AGL:SF/KOR 13
Technical Report 10

SOIL SURVEY

REPUBLIC OF KOREA

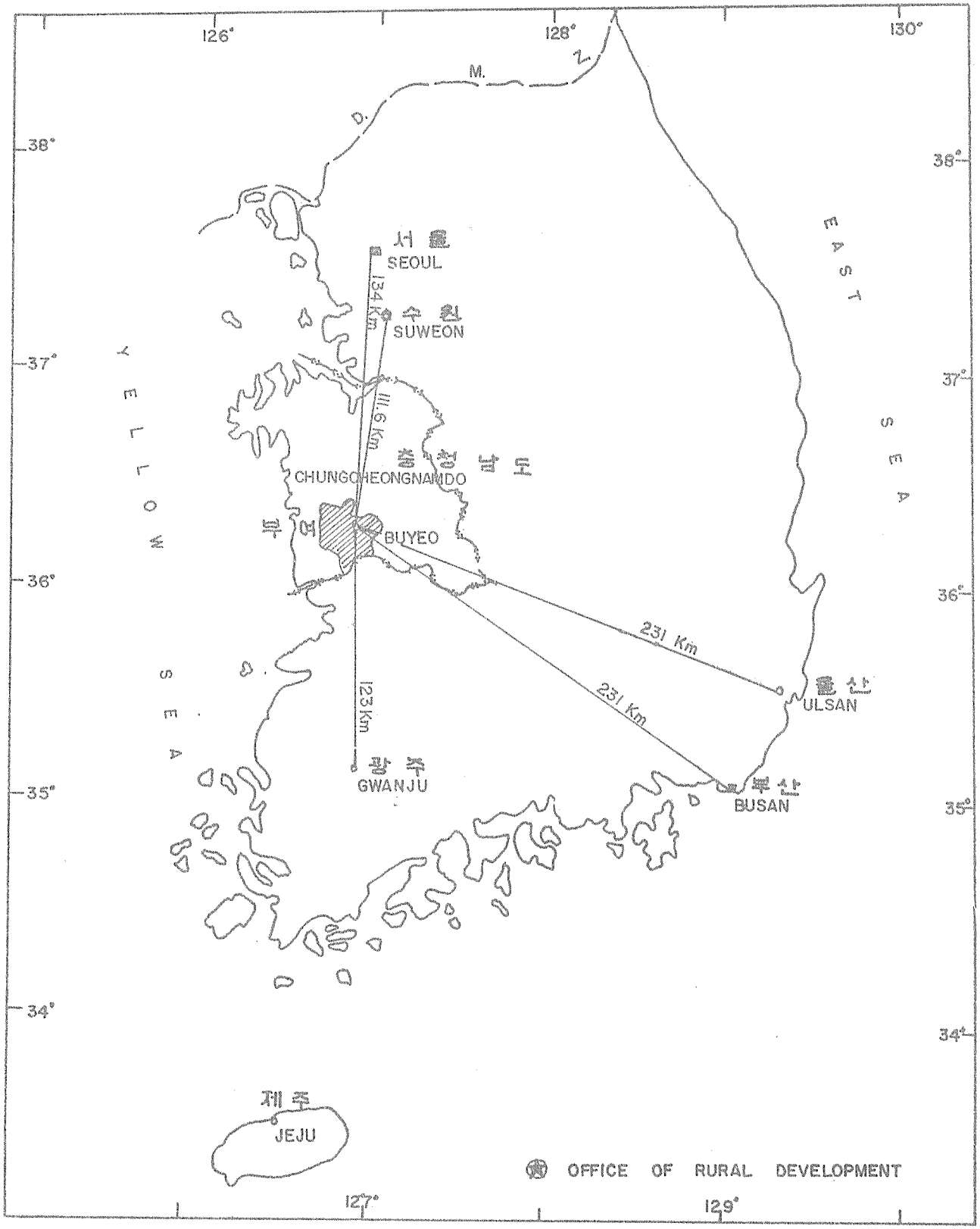
SOIL SURVEY IN BUYEO GUN, CHUNGCHEONGNAM DO

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

SOIL SURVEY

REPUBLIC OF KOREA

LOCATION MAP OF BUYEO GUN, CHUNGCHEONGNAM DO



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SOIL SURVEY

REPUBLIC OF KOREA

SOIL SURVEY IN BUYEO GUN, CHUNGCHEONGNAM 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 Buyeo Gun, Chungcheongnam Do.
Rome, 1970. 74 p. 2 maps. AGL:SF/KOR 13.
Technical Report 10.

ABSTRACT

This report describes soil survey activities in Buyeo 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 (62 558 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 16 500 hectares or 70 percent of the cultivated land is used for paddy rice. Management of the soils for paddy rice is discussed and the soils are placed in four paddy suitability groups, indicating progressively greater limitations in the use of the land for rice.

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

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

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LIST OF ABBREVIATIONS

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

Chapter 1

INTRODUCTION

The detailed soil survey described in this report began in March 1967 and was completed in July 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, 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 the area. It contains important information which will assist the Gun personnel, land owners, 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

This report has been compiled by the following: Jeong-Woo Lee; Myeong Jong; and Charles E. Downey. It is based on the work of:

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

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The list of reports, including the present volume are given below:

Technical Report 1. The Soils of Korea (with map at scale 1:1 000 000)
Technical Report 2. Soil Reconnaissance of Korea (with map at scale 1:250 000)
Technical Report 3. 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 Pyeongchang Gun
Technical Report 9. Soil Survey in Gimje Gun
Technical Report 10. Soil Survey in Buyeo Gun

Each individual 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

Buyeo Gun is in the southwestern part of Chungcheongnam Do (Map 1). It is bounded on the north by Cheungyang and Gongju Guns, on the south by Igsan Gun of Jeollanam Do, on the east by Nonsan Gun, and on the west by Yecheon and Boryeong Guns. The Gun occupies 62 558 ha, and measures 33.6 km from north to south and 34.4 km from east to west.

Buyeo, the Gun seat, is located in the northeast. In 1967 the Gun had a population of 192 209, which had declined by 3 000 as compared with that of 1966. This decline results from the concentration of population into urban areas for employment, required by the rapid industrial development.

2.2 PHYSIOGRAPHY AND DRAINAGE

The Charyeong Mountain range, extending from northeast to southwest through the northwestern part of the Gun, makes a pronounced difference in elevation between areas in the northwest and in the central and southeast. The lowest part is the tidal marsh at the southern point of the Gun along the Geum river, and the highest, in the extreme northwest. The elevation there is 524 m. The Gun is mountainous in the northwest and generally rolling and hilly in the central and southeast. The Guryeong plain, a broad alluvial plain of about 3 000 ha has been developed along the Geum river.

Drainage is mostly by the Geum river and its tributaries. The principal tributaries are the Geumcheon, Geumgancheon, Eunsancheon, and the Oesancheon. These streams join the Geum that flows southward through the central part and then southwestward, forming the Gun boundary.

2.3 WATER SUPPLY

Most water for domestic use is obtained from wells and springs. The Geum and its tributaries are main sources of surface water, being used to irrigate about one third of the rice paddy fields. In addition, large and small reservoirs have been established in many places to irrigate rice paddies.

2.4 CLIMATE

The climate is fairly mild, as this Gun is in the continental humid-temperate zone, and is influenced by the warm current of the Yellow Sea. Winters are cold

generally, and summers are very warm and moist. Spring and autumn are the most pleasant seasons. Information about the temperature and precipitation for the Gun is given in Table 1.

Precipitation is very heavy during the summer and light in the other seasons. Summer precipitation occurs frequently as thunderstorms which are likely to be brief, heavy, and localized. A long spell of rainfall caused by the monsoon is expected in the summer. Data for snow cover in this Gun is not recorded, but according to the Jeonju Meteorological Station, the average number of days with snow-cover is 1 day in November, 5 days in December, 11 days in January, 5 days in February and 2 days in March. These average figures are based on a 30-year record, 1931 through 1960. The average annual snowfall is not known, but the amount varies somewhat from year to year. The first freezing temperature occurs in mid-November, and the last in mid-March. Winter cold fronts generally come from the north.

The climate has not caused major differences among the soils because it is nearly uniform throughout the Gun. As can be expected, most of the soils are highly weathered, leached, strongly acid, and low in fertility.

Table 1

TEMPERATURE AND PRECIPITATION FOR BUYEO GUN

Month	Temperature (C)			Average Precipi-tation (mm)	Duration of Sun shine
	Average Monthly	Average Daily Maximum	Average Daily Minimum		
Jan.	-2.8	2.6	8.2	22.3	159.6
Feb.	-0.2	5.2	-5.4	34.6	161.1
Mar.	5.3	10.9	-0.5	52.8	201.1
Apr.	11.7	18.4	4.9	87.6	219.5
May	17.5	23.8	11.1	90.1	246.3
June	22.3	28.6	16.0	166.0	211.9
July	26.2	31.0	21.4	267.6	190.8
Aug.	26.9	31.7	22.1	258.0	216.4
Sept.	21.1	26.9	15.3	139.7	194.5
Oct.	14.1	20.8	7.3	46.2	218.9
Nov.	10.8	12.9	1.4	45.4	174.1
Dec.	1.1	6.1	-3.9	29.1	147.7
Year	12.8	18.2	6.8	1 239.4	2 342.0

Average temperature and precipitation is based on a 30-year record, 1931 through 1960, by the Korea Central Meteorological Observatory.

2.5 GEOLOGY

Buyeo Gun is underlain primarily by granite-gneiss, granite, red shale and rocks that belong to the Daedong System. Of these rocks granite-gneiss is the most extensive, and occupies most of the northeast and southern parts. Granite is next and underlies the central part. Most of the mountainous areas in the northwest are underlain by rocks of the Daedong System, such as shale, schist and porphyry. Red shale is the least in distribution-extent, and underlies only small areas in the southeast.

2.6 PARENT MATERIALS

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

The dominant underlying rocks are moderately weathered, coarse textured granitic rocks (granite, granite-gneiss). Soils with textures of sandy loam or loam have formed over them. The fine grained schist, porphyry, and red shale are less extensive in Buyeo Gun and have formed soils of mainly loam textures, although there are some soils with finer textures developed over them. The soils developed on the broad alluvial plains are mainly fine sandy loam, silt loam and silty clay loam in texture.

2.7 AGRICULTURE

In Buyeo Gun farming is the most important enterprise, and most farmers operate their own farms.

Crops were harvested from 23 288 ha in 1967. The most extensively grown crop is paddy rice, which occupies 16 468 ha or about 71 percent of the total cultivated land. The rice paddy fields have been mostly developed on the alluvial soils, along the Geum river. Other important field crops are barley, wheat and soybeans.

Livestock and livestock products are important farm commodities. In 1967, there were 5 207 head of cattle, 10 964 hogs, and 182 902 chickens. Farmers raise cattle mainly for farming labour.

Chapter 3

HOW THE SURVEY WAS MADE

This survey was made to learn what kinds of soils are in Buyeo 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 other facts.

Holes were made 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. There, 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 have 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 a soil of that series was first observed and mapped.

Bancheon and Buyeo, for example are the names of two soil series in Buyeo Gun. These would have essentially the same characteristics as the Bancheon and Buyeo 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. These differences are so important in use and management that soil series have been divided into mapping units.

The Seogto series, for example is divided into mapping units based upon slope and also upon the presence of coarse fragments. Thus there are sloping and moderately steep mapping units of Seogto soils with gravelly loam surfaces as well as a steep mapping unit of Seogto soil with cobbly stony loam textures.

There is also another difference between the series and the mapping unit. The series includes a group of profiles that have a definite but limited range in their properties. The mapping unit description, however, must include all of the important properties of the soils that are within the limits of the area shown on the map. Usually within a mapped area there are some profiles that resemble other series more than the series named in the mapping units. In mapping units such as 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 developed soils are also shown on the soil map, but they are given descriptive names, such as stony colluvial land or riverwash, sandy, and are called land types rather than soils.

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. The soils may be similar or they may differ greatly. Although closely associated geographically, the soils in a general soil area may differ in their suitability for agricultural use.

A generalized soil map was made showing eight soil associations in Buyeo Gun. The boundaries of the associations are shown on the general soil map, Map 2. Such a map is useful to 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 association is named for the major soil series in it, but soils of other series may also be present. The Jeonbug-Buyong association and the Jisan-Yongji association are the most important areas for agriculture. In the following pages the soil associations in Buyeo 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-BUYONG ASSOCIATION: NEARLY LEVEL, GENERALLY ACID SOILS OF THE BROAD MARINE PLAINS.

This association, making up about 11 percent of the Gun, is on the broad alluvial and fluvio-marine plains mainly along or near the Geum river. These soils are mostly in the central and extreme southeast. They are deep, poorly or imperfectly drained and gray-coloured. Those dominant in this association are the Jeonbug and Buyong. Mangyeong are also found in this association as minor soils.

The Buyong are used only for growing paddy rice because of the poor drainage and clayey texture. About 40 percent of the Jeonbug and Mangyeong is used for barley, wheat or flax, after paddy rice.

During growing seasons with prolonged drought, paddy rice may often be subject to damage from salt when it is irrigated with water from the Geum river.

4.3 JISAN-YONGJI ASSOCIATION: GENTLY SLOPING AND SLOPING SOILS ON SMALL VALLEYS AND FANS.

This makes up about 8 percent of the Gun. The areas are mainly in the centre and south although small tracts are bound elsewhere. The dominant soils are the Jisan and Yongji with the Gangdong included as minor soils.

Paddy rice is the main land use, but the moderately well drained Yongji may be planted to barley or wheat after this crop.

4.4 MANSEONG-HOGYE ASSOCIATION: GENTLY SLOPING, DARK COLOURED LOAMY SKELETAL SOILS ON THE LOCAL ALLUVIAL PLAINS.

This soil makes up about 5 percent of the Gun. It is on local alluvial plain, fans and small valleys in the northwest. The Hogye are well drained gravelly loam, occupying the upper parts of valleys and fans, and are used mainly for general crops. About 30 percent is used to grow paddy rice. The Mangseong are loamy, with gravel below the depth of 50 cm. These are on the local alluvial plain or in the lower parts of the valleys, and are used mainly for paddy rice because of poor drainage. The sandy and gravelly Hwangryong, minor soils of this association, are next to drainage ways and are mostly left idle, although small areas may be used for general crops.

4.5 NAGDONG-IHYEON ASSOCIATION: NEARLY LEVEL SOILS ALONG THE GEUM RIVER.

This soil association makes up about 6 percent of the Gun, and is distributed on flood plains along the Geum river. The Nagdong and Ihyeon soils are dominant, with the Gyuam being included as minor soils. The Nagdong, nearer to the river, are loamy fine sand, somewhat excessively drained, and are low in water holding capacity. They are mostly used to grow peanuts, a special crop in this Gun. The Ihyeon are silt loam and have a medium water-holding capacity. These are suitable for general crops and are being used largely for vegetables. The Gyuam have a higher water-holding capacity than the Ihyeon, and are used mainly for paddy rice. These soils may be planted to barley after rice.

4.6 SONGJEONG-DALCHEON ASSOCIATION: SLOPING TO STEEP, DEEP SOILS ON HILLY AREAS.

This soil association, making up about 18 percent of the Gun, is mainly bound in the central and southeast, occupying low hills and rolling land. The Songjeong are distributed mainly on 20 to 30 percent slopes, while the Dalcheon are on 7 to 15 percent slopes. Most areas are deep, well drained and eroded. Those with strong slopes are in pine trees or in coppice, with the lower slopes where erosion hazard is not severe being cultivated to crops or used for orchard.

Minor soils are the Bancheon, Gaghwa, and the Bansan. These are generally in cultivated crops. Gravel in the Gaghwa soils should be removed for easier cultivation. Special crops of ginseng are grown on the fine clayey, dark coloured, well drained soils of the Bansan series.

