushed; abrupt, smooth boundary; pH 6.0.

C—83 to 100 cm; yellowish brown (10YR 5/4) gravelly sandy loam with few, medium faint grayish brown (10YR 5/2) mottles; yellowish brown (10YR 5/4) crushed; pH 6.0.

The Sinheung are higher in clay content than the Hamchang soils, and are medium to strongly acid, moderate in natural fertility, and medium in organic matter. Permeability is moderate and available moisture capacity moderate. They have a deep root zone, with most parts being used for rice and winter barley.

5.31.1 Sinheung Loam, 0 to 2 Percent Slopes (Sh)

Most areas have profiles as described for the series. In areas mapped as this soil are included patches that have sandy loam or clay loam surface layers, and a few small tracts with very sandy soil. Runoff is very slow.

This soil is suited to rice and winter barley, but drainage is required to grow crops other than rice.

Capability unit IIw.
Paddy suitability group Pl.

5.32 SINJEONG SERIES

The soils of the series are moderately steep to steep and somewhat excessively drained, formed in materials that weathered mainly from conglomerate, with some sandstone, and members of the fine loamy family of Typic Dystrichrepts.

The A horizon is yellowish brown or strong brown sandy loam, loam, or clay loam. In most places, rounded gravel is on the surface. The B is strong brown to yellowish red loam or sandy loam with some rounded gravel. The C is yellowish brown or strong brown gravelly sandy loam to fine sandy loam.

The Sinjeong are associated with the Habin and Jangweon soils, but the Habin are finer and shallower and underlain by sandstone and shale, while the Jangweon soils have very firm fragipan layers.

A typical profile follows.

Ap—0 to 15 cm; yellowish brown (10YR 5/6) sandy loam; moderate fine coarse granular structure; friable, sticky, and slightly plastic; many fine and coarse roots; clear, smooth boundary; pH 6.0.

B--15 to 40 cm; strong brown (7.5YR 5/6) sandy loam with some gravel; weak blocky to weak granular structure; sticky and plastic; few fine and coarse roots; clear, smooth boundary; pH 6.0.

C--40 to 100 cm; strong brown (7.5YR 5/6) sandy loam with some gravel; pH 5.5.

The Sinjeong soils are low in organic matter content and natural fertility. Permeability is moderate and the available water capacity low. Except in the steeper areas, the Sinjeong soils have relatively deep root zones. They are mainly distributed in areas southwest of Sangju Eub and in the eastern part near the Nagdong river. The native vegetation is pine and oak, bush clover, some shrubs and native grasses.

The land is usually wooded, with a few small tracts cleared for cultivation.

5.32.1 Sinjeong Soils 15 to 30 Percent Slopes, Gullied (SjD4)

Most of this soil is gullied, with small areas between the gullies having profiles similar to that described for the series. In areas mapped as this soil are included small sections with a clay loam texture, and small tracts with lesser slopes.

About 30 percent is cleared of this generally wooded ground, but because of severe erosion, cultivation is not really suited. Erosion is the main hazard, with low fertility also an important limitation. From woodland products low yields may be expected even with good management. It is poorly suited for pasture or grazing land.

Capability unit VIIe.

5.32.2 Sinjeong Soils, 30 to 60 Percent Slopes, Gullied (SjE4)

This soil consists of extremely eroded areas with many gullies. Between the gullies profiles are similar to that described for the series. In some places, a few sandstone rocks are present. In that mapped as this soil are included small areas of rock outcrop, and a few small tracts with steeper slopes.

Pines, oaks, acacia trees, bush clovers, and some shrubs predominate as crops are unsuitable, due to erosion. Low yields of woodland products may be expected even with good management.

Capability unit VIIe.

5.33 SONGJEONG SERIES

The Songjeong series consists of gently sloping to steep, deep to very deep, well drained soils developed in residuum derived from granite and granite-gneiss. These soils, occupying hilly areas mainly in the northeastern part of the Gun, are members of the fine loamy family of Typic Hapludults. In most areas the depth, from the surface, to hard rock, is more than 5 m.

The A horizon is yellowish red, dark yellowish brown, or brown to dark brown light clay loam, loam or sandy loam, 5 to 10 cm thick. The B is yellowish red or red

silty clay loam, clay loam, silt loam, or loam. The C is light brown, yellowish brown or strong brown loam or fine sandy loam. It is usually underlain by micaceous saprolite from igneous rocks.

The Songjeong, occurring with the coarser textured Samgag, which lack B horizons, are similar in some respects to the Taehwa soils, but differ from them in having mica, more red-colour and coarser texture.

A typical profile follows.

Ap—0 to 5 cm; yellowish red (5YR 4/8) light clay loam; strong, fine granular structure; friable, sticky, and plastic; few fine pores; clear, smooth boundary; pH 4.0.

B21t—5 to 20 cm; yellowish red (5YR 4/8) to red (2.5YR 4/8) silty clay loam; moderate, fine, subangular blocky structure; friable, few very fine to coarse pores; gradual smooth boundary; pH 4.8.

B22t—20 to 35 cm; yellowish red (5YR 4/8) to red (2.5YR 4/8) silty clay loam; moderate, coarse subangular blocky structure; thin patchy clay cutans; slightly firm; few very fine to coarse pores; common medium roots; gradual, smooth boundary; pH 4.5.

B23t—35 to 65 cm; yellowish red (5YR 4/8) to red (2.5YR 4/8) silt loam; moderate, medium, angular blocky structure; patchy yellowish red (5YR 4/8) clay cutans; few, medium roots; clear, smooth boundary; pH 4.8.

B31t—65 to 90 cm; yellowish red (5YR 4/8) silt loam, weak coarse subangular blocky structure; few, fine roots; pH 4.8.

B32—90 to 120+ cm; yellowish red (5YR 4/8) loam; massive; friable; few, red clay cutans; pH 5.0.

The Songjeong are low both in natural fertility and organic matter. They have medium to high available moisture capacity and moderate permeability. Cation exchange capacity is medium, and base saturation low.

About 60 percent is in cultivated crops, orchards, or mulberry fields. The remainder is wooded with small pines and some oaks.

5.33.1 Songjeong Loam, 2 to 7 Percent Slopes, Eroded (SoB2)

Most areas have profiles as for the series, but some places have a clay or silty clay subsoil. A few small areas of a soil that has mainly coarse sandy loam saprolite, and small areas that have a much higher base saturation, are also included.

Crops such as barley, soybean, and potato are generally cultivated but rice is unsuited. Erosion is the main management problem.

Capability unit IIe.

Paddy suitability group P2ac.

5.33.2 Songjeong Loam, 7 to 15 Percent Slopes, Eroded (SoC2)

Profiles are generally similar to that described as typical for the series. But, in the areas mapped are included small tracts of a soil having a clay or silty clay subsoil, some small areas that have a much higher base saturation, soils that have coarse sandy loam saprolite, and a few places of two to seven percent slopes.

Cultivated crops, to which this soil is moderately well suited are generally grown. Erosion is the main management hazard.

Capability unit IIIe.
Paddy suitability group P3ac.

5.33.3 Songjeong Loam, 15 to 30 Percent Slopes, Eroded (SoD2)

With this soil are included small areas of greater slopes than the described range, a few small tracts that have a clay or silty clay subsoil, and small areas that are mainly coarse sandy loam saprolite. But, the profiles of most areas are as described for the series.

Because of steeper slopes and the erosion hazard, the soil is poorly suited to cultivated crops, but well suited to pasture, trees, or orchard. About 70 percent is used for cultivated crops, orchard, and mulberry, while the rest is in forest of pine trees. Erosion control is the main management problem.

Capability unit IVe.
Paddy suitability group P4ac.

5.33.4 Songjeong Loam, 30 to 60 Percent Slopes, Eroded (SoE2)

Some areas have a fine gravelly sandy loam surface layer, and small areas have a clay or silty clay subsoil. Small rills and some shallow gullies are to be found. A few small tracts that are mainly coarse sandy loam saprolite are included, as are small areas of greater slopes than the described range. The profiles, otherwise, are usually similar to that described for the series.

This soil is unsuitable for cultivated crops, but well suited to woodlands. Pine forest predominates, but because of steep slopes the erosion hazard is severe.

Capability unit VIe.

5.34 SUBUG SERIES

The series consists of gently sloping to moderately steep, deep, poorly drained, rapidly permeable soils formed in alluvium on small valleys, found in general areas of the Samgag soils. The series is a member of the coarse loamy over sandy skeletal acid family of Fluventic Haplaquepts.

The surface layer is grayish brown, dark grayish brown, or dark gray to very dark gray, mottled with yellowish brown, dark yellowish brown or olive brown sandy loam, loam, or silt loam. The B horizon is grayish brown, gray to dark gray mottled with yellowish brown, strong brown, or olive brown sandy loam to loam or fine gravelly sandy loam. The C is gray to grayish brown, fine gravelly coarse sandy loam or

loamy coarse sand, and is stratified with loamy sand and sandy loam in some places. The series is associated with the Gangdong and Jisan soils, but has less clay content than the Jisan, and lower groundwater table than the Gangdong soils.

A typical profile follows.

Ap—0 to 17 cm; dark grayish brown (2.5Y 4/2) sandy loam; few, fine, faint dark yellowish brown (10YR 4/4) mottles; massive; friable, nonsticky and slightly plastic; few, fine yellow mica; many, fine to medium roots; clear, smooth boundary; pH 6.0.

