AGL:SF/KOR 13
Technical Report 9

SOIL SURVEY

REPUBLIC OF KOREA

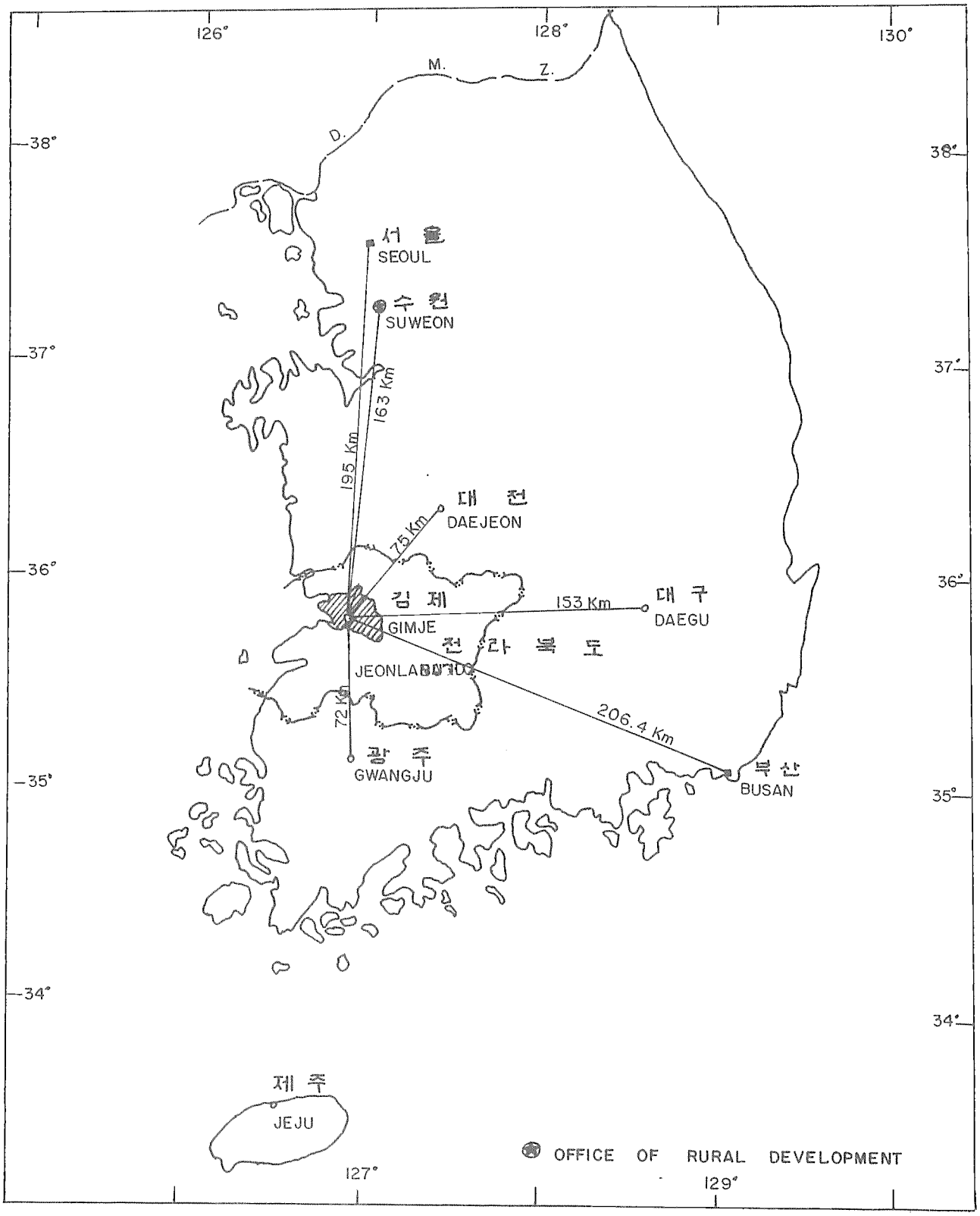
SOIL SURVEY IN GIMJE GUN, JEONLABUG DO

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

SOIL SURVEY

REPUBLIC OF KOREA

LOCATION MAP OF GIMJE GUN, JEONLABUG DO



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Technical Report 9

SOIL SURVEY

REPUBLIC OF KOREA

SOIL SURVEY IN GIMJE GUN, JEONLABUG DO

Report prepared for
the Government of the Republic of Korea
by
the Food and Agriculture Organization of the United Nations
acting as executing agency for
the United Nations Development Programme

UNITED NATIONS DEVELOPMENT PROGRAMME

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Rome, 1970

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 Gimje Gun, Jeonlabug Do. Rome, 1970. 76 p. 2 maps. AGL:SF/KOR 13, Technical Report 9.

ABSTRACT

This report describes soil survey activities in Gimje 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 entire area of the Gun (55 131 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 25 575 hectares of three-fourths 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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Chapter 1

INTRODUCTION

The detailed soil survey described in this report began in June 1966 and was completed in November 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 new research methods and new cartographic methods have been used 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 soil survey work.

This report is an inventory of research findings, in maps and in writing, of soil and soil conditions in Gimje 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.

Technical Reports

The report has been compiled by the following: Charles E. Downey and Jeong-Hwa Jeong. It is based on the work of:

Field Survey: Jeong-Hwa Jeong
Sang-Seog Chae
Byung-Soo Yoo
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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 technical reports is as follows:

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. Soil Survey in Ulju Gun and Ulsan Si
Technical Report 4. Soil Survey in Gimhae Gun
Technical Report 5. Soil Survey in Dalseong Gun and Daegu Si
Technical Report 6. Soil Survey in Gwangsan Gun, Damyang Gun, and Gwangju Si
Technical Report 7. Soil Survey in Sangju Gun
Technical Report 8. Soil Survey in Pyengchang Gun, Gangweon Do
Technical Report 9. Soil Survey in Gimje Gun
Technical Report 10. Soil Survey in Buyeo Gun

Each individual detailed Soil Survey Area Report (Reports 3 to 10) is accompanied by a detailed soil map at scale 1:250 000.

Chapter 2

GENERAL DESCRIPTION OF THE AREA

2.1 LOCATION

The survey area includes all of Gimje Gun, in the western part of Jeollabug Do, one of the western provinces of Korea.

The area is bounded on the north by Oggu and Igsan Guns and Iri City, on the east by Wan-ju Gun, on the south by Buan and Jeongeub Guns, and on the west by the Yellow Sea. It lies between 35°38' and 35°52' north and 127°05' and 126°45' east, extendin approximately 33 km from north to south and 42 km east to west. Gimje Eub, the Gu seat, is about 273 km distance from Seoul, 385 km from Pusan and 154 km from Mog by rail.

The surveyed area has a total of 55 131 ha, and a population of 251 37° of Agriculture and Forestry Statistics for 1968).

2.2 PHYSIOGRAPHY AND DRAINAGE

The eastern part of Gimje Gun is mountainous. Mt. Moag, ı .evation of 793 m, borders Wan-ju Gun, and Mt. Guseong, with an elevation m, borders Geumgu and Geumsan Myeons, forming the central part of a succ ı of mountains in the east. These mountainous areas and those along the Weonpyeong and Duwel rivers have been mined in the past and are still being mined sporadically for gold.

West of Mt. Guweol are numerous minor mountains of less than 150 m elevation. Lower foothills, rolling uplands and pediment slopes are scattered throughout the area.

The gentle slope and drainage of the valley floors is from east to west with scattered undulating hills. This central and western part is a great and fertile plain with dendritic drainage pattern. It has been well known from ancient times as a granary of the nation. The large Mangyeong and Dongjin rivers, along with small rivers such as the Weonpyeong, Duwel and Buyong and their tributaries, form a system of streams furnishing water for the entire plain.

Gimje Gun borders on the Yellow Sea for about 30 km. The tidal flats offer good possibilities for increasing the land area by reclamation, and this work is now under way in a number of places.

2.3 GEOLOGY

The geology of Gimje Gun is composed of granite of unknown age, and sediments of the cretaceous-upper Jurassic system, and the tertiary and quarternary systems of the

Cainozoic period. The major parent rocks are granite, crystalline schist and porphyry.

The soils and land types of Gimje Gun have formed largely in deposits laid down by water. On the low lands along the tributaries that flow into the Mangyeong and Dongjin rivers and along the Duwel and Weonpyeong streams are deposits of recent and subrecent alluvium. The fluvio-marine deposits near the Yellow sea are only slightly elevated and consist mainly of silty and clayey materials.

Strata of peaty materials, generally 10 to 50 cm in thickness, at about 70 cm beneath the surface, are common occurrences in former back swamp marsh positions, usually where small fresh water streams meet the fluvio-marine plain.

2.3.1 Parent Material

In about 40 percent of the area of Gimje Gun, the soils formed in place from residual material, that is, material that weathered from underlying rocks. In the remaining 60 percent they formed from alluvium deposited by water. The dominant underlying rocks are fine textured igneous rocks which weather slowly. Soils with textures of loam, clay loam, silt loam, silty clay loam and clay are dominant over them. Coarse grained igneous rocks are less extensive in Gimje Gun. They have formed mainly sandy loam soils, although some have finer textures. In the alluvial materials, the soils developed on the large fluvio-marine plains have mainly silt loam, silty clay loam or silty clay textures, while those on the floodplains and terraces of inland streams are less silty and more variable in texture. For example the Hwangryong soils on the stream terraces are gravelly because of the gravelly nature of their parent material.

2.4 WATER SUPPLY

Two large rivers form boundaries of Gimje Gun, the Mangyeong river on the north and the Dongjin river on the south. They originate in the mountains east and south-east, and flow generally westward into the Yellow sea. Major tributaries are the Weonpyeong, Duweol, and Buyong streams. These and smaller streams flowing through the Gun supply water for much of the area. In addition, the Dongjin Land Improvement Association obtains water from a reservoir filled by a dam on the Sangju river.

2.5 CLIMATE

Gimje Gun is located in the west coastal region of the Jeonlabug Do where the prevailing winds come from the northwest throughout most of the year. The inland section is generally dry and has low humidity. The seasonal variation in temperature is large, with cold winters and hot summers. The average annual precipitation is high, though concentrated in the summer, and the summer climate is mild, making this area well suited for agriculture, especially for irrigated rice production.

The average monthly temperature, based on the 30 year climate atlas from 1931 to 1961, rises abruptly in May, reaching a peak of 26.1°C in August. It decreases there after with a sudden drop in November and reaches an average of -1.7°C in January. The monthly precipitation is highest in July and lowest in January. The first killing frost occurs between 11th October and 5th November, and the date of the last ranges from 28th March to 29th April. The date of the first snowfall is between 6th November to 19th December. The first freeze ranges from 19th October to 26th November and the last from 23rd March to 15th April.

The climate is of the humid, warm-temperate, continental type. The average temperature and distribution of rainfall, by months, are indicated in Table 1.

In this climate the soils are warm enough for micro-organisms to be active from April 1 through October 31, and are moist and subject to leaching much of the time from April to September. Upland soils are dry to moderately dry much of the time from October 1 to March 30. Paddy soils except for poorly drained paddy are also moderately dry during the winter.

The surface soil is frozen to a depth of about 15 cm for 20 days during the year.

As can be expected in a climate of this type, most of the soils are highly weathered, leached, strongly acid, and low in fertility.

Table 1

AVERAGE TEMPERATURE, PRECIPITATION, AND SNOWFALL IN GIMJE GUN. 1/

Month	Average Temperature (°C)	Average Maximum Temperature (°C)	Average Minimum Temperature (°C)	Average Precipitation (mm)	Maximum Snowfall (cm)
January	-1.7	2.9	-6.69	26.6	17.2
February	0.2	5.2	-4.48	32 8	12.5
March	5.0	10.9	-0.50	61.0	12.2
April	11.3	17.9	5.04	76.4	4.0
May	16.9	23.6	10.94	84.7	-
June	21.4	27.3	16.44	154.6	-
July	25.7	30.4	22.02	279.7	-
August	25.9	31.0	22.24	239.6	-
September	20.6	26.3	15.83	156.4	-
October	13.6	20.6	7.69	51.5	-
November	7.8	13.7	2.39	41.7	5.0
December	1.7	6.3	-2.86	35.5	20.0
Year	12.4	18.0	7.33	1,240.5	20.0

1/ Climate Atlas of Korea, Central Meteorological Office, Seoul, Republic of Korea, 1962.

2.6 AGRICULTURE

The total extent of Gimje Gun is 53 863 ha, of which about 29 percent or 16 000 ha under cultivation. Of the woodland, about 45 percent is in Geumgu and Geumsan Myeons, centering on Mt. Guseong in the east; about 23 percent in Baegsan and Yongji Myeons in the north, with the remainder being scattered among 12 Myeons and Gimje Eub. Most of the forest land is private property, with public and monastery holdings totalling about 7 percent in all.

Of the cultivated areas, irrigated paddy fields include 25 575 ha and upland areas the remainder. Of the irrigated paddies, about half is used for rice only and half is double cropped, growing barley or wheat in the winter and rice in the summer.

Farms are small, with about half having less than 1 ha of cultivated land and only about 4 percent having more than 3 ha.

Chapter 3

HOW THE SURVEY WAS MADE

This survey was made to learn what kinds of soils are in Gimje 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 dug and profiles 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, where stones, rock outcrops, gullies, and similar features are important indicators of kind of soil and actual observation of profiles was at greater intervals.

Comparisons were made among the profiles studied, and were compared with those in other areas where detailed soil surveys had been made.

The soils were classified and named according to the soil classification system used in Korea and other countries. Soils that have profiles almost alike make up a soil series. All the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where it was first observed and mapped.

Dalcheon and Hogye, for example, are the names of two soil series in Gimje Gun. Both these would have essentially the same characteristics as the Dalcheon and Hogye series mapped in other areas in Korea. 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.

The Samgag series, for example, is divided into mapping units based upon slope. Thus there are moderately steep, steep, and very steep mapping units. 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, describes 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 inclusions that are different from the main part of the area. In mapping units such as Mudeung rocky loam, 30 to 60 percent slopes, the part of the area that is rock outcrop obviously does not have a profile. Of course it would be most desirable to have a map with these areas of other soils and areas of rock outcrop shown in their true occurrence, but this is not practical.

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

In preparing the detailed maps soil scientists had a problem of delineating areas where different kinds of soils are so intricately mixed or were in bodies of such small size that it was not practical to show the exact boundaries of each mapping unit. These areas were mapped as a soil complex and contain profiles that are similar to two or more series. The Dalcheon-Songjeong complex units are examples of this kind of a mapping unit. The areas mapped as this kind of soil have profiles similar to the Dalcheon series as well as profiles that are similar to the Songjeong series.

Chapter 4

DESCRIPTION OF THE GENERAL SOIL MAP

4.1 INTRODUCTION

Soils that occur together in a characteristic pattern make up a general soil area, or soil association. An association may consist of only a few or of many soils, which may be similar or may differ greatly. Although closely associated geographically, those in a general soil area may differ in their suitability for agricultural use.

A generalized soil map was made showing eight soil associations in this Gun. The boundaries of the associations are shown on the general soil map, Map 2. This is useful for those who want, a general idea of the soils, to compare different parts of the Gun, or to know the location of large areas suitable for a certain kind of farming or other broad land uses.

Each soil association is named for the major soil series in it, but soils of other series may also be present. The Jeonbug-Gimje association and the Honam-Jisan association are the most important areas for rice production.

In the following pages the soil associations in this Gun are discussed and their general use for agriculture is described. More detailed information about the soils is given in the section 'Description of the Soils'.

4.2 JEONBUG-GIMJE ASSOCIATION

Nearly level, poorly to imperfectly drained, silty, slightly to moderately saline soils on the fluvio-marine plain

This association covers about 40 percent of the Gun in the west and southwest. Some areas are also in the north along or near the Mangyeong river. The Jeonbug and Gimje soils dominate this association, the minor soils are the Bongnam, Buyong, Mangyeong and Gongdeog, and are mostly loam, silt loam or silty clay loam with a high water table. These are planted to rice, except for the areas of tidal flat.

Additional drainage would permit the growing of many other crops, and high yields could be obtained, but pumps would be needed in most areas for better drainage. Some additional areas of land could be brought into production by drying the tidal flats and leaching the soils.

4.3 GWANGSAN-SONGJEONG ASSOCIATION

Sloping to moderately steep, well drained, clayey and loamy soils on the low upland areas

This soil association makes up about 30 percent of the Gun, occupying large areas of the moderately rolling land and low mountainous areas in the central part. The Gwangsan soils, the most extensive, cover about 80 percent of the general soil area, and the Songjeong, 10 percent. The remaining 10 percent of the land is covered by minor soils, such as the Bansan, Yongji, Dalcheon and Samgag.

The Gwangsan are eroded in most places, and that has been and remains the greatest problem. They are deep, fine clayey materials and fine loamy granite saprolite containing some mica and much quartz. The Songjeong are deep, clay loam or sandy loam. Grasses and poorly grown pine trees, are general with less eroded areas being cultivated for general crops.

A thick stand of well adapted trees would do much to control erosion and give some return. Some parts are capable of producing pasture crops if limed, fertilized, and well managed.

4.4 HONAM-JISAN ASSOCIATION

Nearly level to gently sloping, poorly drained soils

This soil association, making up about 3 percent of the Gun, is in the extreme northeast. The Honam soils, dominating the general area and covering about half of the association, usually occupy the upper part of the alluvial plain. The Jisan soils, about 14 percent of the association, are in the small valleys. The Baeggu, Yongji, Gwangsan and Songjeong are included and occupy the remainder. The soils of this association are poorly or imperfectly drained, slowly permeable, and have high available moisture capacities. They are important agricultural soils, and are used mainly for growing paddy rice. The minor soils are usually planted to barley following the rice. Additional drainage is required for a wide range of crops.

4.5 HWADONG-CHANGPYEONG ASSOCIATION

Gently sloping, well to moderately well drained, clayey soils on the stream terraces

This association makes up only about 2 percent of the Gun, but is highly productive. It occupies small areas of the southeast, mainly along or near the Duwal and Wonpyeong Creeks and their tributaries. The Hwadong are the most extensive, covering more than half of the general soil area, while the Changpyeong and minor soils make up the rest.

The soils of this association are slowly permeable and have a high available moisture capacity. They are cultivated to rice in the summer and to barley in the autumn.

4.6 SINDAB-HWANGRYONG ASSOCIATION

Nearly level, very sandy or gravelly, poorly to well drained soils on floodplains along the streams in the mountainous areas

This soil association makes up about 5 percent of the Gun, occupying small areas of the southeast. The Sindab soils dominate and cover more than half of the general soil area, mainly in upper stretches of the stream valleys. The riverwash sandy and cobbly units are also comprised and cover about 10 percent. The Hwangryong and minor soils such as the Hogye, Ihyeon, and Baeggu, make up the rest.

The Sindab are poorly drained and rapidly permeable. They are used for paddy rice. The Hwangryong are excessively drained, gravelly to cobbly, and grow mainly poplars. Some areas where water is available are being used for paddy rice. Some minor soils may be used for general crops after the rice crop.

4.7 YONGJI-SUBUG ASSOCIATION

Gently sloping, poorly to moderately well drained loamy soils in the small valleys

This soil association, making up about 5 percent of the Gun, occupies small valleys in the central and southeastern parts. The Yongji soils cover about half and are mainly in upper parts of the valleys. The Subug cover about 20 percent of the general area.

With this association are included the Riverwash sandy and cobbly unit and minor areas of the Hwangryong, Hogye, Jisan, Baeggu and Sindab soils. The Subug are poorly drained sandy loam over gravelly sand, and the Yongji are moderately well drained and slowly permeable. The major soils are suitable for paddy rice farming. Some of the better drained minor soils have been developed into apple orchard, and are planted to other vegetable crops. In places barley is cultivated after paddy rice.