4.7 HABIN-BUYEO ASSOCIATION: SLOPING TO STEEP, MODERATELY DEEP AND SHALLOW, ROCKY LOAMY SOILS.

This soil association, making up about 4 percent of the Gun, is found on the hills of Saedo and Seogseong Myeon in the southeast. The shallow Habin soils usually occupy higher positions which are covered by poor coppice. The lower parts, occupied by the rocky and loamy Buyeo soils, are eroded and subject to drought, poor in vegetation, with only a few small tracts of slightly eroded soils being cultivated to crops. Minor areas of Samam soils included in this association are similarly cultivated.

4.8 SAMGAG ASSOCIATION: STEEP, SANDY SOILS OVERLYING COARSE TEXTURED GRANITIC ROCKS.

This soil association, steep, sandy soils overlying coarse textured granitic rocks, is the most extensive, occupying about 30 percent of the Gun. The areas are mostly in the southwest and northeast with some tracts in the north and west. The Hogye, as minor soils, are distributed in the small valleys and fans made by the erosion of the Samgag series. The Samgag usually occupy 30 to 60 percent slopes, are deep, well drained, eroded, and low in natural fertility. Poor pine trees and coppice dominate, with the land being used for woodland.

4.9 MUDEUNG-OESAN ASSOCIATION: STEEP, MODERATELY DEEP, AND SHALLOW ROCKY LOAM AND LOAMY SKELETAL SOILS.

This soil association makes up about 18 percent of the Gun, mostly in the northwestern part of the mountainous areas. The Seogto and Bonggye series, minors of this association, are on the mountain foot slopes.

Most of the land is shallow, rocky, cobbly or gravelly, not suitable for farming, but somewhat suited to woodland. Some areas of minor soils grow cultivated crops.

Chapter 5

DESCRIPTION OF THE SOILS

5.1 INTRODUCTION

This section describes the soil series and mapping units of Buyeo Gun. The soil series is described first, and then the mapping units of the series. Following the name of each mapping unit there is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. To get full information on any one mapping unit, it is best to read first the description of the series which gives the general concept of a soil and then the description of the mapping unit which presents 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 soils, 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 can be organized and applied in managing farms, fields, and woodland; in developing rural areas; in engineering work; and in many other ways. They are placed in broad classes to facilitate study and comparison in large areas, such as entire countries or sections of countries. The soil classification system currently used by the United States was placed in general use by the Korea Soil Survey in 1968. The current system is under continual study.

(1) Order

Ten orders are recognized in the current systems. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxosols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. The exceptions, Entisols and Histosols, are in many different climates. Table 2 shows the five soil orders in this surveyed area, Ultisols, Alfisols, Inceptisols, Entisols, and Mollisols.

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

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

Inceptisols are mineral soils in which horizon have definitely started to develop. They generally are on young, but not recent land surfaces.

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

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

(2) Suborder

Each order is subdivided into suborders, primarily on the basis of soil characteristics that seem to produce classes having the greatest genetic similarity. The suborders have a narrower climatic range than the orders. The criteria for suborders chiefly reflect the presence or absence of waterlogging or soil differences resulting from the climate or vegetation. Those properties are mineralogy, chemistry, degree of gleying, soil moisture, texture, and the presence or absence of accumulated soluble material. The suborder is not shown in Table 2.

(3) Great group

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

(4) Subgroup

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

(5) Families

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

Table 2

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

Series	Current Classification			1938 Classification
	Family	Subgroup	Order	Great Soil Group
Bancheon	Fine clayey	Typic Hapludalfs	Alfisol	Red-Yellow Podzolic
Bansan	Fine clayey	Humic Hapludults	Ultisol	Red-Yellow Podzolic
Bonggye	Fine clayey	Typic Hapludults	Ultisol	Red-Yellow Podzolic
Buyeo	Fine loamy	Typic Hapludalfs	Alfisol	Red-Yellow Podzolic
Buyong	Fine clayey nonacid	Fluventic Haplaquepts	Inceptisol	Low-Humic Gley
Dalcheon	Fine clayey	Typic Hapludults	Ultisol	Red-Yellow Podzolic
Gaghwa	Fine clayey	Typic Hapludults	Ultisol	Red-Yellow Podzolic
Gangdong	Fine loamy over sandy	Fluventic Haplaquepts	Inceptisol	Low-Humic Gley
Gyuam	Coarse silty	Aquic Fluventic Eutrochrepts	Inceptisol	Alluvial
Habin	Coarse loamy	Lithic Eutrochrepts	Inceptisol	Lithosols
Hogye	Loamy skeletal	Fluventic Hapludolls	Mollisol	Alluvial
Honam	Fine clayey	Typic Ochraqualfs	Alfisol	Low-Humic Gley
Hwadong	Fine clayey	Aquic Hapludalfs	Alfisol	Red-Yellow Podzolic
Hwangryong	Sandy skeletal	Typic Udipsamments	Entisol	Alluvial
Ihyeon	Coarse silty	Dystric Fluventic Eutrochrepts	Inceptisol	Alluvial
Jeonbug	Fine silty nonacid	Aeric Fluventic Haplaquepts	Inceptisol	Low-Humic Gley

../..

Table 2 (Cont'd)

Series	Current Classification			1938 Classification
	Family	Subgroup	Order	Great Soil Group
Jisan	Fine loamy nonacid	Fluventic Haplaquepts	Inceptisol	Low-Humic Gley
Mangyeong	Coarse silty nonacid	Fluventic Haplaquepts	Inceptisol	Low-Humic Gley
Manseong	Fine loamy over sandy skeletal	Aeric Fluventic Haplaquepts	Inceptisol	Low-Humic Gley
Mudeung	Fine loamy	Lithic Dystrochrepts	Inceptisol	Lithosols
Nagdong	Sandy	Typic Udipsamments	Entisol	Alluvial
Oesan	Loamy skeletal	Typic Dystrochrepts	Inceptisol	Lithosols
Samam	Fine loamy	Aquic Dystric Eutrochrepts	Inceptisol	Alluvial
Samgag	Coarse loamy	Typic Dystrochrepts	Inceptisol	Lithosols
Seogto	Loamy skeletal	Dystric Fluventic Eutrochrepts	Inceptisol	Regosols
Sindab	Sandy	Typic Psammaquents	Entisol	Alluvial
Sinheung	Fine loamy	Aeric Fluventic Haplaquepts	Inceptisol	Low-Humic Gley
Songjeong	Fine loamy	Typic Hapludults	Ultisol	Red-Yellow Podzolic
Togye	Sandy	Typic Udipsamments	Entisol	Alluvial
Yongji	Fine loamy	Aquic Fluventic Eutrochrepts	Inceptisol	Alluvial-Red Yellow Podzolic

(6) Series

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

5.2 BANCHEON SERIES

The Bancheon series, a member of the fine clayey family of Typic Hapludalfs, consists of gently sloping to sloping, deep, well drained soils that formed on slightly to moderately dissected terraces. These soils are commonly associated with the Hwadong soils, but are better drained.

A typical profile follows:

Ap--0 to 4 cm; strong brown (7.5YR 5/6) silty clay; moderate, fine granular structure; friable, sticky, and plastic; common, fine barley roots; smooth boundary; pH 5.1.

B21t--4 to 10 cm; yellowish red (5YR 5/6) silty clay; weak, fine, subangular blocky structure and moderate, fine to medium granular structure; firm, sticky, and plastic; few, fine barley roots; pH 5.3.

B22t--10 cm; yellowish red (5YR 4/8) silty clay; moderate, medium to coarse subangular blocky structure; firm, sticky, and plastic; thin cutans; few, fine pores; clear, smooth boundary; pH 5.4.

B22t--70 to 110 cm; yellowish red (5YR 5/6-5/8), red (2.5YR 4/6), very dark brown (10YR 2/2), and dark reddish brown (5YR 3/4), yellowish red (5YR 4/6), silty clay; strong, coarse, subangular blocky structure, breaking to strong, fine, angular blocky structure; firm, very sticky, and very plastic; thick, clay cutans; pH 5.3.

The surface layer is brown, or dark brown clay loam, silty clay or silty clay loam, but where eroded it is yellowish red to strong brown. The Bt horizon is yellowish red or strong brown clay loam to silty clay. Reaction ranges from strongly to moderately acid in all horizons.

The Bancheon soils are moderate both in natural fertility and in organic matter content. Permeability is moderate and available water capacity high. They have high cation exchange capacities and base saturation. Most of the acreage is cultivated to crops other than rice. These respond to good management.

5.2.1 Bancheon Silty Clay Loam, 2 to 7 Percent Slopes (BcB).

This soil is on gently sloping terraces and formed in old alluvium. Most areas have profiles like that typical for the series. In the mapped areas are included:

small tracts that have loam, silt loam, or clay loam surface layers, a few slopes ranging from 0 to 2 percent, and small areas having a strong structure or a thick silt loam A horizon.

Crops such as sweet potato, soybean, barley, and red pepper (which produce high yields when well managed) are generally well suited. Forage crops will also produce well, but paddy rice is not often grown because of the lack of irrigation water.

The main management requirements are erosion control and fertility improvement.

Capability unit IIe.
Paddy suitability groups P2ac.

5.2.2 Bancheon Clay Loam, 7 to 15 Percent Slopes, Eroded (BcC2).

This soil is on sloping terraces, with most areas having profiles similar to that typical for the series. Small tracts with silty clay loam, silty clay or loam surfaces, and some small areas that have a strong grade of soil structure, finer texture, and thick silt loam surfaces, are also included.

Most areas are suited to sweet potato, soybean, radish, and barley, and fair yields are obtained. Forage crops will grow well and protect the land from erosion. Paddy rice is usually not suitable because of lack of water, the difficulty of establishing paddy on these slopes, and poor tilth. Major management problems are erosion, low fertility, and droughtiness.

Capability unit IIIe.
Paddy suitability group P3ac.

5.3 BANSAN SERIES.

The Bansan series, consisting of sloping, deep, well drained soils that formed over granite saprolite in concave positions, is a member of the fine clayey family of Humic Hapludults. These soils are commonly associated with the Dalcheon, Songjeong, and Samgag. The surface layers of the Bansan are darker coloured than Songjeong and Dalcheon soils. In most places hard rock is more than 200 cm from the surface.

A typical profile follows:

Ap--0 to 15 cm; dark brown (10YR 3/3) loam; brown (10YR 5/3) dry; moderate, fine, granular structure; friable, slightly sticky, and slightly plastic; clear, smooth boundary; pH 5.5.

A1--15 to 35 cm; dark brown (10YR 3/3) loam; weak, medium subangular blocky structure, breaking to weak, fine and medium, granular structure; slightly firm, slightly sticky, and slightly plastic; common, fine pores; clear, smooth boundary; pH 4.7.

B1--35 to 60 cm; dark brown (7.5YR 3/2) silty clay loam; moderate, fine, subangular blocky structure;

firm, sticky, and plastic; thin, continuous clay cutans; common, fine pores; few, fine barley roots; abrupt, smooth boundary.

B2t--60 to 110 cm; yellowish red (5YR 4/6) moist, silty clay; moderate, coarse subangular blocky structure; thin continuous, clay cutans; common, fine pores; few, fine roots; clear, smooth boundary; pH 5.1.

B31t--110 to 130 cm; brown to dark brown (7.5YR 4/4), silty clay loam; weak, coarse, subangular blocky structure; thin discontinuous clay cutans of dark brown (7.5YR 3/2); gradual, smooth boundary; pH 5.3.

B32t--130 to 150+ cm; brown to strong brown (7.5YR 5/5) clay loam; common, medium, light yellowish brown (10YR 4/4) mottles; moderate, coarse, platy structure, breaking to weak, medium, subangular blocky structure; pH 5.7.

The A horizon is very dark brown to brown loam, silty clay loam or clay loam and is 15 to 30 cm thick. The Bt horizon is yellowish red silty clay to silty clay loam, and 50 to 80 cm thick.

The Bansan are medium to high in natural fertility, medium to high in organic matter content, moderate in permeability and infiltration, and high in available water capacity. Cation exchange capacity is high and base saturation low. Crops other than rice are commonly grown on these soils.

5.3.1 Bansan Clay Loam, 7 to 15 Percent Slopes (BsC).

This soil is on sloping concave positions. In most places it has a profile like that described for the series but some small tracts of less or greater slope, massive structure, a few dense very slowly permeable layers in lower profiles and some areas with medium base saturation, have been included.

Most of the soil is suited to barley, sweet potato, vegetables, and ginseng. The main management problems are erosion and low fertility.

Capability unit IIIe.
Paddy suitability group P3ac.

5.4 BONGGYE SERIES

The Bonggye series, consisting of moderately steep, moderately deep, well drained soils formed in residuum derived from porphyry, is a member of the fine clayey family of Typic Hapludults. These soils, distributed in the centre and south, are commonly associated with Mudeung soils. The Mudeung are shallow to rock, while the Bonggye lack mica that is characteristic of Dalcheon soils.

A typical profile follows:

A--0 to 10 cm; yellowish brown (10YR 5/6) silt loam; weak, fine and coarse, granular structure; very friable, slightly sticky, and slightly plastic; many, fine and medium grass roots; clear, smooth boundary; pH 5.4.

B1--10 to 20 cm; yellowish red (5YR 4/8) silty clay loam; weak, medium to coarse, subangular blocky structure and weak, fine granular structure; firm, sticky, and plastic; many, fine and coarse, pine roots; few, angular gravels; few, very fine pores; clear, wavy boundary; pH 5.5.

B21t--20 to 35 cm; yellowish red (5YR 5/6) silty clay loam; weak, coarse subangular blocky structure; firm, sticky, and plastic; few, fine pine roots; few, fine pores; gradual, wavy boundary; pH 5.6.

B22t--35 to 100 cm; yellowish red (5YR 5/8) gravelly silty clay (about 20 percent of gravel); weak, coarse, subangular blocky structure, breaking to fine and medium, granular; few, fine manganese concretions; slightly weathered angular gravel; few, fine pine roots; few, fine pores; clear, wavy boundary; pH 5.8.

C--100 to 120+ cm; strongly weathered porphyry.

The surface layer is brown to yellowish brown loam or silt loam 5 to 15 cm thick. The Bt horizon is yellowish red to reddish brown silty clay loam to clay loam 70 to 100 cm thick.

The Bonggye are low in natural fertility, low in organic matter content, moderate in permeability and infiltration, and moderate in available moisture capacity. They have moderate to high cation exchange capacity and low base saturation. Root zones are deep and pine forest predominates.

5.4.1 Bonggye Silt Loam, 15 to 30 Percent Slopes (ByD)

This soil, on moderately steep hills, generally has a profile like that typical for the series. Some small tracts with less and greater slopes, and a few small areas that are redder and coarser textured, have also been included.

Most areas are covered with poor pine and other trees as well as some shrubs and grass. The main management concerns are erosion control and improving low fertility.

Capability unit IVe.
Paddy suitability group P4ac.

5.5 BUYEO SERIES

The Buyeo series, consisting of sloping to moderately steep, moderately deep, somewhat excessively drained soils that formed in residuum derived from red shale, is a member of the fine loamy family of Typic Hapludalfs. These soils are mainly in the south east on both sides of the Geum river valley and are commonly associated with the Samam and Habin soils. The Buyeo are over the same kind of rock as the Habin but differ from them chiefly in being thicker.

A typical profile follows:

Ap--0 to 8 cm; reddish brown (2.5YR 4/4) loam; moderate, fine granular structure; friable, sticky, and plastic; many, fine and coarse pine tree roots; abrupt, smooth boundary; pH 5.2.

B21t—8 to 25 cm; red (2.5YR 4/6) loam; weak, coarse, angular blocky structure; firm, sticky, and plastic; few, fine pine tree roots; clear, smooth boundary; pH 5.2.

B22th—25 to 52 cm; weak red (10R 4/4) silt loam; structureless (massive); thick (about 4 cm) horizontal and oblique white (N 8/0) coating and reddish brown (2.5YR 4/4) clay flows; firm, sticky, and plastic; clear, irregular boundary; pH 5.2.

C1—52 to 85 cm; weak red to dusky red (10R 3.5/4) silt loam; few, medium and coarse black (5YR 2/1) mottles; structureless (massive); firm, sticky, and plastic; pH 5.3.

C2—85 to 110+ cm; weak red (10R 4/3) loam; very firm and strongly weathered red shale material; pH 5.3.