B21g—17 to 25 cm; grayish brown (2.5Y 5/2) sandy loam; many fine prominent yellowish red (5YR 4/8) mottles; weak, coarse platy structure; nonsticky and nonplastic; common, fine mica; very fine to medium roots; abrupt, smooth boundary; pH 6.0.

B22g—25 to 50 cm; grayish brown (2.5Y 5/2) sandy loam with few, fine to medium dark yellowish brown (10YR 4/4) mottles; massive; slightly firm; common, fine mica; clear, smooth boundary; pH 6.0.

B23g—50 to 70 cm; grayish brown (10YR 5/2) fine gravelly coarse sandy loam; many fine to medium prominent yellowish red (5YR 4/8) mottles; brown (10YR 5/3) crushed; massive; slightly sticky and slightly plastic; few fine mica; clear, smooth boundary; pH 6.0.

B24g—70 to 90 cm; gray (10YR 5/1) sandy loam with few fine to medium distinct dark yellowish brown (10YR 4/4) mottles; massive; slightly sticky and slightly plastic; abrupt, smooth boundary; pH 6.0.

Cg—90 to 150 cm; grayish brown (10YR 5/2) gravelly loamy coarse sand; stratified with dark gray (10YR 4/1) fine sandy loam layers (less than 5 cm in thickness); pH 6.0.

The Subug are medium to slightly acid, moderate in natural fertility, and medium in organic matter. Available moisture capacity is low, as is cation exchange capacity. Base saturation is medium to high. The land is generally used for rice and winter barley. All crops respond well to fertilization.

5.34.1 Subug Sandy Loam, 2 to 7 Percent Slopes (SpB)

This deep, poorly drained, rapidly permeable soil occupies gently sloping fans and valleys, mainly in general areas of Samgag soils. The profiles are usually similar to that described for the series, but included in this mapping unit are some land that has a loam or sand surface layer, small areas of the Gangdong and Jisan soils, and a few small tracts with a fine gravelly surface layer. While some areas are planted to barley, most areas are suitable only for growing paddy rice because of the poor drainage. At present, they are cultivated to winter barley after paddy rice. Major management problems are the provision of drainage for high yields of general crops other than rice, and the reduction of leaching of plant nutrients.

Capability unit IIw.
Paddy suitability group P3ab.

5.34.2 Subug Sandy Loam, 7 to 15 Percent Slopes (SpC)

This deep, poorly drained, rapidly permeable soil, occupies sloping fans and small valleys in the general area of Samgag soils. The profile resembles the one described for the series. In this mapping unit are included some areas having a surface layer of loam or sand, some tracts with a fine gravelly surface layer, and small areas of Gangdong and Jisan soils.

Rice and winter barley are generally suitable. Establishing good drainage, minimizing the leaching of crop nutrients, and controlling erosion, are the main management requirements.

Capability unit IIIe.
Paddy suitability group P3ab.

5.34.3 Subug Sandy Loam, 15 to 30 Percent Slopes (SpD)

This deep, poorly drained, rapidly permeable soil occurs in moderately steep small valleys and fans. The profiles are mostly similar to the one described for the series. But, with this soil are included small areas that have a surface layer of sand or loam, small tracts of excessively drained coarse sandy soils, and some better drained loamy soils.

Rice and barley predominate, while the main management concerns are erosion control, the leaching of crop nutrients, and rapid runoff.

Capability unit IVe.
Paddy suitability group P4ab.

5.35 TAEHWA SERIES

Soils of this series are moderately deep to deep and well drained, have formed in material that weathered from fine grained granite and granite-gneiss, and are members of the fine loamy family of Typic Hapludults. In most place depth to hard rock is more than 5 m.

The A horizon is dark yellowish brown to brown loam, fine sandy loam or loam. The B is yellowish brown to strong brown loam or light clay loam with a weak, sub-angular blocky structure. The C horizon is a thick layer of saprolite.

A typical profile follows.

Al--0 to 10 cm; dark yellowish brown (10YR 4/4) gravelly very fine sandy loam; weak, fine to medium granular structure; friable, slightly sticky, and nonplastic; many, fine to medium roots; gradual, smooth boundary; pH 5.5.

B2l--10 to 35 cm; yellowish brown (10YR 5/4) gravelly silt loam; weak, coarse subangular blocky breaking easily to weak, moderate granular structure; friable, slightly sticky, and slightly plastic; common, fine to medium pores; common, fine to medium roots; gradual, smooth boundary; pH 5.5.

B2—35 to 55 cm; strong brown (7.5YR 5/6) heavy loam with few, fine, distinct, light olive brown (2.5Y 5/4) mottles; weak, coarse, subangular blocky structure; firm, sticky and plastic; common, fine to medium pores; few, fine roots; clear, smooth boundary; pH 5.0.

B3—55 to 110 cm; strong brown (7.5YR 5/8) and yellowish brown (10YR 5/6) loam with weak, coarse subangular blocky; very firm, slightly, sticky, and slightly plastic; strong brown (7.5YR 5/8) crushed; clear, smooth boundary; pH 5.0.

C—110 to 150 cm; yellowish brown (10YR 5/6) sandy loam; massive; nonsticky and nonplastic; pH 5.0.

The Taehwa are medium in natural fertility and organic matter. Permeability is moderate, and the available water capacity medium. They have a deep root zone, with native vegetation of pine and oak trees, bush clovers, some shrubs, and native grasses predominating. Some places which have less than 30 percent slopes are cultivated for crops, such as barley, sesame, soybean, sweet potato, and white potato. Tobacco plants are also grown. Crops respond to plentiful application of lime, fertilizer and compost.

5.35.1 Taehwa Gravelly Silt Loam, 7 to 15 Percent Slopes, Eroded (TaC2)

Most areas have profiles similar to that described for the series. But, included in areas mapped as this soil are small tracts of sandy loam or clay loam, and a few lesser slopes. Organic matter is low and natural fertility is medium. Permeability is moderate and available water capacity medium. The land is usually cultivated to crops like barley, soybean, potato, and sweet potato, with some places growing pear orchards and mulberry fields. Moderate yields can be expected from crops commonly grown in the Gun when limed and fertilized. Erosion is the main management hazard.

Capability unit IIIe.
Paddy suitability group P3ac.

5.35.2 Taehwa Gravelly Silt Loam, 15 to 30 Percent Slopes, Eroded (TaD2)

Most areas have profiles similar to that described for the series. In some places, shallow gullies and rills are common and the surface is a mixture of the surface and subsoil. But, in areas mapped as this soil are included small areas with a gravelly clay loam surface layer, some rock outcrop, small tracts of soils with sandy loam textures, and some soils shallow to rock.

Runoff is medium. About 70 percent is cultivated to crops, with tobacco being grown in the western high mountainous region. The remainder is in pines. Unless management is good, crop yields are below average. The main management concerns are improving fertility and erosion control.

Capability unit IVe.
Paddy suitability group P4ac.

5.35.3 Taehwa Rocky Silt Loam, 30 to 60 Percent Slopes, Eroded (TrE2)

About 5 to 15 percent of this mapping unit is rock outcrops, with the remainder having a profile similar to that described for the series. In some places, small

rills and shallow gullies are common. A few small areas with greater slopes, small areas of shallow soils, and soils with coarse sandy loam textures, are also included.

Runoff is rapid to very rapid. Most of the area is in pines, oaks, and native wild grasses, and because of steepness and erosion hazard, crops are not suitable. Moderate yields of grazing and forest products may be obtained if good management prevails.

Capability unit VIe.

5.36 YONGJI SERIES

The series consists of gently sloping to moderately steep, moderately deep to deep, moderately well drained soils that formed in material deposited from local alluvium-colluvium. In most places depth of solum ranges from 100 to 150 cm. The series is a member of the fine loamy family of Aquic Fluventic Eutrochrepts.

A typical profile follows.

Ap—0 to 8 cm; dark gray (10YR 4/1) loam with many, fine to medium, faint mottles of dark yellowish brown (10YR 4/4); massive; slightly sticky and plastic; grayish brown to olive brown (2.5Y 4/4) crushed; many, fine yellow mica; many, fine to medium roots; clear, smooth boundary; pH 6.0.

B1—8 to 18 cm; very dark gray (5Y 3/1) loam; common, coarse distinct dark grayish brown (10YR 4/2) mottles; slightly firm, sticky, and plastic; very dark gray to dark gray (5Y 3/1 - 4/1) crushed; few, fine yellow mica; few, fine to medium rice roots; abrupt, wavy boundary; pH 6.5.

B21—18 to 38 cm; dark yellowish brown (10YR 4/4) loam with many, medium to coarse distinct dark gray (10YR 4/1) mottles; dark grayish brown (10YR 4/2) crushed; weak, fine to medium subangular blocky structure; slightly firm, sticky, and plastic; common, fine yellow mica; few, fine roots; clear, smooth boundary; pH 6.5.

B22—38 to 54 cm; dark yellowish brown (10YR 3/4) silt loam with common, medium to coarse distinct gray to dark gray (10YR 5/1 - 4/1) mottles; dark yellowish brown (10YR 4/4) crushed; weak, fine to medium subangular blocky structure; slightly firm, sticky, and plastic; common, fine yellow mica; clear, smooth boundary; pH 6.0.

B22—54 to 80 cm; dark yellowish brown (10YR 4/4) silty clay loam with few, medium dark grayish brown to very dark brown (10YR 2/2) mottles; weak, fine to medium subangular blocky structure; very sticky and plastic; common, medium black manganese concretions; gradual, smooth boundary; pH 6.0.

B3—80 to 120 cm; dark yellowish brown (10YR 4/4) silt loam; firm, very sticky, and plastic; few, fine to medium manganese concretions; pH 6.0.