4.8 SAMGAG-TAEHWA ASSOCIATION

Moderately steep to steep, well to excessively drained, sandy loam to silt loam soils over saprolite of igneous rocks

This association, making up about 10 percent of the Gun, occupies a large area of the southeastern corner with a small area in the extreme west. The Samgag soils dominate, covering about 80 percent of the association; the Taehwa soils make up about 14 percent, and minor soils including the Seogto and Jangweon, the remaining 6 percent. The major soils are mostly eroded, rocky sandy loam or loam over sandy loam saprolite. The general area has many gullies.

The soils of this association are not suited to farming but are moderately to woodland. Some land of lower slopes is cultivated to general crops.

4.9 MUDEUNG-ROCKLAND ASSOCIATION

Steep to very steep, somewhat excessively drained, shallow, rocky soils and land type with rock outcrops

This soil association in the Moag mountain in the extreme eastern part, makes up about 5 percent of the Gun. The Mudeung dominate the general soil area, and cover about 80 percent. Rock land type and minor soils make up the rest.

The Mudeung are shallow and usually have less than 50 cm of loamy material over hard bedrock. Available moisture capacity and natural fertility are both low. Poor pine forest, not suited to farming is general. Some minor soils with high available moisture capacity and moderately deep soil depth are being cultivated.

Chapter 5

DESCRIPTION OF THE SOILS

5.1 INTRODUCTION

This section describes the soil series and mapping units of the Gimje Gun. The soil series is given first, and then the mapping units of the series. Following the name of each mapping unit there is a symbol in parentheses. This identifies the mapping unit on the detailed soil map. To get full information on anyone mapping unit, it is best to read first the description of the series which describes the general concept of a soil and then the mapping unit which 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 discussion of Capability Unit and Paddy Suitability Groups. Table 3 lists these groupings for each soil.

5.1.1 Classification of Soils

Soils are classified so that we may more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soil, to use their relationships to one another and to the whole environment, and to develop principles that help us understand their behaviour and their response to manipulation. First through classification, and then through the use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

Thus in classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and applied in managing farms, fields, and woodland; in developing rural areas; in engineering work; and so on. They are placed in broad classes, to facilitate study and comparison in large areas, such as entire countries.

Additional information about the classification of soils of Korea is given in 'The Soils of Korea', the Korea Soil Survey Project, Technical Report 1, FAO, Rome. Table 2, following, sets out the current and older system of classification.

5.2 BAEGGU SERIES

The Baeggu series, consisting of gently sloping, deep, very poorly drained soils formed in alluvium, are members of the fine loamy family of Fluventic Haplaquepts. These soils occur on alluvial fans and small valleys. Bedrock is seldom observed in profiles of less than 2 m.

Table 2

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

Series	Current Classification			1938 Classification
	Family	Subgroup	Order	Great Soil Group
Baeggu	Fine loamy	Fluventic Haplaquepts	Inceptisols	Low-Humic Gley
Bansan	Fine clayey	Humic Hapludults	Ultisols	Red-Yellow Podzolic
Bongnam	Fine clayey	Fluventic Haplaquepts	Inceptisols	Low-Humic Gley
Buyong	Fine clayey	Fluventic Haplaquepts	Inceptisols	Low-Humic Gley
Changpyeong	Fine clayey	Typic Hapludalfs	Alfisols	Red-Yellow Podzolic
Dalcheon	Fine clayey	Typic Hapludults	Ultisols	Red-Yellow Podzolic
Geugrag	Fine clayey	Aeric Ochraqualfs	Alfisols	Red-Yellow Podzolic
Gimje	Fine clayey	Fluventic Haplaquepts	Inceptisols	Low-Humic Gley
Gongdeog	Fine clayey	Fluventic Haplaquepts	Inceptisols	Low-Humic Gley
Gwanghwal	Coarse silty	Typic Haplaquepts	Inceptisols	Saline Alluvial
Gwangsan	Fine clayey	Typic Hapludults	Ultisols	Red-Yellow Podzolic
Hogye	Loamy skeletal	Fluventic Hapludolls	Mollisols	Alluvial
Honam	Fine clayey	Typic Ochraqualfs	Alfisols	Low-Humic Gley
Hwadong	Fine clayey	Aquic Hapludalfs	Alfisols	Red-Yellow Podzolic
Hwangryong	Sandy skeletal	Typic Udipsamment	Entisols	Alluvial
Ihyeon	Coarse silty	Dystric Fluventic Eutrochrepts	Inceptisols	Alluvial
Jeonbug	Fine silty	Aeric Fluventic Haplaquepts	Inceptisols	Low-Humic Gley
Jisan	Fine loamy	Fluventic Haplaquepts	Inceptisols	Low-Humic Gley
Mangyeong	Coarse silty	Fluventic Haplaquepts	Inceptisols	Low-Humic Gley
Mudeung	Fine loamy	Lithic Dystrochrepts	Inceptisols	Lithosols
Samgag	Coarse loamy	Typic Dystrochrepts	Inceptisols	Lithosols
Seogto	Loamy skeletal	Dystric Fluventic3 Eutrochrepts	Inceptisols	Regosol
Seongsan	Coarse loamy	Dystric Fluventic Eutrochrepts	Inceptisols	
Sindab	Sandy	Typic Psammaquent	Entisols	Alluvial
Songjeong	Fine loamy	Typic Hapludults	Ultisols	Red-Yellow Podzolic
Subug	Coarse loamy	Fluventic Haplaquents	Entisols	Low-Humic Gley
Taehwa	Fine loamy	Typic Hapludults	Ultisols	Red-Yellow Podzolic

A typical profile follows.

Ap--0 to 9 cm; brown to dark brown (10YR 4/3) silt loam; with common, fine to medium distinct, mottles of strong brown (7.5YR 5/6); weak, medium to coarse granular structure; friable, slightly sticky, and slightly plastic; common, fine to coarse white and yellow mica; few, fine to medium quartz; many, fine to medium roots; clear, smooth boundary (9 to 15 cm thick); pH 5.1.

Ap2--9 to 20 cm; grayish brown (2.5Y 5/2) clay loam with many, medium to coarse prominent mottles of yellowish red (5YR 4/8); massive; firm, sticky, and plastic; common, fine to coarse white and yellow micas; few, fine to medium quartz; many, fine to medium roots; clear, smooth boundary (5 to 10 cm thick); pH 5.3.

Bg--20 to 33 cm; very dark gray (N3/) silty clay loam with common, fine to medium, distinct mottles of olive (5Y 4/3); massive; firm, sticky, and plastic; common, medium to fine, pores; many, fine to coarse white and yellow mica; few, fine, quartz; many, fine to medium roots; clear, smooth boundary (10-20 cm thick); pH 5.5.

C1g--33 to 55 cm; gray (5Y 5/1) loam with common, coarse, prominent, mottles of dark red (2.5YR 3/6) and yellowish red (5YR 4/8); common, medium to coarse $FeCo_3$ concretion and mottles; friable, slightly sticky, and slightly plastic; many, fine to medium roots; diffuse, smooth boundary (10-20 cm thick); pH 5.6.

C2g--55 to 120 cm; dark gray (5Y 4/1) loam; massive; many, coarse $FeCo_3$ concretion and mottles; friable, slightly sticky, and slightly plastic; undecomposed organic matter is common; mica, quartz, and pores as above; abrupt, smooth boundary (5.26 cm thick); pH 5.2.

C3g--120 to 150+ cm; dark gray (N4/) coarse sandy loam; single grain; loose, nonsticky and nonplastic.

The Ap horizon is gray to dark gray, grayish brown being mottled with strong brown, yellowish red, or yellowish brown. It ranges in texture from silt loam to silty clay loam or clay loam, and in thickness from 10 to 16 cm. The B horizon is gray to very dark gray silty clay loam to silty clay with common, fine to medium mottles of olive, olive brown, strong brown, or yellowish brown. The C horizon is dark gray to very dark gray loam to silty clay loam or coarse sandy loam with ferrous carbonate concretions. Mica and quartz are common throughout the profile.

The Baeggu occur with the Sindab, Gimje, and Bongnam soils. The Sindab are coarse textured, having developed in alluvial plains and in depressions of riverbeds. The Gimje are more clayey and have an organic matter layer 50 cm below the surface, while the Baeggu differ from the Jisan chiefly in having less drainage, and from the Gangdong in lacking a peaty layer.

The Baeggu are slightly to strongly acid, and are moderate both in natural fertility and organic matter content. Permeability is moderate, and available water

capacity medium. The groundwater table is near the surface throughout the year. Cation exchange capacity is medium, and base saturation medium to high.

These soils occupy small areas in the Gun, and are mostly in paddy, with only rice being grown because of poor drainage and the high groundwater table.

5.2.1 Baeggu Silt Loam, 2 to 7 Percent Slopes (BaB)

Most areas have a profile similar to that described for the series. With this soil are included some lesser slopes than the described range, some tracts with a clay loam surface, small areas free of ferrous carbonate, and small areas of very sandy and clayey soils.

Paddy predominates and rice only is suited. A wide range of crops might be grown if the groundwater table were lowered and adequate drainage provided.

Capability unit IIIw.
Rice suitability group P2a.

5.3 BANSAN SERIES

The series, consisting of gently sloping, very deep, well drained soils formed from areas underlain by granite and porphyrite saprolite, is a member of the fine clayey family of Humic Hapludults. These soils occur on concave areas and fan terraces in narrow valleys. Depth to hard bedrock ranges from 5 to 7 m.

A typical profile follows.

Ap—0 to 15 cm; dark brown (10YR 3/3) silt loam; moderate fine granular structure; friable, slightly sticky, and plastic; many, fine pores; few, fine quartz grain and mica; common, fine to medium soybean roots; clear, smooth boundary; pH 5.7.

A1—15 to 27 cm; brown to dark brown (10YR 4/3) or dark yellowish brown (10YR 4/4) silt loam; weak, fine to coarse subangular blocky structure breaking to moderate, fine to medium granular structure; friable, sticky, and plastic; common, fine pores; few, fine quartz and mica; clear, wavy boundary; thickness 6-15 cm; pH 5.8.

B21t—27 to 53 cm; brown to dark brown (7.5YR 4/4) silty clay loam with faint common, fine to medium yellowish red (5YR 4/6) mottles; few, fine manganese concretions; moderate, fine to coarse subangular blocky structure; patchy thin clay cutans; friable, sticky and plastic; many, fine to medium pores; few, fine quartz and mica, grains; few, fine roots; gradual, smooth boundary; pH 5.9.

B22t—53 to 76 cm; strong brown (7.5YR 5/6) silty clay loam with common, fine to medium yellowish red (5YR 4/6) mottles; moderate, medium to fine subangular blocky structure; firm, sticky, and plastic; discontinuous,

moderate thick, clay cutans; few, fine manganese concretions; many, fine to medium pores; common, fine quartz grains and few, fine mica; few, fine roots; clear, smooth boundary; pH 6.0.

B23t--76 to 93 cm; mottled brown to dark brown (7.5YR 4/4) yellowish brown (10YR 5/6), light yellowish brown (10YR 6/4) silt loam; crushed colour brown to dark brown (7.5YR 4/4); moderate coarse to medium, subangular blocky structure; firm, sticky, and plastic; many, fine to coarse manganese concretions; discontinuous, thick clay cutans; common pores; common, medium to fine quartz grains; few, fine mica; clear, smooth boundary; pH 6.1.

B31--93 to 120 cm; yellowish red (5YR 4/6) loam; weak, coarse subangular blocky structure; firm, sticky, and plastic; discontinuous thick clay cutans; common, fine to medium manganese concretions; many pores; quartz grains and mica as above; clear, smooth boundary; pH 6.3.

B32--120 to 170+ cm; crushed colour yellowish red (5YR 4/6) clay loam; weak, coarse subangular blocky structure; firm, sticky, and plastic; discontinuous, moderate thick clay cutans; common, fine to medium manganese concretions; common pores; many quartz grain and mica; pH 6.2.

The A horizon ranges in texture from silt loam to silty clay loam or loam, and is dark brown or very dark brown. The thickness is from 15 to 50 cm. The B2 horizons are yellowish red, dark reddish brown or strong brown clay loam to silty clay or silty clay loam. The B3 horizons are fine sandy loam to silty clay loam with various colours.

The Bansan occur with the Yongji, Seongsan, and Baegsan soils. The first are better drained than the second and are finer textured and less drained than the third. These also differ from the Baegsan in being less drained, and in soil colour.

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

Nonirrigated crops are general but some parts where irrigation water is available, are cultivated to paddy rice. Orchard and mulberry fields have also been established.

5.3.1 Bansan-Yongji Complex, 2 to 7 Percent Slopes (ByB)

These soils are on gently sloping concave areas and fan terraces in narrow valleys. About 40 percent has a profile like the Yongji and about 50 percent is similar to the Bansan soil. The remaining 10 percent consists of small areas of other soils. In the mapping unit are included some greater slopes than the described range, some tracts of an eroded soil with a surface layer of yellowish red to yellowish brown loam or silty clay loam, small areas of the Seongsan, Baegsan, and Jangweon soils, and some imperfectly drained land.

This complex is suited to cultivation with about 20 percent of the Bansan in rice, and the rest in other crops. All of the Yongji soils are in paddy, and are cultivated

to rice in the summer and to barley or wheat during the winter. These soils have no management problem except for the need of better drainage on the Yongji soil, in order to grow nonirrigated crops.

Capability unit IIe.
Rice Suitability group P2ac.

5.4 BONGNAM SERIES

The Bongnam series, consisting of level to nearly level, deep, poorly drained soils formed in alluvium, is a member of the fine clayey family of Fluventic Haplaquepts. These soils are found on the broad fluvio-marine plains.

A typical profile follows.

Ap1g—0 to 12 cm; gray (5Y 5/1) silty clay loam; many, fine to medium prominent strong brown (7.5YR 5/6) and common, medium prominent yellowish red (5YR 4/8) mottles; firm, sticky, and plastic; many, fine to medium pores; many, very fine mica; abundant, fine to medium roots; clear, smooth boundary; pH 5.0.

B21—12 to 22 cm; gray to grayish brown (10YR 5/1-5/2) silty clay loam; many, coarse, distinct brown to dark brown (7.5YR 4/4) and common, fine to medium, prominent yellowish red (5YR 4/8) mottles; grayish brown to dark grayish brown (10YR 5/2-4/2) crushed colour; weak, coarse platy structure; firm, sticky, and plastic; thin, patchy clay cutans; many, fine to medium pores; common, very fine mica; abundant, fine and medium roots; clear, smooth boundary; pH 5.5.

B22—22 to 45 cm; gray to light gray (10YR 5/1-6/1) silty clay; many, fine to coarse, distinct yellowish brown (10YR 5/8) mottles; strong medium to coarse prismatic structure; very firm, sticky, and plastic; thick pores; common, very fine mica; common, fine and medium roots; diffuse, smooth boundary; pH 6.0.

B23—45 to 68 cm; gray (10YR 5/1) silty clay; many, coarse prominent reddish brown (5YR 4/4) and coarse distinct brown to dark brown (7.5YR 4/4) mottles; crushed colour brown to dark brown (10YR 4/3) moderate coarse, prismatic structure; firm, very sticky, and very plastic; few manganese concretions; pores as above; no mica; roots as above; gradual, smooth boundary; pH 6.0.

A11b—68 to 84 cm; black (10YR 2/1) clay; massive; firm, sticky, and plastic; common pores; few, undecomposed organic fibers; pH 6.0.

A12b—(peat)—84 to 112 cm; very dark brown (10YR 2/2) silty clay loam; peaty mineral layer; no roots; clear, smooth boundary; pH 6.5.

C1bg--112 to 180 cm; light greenish gray silty clay; many, fine to medium, prominent brown to dark brown (7.5YR 4/4) mottles; massive; sticky and plastic; many, fine to coarse pores; common, fine to medium roots; clear, smooth boundary; pH 6.5.

The Ap horizon is gray, dark grayish, brown, or dark gray silty clay loam, silty clay, or clay with yellowish red, yellowish brown, strong brown or red mottles. It ranges in thickness from 9 to 22 cm. The B horizon is gray, dark gray, grayish brown, or light gray silty clay loam, silty clay, or clay with mottles of strong brown, reddish brown, or yellowish red. The A11b and A12b horizons are black, very dark brown or very dark grayish brown silty clay loam. The contain 3 to 20 percent organic matter and are 20 to 50 cm thick.

The Bongnam are found with the Gimje and Jeonbug soils in the broad fluvio-marine plains and with Gongdeog, Buyong and Baeggu soils in the narrow alluvial plains. The Bongnam differ from the Gimje in having a thicker dark buried horizon while the Gongdeog have a much thicker buried horizon than the Bongnam.

These soils are medium acid to neutral and are high both in natural fertility and organic matter content. Permeability is very slow, and available water capacity high. Cation exchange capacity and base saturation are high.

All the areas are in paddy rice, and some are planted to barley in winter.

5.4.1 Bongnam Silty Clay Loam, 0 to 1 Percent Slopes (Bn)

Most areas have a profile similar to that described for the series. With this soil are included many areas of a silty clay or clay surface soil, and a few small tracts in which all the horizons have been disturbed during gold mining operations.

Paddy rice is well suited and with improved drainage and good management high yields of many other crops could be obtained.

Capability unit IIIw.
Rice suitability group P1.

5.5 BUYONG SERIES

The Buyong series, consisting of nearly level to level, deep, poorly drained soils formed in alluvium on fluvio-marine plains, is a member of the fine clayey family of Fluventic Haplaquepts.

A typical profile follows.

Ap--0 to 12 cm; grayish brown (2.5Y 5/2) silt loam with common, fine to medium, prominent mottles of strong brown (7.5YR 5/6); moderate, fine to medium granular structure; friable, sticky, and plastic; few, fine to very fine pores; few, fine to very fine, white and yellow mica; abundant, fine rice roots; gradual, smooth boundary; pH 5.1.

B21g--12 to 20 cm; dark grayish brown (2.5Y 4/2) silt loam with common, medium to fine prominent mottles of yellowish red (5YR 5/6); weak, medium to coarse platy structure; firm, sticky, and plastic; common, fine to medium pores; few mica; common, fine roots; clear, smooth boundary; pH 5.4.

B22g--20 to 35 cm; dark gray (5Y 4/1) silt loam with many, fine to coarse, prominent mottles of dark red (2.5YR 3/6); weak, coarse prismatic, breaking to weak, medium subangular blocky structure; firm, sticky, and plastic; common, fine pores; few mica; few, fine roots; abrupt, smooth boundary; pH 5.6.

B23g--35 to 48 cm; gray (5Y 5/1) silty clay loam with many, medium to coarse, distinct mottles of light olive brown (2.5Y 5/6); strong, medium to coarse subangular blocky, breaking to strong, fine to medium angular blocky structure; firm, sticky, and plastic; common, fine to medium pores; few mica; abrupt, smooth boundary; pH 6.5.

B24g--48 to 63 cm; very dark gray (5Y 3/1) silty clay with many, coarse, prominent mottles of yellowish brown (10YR 5/8); strong, medium to coarse prismatic, breaking to moderate, medium to coarse subangular blocky structure; firm, very sticky, and very plastic; few, fine pores; few mica; clear, wavy boundary; pH 6.8.

B25g--63 to 150 cm; dark gray (N4/) silty clay with common, coarse, distinct mottles of light olive brown;; (2.5Y 5/6) moderate, coarse prismatic; firm, very sticky, and very plastic; few, medium pores; few, fine to very fine, white and yellow mica; abrupt, wavy boundary; pH 6.7.

The Buyong soils have an Ap horizon that ranges in colour from gray to dark gray or grayish brown, and in texture from silty clay loam to clay loam or silt loam, with mottles of strong brown, yellowish red, or yellowish brown. The thickness of the Ap horizon ranges from 9 to 22 cm, and subsoil from 100 to 150 cm. The latter is gray to very dark gray, very dark brown or black silty clay loam to silty clay or silt loam with strong brown, yellowish red, yellowish brown or light olive brown mottles. The C horizon is gray or greenish gray silty clay, clay loam or silty clay loam. Fine to very fine mica flakes are throughout the profile.