The surface layer is weak red to reddish brown loam or silt loam. The B horizons are red to weak red heavy loam or silt loam which may be gravelly or cobbly. A moderately thick loam or silt loam substratum is normal.

Natural fertility is moderately low, cation exchange capacity medium, base saturation medium to high and organic matter content low. Available moisture capacity is medium and soil reaction strongly acid. Most land is cultivated to crops other than rice, with some tracts growing persimmon, chestnut, and pine trees.

5.5.1 Buyeo Rocky Loam, 7 to 15 Percent Slopes (BuC).

This soil, on sloping low hills, generally has a profile like that described for the series. Rock outcrops and stony areas are present but are on less than 5 percent of the mapped area. Some small areas are on slopes of less than 7 percent. Also included are a few small areas that are severely eroded and some parts that are very shallow over red shale rocks.

Cultivation is poorly suited but tobacco, barley, and sweet potato, which produce relatively low yields, are cultivated. Some places are planted to persimmon, chestnut, and pines. Erosion and low fertility are main management problems.

Capability unit IVe.

5.5.2 Buyeo Rocky Loam, 15 to 30 Percent Slopes, Eroded (BuD2).

Most areas have profiles like that typical for the series. From 5 to 15 percent of the mapped area is rock outcrop, with some land severely eroded and lacking the B horizon. Gullies, too, are common, with small areas where the soil is shallow over hard rock, also being included.

About one half of the mapped areas is planted to crops such as sweet potato, barley, and soybean, but is poorly suited. Woodland is well suited and perennial forage crops would produce moderate yields if well managed. Main management requirements are to control erosion and raise fertility.

Capability unit VIe.

5.6 BUYONG SERIES

The Buyong series, consisting of level, poorly drained, deep, dark gray or gray soils that formed in fluvio-marine deposits on broad alluvial plains, is a member of the fine clayey, non acid family of Fluventic Haplaquepts. The Buyong are commonly associated with the Jeonbug and Mangyeong soils. Jeonbug are light silty clay loam, and Mangyeong are silt loam with a weak structure.

A typical profile follows:

Ap--0 to 8 cm; dark grayish brown (2.5Y 4/2) silty clay; common, medium, prominent, strong brown (7.5YR 5/8) mottles; weak, medium and coarse, granular structure; slightly firm, sticky, and plastic; clear, smooth boundary; pH 5.5.

B1--8 to 22 cm; dark gray (5Y 4/1), silty clay; common, fine, prominent yellowish red (5YR 4/8) mottles; dark grayish brown (2.5Y 4/2) crushed; weak, coarse, subangular blocky structure; firm, sticky, and plastic; common, fine rice roots; common, fine, continuous pores; clear, smooth boundary; pH 5.5.

B21--22 to 40 cm; very dark gray (10YR 3/1) silty clay; common, medium, prominent, yellowish red (5YR 4/8) mottles; very dark grayish brown (10YR 3/2) crushed; weak, very coarse, prismatic structure, breaking to coarse blocky structure; firm, sticky, and plastic; common, fine pores; gradual, smooth boundary; pH 6.0.

B22gir--40 to 60 cm; dark gray (5Y 4/1) silty clay loam; many, medium, prominent, strong brown (7.5YR 5/6) mottles; dark grayish brown (2.5Y 4/2) crushed; moderate, very coarse, prismatic structure, breaking to weak, blocky structure; firm, sticky, and plastic; common, fine and coarse pores; few, fine manganese concretions; few, very fine mica; abrupt, wavy boundary; pH 6.5.

B3g--60 to 90 cm; grayish brown (10YR 5/2) silty clay loam; common, medium distinct, gray (N 6/) mottles, dark yellowish brown (10YR 4/4) crushed; weak, coarse, prismatic structure; many, fine manganese concretions; common, fine roots; abrupt, smooth boundary; pH 6.5.

Cg--90 to 120+ cm; dark greenish gray (10GY 4/1), silty clay loam; massive; slightly firm, slightly sticky, and slightly plastic; common, fine reed roots; pH 7.5.

The Ap layer is silt loam or silty clay loam, ranging in colours from dark grayish brown to gray, and in thickness from 5 to 20 cm. The B horizon is dark gray to dark grayish brown silty clay loam to silty clay, and is 50 to 70 cm thick. The Buyong soils are moderate in natural fertility and organic matter content. Infiltration and permeability are slow, and the available water capacity high. Cation exchange capacity and base saturation are high. All areas are used for rice paddy.

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

Most areas of this soil have profiles like that for the series. Some areas have high sodium saturation and free salts in their lower profiles. Small areas with silt loam surface horizons are also included.

This soil is well suited to rice, but poorly suited to anything else because of poor drainage. If this were rectified many other kinds of crops could be grown. The main management concerns are raising fertility and removing salt from the soil.

Capability unit IIIw.
Paddy suitability group P1.

5.7 DALCHEON SERIES

The Dalcheon includes sloping, well drained, deep soils, formed in materials weathered from granite, gneiss, and schist. They are members of the fine clayey family of Typic Hapludults, located in the centre and south, and are commonly associated with Samgag, and Gaghwa. Dalcheon soils, however, lack gravel and cobbles throughout the profile which are present in Gaghwa. Hard rock is usually more than 100 cm from the surface.

A typical profile follows:

A---0 to 7 cm; strong brown (7.5YR 5/6) loam; weak, fine granular structure; friable, slightly sticky, and slightly plastic; abrupt, smooth boundary; pH 5.2.

B21t---7 to 15 cm; yellowish red (5YR 5/8) clay; weak, medium and coarse, subangular blocky structure; friable, sticky, and plastic; clear, smooth boundary; pH 5.5.

B22t---15 to 30 cm; yellowish red (5YR 4/6) clay; strong, fine and medium, angular blocky structure; firm, very sticky, and very plastic; thick, continuous clay cutans; few, fine mica; clear, smooth boundary; pH 5.6.

B3t---30 to 55 cm; mottled red (2.5YR 4/6) and reddish yellow (5YR 6/8), clay; red (7.5YR 4/6) crushed; moderate, medium and coarse, subangular blocky structure; firm, sticky, and plastic; few, fine mica; thick discontinuous cutans; clear, smooth boundary; pH 5.5.

C1---55 to 125+ cm; mottled brownish yellow (10YR 6/8) and yellowish red (5YR 4/4) loam; yellowish red (5YR 5/8) crushed; massive; slightly firm, sticky, and plastic; thick, continuous clay flows; common, fine mica; mass is granite saprolite; pH 5.5.

The A horizon is brown or strong brown silt loam, or clay loam, and ranges from 5 to 15 cm in thickness. The B2t horizon is yellowish red to red clay or silty clay, 30 to 70 cm thick. The C horizon is variable in colour and contains fine mica.

These soils are low both in natural fertility and in organic matter content. Infiltration and permeability are moderate, and available water capacity high. Cation exchange capacity is high and base saturation low.

Most of the area is in cultivated crops other than paddy rice. These grow well and respond to a liberal application of lime and fertilizer.

5.7.1 Dalcheon Silt Loam, 7 to 15 Percent Slopes, Eroded (DcC2).

This soil, on sloping hills, generally has a profile like that typical. Some small areas of steeper slopes, and some areas with thick B horizons, as well as a few areas with coarse sandy loam saprolite below the plough layer, are included.

Crops such as sweet potatoes, tobacco, and soybeans do well but paddy rice will only adapt moderately because of water losses through the profile. Forage crops would also grow well on this soil. Very few areas have water available for flooding. Erosion, low fertility, and droughtiness are problems in management.

Capability unit IIIe.
Paddy suitability group P3ac.

5.8 GAGHWA SERIES

The Gaghwa series, consisting of deep, well drained soils developed in alluvial-colluvial materials, are members of the fine clayey family of Typic Hapludults. These soils, commonly associated with the Seogto, are thicker and finer-textured in the B horizon than them, with gravel and cobbles common in the lower profile.

A typical profile follows:

Ap—0 to 10 cm; brown to dark brown (7.5YR 4/4) when wet, cobbly loam; brown (10YR 5/3) when dry; moderate, fine and medium, granular structure; slightly firm, slightly sticky, and slightly plastic; many, fine tobacco roots; few, angular gravel; clear, smooth boundary; pH 5.7.

B21t—10 to 30 cm; reddish brown (5YR 4/4) when wet, cobbly clay loam; brown (7.5YR 5/4) when dry; moderate, medium, subangular blocky structure; slightly firm, sticky, and plastic; thick, continuous, clay cutans; few, angular gravel; clear, smooth boundary; pH 5.8.

B22t—30 to 70 cm; reddish brown (5YR 4/4) gravelly cobbly clay loam; moderate, medium, subangular blocky structure; slightly firm, sticky, and plastic; thin clay cutans; common, fine roots; abrupt, smooth boundary; pH 5.7.

B3—70 to 110 cm; brown to dark brown (7.5YR 4/4) cobbly and gravelly loam; few, medium, distinct grayish brown (10YR 5/2) mottles; weak, coarse, platy structure breaking to fine and medium subangular blocky structure; firm, slightly sticky, and slightly plastic.

The surface layer is strong brown to brown or dark brown loam, or cobbly loam. The B horizon is strong brown, yellowish red or reddish brown, firm, clay loam, 100 to 150 cm thick.

The Gaghwa are medium in natural fertility and in organic matter content. Infiltration and permeability are moderately slow, and the available water capacity is medium to high. Cation exchange capacity is high, and base saturation low.

About half of these soils are cultivated to crops other than rice, and the other half is in pines and other small trees. Erosion is a general problem.

5.8.1 Gaghwa Cobbly Loam, 2 to 7 Percent Slopes, Eroded (GaB2).

This soil is on concave gently sloping mountain foot slopes, with most areas having profiles like that typical for the series description. Some areas have subsoils of light clay loam or loam. In the mapped areas are also included small areas with a sandy loam surface layer and with a redder subsurface, as well as minor areas with greater slopes. In places the A horizon is somewhat thicker than that described.

General crops other than rice are now cultivated, but it could be grown well if the soil were levelled and irrigation water supplied. Erosion is a moderate problem if annual crops are grown, but losses will be small when perennial forage crops are cultivated.

Capability unit IIe.
Paddy suitability groups P2ac.

5.8.2 Gaghwa Cobbly Loam, 7 to 15 Percent Slopes, Eroded (GaC2).

This soil is on concave mountain footslopes, with most areas having profiles similar to that typical for the series. In the mapped areas are included small areas that have clay loam, sandy clay loam or gravelly to cobbly clay loam Ap horizon. In places the A horizon is thicker than described. Some small areas with coarser textured B horizons than those in the typical profile, and a few small areas with a fragipan in the lower profile are also comprised.

Crops other than rice, such as red pepper, soybean, sesame, tobacco, and mulberry are generally cultivated. The remainder is in pines, oaks, alders, and shrubs. Erosion is a severe problem when annual crops are grown.

Capability unit IIIe.
Paddy suitability group P3ac.

5.8.3 Gaghwa Cobbly Loam, 15 to 30 Percent Slopes, Eroded (GaD2).

Most areas have profiles like that described for the series. In this mapping unit are included small areas that have a clay loam, sandy clay loam, sandy loam or gravelly to cobbly clay loam surface layer. Some areas have a coarser textured B horizon than that typical, a few small areas have a fragipan in the lower profile, while in places the A horizon is thicker than usual.

A limited range of crops, because of the erosion hazard and steep slopes do well, but pasture and trees are well suited. Erosion is the chief management hazard.

Capability unit IVe.
Paddy suitability group P4ac.

5.9 GANGDONG SERIES

The Gangdong series, consisting of nearly level and gently sloping, deep, poorly drained soils that formed in small alluvial valleys in the general areas of Samgag, Songjeong, and Dalcheon soils, is a member of the fine loamy over sandy nonacid family of Fluventic Haplaquepts.

A typical profile follows:

Ap--0 to 10 cm; very dark grayish brown (2.5Y 3/2), loam; few, fine, yellowish red (5YR 4/8) mottles; weak, medium and fine granular structure; friable, non-sticky, and nonplastic; many, fine roots; common, fine mica; common, fine pores; abrupt, smooth boundary; pH 5.0.

B21g--10 to 25 cm; dark gray (5Y 4/1) loam; many, medium, dark yellowish brown (10YR 4/4) mottles; olive gray (5Y 4/2) crushed; massive; slightly firm, slightly sticky, and slightly plastic; common, fine roots; few, fine pores; gradual, smooth boundary; pH 5.0.

B22g--25 to 40 cm; very dark gray (5Y 3/1) silt loam; few, medium, olive brown (2.5Y 4/4)mottles; massive; slightly firm, non-sticky, and nonplastic; few, fine pores; clear, smooth boundary; pH 6.5.

C3g--40 to 80 cm; very dark gray (5Y 3/1) loam; massive; slightly firm, sticky, and slightly plastic; common, fine pores; few, fine roots; few, fine mica; abrupt, smooth boundary; pH 6.5.

IICg--80 to 120 cm; very dark gray (5Y 3/1) gravelly loamy coarse sand.

The Ap horizon is very dark grayish brown, olive gray, or olive loam or silt loam about 15 cm thick. Yellowish brown or yellowish red mottles are found in upper B horizons. These soils are underlain by sand or gravelly loamy sand below about 100 cm. The water table is about 50 cm below the surface.

The Gangdong soils are moderate in natural fertility, and medium in organic matter content. Cation exchange capacity is low and base saturation high. Available moisture capacity is low and permeability is moderately rapid. These soils are used mainly for paddy rice, and produce moderate crops.

5.9.1. Gangdong Loam, 0 to 2 Percent Slopes (Gd).

Most areas of this soil have a profile similar to that described for the series. Small tracts of a soil with a clay loam surface layer, and some greater slopes than the described range, are also included.

A limited range of crops are suited because of the high water table, but paddy rice is well adapted and is grown almost everywhere.

Capability unit IIw.
Paddy suitability group P2b.

5.9.2 Gangdong Loam, 2 to 7 Percent Slopes (GdB).

This soil, on broad alluvial plains or small valleys, generally has a profile like that typical for the series. Small tracts that have a clay loam surface layer, and some small areas of sloping soil, are also included.

Paddy rice grows well, but the water table is too high for most other crops. Lowering that would permit a wider crop selection but yields would be apt to be low in years of unfavourable rainfall due to the low available moisture capacity after drainage.

Capability unit IIw.
Paddy suitability group P3ab.

5.10 GYUAM SERIES

The Gyuam series, consisting of deep, nearly level, moderately well drained soils formed in alluvium, is a member of the coarse silty family of Aquic Fluventic Eutrochrepts. These soils are mainly on broad alluvial plains, and are associated with the Ihyeon, Jeonbug, and Buyong. The Gyuam differ from Ihyeon chiefly in having gray colours in the lower profile. The Jeonbug and Buyong have silty clay loam textures.

The Gyuam soils are widely distributed in the southern part of Gyuam Myeon along the Geum river. They have deep root zones, and the depth to the water table is 100 cm or more.

A typical profile follows:

Ap---0 to 12 cm; grayish brown (2.5Y 5/2) silt loam; weak, medium blocky; friable, slightly sticky, and nonplastic; many roots; common fine mica flakes; abrupt, smooth boundary; pH 6.5.

B1---12 to 28 cm; grayish brown (2.5Y 5/2) silt loam with common medium dark brown (7.5YR 4/4); weak, medium blocky structure; friable, non-sticky, and nonplastic; common roots; common fine mica flakes; abrupt, smooth boundary; pH 6.0.

B2---28 to 50 cm; brown (10YR 5/3) fine or very fine sandy loam with common, medium distinct dark brown (7.5YR 4/4) mottles; single grain; friable; few roots; common fine mica flakes; abrupt, wavy boundary.

C1---50 to 90 cm; dark gray (5Y 4/1) silt loam with many medium distinct brown to dark brown (7.5YR 4/4) mottles; sticky and plastic; few, fine roots; common fine mica flakes; abrupt, smooth boundary; pH 6.0.

C2---90 to 140 cm; dark gray (10YR 4/1) silt loam; massive; pH 6.0.