The A horizon is grayish brown to dark brown silt loam. The B is light olive brown to grayish brown loam to clay loam, and is stratified with sandy loam in places. The C is yellowish brown or dark brown loam, sandy loam, gravelly loam, or gravelly sandy loam. The Yongji are mostly in small alluvial valleys in general places where the Samgag soils are.

The soils are slightly to medium acid, natural fertility is moderately high, and organic matter content medium. The available moisture capacity is medium to high.

A two-crop-a-year cropping system of paddy rice and winter barley is usual and crops respond well to fertilization.

5.36.1 Yongji Loam, 2 to 7 Percent Slopes (YjB)

This soil has a profile similar to that described for the series, but it includes: some land that has slopes ranging from zero to two percent, small tracts with sandy loam or clay loam surface layers, small areas of soils without gray or grayish brown mottles, and some areas that have dominant colours of gray or grayish brown.

All of the areas are suitable for rice and winter barley, and higher yields of the latter may be obtained if additional drainage ditches are dug. Erosion, a hazard in cultivated areas, is the main management problem.

Capability unit IIe.
Paddy suitability group P2ac.

5.36.2 Yongji Loam, 7 to 15 Percent Slopes (YjC)

This soil generally has a profile similar to that described for the series. In this soil are included small tracts that have a sandy loam or clay loam surface layer, small areas with grayish brown mottles, and some with dominant colours of gray or grayish brown.

A wide range of crops are generally suited, including paddy rice and winter barley. Higher yields of the latter may be expected if drainage ditches are dug. The main management problem is erosion control.

Capability unit IIIe.
Paddy suitability group P3ac.

5.36.3 Yongji Loam, 15 to 30 Percent Slopes (YjD)

Most areas have a profile similar to that described for the series, but some small areas with gravelly surface soil are included.

Crops, including rice and winter barley predominate, but are poorly suited at the moment due to erosion, and runoff caused by steep slopes. The main management concerns are control of both.

Capability unit IVe.
Paddy suitability group P4ac.

Chapter 6

USE AND MANAGEMENT OF SOILS

6.1 INTRODUCTION

In this section of the soil survey, the system of capability classification used by the Korea Soil Survey Project is explained and the soils in each capability unit are described. The suitability and limitations of the soils for cultivated crops and pasture, and the management practices required for higher yields are given.

The soil characteristics favourable for paddy rice differ from those for other crops. Rice is considered in the discussions of capability groups, and is discussed in greater detail in the following section on paddy suitability groups. The subsection on capability groups also describes the suitability of some soils for woodland.

6.2 CAPABILITY GROUPS OF SOILS

Capability classification is a grouping of soils to show, in a general way, their suitability for most kinds of farming. It is a practical classification based on the limitations of the soils, the risk of damage when they are used, and the way they respond to treatment when planted to common field crops or sown to pasture crops. The soils are classified according to degree and kind of permanent limitation, but without consideration of major and generally expensive land-forming that would change the shape, depth, or other characteristics of the soils, and without consideration of possible but unlikely major reclamation projects.

Capability classes. The broadest groupings are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitation and narrower choices for practical use. There are no soils placed in Class V in Sangju Gun. Classes are described as follows:

- | | |
|-----------|---|
| Class I | Soils have few limitations that restrict their use. |
| Class II | Soils have moderate limitations that reduce the choice of plants or require special management practices. |
| Class III | Soils have severe limitations that reduce the choice of plants, require special management practices or both. |
| Class IV | Soils have very severe limitations that restrict the choice of plants or require very careful management or both. |
| Class V | Soils have little or no erosion hazard, but have other limitations, impractical to remove, that limit their use to pasture or woodland. |

- Class VI Soils have severe limitations that make them generally unsuitable for cultivation and that limit their use to pasture or woodland.
- Class VII Soils have severe limitations that make them unsuitable for cultivation or pasture and limit their use to woodland.
- Class VIII Soils and landforms that do not produce vegetation of commercial value.

Capability subclasses are soil groups with each capability class, and are designated by adding a small letter, e, s, or w to the class numeral, for example, IIe. The letter 'e' indicates that the main limitation is risk of erosion unless close-growing plant cover is maintained, 's' that the soil is shallow, droughty, or stony; and 'w' that water in or on the soil interferes with plant growth or cultivation.

The classification does not necessarily reflect the value of the land. The Class IIw and IIIw lands are well suited to paddy rice, and produce high yields of rice without special or difficult irrigation practices. These soils are too wet to produce good yields of other crops without additional drainage. The IVs soils produce good crops of melons and peanuts, but they are too droughty to grow most other crops well. In Class I there are no subclasses because the soils of this class have few limitations.

The soils of a subclass are so similar in their important characteristics that they have similar management, productivity and crop responses. Some individual soils within a subclass may have secondary problems. Some wet soils designated as 'w' are sloping and have a secondary problem of erosion. These problems are explained in the discussion of the capability unit. Some management suggestions are given in the mapping unit description of this report. Detailed information on the management of paddy soils is given in the paddy suitability section.

Land capability groups are discussed more fully in 'The Soils of Korea', of the Korea Soil Survey Project, Technical Report 1, FAO, Rome.

6.2.1 Class I. Soils Having Few Limitations Restricting Use

6.2.1.1 Capability unit I

The only soil in this capability unit, is level to nearly level, deep, moderately well drained and moderately permeable. This soil has high available moisture capacity, moderate to high natural fertility and organic matter content, and is slightly acid. It is Gyuam silt loam, zero to two percent slopes.

The soil is well suited for a wide range of crops, and is being used for paddy rice in the summer and winter barley in the winter-spring. It is highly productive and can be intensively cultivated if well managed.

Good management includes ploughing under all available crop residues, adequate fertilization, and applying lime as needed. Some parts need additional drainage ditches to improve the yields of winter grain crops.

6.2.2 Class II. Soils Having Moderate Limitations

6.2.2.1 Capability unit IIe

In this capability unit are gently sloping, deep, well to moderately well drained, moderately permeable, fertile soils, generally having a high available moisture capacity. They are:

Baegsan loam, 2 to 7 percent slopes.

Banho silt loam, 2 to 7 percent slopes.

Gongseong silty clay loam, 2 to 7 percent slopes.

Hwadong silty clay loam, 2 to 7 percent slopes.

Songjeong loam, 2 to 7 percent slopes, eroded.

Yongji loam, 2 to 7 percent slopes.

The soils are suited to a wide range of crops, including paddy rice, soybeans, barley, wheat, corn, and many other crops commonly grown in the Gun. Many areas are planted to winter barley after paddy rice. Erosion is a moderate hazard. Most of the soils are strongly acid. To help retard runoff and control erosion, a combination of some of the following measures may be used: terracing, grassed waterways, and contour tillage. Many tracts have been level-terraced and dyked to grow paddy rice. In these rice fields, erosion and runoff are effectively controlled and retarded as long as the paddy dykes are properly maintained. Well-constructed weir dams between paddies will prevent erosion of paddy walls. Good management also includes minimum tillage, ploughing under crop residues, liming as needed, and proper fertilization. The Hwadong soils have a high clay content, and sandy materials added to them will improve soil texture.

6.2.2.2 Capability unit IIi

This capability unit consists of nearly level or gently sloping, deep, well drained, rapidly permeable, coarse-textured soils. They are generally low in available moisture capacity, and moderate to low both in natural fertility and organic matter content. They are:

Bonryang sandy loam, 0 to 2 percent slopes.

Hogye gravelly loam, 2 to 7 percent slopes.

Imog sandy loam, 2 to 7 percent slopes.

Jungdong fine sandy loam, 0 to 2 percent slopes.

Sangju fine gravelly sandy loam, 2 to 7 percent slopes.

Seongsan sandy loam, 2 to 7 percent slopes.

These are suitable for a wide range of crops such as barley, wheat, and soybean. They are also well suited to orchards of apples, pears, peaches, and mulberry trees. A very few small tracts are planted to paddy rice, but yields are low.

Droughtiness because of the high water seepage through the rapidly permeable, coarse loamy or gravelly coarse sandy soils, is a moderate problem. The Bonryang and Jungdong soils are also subject to damage by overflow from the Nagdong river or its tributaries, but the flood water drains rapidly. The soils of this unit do not hold plant nutrients well and because of this characteristic, smaller, more frequent applications of fertilizer are better than applying a large amount that may be leached out. Diversion ditches and dykes will reduce the flood hazard.

6.2.2.3 Capability unit IIw

This unit consists of nearly level or gently sloping, poorly or imperfectly drained, deep, moderately to moderately rapidly permeable soils that have high water tables. These soils are:

Gangdong loam, 2 to 7 percent slopes.

Gangdong loam, 7 to 15 percent slopes.

Geugrag silt loam, 0 to 2 percent slopes.

Jisan loam, 2 to 7 percent slopes.

Sinheung loam, 0 to 2 percent slopes.

Subug sandy loam, 2 to 7 percent slopes.

Available moisture capacity is high in the Geugrag and Jisan soils, but low to moderate in the rest.

All are in rice paddy, which is suitable, because of the poor drainage and high water table. Many areas are also later planted to winter barley or wheat. If properly drained, a wide range of crops would grow well. The terraced paddy field systems, built on the gently sloping soils, are effective erosion control measures, and weir dams will prevent damage to paddy walls by overflow. Some of the soils are strongly acid, and need liming.

6.2.3 Class III. Soils with Severe Limitations

6.2.3.1 Capability unit IIIe

In this capability unit are sloping, deep, well drained, mostly moderately to rapidly permeable soils. These soils are:

Anyong cobbly loam, 7 to 15 percent slopes.