The Buyong, associated with the Jeonbug, Bongnam, Gimje, and Jisan soils, differ from the Jeonbug in being finer textured, and from the Bongnam and Gimje in being deeper and having no dark coloured horizon in the lower subsoil.

The Buyong are medium to strongly acid in the surface layer, and slightly acid to neutral in the B and C horizons. Natural fertility is high and organic matter content medium. Permeability is slow, and available moisture capacity high. Cation exchange capacity and base saturation are high.

All of the areas are in paddy rice, and some are cultivated to winter barley or wheat.

5.5.1 Buyong Silty Clay Loam, 0 to 1 Percent Slopes (Bg)

Most areas of this soil have a profile similar to that described for the series. With this soil are included small tracts of more silty soils, and small areas of a gently sloping soil.

Paddy rice predominates and does well while with additional drainage good yields of many crops could be obtained. Barley or wheat. after harvest of rice, is grown in some places.

Capability unit IIIw.
Paddy suitability group P1.

5.6 CHANGPYEONG SERIES

The Changpyeong series, consisting of sloping, deep, well drained soils formed in old alluvium on dissected old pediplains, is a member of the fine clayey family of Typic Hapludalfs. These soils occur as small areas south of the upper part of Duweol Cheon (stream) in Hwangsan and Geumgu Myeons.

A typical profile follows.

Ap--0 to 18 cm; yellowish red (5YR 4/6) silty clay loam; moderate, fine granular structure; firm, very sticky and very plastic; many, fine pores; abundant, fine to medium, roots; abrupt, smooth boundary; pH 4.5.

B21t--18 to 40 cm; dark red (2.5YR 3/6) silty clay; many, fine to coarse MnO2 concretion; strong, medium to coarse subangular blocky structure; firm, very sticky, and very plastic; continuous, thick clay cutans; common, fine to medium pores; common, fine roots; gradual, smooth boundary; pH 5.5.

B22t--40 to 120 cm; dark red (2.5YR 3/6) silty clay loam; many, fine to medium MnO2 concretion; weak, coarse prismatic structure; very firm, very sticky, and very plastic; continuous, thick clay cutans; common, fine to medium pores; clear, smooth boundary; pH 5.0.

B3t--120 to 165 cm; red (2.5YR 4/6) silty clay loam; common, medium, distinct yellowish red (5YR 5/6) mottles; few, fine, MnO2 concretion; weak, medium to coarse prismatic structure; very firm, very sticky, and very plastic; continuous, thick clay cutan; common, fine to medium pores; clear, smooth boundary; pH 5.0.

The Ap horizon ranges from silty clay loam to silty clay, and is yellowish red to dark red. It is about 10 to 18 cm thick. The B horizon ranges from 60 to 200 cm in thickness, and is dark red to red or yellowish red silty clay, clay, or silty clay loam. In the lower part it is mottled with strong brown, light gray, or yellowish brown.

The Changpyeong occur with the Hwadong, Gwangsan and Jeonnam soils, and are similar to the Gwangsan except that they have coarse sand grains and some mica, and are formed in old alluvium.

The Changpyeong are strongly acid, medium in natural fertility and low in organic matter. Permeability is very slow, and available moisture capacity high. Cation exchange capacity and base saturation are high.

Most of the areas are in cultivated crops. In places, where irrigation water is available, paddy rice is grown.

5.6.1 Changpyeong Silty Clay Loam, 2 to 7 Percent Slopes, Eroded (CpB2)

This very deep, well drained soil is the only Changpyeong soil mapped in the Gun, and occupies small areas south of the upper part of the Duweolcheon stream. The profile is usually as described for the series, with small areas of greater slopes than the described range, a few small areas that contain few gravel in the subsoil, and small tracts with gray mottles in the lower subsoil being included.

It is well suited to a wide range of crops, with most parts being cultivated to crops other than rice. Erosion is the chief management hazard. Terraces, grassed waterways, contour cultivation, and the growing of sod crops will help erosion control.

Capability unit IIe.
Rice suitability group P2ac.

5.7 DALCHEON SERIES

The Dalcheon series, consisting of sloping to moderately steep, deep, well drained soils formed in residual materials weathered from granite, are members of the fine clayey family of Typic Hapludults. These soils are on hills and low mountain sides chiefly in the east.

A typical profile follows.

Ap—0 to 4 cm; dark red (2.5YR 3/6) clay; weak, fine granular structure; friable, sticky and plastic; few, fine pores; few, fine quartz grains and mica flakes; common, fine to coarse roots; clear, smooth boundary; pH 5.7.

B21t—4 to 14 cm; red (2.5YR 4/8) sandy clay loam; weak, fine subangular blocky structure; friable, sticky, and plastic; patchy, thin clay cutans; common, fine pores; few, fine quartz grains; common, fine to coarse roots; clear, smooth boundary; pH 5.7.

B22t—14 to 31 cm; red (2.5YR 4/6) sandy clay loam; weak, fine platy structure; firm, sticky, and plastic; thick clay cutans; common, fine pores; few, fine quartz grains; many, fine mica flakes; common, fine to coarse roots; gradual, smooth boundary; pH 5.8.

B3—31 to 47 cm; red (2.5YR 4/6) coarse sandy loam; weak, fine platy structure; firm, sticky, and plastic; thick clay cutans; common, fine pores; many, fine quartz grains; many, fine mica flakes; common, fine to coarse roots; clear, smooth boundary; pH 5.8.

B3—47 to 110 cm; red (2.5YR 5/6) coarse sandy loam; massive; firm, slightly sticky, and slightly plastic; thin clay cutans; common, fine pores; many, fine quartz grains; many, fine mica flakes; few roots; abrupt, smooth boundary; pH 6.0.

C--110 to 150+ cm; reddish yellow (7.5YR 6/6) coarse sandy loam saprolite; massive; friable; common, fine pores; many, fine quartz grains; many, fine mica flakes; few roots; pH 6.0.

Where not eroded, the Ap horizons range from brown to dark brown to dark brown or strong brown in colour, and from loam to clay loam in texture. In eroded areas they may be red or dark red clay loam or clay. They are usually 10 to 18 cm thick. The B horizon is yellowish red to red silty clay loam, sandy clay loam, or clay. The C horizon is coarse sandy loam or loamy sand granite saprolite. Depth to bedrock is 3 or 4 m.

The Dalcheon occur with the Songjeong, Gwangsan, Jeonnam, Jingog or Samgag soils. The first have finer texture and thinner B horizons than the Songjeong and thinner B horizons than the Gwangsan, Jeonnam, and Jingog soils, but the textures are similar.

The Dalcheon are strongly acid, and are low both in natural fertility and organic matter content. Permeability is moderate to moderately slow and available moisture capacity medium. Cation exchange capacity is moderate to high and base saturation low.

The area of these soils is small, and is mostly in cultivated crops. Some areas are wooded. A few small areas with irrigation systems are used for paddy rice.

5.7.1 Dalcheon-Songjeong Complex, 7 to 15 Percent Slopes, Eroded (DJC2)

About 55 percent has a profile similar to that for the Dalcheon series, and 45 percent similar to the Songjeong series. Soils of these series are distributed in such an intricate pattern that they can not be mapped separately at the scale used. In most places the original surface soils of brown to dark brown or strong brown loam, silty clay loam or silt loam have been lost through erosion.

With these are included small tracts of only slightly eroded soil that have a brown to dark brown or strong brown surface layer, small tracts of less sloping soil than the described range, and small areas of gullied land. These soils have a thick root zone, and are easy to work. Surface runoff is rapid to very rapid, and erosion is a severe hazard if cultivated.

Cultivated crops are usually grown, and a few small areas are irrigated to grow paddy rice. Some places are wooded or left idle. The soils are suited to cultivation for such crops as upland rice, barley, wheat, soybeans, potatoes, and vegetables. Terraces, contour cultivation, grassed waterways and perennial forage crops will contribute to erosion control.

Capability unit IIIe.
Rice suitability group P3ac.

5.7.2 Dalcheon-Songjeong Complex, 15 to 30 Percent Slopes, Eroded (DJD2)

This complex consists of nearly equal parts with profiles similar to that described for the Dalcheon and Songjeong series. Most of the brown to dark brown or strong brown original surface layer has been lost through erosion. The present surface soil colours are red to yellowish red or dark red, but where plants are grown well it is brown to yellowish brown. With this complex are included small areas of greater slopes and some areas of only slightly eroded soil. A few small scattered areas of gullied land, and small tracts having stony to cobbly surfaces are also included. The soils of this complex have a thick root zone, and are easy to work. Surface runoff is rapid to very rapid, and erosion hazard severe if the land is carelessly cultivated.

Cultivation is, however, suitable if careful management is provided. Most of the areas are used for woodland, with some cultivated to potato, sweet potato, upland rice, and tobacco. Mulberry fields and orchards have been established in some places. The very severe erosion is a chief hazard to soil management, but when limed and fertilized high yields of forage crops can be expected.

Capability unit IVe.
Rice suitability group P4ac.

5.8 GEUGRAG SERIES

The series, consisting of level to nearly level, deep, moderately well drained soils, on slightly dissected low river terraces in alluvial valleys and broad plains, is a member of the fine clayey family of Aeric Ochraqualfs.

A typical profile follows.

Ap--0 to 10 cm; gray (10YR 5/1) silt loam with common, medium, distinct strong brown (7.5YR 5/6) mottles; massive, breaking to weak, fine to medium granular structure; friable, slightly sticky and slightly plastic; many, fine roots; clear, smooth boundary; pH 4.5.

Ap2--10 to 22 cm; distinctly mottled light gray (10YR 6/1), yellowish brown (10YR 5/8), dark yellowish brown (10YR 4/4) silt loam; weak, coarse prismatic breaking to weak, fine platy; firm, slightly sticky, and slightly plastic; common, fine to coarse pores; common, fine roots; clear, smooth boundary; pH 5.0.

B21t--22 to 88 cm; dark yellowish brown (10YR 4/4) clay to silty clay with many, coarse, faint brown to dark brown (10YR 4/3) and distinct yellowish brown (10YR 5/8) mottles; moderate, coarse prismatic breaking to moderate coarse to medium subangular blocky structure; firm, sticky and plastic; few, fine pores; few, fine roots; clear, wavy boundary; pH 6.5.

B22tg--88 to 150+ cm; gray (10YR 5/1) silty clay with many coarse faint brown to dark brown (10YR 4/3) and distinct yellowish brown (10YR 5/8) mottles; prismatic which breaks to weak, coarse platy; firm, sticky and plastic; pH 5.7.

The Ap horizon is gray, grayish brown or dark grayish brown, heavy silt loam to silty clay loam with mottles of yellowish brown, dark yellowish brown or strong brown. The upper B is yellowish brown to dark yellowish brown or brown to dark brown silty clay or heavy silty clay loam with common or many mottles, and the lower B is dominantly gray silty clay loam, silty clay or clay loam with yellowish brown or dark yellowish brown mottles. It contains black or dark brown manganese concretions.

The Geugrag, associated with the Hwadong, Bongnam and Gimje soils, are better drained, less gray coloured, higher in elevation than the Honam and more gray coloured, more mottled, lower in elevation than the Hwadong.

They are slightly to strongly acid, moderate in natural fertility and medium in organic matter. Available moisture capacity is high, and permeability slow. Cation exchange capacity and base saturation are high.

All of the areas are in rice paddy under a good irrigation system. These soils are cultivated to winter barley or wheat after paddy rice each year.

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

The profile of most areas is similar to that described for the series. With this soil are included many areas with silty clay surface soils, small areas that have a clay surface layer, and a few small areas of greater slope than the described range.

The Geugrag is high in clay content, has a thick root zone, and is easy to work. Surface runoff is low. The soil is best suited to paddy rice, and well suited to a wide range of crops. However, almost all of the areas are cultivated to paddy rice under a good irrigation system, and after harvest, they are sown to winter barley or wheat. Drainage is needed to increase yields of crops other than rice.

Capability unit IIw.
Rice suitability group P1.

5.9 GIMJE SERIES

The Gimje series, consisting of nearly level to level, deep, imperfectly drained soils developed in alluvium on broad fluvio-marine plains in the western part of the Gun, is a member of the fine clayey family of Fluventic Haplaquepts.

A typical profile follows.

Ap1g--0 to 10 cm; gray (5Y 5/1) clay; common, medium prominent yellowish red (5YR 4/8) mottles; grayish brown (2.5Y 5/2) crushed colour; moderate, fine and medium granular structure; firm, sticky, and plastic; few, fine pores; abundant, fine roots; clear, smooth boundary; pH 5.0.

B21g--10 to 18 cm; gray (5Y 5/1) clay; many, medium to coarse, prominent yellowish red (5YR 4/6) mottles; grayish brown to dark grayish brown (10YR 5/2-4/2) crushed colour; weak, very coarse, prismatic structure; firm, very sticky, and very plastic; thin, patchy,

cutans; few, fine, oblique, tubular pores; common, fine, dead roots; clear, smooth boundary; pH 5.0.

B22g--18 to 26 cm; gray (5Y 5/1) clay; many, medium to coarse, prominent yellowish red (5YR 4/6) mottles; very dark grayish brown (10YR 3/2) crushed colour; weak, very coarse prismatic structure; firm, very sticky, and very plastic; thin, patchy cutans of dark gray (N4/); common, fine discontinuous, oblique, inped, tubular pores; few, fine roots; abrupt, smooth boundary; pH 6.5.

Alb--26 to 38 cm; black (2Y 2/1) silty clay; few, medium to coarse, prominent yellowish red (5YR 5/8) mottles; weak, very coarse, prismatic structure; firm, very sticky, and very plastic; common, fine to medium, oblique tubular pores; abundant, decomposed plant root and stem organic matter, roots as above; clear, smooth boundary; pH 6.5.

B21bg--38 to 53 cm; mottled, yellowish brown (10YR 5/8), dark greenish gray (5GY 4/1), brownish yellow (10YR 6/6) moist; silty clay loam; dark grayish brown (2.5Y 4/2) crushed colour; very coarse prismatic structure; firm, very sticky, and very plastic; thin, continuous, cutans; few, fine, oblique, tubular pores; few, very fine, dead roots; diffuse, smooth boundary; pH 6.5.

Cbg--53 to 150 cm; greenish gray (5GY 5/1) moist; silty clay loam; olive (5Y 5/4), light olive brown (2.5Y 5/6) and gray (2.5YR 5/1) mottles; very firm, very sticky, and very plastic; abundant roots; abrupt, smooth boundary; pH 7.0.

The Ap horizon ranges in thickness from 9 to 18 cm, and is gray, dark gray, or grayish brown silty clay loam, silty clay, or clay. The B2 horizons are gray or very dark gray clay, silty clay, or silty clay loam. The Alb are black to very dark brown silty clay with 3 to 20 percent organic matter and are 10 - 20 cm thick. Those below the buried A are gray, olive gray, greenish gray, or dark greenish gray silty clay loam to silt loam. Fine mica is common in the C.

The soils of the Gimje series are associated with the Bongnam, Buyong, Jeonbug, and Geugrag in the broad fluvio-marine plains, and with the Gongdeog and Baeggu soils in the narrow alluvial plains. The Gimje differ from the Bongnam and Gongdeog in having a thinner dark coloured layer high in organic matter. The Buyong do not have the dark coloured buried horizon, and are finer textured than the Jeonbug. The Gimje are better drained, and have a thinner buried A horizon than the Gongdeog.

The organic matter content and natural fertility are high. These soils are medium to slightly acid. Permeability is slow, and available moisture capacity high. Cation exchange capacity and base saturation are high.

All of the areas are in paddy, and cultivated to paddy rice in summer and to winter crops, such as barley or wheat.

5.9.1 Gimje Silty Clay Loam, 0 to 1 Percent Slopes (Gj)

In many places the surface layer is very dark gray, but the profile of most areas is similar to that described for the series. With this soil are included small areas in which all horizons were disturbed by gold mine activities, and a few small tracts with silt loam and light silty clay loam textures. This soil has a thick root zone, and is easy to work. Surface runoff is very slow.

All the land is used for rice and winter barley, but drainage is needed to increase the yields of the latter. If a well designed system were installed high yields of a wide variety of crops could be obtained with good management. This soil is best suited to paddy rice, and also suited to winter grain crops, such as barley or wheat.

Capability unit IIIw.
Rice suitability group P1.

5.10 GONGDEOG SERIES

The Gongdeog series, consisting of level to nearly level, deep, poorly drained soils formed in alluvium, is a member of the fine clayey family of Fluventic Haplaquepts. These soils occur as small areas between the fluvio-marine plain and alluvial plain.

A typical profile follows.

Apg--0 to 7 cm; gray (5Y 5/1) silty clay loam with many, fine to medium, prominent yellowish red (5YR 5/8) mottles; weak, coarse, subangular blocky structure; friable, sticky, and plastic; many, fine to medium pores; few quartz and mica grains; abundant, fine and medium roots; clear, smooth boundary; pH 5.0.

B1g--7 to 18 cm; dark gray (5Y 4/1) silty clay loam with many, fine to medium, prominent yellowish red (5YR 4/8) mottles; weak, medium to coarse subangular blocky structure; friable, sticky, and plastic; many, fine to medium pores; few quartz and mica grains; common, fine and medium rice roots; abrupt, smooth boundary; pH 6.0.

B21g--18 to 38 cm; very dark gray (5Y 3/1) silty clay with common, fine to medium, prominent yellowish red (5YR 5/8), faint olive (5Y 4/4) and distinct olive brown (2.5Y 4/4) mottles; massive; firm, sticky, and plastic; common, fine to medium pores; few quartz and mica grains; few, fine roots; clear, smooth boundary; pH 6.2.

B22g--38 to 53 cm; dark gray (5Y 4/1) silty clay loam with common, medium to coarse faint olive (5Y 4/4) mottles and many, fine to coarse $FeCo_3$ concretion and mottles; weak, coarse blocky structure; firm, sticky, and plastic; common, fine to medium pores; few, fine to medium roots; abrupt, smooth boundary; pH 6.3.

A11b—53 to 59 cm; black (N2/) silty clay; massive; firm, sticky, and plastic; few, fine to medium pores; few, fine roots; 3 to 30 percent organic matter; abrupt, smooth boundary; pH 6.5.

A12b—59 to 67 cm; very dark gray (10YR 3/1) silty clay; massive; few, fine to medium pores; few, fine roots; 3 to 30 percent organic matter; abrupt, smooth boundary; pH 6.0. (muck layer).

C3g—67 to 130+ cm; black to very dark brown clay containing 3 to 20 percent brown organic matter; pH 6.0.

The Ap horizon is 7 to 12 cm thick, and is gray to dark gray silty clay loam to clay loam. The B horizon is dark gray, very dark gray, or dark grayish brown silty clay loam to silty clay with concretions or mottles of ferrous carbonate. Below the B horizon is a very dark brown to black mineral horizon with some organic matter. This is the surface of a soil that has been buried by more recent deposition and is underlain by greenish gray clay.

The Gongdeog occur with the Bongnam and Gimje soils, and have a thicker peat layer than the Bongnam.

These soils are strongly acid to neutral throughout the profile, and are high both in organic matter and in natural fertility. Groundwater table is near the surface throughout the year. Permeability is slow, and available moisture capacity high. Cation exchange capacity and base saturation are high.

All areas are in paddy and cultivated only to paddy rice because of the poor drainage and high groundwater table.

5.10.1 Gongdeog Silty Clay Loam, 0 to 2 Percent Slopes (Gg)

Most areas have profiles similar to that described for the series, but with this soil are included a few small areas of soils with greater slopes, and a few scattered small areas with a light clay loam texture. At the present time only paddy rice is grown because of poor drainage and high groundwater table. A well designed drainage system would lower that and permit the growth of many kinds of crops in addition to, or instead of, rice.