The surface layer ranges from grayish brown in paddies to brown in other areas, and from 10 to 25 cm in thickness. The B horizon is brown and the underlying materials are dark gray to gray. Strata of sandy loam and silty clay loam are common, with many mica flakes throughout the profile.

The Gyuam are moderate in natural fertility, medium in organic matter, medium in cation exchange capacity, and high in base saturation. They have high available moisture capacity and their reaction is medium to slightly acid.

Cultivated crops, including paddy rice, are usual.

5.10.1 Gyuam Silt Loam, 0 to 2 Percent Slopes (Gy).

Most areas have profiles like that typical for the series. Some tracts where the surface layer is very fine sandy loam or sandy loam are included, as are some areas having stratified layers of silty clay loam, very fine sandy loam or sandy loam. A few small parts have a sandy substratum below 150 cm.

This soil is very well suited to most of the crops grown in the Gun, but more than average amounts of water are needed for paddy rice because of water losses through seepage. In all other respects rice production is well suited.

Capability unit I.
Paddy suitability group P2c.

5.11 HABIN SERIES

The Habin series, consisting of steep, shallow somewhat excessively drained soils that formed over interbedded sedimentary rocks such as red shale and fine gravelly sandstone, is a member of the coarse loamy family of Lithic Eutrochrepts. These are usually associated with the Buyeo soils. Most areas are in the south and are usually on steep upper slopes and summit sites, while Buyeo are on sloping to moderately steep lower slopes.

A typical profile follows:

A--0 to 10 cm; reddish brown (2.5YR 4/4) when moist loam; moderate fine granular structure; few, fine roots; clear, smooth boundary; pH 5.5.

B2--10 to 26 cm; reddish brown (2.5YR 3.5/4) gravelly loam; weak medium subangular blocky structure; friable, slightly sticky, and nonplastic; pH 6.0.

D--26+ cm; red shale; pH 6.5.

The surface layer is weak red, reddish brown, or red loam or silt loam. Depth to hard rock ranges from 10 to 50 cm.

Habin soils are low both in natural fertility and in organic matter. Available moisture capacity is low to very low and permeability is moderately rapid. Cation exchange capacity is low, and base saturation medium. Most areas are in forest of pine and larch, with some grassland.

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

Most areas have profiles like that typical for the series. About 10 to 30 percent of the mapped areas has rocks on the surface. In areas mapped as this soil

are also included some places with sheet and gully erosion, and a few small tracts with slopes of less than 30 percent.

Pine, larch trees and wild grasses are the main cover. Woodland is best suited but some areas are in grass. The main management concern is erosion control.

Capability unit VIIe.

5.12 HOGYE SERIES

The Hogye series, consisting of deep, well drained soils that formed in alluvium on gently sloping to sloping alluvial fans and in small valleys, is a member of the loamy skeletal family of Fluventic Hapludolls. These soils are in the centre and north and are commonly associated with the Bonggye and Mudeung. Hwangryong are often found in small valleys with the Hogye.

A typical profile follows:

Ap---0 to 15 cm; very dark gray to black (10YR 2.5/1) gravelly silt loam; moderate, medium and fine granular structure; friable, non-sticky, and nonplastic; many, fine living, grass roots; few, fine pores; few, very fine mica; abrupt, smooth boundary; pH 5.1.

A1---15 to 35 cm; black (10YR 2/1) gravelly loam; common, medium and fine, prominent, strong brown (7.5YR 5/6) mottles; weak, coarse, blocky structure; slightly firm, slightly sticky, and slightly plastic; common, fine discontinuous pores; few, fine, manganese mottles; clear, smooth boundary (15 to 25 percent of coarse angular and round gravel); pH 5.7.

C---35 to 70+ cm; dark grayish brown to olive brown (2.5Y 4/3) very gravelly loam; mottled, olive gray (5Y 4/2), yellowish brown (10YR 5/6), and very dark gray (5Y 3/1); slightly firm, slightly sticky and slightly plastic; pH 5.9.

The A horizon is black to dark gray, gravelly loam or silt loam. The Hogye are moderate in natural fertility and high in organic matter content. Available water capacity is low to moderate, and permeability is moderate to rapid. Cation exchange capacity is moderate, and base saturation high. Most of the areas have been cultivated to common crops. A few areas are in rice paddy.

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

This soil is on alluvial fans and in small valleys. Most areas have profiles like that typical for the series. In areas mapped as this soil are included small tracts with a sandy loam or silty clay loam surface layer. Some areas also have grayer colours and these tend to be rather poorly drained.

Lettuce, red pepper, spinach, and Chinese cabbage are well suited to this soil, and persimmon trees produce high yields. About 40 percent is in paddy fields. The

main management problems are droughtiness and leaching of plant nutrients. Rice paddy is poorly suited because of high water losses.

Capability unit IIs.
Paddy suitability group P4abc.

5.12.2 Hogye Gravelly Loam, 7 to 15 Percent Slopes (HgC).

This is on sloping alluvial fans and in small valleys, with most parts having profiles similar to that typical for the series. In areas mapped as this soil are included small areas with a sandy loam surface layer, and with steeper slopes.

Most of the land is in crops other than rice. These include chinese cabbage, red pepper, lettuce, and soybean, all producing fair yields. Rice paddy, because of high water losses is not suitable. Low available moisture capacity is the chief management problem.

Capability unit IIIe.
Paddy suitability group P4abc.

5.13 HONAM SERIES

The series, consisting of level, deep, poorly drained soils that formed in alluvium, is a member of the fine clayey family of Typic Ochraqualfs. These soils are found on broad alluvial plains, and are commonly associated with Sinheung, Sindab, and Gangdong soils. Sinheung have loam textures, and Sindab or Gangdong soils have sandy loam. They are located mostly in the southern part of Buyeo Gun.

A typical profile follows:

Ap--0 to 10 cm; dark grayish brown (10YR 4/2) silt loam; few, fine, yellowish red (5YR 4/8) mottles; massive; friable, slightly sticky, and slightly plastic; many, fine and medium rice roots; abrupt, smooth boundary; pH 5.5.

A1--10 to 26 cm; dark gray (N 4/) silt loam; common, medium, distinct, brown to dark brown (7.5YR 4/4) mottles; weak, coarse, platy structure, breaking to weak and moderate, coarse and medium, blocky structure; slightly plastic; few, very fine pores; clear, smooth boundary; pH 6.0.

B1g--26 to 48 cm; light olive gray (5Y 6/2) silt loam with common, medium distinct brown and dark brown (7.5YR 4/4) mottles; weak, coarse prismatic structure breaking to weak and moderate, coarse and medium blocky; pH 6.0.

B2tg--48 to 92 cm; pale brown (10YR 6/3) silty clay loam with many, medium and coarse, strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure breaking to angular blocky; thin clayey cutans; firm, sticky, and plastic; abrupt, smooth boundary; pH 6.0.

B3tg--92 to 120 cm; gray to dark gray (5Y 4.5/1) silty clay loam; few, medium, faint dark yellowish brown (10YR 4/4) mottles; moderate coarse prismatic structure breaking to angular blocky; thin clayey cutans; very firm, very sticky, and very plastic; pH 6.5.

Remarks: Common, very fine, yellow mica throughout the profile.

The Ap horizon is dark grayish brown, gray or dark gray loam or silt loam and about 15 cm thick. These soils are high in natural fertility, available moisture capacity, cation exchange capacity, and base saturation.

Most of the areas are in paddy rice, which produces high yields under the present management. Some places are cultivated to barley for winter crops.

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

This soil is on nearly level broad alluvial plains. The profile is generally similar to that typical. Some small areas with slopes of 2 to 4 percent, are included.

This soil is very well suited to paddy rice. Installation of drainage ditches and tiles would permit cultivation for barley and other crops in addition to, or instead of, rice.

Capability unit IIIw.
Paddy suitability group P1.

5.14 HWADONG SERIES

The Hwadong series, consisting of gently sloping, moderately well drained, deep soils on broad terrace plains, are members of the fine clayey family of Aquic Hapludalfs. These soils are developed in old alluvial materials, and are commonly associated with the better drained Bancheon soils.

A typical profile follows:

Ap--0 to 8 cm; yellowish brown (10YR 5/4) clay loam; common, fine to medium, distinct, strong brown (7.5YR 5/6) mottles; moderate, fine and medium, granular structure; slightly firm, sticky, and plastic; clear, smooth boundary; pH 5.2.

A3--8 to 15 cm; dark grayish brown (10YR 4/2) clay loam; many, medium to coarse, distinct dark yellowish brown (10YR 4/3.5) mottles; weak, coarse, platy structure; slightly firm, sticky, and plastic; abrupt, smooth boundary; pH 5.7.

B21t--15 to 45 cm; mottled, yellowish brown (10YR 5/8) dark yellowish brown (10YR 4/4), brown (7.5YR 5/4), and light gray (10YR 6/1), light yellowish brown to yellowish brown (10YR 5.5/4) clay loam; moderate, very coarse, prismatic structure; firm, sticky, and plastic;

thick, continuous, gray clay cutans; many, coarse, black manganese concretions; few, coarse pores; gradual, smooth boundary; pH 5.9.

B22t--45 to 70 cm; mottled, brown to dark brown (7.5YR 4/4), yellowish brown (10YR 5/6), and dark gray (10YR 4/1) clay loam; weak, coarse, prismatic structure, breaking to medium, coarse, subangular blocky; firm, very sticky, and very plastic; thick, continuous clay cutans; few, fine manganese concretions; clear, smooth boundary; pH 5.6.

B3t--70 to 85 cm; mottled, strong brown (7.5YR 5/8), brown to dark brown (7.5YR 4/4), pale brown (10YR 6/3), and black (10YR 2/1) loam; yellowish brown (10YR 5/4) crushed; weak, coarse, subangular blocky structure; slightly firm, slightly sticky, and slightly plastic; many, coarse, manganese concretions; gradual, smooth boundary; pH 5.6.

Cg--85 to 130+ cm; light gray (10YR 7/1), silty clay loam; many, fine and coarse strong brown (7.5YR 5/8) mottles; massive; pH 5.6.

The surface layer is yellowish brown silty clay loam to clay loam about 15 cm thick, but in the paddy soil its colour is dark grayish brown or olive gray. The B horizon is yellowish brown silty clay loam or clay loam and has light gray mottles.

These soils are high in natural fertility, low to medium in organic matter content, and medium acid. Cation exchange capacity and base saturation are high. Available moisture capacity is high, and permeability is slow. Rice paddy predominates with good irrigation systems. The land is also used to grow barley in the winter.

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

Most areas have profiles like that typical for the series. In the mapped areas are included small tracts with silt loam or loam surface layers, and small areas with silty clay B horizons. Some small areas have slopes of less than 2 percent.

Most of the soil is well suited to paddy rice in the summer and to barley or wheat for winter crops. Moderate erosion is a management problem.

Capability unit IIe.
Paddy suitability group P2ac.

5.15 HWANGRYONG SERIES

The Hwangryong series, consisting of excessively drained, deep soils on nearly level narrow flood plains, is a member of the sandy skeletal family of Typic Udipsamments. These soils formed in recent alluvium, are commonly associated with the Hogye soils.

A typical profile follows:

Ap--0 to 10 cm; very dark grayish brown (10YR 3/2), gravelly loamy sand; weak, fine granular structure;

friable, non-sticky, and nonplastic; many, fine living tobacco roots; many, fine and medium, round gravel (about 35 percent); pH 5.9.

C--10 to 70 cm; very dark grayish brown (10YR 3/2) very gravelly cobbly loamy sand (the amount of gravel and cobbles is more than 70 percent).

The surface layer is usually brown, dark brown or dark yellowish brown loamy sand or sandy loam with few to many pieces of gravel, but in paddy soil it has gray colours. The C horizon is nearly the same as the A horizon in colour and in texture, except that the amount of gravel and cobbles is more than 35 percent.

Natural fertility and organic matter are both low and the soil is strongly to medium acid. Available moisture capacity is very low, and permeability very rapid. Cation exchange capacity is very low and base saturation high.

About half is in paddy rice and the remainder in other crops. Moderate to low yields, except for special vegetables, is usual.

5.15.1 Hwangryong Gravelly Loamy Sand, 0 to 2 Percent Slopes (Hr).

Most areas have a profile similar to that typical. In the mapped areas are included small areas where the surface layer is loam or silt loam (these are mostly cultivated to paddy rice), and some small tracts with slopes of more than 2 percent.

Paddy fields, adjacent to creeks from which irrigation water is available, produce low to moderately low yields. In places where irrigation water is not available, water melon, cucumber, and buckwheat are the most common and favoured. Overflow, low fertility, and low available moisture capacity are the chief management problems.

Capability unit IVs.
Paddy suitability group P4bc.

5.16 IHYEON SERIES

The Ihyeon series, consisting of nearly level, well drained deep soils on broad alluvial plains, is a member of the coarse silty family of Dystric Fluventic Eutrochrepts. These soils are commonly associated with the Gyuam and Nagdong and are found mostly in the east along the Geum river.

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 and moderate fine granular structure; non-sticky and nonplastic; many, fine to medium rice roots; clear, smooth boundary; pH 5.5.

C1--10 to 50 cm; brown to dark brown (10YR 4/3) silt loam; weak, coarse and medium subangular blocky structure; slightly sticky and nonplastic; few, fine roots; clear, smooth boundary; pH 6.0.

C2---50 to 130 cm; brown to dark brown (10YR 4/3) silt loam; weak, coarse platy breaking to weak, coarse and medium subangular blocky structure; many, fine to medium, faint manganese accumulations of dark brown (10YR 3/3); few, medium tubular worm cast holes and few, fine pores; clear, smooth boundary; pH 6.5.

C3---130 to 180+ cm; yellowish brown (10YR 5/6) sand; pH 6.8 to 7.0.

Their colours are brown to dark brown or dark yellowish brown loam to silt loam and their thickness is more than one metre. They are commonly underlain by loamy sand or sand. Natural fertility is moderate, organic matter, medium, and acidity, slight. Available moisture capacity is high, and permeability moderate. Base saturation is medium to high, and cation exchange capacity medium. Rice, barley, and vegetables are grown and vegetables, especially, produce high yields.

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

This soil, on nearly level broad alluvial plains, generally has a profile much like that typical. With this soil are included some small tracts that have a sandy loam or very fine sandy loam surface layer.

Many grain and vegetable crops are well suited, and some places are planted to flax. Paddy rice produces moderately high yields where irrigation systems are established and well managed. There are no specific limiting factors for the production of most crops.

Capability unit I.
Paddy suitability group P2c.

5.17 JEONBUG SERIES

The Jeonbug series, consisting of imperfectly drained, deep, gray to dark gray soils on nearly level broad alluvial marine plains, is a member of the fine silty, nonacid family of Aeric Fluventic Haplaquepts. These soils are commonly associated with Gyuam, Nagdong, and Buyong. Gyuam and Nagdong are coarser and better drained than the Jeonbug which differs from the Buyong in having a light silty clay loam rather than a heavy silty clay loam to silty clay substratum.

A typical profile follows:

Ap---0 to 13 cm; dark gray to gray (5Y 4/1-5/1) silt loam with few, fine, faint yellowish brown (10YR 5/8) mottles along the root channels; weak, medium granular structure; friable; pH 5.5.

B21g---13 to 25 cm; dark gray (5Y 4/1) silt loam with common, fine to very coarse dark red (2.5YR 3/6) iron mottles on the ped faces; weak coarse prismatic structure breaking to weak, medium platy structure; slightly sticky and slightly plastic; many, fine vertical tubular pores; abrupt, smooth boundary; pH 7.0.

B22g-25 to 45 cm; mottled olive (5Y 5/4) grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/8) silty clay loam; crushed colour, light olive brown (2.5Y 5/4); moderate coarse prismatic structure; clear, smooth boundary; pH 7.3.

B23g--45 to 70 cm; mottled olive gray (5Y 5/2) yellowish brown (10YR 5/6) and very dark brown (10YR 2/2) silty clay loam, crushed colour olive brown (2.5Y 4/4); moderate coarse prismatic structure and continuous gray cutans on ped faces and vertical root channels; very sticky and very plastic; pH 6.3.