Baegsan loam, 7 to 15 percent slopes.

Banho silt loam, 7 to 15 percent slopes.

Gongseong silty clay loam, 7 to 15 percent slopes.

Hwadong silty clay loam, 7 to 15 percent slopes.

Jangweon gravelly loam, 2 to 7 percent slopes.

Jisan loam, 7 to 15 percent slopes.

Sangag sandy loam, 7 to 15 percent slopes, eroded.

Sangju fine gravelly sandy loam, 7 to 15 percent slopes.

Seogto gravelly loam, 7 to 15 percent slopes.

Seongsan sandy loam, 7 to 15 percent slopes.

Songjeong loam, 7 to 15 percent slopes, eroded.

Subug sandy loam, 7 to 15 percent slopes.

Taehwa gravelly silt loam, 7 to 15 percent slopes, eroded.

Yongji loam, 7 to 15 percent slopes.

The Jangweon soil is the only one of this unit that is gently sloping. It has restricted permeability, because of its compact horizon known as a fragipan, at a depth of 30 to 50 cm. The Jisan and Gangdong are poorly drained, but erosion is a greater hazard than wetness. Usually the soils have moderate to high available moisture capacities but the Gangdong, Sangju, and Seongsan soils are low in this characteristic.

Cultivation is suitable and includes barley, wheat, soybean, vegetables, and other summer crops commonly found in the Gun. Paddy rice is grown on some areas of the poorly or moderately well drained soils like Jisan, Gangdong, Hwadong, or Yongji. Some of these are used for barley during the winter-spring.

Erosion is a danger if protection is not given with special conservation practices or perennial plants. The Gangdong, Sangju, and Seongsan soils are also subject to droughtiness because of their rapid permeability and low available moisture capacity.

Contour tillage, terraces, grassed waterways, and weir dams will help to retard runoff and control erosion. A system of drainage ditches is needed for the Jisan and Gangdong to remove excess surface water or to lower the water table. Cobbles and gravel should also be removed from the Anyong and Seogto for easier cultivation. Proper fertilization, liming and conserving all crop residues will help produce higher yields.

Pasture, orchards, and mulberry fields will do well, but a complete pasture establishment programme must include land preparation, liming, fertilization, seeding of adapted plants and regulation of grazing. For orchards and mulberry fields, these soils need to be bench-terraced. Growing of green manure as intercrops will improve the soil fertility, reduce erosion, and increase yields.

6.2.3.2 Capability unit IIIw

In this capability unit are level to nearly level, deep, poorly drained soils formed in alluvium in the low portions of floodplains, commonly at lower elevation

than the streambed. They are:

Hamchang silt loam, 0 to 2 percent slopes.

Hamchang soils, sandy loam overwash, 0 to 2 percent slopes.

These soils, having moderate available moisture holding capacities and moderate to rapid permeability, are strongly to medium acid, and high in natural fertility. They have high water tables, and generally are cultivated only to paddy rice.

With improved drainage they could be used for other crops, but drainage would be difficult because of the low elevations and lack of outlets.

6.2.4 Class IV. Soil with Very Severe Limitations

6.2.4.1 Capability unit IVe

In this capability unit are mostly moderately steep, deep, well drained, cobbly or gravelly, eroded soils. They are:

Anyong cobbly loam, 15 to 30 percent slopes.

Baegsan loam, 15 to 30 percent slopes.

Jangweon gravelly loam, 7 to 15 percent slopes.

Jangweon gravelly, 15 to 30 percent slopes.

Samgag sandy loam, 15 to 30 percent slopes, eroded.

Sangju fine gravelly sandy loam, 15 to 30 percent slopes.

Seogto gravelly loam, 15 to 30 percent slopes.

Songjeong loam, 15 to 30 percent slopes, eroded.

Subug sandy loam, 15 to 30 percent slopes.

Taehwa loam, 15 to 30 percent slopes, eroded.

Yongji loam, 15 to 30 percent slopes.

The Subug is the only one that is poorly drained, or has a higher water table. Its permeability is rapid. Most soils have moderate or low available moisture capacities. In the eroded soils, the original surface layer has been washed away, and the light-coloured subsoil is now exposed. As a result, these soils are low in natural fertility and in organic matter content.

The land is mostly in poor pine forest, with some small areas in cultivated crops. It is poorly suited to the latter, but well suited to pasture, orchards, and trees. Erosion is only a small problem when the soils are covered with good grass pasture.

Good yields from pasture can be expected if fertilizer and lime are used. Orchards should be established on bench terraces.

Cover crops and other erosion control measures are necessary in clean-tilled orchards. Maintaining grassed waterways will prevent gullyng. Many areas with a sparse stand of trees are being eroded very rapidly, mainly because of the raking and removal of leaves and other surface litter. For higher yields of the general agricultural crops, the soils should be treated with much lime, phosphorus and compost. Bench terracing will assist in erosion control. Crop residues, left on the surface, provide cover, promote the infiltration of water, and reduce losses from erosion. The Subug soil is being used for paddy rice because of the poor drainage, but is poorly suited to this crop because of the slope. Barley is also grown during the winter-spring. Erosion is a greater hazard on this soil than wetness. There is no erosion problem on the paddy soils as long as the dikes are properly maintained.

6.2.4.2 Capability unit IVs

This capability unit consists of level to sloping, deep, well drained, very coarse textured, rapidly permeable soils that have a very low available moisture capacity. They are:

Hwabong loamy sand, 0 to 2 percent slopes.

Hwangryong sandy loam, 0 to 2 percent slopes.

Ibseog fine gravelly loam coarse sand, 2 to 7 percent slopes.

Ibseog fine gravelly loamy coarse sand, 7 to 15 percent slopes.

Both natural fertility and organic matter are low and most cultivated crops are poorly suited. But, peanuts, melons, tobacco, some vegetables, poplar, mulberry, and orchards do well. Some of the Hwangryong soils are in paddy rice as much water is available from the nearby streams.

Droughtiness is the chief hazard because of low available moisture capacity, while damage from erosion on the more sloping soils is also a limiting factor. Flooding is only for short periods of time and crop damage is caused by the rapidly moving, rather than standing, water.

The addition of fine clayey soil will improve the coarse texture and water holding capacity. Split applications of fertilizer will lessen the effects of the leaching caused by the rapid water loss. The Hwangryong soils are easier to cultivate if the gravel is removed from the surface.

6.2.4.3 Capability unit IVw

The only soil in this capability unit is level to nearly level poorly drained, deep, rapidly permeable, and coarse textured, with a high water table. It is Sindab sandy loam, zero to two percent slopes.

The Sindab soil is on depressed floodplains that have poor drainage outlets. It is low in available moisture capacity, natural fertility and organic matter content.

Wetness is the chief hazard. The soil is poorly suited to most cultivated crops, and is being used only for paddy rice because of the high water table. The yields are generally low.

This soil is also subject to droughtiness when drained because of the rapid permeability and low available moisture capacity, and difficult to drain because the elevation is lower than the streambed. Proper fertilization by split application is needed to counteract the leaching of fertility elements through the coarse-textured soils.

6.2.5 Class VI. Soils Suitable only for Pasture or Woodland

6.2.5.1 Capability unit VIe

This unit consists of moderately steep to steep, deep or shallow, well drained, bouldery to rocky, eroded soils. They are:

Cheongog bouldery clay loam, 30 to 60 percent slopes, eroded.

Habin rocky loam, 15 to 30 percent slopes, eroded.

Habin rocky loam, 30 to 60 percent slopes, eroded.

Nagseo rocky loam, 15 to 30 percent slopes, eroded.

Samgag sandy loam, 15 to 30 percent slopes, severely eroded.

Samgag rocky sandy loam, 30 to 60 percent slopes, eroded.

Songjeong loam, 30 to 60 percent slopes, eroded.

Tashwa rocky silt loam, 30 to 60 percent slopes, eroded.

Because of the steep slopes, shallow soil depth, advanced erosion, and rockiness or stoniness, these soils are unsuitable for cultivation, but are for pasture and woodland, if properly managed. Poor pine forest or grassland is usual, but managing the latter is difficult in many places due to the steep slopes. As intensive grazing will leave the soils bare and subject to further erosion, its control is desirable.

Farmers should select tracts that are best suited to trees or pasture, and then improve the wooded areas by keeping stock off. Many of these soils have surface layers that are strongly acid in reaction, and this reaction is favourable to pine trees, but not to pasture, which will require much liming. Some of the soils can be developed into orchard or mulberry fields.

6.2.6 Class VII. Soils Limited to Woodland

6.2.6.1 Capability unit VIIe

This unit consists of steep, well drained, deep, rocky, severely eroded or gullied soils. They are:

Gwanag rocky sandy loam, 30 to 60 percent slopes, eroded.

Nagseo rocky loam, 30 to 60 percent slopes, eroded.

Nagseo rocky loam, 60 to 100 percent slopes, eroded.

Nagseo rocky loam, 60 to 100 percent slopes, severely eroded.

Samgag rocky sandy loam, 30 to 60 percent slopes, severely eroded.

Samgag rocky soils, 30 to 60 percent slopes, gullied.

Sinjeong soils, 15 to 30 percent slopes, gullied.

Sinjeong soils, 30 to 60 percent slopes, gullied.

The soils are so steep, rocky, severely eroded or gullied, that they are suited only for woodland. Cultivation is not practicable, and grazing is severely limited even under intensive management. To reduce losses from erosion, leaf litter should be left on the surface and the bare areas reforested.