Capability unit IIIw.
Rice suitability group P1.

5.11 GWANGHWAL SERIES

The Gwanghwal series, consisting of nearly level to level, deep, poorly drained soils with high salt content, are members of the coarse silty family of Typic Haplaquepts. These soils occur on broad fluvio-marine plains along or near the coast of the Gun.

A typical profile follows.

Apg—0 to 9 cm; dark gray (5Y 4/1) silt loam with few, fine prominent yellowish red (5YR 4/8) mottles; many, fine to

coarse prominent yellowish brown (10YR 5/6) mottles; olive gray (5Y 5/2) crushed colour; friable; few, fine to medium pores; many, fine mica flakes; abundant, fine to medium roots; abrupt, smooth boundary; pH 8.0.

C1g--9 to 20 cm; mottled, pale olive (5Y 6/3), dark yellowish brown (10YR 3/4), gray (5Y 5/1), strong brown (7.5YR 5/8), olive gray (5Y 5/2) crushed colour; very fine sandy loam; stratified platy; friable; few, fine to medium pores; many, fine mica flakes; common, fine roots; abrupt, smooth boundary; pH 8.0.

C2g--20 to 33 cm; mottled, greenish gray (10GY 5/1), dark gray (5Y 4/1), dark reddish brown (2.5YR 2/4), black (10YR 2/1), olive (5Y 5/3), and reddish brown (5YR 4/4) silt loam; crushed colour, dark grayish brown (10YR 4/2); friable, slightly sticky, and nonplastic; many, fine mica flakes; abrupt, smooth boundary; pH 8.0.

C3g--33 to 55 cm; mottled, olive gray (5Y 4/2), very dark brown (10YR 2/2), and brown to dark brown (10YR 4/3), dark grayish brown (10YR 4/2) very fine sandy loam; few, coarse manganese concretion; nonsticky and nonplastic; many, fine mica flakes; abrupt, smooth boundary; pH 8.5.

C4--55 to 85 cm; greenish gray silt loam; few, coarse manganese concretion; platy; pH 9.0.

C5g--85 to 150 cm; greenish gray silt loam; pH 9.0.

The Gwanghwal soils have a gray to dark gray or grayish brown silt loam or very fine sandy loam Ap horizon 7 to 9 cm thick. The C horizons are gray to dark gray or greenish gray silt loam or very fine sandy loam. Salt contents are medium to high ranging from 0.15 to more than 7 percent total soluble salts.

The Gwanghwal, occurring with the Jeonbug and Mangyeong soils, are coarse textured, better drained, and more saline than the Jeonbug, but the Mangyeong are better drained than all.

The Gwanghwal are moderately alkaline and are medium in organic matter. Permeability is moderate, and available moisture capacity high. Cation exchange capacity is medium, and base saturation high. The high salt content limits crop yields. Most areas are in paddy, but some are used for salt-field. A few small tracts are also cultivated to winter barley after paddy rice.

5.11.1 Gwanghwal Silt Loam, 0 to 1 Percent Slopes (Gw)

In places the surface layer is very fine sandy loam, but the profiles in most areas are similar to that described for the series. With this soil are included some areas with low salt content and small areas with a silty clay loam surface layer. The groundwater table is about 40 to 100 cm below the surface. Surface runoff is very slow.

The Gwanghwal soil is suited only to paddy rice because of poor drainage. Most areas are cultivated to it, with some parts growing winter barley or wheat after the

rice harvest. A few areas along the coast are used for salt-fields. The main management requirements are to remove the excess salts and provide drainage. Installation of a well designed drainage system would too assist in this removal and make it possible to grow a wide variety of crops.

Capability unit IIIwc.
Rice suitability group P3d.

5.12 GWANGSAN SERIES

The Gwangsan series, consisting of sloping, deep, well drained soils formed over saprolite of granite and granite-gneiss, are members of the fine clayey family of Typic Hapludults. These soils are on dissected low hills in the eastern part of the Gun. Depth to bedrock ranges form 1 to 7 m.

A typical profile follows.

Ap--0 to 10 cm; reddish brown (5YR 4/4) clay loam; weak, fine to medium, subangular blocky breaking to weak, fine to medium granular structure; friable, sticky, and plastic; patchy; common, fine to coarse pores; common, fine quartz grains; few, fine mica flakes; common, fine roots; abrupt, smooth boundary; pH 5.3.

B21t--10 to 36 cm; red (2.5YR 4/6) clay; strong, fine to medium subangular blocky structure; firm, sticky and plastic; thick clay cutans; common, fine to coarse pores; few, fine quartz grains; few, fine mica flakes; few, fine roots; diffuse, smooth boundary; pH 5.4.

B22t--36 to 100 cm; dark red (2.5YR 3/6) clay; strong, coarse prismatic breaking to strong, coarse subangular blocky structure; very firm, very sticky, and very plastic; few, fine to coarse pores; many, fine quartz grains; few, fine mica flakes; few, fine roots; clear, smooth boundary; pH 5.6.

B3--100 to 130 cm; red (2.5YR 4/8) clay loam; massive; very firm, sticky, and plastic; few, fine pores; common, fine mica flakes; common, fine quartz grains; diffuse, smooth boundary; pH 5.6.

C--130 to 180 cm; sandy loam mottled with red (2.5YR 5/8) light red (2.5YR 6/8), reddish yellow (5YR 7/6) and white (10YR 8/2); firm, slightly sticky, and plastic; few, fine pores; few, fine quartz grains;;many, fine mica flakes; original rock structure; pH 5.7.

The Ap horizon is yellowish red to red or reddish brown silty clay loam, clay loam, or silty clay, and is 9 to 15 cm thick. The B2 horizon is red, dark red, or yellowish red silty clay to clay. The B3 horizon is red, dark red, strong brown or yellowish red clay loam, silty clay loam, or sandy loam. The C horizon is saprolite of silt loam, sandy loam, or sandy clay loam.

The Gwangsan, occurring with the Jingog, Samgag, Changpyeong, Dalcheon, Songjeong, and Hwadong soils, differ from the Jingog in lacking a silty layer over residual

material in the surface layer and upper subsoil. These soils are finer textured, less permeable than the Samgag, and differ from the Changpyeong in being developed in residuum rather than in old alluvium.

They are medium to strongly acid, low in natural fertility, and are medium to low in organic matter. Permeability is very slow, and available moisture capacity moderate to high. Cation exchange capacity is moderate to high and base saturation low.

Most of the land is in cultivated crops, and some areas are in paddy under a good irrigation system, with few small tracts in forest.

5.12.1 Gwangsan-Jingog Complex, 7 to 15 Percent Slopes, Eroded (GGC2)

The soils in this complex occur as small areas on sloping low hills and foot-slopes, and consist of about 80 percent Gwangsan and 20 percent Jingog soils. These have profiles similar to that described for the series.

In this mapping unit are included some areas of only slightly eroded soil that has a brown to dark brown surface layer, some small areas of gently sloping soil, and small tracts of coarse sandy loam and loam. Surface runoff is medium to rapid, and erosion hazard moderate. These soils have a thick root zone, and are easy to work.

A wide range of crops are suited with most parts being cultivated. Some areas are used for paddy rice because irrigation water is available. A few small tracts are in pine forest. Erosion is a severe problem when these soils are planted to annual crops. The main management problem is erosion control and terraces, contour tillage, meadow crops, grassed waterways and other conservation practices are good management practices.

Capability unit IIIe
Rice suitability group P3ac.

5.13 HOGYE SERIES

The Hogye series, consisting of gently sloping, deep, well drained soils developed in recent alluvium, is a member of the loamy skeletal family of Fluventic Hapludolls, and occurs on alluvial fans in the Weonpyeong plain adjacent to Weongpyeong Cheon (stream) and in small valleys in mountainous areas.

A typical profile follows.

Ap--0 to 10 cm; very dark grayish brown (10YR 3/2) gravelly sandy loam; weak, fine granular structure; friable, slightly sticky, and slightly plastic; many roots; clear, smooth boundary; pH 7.3.

A1--10 to 36 cm; very dark grayish brown (10YR 3/2) gravelly sandy loam with many faint dark brown (10YR 3/3) to dark yellowish brown (10YR 3/4) mottles; weak fine granular structure; many, fine and medium pores; common roots; abrupt, smooth boundary; pH 5.4.

C1--36 to 100+ cm; brown to dark brown (10YR 4/3) very gravelly to cobbly sandy loam; massive; friable, nonsticky, and nonplastic; pH 6.2.

The A horizon is black, very dark grayish brown, or very dark brown gravelly sandy loam, or gravelly loam, 25 to 60 cm thick. The C horizons are dark yellowish brown or brown very gravelly sandy loam or very gravelly loam. They are strongly to slightly acid.

The Hogye are darker coloured, coarser textured, and have less gravel in the subsurface layer and in the substrata than the Seogto soils that occur on footslopes. They also differ from the Hagsan in having better drainage, more gravel, and a dark colour throughout the profile.

The Hogye soils are slightly to strongly acid, and high in natural fertility and organic matter. Permeability is moderate to rapid, and available moisture capacity medium to low. Cation exchange capacity is low to medium, and base saturation high.

About half of the areas are in paddy rice, and the remaining half is cultivated to other crops. Some areas are planted to winter wheat after harvest of onion and other summer crops.

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

Some areas have a gravelly loamy sand texture, with the profile otherwise being similar to that described for the series. With this soil are also included small areas of less or greater slopes than the descrioed range, as well as a few small tracts of poorly drained sandy loam.

The root zone is thick and many areas are easily worked because farmers have removed most of the coarse gravel from the plough layer. Surface runoff is slow and erosion a moderate hazard. A wide range of crops is suited but yields may be low in dry seasons because of lack of soil water. Half of the areas are cultivated to paddy rice, and the rest is in other crops.

Capability unit IIs.
Rice suitability group P4abc.

5.14 HONAM SERIES

The Honam series consisting of nearly level deep, poorly drained soils formed in alluvium on the broad alluvial plains chiefly northeast of Yongji Myeon, are members of the fine clayey family of Typic Ochraqualfs.

A typical profile follows.

Ap1--0 to 12 cm; dark gray (5Y 4/1) silt loam with common, fine to medium, distinct olive brown (2.5Y 4/4) mottles; massive; firm, slightly sticky, and plastic; many, fine roots; clear, smooth boundary; pH 5.5.

B1g--12 to 22 cm; dark gray (5Y 4/1) silty clay loam with many, fine to coarse prominent strong brown (7.5YR 5/6) and few, coarse prominent dark red (2.5YR 3/6) mottles; massive; firm, sticky, and plastic; many, fine to medium pores; many,

fine mica; many, fine roots; abrupt, smooth boundary; pH 5.6.

B21tg--22 to 67 cm; grayish brown to dark grayish brown silty clay loam with many, fine, distinct, dark yellowish brown (10YR 4/4) mottles; moderate, coarse prismatic structure; firm, sticky, and plastic; thick clay cutans; many, fine to coarse pores; many, fine mica; few, fine roots; gradual, smooth boundary; pH 6.6.

B22tg--67 to 98 cm; very dark gray to very dark grayish brown (10YR 3/1-3/2) silty clay loam with few, fine prominent yellowish red (5YR 4/8) and common, fine faint dark yellowish brown (10YR 4/4) mottles; strong, coarse prismatic structure; firm, sticky, and plastic; many, fine to coarse pores; many, very fine micas; few, fine roots; clear, smooth boundary; pH 6.7.

B23--98 to 133 cm; same as above except many fine manganese concretion; no roots; gradual, smooth boundary; pH 6.4.

The Ap horizon ranges from gray to dark grayish brown or light olive gray in colour, and ranges from silt loam to clay loam with mottles of olive brown, strong brown, yellowish brown, and yellowish red. The B2 horizons are grayish brown, dark grayish brown, or gray silty clay loam to silty clay or clay with yellowish red, strong brown, and reddish brown mottles.

The Honam soils, associated with the Geugrag, Bongnam, Gimje, and Buyong, are less drained and more gray coloured than the Geugrag soils, and also differ from the Bongnam and Gimje in lacking peat or muck layers.

The Honam are strongly to slightly acid, moderately high in natural fertility, and are medium in organic matter content. They are slowly permeable, and have a high available moisture capacity. Cation exchange capacity, and base saturation are high.

All of the areas are planted to rice with a good irrigation system, and some are cultivated to winter wheat or barley.

5.14.1 Honam Silty Clay Loam, 0 to 2 Percent Slopes (Hn)

Most areas have profiles similar to that described for the series, but small areas of gently sloping soil are included. This soil has a thick root zone, and is easy to work. Surface runoff is very slow.

Paddy rice is best suited, and a wide range of crops, if the land is drained and well managed, will also do well. Rice is grown everywhere in the summer and some part are planted to barley or wheat in the winter. To increase yields of nonirrigated crops drainage is required.

Capability unit IIIw.
Rice suitability group P1.

5.15 HWADONG SERIES

The Hwadong series, consisting of gently sloping, deep, moderately well drained soils formed in old alluvium on stream terraces and alluvial plains, are members of

the fine clayey family of Aquic Hapludalfs.

A typical profile follows.

Ap1—0 to 12 cm; gray (5Y 5/1) silty clay loam with common, fine to medium prominent yellowish red (5YR 4/6) and few, fine to medium strong brown (7.5YR 5/6) mottles; massive; friable, sticky, and plastic; many, fine to medium pores; common, fine micas; few, fine quartz; many, fine to medium roots; clear, smooth boundary; pH 5.5.

Ap2—12 to 21 cm; grayish brown to dark grayish brown (2.5Y 5/2-4/2) silty clay loam with many fine to medium, prominent, yellowish red (5YR 4/8) and common, fine to medium, red (2.5YR 5/8) mottles; weak, medium to coarse, platy structure; firm, sticky, and plastic; many, fine to medium pores; common, fine micas; few, fine quartz; common, fine roots; abrupt, smooth boundary; pH 5.5.

B21t—21 to 37 cm; dark grayish brown (10YR 4/2), yellowish brown (10YR 5/4), and brown (10YR 5/3) silty clay with common, fine to medium, very dark brown (10YR 2/2) manganese mottles; moderate, fine to medium subangular blocky structure; firm, very sticky, and very plastic; thick clay cutans; many, fine to medium pores; few, very fine micas; few, fine roots; gradual, smooth boundary; pH 6.5.

B22t—37 to 70 cm; dark yellowish brown (10YR 4/4), reddish brown (5YR 4/4), and brown to dark brown (7.5YR 4/4) clay with many, medium to coarse, very dark brown (10YR 2/2) manganese mottles; moderate, fine to medium subangular blocky structure; firm, very sticky, and very plastic; thick clay cutans; many, fine to coarse pores; few, very fine micas; few, fine roots; clear, smooth boundary; pH 6.5.

B23t—70 to 120 cm; strong brown (7.5YR 5/6) silty clay with many, medium to coarse very dark brown (10YR 2/2) manganese mottles; strong, coarse subangular blocky structure; very firm, very sticky, and very plastic; many, fine to coarse pores; few, very fine micas; gradual, smooth boundary; pH 7.0.

B31t—120 to 180 cm; brownish yellow (10YR 6/6) silty clay with common, medium to coarse very dark brown (10YR 2/2) manganese mottles; moderate, medium to coarse platy structure; very firm, very sticky, and very plastic; common, fine to coarse pores; few, very fine micas; thick clay cutans; clear, smooth boundary; pH 5.5.

The Ap horizon is yellowish brown or strong brown except in paddy where it is gray or grayish brown to dark grayish brown with strong brown, reddish yellow and yellowish brown mottles. Texture is silty clay loam or silty clay and thickness ranges from 10 to 22 cm. The B2 horizons are commonly strong brown or yellowish brown silty clay loam to silty clay mottled in the lower parts with gray, light gray, yellowish red, or reddish yellow. Thickness of the B2 ranges from 50 to 100 cm. The B3 horizons are yellowish brown to yellowish red silty clay loam or clay with light gray to gray mottles.

The Hwadong occur with the Changpyeong, Gwangsan, Honam, Jeonnam, and Geugrag soils. The Hwadong are less well drained and more mottled than the Bancheon and are better drained and less gray coloured than the Honam.

They are slightly to strongly acid, moderate in natural fertility and in organic matter. Permeability is slow, and available moisture capacity high. Cation exchange capacity and base saturation are high.

All the land is cultivated to paddy rice and winter wheat or barley.

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

Most areas have profiles similar to that described for the series, but with this soil are included a few small areas of imperfectly drained soils and some small tracts of nearly level soils. The root zone is thick and is easy to work, surface runoff is slow, and erosion a moderate hazard.

The land is well suited to a wide range of crops, with most areas used for rice in the summer and wheat or barley in the winter.

Capability unit IIe.
Rice suitability group P2ac.

5.16 HWANGRYONG SERIES

The Hwangryong series, consisting of nearly level, deep, excessively drained soils developed in alluvium, are members of the sandy skeletal family of Typic Udipsamments. These soils are on floodplains along the rivers or streams.

A typical profile follows.

Ap--0 to 12 cm; brown to dark brown (10YR 4/3) gravelly sandy loam; single grain; friable; many quartz fragments; many, fine mica flakes; many, fine roots; gradual, smooth boundary; pH 5.2.

C1--12 to 40 cm; brown to dark brown (10YR 4/3) gravelly sandy loam; single grain; friable; many, fine pores; many, fine mica flakes; common, fine quartz fragments; common, fine roots; abrupt, smooth boundary; pH 5.3.

C2--40 to 120+ cm; pale brown (10YR 6/3) very gravelly sand; single grain; no roots; pH 6.3.

The Ap horizon ranges from gravelly sandy loam to gravelly loamy coarse sand or gravelly loam. Farmers have removed the coarser gravel from the surface of many rice paddies. The Ap horizon colour is brown to dark brown, and its thickness ranges from 12 to 15 cm. A few mottles of grayish brown to dark grayish brown are in the surface layer of some soils that are used for paddy rice. The C horizon is yellowish brown, pale brown or dark yellowish brown, very gravelly loamy sand.

The Hwangryong, occurring with the Hwabong and Hogye soils, differ from the Hwabong in having gravel throughout the profile, and are coarser textured, more permeable, with less organic matter than the Hogye.

The Hwangryong are strongly acid to neutral and are very low both in natural fertility and in organic matter. Permeability is rapid, and available moisture capacity very low. Cation exchange capacity is very low and base saturation moderate or high.

The areas of these soils are not large, and are mostly growing poplars. Some areas, where water is available from streams, are cultivated to paddy rice in the summer and to barley or wheat in the winter. Horticultural plants are grown in some elevated areas.

5.16.1 Hwangryong Gravelly Loamy Sand, 0 to 2 Percent Slopes (Hl)

Most areas have profiles similar to that described in the series. With this soil are included many areas of gravel-free loamy coarse sand or sandy loam surface soil, where farmers have removed much gravel from the plough layer, small tracts without gravel, and some areas of dark coloured gravelly loam. It is difficult to work because of the gravel content, but is improved when clayey soil is added to reduce leaching of plant nutrients.

A limited range of crops grow well, and peanuts and poplar are well suited. Most of the areas are in poplars, with some parts in cultivated crops, including rice, wheat, barley, soybean, buckwheat, rye, and potato. Yields are generally low in seasons of limited rainfall.

Capability unit IVs.
Rice suitability group P4bc.

5.17 IHYEON SERIES

The Ihyeon series, consisting of nearly level, deep, well drained soils developed in alluvium, are members of the coarse silty family of Dystric Fluventic Eutrochrepts. These soils are distributed as long narrow areas in broad alluvial plains and fans chiefly in Yongji Myeon.

A typical profile follows.

Ap---0 to 10 cm; brown to dark brown (10YR 4/3) silt loam; weak, medium, subangular blocky breaking to weak, fine to medium granular structure; friable; many, fine mica flakes; many, fine to medium roots; clear, smooth boundary; pH 5.4.