B3g--70 to 90 cm; strong brown (7.5YR 5/6) silty clay loam with many coarse gray cutans on ped face and root channels; crushed colour dark yellowish brown (10YR 4/4); moderate, coarse prismatic structure; very sticky and very plastic; pH 7.0.

Cg--90 to 200+ cm; gray (5Y 5/1) silt loam with coarse prominent strong brown (7.5YR 5/6) mottles; massive structure or weak very coarse prismatic structure; sticky and plastic.

The surface layer is dark grayish brown to dark gray loam to silt loam. The subsoil is dark gray to gray or light gray silt loam to silty clay loam.

Natural fertility is high, organic matter medium, and acidity slight to neutral. They have a high available moisture capacity, high cation exchange capacity, and high base saturation. Paddy field is the predominant agricultural land use.

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

Most areas have a profile similar to that typical. Some areas have dominantly gray colours throughout. The surface textures are heavy silt loam and light silty clay loam. Small tracts with slopes ranging from 2 to 4 percent, are included.

Paddy rice is usually well suited, but, because of wetness, not other crops. However, with the installation of well designed drainage systems a wide variety could be grown.

Capability unit IIw.
Paddy suitability group P1.

5.18 JISAN SERIES

The Jisan series, consisting of poorly drained, deep soils on gently sloping and sloping narrow valleys and fans, is a member of the fine loamy nonacid family of Fluventic Haplaquepts. This series formed in alluvial materials is commonly associated with soils of the Dalcheon, Songjeong, Samgag, Bonggye, and Mudeung series.

A typical profile follows:

Ap--0 to 12 cm; dark grayish brown (2.5Y 4/2) loam; common, medium, prominent strong brown (7.5YR 5/6) mottles; moderate, fine granular structure; friable, slightly sticky, and slightly plastic; few, fine mica grains; many, fine roots; abrupt, smooth boundary; pH 5.1.

B21g--12 to 30 cm; olive gray (5Y 5/2) loam; few, fine, prominent dark yellowish brown (10YR 4/4) mottles; weak, coarse subangular blocky structure; slightly firm, sticky, and plastic; common, fine mica grains; common, fine pores; clear, smooth boundary; pH 5.5.

B22g--30 to 65 cm; grayish brown (2.5Y 5/2) loam; common, fine distinct, yellowish brown (10YR 5/8) mottles; light olive brown (2.5Y 5/4) crushed; weak, very coarse prismatic structure; common, fine mica grains; common, fine pores; thin, patchy broken gray coatings on structural faces; clear, smooth boundary; pH 6.5.

B3g--65 to 100 cm; gray (5Y 5/1) loam; many, medium, prominent yellowish brown (10YR 5/8) mottles; moderate, coarse prismatic structure; thin, patchy broken grayish brown (2.5Y 5/2) coatings; abrupt, smooth boundary; pH 6.5.

Cg--100 to 170+ cm; very dark gray (5Y 3/1) loam stratified with loamy sand; massive; common, coarse and medium iron carbonate concretions; pH 6.5.

The surface layer is dark grayish brown to very dark grayish brown loam or silt loam. The subsoil has variable colours of grayish brown, olive gray, gray, and very dark gray, and ranges from clay loam to loam. Some of these soils have dark gray silty clay loam or clay loam strata in the lower profile. The depth to water table is 80 to 150 cm, averaging about 90.

Natural fertility is moderate, organic matter content moderately low, and acidity medium to slight. Cation exchange capacity is medium and base saturation high. Available water capacity is medium. These soils are used mainly for paddy rice, which is well suited except for areas with moderately steep slopes. Drainage would be needed for the production of most other crops.

5.18.1 Jisan Loam, 2 to 7 Percent Slopes (JiB).

This soil, on gently sloping small valleys and on fans of small streams entering larger valleys, has generally a profile similar to that described for the series. In the mapped areas are included patches that have sandy loam or clay loam surface layers, and a few small tracts with less slope. This soil is well suited to paddy rice, producing high yields when well fertilized and managed. Other crops could be grown if a well designed drainage system were installed.

Capability unit IIw.
Rice suitability group P2a.

5.18.2 Jisan Loam, 7 to 15 Percent Slopes (JiC).

This soil, in sloping narrow, small valleys and fans of streams entering large valleys, has a profile much like that in the series description. A few small areas with sandy loam or clay loam surface layers, as well as some slopes of more than 15 percent, are included. In managing these steeper areas the main concern is erosion control of banks. Many different crops could be grown if properly designed drainage systems were installed.

Capability unit IIIe.
Paddy suitability group P3a.

5.19 *MANGYEONG SERIES*

The Mangyeong series, consisting of very deep, imperfectly drained soils that formed in fluvio-marine deposits, is a member of the coarse silty family of Fluventic Haplaquepts. These soils are found on broad alluvial plains and are usually associated with the Buyong, Jeonbug, and Byuam soils. Most of the Mangyeong soils are distributed on the southern and southeastern parts of the Gun along the Geum river.

A typical profile follows:

Ap1--0 to 15 cm; grayish brown (2.5Y 5/2) silt loam; common, fine, distinct, yellowish brown (10YR 5/6) mottles; moderate, fine, and medium granular structure; friable, non-sticky, and slightly plastic; many, fine mica flakes; many, fine roots; abrupt, smooth boundary; pH 5.4.

A1--15 to 30 cm; olive gray (5Y 5/2) silt loam; common, coarse, prominent yellowish red (5YR 4/0) mottles; grayish brown (2.5Y 5/2) crushed; weak, coarse subangular blocky structure; friable, non-sticky, and slightly plastic; many, fine mica flakes; many, fine roots; abrupt, smooth boundary; pH 5.4.

B1--30 to 42 cm; grayish brown (2.5Y 5/2) silt loam; common, fine and medium, prominent brown to dark brown (7.5YR 4/4) mottles; weak, coarse platy structure; friable, slightly sticky, and slightly plastic; common, fine pores; common, fine roots; clear, smooth boundary; pH 7.3.

B2--42 to 120 cm; gray (5Y 5/1) silt loam; common, fine, prominent yellowish red (5YR 4/0) and very dark grayish brown (10YR 3/2) mottles, brown to dark brown (10YR 4/3) crushed; weak, coarse prismatic structure; slightly firm, slightly sticky, and slightly plastic; pH 8.0.

The surface layer is grayish brown to dark grayish brown or olive gray, very fine sandy loam to loam or silt loam. The soils have lower horizons with gray to olive gray or grayish brown loam or silt loam. In some places these are silt loam stratified with very fine sandy loam. The water table is 120 cm to 200 cm from the surface.

Natural fertility is moderate, organic matter medium, cation exchange capacity moderately low and base saturation high. They are medium to slightly acid in

surface layers and neutral to moderately alkaline in subsoil and in substrata. Available moisture capacity is high.

Most of the land is in paddy rice in summer and barley in winter.

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

Most areas have profiles similar to that typical but in that mapped are included small tracts with a sandy loam surface layer, and some small parts with greater slopes.

Paddy rice is well suited, while barley can also be grown in the winter and flax in the spring. Crop yields are reduced in seasons of excessive rainfall.

Capability unit IIw.
Paddy suitability group P2b.

5.20 MANSEONG SERIES

The Manseong series, consisting of nearly level, deep, somewhat poorly drained soils that formed in alluvium, is a member of the fine loamy over sandy skeletal family of Aeric Fluventic Haplaquepts. These soils are on alluvial plains mainly in the northern part of the Gun, and are commonly associated with the Gangdong and Hogye. But, the Gangdong are sandy loam, and the Hogye are better drained, than them.

A typical profile follows:

Ap---0 to 13 cm; very dark gray (10YR 3/1) loam; weak, medium, blocky structure, breaking to moderate, fine and medium granular structure; friable, non-sticky, and nonplastic; many, fine and medium rice roots; abrupt, smooth boundary; pH 5.5.

A3---13 to 27 cm; dark grayish brown (2.5Y 4/2) loam; common, fine and medium, yellowish red (5YR 4/6) mottles; weak, coarse, prismatic and moderate, coarse and medium, platy structure; friable, non-sticky, and nonplastic; common, fine and very fine, pores; few, fine, rice roots; about 3 percent gravel by volume; clear, smooth boundary; pH 5.5.

Bg---27 to 43 cm; very dark grayish brown (2.5Y 3/2) loam; many, medium, yellowish red (5YR 4/6) mottles, dark brown (10YR 3/3) crushed; weak, medium subangular blocky structure and weak, medium platy structure; friable, non-sticky, and nonplastic; few, fine and very fine pores; about 3 percent gravel; clear, smooth boundary; pH 6.0.

C---43 to 68+ cm; very dark grayish brown (10YR 3/2), very gravelly and stony sandy loam (more than 50 percent of gravel and cobbles) with few, medium, faint, brown mottles; massive; few, medium, worm cast holes.

The surface layer is very dark gray to dark gray loam to silt loam. Depth to a very gravelly C horizon is 50 to 80 cm. Natural fertility is moderate, organic

matter content medium, as is cation exchange capacity and base saturation. Permeability is moderate and available moisture capacity, low.

Paddy rice is generally cultivated in the summer and barley or wheat in the winter.

5.20.1 Manseong Loam, 0 to 2 Percent Slopes (Ms).

Most areas have profiles similar to that typical. Small areas of greater slopes than the described range, are included as are small tracts where the very gravelly layer begins at 50 cm. Im some places the lower layers are fine sandy loam or sandy loam.

Paddy rice is the dominant crop and is well suited. Wetness is a management problem for anything else. Installation of well designed drainage systems would permit the growing of a wide variety of crops, and good yields of many could be obtained if well managed.

Capability unit IIw.
Paddy suitability group P2b.

5.21 MUDEUNG SERIES

The Mudeung series, consisting of shallow, somewhat excessively drained soils that formed over schist and porphyry in steep mountainous regions, are members of the fine loamy family of Lithic Dystrochrepts. These soils are mainly in the northwestern part of the Gun, and are commonly associated with Bonggye soils. Mudeung soils have formed over porphyry, while Samgag are over granite saprolite and have coarser textures than them. Areas of rock outcrops and talus are also associated.

A typical profile follows:

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

B--15 to 30 cm; brown to dark brown (10YR 4/3) gravelly loam; weak medium subangular blocky structure, breaking to granular; friable, slightly sticky; common fine roots; clear wavy boundary.

C--30 to 40 cm; pale brown loamy materials with rock structure.

D--40+ cm; hard andesite porphyry.

These soils have dark brown to dark grayish brown gravelly or stony loam or silt loam surface layers. Depth to hard rock ranges from 20 to 50 cm. Mudeung soils are moderately low in natural fertility, medium in organic matter, medium in cation exchange capacities, and low in base saturation. Available moisture capacity is also low. Reaction is medium to strongly acid. Pine forest predominates,

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

This soil, on high and steeply dissected mountains, has a profile similar to that typical for the series. Rock outcrops make up 5 to 25 percent of the mapped area. Small tracts of less or greater slopes than the described range, and small areas with the surface layer ranging in texture from sandy loam to gravelly sandy loam, are also included. Many small parts of deeper soils are adjacent to the streams that drain the area.

Pine forest predominates with oaks, alders, maples, and several kinds of shrubs being found in places. Trees grow well to make a dense forest in the small tracts of deeper soils. Erosion, moderately low fertility, and low available moisture capacity are the main management problems.

Capability class VIe.

5.22 NAGDONG SERIES

The Nagdong series, consisting of deep, somewhat excessively drained soils on nearly level flood plains, is a member of the sandy family of Typic Udipsamments. These soils are distributed in the southern and southeastern part of the Gun along the Geum river, and are commonly associated with Gyuam and Ihyeon.

A typical profile follows:

Ap--0 to 12 cm; yellowish brown (10YR 5/4) loamy fine sand; single grain; many, fine mica flakes; gradual, smooth boundary; pH 5.2.

C--12 to 120+ cm; yellowish brown (10YR 5/4) loamy fine sand with thin strata of silt; more compact than the surface layer; many, fine mica flakes; pH 5.9.

The surface layer is yellowish brown to brown to dark brown loamy fine sand. Fine mica grains are common throughout the profile.

The Nagdong are low in natural fertility and in organic matter content. Available moisture capacity is low, cation exchange capacity low, and base saturation medium to high.

Crops other than rice, usually are grown and produce high yields when irrigated and well fertilized.

5.22.1 Nagdong Loamy Fine Sand, 0 to 2 Percent Slopes (Nd).

This soil, on flood plains in narrow strips along the Geum river, has a profile similar to that typical for the series. This soil is subject to occasional floods from which it receives fresh deposits of alluvium.

With this mapping unit are included small tracts with sandy loam texture throughout the profile. These have a moderate available moisture capacity and produce higher yields than the typical Nagdong soil.

Peanuts, barley, buckwheat, and vegetables common in this Gun are grown and produce high yields where irrigated and well fertilized. The addition of compost improves the capacity to hold water and nutrients. Flooding, droughtiness, low available moisture capacity, and low natural fertility are hazards. Paddy rice is not well suited.

Capability unit IIIs.
Paddy suitability group P4bc.

5.23 OESAN SERIES

The Oesan series, consisting of somewhat excessively drained, deep soils that formed in schist and gneiss materials on strongly dissected steep mountains, is a member of the loamy skeletal family of Typic Dystrochrepts. Depth to hard rock is more than 70 cm from the surface. These soils are near the western Gun boundary, and are commonly associated with Mudeung, Seogto, and Gaghwa soils.

A typical profile follows:

Ap---0 to 10 cm; brown to dark brown (7.5YR 4/4) gravelly loam; weak, fine and medium, granular structure; friable, slightly sticky, and slightly plastic; many, fine and medium roots; common mica flakes; clear, smooth boundary; pH 5.4.

B21---10 to 20 cm; strong brown (7.5YR 5/6) gravelly loam; weak, medium and coarse, granular structure; slightly firm, slightly sticky, and slightly plastic; many, fine and coarse roots; common, fine pores; about 20 percent angular schist gravel common mica flakes; clear, wavy boundary; pH 5.4.

B22---20 to 55 cm; yellowish red (5YR 5/6) gravelly loam; massive; slightly firm, slightly sticky, and sl ghtly plastic; few, coarse pine roots; common mica flakes; clear, irregular boundary; pH 5.4.

C---55 to 100 cm; very pale brown (10YR 7/3); few, fine and medium, red (10YR 4/8) mottles; very gravelly loam; many mica flakes; gravel is schist and is about 50 percent of the mass; pH 5.4.

The surface layer ranges from brown to dark brown, or strong brown in small areas where eroded, the texture from stony loam to loam or silt loam. The upper subsoil is strong brown, yellowish brown, or yellowish red gravelly loam to loam. The lower subsoil is yellowish brown or yellowish red in colour, and the gravel content increases with depth.

The Oesan soils are low in fertility, medium or low in organic matter and are strongly to medium acid. They have low base saturation, medium cation exchange capacity, and low available moisture capacity. The land is in forest of pine, alders, chestnuts, and wild grass. Trees grow well on these soils except in places where rocks are exposed.

5.23.1 Oesan Channery Loam, 30 to 60 Percent Slopes (OsE).

This soil is in steep mountainous regions, and most areas have profiles similar to that typical for the series. Two to 10 percent of the mapped areas is rock outcrop. Also included are small tracts with less and greater slopes, and a few small areas with much less gravel content than usual.

Pine forest predominates with some alders, chestnuts, and wild grass. Some moderately steep land has been cleared for crops, but except where rocks are common, trees grow well to make a dense forest. Because of erosion, stoniness, low available-water capacity, and poor workability crops are not really suited.

Capability unit VIIe.

5.24 RIVERWASH COBBLY (RC).

This land, consisting of areas of cobbles and stones mixed with sand, is located on the first bottoms along streams and rivers. It is commonly associated with Hwabong and Hwangryong soils.

The Hwangryong are similar but they include enough fine materials to support vegetation. Some parts are covered with wild grass, but mainly the ground is barren.

Fertility is very low as is available moisture capacity. In the rainy season flooding is frequent.

Capability unit VIII.

5.24.1 Riverwash sandy (RS).

This land, consisting of sandy materials deposited along the Geum river, is in the south and southwest. It is mainly associated with Nagdong soils.