6.2.7 Class VIII. Nonproductive Soils

6.2.7.1 Capability unit VIII

This unit consists of miscellaneous land units and soil materials that are so shallow and rocky, coarse or periodically flooded, that useful plants do not grow. They are:

Riverwash, cobbly

Riverwash, sandy

Rock Land

6.3 PADDY LAND SUITABILITY GROUP

Rice is the most important crop in Korea. This crop grows well on soils that are too wet for growing most other crops. These wet soils are classified as IIw or IIIw in the capability classification. About 19 643 ha, or 62 percent of the total cultivated areas (31 761 ha) in the Gun are used for paddy rice. In this section, the use and management of the soils suitable for growing paddy rice are discussed.

Management of paddy land can be planned more effectively if soils are grouped according to those characteristics that affect the growth of paddy rice and management of paddies. For this reason, the soils of Sangju Gun have been placed in four paddy land suitability groups, which are designated by P1, P2, P3, and P4. The numerals indicate progressively greater limitations in the use of land for rice. The four suitability groups for rice paddy used by the Korea Soil Survey are defined as follows:

P1 Very well suited:

Land that is suitable for rice paddy without the necessity of special development or management practices. This land has no special limitations or hazards.

P2 Well suited:

Land that is suitable for rice paddy with the application of simple special development and management practices. This land has moderate hazards and limitations.

P3 Moderately suited:

Land that is suitable for rice paddy with the application of difficult special development and management practices. This land has severe hazards and limitations.

P4 Poorly suited:

Land that is of limited or questionable suitability for paddy because of very severe hazards, limitations, and very difficult special management practices.

Suitability subgroups are soil classes within each suitability group; they are designated by adding small letters, a, b, c, or d to the group numeral, for example, P2ac. The letter 'a' shows that the main limitation is slopes; 'b' that the soil is limited mainly because of coarse texture or rapid permeability; 'c' that the soil is well drained or has low water table; and 'd' that the soil is limited mainly because of adverse chemical nature, such as acidity and salt. In Group P1 there are no subgroups, because the soils of this group have no special limitations.

Some of the soils in subclass IIw and IIIw of the capability system are classified as P1 because the high water table is a desirable characteristic of soil used for growing paddy rice. Steep, gullied, stony or rocky soils are unsuitable for paddy rice, and are not included in this classification.

6.3.1 Group P1. Very Well Suited

6.3.1.1 Paddy suitability group P1

This group consists of level to nearly level, deep, poorly or imperfectly drained, very slowly permeable soils that have high water tables. These soils are:

Geugrag silt loam, 0 to 2 percent slopes.

Sinheung loam, 0 to 2 percent slopes.

The soils are dominantly fine textured, and generally have high available moisture capacities. High natural fertility and high or medium organic matter content, is also usual.

Management practices other than proper fertilization and good cultural practices commonly needed for paddy soils are not required. Deep ploughing will help obtain somewhat higher yields, and calcium silicate will reduce lodging of rice. The high water table is a limitation to growing winter grain crops, such as barley or wheat, during the winter-spring season. Early season culture, good varieties, and high level fertilization are good measures to obtain high yields.

6.3.2 Group P2. Well Suited

6.3.2.1 Paddy suitability group P2a

The only soil in this group, is a gently sloping, deep, poorly drained, moderately permeable soil that has a high water table and moderate to high available moisture capacity. It is Jisan loam, 2 to 7 percent slopes.

The slope is the only limitation that affects paddy size and shape. Paddy systems constructed on the gently sloping soils have small paddies with irregular shapes and are subject to losses of irrigation water and runoff, unless paddy dykes are well maintained. Well-constructed weir dams are needed to control erosion paddy walls and to regulate the water level for growing paddy rice. Deep ploughing with adequate fertilization would increase yields, and application of calcium silicate will help reduce lodging of rice plants.

6.3.2.2 Paddy suitability group P2ac

This group consists of gently sloping, deep, well drained, moderately to slowly permeable soils with medium and heavy texture. These soils have low water tables. They are:

Baegsan loam, 2 to 7 percent slopes.

Banho loam, 2 to 7 percent slopes.

Gongseong silty clay loam, 2 to 7 percent slopes.

Hwadong silty clay loam, 2 to 7 percent slopes.

Songjeong loam, 2 to 7 percent slopes, eroded.

Yongji loam, 2 to 7 percent slopes.

The available moisture capacities are mostly high or moderately high, and natural fertilities are dominantly moderate or moderately low. Hwadong and Yongji soils are mostly in rice paddy, and also are cultivated to barley or wheat during the winter-spring. The rest of the soils are mostly in barley, wheat, soybeans, and summer crops other than rice. All the soils in this group are suited to paddy rice if paddy is established on these soils, water sources developed, and cobbles removed.

Some droughtiness and loss of water because of the good drainage and the slopes is common. Because of the low water table, frequent irrigation is needed to supply rice plants with enough water, and paddy systems need well constructed weir dams to protect dykes from damage by overflow. Deep ploughing and application of calcium silicate are good cultural practices. Because of the high clay content the Hwadong need application of sandy soils to improve surface texture. Winter grain crops like

barley or wheat grow well during the winter and spring after paddy rice. Crops other than rice will also grow well during the summer.

6.3.2.3 Paddy suitability group P2b

The only soil in this group, is a level to nearly level, deep, imperfectly drained, coarse textured soil that has a high water table. It is Seogyne fine sandy loam, 0 to 2 percent slopes.

This soil has low available moisture capacities and rapid permeability, but a high water table favourable for the growing of paddy rice. Natural fertility is moderate to low and organic matter content low to moderately low.

Most of this soil is suitable for paddy rice because of available water, but it is subject to droughtiness if drained due to rapid permeability and low available moisture capacity. Addition of clay and compost, and split applications of nitrogen are necessary to reduce the effects of leaching. Occasional growing of green manure crops will improve soil fertility.

6.3.2.4 Paddy suitability group P2c

The only soil in this group, is level to nearly level, deep, moderately well drained, moderately permeable, medium-textured, and has high available moisture capacity, high natural fertility, and medium organic matter content. It is Gyum silt loam, 0 to 2 percent slopes.

This soil has a moderately low water table. It is well suited to paddy rice which predominates. In most areas barley is now cultivated in the winter-spring.

6.3.3 Group P3. Moderately Suited

6.3.3.1 Paddy suitability group P3a

The only soil in this group is sloping, poorly drained, deep, moderately permeable, and has a high water table and high available moisture capacity. It is Jisan loam, 7 to 15 percent slopes.

The soil is used and suitable for paddy rice because of the high water table. But the strong slope is a limitation affecting paddy size and shape, which allows damage to dikes and loss of irrigation water following excessive rains. Weir dams are needed to control the runoff and regulate the water level required for the crop's growth. Deep ploughing and proper fertilization will increase rice yields.

6.3.3.2 Paddy suitability group P3ab

This paddy suitability group consists of gently sloping to sloping, poorly drained, deep, rapidly permeable, medium textured soils that have high water tables and low available moisture capacities. They are:

Gangdong loam, 2 to 7 percent slopes.

Gangdong loam, 7 to 15 percent slopes.

Subug sandy loam, 2 to 7 percent slopes.

Subug sandy loam, 7 to 15 percent slopes.

These soils are moderate in natural fertility and organic matter, and are suitable for paddy rice because of the high water table, but slope and low available moisture capacity are major limitations.

Paddy dikes with well-built weir dams are needed to control erosion. Nitrogen and other fertilizers should be applied to the soils in several applications during the growing season to reduce leaching. The addition of clay will also cut down on the leaching of plant nutrients. Dense planting and dryland direct seeding are good rice culture practices.

6.3.3.3 Paddy suitability group P3ac

This group consists of sloping, deep, well or moderately well drained, moderately to moderately slowly permeable soils that have low water tables. They are:

Anyong cobbly loam, 7 to 15 percent slopes.

Baegsan loam, 7 to 15 percent slopes.

Banho loam, 7 to 15 percent slopes.

Gongseong silt loam, 7 to 15 percent slopes.

Hwadong silty clay loam, 7 to 15 percent slopes.

Jangweon gravelly loam, 2 to 7 percent slopes.

Songjeong loam, 7 to 15 percent slopes, eroded.

Taehwa gravelly silt loam, 7 to 15 percent slopes, eroded.

Yongji loam, 7 to 15 percent slopes.

The Yongji soil is the only soil that is presently used for paddy rice. Available moisture holding capacity in the Yongji and Hwadong soils is high, but in the remainder is low or moderate in this characteristic.

Most of the soils at the moment are used for general crops other than rice, with some areas in forest or orchard. These can be developed for paddy rice with the application of difficult special development and management practices.

For paddy land use they should be level-terraced and diked, and a water supply should be developed. Rice paddies will need well-constructed weir dams to protect the dykes from damage by overflow following intense rains, because the slopes of these soils make them subject to severe erosion. The paddy system also permits other general crops to grow without erosion losses. Deep ploughing and application of compost will be good practices in growing paddy rice.

6.3.3.4 Paddy suitability group P3b

In this group are level to nearly level, deep, poorly drained, rapidly permeable, coarse-textured soils with low available moisture holding capacity but with high water tables. These soils are usually on lower positions than the streambeds. They are:

Hamchang silt loam, 0 to 2 percent slopes.

Hamchang soils, sandy loam overwash, 0 to 2 percent slopes.

Sindab sandy loam, 0 to 2 percent slopes.

These soils are now used for paddy rice because of the high water table. They would be subject to droughtiness if drained, because of the rapid permeability and very low available moisture capacity. Application of clayey soil and compost, and split application of fertilizer will reduce the leaching of plant nutrients and increase crop yields. The occasional growing of green manure crops will improve the soil.