B---10 to 50 cm; dark yellowish brown (10YR 4/4) to brown (10YR 5/3) silt loam; weak, medium to coarse subangular blocky structure; firm and slightly sticky; many, fine mica flakes; few, fine roots; clear, smooth boundary; pH 6.0.

C---50 to 130 cm; brown to dark brown (10YR 4/3) silt loam; weak, coarse platy structure breaking to weak, coarse to medium subangular blocky structure; many, fine mica flakes; few, fine pores.

The Ap horizon in nonirrigated land ranges from brown to dark brown in colour, and in paddy soil from gray to dark grayish brown. This soil has a silt loam to silty clay loam or loam Ap horizon 15 to 30 cm thick. The B horizons are brown to

dark brown or dark yellowish brown silt loam to very fine sandy loam. The C is brown to dark brown or yellowish brown to dark yellowish brown, and ranges from silt loam to loamy sand or sand. Many fine mica flakes are found throughout the profile, with some mottles of grayish brown in the profile of paddy soils.

The Ihyeon are on the same alluvial plains with the Gimje and Jeonbug soils, but are better drained. The Gimje are silty clay loam to silty clay rather than silt.

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

The areas of these soils are very small and occupy a part of Yongji Myeon. All of the land is cultivated to rice and other crops.

5.17.1 Ihyeon Silt Loam, 0 to 2 Percent Slopes (Ih)

Profiles of most areas are similar to that described for the series. Some areas with fine sandy loam and loam textures are included as are a few small tracts with light silty clay loam textures. The Ihyeon soil has a thick root zone, and is easy to work. Surface runoff is slow, and erosion is a slight hazard, but the land is subject to overflow in the rainy season.

A wide range of crops are well suited. Nearly half is in paddy that is usually planted to barley after the rice harvest. The remainder is in other crops. Mulberry trees are grown in some places.

Capability unit 1.
Rice suitability group P2c.

5.18 JEONBUG SERIES

The Jeonbug series, consisting of nearly level to level, deep, imperfectly drained soils formed in alluvium on broad fluvio-marine plains, are members of the fine silty family of Aeric Fluventic Haplaquepts.

A typical profile follows.

Ap1g—0 to 10 cm; gray to dark gray (5Y 5/1-4/1) silt loam with many, fine to medium prominent yellowish brown (10YR 5/8) mottles; massive; friable, slightly sticky, and slightly plastic; common, fine root channel pores; common, very fine mica flakes; abundant, fine to medium dead rice roots; clear, smooth boundary; pH 5.0.

A12g—10 to 19 cm; gray (5Y 5/1) silt loam with common, fine to medium prominent yellowish red (5YR 5/8) and olive brown (2.5Y 4/4) mottles; dark grayish brown (2.5Y 4/2) when crushed; firm, sticky, and plastic; common, fine pores; mica as above; dead rice roots; clear, smooth boundary; pH 5.5.

B21g—19 to 27 cm; dark gray (5Y 4/1) silt loam with many, fine prominent yellowish red (5YR 5/8) mottles; weak, coarse prismatic; firm, sticky, and plastic; mica as above; few, fine dead rice roots; clear, smooth boundary; pH 6.0.

B22g—27 to 44 cm; very dark gray (10YR 3/1) silty clay loam with common, fine to medium distinct mottles of yellowish brown (10YR 5/8); moderate, fine to medium angular blocky; very firm, sticky, and plastic; few, fine pores; few mica flakes; few roots; abrupt, wavy boundary; pH 7.0.

B23—44 to 85 cm; mottled yellowish brown (10YR 5/8), olive gray (5Y 5/2) and strong brown (7.5YR 5/8) silt loam; olive brown (2.5Y 4/4) when crushed; weak, coarse prismatic; firm, sticky, and plastic; continuous thick very dark grayish brown (10YR 3/2) cutans; many, fine coarse pores; common, fine to medium, very dark brown (10YR 2/2) manganese concretions and mica flakes as above; roots as above; diffuse, smooth boundary; pH 7.0.

B3g—85 to 120 cm; olive gray (5Y 4/2) silt loam with common, medium to fine distinct mottles of dark yellowish brown (10YR 4/4) massive; firm, sticky, and plastic; common, fine to coarse pores; many, fine mica flakes; diffuse, smooth boundary; pH 7.0.

C1g—120 to 160 cm; dark gray (5Y 4/1) silt loam with common, fine to medium faint mottles of olive gray (5Y 4/2); massive; friable, sticky, and plastic; few pores; continuous thick clay flow along the coarse pores; common, fine mica flakes; diffuse, smooth boundary; pH 8.0.

The surface layer, ranging from silt loam to silty clay loam, is gray to dark gray or grayish brown, and is 9 to 22 cm thick. The subsoil is silty clay loam or silt loam but may have thin horizons of silty clay. It is light gray, gray, dark gray, olive gray or dark grayish brown. The C horizon is gray or greenish gray to bluish gray silt loam, silty clay loam or silt. These soils have many to common mottles throughout the profile, ranging from yellowish red to yellowish brown or olive brown in the surface layer, strong brown to yellowish brown or olive in the subsoil, and yellowish red to yellowish brown or olive gray in the C horizon. Many fine mica flakes are in the profile too.

The Jeonbug soils are found in the same general areas with the heavy textured Gimje and Bongnam, and with the very silty Gwanghwal and Mangyeong soils. The Jeonbug are strongly to medium acid in the surface soil, and neutral to mildly alkaline below it. Natural fertility is moderate, and organic matter content medium. Permeability is moderate, and available moisture capacity high. Cation exchange capacity is medium, and base saturation high. All the land is in paddy, and also cultivated to crops such as barley or wheat.

5.18.1 Jeonbug Silt Loam, 0 to 1 Percent Slopes (Jb)

The profile is similar to that described for the series. But, with this soil are included small tracts with a heavy silty clay loam or clay loam surface layer. The

root zone is thick and is easy to work. Paddy rice is best suited, while other crops such as barley will do well. All the areas are used for a cropping system of paddy rice followed by a winter crop of barley or wheat, but the land is generally too wet for the highest production of crops. Additional drainage would increase yields.

Capability unit IIw.
Rice suitability group P1.

5.19 JISAN SERIES

The Jisan series, consisting of gently sloping, poorly drained, deep soils, is a member of the fine loamy family of Fluventic Haplaquepts. These soils formed in alluvium on narrow alluvial valleys and fans, and are located in all hilly and mountainous areas of the Gun.

A typical profile follows.

Ap—0 to 11 cm; gray (5Y 5/1) silty clay loam with many, fine to medium distinct, olive brown (2.5Y 4/4) and common, fine to medium, distinct yellowish red (5YR 5/8) mottles; moderate, medium to coarse granular structure; friable, sticky and plastic; many, fine to coarse pores; few, fine, white mica flakes; many, fine to medium roots; abrupt, smooth boundary; pH 5.2.

B1—11 to 23 cm; very dark gray (5Y 3/1) silty clay loam with many, fine, prominent, yellowish red (5YR 4/8) and common, fine, distinct olive (5Y 4/3) mottles; massive; firm, sticky, and plastic; common, fine pores; common, fine mica; common, fine roots; clear, smooth boundary; pH 4.7.

B12—23 to 45 cm; gray (5Y 5/1) silty clay loam with many, medium to coarse olive brown (2.5Y 4/4) and fine to medium, distinct, yellowish red (5YR 4/6) mottles; moderate, medium to coarse prismatic structure; firm, very sticky, and very plastic; many, fine pores; common, fine roots; clear, smooth boundary; pH 6.2.

B21—45 to 62 cm; dark gray (5Y 4/1) silty clay loam with many, fine to medium distinct, olive brown (2.5Y 4/4) and common, fine, distinct, yellowish red (5YR 4/6) mottles; strong, coarse, prismatic structure; firm, very sticky, and very plastic; common, manganese concretions; many, fine pores; few, fine roots; clear, smooth boundary; pH 6.4.

B22—62 to 76 cm; dark gray (5Y 4/1) silty clay loam with many, medium to coarse, prominent, olive brown (2.5Y 4/4) and common, fine to medium prominent, yellowish red (5YR 5/8) mottles; strong coarse prismatic structure; firm, very sticky, and very plastic; few black manganese concretions; common, fine pores; few, fine roots; abrupt, smooth boundary; pH 6.4.

B23—76 to 92 cm; dark gray (5Y 4/1) silty clay loam with many, coarse, prominent, yellowish red (5YR 5/8) and many,

coarse distinct olive brown (2.5Y 4/4) mottles; massive; firm, very sticky, and very plastic; few, fine pores; few, fine roots; abrupt, smooth boundary; pH 6.3.

G---92 to 130+ cm; very dark gray (5Y 3/1) silty clay loam; massive; firm, very sticky, and very plastic; few, fine pores; common, fine to coarse $FeCo_3$ concretion; pH 5.7.

The surface layer is 12 to 25 cm thick, and ranges from silty clay loam to clay loam with mottles of olive brown, yellowish red, and yellowish brown. Its colour ranges from gray to dark grayish brown. The subsoil is gray to grayish brown, and ranges from silty clay loam to clay loam with strong brown, yellowish red and yellowish brown mottles. The thickness is between 50 to 80 cm. The substratum is gray silty clay loam, loam, and clay loam with many fine manganese concretions and mottles. These soils, to a depth of 1 m, contain many fine mica flakes.

The Jisan, occurring with the Yongji, Baeggu, and Subug, are less drained than the Yongji, and somewhat better drained than the Baeggu.

Organic matter content is medium and natural fertility high. They are generally strongly acid, moderately permeable, and have medium available moisture capacities. Cation exchange capacity is medium and base saturation high.

The areas covered by these soils are relatively large and are mostly in rice paddy. Winter barley is grown after the rice harvest.

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

Most areas have profiles similar to that described for the series, but with this soil are included small areas of coarse textured soils, of somewhat better drained soils, and some with greater slope than the described range. The Jisan has a thick root zone, and is easy to work. Surface runoff is very slow.

Paddy rice does well as do other crops, such as barley. All the land is in irrigated paddy and some is planted to winter barley after the rice harvest. Drainage is needed to increase yields of winter crops.

Capability unit IIw.
Rice suitability group P2a.

5.20 MANGYEONG SERIES

The Mangyeong series, consisting of nearly level to level, deep, poorly drained soils formed in alluvium, are members of the coarse silty family of Fluventic Haplaquepts. These soils are on broad fluvio-marine plains along or near the mouth of the Mangyeong river.

A typical profile follows.

Ap1g—0 to 10 cm; gray (5Y 5/1) silt loam with common, fine, brown to dark brown (7.5YR 4/4) mottles; weak, fine granular structure; friable; many very fine mica flakes; many fine roots; clear, smooth boundary; pH 5.7.

Ap2g--10 to 21 cm; gray (5Y 5/1) silt loam with common, medium to coarse yellowish brown (10YR 5/6) and brown to dark brown (7.5YR 4/4) mottles; weak, coarse platy structure; friable, nonsticky, and slightly plastic; many very fine mica flakes; few, fine pores; many, fine roots; abrupt, smooth boundary; pH 6.0.

B1g--21 to 70 cm; gray (5Y 5/1) silt loam with few medium to coarse, dark brown (7.5YR 3/2) mottles; massive; friable, slightly sticky, and slightly plastic; common, medium to coarse pores; many very fine mica flakes; few, fine roots; clear, smooth boundary; pH 7.5.

B31g--70 to 86 cm; grayish brown (2.5Y 5/2) silt loam with few, coarse brown to dark brown (10YR 5/3-3/3) mottles; fine platy structure; very friable; many, fine to medium mica flakes; few, medium pores; no roots; clear, smooth boundary; pH 8.0.

B32g--86 to 125 cm; gray (5Y 5/1) silt loam with few coarse brown to dark brown (10YR 4/3) mottles; thin, platy structure; friable, slightly sticky, and slightly plastic; dark gray cutans; few, very coarse pores; pH 8.0.

C1g--125 to 170 cm; dark greenish gray (5GY 4/1) silt loam; friable; pH 8.2.

The surface layer is gray, dark gray, dark grayish brown or dark yellowish brown silt loam with mottles of brown to dark brown, yellowish red, yellowish brown, and reddish brown. It ranges from 10 to 25 cm in thickness. The subsoil ranges from gray to dark gray or grayish brown to dark grayish brown in colour, and from silt loam to very fine sandy loam with mottles of yellowish red, yellowish brown, strong brown, and brown to dark brown. The substratum is gray to dark gray, dark greenish gray or olive gray silt loam or very fine sandy loam with mottles of brown to dark brown and yellowish brown. In most areas it has more than 15 percent saturation with sodium below 100 cm. Many mica flakes are found in the profile.

The Mangyeong soils, occurring with the Jeonbug and Gwanghwal, are coarser-textured and more permeable than the Jeonbug, better drained and less saline than the Gwanghwal.

They are medium to slightly acid in the surface layer, but beneath it are moderately to strongly alkaline. Organic matter content and natural fertility are low to medium. Permeability is moderate, and available moisture capacity high. Cation exchange capacity is medium and base saturation high.

A good irrigation system has been developed, with the land being cultivated to paddy rice in summer and to barley or wheat in winter. Some elevated areas without irrigation water are used for crops other than rice.

5.20.1 Mangyeong Silt Loam, 0 to 1 Percent Slopes (Mg)

The profiles in most areas are similar to that described for the series, but in this mapping unit are included many tracts that contain soils which have been disturbed by gold mine activities. There, the surface layer and the subsoil are

gray to dark gray or grayish brown loam to sandy loam with mottles of strong brown, yellowish brown, yellowish red and reddish brown. Some cobbles and gravel are found in places. The C horizon ranges from sand to sandy loam, and is dark gray or greenish gray to dark greenish gray. Some areas with heavy silt loam or light silty clay loam textures, and some high in salt similar to the Gwanghwal soils, are included. The root zone is thick, and workability is good. Surface runoff is very slow.

Crops such as paddy rice, barley, and wheat do well with most of the land being cultivated to paddy rice in summer and to barley or wheat during the winter. Where irrigation water is not available, land is cultivated only to nonirrigated crops. Drainage is needed to increase the yields of barley or wheat grown on paddy soil, while many other crops could be grown if a well designed drainage system were installed.

Capability unit IIw.
Rice suitability group P2b.

5.21 MINE DUMP (MD)

This unit consists of deep, well drained heaps of soil materials that are the result of gold mine operations.

The texture ranges from clay loam or silty clay loam to gravelly sandy loam. The surface layers are mainly brown to dark brown. These tracts are mostly adjacent to the Ducheon, Duweol, and Weonpyeong streams. The soils along the Duweol are loam to clay loam but those near the Weonpyeong are coarse loam and sandy loam.

The mined land is slightly to strongly acid, and is low both in organic matter content and in natural fertility. Permeability is slow to rapid, and available moisture capacity is generally variable. The root zone is thick.

These areas are suited to cultivation if well managed and grow barley, wheat, soybean, and rye. Crop yields, however, are generally poor.

Capability unit IIIs.

5.22 MUDEUNG SERIES

The Mudeung series, consisting of steep, shallow, somewhat excessively drained soils formed in residuum derived from porphyry and porphyrite, is a member of the fine loamy family of Lithic Dystrochrepts. These soils are on mountainous areas chiefly in Moag mountain. Depth to bedrock is generally less than 50 cm.

A typical profile follows.

A--0 to 15 cm; brown to dark brown (10YR 4/3) gravelly loam; weak, fine granular structure; friable; many, fine to coarse roots; abrupt, smooth boundary; pH 5.2.

B--15 to 30 cm; dark yellowish brown (10YR 4/4) gravelly loam; weak, medium subangular blocky structure breaking to fine and medium granular; friable, slightly sticky, slightly plastic; common, fine roots; clear wavy boundary; pH 5.5.

R--30+ cm; porphyry bedrock.

The surface layer, where only slightly eroded, is brown to very dark brown or very dark grayish brown cobbly to stony loam or silt loam, but where severely eroded, is yellowish brown to very dark yellowish brown gravelly to stony sandy loam. Its thickness ranges from 15 to 30 cm. Rock outcrops are common.

The Mudeung are associated with the Taehwa soils, but are shallower, and have harder rock materials than them.

The Mudeung are medium in organic matter content, moderate in natural fertility, and are strongly acid. They are moderately permeable, and low to very low in available moisture capacity. Cation exchange capacity is medium and base saturation low.

Most of the areas are in forest of poor pines mixed with some oaks, alders and maples, with an understory of shrubs.

5.22.1 Mudeung Rocky Loam, 30 to 60 Percent Slopes (MdE)

About 25 to 50 percent of the area of this soil is rock outcrop. In most places the surface layer is gravelly to stony and where not rocky the profile is usually like that described for the series. With this soil are included small areas of greater slope than the described range and some areas of mainly coarse sandy loam saprolite similar to the Samgag soils.

The Mudeung has a thin root zone, surface runoff is rapid, and erosion hazard slight in areas with grass cover. However, it would be severe if cultivated.

Woodland is suited and most of the land is in forest, but with good management low to moderate amounts of grazing could be obtained.

Capability unit VIe.

5.22.2 Mudeung Very Rocky Loam, 30 to 60 Percent Slopes (MvE)

The soil is very similar to the Mudeung rocky loam, 30 to 60 percent slope (MdE), except that about 50 to 90 percent is rock outcrops. Between the rocks the profile is like that described for the series, but in most places the surface layer is gravelly to stony. With this unit are included small areas of greater slope than the described range, cobbly to stony sandy loam surface soil, and small tracts of Samgag and Seogto soils.

This soil has a thin root zone. Surface runoff is rapid, and erosion a slight hazard. This would be severe if the land were cultivated.

Only woodland is suitable and poor pine forest predominates. Forage crops will grow but good returns cannot be expected.

5.22.3 Mudeung Rocky Loam, 30 to 60 Percent Slopes, Eroded (MdE2)

This soil is very similar to Mudeung rocky loam, 30 to 60 percent slopes (MdE), except that all of the areas have been eroded, and generally have a shallow surface layer of yellowish brown to very dark yellowish brown gravelly to stony sandy loam.

Many rock outcrops are present, usually 20 to 50 percent of the area. In other respects the profile between rocks is similar to that described for the series. With this soil are included small tracts of greater slope than the described range, and small areas of deep coarse loamy saprolite.

The root zone is very thin, surface runoff rapid, and erosion hazard severe to very severe. Cultivation is unsuited but woodland is, if well managed. Most areas are now in poor pine forest. Small amounts of grazing could be obtained given good management.

Capability unit VIe.

5.23 RIVERWASH (COBBLY AND SANDY) (RCS)

This unit, consisting of areas with only cobbles and stones mixed with sand, is mainly along the Weonpyeong stream in Weonpyeong plain. Most land is flooded frequently in the summer season. The cobble and sand materials are sometimes used for construction material, such as building and road fill. Poplar trees are grown in some places.

Capability unit VIII.

5.24 SAMGAG SERIES

The Samgag series, consisting of sloping to steep, deep, somewhat excessively drained soils developed in residuum weathered from granite and granite-gneiss, is a member of the coarse loamy family of Typic Dystrochrepts. These soils are distributed on strongly dissected hilly to mountainous areas in the eastern part of the Gun. Depth to bedrock ranges from 1 to 3 m or more.

A typical profile follows.

A1—0 to 15 cm; brown to dark brown (10YR 4/3) coarse sandy loam; weak, fine granular structure; friable; many fine pores; common fine mica flakes; many fine quartz fragments; many fine to medium roots; clear, smooth boundary; pH 6.0.

B—15 to 26 cm; brown (10YR 5/3) sandy loam; weak coarse subangular blocky structure; friable; few, fine pores; common fine mica flakes; many fine quartz fragments; common fine roots; abrupt, smooth boundary; pH 6.1.