Both natural fertility and available moisture capacity are low. In the rainy season flooding from the Geum river is frequent. Reclamation is not economically feasible.

Capability unit VIII.

5.25 ROCK LAND (RL)

This Rock land, sloping to moderately steep, is located on heights closely associated with mountains where the Samgag and Mudeung series are found. The stones and rocks, mostly of granite, granite gneiss, diorite and conglomerate, cover 50 to 90 percent of the surface, and range from 25 to 60 cm in diameter. This land is commonly associated with Seogto, Samgag, and Mudeung soils. Only small amounts of low quality woodland products are produced, and agriculture is not a viable proposition.

Capability unit VIII.

5.26 SAMAM SERIES

The Samam series, consisting of deep, moderately well drained soils that formed in alluvium washed from nearby uplands underlain by red shale materials, is a member of the fine loamy family of Aquic Dystric Eutrochrepts. The soils are found in narrow alluvial valleys and mountain-foot slopes in the general areas of the Habin and Buyeo.

A typical profile follows:

Ap--0 to 14 cm; dark reddish gray (5YR 4/2) loam; moderate, medium to coarse, granular structure; friable, non-sticky, and nonplastic; many, roots; clear smooth boundary; pH 5.0.

A1--14 to 24 cm; reddish brown (5YR 5/3) silt loam; common, fine, distinct, strong brown (7.5YR 5/6) mottles; weak, fine to medium, subangular blocky structure; slightly firm, non-sticky, and nonplastic; roots as above; clear, smooth boundary; pH 4.9.

B--24 to 46 cm; weak red (2.5YR 4/2) silt loam; common, fine, distinct yellowish red (5YR 4/8) mottles; weak to moderate, coarse, subangular blocky structure, breaking to moderate, medium, platy structure; slightly firm, slightly sticky, and slightly plastic; abrupt, smooth boundary.

C1--46 to 54 cm; weak red (2.5YR 4/2) loam; common, fine and medium, faint light reddish brown (5YR 6/3) mottles; massive; firm, non-sticky, and nonplastic; clear, smooth boundary; pH 6.1.

C2--54 to 71 cm; reddish brown (2.5YR 4/4) silt loam; massive; slightly firm, non-sticky, and nonplastic; common, fine pores; gradual, smooth boundary; pH 6.9.

C3--71 to 98 cm; reddish brown (5YR 4/3) silt loam; massive; slightly firm, sticky, and plastic; common, fine pores; gradual, smooth boundary; pH 7.1.

C4-98 to 117 cm; mottled, reddish brown (5YR 4/3) and yellowish red (5YR 5/8), reddish brown (5YR 5/3) crushed; silty clay loam; structureless (massive); slightly firm, very sticky, and very plastic; common, fine pores with thin clay films; abrupt, smooth boundary; pH 7.1.

Cg--117 to 150 cm; mottled, dark gray (2.5Y 4/0) and strong brown (7.5YR 4/8), olive brown (2.5Y 5/4) crushed; silty clay loam; structureless (massive); slightly firm, very sticky, and very plastic; few, fine, weak red clay films along the pores (crotovinas); few, fine pores; pH 6.9.

The surface layer is reddish gray to dark reddish gray loam or silt loam and 15 to 20 cm thick. The C horizons are weak red to reddish brown loam, silt loam or silty clay loam. Generally the C horizons have gray colours in the lower part. Gravel and cobbles of red shale materials are common.

The Samam soils are moderate in natural fertility, medium in organic matter and strongly to slightly acid. Cation exchange capacity is medium and base saturation high. They have high available water capacities.

Paddy rice, which is well adapted to the soils is dominant. Some additional drainage would be needed for the maximum production of most other crops.

5.26.1 Samam Loam, 2 to 7 Percent Slopes (SaB).

This soil, on gently sloping small valleys and fans with small streams, a profile usually similar to that described in the series. Practically all of these soils have been graded into rice paddies. In terraces of paddy systems the paddy soil in the upper side has gray colours and poor drainage, while that in the lower side has reddish brown and good drainage. The water table is high on the upper parts.

With this soil are included some small areas with silty clay loam in the lower profile, and a few slopes of less than 2 percent. Paddy rice is well suited and produces high yields when well fertilized and managed. Better drainage is needed for maximum production of other crops.

Capability unit IIe.
Paddy suitability group P2ac.

5.27 SAMGAG SERIES

The Samgag series, consisting of deep, excessively drained soils on the steep mountains in the central and northeastern part of the Gun, is a member of the coarse loamy family of Typic Dystrochrepts. They are found commonly on slopes above the Seogto, Togye, Yongji, and Jisan soils.

A typical profile follows:

A--0 to 15 cm; yellowish brown (10YR 5/8) sandy loam; weak, very fine to fine granular structure; very friable; many, fine to medium roots; abrupt, smooth boundary; pH 4.9.

B--15 to 63 cm; brownish yellow (10YR 6/6) sandy loam; weak, fine to very fine granular structure; very friable; many, fine to medium roots; clear, smooth boundary; pH 5.2.

C--65 to 140 cm; very pale brown (10YR 7/3) sandy loam saprolite; with some red, black, brown and white sandy grains; massive structure; friable; few, fine roots; clear, smooth boundary; pH 5.2.

The surface layer, sandy loam or coarse sandy loam with less than 15 percent gravel and cobbles, is yellowish brown to dark brown, and is 10 to 20 cm thick. The B horizon is dark brown, brownish yellow, or yellowish red coarse sandy loam or loam. The C horizon is saprolite and is very pale brown yellow coarse sandy loam or loamy sand. Depth to hard rock is usually one metre or more.

The Samgag are low in natural fertility, organic matter, cation exchange capacity, and base saturation. They are strongly to medium acid, and have a low available moisture capacity.

Some soils on the gentle slopes are planted to crops, but yields are low. Vegetation consists mainly of pines, with some alders and acacias.

5.27.1 Samgag Sandy Loam, 30 to 60 Percent Slopes, Eroded (SgE2).

Most areas have a profile similar to that typical. Some small tracts have a layer of yellowish clay loam over the sandy loam saprolite, and stones are present in many areas. But, usually less than 15 percent of the surface is thus covered. Other areas have surface layers ranging in texture from gravelly sandy loam to loam or gravelly loam. Some small slopes of more than 60 percent, are also found.

Most of the mapping unit is in forest of pine, but with proper management grazing could be obtained. The main management problems are erosion and droughtiness.

Capability unit VIe.

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

Most areas have profiles similar to that typical with stones covering from 15 to 25 percent of the surface area. In the mapped areas are included small places where the surface layer is gravelly loamy sand or sand, and a few small tracts which are not severely eroded.

Pines dominates, with some alders and acacias to prevent erosion and provide firewood, also being grown. This soil is mainly suited to woodland, but some areas could provide grazing if properly managed. Erosion, low fertility, and coarse texture are main management problems.

Capability class VIIe.

5.27.3 Samgag Soils, 30 to 60 Percent Slopes, Gullied (SgE4).

The gullies in these soils are moderately deep to deep, and the surface layer is gravelly, stony, or rocky sandy loam or loamy sand, with a variable colour. Slopes range mostly from 40 to 60 percent, but a few are more than that. Stones cover 20 to 40 percent of the area. Some areas where rock outcrops are common, have been included.

Erosion continues but some land has been stabilized. Most of the mapping unit is in pines, with tracts planted to alders and acacias for erosion control. This soil is mainly suited to woodland. Erosion, low fertility, and coarse texture are serious management problems.

Capability unit VIIe.

5.28 SEOGTO SERIES

The Seogto series, consisting of sloping to moderately steep, well drained soils that formed in colluvium eroded from areas underlain by schist, granite, andesite porphyry, and quartz conglomerate, is a member of the loamy skeletal family of Dystric Fluventic Eutrochrepts. These are found on mountain footslopes, commonly below the Mudeung and Samgag soils. The Seogto differ from the Gaghwa soils in lacking fine textured B horizons, and are widely distributed on the central and northern regions.

A typical profile follows:

A1--0 to 10 cm; brown to dark brown (10YR 4/3) gravelly to cobbly loam (10 to 50 percent of gravel and cobbles); weak, fine and medium, granular structure; friable, slightly sticky, and slightly plastic; many, fine roots; abrupt, smooth boundary; pH 5.4.

B2--10 to 35 cm; brown to dark brown (7.5YR 4/4) gravelly to cobbly sandy loam (gravels and cobbles are as above); weak, fine and medium, subangular blocky structure, breaking to fine granular; many, fine roots; clear, smooth boundary; pH 5.6.

C--35 to 300+ cm; dark yellowish brown (10YR 4/4) very gravelly to cobbly loam; structureless; more than 50 percent of gravels, cobbles, and stones; pH 5.9.

The A1 layer is brown, dark brown, or dark yellowish brown gravelly, cobbly or stony loam, silt loam, and ranges from 10 to 30 cm in thickness. The B2 horizon is brownish yellow to dark yellowish brown or brown gravelly or cobbly sandy loam or loam less than 20 cm thick. The substratum is very gravelly or cobbly loam or silt loam. All horizons have one to fifteen percent stones. Depth to hard rock is more than 150 cm.

Seogto soils are moderate in fertility and low in organic matter content and available moisture capacity. Cation exchange capacity is low, and base saturation medium. Most of the land is used for common crops other than rice. Some places with steeper slopes are in pines and small hardwoods.

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

Most areas have a profile similar to that typical for the series. In the mapped areas are included small tracts with surface layers of strong brown loam or silt loam, some small tracts with slopes of less than 7 percent and a few areas where the substratum is very gravelly or cobbly sandy loam.

This soil is well suited to grass, mulberries, persimmons and chestnuts, but most of the mapping unit is in crops such as soybeans and red peppers. A few areas are used for rice. Ramie, potatoes, and vegetables are also cultivated. Erosion, low fertility, gravel-content, and droughtiness are the main management problems.

Capability unit IIIe.
Paddy suitability group P4abc.

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

This soil has a profile similar to that typical for the series. In the mapped areas are included small places where the surface layer is strong brown loam or silt loam. Grass, mulberries, and chestnuts, are well suited with beans, peas, and red peppers also grown in parts. Some places are cultivated to ramie, potatoes, and vegetables.

Erosion, low fertility, coarse fragments, and droughtiness are problems. Pasture and hay, if the stones were removed, would do well.

Capability unit IVe.
Paddy suitability group P4abc.

5.28.3 Seogto Stony Loam, 30 to 60 Percent Slopes (SsE).

This soil has a thinner surface layer and much more cobbles and stones than the typical profile described for the series. Small areas with strong brown loam or silt loam surface layers, are included.

Pines and other small trees dominate with chestnuts and persimmons, which do well growing. Erosion, stoniness, droughtiness, and poor workability are main management problems. This soil is too stony for hay crops as the stones interfere with the use of machinery.

Capability unit VIe.

5.29 SINDAB SERIES

The Sindab series consisting of poorly drained, deep, dark gray soils, is a member of the sandy family of Typic Psammaquents. They are found in small valleys in areas of severely eroded Samgag soils, also on broad alluvial plains, and are associated with the Gangdong series. But, the Sindab has coarser textured B horizons than them.

A typical profile follows:

Ap--0 to 15 cm; dark grayish brown (2.5Y 4/2) gravelly sandy loam with many, medium prominent yellowish red (5YR 4/8) mottles; weak, fine, granular structure; many, fine mica grains; abrupt, smooth boundary; pH 5.0.

C1g--15 to 30 cm; very dark gray (5Y 3/1) gravelly loamy sand with few, fine, yellowish red (5YR 4/8) mottles; structureless single grain; common, fine iron carbonate concretions; clear, smooth boundary; pH 6.0.

C2g--30 to 40 cm; dark gray (5Y 4/1) silt loam; few, medium, dark grayish brown mottles; massive; many, fine pores; abrupt, smooth boundary; pH 6.0.

C3g--40 to 100+ cm; dark gray (5Y 4/1) sand.

The Ap horizon is dark grayish brown to very dark gray sandy loam or loamy sand ranging from 15 to 20 cm in thickness. The C horizons are dark gray to very dark gray sandy loam to gravelly coarse laomy sand or sand. In places it is stratified with silt loam, loam, or sandy loam. Some areas have quartz pebbles and cobbles. The depth to the water table ranges from 0 to 50 cm.

The Sindab series is low in natural fertility and in organic matter. Cation exchange capacity is very low and the base saturation is moderate. Available moisture capacity will be very low if the water table is lowered.

The soils of the Sindab series are mainly used only for paddy rice.

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

This poorly drained, deep, sandy soil on small flood plains mainly in areas of the Samrae, has a profile similar to that typical for the series. In the mapped areas are included some soils with more silt and clay content. These have higher available moisture and cation exchange capacities than usual. Small areas with a loam or loamy sand surface layer and slopes of 2 to 4 percent adjacent to the upland soils, are also comprised.

Only paddy rice is suited because it is too wet for other general crops, and drainage would be of doubtful value because lowering the water table would make the soil droughty. The major management problems are poor drainage and coarse texture.

Capability unit IVw.
Paddy suitability group P3b.

5.30 SINHEUNG SERIES

The Sinheung series, consisting of nearly level, deep, imperfectly drained soils formed in alluvial materials, is a member of the fine loamy nonacid family of Aeric Fluventic Haplaquepts. The depth to the water table is about 100 cm. These soils are commonly associated with the Sindab, Gangdong, Jeonbug, and Buyong series, and are usually adjacent to the upland. The Sinheung have less clay than the Jeonbug and Buyong and are better drained than Sindab and Gangdong.

A typical profile follows:

Ap--0 to 12 cm; light olive brown (2.5Y 5/4) silt loam; friable, non-sticky, and nonplastic; structureless; common, fine, distinct strong brown (7.5YR 5/6) mottles; light olive brown (2.5Y 5/4) crushed; abrupt, smooth boundary; pH 5.0.

A1g--12 to 32 cm; dark gray to gray (5Y 4.5/1) loam; few, medium, distinct strong brown (7.5YR 5/6) mottles, olive gray (5Y 5/2) crushed; weak, coarse blocky structure; abrupt, smooth boundary; pH 6.0.

B21--32 to 54 cm; faintly mottled brown (10YR 4/3) and grayish brown (10YR 5/2) silt loam; few, medium, distinct yellowish brown (10YR 5/6) mottles in prisms, dark grayish brown (2.5Y 4/2) crushed; weak, coarse prismatic structure, breaking to weak, coarse platy in upper part; slightly firm, slightly sticky, and slightly plastic; few, fine pores; abrupt, smooth boundary; pH 6.5.

B22g--54 to 97 cm; dark grayish brown (10YR 3/2) silt loam; common, medium, distinct yellowish brown (10YR 5/6) mottles; weak to moderate, coarse prismatic structure with moderately thick continuous gray coatings on structural faces; firm, sticky, and plastic; common, very fine pores; abrupt, smooth boundary; pH 6.5.

Cg--97 to 140 cm; dark grayish brown (2.5Y 4/2) silt loam stratified with fine sandy loam, loam; few, medium, faint olive brown (2.5Y 4/4) mottles; pH 6.5.

Heavy loam and heavy silt loam textures dominate in all horizons but many profiles have a thin strata of other textures. The A horizon is olive brown or dark grayish brown, and 10 to 15 cm thick. The upper B horizons are dominantly brown with many gray mottles. The lower B and C are dominantly gray with some brown mottles.

The Sinheung soils are moderate in organic matter, and medium in cation exchange capacity. Base saturation is medium to high, and the available water capacity is moderate to high. Generally, they have deep root zones.

The Sinheung soils are mainly used for paddy rice, and produce high yields when well fertilized and managed.

5.30.1 Sinheung Loam, 0 to 2 Percent Slopes (Sh).

This soil is imperfectly or poorly drained, and occurs on gently sloping alluvial plains. Some areas have a profile as described in the series, but many parts have dominantly gray colours. Some small areas have very sandy profiles.

Paddy rice is well suited and with improved drainage and good management high yields of many crops including barley, wheat, corn, and soybeans, could be produced.

Capability unit IIw.
Woodland suitability groups P1.