6.3.4 Group P4. Poorly Suited

6.3.4.1 Paddy suitability group P4ab

The only soil in this group is moderately steep, poorly drained, deep, coarse-textured and rapidly permeable. Its available moisture capacity is low, and natural fertility and organic matter content are moderate. This soil is in small valleys in the general area of the Sangag soils. It is Subug sandy loam, 15 to 30 percent slopes.

Paddy rice and winter barley are main crops, but because of the steep slopes and rapid permeability, nothing is well suited.

Dykes with well-built weir dams are needed to control erosion of paddy walls. Nitrogen and other fertilizers should be applied to the soil in several applications during the growing season to reduce leaching. The addition of clay will also lessen the leaching of plant nutrients. Close planting and dryland direct seeding are good rice culture practices.

6.3.4.2 Paddy suitability group P4abc

This group consists of gently sloping to moderately steep, well drained, deep, moderately to moderately rapidly permeable, gravelly soils with moderate to low available moisture capacities. These soils have low water tables. They are:

Hogy gravelly loam, 2 to 7 percent slopes.

Ibseog fine gravelly loamy coarse sand, 2 to 7 percent slopes.

Ibseog fine gravelly loamy coarse sand, 7 to 15 percent slopes.

Imog sandy loam, 2 to 7 percent slopes.

Sangju fine gravelly sandy loam, 2 to 7 percent slopes.

Sangju fine gravelly sandy loam, 7 to 15 percent slopes.

Sangju fine gravelly sandy loam, 15 to 30 percent slopes.

Seogto gravelly loam, 7 to 15 percent slopes.

Seogto gravelly loam, 15 to 30 percent slopes.

Seongsan sandy loam, 2 to 7 percent slopes.

Seongsan sandy loam, 7 to 15 percent slopes.

Very few areas have been developed into paddy systems, being poorly suited because of the slope and high water requirement. To grow paddy rice, a dependable water supply is needed but construction costs to develop paddy systems would be high, as would losses of water and plant nutrients in them. The gravel interferes with cultivation if not removed.

Paddies made on these soils will also need good weir dams to control erosion of paddy walls, and the addition of clayey soils and removal of gravel to reduce the effects of leaching of plant nutrients. Proper fertilization, thick planting, and dryland direct seeding are good rice cultural practices. Compost added will also improve yields.

6.3.4.3 Paddy suitability group P4ac

This group consists of moderately steep, well or moderately well drained, deep or moderately deep, moderately to slowly permeable soils that have low or very low water tables.

Anyong cobbly loam, 15 to 30 percent slopes.

Baegsan loam, 15 to 30 percent slopes.

Jangweon gravelly loam, 15 to 30 percent slopes.

Songjeong loam, 15 to 30 percent slopes, eroded.

Yongji loam, 15 to 30 percent slopes.

Taehwa gravelly silt loam, 15 to 30 percent slopes, eroded.

At present most of these soils are in crops other than rice, or are wooded or left idle. Because of strong slopes and lack of irrigation water, paddy rice is poorly suited. To be put into rice production they would need to be level terraced, and a dependable source of water developed. Dryland direct seeding is a possible way when water supplies are not dependable. Deep ploughing and application of calcium silicate and compost are good management practices. Erosion of paddy walls by excess water can be controlled by building weir dams. Winter grain crops such as wheat and barley will grow well.

6.3.4.4 Paddy suitability group P4bc

These soils are level to nearly level, deep, well drained, rapidly permeable, sandy soils with very low available moisture capacities and low water tables. They have low clay content and low cation exchange capacity, and are subject to droughtiness. The soils in this paddy suitability group are:

Bonryang sandy loam, 0 to 2 percent slopes.

Hwabong loamy sand, 0 to 2 percent slopes.

Hwangryong sandy loam, 0 to 2 percent slopes.

Jungdong fine sandy loam, 0 to 2 percent slopes.

Paddy rice is grown in a few small areas where water is available, but the remainder is poorly suited to cultivated crops other than peanut, melons, mulberry, and some orchard.

The loss of water and plant nutrients can be controlled to some extent by applying clayey soil. Split application of fertilizer will reduce leaching of fertilizers.

Table 4

GUIDE TO MAPPING UNITS

Map Symbol	Mapping Unit	Capability Unit	Paddy Suit. Group
AnC	Anyong cobbly loam, 7 to 15 percent slopes.	IIIe	P3ac
AnD	Anyong cobbly loam, 15 to 30 percent slopes.	IVe	P4ac
BeB	Baegsan loam, 2 to 7 percent slopes.	IIe	P2ac
BeC	Baegsan loam, 7 to 15 percent slopes.	IIIe	P3ac
BeD	Baegsan loam, 15 to 30 percent slopes.	IVe	P4ac
BhB	Banho silt loam, 2 to 7 percent slopes.	IIe	P2ac
BhC	Banho silt loam, 7 to 15 percent slopes.	IIIe	P3ac
Bo	Bonryang sandy loam, 0 to 2 percent slopes.	IIs	P4bc
CbE2	Cheongog bouldery clay loam, 30 to 60 percent slopes, eroded.	VIe	
GdB	Gangdong loam, 2 to 7 percent slopes.	IIw	P3ab
GdC	Gangdong loam, 7 to 15 percent slopes.	IIw	P3ab
Gr	Geugrag silt loam, 0 to 2 percent slopes.	IIw	P1
GsB	Gongseong silty clay loam, 2 to 7 percent slopes.	IIe	P2ac
GsC	Gongseong silty clay loam, 7 to 15 percent slopes.	IIIe	P3ac
GnE2	Gwanag rocky sandy loam, 30 to 60 percent slopes, eroded.	VIIe	
Gy	Gyuam silt loam, 0 to 2 percent slopes.	I	P2c
HbD2	Habin rocky loam, 15 to 30 percent slopes, eroded.	VIe	

Table 4 (Cont'd)

Map Symbol	Mapping Unit	Capability Unit	Paddy Suit. Group
HbE2	Habin rocky loam, 30 to 60 percent slopes, eroded.	VIe	
Hh	Hamchang silt loam, 0 to 2 percent slopes.	IIIw	P3b
Ha	Hamchang soils, sandy loam overwash, 0 to 2 percent slopes.	IIIw	P3b
HgB	Hogye gravelly loam, 2 to 7 percent slopes.	IIs	P4abc
Hw	Hwabong loamy sand, 0 to 2 percent slopes.	IVs	P4bc
HdB	Hwadong silty clay loam, 2 to 7 percent slopes.	IIe	P2ac
HdC	Hwadong silty clay loam, 7 to 15 percent slopes.	IIIe	P3ac
Hk	Hwangryong sandy loam, 0 to 2 percent slopes.	IVs	P4bc
IbB	Ibseog fine gravelly loamy coarse sand, 2 to 7 percent slopes.	IVs	P4abc
IbC	Ibseog fine gravelly loamy coarse sand, 7 to 15 percent slopes.	IVs	P4abc
ImB	Imog sandy loam, 2 to 7 percent slopes.	IIs	P4abc
JwB	Jangweon gravelly loam, 2 to 7 percent slopes.	IIIe	P3ac
JwC	Jangweon gravelly loam, 7 to 15 percent slopes.	IVe	P4ac
JwD	Jangweon gravelly loam, 15 to 30 percent slopes.	IVe	P4ac
JiB	Jisan loam, 2 to 7 percent slopes.	IIw	P2a
JiC	Jisan loam, 7 to 15 percent slopes.	IIIe	P3a
Jd	Jungdong fine sandy loam, 0 to 2 percent slopes.	IIs	P4bc
NsD2	Nagseo rocky loam, 15 to 30 percent slopes, eroded.	VIe	
NsE2	Nagseo rocky loam, 30 to 60 percent slopes, eroded.	VIIe	
NsF2	Nagseo rocky loam, 60 to 100 percent slopes, eroded.	VIIe	

Table 4 (Cont'd)

Map Symbol	Mapping Unit	Capability Unit	Paddy Suit. Group
NsF3	Nagseo rocky loam, 60 to 100 percent slopes, severely eroded.	VIIe	
RC	Riverwash, cobbly	VIII	
RS	Riverwash, sandy	VIII	
RL	Rock Land	VIII	
SgC2	Sangag sandy loam, 7 to 15 percent slopes, eroded.	IIIe	
SgD2	Sangag sandy loam, 15 to 30 percent slopes, eroded.	IVe	
SgD3	Sangag sandy loam, 15 to 30 percent slopes, severely eroded.	VIe	
SmE2	Sangag rocky sandy loam, 30 to 60 percent slopes, eroded.	VIe	
SmE3	Sangag rocky sandy loam, 30 to 60 percent slopes, severely eroded.	VIIe	
SmE4	Sangag rocky soils, 30 to 60 percent slopes, gullied.	VIIe	
SuB	Sangju fine gravelly sandy loam, 2 to 7 percent slopes.	IIs	P4abc
SuC	Sangju fine gravelly sandy loam, 7 to 15 percent slopes.	IIIe	P4abc
SuD	Sangju fine gravelly sandy loam, 15 to 30 percent slopes.	IVe	P4abc
StC	Seogto gravelly loam, 7 to 15 percent slopes.	IIIe	P4abc
StD	Seogto gravelly loam, 15 to 30 percent slopes.	IVe	P4abc
SzB	Seongsan sandy loam, 2 to 7 percent slopes.	IIs	P4abc
SzC	Seongsan sandy loam, 7 to 15 percent slopes.	IIIe	P4abc
Sn	Sindab sandy loam, 0 to 2 percent slopes.	IVw	P3b
Sh	Sinheung loam, 0 to 2 percent slopes.	IIw	P1
SjD4	Sinjeong soils, 15 to 30 percent slopes, gullied.	VIIe	