C—26 to 120+ cm; mottled, pinkish white (5YR 8/2), very dark grayish brown (2.5Y 3/2), brownish yellow (10YR 6/8) and reddish yellow (7.5YR 6/8) sandy loam saprolite; single grain; friable; many, fine mica flakes; many fine quartz fragments; pH 6.8.

The surface layer ranges from sandy loam to coarse sandy loam or loamy sand, and is brown to dark brown, yellowish brown or strong brown. It ranges in thickness from 5 to 20 cm. Gravel and stones are found in some places, and rock outcrops are common on the surface.

The C horizon is granitic saprolite of yellowish brown, yellowish red, reddish brown, or reddish yellow coarse sandy loam, sand, or loamy sand.

The Samgag, occurring with the Songjeong, Seogto, and Dalcheon soils, are low both in natural fertility and in organic matter content, and are strongly acid. Permeability is very rapid, and available moisture capacity low. Cation exchange capacity and base saturation are also low.

Pine forest is usual with some alders and acacia growing too. Lower slopes have been cleared, and are cultivated to nonirrigated crops.

5.24.1 Samgag Rocky Sandy Loam, 15 to 30 Percent Slopes, Severely Eroded (SmD3)

In most places the surface layer is stony to gravelly, and ranges from 10 to 20 cm in thickness. Erosion has removed most of the original surface soil, exposing the C horizon. Some areas are gullied, and shallow gullies with exposed bedrocks are common in some places. Rock outcrops occupy about 10 to 30 percent of the areas. The profile for the remainder is similar to that described for the series.

In this mapping unit are also included a few small tracts of a soil that has a subsurface layer of sandy clay loam or loam, small areas of greater slope, and some areas with yellowish red clay loam, silty clay loam, and silty clay upper horizons.

This soil has a thick root zone. Surface runoff is very rapid, and erosion hazard severe. Woodland or pasture are better suited rather than agricultural crops. Forest predominates with some lower slopes being cultivated to rye, potato, upland rice, wheat, and barley. Mulberry field and orchard have been established. In managing this soil erosion control is the main problem. With good management moderate yields of forest products and pasture may be obtained.

Capability unit VIe.

5.24.2 Samgag Rocky Sandy Loam, 30 to 60 Percent Slopes, Severely Eroded (SmE3)

Most of the original surface layer has been lost through erosion, and the C horizon exposed in some places. Rock outcrops are common on between 10 to 30 percent of the land's surface. The surface layer generally is stony to gravelly, and ranges from 5 to 10 cm in thickness, and between rock outcrops the profile is much like that described for the series. In these areas are included a few small tracts that have a sandy clay loam or loam subsurface layer, some of eroded or only slightly eroded soil, some areas of shallow to hard rock, and gullied land.

The root zone is thick. Surface runoff is very rapid, and erosion a severe hazard. Only woodland is generally suited with most land in poor forest of pine and alder. A few tracts have been cleared, and are cultivated to rye, potato, and other similar crops. Erosion control is the main management problem.

Capability unit VIIe.

5.24.3 Samgag Very Rocky Sandy Loam, 30 to 60 Percent Slopes, Severely Eroded (SvE3)

The rock outcrops occupy about 30 to 60 percent of the area, and erosion has removed most of the original surface layer, exposing the C horizon in some places.

The surface layer is 5 to 10 cm thick, and is gravelly to stony in many places. The profile in other respects is similar to that described for the series. In this unit are included small areas with a sandy clay loam or loam subsurface soil, some areas of eroded or only slightly eroded soils, some areas of soils shallow to hard rock, and gullied land.

This soil has a thick root zone for trees, but surface runoff is very rapid, and erosion hazard severe. Nearly all areas are wooded, which is suitable. The major management problem is erosion control. Only small amounts of grazing may be obtained when is managed for pasture.

Capability unit VIIe.

5.25 SEOGTO SERIES

The Seogto series, consisting of sloping to moderately steep, well drained, stony soils developed in alluvium-colluvium transported from areas underlain by acid-crystalline materials, porphyry, granite and granite-gneiss, is a member of the loamy skeletal family of Dystric Fluventic Eutrochrepts. These soils are on dissected mountain footslopes of the Moag mountains in the east of the Gun. Depth to bedrock ranges from 2 to 3 m.

A typical profile follows.

Ap—0 to 9 cm; yellowish brown (10YR 5/6) gravelly to cobbly loam; structureless; friable, slightly sticky, and slightly plastic; few, fine mica flakes; many coarse quartz fragments; common, slightly to moderately weathered gravel, cobbles and stones; many, fine roots; clear, smooth boundary; pH 5.6.

B—9 to 60 cm; reddish yellow (5YR 7/8) very gravelly to cobbly clay loam with common, fine to medium prominent strong brown (7.5YR 5/6) mottles; weak, fine to medium subangular blocky structure; firm, sticky, and plastic; few, fine pores; few, fine mica flakes; few, fine quartz fragments; some cobbles; few, fine roots; clear, wavy boundary; pH 5.7.

C—60 to 130 cm; mottled, brownish yellow (10YR 6/8), strong brown (7.5YR 5/6) brown (7.5YR 5/4), very dark grayish brown (10YR 3/2) very gravelly to cobbly sandy loam; massive; firm, slightly sticky, and slightly plastic; many, fine to coarse manganese concretion; common, fine mica flakes; common, fine quartz fragments; many cobbles; clear, wavy boundary; pH 6.3.

The Ap horizon is brown to dark brown or yellowish brown loam to clay loam or silty clay loam, and contains common to many angular gravels, cobbles, and some stone. The B and C horizons are yellowish brown to brown, yellowish red, brownish yellow or reddish yellow sandy loam to clay loam with many to common gravel, cobbles and stones.

The Seogto are on the same footslopes as the Jangweon and are mapped only in a complex mapping unit with them. This series differs from the Jangweon in lacking a fragipan horizon. The soils are slightly to strongly acid, moderate to moderately

low in natural fertility, and medium in organic matter. Permeability is moderately rapid, and available moisture capacity is low to medium. Cation exchange capacity is low, and base saturation medium to high.

Cultivated crops other than rice are general and in some areas chestnut, persimmon, and mulberry trees are growing.

5.25.1 Seogto-Jangweon Complex, 7 to 15 Percent Slopes (SJC)

The Seogto soils occupy the upper part of the footslopes and the Jangweon the lower. The former make up about one half of the area, and the latter with other soils, the rest. They have profiles similar to the ones described for their series. Some small areas have a gravel-free surface soil. Some areas of gold mine dumps, and a few small areas of less sloping soil are also included. The Seogto have a thick rooting zone, and the Jangweon a thinner root zone. They are difficult to work because of the high cobble content. Surface runoff is medium to rapid, and erosion a severe hazard.

Only a limited range of crops will do well, the soils being best suited for orchard, chestnut, persimmon, and pasture. However, now they are mostly in cultivated crops. The cobble content and erosion hazard are the main management proolems.

Capability unit IVe.

5.25.2 Seogto-Jangweon Complex, 15 to 30 Percent Slopes (SJD)

The Seogto occupy the upper part of the footslopes and the Jangweon soils the lower part. This complex consists of about 70 percent Seogto, 20 percent Jangweon, and 10 percent of other soils. The profiles are similar to these described for their respective series except somewhat more stones are common. In this mapping unit are included some areas of gold mine dump. The rooting zone is thick in the Seogto, but thin in the Jangweon. They are difficult to work because of the high gravel and stone content. Surface runoff is medium to rapid, and erosion hazard severe.

Cultivation, if erosion is adequately controlled, is possible, but pasture, orchard, or woodland are better suited. About 40 percent is in cultivated crops, 30 percent in orchard of nut trees, and another 30 percent is wooded. Removal of stones from the surface layer, and erosion control, are the main management problems.

Capability unit IVe.

5.26 SEONGSAN SERIES

The Seongsan series, a member of the coarse loamy family of Dystric Fluventic Eutrochrepts, consists of gently sloping, deep, well drained soils formed in alluvium-colluvium washed from the adjacent areas underlain by granitic materials. These soils are on concave footslopes and small valley areas. Depth to bedrock ranges from 5 to 10 m.

A typical profile follows.

A11—0 to 10 cm; brown (7.5YR 5/4) sandy loam; weak, fine to medium granular structure; friable, nonsticky, and non-

plastic; many fine pores; many fine mica flakes; common fine gravel; many fine roots; clear, smooth boundary; pH 6.0.

A12--10 to 43 cm; strong brown (7.5YR 5/6) coarse sandy loam; massive, breaking to weak granular structure; firm; common fine pores; many fine mica flakes; common fine gravel; common fine to medium roots; abrupt smooth boundary; pH 6.0.

B1--43 to 65 cm; reddish yellow (5YR 6/8) coarse sandy loam; weak medium granular structure; friable; common fine pores; many fine mica flakes; common fine gravel; common fine to medium roots; abrupt smooth boundary; pH 6.0.

B2--65 to 86 cm; yellowish red (5YR 5/8) coarse sandy loam; massive breaking to single grain; friable, slightly sticky, and nonplastic; common fine pores; many fine mica flakes; common fine gravel; common fine to medium roots; clear smooth boundary; pH 6.1.

B3--86 to 110 cm; yellowish red (5YR 5/8) coarse sandy loam; single grain; friable, nonsticky, and nonplastic; common fine pores; common fine mica flakes; common fine gravel; few, fine roots; gradual, smooth boundary; pH 6.1.

The surface layer, 20 to 40 cm thick, is generally yellowish red to red or yellowish brown, and brown to dark brown or strong brown in cultivated areas. Texture ranges from sandy loam to silt loam or loam.

The Seongsan, associated with the Yongji and Bansan soils, are slightly to strongly acid, low in natural fertility, and medium in organic matter content. Permeability is rapid, and available moisture capacity medium. Cation exchange capacity is low, and base saturation high.

Most areas are in cultivated crops other than rice, but some are in poor pine forest and grassland.

5.26.1 Seongsan-Yongji Complex, 2 to 7 Percent Slopes (SYB)

The Seongsan are coarse loamy and well drained, while the Yongji are fine loamy and moderately well drained. The Seongsan soils are the more extensive. Most areas have profiles similar to that described for their respective series. Small areas of soils with dark surfaces and a few small scattered areas of greater slope than the described range are also comprised. The Seongsan of this complex have a thick root zone. Surface runoff is moderate, and erosion hazard slight.

The Seongsan is suited to locally grown crops if it is treated with clayey soil. The Yongji are well suited to both paddy rice and nonirrigated crops if adequate drainage is provided. All areas are cultivated to rice and barley or wheat.

Capability unit IIs.
Rice suitability group P4abc.

5.27 SINDAB SERIES

The series consists of gently sloping, deep, poorly drained soils formed in alluvium washed from uplands underlain by granite. These soils are members of the sandy family of Typic Psammaquents.

A typical profile follows.

Ap--0 to 10 cm; mottled, gray (5Y 5/1), yellowish red (5YR 4/8) and strong brown (7.5YR 5/6) sandy loam; massive; friable, nonsticky, and nonplastic; many fine pores; many fine mica flakes; many fine roots; abrupt smooth boundary; pH 6.9.

C1g--10 to 25 cm; dark gray to very dark gray (5Y 4/1-3/1) loamy sand with few fine, prominent, strong brown (7.5YR 5/8) mottles; massive; firm, nonsticky, and nonplastic; common fine mica flakes; fresh gravel fragments; few fine roots; abrupt smooth boundary; pH 5.7.

C2g--25 to 100+ cm; gray (5Y 5/1) loamy coarse sand; single grain; loose, nonsticky, and nonplastic; many fine mica flakes; common gravel; pH 5.7.

These soils have an Ap horizon of gray to dark gray or grayish brown sandy loam to coarse sandy loam or loamy sand with brown to dark brown or yellowish brown mottles. The Cg horizons are gray to very dark gray sand or loamy sand with mottles of strong brown or yellowish red, and contain some gravel in places. Fine mica and quartz are common in the profile.

The Sindab soils, commonly associated with the Baeggu and Hwangryong, are coarser textured than the second, and also differ from the well drained Hwangryong soils in lacking gravel.

Natural fertility and organic matter content are low, and the soil is slightly to medium acid. They are rapidly permeable, and have a low available moisture capacity. Cation exchange capacity is low, and base saturation medium to high. The area they cover is large, and mostly in rice paddy.

5.27.1 Sindab-Baeggu Complex, 0 to 2 Percent Slopes (SB)

The Sindab are about 70 percent and the Baeggu soils 30 percent of the complex. Most areas have a profile like that described for the Sindab or the Baeggu series. In this complex are included small areas of a poorly drained soil which has been disturbed by gold mine operations, a few small tracts of imperfectly drained, silt loam to very fine sandy loam, and some small scattered areas of fine loamy to coarse loamy soils developed in local alluvium. The Sindab soils are low, and the Baeggu medium, in clay content.

Surface runoff is slow to very slow and the groundwater table is usually near the surface. Rice because of the poor drainage, is best suited and all of the areas are in paddy. Major management needs are to reduce the leaching of nutrients and improve drainage.

Capability unit IVw.
Rice suitability group P3b.

5.28 SONGJEONG SERIES

The Songjeong series, consisting of sloping to moderately steep, deep, well drained soils formed over granite-gneiss saprolite, are members of the fine loamy family of Typic Hapludults. These soils are on dissected pediplains of mountain areas. Depth to bedrock ranges from 3 to 8 m.

A typical profile follows.

B21t--0 to 20 cm; red (2.5YR 4/6) sandy clay loam with common, fine distinct light red (2.5YR 6/8) mottles; weak, fine to medium blocky structure; friable, nonsticky and nonplastic; patchy, thin clay cutans; many fine pores; many fine to medium mica flakes; many fine to medium roots; clear smooth boundary; pH 5.4.

B22t--20 to 50 cm; red (2.5YR 4/8) sandy clay loam with many, fine to medium distinct, light red (2.5YR 6/8) mottles; weak, very coarse blocky structure; friable, nonsticky, and nonplastic; thick clay cutans; many fine pores; many fine to medium mica flakes; few fine roots; diffuse smooth boundary; pH 5.5.

B3--50 to 100 cm; red (2.5YR 4/8) sandy loam with common, fine to medium, distinct mottles of red (2.5YR 5/8) and common, fine, prominent mottles of dark brown (10YR 3/3); massive; friable; many fine to medium mica flakes; many fine pores; diffuse, smooth boundary; pH 5.9.

C1--100 to 150 cm; mottled, red (2.5YR 5/8), very dark grayish brown (10YR 3/2) and reddish yellow (5YR 6/8) coarse sandy loam saprolite; friable; many, fine pores; many, fine to medium mica flakes; diffuse smooth boundary; pH 5.8.

C2--150 to 200 cm; white (5YR 8/1), dusky red (2.5YR 3/2), strong brown (7.5YR 5/8) and very dark grayish brown (10YR 3/2) coarse sandy loam saprolite; single grain; pH 5.8.

The Songjeong have surface layers of brown to dark brown or yellowish brown loam or silt loam in the only slightly eroded areas, but in those severely eroded the surface layer is red to yellowish red sandy loam to sandy clay loam. The subsoil is red, yellowish red or reddish brown loam, silt loam, sandy loam or sandy clay loam. The C horizon is strongly weathered acidic crystalline saprolite. Many mica flakes are throughout the profile.

The Songjeong are associated with the Dalcheon, Samgag, Jeonnam, and Jingog soils. These are fine loamy, while the Dalcheon, Jeonnam, and Jingog are fine clayey. They differ from the Samgag soils in having finer texture and greater soil depth.

The Songjeong soils, strongly acid, low in natural fertility, and low in organic matter, are moderately permeable, and have a medium available moisture capacity. Cation exchange capacity is medium, and base saturation low.

The areas covered by these soils are small, and are mostly in cultivated crops, with some wooded areas.

5.28.1 Songjeong-Samgag Complex, 7 to 15 Percent Slopes, Eroded (SSC2)

These soils are so intermixed that they can not be mapped separately on the scale used. About 70 percent of the mapped area has a profile similar to that described in the Songjeong series. The rest is similar to that described in the Samgag series. In the areas mapped are included some hilly tracts in Yongji Myeon, graded for an airport, but now used for farming, some small areas of more clayey soil and a few small places with less slope than the described range. Surface runoff is moderate to rapid, and erosion is a severe hazard. These soils are easy to work, and have a thick rooting zone.

The soils of this complex are suited to a wide range of locally grown nonirrigated crops. These are grown with small areas cultivated to paddy rice. Erosion control is the main management problem. Terraces, contour cultivation, grassed waterways and other conservation practices, as well as perennial hay and pasture crops, will do much to control this.

Capability unit IIIe.

5.28.2 Songjeong-Samgag Complex, 7 to 15 Percent Slopes, Severely Eroded (SSC3)

The upper horizons of this mapping unit have been eroded and common to many gullies have cut into the underlying saprolite to depth of 50 to 100 cm. Most of the areas between them have profiles similar to that described for Songjeong or the Samgag series.

Cultivation in the past was usual, but now the land is left idle. Some areas have a cover of poor trees and shrubs. Smoothing and grading of these soils is costly and much fertilizer will be required to obtain moderate yields of crops. Conservation practices and cropping systems that reduce soil losses are needed to keep it productive. With much fertilizer and good management moderate yields of many crops including forage may be obtained.

Capability unit IIIe.

5.28.3 Songjeong-Samgag Complex, 15 to 30 Percent Slopes, Severely Eroded (SSD3)

The upper horizons have been removed by erosion, and many gullies have cut into the underlying saprolite to a depth of 1 m or more. Most areas between have profiles similar to that described for the Songjeong or the Samgag series.

Cultivation in the past was usual, but because of erosion, now only trees are grown. The soils are better suited to the production of pasture and hay than the annual crops, but bench terraces will reduce erosion losses if the latter are cultivated.

Capability unit IVe.

5.29 SUBUG SERIES

The Subug series, consisting of deep, gently sloping, poorly drained soils, is a member of the coarse loamy over sandy skeletal family of Fluventic Haplaquepts.

These soils formed in alluvium on local valley floodplains and terraces in the mountainous areas of the east.

A typical profile follows.

Ap--0 to 10 cm; olive gray (5Y 5/2) sandy loam with many fine prominent strong brown mottles; massive; friable, slightly sticky, and slightly plastic; many fine to medium pores; many fine mica flakes; many roots; clear, smooth boundary; pH 4.7.

C1g--18 to 40 cm; olive gray and olive brown (5Y 5/2 and 2.5Y 4/4) loam with common, distinct yellowish brown mottles; weak angular blocky structure; continuous thin cutans; common fine quartz crystals and many fine mica flakes; common fine roots; clear, smooth boundary; pH 5.5.

C2g--40 to 60 cm; light gray to gray (5Y 6/1), dark brown (10YR 3/3), and light olive brown (2.5Y 5/4) sandy loam; weak, coarse blocky structure; slightly sticky and slightly plastic; patchy cutans; few, fine gravel pieces; many fine manganese concretions; few fine roots; abrupt smooth boundary; pH 6.0.

IIC3g--60 to 75 cm; mottled, strong brown (7.5YR 5/8), light gray (10YR 7/2), and dark brown (7.5YR 3/2) very gravelly loamy sand single grain; many fine quartz gravel pieces and many fine mica flakes; few fine roots; common fine pores; abrupt smooth boundary; pH 6.5.

IIC4g--75 to 130+ cm; grayish brown (10YR 5/2) very gravelly loamy sand; single grain; pH 7.5.

The loamy surface layers, ranging in thickness from 30 to 75 cm, are olive gray, gray, dark gray or grayish brown to dark grayish brown, and are mottled with olive brown, dark yellowish brown and yellowish red. Texture ranges from sandy loam to loam or silt loam with or without some gravel. The substratum, grayish brown to dark grayish brown very gravelly loamy sand, is mottled in places with shades of gray, brown and yellowish red. The gravel content is more than 35 percent, and increases with depth.

The Subug are associated with Jisan and Hogye soils. They are coarser-textured than the Jisan, and are not so well drained as the Hogye.