5.31 SONGJEONG SERIES

The Songjeong series, consisting of deep, well drained, residual soils over granite, granite gneiss, and schist, is a member of the fine loamy family of Typic Hapludults. These soils are on sloping, moderately steep or steep hills and low mountains. They have deep root zones, with a hard rock more than 100 cm from the surface. Songjeong are commonly associated with Dalcheon and Gaghwa soils, and differ from the former in having thicker B horizons and coarser textures. Gaghwa differ in being gravelly or cobbly and in having finer textures. The Songjeong are distributed generally in the centre and south.

A typical profile follows:

Ap--0 to 4 cm; reddish brown (5YR 5/4) loam; very fine and fine granular structure; very friable, non-sticky, and nonplastic; many, fine and medium grass and pine roots; common mica flakes; abrupt, smooth boundary; pH 5.0.

B2t--4 to 29 cm; red (2.5YR 4/6) loam; weak, fine and medium subangular blocky structure and moderate, fine and very fine granular structure; thin patchy clay cutans; friable, sticky, and plastic; granite gneiss and quartz gravel (less than 5 percent in volume); common, fine and medium grass and pine roots; common mica flakes; abrupt, smooth boundary; pH 4.5.

B3t--29 to 114 cm; red (2.5YR 4/4) sandy loam; structureless (massive); friable; common, very fine pores; common mica flakes; clear wavy boundary; pH 4.5.

C--114+ cm; granite gneiss saprolite.

The A horizon is reddish brown or yellowish brown loam or silt loam, but is red or yellowish red loam or sandy loam in the eroded soils. The thickness of this layer is 10 to 20 cm. The upper subsoil is yellowish red to red loam or silt loam to silty clay loam. The lower subsoil is similar to the upper subsoil in colour, but somewhat coarser in texture. The total thickness of the subsoil is 80 cm or more.

These soils are low in natural fertility and organic matter content. Cation exchange capacity is medium and base saturation low. Water enters and passes through these soils at a moderate rate. They have a medium available moisture capacity. The sloping areas and some of the moderately steep slopes are cultivated to common crops other than rice, and steeper slopes are mostly vegetated to pines, shrubbery, and wild grass. Crops on these soils respond to good management, including the application of compost.

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

This soil, on sloping hills with short slopes, generally has a profile similar to that typical. In the mapped areas are included small areas with a clayey subsoil, and small tracts with slopes of less than 7 percent.

Ginseng, barley, soybean, sesame, and peach trees usually do well. Erosion is a severe problem, while droughtiness and low fertility are also of concern. Paddy rice is only moderately suited because of the slope, low water table, and permeability.

Capability unit IIIe.
Paddy suitability group P3ac.

5.31.2 Songjeong Loam, 7 to 15 Percent Slopes, Severely Eroded (SoC3).

The surface layer is yellowish red or red as most of the original solum has been removed by sheet and rill erosion. Apart from this, the profile is similar to that typical for the series. But, some small areas with sandy loam, silty clay loam, gravelly loam, gravelly clay loam or gravelly sandy loam texture, small tracts with clay subsoils, and areas consisting entirely of material similar to the C horizon, are also included.

Barley, soybean, red pepper, sesame, and peach trees are mostly suited but yields are low compared with uneroded areas. Erosion, droughtiness, and low fertility are serious management problems. Paddy rice will do only moderately well due to the above mentioned hazards.

Capability unit IIIe.
Paddy suitability group P3ac.

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

The depth of solum in most areas is shallower than that described as typical for the series, but other characteristics are similar. Some small areas with heavy

silty clay loam to silty clay subsoils, and small tracts where the surface layer is silty clay loam or sandy loam with some gravel, are also included.

About half of the areas are in barley, soybean, red pepper, and peach trees. The remainder is natural forest such as pines, and alders, with wild grass. Crops, when compost is applied and irrigation water is available, do well, as do forage crops. Erosion, droughtiness, low fertility, and slope are serious management problems. Paddy rice is poorly suited because of these hazards.

Capability unit IVe.
Paddy suitability group P4ac.

5.31.4 Songjeong Loam, 15 to 30 Percent Slopes, Severely Eroded (SoD3).

The surface layer is dominantly yellowish red or red because most of the original solum has been removed by sheet and rill erosion. Except for the surface most areas have profiles similar to that described for the series. That layer is loam or silt loam, but some small tracts with sandy loam, silty clay loam, gravelly loam, gravelly clay loam or gravelly sandy loam textures are included. Also included are small areas of Jeonnam and Samgag soils.

Pines, alders and wild grass dominate. Mulberries grow well. Erosion, droughtiness, and low fertility are serious management problems. Paddy rice is not suited because of these hazards and the slope but forage crops are.

Capability unit IVe.

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

The subsoil is generally thinner than that of the profile described as typical for the series, but characteristics otherwise are similar. Small areas with a surface layer that is sandy clay loam, gravelly loam, or gravelly clay loam, and few small tracts with thick clayey subsoils are also included.

Most areas are in pines, alders, and wild grass. Mulberries too are suitable. Erosion, droughtiness, low fertility, and steep slopes are serious management problems. However, with proper care moderate amounts of forage could be obtained.

Capability unit VIe.

5.31.6 Songjeong Loam, 30 to 60 Percent Slopes, Severely Eroded (SoE3).

This soil is thinner in the subsoil and yellowish red or red in the surface layer as most of the original solum has been removed by sheet and rill erosion. In other respects profiles generally are similar to that typical, except some small tracts where the surface layer is sandy loam, gravelly sandy loam, silty clay loam, loam, gravelly loam or gravelly clay loam.

Pines, alders, shrubbery, and some patches of wild grass predominate. Mulberries can be grown. Accelerated erosion, droughtiness, low fertility, and poor workability are severe management problems. Nevertheless, moderate amounts of forage could be obtained.

Capability unit VIe.

5.31.7 Songjeong Soils, 30 to 60 Percent Slopes, Gullied (SoPM).

The soils are on strongly dissected steep hills and low mountains, and had profiles similar to the typical one in the series which have now been changed by erosion. The gullies are moderately deep or deep. The surface layer ranges from gravelly sandy loam to sandy saprolite which is exposed in places, while the subsoil ranges from yellowish red to red in colour. Some areas of greater slopes are included.

Some land is still eroding, and some has been stabilized. This soil is not suited to crops or pasture, and reclaiming it for farming is not economically feasible. Thus well managed woodland would give moderate returns. At present pines and alders are the usual land cover.

Capability unit VIIe.

5.32 TIDAL MARSH (TS)

The Tidal Marsh is a long, narrow area adjacent to the Geum river. The lower parts are covered by water daily, the higher usually at high tides. The land is nearly level silt loam or clayey material that in places contains a considerable amount of very fine sand. There is an excess of soluble salts.

Without extensive reclamation by dikes and drainage, agriculture will not be possible.

Capability unit VIII.

5.33 TOGYE SERIES

The Togye series, consisting of deep, excessively drained soils that formed in alluvium-colluvium eroded from the Samgag soils, is a member of the sandy family of Typic Udipsamments. They are found on gently sloping to sloping low terraces, mountain footslopes, and fans, and are commonly associated with the Samgag and Yongji, differing from the latter in being coarse textured and better drained. They are widely distributed in the central and northern mountainous regions.

A typical profile follows:

Ap--0 to 9 cm; brown to dark brown (7.5YR 4/4) loamy coarse sand; weak, fine and medium granular structure; many, fine and medium barley roots; clear, smooth boundary; pH 5.7.

C--9 to 100+ cm; strong brown (7.5YR 5/6) loamy coarse sand; structureless (single grained); few fine roots; many fine mica flakes; pH 5.7.

The Ap horizon ranges from brown to dark brown in colour and from fine sandy loam, sandy loam to loamy coarse sand in texture. The C horizon ranges from sandy loam to fine gravelly loamy sand.

They are low in natural fertility, low to very low in cation exchange capacity, low in organic matter content and medium to high in base saturation. Available moisture capacity is very low and the soil is rapidly permeable. Crops such as barley, buckwheat, red pepper and other vegetables, are grown.

5.33.1 Togye Loamy Coarse Sand, 2 to 7 Percent Slopes (TgB).

This soil on gently sloping low terraces and fans, generally has a profile similar to that described in the series. In the mapped areas are comprised: some small tracts with a surface layer of loam, silt loam, or loamy sand, a few small tracts with fine gravelly loamy sand or fine gravelly sandy loam C horizons, some areas having silty clay loam to sandy loam textures at a depth of about one metre, and patches with slopes of less than 2 percent.

This soil is not well suited to cultivation, but general crops other than paddy rice can be grown if irrigation is practised. Good yields of barley, soybean, red pepper, and buckwheat are obtained in years of high rainfall. The major problems are droughtiness and low fertility. A minor problem is erosion of streambeds which carry water through these areas. Grassed streambeds or waterways will help curtail this.

Capability unit IVe.
Paddy suitability group P4abc.

5.33.2 Togye Loamy Coarse Sand, 7 to 15 Percent Slopes (TgC).

This soil is on sloping mountain footslopes, low terraces and fans, mainly below Samgag soils. It has a profile much like that typical for the series, except for some gravel in the lower part.

Mostly crops are poorly suited, but some such as mulberry, sesame, tobacco, and barley can be grown, given good management. The major problems are droughtiness and low fertility.

Capability unit IVs.
Paddy suitability group P4abc.

5.34 YONGJI SERIES

The Yongji series, consisting of deep, moderately well drained soils that formed in alluvial materials on gently sloping to sloping narrow small valleys and low terraces, is a member of fine loamy family of Aquic Fluventic Eutrochrepts. These soils are commonly associated with the Samgag, Songjeong, Togye, Seogto, and Jisan. The Yongji is better drained than the last mentioned and is widely distributed throughout the Gun.

A typical profile follows:

Ap--0 to 15 cm; dark grayish brown (2.5Y 4/2) silt loam with common, fine and medium, distinct brown to dark brown (7.5YR 4/4) mottles; massive; friable; abrupt, smooth boundary; pH 5.0.

B21g--15 to 22 cm; dark grayish brown (2.5Y 4/2) silt loam with many, medium prominent strong brown (7.5YR 5/8) mottles; moderate, coarse platy; abrupt, smooth boundary; pH 6.0.

B22g--22 to 49 cm; very dark brown (10YR 3/2) to very dark grayish brown (10YR 4/2) silt loam; moderate medium, coarse platy; firm; many, fine root channels; abrupt, irregular boundary; pH 6.5.

B23g--49 to 90 cm; mottled yellowish brown (10YR 5/8), grayish brown (2.5YR 5/2) and brown (10YR 5/3) silt loam; weak subangular blocky; gradual, smooth boundary; pH 6.5.

C--90 to 120 cm; grayish brown (2.5Y 5/2), yellowish brown (10YR 5/6), and dark gray (10YR 4/1) silty clay loam; massive.

Textures commonly are heavy gritty silt loam, heavy loam, light clay loam, or light gritty silty clay loam with a thin strata of sandy loam and loamy fine sand being present in some profiles. In soils used for paddy rice the upper horizons are dark grayish brown or dark gray with bright coloured mottles. The lower horizons are dominantly brown with many gray, grayish brown, or dark grayish brown mottles. Textures are variable below 100 cm.

The Yongji are moderate in natural fertility, medium in cation exchange capacity, and high in base saturation. They have moderate to high available water capacities. The root zone is deep. The land is used for paddy rice and barley.

5.34.1 Yongji Loam, 2 to 7 Percent Slopes (YjB).

Most areas have a profile like that described for the series. In the areas mapped are included small tracts with a sandy loam surface layer, soils with browner colours, and many places with dominant colours of gray and grayish brown throughout the profile.

This soil is well suited to most crops including paddy rice, and produces moderately high yields in general conditions, but good management is needed. The major management problem is erosion control, which would not exist in a well constructed paddy system. Often the paddies are too wet to grow barley.

Capability unit IIe.
Paddy suitability group P2ac.

5.34.2 Yongji Loam, 7 to 15 Percent Slopes (YjC).

Most areas have profiles similar to that typical but soils with dominant colour of gray, dark gray, and dark grayish brown, have been included in that mapped.

This soil is well suited for paddy rice and barley, and produces high yields. Other crops commonly grown in the Gun can also give good results when the land is drained and well managed.

Capability unit IIIe.
Paddy suitability group P3ac.

Chapter 6

USE AND MANAGEMENT OF SOILS

6.1 INTRODUCTION

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

The soil characteristics favourable for paddy rice differ from those for other crops. Rice is considered in the discussions of capability groups, and is discussed in greater detail in the following section on paddy suitability groups. The sub-section 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 the degree and kind of permanent limitation, but without comsideration 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 Buyeo 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 within each capability class, and are designated by adding a small letter, e, s, or w to the class numeral, for example, IIe The letter 'e' 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, and 'w' that water in or on the soil interferes with plant growth or cultivation.

The classification does not necessarily reflect the value of the land. The Class IIw and IIIw lands are well suited to paddy rice, and produce high yields of rice without special or difficult irrigation practices. These soils are too wet to produce good yields of other crops without additional drainage. The IVs soils produce good crops of melons and peanut, but are too droughty for the good production of most other crops. In Class I there are no subclasses because those 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 subclass discussion of the capability unit, and management suggestions are given in the mapping unit descriptions 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.

In this capability unit are level to nearly level, well to moderately well drained, deep soils that have silty surface layers and a high available moisture capacity. These soils have moderate or high natural fertility and medium organic matter content. They are:

Gyuam silt loam, 0 to 2 percent slopes.

Ihyeon silt loam, 0 to 2 percent slopes.

A wide range of crops, including paddy rice will do well as the land is highly productive, and can be cropped intensively. All available crop residues turned into the soils will improve fertility, and liming as required is 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 capability unit are gently sloping, deep, moderately well to well drained, moderately permeable, fertile soils. These are generally high in available moisture

capacity. They are:

Bancheon silty clay loam, 2 to 7 percent slopes.

Gaghwa cobbly loam, 2 to 7 percent slopes, eroded.

Hwadong silty clay loam, 2 to 7 percent slopes.

Samam loam, 2 to 7 percent slopes.

Yongji loam, 2 to 7 percent slopes.

A wide range of crops, such as soybean, rice, corn, barley, wheat, and many others commonly grown in the Gun are suited, but the land is subject to moderate erosion when ploughed and not protected by conservation practices. Most of the soils are strongly acid.

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

Good management also includes minimum tillage, turning under of crop residues, liming as needed and proper fertilization.

6.2.2.2 Capability unit IIs.

This soil is gently sloping, well drained, deep, rapidly permeable, dark coloured, and has gravelly loam or gravelly sandy loam texture. It is moderate in natural fertility, high in organic matter content, and low to medium in available moisture capacity. It is Hogye gravelly loam, 2 to 7 percent slopes.

Soybeans, barley, wheat, vegetables and many other crops, as well as orchard and mulberry fields, are well suited. It is moderately subject to droughtiness because of the high water loss through the rapidly permeable, gr velly loamy soil. Removal of this will make cultivation easier, but it is a difficult process. Frequent application fertilizer will lessen the effect of leaching.

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 tables. These soils are:

Gangdong loam, 0 to 2 percent slopes.

Gangdong loam, 2 to 7 percent slopes.

Jeonbug silt loam, 0 to 1 percent slopes.

Jisan loam, 2 to 7 percent slopes.

Mangyeong silt loam, 0 to 1 percent slopes.

Manseong loam, 0 to 2 percent slopes.

Sinheung loam, 0 to 2 percent slopes.

The soils of this unit generally have a high available moisture capacity except for the Gangdong which are loamy over sand and have a somewhat lower one. Paddy rice does well, but for other crops, installations to drain the soils and lower the water table, would be required.

No special measures to control erosion are needed as most of the land has been shaped into paddies. But, the paddy dikes need to be properly maintained to control the runoff over the paddy walls. If drained, winter crops such as barley and alternative summer crops would also do well. Green manure crops, proper fertilization, and liming as needed will increase yields. The Gangdong soils need split applications of fertilizer and the addition of fine clayey soil to reduce the leaching of plant nutrients.

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 to poorly drained, gravelly to cobbly, eroded soils. They are:

Bancheon silty clay loam, 7 to 15 percent slopes, eroded.