Table 4 (Cont'd)

Map Symbol	Mapping Unit	Capability Unit	Paddy Suit. Group
SjE4	Sinjeong soils, 30 to 60 percent slopes, gullied.	VIIe	
SoB2	Songjeong loam, 2 to 7 percent slopes, eroded.	IIe	P2ac
SoC2	Songjeong loam, 7 to 15 percent slopes, eroded.	IIIe	P3ac
SoD2	Songjeong loam, 15 to 30 percent slopes, eroded.	IVe	P4ac
SoE2	Songjeong loam, 30 to 60 percent slopes, eroded.	VIe	
SpB	Subug sandy loam, 2 to 7 percent slopes.	IIw	P3ab
SpC	Subug sandy loam, 7 to 15 percent slopes.	IIIe	P3ab
SpD	Subug sandy loam, 15 to 30 percent slopes.	IVe	P4ab
TaC2	Taehwa gravelly silt loam, 7 to 15 percent slopes, eroded.	IIIe	P3ac
TaD2	Taehwa gravelly silt loam, 15 to 30 percent slopes, eroded.	IVe	P4ac
TrE2	Taehwa rocky silt loam, 30 to 60 percent slopes, eroded.	VIe	
YjB	Yongji loam, 2 to 7 percent slopes.	IIe	P2ac
YjC	Yongji loam, 7 to 15 percent slopes.	IIIe	P3ac
YjD	Yongji loam, 15 to 30 percent slopes.	IVe	P4ac

Table 5

EXTENT (HECTARES) OF MAPPING UNITS

Map Symbol	Mapping Unit	Area (hectares)	Percent
AnC	Anyong cobbly loam, 7 to 15 percent slopes.	623	0.5
AnD	Anyong cobbly loam, 15 to 30 percent slopes.	1 351	1.1
BeB	Baegsan loam, 2 to 7 percent slopes.	1 523	1.2
BeC	Baegsan loam, 7 to 15 percent slopes.	2 032	1.6
BeD	Baegsan loam, 15 to 30 percent slopes.	354	0.3
BhB	Banho silt loam, 2 to 7 percent slopes.	179	0.1
BhC	Banho silt loam, 7 to 15 percent slopes.	616	0.5
Bo	Bonryang sandy loam, 0 to 2 percent slopes.	1 527	1.2
CbE2	Cheongog bouldery clay loam, 30 to 60 percent slopes, eroded.	156	0.1
GdB	Gangdong loam, 2 to 7 percent slopes.	616	0.5
GdC	Gangdong loam, 7 to 15 percent slopes.	238	0.2
Gr	Geugrag silt loam, 0 to 2 percent slopes.	1 961	1.6
GsB	Gongseong silty clay loam, 2 to 7 percent slopes.	108	0.1
GsC	Gongseong silty clay loam, 7 to 15 percent slopes.	120	0.1
GnE2	Gwanag rocky sandy loam, 30 to 60 percent slopes, eroded.	11 143	8.9
Gy	Gyuam silt loam, 0 to 2 percent slopes.	1 203	0.1

Table 5 (Cont'd)

Map Symbol	Mapping Unit	Area (hectares)	Percent
HbD2	Habin rocky loam, 15 to 30 percent slopes, eroded.	378	0.3
HbE2	Habin rocky loam, 30 to 60 percent slopes, eroded.	3 208	2.5
Hh	Hamchang silt loam, 0 to 2 percent slopes.	1 196	0.9
Ha	Hamchang soils, sandy loam overwash, 0 to 2 percent slopes.	808	0.6
HgB	Hogye gravelly loam, 2 to 7 percent slopes.	484	0.4
Hw	Hwabong loamy sand, 0 to 2 percent slopes.	714	0.6
HdB	Hwadong silty clay loam, 2 to 7 percent slopes.	781	0.6
HdC	Hwadong silty clay loam, 7 to 15 percent slopes.	65	0.1
Hk	Hwangryong sandy loam, 0 to 2 percent slopes.	1 487	1.2
IbB	Ibseog fine gravelly loamy coarse sand, 2 to 7 percent slopes.	175	0.1
IbC	Ibseog fine gravelly loamy coarse sand, 7 to 15 percent slopes.	148	0.1
ImB	Imog sandy loam, 2 to 7 percent slopes.	231	0.2
JwB	Jangweon gravelly loam, 2 to 7 percent slopes.	175	0.1
JwC	Jangweon gravelly loam, 7 to 15 percent slopes.	526	0.4
JwD	Jangweon gravelly loam, 15 to 30 percent slopes.	189	0.2
JiB	Jisan loam, 2 to 7 percent slopes.	2 655	2.1
JiC	Jisan loam, 7 to 15 percent slopes.	1 329	1.1
Jd	Jungdong fine sandy loam, 0 to 2 percent slopes.	558	0.4
NsD2	Nagseo rocky loam, 15 to 30 percent slopes, eroded.	215	0.2
NsE2	Nagseo rocky loam, 30 to 60 percent slopes, eroded.	1 600	1.3

Table 5 (Cont'd)

Map Symbol	Mapping Unit	Area (hectares)	Percent
NsF2	Nagseo rocky loam, 60 to 100 percent slopes, eroded.	4 400	3.5
NsF3	Nagseo rocky loam, 60 to 100 percent slopes, severely eroded.	324	0.3
RC	Riverwash, cobbly	769	0.6
RS	Riverwash, sandy	1 644	1.3
RL	Rock Land	9 561	7.5
SgC2	Sangag sandy loam, 7 to 15 percent slopes, eroded.	352	0.3
SgD2	Sangag sandy loam, 15 to 30 percent slopes, eroded.	1 854	1.1
SgD3	Sangag sandy loam, 15 to 30 percent slopes, severely eroded.	623	0.5
SmE2	Sangag rocky sandy loam, 30 to 60 percent slopes, eroded.	20 696	16.5
SmE3	Sangag rocky sandy loam, 30 to 60 percent slopes, severely eroded.	21 146	16.7
SmE4	Sangag rocky soils, 30 to 60 percent slopes, gullied.	1 367	1.1
SuB	Sangju fine gravelly sandy loam, 2 to 7 percent slopes.	705	0.6
SuC	Sangju fine gravelly sandy loam, 7 to 15 percent slopes.	818	0.7
SuD	Sangju fine gravelly sandy loam, 15 to 30 percent slopes.	204	0.2
StC	Seogto gravelly loam, 7 to 15 percent slopes.	2 204	1.7
StD	Seogto gravelly loam, 15 to 30 percent slopes.	2 634	2.1
SzB	Seongsan sandy loam, 2 to 7 percent slopes.	31	<u>1/</u>

1/ Less than .05 percent

Table 5 (Cont'd)

Map Symbol	Mapping Unit	Area (hectares)	Percent
SzC	Seongsan sandy loam, 7 to 15 percent slopes.	71	0.1
Sn	Sindab sandy loam, 0 to 2 percent slopes.	789	0.6
Sh	Sinheung loam, 0 to 2 percent slopes.	438	0.3
SjD4	Sinjeong soils, 15 to 30 percent slopes, gullied.	1 458	1.2
SjE4	Sinjeong soils, 30 to 60 percent slopes, gullied.	4 115	3.3
SoB2	Songjeong loam, 2 to 7 percent slopes, eroded.	122	0.1
SoC2	Songjeong loam, 7 to 15 percent slopes, eroded.	763	0.4
SoD2	Songjeong loam, 15 to 30 percent slopes, eroded.	564	0.4
SoE2	Songjeong loam, 30 to 60 percent slopes, eroded.	99	0.1
SpB	Subug sandy loam, 2 to 7 percent slopes.	546	0.4
SpC	Subug sandy loam, 7 to 15 percent slopes.	599	0.5
SpD	Subug sandy loam, 15 to 30 percent slopes.	213	0.2
TaC2	Taehwa gravelly silt loam, 7 to 15 percent slopes, eroded.	93	0.1
TaD2	Taehwa gravelly silt loam, 15 to 30 percent slopes, eroded.	1 109	0.9
TrE2	Taehwa rocky silt loam, 30 to 60 percent slopes, eroded.	1 830	1.5
YjB	Yongji loam, 2 to 7 percent slopes.	1 286	1.0
YjC	Yongji loam, 7 to 15 percent slopes.	1 014	0.8
YjD	Yongji loam, 15 to 30 percent slopes.	283	0.2
	Water	532	0.4
	<u>Total</u>	<u>125 928</u>	<u>1/</u>

1/ It does not total exactly 100.0 because of rounding of figures.