Organic matter content is medium to high and natural fertility moderately high. They are medium to strongly acid. Permeability is moderately rapid, and available moisture capacity low. Cation exchange capacity is low, and base saturation medium to high.

The total land is of small extent and chiefly is found in small valleys of the mountainous areas in the east. Rice, barley or wheat, are grown in most places.

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

Most areas have a profile like that described for the series. But, included in the areas mapped are some silty clay loam surface soil, small tracts that have a

silty clay loam subsoil, a few small scattered areas of moderately to well drained soils, small areas of dark coloured, well drained, very gravelly soils, and small areas of sloping land. This soil has a moderately thick rooting zone, and is easy to till. Surface runoff is medium to slow.

Paddy rice is suitable as are general crops if good drainage is provided. Rice paddy, cultivated to barley during the winter months, is dominant. The main management problems are the leaching of plant nutrients and insufficient drainage for most crops.

Capability unit IIIw.
Rice suitability group P3ab.

5.30 TAEHWA SERIES

The Taehwa series, consisting of steep, deep, well drained soils developed in residuum weathered from porphyry, granite, and granite-gneiss, are members of the fine loamy family of Typic Hapludults. These soils are distributed on strongly dissected mountainous areas. Depth to bedrock ranges from 2 to 5 m.

A typical profile follows.

Ap—0 to 10 cm; brown (10YR 5/3) loam; weak, fine granular structure; friable, slightly sticky, and plastic; many fine to medium pores; few fine mica flakes; few, fine quartz gravel pieces; many fine to coarse roots; clear smooth boundary; pH 6.1.

B21—10 to 45 cm; yellowish brown (10YR 5/6) gravelly to cobbly sandy loam; massive; friable, slightly sticky, and plastic; many fine to medium pores; few fine mica flakes; few fine to medium roots; clear smooth boundary; pH 6.2.

B22—45 to 75 cm; strong brown (7.5YR 5/6) sandy loam; massive; firm, slightly sticky, and slightly plastic; common, fine to medium, prominent, white (10YR 8/2) mottles; common fine pores; no mica; few gravel pieces; few fine roots; clear smooth boundary; pH 6.7.

C1—75 to 150+ cm; mottled, strong brown (7.5YR 5/6), white (10YR 8/2); brownish yellow (10YR 6/6) gravelly sandy loam; single grain; friable; many fine mica flakes; pH 6.9.

The surface layer is brown to dark brown or yellowish brown, friable loam, silt loam, or fine sandy loam, and ranges in thickness from 10 to 20 cm. The subsoil is strong brown to yellowish brown, friable to firm fine loamy soil, and is 50 to 100 cm thick. The substratum is mottled strong brown to pale brown, moderately to weakly weathered sandy loam to silt loam.

The Taehwa, commonly associated with the Mudeung soils, have less rock outcrops and are deeper than them.

They are medium to low in organic matter, moderately low in natural fertility, and are strongly to slightly acid. They are moderately permeable, and have a medium available moisture capacity. Cation exchange capacity is low to medium, and base saturation is low.

These soils are mostly in the Moag mountain areas, and are in forest of pine, alder, acacia, and oak. A few small areas have been cleared, and are cultivated to crops other than rice.

5.30.1 Taehwa Rocky Loam, 30 to 60 Percent Slopes, Severely Eroded (TrE3)

In most places rock outcrops and stones are common on the surface. The former occupy about 25 to 50 percent of the area, but most land has a profile like that described for the series. In the areas mapped are comprised a few scattered small areas of a slightly eroded soil that has a sandy clay loam or silt loam surface soil, small scattered tracts of the Samgag, Seogto, and Jangweon soils, and some gullied land. The root zone is thick. Surface runoff is very rapid, and erosion hazard very severe.

Woodland or pasture is suited and most places are in poor fine forest, with a few small tracts in nonirrigated crops. Erosion control is the major management problem. Moderate amounts of grazing can be obtained from this soil when it is well managed for pasture land.

Capability unit VIIe.

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.

Soil characteristics favourable for paddy rice differ from those for other crops. Rice is considered in the discussions of capability groups, and is also 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 grouping, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. There are no soils placed in Class V in Gimje 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 in each capability class, and are designated by adding a small letter, e, s, w, or c to the class numeral, for example, IIe. The letter 'e' shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; 's' that the soil is shallow, droughty, or stony; 'w' that water in or on the soil interferes with plant growth or cultivation, and 'c' indicates that the soil chemistry (high salt content and high acidity, etc.) is a limiting factor.

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 without special management, with irrigation water needs being low. These soils are too wet to produce good yields of other crops without additional drainage. The IVs soils produce good crops of melon and peanuts, but they are too droughty to grow most other crops. In Class I there are no subclasses because these soils 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 subclass. 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.

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, well drained, deep soil with a silty surface layer and high available moisture capacity. This soil has moderate or high natural fertility and medium organic matter content. The unit makes up 0.5 percent or 292 ha of the total area of the Gun. It is Ihyeon silt loam, 0 to 2 percent slopes.

A wide range of crops, including paddy rice, is well suited. The land is highly productive, and can be cropped intensively if it is well managed. All available crop residues turned into the soils will improve fertility. Liming, as needed, is also a good management practice. Neither artificial drainage nor special practices to control erosion are needed.

6.2.2 Class II. Soils Having Moderate Limitations

6.2.2.1 Capability unit IIe.

In this unit are gently sloping, deep, moderately well to well drained, moderately permeable, fertile soils with a high available moisture capacity.

These cover 5 710 ha or about 9 percent of the Gun. They are:

Bansan-Yongji complex, 2 to 7 percent slopes.

Changpyeong silty clay loam, 2 to 7 percent slopes, eroded.

Hwadong silty clay loam, 2 to 7 percent slopes.

The soils of this unit are used for a wide range of crops, such as soybean, rice, corn, barley, wheat, and many other crops commonly grown in the Gun, but are subject to moderate erosion hazard when they are regularly cropped and not protected by soil conservation practices. Most of the soils are strongly acid.

The erosion can be controlled by contour farming, terraces, grassed waterways, and diversion channels. Many tracts have been level-terraced and diked to grow paddy rice. In these paddies, erosion and runoff are controlled as long as the paddy dykes are properly maintained, with well-constructed weir dams.

Good management also includes minimum tillage, crop residues turned in, liming as needed, and proper fertilization. The Hwadong soils need some application of sandy soil because of their high clay content.

6.2.2.2 Capability unit IIs

The soils in this unit are gently sloping, well drained, deep, rapidly permeable, dark coloured, and have gravelly loam or coarse sandy loam textures, covering 2 007 ha or approximately 4 percent of the Gun. These soils are moderate in natural fertility, high in organic matter content, and low to medium in available moisture capacity. They are:

Hogye gravelly loam, 2 to 7 percent slopes.

Seongsan-Yongji complex, 2 to 7 percent slopes.

The Yongji soil included in this unit is moderately well drained, moderately permeable, and has a high available moisture capacity. It is suited for paddy and cultivated to paddy rice in the summer, and barley in the winter-spring. The rest of the soils are suited, for instance, to soybeans, barley, wheat, vegetables, and to orchard and mulberry fields. They are moderately subject to droughtiness because of the high water loss through the rapidly permeable, gravelly loam or coarse sandy loam profile. Removal of gravel will help reduce this water seepage and will make cultivation easier, but it is difficult to remove the gravel from the Hogye soil. Frequent application of fertilizer will lessen the effect of the leaching of plant nutrients.

6.2.2.3 Capability unit IIw

This capability unit consists of level and gently sloping, poorly to imperfectly drained, moderately or moderately rapidly permeable soils that have high water table, covering 15 282 ha or about 30.3 percent of the Gun. These soils are:

Geugrag silt loam, 0 to 2 percent slopes.

Jeonbug silt loam, 0 to 1 percent slopes.

Jisan loam, 2 to 7 percent slopes.

Nangyeong silt loam, 0 to 1 percent slopes.

The soils of this unit generally have a high or medium available moisture capacity, and are suited to paddy rice because of their high water table. But, special management practices may be required to grow other crops, such as ditches to drain the soils and lower the water table.

No special measures to control erosion are needed as most of the land has been shaped into paddies. However, the paddy dikes need to be properly maintained to control runoff and erosion of paddy walls. Well-built weir dams will prevent this. If these soils were drained, winter grain crops such as barley would grow well after paddy rice, and crops other than rice would also do well during the summer. Proper fertilization and liming as needed will increase yields.

6.2.3 Class III. Soils with Severe Limitations

6.2.3.1 Capability unit IIIe

In this capability unit are mostly sloping, deep, well drained eroded soils, which cover 10 952 ha or about 20 percent of the Gun total area. These soils are:

Dalcheon-Songjeong complex, 7 to 15 percent slopes, eroded.

Gwangsan-Jingog complex, 7 to 15 percent slopes, eroded.

Songjeong-Samgag complex, 7 to 15 percent slopes, eroded.

Songjeong-Samgag complex, 7 to 15 percent slopes, severely eroded.

Most of the soils have moderate or high available moisture capacities. In the eroded areas, the original surface layer has been washed away, and the light-coloured subsoil is now exposed. As a result, natural fertility is low as is organic matter content. The land is mostly suitable for crops and is being used for those such as barley, wheat, and soybean. Some areas are in woodland.

Erosion is the chief hazard in cultivated areas. Contour tillage, terraces, grassed waterways, and weir dams will help.

Proper fertilization, liming as needed, and all crop residues turned in will also help produce high yields.

Pasture is also suited and a complete establishment programme including land preparation, liming, fertilization, seeding of adapted plants and regulation of grazing is required.

For orchards and mulberry fields, bench terraces constructed on these soils will assist in erosion control. Green manure crops cultivated as intercrops between orchards or mulberry trees will improve the soil fertility, reduce erosion, and increase yields.

6.2.3.2 Capability unit IIIs

The only soil in this ground is mine dump. The materials are somewhat variable in texture, but generally deep, moderately permeable, and well drained. Local areas may be ponded. Slopes are short and irregular and include somewhat lesser and greater slopes than indicated by the described range.

Because of the irregular topography rice is not suited but barley, wheat, soybeans and potatoes are grown. Some of the more sandy land may grow better crops of rye than barley. A well balanced programme of fertilization and other cultural practices will help the production of moderate yields on this soil.

6.2.3.3 Capability unit IIIw

In this capability unit are level to nearly level, poorly drained, deep soils that have a high water table. These cover 8 217 ha or about 15 percent of the Gun. They are:

Baeggu silt loam, 2 to 7 percent slopes.

Bongnam silty clay loam, 0 to 1 percent slopes.

Buyong silty clay loam, 0 to 1 percent slopes.

Gimje silty clay loam, 0 to 1 percent slopes.

Gongdeog silty clay loam, 0 to 2 percent slopes.

Honam silty clay loam, 0 to 2 percent slopes.

Subug sandy loam, 2 to 7 percent slopes.

Available moisture capacity is high, and permeability is slow to very slow.

Paddy rice is generally cultivated each year, and some of the soils are planted to winter barley after its harvest. The high water table is the chief hazard in growing other suitable crops, but if the soils were adequately drained, this would be possible. A system of drainage ditches and other drainage installations is needed to remove excess surface water, to lower water table, and to improve internal drainage. This is difficult because of the low elevations and the permeability of the subsoil which permits only slow drainage. Pumping would be required in many areas because of the proximity to sea level. In the Buyong and Honam soils, bedding or hill row culture is advisable to increase drainage when growing general crops.

Cover crops and crop residues will supply organic matter and help to maintain tilth in intensively cultivated areas. Higher yields can be expected if adequate fertilizer and lime are used.

6.2.3.4 Capability unit IIIwc

The only soil in this unit covers 537 ha or about 1 percent of the Gun. It is level to nearly level, poorly drained, deep, moderately permeable, and moderately alkaline, and has a high salt content. This soil was a tidal flat, but is now protected from flooding by dikes. It is Gwanghwal silt loam, 0 to 1 percent slopes.

Paddy rice is suitable, and is grown in the summer, followed by barley in the winter-spring season. A few small areas are used for extracting salt from sea water.

The high salt content with poor drainage is the chief hazard in growing cultivated crops. Thus, irrigation with fresh water should be frequent in order to remove it. The installation of tile drains will help create conditions for higher yields of crops other than rice. Bedding or hill row culture are poor substitutes for a well designed drainage system.

6.2.4 Class IV. Soil with Very Severe Limitations

6.2.4.1 Capability unit IVe

In this capability unit are moderately steep and sloping, deep or moderately deep, well drained soils, which cover 1 620 ha or about 3 percent of the Gun. These soils are:

Dalcheon-Songjeong complex, 15 to 30 percent slopes, eroded.

Seogto-Jangweon complex, 7 to 15 percent slopes.

Seogto-Jangweon complex, 15 to 30 percent slopes.

Songjeong-Samgag complex, 15 to 30 percent slopes, severely eroded.

Most of the soils have moderate or low available moisture capacities. On the eroded land the original surface layer has been washed away and the light-coloured subsoil is now exposed. As a result, natural fertility and organic matter content are low.

Pine forest dominates with some soils in cultivated crops. The latter is poorly suited, but pasture, orchards, and trees are not. Erosion is only a small problem when these soils are covered with good grass pasture. High yields of forage crops can be expected if fertilizer and lime are used. Orchards established on bench terraces will produce well without the hazard of erosion developing.

Cover crops and other erosion control measures are necessary in clean-tilled orchards that are not terraced. Maintaining grassed waterways will prevent gullying. Many areas with a sparse stand of trees are being eroded very rapidly mainly because the soil is bare after raking and removing 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.

6.2.4.2 Capability unit IVs

The only soil in this capability unit is nearly level, deep, well drained, very coarse textured, rapidly permeable soils that have very low available moisture capacity. This soil covers 200 ha or about 0.4 percent of the Gun. It is Hwangryong gravelly loamy sand, 0 to 2 percent slopes.

Natural fertility and organic matter are both low and the land is poorly suited to most cultivated crops. But, peanut, melon, tobacco, some vegetables, poplar, mulberry, and orchards are well suited. Some of the Hwangryong soils are in paddy rice as water is available from the nearby streams. Droughtiness or low available moisture capacity is the chief hazard, and pastures as well as other crops would produce better yields if irrigated. Flooding is only for short periods of time and most damage is caused by the rapidly moving water.

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

6.2.4.2 Capability unit IVw

In this capability unit are level or gently sloping, poorly drained, deep, rapidly permeable, coarse-textured soils that have high water tables. These soils cover 1 187 ha or approximately 2 percent of the Gun. They are:

Sindab-Baeggu complex, 0 to 2 percent slopes.

These soils are on depressed floodplains that have poor drainage outlets. The Sindab areas of the Sindab-Baeggu complex are low in available moisture capacity, natural fertility, and in organic matter content. The Baeggu areas have a moderate available moisture capacity and are less droughty.

Wetness and rapid permeability are the chief hazards. Paddy rice, because of the high water table, is the only suitable crop and its yields are generally low.

Drainage of the Sindab soil is difficult because of its elevation which is lower than the stream bed. Proper fertilization in split application is needed to lessen the effects of leaching through the coarse-textured profile.

6.2.5 Class VI. Soils Suitable Only for Pasture or Woodland

6.2.5.1 Capability unit VIe

This capability unit consists of moderately steep to steep, deep or shallow, well drained, rocky, eroded or severely eroded soils, and covers 3 102 ha or approximately 6 percent of the Gun. They are:

Mudeung rocky loam, 30 to 60 percent slopes.

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

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

Because of the steep slopes, shallow soil depth, advanced erosion, rockiness or stoniness, these soils are generally unsuited for cultivation. But pasture and woodland if properly managed are suited. The present land use is poor pine forest or grassland, but, managing the latter is difficult because of the steep slopes, and intensive grazing will leave the soils bare and subject to further erosion. This will be low, however, on properly managed land.

Farmers should select areas that are best suited to trees or to pasture, and should improve the wooded areas by protecting them from grazing. Trees can be planted where necessary, or if pasture is desired, the areas can be cleared, fertilized, and seeded to adapted forage crops. But, many of these soils have a surface layer that is strongly acid in reaction, which is favourable to pine trees, but would require much liming to develop the soils for pasture. Some tracts can be developed into orchard or mulberry field.

6.2.6 Class VII. Soils Limited to Woodland

6.2.6.1 Capability unit VIIe

This capability unit consists of steep, well drained, deep, rocky or very rocky soils, and cover 3 244 ha or about 6 percent of the Gun.

Mueung very rocky loam, 30 to 60 percent slopes.

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

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

Taehwa rocky loam, 30 to 60 percent slopes, severely eroded.

Because of the topography only woodland is possible with grazing 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

In Gimje Gun the miscellaneous land unit, Riverwash, cobbly and sandy, is the only mapping unit in Class VIII. It consists of coarse sandy and cobbly deposits along the major stream channels. These are of such coarse soil materials and are so frequently flooded that useful plants do not grow.

6.3 PADDY LAND SUITABILITY GROUPS

Rice, the most important crop in Korea, grows well on soils that are too wet for most other crops. These wet soils are classified as IIw or IIIw in the capability classification. About 25 575 ha, three-fourths of the total cultivated area of 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 Gimje Gun suitable for the production of

paddy rice 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 letter, a, b, c, or d to the group numeral, for example, P2ac. The letter 'a' shows that the main limitation is slope; '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 is no subgroup, because the soils have no special limitations.

Some of the soils in subclass IIw and IIIw of the capability system are classified as P1 as 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 for Paddy

6.3.1.1 Paddy suitability group P1

This group, consisting of level to nearly level, deep, poorly or imperfectly drained, very slowly permeable soils that have a high water table, covers 15 017 ha or 28 percent of the Gun. The soils are:

Bongnam silty clay loam, 0 to 1 percent slopes.

Buyong silty clay loam, 0 to 1 percent slopes.

Geugrag silt loam, 0 to 2 percent slopes.

Gimje silt clay loam, 0 to 1 percent slopes.

Gongdeog silty clay loam, 0 to 2 percent slopes.

Honam silty clay loam, 0 to 2 percent slopes.

Jeonbug silt loam, 0 to 1 percent slopes.

The soils of this group are dominantly fine textured, and generally have high available mosture capacities. Most are high in natural fertility and high or medium in organic matter content.

Few management practices, other than proper fertilization and good cultural practices that are commonly needed for any paddy soils are required. Deep ploughing will help obtain somewhat higher yields, and calcium silicate fertilizer will reduce lodging. The high water table is a limitation to growing winter grain crops, such as barley or wheat, which the establishment of a well designed drainage system would permit. Early season culture, good varieties, and high level fertilization are also good measures to help obtain high yields.

6.3.2 Group P2. Well Suited for Paddy

6.3.2.1 Paddy suitability group P2a

These soils, gently sloping, deep, poorly drained, and moderately permeable with high water tables and moderate to high available moisture capacity, make up about 5 percent or 2 880 ha of total area of the Gun. They are:

Baeggu silt loam, 2 to 7 percent slopes.

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 usually have small paddies with irregular slopes, and are subject to losses of irrigation water and runoff unless dykes are properly maintained. Well-constructed weir dams are needed to control runoff from the 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 resist 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 textures. These have low water tables, and make up about 10 percent or 5 710 ha of the Gun total area. They are:

Bansan-Yongji complex, 2 to 7 percent slopes.

Changpyeong silty clay loam, 2 to 7 percent slopes, eroded.

Hwadong silty clay loam, 2 to 7 percent slopes.

The available moisture capacity is mostly high or moderately high, and natural fertility 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 used for barley, wheat, soybeans, and other nonirrigated crops. They are also well suited to paddy rice if paddy is established and water sources developed.

The soils of this group are subject to some loss of water because of the low water table and the slopes. Due to the former, frequent irrigation is needed to supply th rice plants with water. Paddy systems need well constructed weir dams to protect the paddy dykes from damage by overflow. Deep ploughing and application of calcium silicate are good cultural practices. Grain crops like barley or wheat grow well during the winter and spring after paddy rice. Many crops other than rice will also grow well during the summer.

6.3.2.3 Paddy suitability group P2b

The only soil in this paddy suitability group, is a deep, moderately to moderately rapidly permeable, poorly drained, level, silty or very fine sandy soil, nearly neutral in reaction and having a high available moisture capacity. It is Mangyeong silt loam, 0 to 1 percent slopes.

Fertilizer losses may be somewhat high but this can be reduced by the split application. On some tracts of very fine sandy soil the application of clay may be beneficial in reducing plant nutrient losses. Other beneficial practices are thick planting and the use of compost.

6.3.2.4 Paddy suitability group P2c

The only soil in this group, is level to nearly level, deep, well drained, moderately permeable, and silty. It covers 292 ha or 0.5 percent of the total area of the Gun. Available moisture capacity is high, natural fertility moderate, organic matter content medium, and the water table low. It is Ihyeon silt loam, 0 to 2 percent slopes.

Paddy rice is well suited but the low water table and moderate permeability allow somewhat excessive loss of water. At present nearly half of the area is in paddy rice which is planted to barley in the winter-spring. The rest is cultivated to other crops. Summer crops, such as soybean may be grown instead of paddy rice.

Loss of water and dissolved plant nutrients are a moderate problem. The loss of nitrogen fertilizer can be reduced by making several applications in small amount during the growing season. Because of the loss of water, a good irrigation system is needed. Dense planting and spreading compost are good management practices.

6.3.3 Group P3. Moderately Suited for Paddy

6.3.3.1 Paddy suitability group P3ab

The only soil in this group, is gently sloping to sloping, poorly drained, deep, moderately rapidly permeable, coarse textured, and has a high water table. It is Subug sandy loam, 2 to 7 percent slopes.

Natural fertility is moderately high and organic matter, medium. It covers 690 ha or 1.2 percent of the Gun total area, and is used for paddy rice, because of

the high water table. The slope and rapid permeability are chief limitations. If drained for production of other crops, low available moisture holding capacity would also be a limitation.

Paddy dikes with well-built weir dams are needed to control erosion, and nitrogen and other fertilizer should be applied to the soil in several applications during the growing season to reduce leaching. The addition of fine clay will also reduce the leaching of plant nutrients. Dense planting and dry land direct seeding are good rice culture practices.

6.3.3.2 Paddy suitability group P3ac

This group, consisting of sloping, deep, well or moderately well drained, moderately to moderately slowly permeable, eroded soils that have low water tables, covers 9 927 ha or 18 percent of the Gun. The soils are:

Dalcheon-Songjeong complex, 7 to 15 percent slopes, eroded.

Gwangsan-Jingog complex, 7 to 15 percent slopes, eroded.

Mainly general crops, with some areas of paddy rice where irrigation water is available is the usual pattern of land use. The soils of this group are suited to paddy rice, but the slope and low water table are problems, and only with the application of difficult special development and management practices (level-terracing and diking) can these be overcome. Paddies made on these soils need well-constructed weir dams to protect the dykes from damage by overflow following intense rains, because the slopes make them subject to erosion. The paddy system also permits other general crops to grow. Deep ploughing and application of compost are good cultural practices.

6.3.3.3 Paddy suitability group P3b

The only soil in this group, is level to nearly level, deep, poorly drained, rapidly permeable, sandy soil with low available moisture capacity and a high water table. This soil is usually on lower positions than stream bed. It is Sindab-Baeggu complex, 0 to 2 percent slopes.

All the land is now used and is suited for paddy rice because of the high water table, but is 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.

6.3.3.4 Paddy suitability group P3d

The only soil in this suitability group is a nearly level, deep, poorly drained, moderately permeable silty soil, covering 537 ha or about 1 percent of the Gun. The principal limitation for rice production is its high content of salts. It is Gwanghwal silt loam, 0 to 1 percent slopes.

The installation of tile drains and frequent irrigations with fresh water would remove them and in areas where yields are severely affected, drainage, and growing less sensitive plants may be profitable. The pH of these soils should be checked frequently as somewhat similar soils in other areas become acid when drained.

6.3.4 Group P4. Poorly Suited for Paddy

6.3.4.1 Paddy suitability group P4abc

This group, consisting of gently sloping to sloping, well drained, deep, moderately to rapidly permeable, gravelly or cobbly soils with moderate to low available moisture capacities, has low water tables, and covers 2 924 ha or 5.3 percent of the Gun. The soils are:

Hogye gravelly loam, 2 to 7 percent slopes.

Seongsan-Yongji complex, 2 to 7 percent slopes.

These soils are poorly suited for growing paddy rice, because of the slope and high water requirement. The minor soils like the Jangweon and Yongji are moderately well drained, and are mostly used for paddy rice. Losses of water and plant nutrients in the major soils would be high in paddies, while gravel and cobbles interfere with cultivation if not removed.

Paddies made on these soils will need good weir dams to control erosion of paddy walls. The construction of paddies is difficult because of the coarse fragments. Fine clayey soils should be added and gravel removed to reduce the effects of leaching of plant nutrients. Proper fertilization, thick planting, and dry land direct seeding are good rice cultural practices. Compost added will also improve yields.

6.3.4.2 Paddy suitability group P4ac

The only mapping unit in this group, consists of moderately steep, well drained, deep, moderately to moderately slowly permeable soils that have very low water tables. It covers 490 ha or about 0.9 percent of the Gun total area. It is Dalcheon-Songjeong complex, 15 to 30 percent slopes, eroded.

At present, most of this unit is in nonirrigated cultivated crops, with a few small areas irrigated to grow paddy rice with other areas wooded or left idle.

These soils are poorly suited to paddy rice because of the strong slopes and lack of irrigation water. Level-terraced for paddy systems is required as is a dependable source of water. Dry land direct seeding may be a way of growing rice on these soils. Deep ploughing and application of calcium silicate and compost are good management practices. Erosion of paddy walls would be controlled by weir dams. Winter grain crops following rice will grow well on these paddies.

6.3.4.3 Paddy suitability group P4bc

The only soil in this group, is level to nearly level, deep, well drained, rapidly permeable, sandy soil with very low available moisture capacity and low water table. This soil makes up 0.4 percent or 200 ha of the total area of the Gun. It is Hwangryong gravelly loamy sand, 0 to 2 percent slopes.

It has low clay content and low cation exchange capacity, and is subject to droughtiness. Paddy rice is grown in a few small areas where water is available, but the rest is poorly suited to cultivated crops other than peanut, melons, mulberry, and some orchard. Forage crops would produce high yields on this soil if irrigated. To grow paddy rice irrigation systems should be installed, and areas being considered

for construction of rice paddies should be investigated for content of coarse fragments that would interfere with cultivation.

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

Table 3

GUIDE TO MAPPING UNITS

Map Symbol	Mapping Unit	Capability Unit	Paddy Suit. Group
BaB	Baeggu silt loam, 2 to 7 percent slopes.	IIIw	P2a
BYB	Bansan-Yongji complex, 2 to 7 percent slopes.	IIe	P2ac
Bn	Bongnam silty clay loam, 0 to 1 percent slopes.	IIIw	P1
Bg	Buyong silty clay loam, 0 to 1 percent slopes.	IIIw	P1
CpB2	Changpyeong silty clay loam, 2 to 7 percent slopes, eroded.	IIe	P2ac
DJC2	Dalcheon-Songjeong complex, 7 to 15 percent slopes, eroded.	IIIe	P3ac
DJD2	Dalcheon-Songjeong complex, 15 to 30 percent slopes, eroded.	IVe	P4ac
Gr	Geugrag silt loam, 0 to 2 percent slopes.	IIw	P1
Gj	Gimje silty clay loam, 0 to 1 percent slopes.	IIIw	P1
Gg	Gongdeog silty clay loam, 0 to 2 percent slopes.	IIw	P1
Gw	Gwanghwal silt loam, 0 to 1 percent slopes	IIIwc	P3d
GGC2	Gwangsan-Jingog complex, 7 to 15 percent slopes, eroded.	IIIe	P3ac
HgB	Hogye gravelly loam, 2 to 7 percent slopes.	IIs	P4abc
Hn	Honam silty clay loam, 0 to 2 percent slopes.	IIIw	P1
HdB	Hwadong silty clay loam, 2 to 7 percent slopes.	IIe	P2ac
Hl	Hwangryong gravelly loamy sand, 0 to 2 percent slopes.	IVs	P4bc
Ih	Ihyeon silt loam, 0 to 2 percent slopes.	I	P2c
Jb	Jeonbug silt loam, 0 to 1 percent slopes.	IIw	P1
JiB	Jisan loam, 2 to 7 percent slopes.	IIw	P2a

Map Symbol	Mapping Unit	Capability Unit	Paddy Suit. Group
Mg	Mangyeong silt loam, 0 to 1 percent slopes.	IIw	P2b
MD	Mine dump.	IIIs	
MdE	Mudeung rocky loam, 30 to 60 percent slopes.	VIe	
MvE	Mudeung very rocky loam, 30 to 60 percent slopes.	VIIe	
MdE2	Mudeung rocky loam, 30 to 60 percent slopes, eroded.	VIe	
RCS	Riverwash (cobbly and sandy)	VIII	
SmD3	Samgag rocky sandy loam, 15 to 30 percent slopes, severely eroded.	VIe	
SmE3	Samgag rocky sandy loam, 30 to 60 percent slopes, severely eroded.	VIIe	
SvE3	Samgag very rocky sandy loam, 30 to 60 percent slopes, severely eroded.	VIIe	
SJC	Seogto-Jangweon complex, 7 to 15 percent slopes.	IVe	
SJD	Seogto-Jangweon complex, 15 to 30 percent slopes.	IVe	
SYB	Seongsan-Yongji complex, 2 to 7 percent slopes.	IIs	P4abc
SB	Sindab-Baeggu complex, 0 to 2 percent slopes.	IVw	P3b
SSC2	Songjeong-Samgag complex, 7 to 15 percent slopes, eroded.	IIIe	
SSC3	Songjeong-Samgag complex, 7 to 15 percent slopes, severely eroded.	IIIe	
SSD3	Songjeong-Samgag complex, 15 to 30 percent slopes, severely eroded.	IVe	
SpB	Subug sandy loam, 2 to 7 percent slopes.	IIIw	P3ab
TrE3	Taehwa rocky loam, 30 to 60 percent slopes, severely eroded.	VIIe	

Table 4

EXTENT (HECTARES) OF MAPPING UNITS

Map Symbol	Mapping Unit	Area (hectares)	Percent
BaB	Baeggu silt loam, 2 to 7 percent slopes.	1 390	2.5
BYB	Bansan-Yongji complex, 2 to 7 percent slopes.	4 358	7.9
Bn	Bongnam silty clay loam, 0 to 1 percent slopes.	471	0.9
Bg	Buyong silty clay loam, 0 to 1 percent slopes.	943	1.7
CpB2	Changpyeong silty clay loam, 2 to 7 percent slopes, eroded.	392	0.7
DJC2	Dalcheon-Songjeong complex, 7 to 15 percent slopes, eroded.	4 722	8.6
DJD2	Dalcheon-Songjeong complex, 15 to 30 percent slopes, eroded.	490	0.9
Gr	Geugrag silt loam, 0 to 2 percent slopes.	918	1.7
Gj	Gimje silty clay loam, 0 to 1 percent slopes.	3 729	6.8
Gg	Gongdeog silty clay loam, 0 to 2 percent slopes.	265	0.5
Gw	Gwanghwal silt loam, 0 to 1 percent slopes.	537	1.0
GGC2	Gwangsan-Jingog complex, 7 to 15 percent slopes, eroded.	5 205	9.4
HgB	Hogye gravelly loam, 2 to 7 percent slopes.	637	1.2
Hn	Honam silty clay loam, 0 to 2 percent slopes.	731	1.3
HdB	Hwadong silty clay loam, 2 to 7 percent slopes.	960	1.7
Hl	Hwangryong gravelly loamy sand, 0 to 2 percent slopes.	200	0.4
Ih	Ihyeon silt loam, 0 to 2 percent slopes.	292	0.5
Jb	Jeonbug silt loam, 0 to 1 percent slopes.	8 260	15.0
JiB	Jisan loam, 2 to 7 percent slopes.	1 490	2.7

Map Symbol	Mapping Unit	Area (hectares)	Percent
Mg	Mangyeong silt loam, 0 to 1 percent slopes.	5 694	10.3
MD	Mine dump.	222	0.4
MdE	Mudeung rocky loam, 30 to 60 percent slopes.	1 730	3.1
MvE	Mudeung very rocky loam, 30 to 60 percent slopes.	768	1.4
MdE2	Mudeung rocky loam, 30 to 60 percent slopes, eroded.	655	1.2
RCS	Riverwash (cobbly and sandy)	215	0.4
SmD3	Samgag rocky sandy loam, 15 to 30 percent slopes, severely eroded.	717	1.3
SmE3	Samgag rocky sandy loam, 30 to 60 slopes, severely eroded.	229	0.4
SvE3	Samgag very rocky sandy loam, 30 to 60 percent slopes, severely eroded.	263	0.5
SJC	Seogto-Jangweon complex, 7 to 15 percent slopes.	837	1.5
SJD	Seogto-Jangweon complex, 15 to 30 percent slopes.	293	0.5
SYB	Seongsan-Yongji complex, 2 to 7 percent slopes.	1 450	2.6
SB	Sindab-Baeggu complex, 0 to 2 percent slopes.	1 187	2.1
SSC2	Songjeong-Samgag complex, 7 to 15 percent slopes, eroded.	373	0.7
SSC3	Songjeong-Samgag complex, 7 to 15 percent slopes, severely eroded.	652	1.2
SSD3	Songjeong-Samgag complex, 15 to 30 percent slopes, severely eroded.	129	0.2
SpB	Subug sandy loam, 2 to 7 percent slopes.	690	1.2
TrE3	Taehwa rocky loam, 30 to 60 percent slopes, severely eroded.	1 984	3.6
	WR	746	1.4
	Others	307	0.6
	Total area of Gun	55 131	100.0

Appendix 1

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 combination of slippage and local wash.
Colluvium	Soil material, rock fragments or both moved by creep, or local wash and deposited at the base of a steep slope.

Consistence, Soil — 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 -

Loose. - Noncoherent; will not hold together in a mass.

Friable. - When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm. - When moist, crushed under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic. - When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a 'wire' when rolled between thumb and forefinger.

Sticky. - When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard. - When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft. - When dry, breaks into powder or individual grains under very slight pressure.

Cutan — 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.

Depth of Soil — 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.

Erosion — 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.

Family (soil) — 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.

Fluvio-marine — Deposited by joint action of streams and sea.

Fragipan — 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.

Horizon, Soil — A layer of soil, approximately parallel to the surface, that has distinct characteristics.

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:

	pH
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 12 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 flood-plain.

Texture, Soil

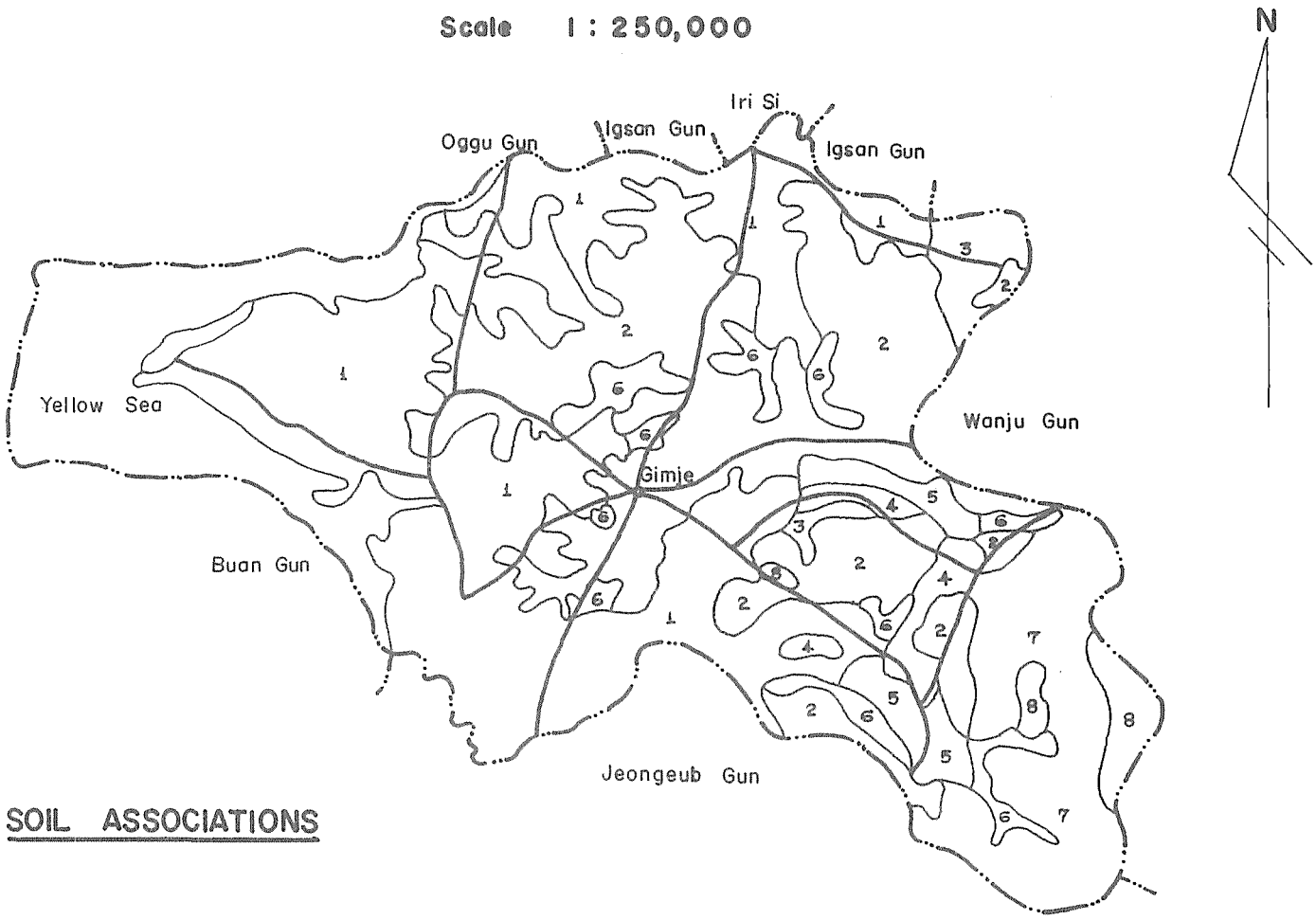
The relative proportions of sand, silt and clay in a soil mass.

Water Table

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

GENERAL SOIL MAP OF GIMJE GUN

Scale 1 : 250,000



SOIL ASSOCIATIONS

1 Jeonbug-Gimje Association: Nearly level, poorly to imperfectly drained, silty, slightly to moderately saline soils on the fluvio-marine plain.

2 Gwangsan-Songjeong Association: Sloping to moderately steep, well drained, clayey and loamy soils on the low upland areas.

3 Honam-Jisan Association: Nearly level to gently sloping, poorly drained soils.

4 Hwadong-Changpyeong Association: Gently sloping, well to moderately well drained, clayey soils on the stream terraces.

5 Sindab-Hwangryong Association: Nearly level, very sandy or gravelly, poorly to well drained soils on flood plains along the streams in the mountainous areas.

6 Yongji-Subug Association: Gently sloping, poorly to moderately well drained loamy soils in the small valleys.

7 Samgag-Taehwa Association: Moderately steep to steep, well to excessively drained, sandy loam to silt loam soils over saprolite of igneous rocks.

8 Mudeung-Rockland Association: Steep to very steep, somewhat excessively drained, shallow, rocky soils and land type with rock outcrops.