Appendix

GLOSSARY

Acidity	See reaction, soil.
Acid Sulphate Soil	A wet soil containing iron sulphates and iron carbonates, that is or becomes extremely acid when drained.
Alluvial	Consisting of or formed in material deposited by water.
Alluvium	Soil material that has been transported and deposited by water.
Available Moisture Capacity	The capacity of a soil to hold water in a form available to plants. The amount of moisture held in a soil between field capacity, or about one-third atmosphere of tension, and the wilting coefficient, or about 15 atmospheres of tension. Terms for available moisture capacity given in this survey (determined to a depth of 125 cm) are the following: High - 25 cm or more; medium - 15 to 25 cm; low - 7 to 15 cm; and very low - less than 7 cm.
Base Saturation	The degree to which soil material that has base exchange properties is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity: High - 60 to 100 percent; medium - 35 to 60 percent; and low - less than 35 percent.
Cation-exchange Capacity	A measure of the total amount of exchangeable cations that can be held by a soil. It is expressed in terms of milliequivalents (me) per 100 g of soil material that is neutral in reaction (pH 7.0) or at some other stated pH value: High - 10 me or more; medium - 6 to 10 me; low - 3 to 6 me; and very low - less than 3 me.
Clay	As a soil separate, the mineral soil particles less than 0.002 mm in diameter. As a soil textural class, soil material that is 40 percent or more clay less than 45 percent sand, and less than 40 percent silt.
Clay Film	A cutan composed of oriented clay particles.
Colluvial	Having been transported by gravity, mass slippage or a combination of slippage and local wash.
Colluvium	Soil material, rock fragments or both moved by creep, slide, or local wash and deposited at the base of a steep slope.

Consistence, Soil	<p>The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are -</p> <p><u>Loose</u>. - Noncoherent; will not hold together in a mass.</p> <p><u>Friable</u>. - When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.</p> <p><u>Firm</u>. - When moist, crushed under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.</p> <p><u>Plastic</u>. - When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.</p> <p><u>Sticky</u>. - When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.</p> <p><u>Hard</u>. - When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.</p> <p><u>Soft</u>. - When dry, breaks into powder or individual grains under very slight pressure.</p>
Cutan	<p>A coating or film, on the outside of a soil aggregate or mass. It may consist of clay, silt, oxides of iron or manganese, organic matter, or other materials.</p>
Depth of Soil	<p>Thickness of soil over a specified layer, generally a layer that does not permit the growth of roots. Classes used in this soil survey to indicate depth are the following: Deep - 1 m or more; moderately deep - 50 cm to 1 m; and shallow - less than 50 cm.</p>
Erosion	<p>The washing of soil from the soil surface. It includes washing of a continuous thin layer from the surface, known as sheet erosion, as well as the formation of small valleys known as gully erosion.</p>
Family (soil)	<p>A level of classification of closely related soils immediately above the series level. The soils of a family are usually very similar in their management characteristics.</p>
Fluvio-marine	<p>Deposited by joint action of streams and sea.</p>
Fragipan	<p>A dense and brittle pan, or layer, that owes its hardness mainly to extreme density or compactness rather than to content of much clay or cementation. Fragments that are removed are friable, but the material in place is so dense that roots cannot penetrate it and water moves through it very slowly by following vertical channels and cleavage planes.</p>
Horizon, Soil	<p>A layer of soil, approximately parallel to the surface, that has distinct characteristics.</p>

Loam (1) Soil containing a relatively even mixture of sand and silt and a somewhat smaller proportion of clay, generally a desirable quality. May be subdivided into textural classes, such as sandy loam, loam, silt loam, and clay loam. (2) Specifically, soil material containing 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

Mapping Units The units shown on soil maps. They may be mainly soil series, phases of soil series, complexes of soil series, or some other combination such as mixtures of soil series and rock outcrop.

Massive Consisting of large, uniform masses of cohesive soil, in some places with ill-defined and irregular breakage, as in some of the fine-textured alluvial soils; structureless.

Paddy A small field that has been levelled with a bunt capable of retaining a shallow depth of water. Paddies are used principally for growing rice.

Permeability, Soil The quality of a soil that enables it to transmit air and water. The following relative classes of soil permeability, used in this soil survey, refer to estimated rates of movement of water in millimeters per hour through saturated, undisturbed cores under a 2.5 cm head of water: Very slow - less than 1 mm; slow - 1 to 5 mm; moderately slow - 5 to 15 mm; moderate - 15 to 50 mm; moderately rapid - 50 to 150 mm; rapid - more than 150 mm.

Reaction, Soil The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour", soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	<u>pH</u>
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Sand As a soil separate, individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 mm in diameter. Most sand grains consist of quartz, but sand may be of any mineral composition. As a textural class, soil material that is 85 percent or more sand and not more than 10 percent clay.

Silt As a soil separate, individual mineral particles in a soil that range from the upper limit of clay (0.002 mm) in diameter to the lower limit of very fine sand (0.05 mm). As a textural class, soil material that is 80 percent or more silt and less than 10 percent clay.

Slope

Soil slope is measured by using a hand level and is expressed as the percent the vertical distance (change of elevation) is of the horizontal distance. Slope classes and terms used to describe them are as follows:

Slope Percent	Class	Mapping Symbol
0 - 2	Nearly level	A
2 - 7	Gently sloping	B
7 - 15	Sloping	C
15 - 30	Moderately steep	D
30 - 60	Steep	E
60 or more	Very steep	F

Soil

The thin outer layer of the earth's crust which serves as a medium for the growth of land plants.

Structure, Soil

The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles.

Terrace

An alluvial plain that has elevation above the present floodplain.

Texture, Soil

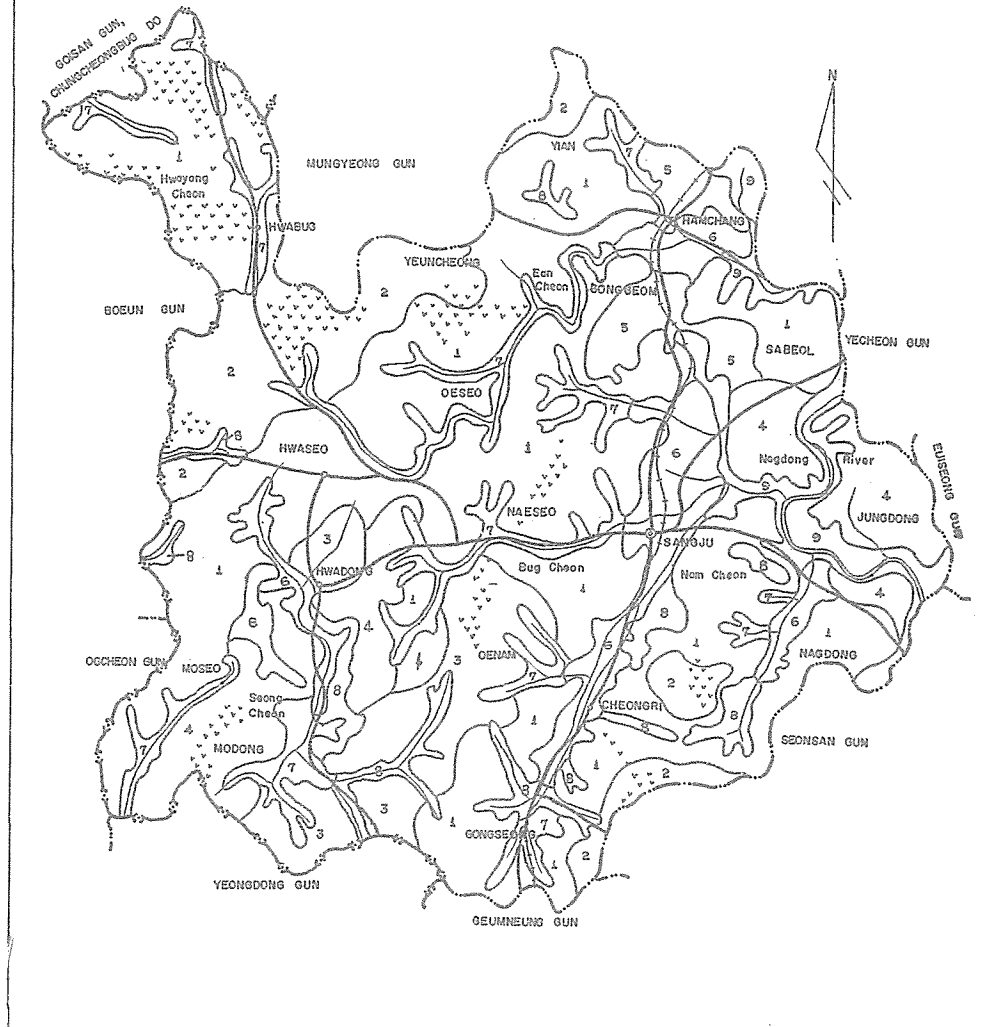
The relative proportions of sand, silt and clay in a soil mass.

Water Table

The upper surface of groundwater; the highest part of the soil or underlying rock that is wholly saturated with water.

Fig.2 GENERAL SOIL MAP
SANGJU GUN, GYEONGSANGBUG DO

S = 1: 250,000



Soil Association

- 1 Samgag-Sangju-Itseog Association: Dominant but some areas of sloping in the valleys, excessively drained soils of the mountain.
- 2 Gwanag-Taehwa-Seogto Association: Dominant shallow soils, but some moderately deep soils on lesser slopes.
- 3 Nageo-Seogto Association: Steep and very shallow soils on high mountains with some soils in the valleys.
- 4 Sinjeong-Habin-Jangweon Association: Shallow deep, sloping to steep soils developed over stone and shale.
- 5 Samgag-Songjeong Association: Gently sloping to moderately steep, well and excessively drained clayey to sandy loam soils of the rolling hills.
- 6 Hamchang-Geugrag-Hwadong Association: Near to gently sloping, poorly and moderately well drained flood plain and low terrace soils.
- 7 Sangju-Baegsan-Hwangryong Association: Near to moderately steep soils of the small stream valleys.
- 8 Jisan-Jangweon-Yongji Association: Gently to moderately steep, poorly drained to moderately well drained soils of the small valleys.
- 9 Jungdong-Sindab Association: Nearly level to well drained sandy soils of river flood plain.