Bansan clay loam, 7 to 15 percent slopes.

Dalcheon silt loam, 7 to 15 percent slopes, eroded.

Gaghwa cobbly loam, 7 to 15 percent slopes, eroded.

Hogye gravelly loam, 7 to 15 percent slopes.

Jisan loam, 7 to 15 percent slopes.

Seogto gravelly loam, 7 to 15 percent slopes.

Songjeong loam, 7 to 15 percent slopes, eroded.

Songjeong loam, 7 to 15 percent slopes, severely eroded.

Yongji loam, 7 to 15 percent slopes.

Most of the soils in this unit have a moderate or high available moisture capacity. They are mostly suitable for barley, wheat, soybean, and other summer crops commonly grown in the Gun. Some areas are in woodland. The Jisan, Yongji, and some others are planted to paddy rice during the summer and to barley or wheat in the winter-spring. The Jisan need to be drained to grow barley or wheat because of the high water table.

Erosion is the chief hazard in cultivated areas. Contour tillage, terraces, grassed waterways, and weir dams will help to retard runoff and control erosion. Wetness or high water table in the Jisan soil is another severe limitation in growing

crops other than rice. On this land, a system of ditches is needed to remove excess surface water, and to lower the water table during wet seasons.

Yields are somewhat reduced following dry seasons, but some areas can be used for rice and other crops when sources of water are developed. Gravel and cobbles need to be removed, if present, for easier cultivation. Proper fertilization and liming are necessary, and all crop residues should be turned in for higher crop yields.

These soils are also suitable for pasture. A complete establishment programme including land preparation, liming, fertilization, seeding of adapted plants and regulation of grazing will make long lasting productive pastures.

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

6.2.3.2 Capability unit IIIw.

In this capability unit are level to nearly level, poorly drained, deep soils that have high water tables. They are:

Buyong silty clay loam, 0 to 1 percent slopes.

Honam silty clay loam, 0 to 2 percent slopes.

Available moisture capacity is high, and permeability slow.

Soils of this unit are cultivated to paddy rice each year, and some are planted to winter barley afterwards. Other general crops will grow well too if the soils are adequately drained.

A system of drainage ditches and other drainage installations is needed to remove excess surface water, to lower the water table, and to improve internal drainage. However, this is difficult because of the low elevations and the slow permeability of the subsoil which permits only slow drainage. Pumping would be required to lower the water table in many areas because of the lack of outlets. Bedding or hill row culture is advisable in growing general crops.

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

6.2.3.3 Capability unit IIIs.

This soil is level to nearly level, somewhat excessively drained, and deep. Available moisture capacity is low, and permeability is rapid to very rapid. Natural fertility and organic matter content are low. It is Nardong loamy fine sand, 0 to 2 percent slopes.

Peanuts, melons, rye, barley, wheat, and many kinds of vegetables do well, as do apple, pear, and mulberry trees. Droughtiness and damage from flooding are disadvantages. The addition of a large amount of compost and fine clayey soil will improve the capacity to hold water and nutrients, and split applications of fertilizer will also help to lessen leaching. Growing green manure crops as intercrops is advisable in orchards or mulberry fields.

6.2.4 Class IV. Soil with Very Severe Limitations.

6.2.4.1 Capability unit IVe.

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

Bonggye silt loam, 15 to 30 percent slopes.

Buyeo rocky loam, 7 to 15 percent slopes, eroded.

Gaghwa cobbly loam, 15 to 30 percent slopes, eroded.

Seogto gravelly loam, 15 to 30 percent slopes.

Songjeong loam, 15 to 30 percent slopes, eroded.

Songjeong loam, 15 to 30 percent slopes, severely eroded.

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

Poorly grown pine forest, with some in cultivated crops predominate, but the land is poorly suited to the latter. However, pasture, orchards, and trees are well suited. Erosion is only a small problem when these soils are covered with good grass pasture, and high yields of forage can be expected if fertilizer and lime are used.

Orchards should be established on bench terraces. Cover crops and other erosion control measures are necessary in clean-tilled orchards. Maintaining grassed waterways will prevent gullying. Many areas with a sparse stand of trees are being eroded very rapidly, mainly because of the raking and removing of surface litter. For higher yields of 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.

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

Hwangryong gravelly sandy loam, 0 to 2 percent slopes.

Togye loamy coarse sand, 2 to 7 percent slopes.

Togye loamy coarse sand, 7 to 15 percent slopes.

They are low both in natural fertility and in organic matter and are generally poorly suited to most cultivated crops, but are well suited to peanuts, melons, tobacco, some vegetables, poplar, mulberry, and orchards. 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 damage from erosion on the more

sloping land is also a limiting factor. Flooding is only for short periods of time, and most flood damage is by the rapidly moving water.

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

6.2.4.3 Capability unit IVw.

This soil is level to nearly level, poorly drained, deep, rapidly permeable, coarse-textured, and has a high water table. It is Sindab sandy loam, 0 to 2 percent slopes. The location is depressed flood plains, where outlets for drainage are poor. Available moisture capacities, natural fertility, and organic matter content are all low.

Only paddy rice is grown, with some parsley, as the water table remains on the surface. Yields are generally low. Increasing drainage or lowering the water table is not practicable because of the lack of suitable outlets, rapid permeability, and low available moisture capacity. Proper fertilization in split applications is needed for higher yields because of leaching of fertility elements through this coarse textured soil.

6.2.5 Class VIe. Soils Suitable only for Pasture or Woodland.

6.2.5.1 Capability unit VIe.

This capability unit consists of moderately steep to steep, deep to shallow, well drained, stony to rocky, and eroded soils. They are:

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

Mudeung rocky loam, 30 to 60 percent slopes.

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

Seogto stony loam, 30 to 60 percent slopes, eroded.

Songjeong loam, 30 to 60 percent slopes, eroded.

Songjeong loam, 30 to 60 percent slopes, severely eroded.

Because of the steep slopes, shallow soil depth, advanced erosion, rockiness or stoniness, these soils are so erodible that they are unsuitable for cultivation. But, pasture and woodland if properly managed, will do well. Poor pine forest or grassland predominate, but managing the latter is difficult in many places because of the steep slopes. Intensive grazing will leave the soils bare and subject to further erosion. Therefore, control of grazing is necessary to maintain good pasture.

Farmers should select areas that are best suited to trees or pasture, then improve the former by protecting them from grazing. Many of these soils have a surface layer that is strongly acid in reaction. This is favourable to pine trees, but much lime is needed to develop the soils for pasture. Some of the soils can be developed into orchard or mulberry fields.

6.2.6 Soils Limited to Woodland.

6.2.6.1 Capability unit VIIe.

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

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

Oesan channery loam, 30 to 60 percent slopes.

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

Samgag soils, 30 to 60 percent slopes, gullied.

Songjeong soils, 30 to 60 percent slopes, gullied.

The soils of this unit are so steep, rocky, severely eroded or gullied that they are suited only for woodland. Cultivation is not practicable, and grazing is severely limited even under intensive management. Woodland is a more suitable use. To reduce erosion losses leaf litter should remain on the surface and the bare areas should be reforested.

6.2.7 Class VIII. Nonproductive Soils.

6.2.7.1 Capability unit VIII.

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

Riverwash cobbly.

Riverwash sandy.

Rock land.

Tidal marsh.

6.3 PADDY LAND SUITABILITY GROUPS

Rice, the most important crop in Korea, grows well on soils that are too wet for growing most other crops. These wet soils are classified as IIw or IIIw in the capability classification. About 16 468 ha or 70 percent of the total cultivated areas (23 288 ha) in the Gun are used for paddy rice. In this section, the use and management of the soils suitable for growing paddy rice are discussed.

Management of paddy land can be planned more effectively if soils are grouped according to those characteristics that affect the growth of paddy rice and management of paddies. For this reason, the soils of Buyeo Gun have been placed in four paddy

land suitability groups, which are designated by P1, P2, P3, and P4. The numerals indicate progressively greater limitations in the use of land for rice. The four suitability groups for rice paddy used by the Korea Soil Survey are defined as follows:

P1 Very well suited:

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

P2 Well suited:

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

P3 Moderately suited:

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

P4 Poorly suited:

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

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

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

6.3.1 Group P1. Very Well Suited.

6.3.1.1 Paddy suitability group P1.

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

Buyong silty clay loam, 0 to 1 percent slopes.

Honam silty clay loam, 0 to 2 percent slopes.

Jeonbug silt loam, 0 to 1 percent slopes.

Sinheung loam, 0 to 2 percent slopes.

The soils of this group are dominantly fine textured, and generally have high available moisture capacities. Natural fertility is usually high and organic matter content, high or medium.

These soils need few management practices other than proper fertilization and good cultural practices that are commonly needed for paddy soils. Deep ploughing will help obtain somewhat higher yields. Calcium silicate fertilizer will reduce lodging of rice. The high water table is a limitation to growing winter grain crops, such as barley or wheat, during the winter-spring season. Early season culture, good varieties, and high level fertilization are also apt measures to obtain high yields.

6.3.2 Group P2. Well Suited.

6.3.2.1 Paddy suitability group P2a.

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

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

6.3.2.2 Paddy suitability group P2ac.

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

Bancheon silty clay loam, 2 to 7 percent slopes.

Gaghwa cobbly loam, 2 to 7 percent slopes, eroded.

Hwadong silty clay laom, 2 to 7 percent slopes.

Samam loam, 2 to 7 percent slopes.

Yongji loam, 2 to 7 percent slopes.

The available moisture capacities are mostly high or moderately high, and their natural fertility levels are dominantly moderate or moderately low. Hwadong, Samam, and Yongji are usually in rice paddy, being cultivated to barley or wheat during the winter-spring. The rest is used for barley, wheat, soybeans, and summer crops other than rice. The Bancheon and Gaghwa are well suited to paddy rice if paddy is established and water sources developed.

The soils of this group are subject to some droughtiness and loss of water because of the good drainage and the slopes. Because of the low water table, frequent irrigation is needed to supply rice plants with enough 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. Winter grain crops like barley or wheat grow well during the winter and spring after paddy rice. Crops other than rice will also grow well during the summer.

6.3.2.3 Paddy suitability group P2b.

This group, consisting of level to nearly level, poorly to moderately well drained, loamy over sandy soils, and coarse silty soils, have high water tables. They are:

Gangdong loam, 0 to 2 percent slopes.

Mangyeong silt loam, 0 to 1 percent slopes.

Manseong loam, 0 to 2 percent slopes.

These soils have low to high available moisture capacities and rapid permeability. The high water tables are favourable for growing paddy rice. Natural fertility is moderate to low, organic matter content, low to moderately low.

Most of the soils are used for paddy rice because water is available. The Gangdong and Manseong are subject to droughtiness if drained because of their rapid permeability and low available moisture capacity. The addition of fine clay and compost, and split application of nitrogen phosphate are both necessary to reduce the effects of leaching. Occasional growing of green manure crops will improve the soil fertility.

6.3.2.4 Paddy suitability group P2c.

The soils in this group are level to nearly level, deep, well drained, moderately permeable, and medium textured. Available moisture capacity is high, natural fertility, moderate, organic matter content, medium, and water tables, low. They are:

Gyuam silt loam, 0 to 2 percent slopes.

Ihyeon silt loam, 0 to 2 percent slopes.

The low water table is the only limiting factor in these soils for growing paddy rice. They are very well suited to this crop if the water problem is solved. Present use is paddy rice, with barley in the winter-spring.

Losses of water and dissolved plant nutrients are moderate problems, and the loss of nitrogen fertilizer can be reduced by making several applications in small amounts during the growing season. Because of the loss of water, a good irrigation system is required to maintain optimum water levels for rice production. Dense planting and spreading of compost are good management practices. Barley grows well during the winter, and during summer other crops such as soybeans may be considered instead of paddy rice.

6.3.3 Group P3. Moderately Suited.

6.3.3.1 Paddy suitability group P3a.

This soil is a sloping, poorly drained, deep, moderately permeable, with a high water table and high available moisture capacity. It is Jisan loam, 7 to 15 percent

slopes.

Paddy rice because of the high water table, is usually grown, but the strong slope is a limitation that affects paddy size and shape, and permits damage of paddy dikes and loss of irrigation water following excessive rains. Weir dams are thus needed to control runoff and regulate the water level to that best suited for its growth. Deep ploughing and proper fertilization will increase yields.

6.3.3.2 Paddy suitability group P3ab.

The only soil in this group, is a gently sloping to sloping, poorly drained, deep, rapidly permeable, medium textured, with a high water table and low available moisture capacity. It is Gangdong loam, 2 to 7 percent slopes.

This soil is moderate in natural fertility and organic matter, and is used for paddy rice because of the high water table. But, slope and low available moisture capacity are limitations.

Paddy dykes with well-built weir dams are needed to control erosion, and nitrogen with other fertilizers should be applied in several applications during the growing season to reduce leaching. The addition of fine clay will also act as a preventative. Dense planting and dryland direct seeding are good rice culture practices.

6.3.3.3 Paddy suitability group P3ac.

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

Bancheon silty clay loam, 7 to 15 percent slopes.

Bansan clay loam, 7 to 15 percent slopes.

Dalcheon silt loam, 7 to 15 percent slopes, eroded.

Gaghwa cobbly loam, 7 to 15 percent slopes, eroded.

Songjeong loam, 7 to 15 percent slopes, eroded.

Songjeong loam, 7 to 15 percent slopes, severely eroded.

Yongji loam, 7 to 15 percent slopes.

The Yongji soil is the only one being used for paddy rice. Available moisture capacity in these soils is moderate to high.

General crops other than rice, is the usual land use with some areas in forest or orchard. Only with the application of difficult special development and management practices could rice be developed. For the paddy land use of the soils level-terraces and dykes are essential, as well as the development of a water supply. Rice paddies will also need well-constructed weir dams to protect the dykes from damage by overflow following intense rains because the slope makes them subject to erosion. The paddy system obviously permits other general crops to grow on the soils also without losses. Deep ploughing and application of compost will be good practices in growing rice.

6.3.3.4 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 positions lower than the stream bed. It is Sindab sandy loam, 0 to 2 percent slopes.

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

6.3.4 Group P4. Poorly Suited.

6.3.4.1 Paddy suitability group P4abc.

This group, consisting of gently sloping to sloping, well drained, deep, moderately to moderately rapidly permeable, gravelly soils with moderate to low available moisture capacity, has a low water table. The soils are:

Hogye gravelly loam, 2 to 7 percent slopes.

Hogye gravelly loam, 7 to 15 percent slopes.

Seogto gravelly loam, 7 to 15 percent slopes.

Seogto gravelly loam, 15 to 30 percent slopes.

Togye loamy coarse sand, 2 to 7 percent slopes.

Togye loamy coarse sand, 7 to 15 percent slopes.

Very few areas have been developed into paddy systems, other cultivated crops being usual. Paddy rice is poorly suited, because of the slope and high water requirement. To grow it a dependable water supply is essential. Construction costs to develop a paddy system would be high, as would losses of water and plant nutrients. Gravel interferes with cultivation if not removed.

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

6.3.4.2 Paddy suitability group P4ac.

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

Bonggye silt loam, 15 to 30 percent slopes.

Gaghwa cobbly loam, 15 to 30 percent slopes, eroded.

Songjeong loam, 15 to 30 percent slopes, eroded.

Songjeong loam, 15 to 30 percent slopes, severely eroded.

At present, poor forest is usual with some land in cultivated crops other than rice. Paddy rice, because of the strong slopes and the water problem, is poorly suited, and level-terracing for paddy systems, with a dependable source of water would be necessary. Dryland direct seeding may be a way of growing rice on these soils.

Cobbles and gravel need to be removed for easier cultivation, while deep ploughing, application of calcium silicate and compost, are good management practices. Occasional growing of green manure crops will improve soil fertility. Erosion of paddy walls could be controlled by weir dams. Winter grain crops will grow well following the rice.

6.3.4.3 Paddy suitability group P4bc.

The soils in this paddy suitability group are:

Hwangryong gravelly sandy loam, 0 to 2 percent slopes.

Nagdong loamy fine sand, 0 to 2 percent slopes.

These soils are level to nearly level, deep, well drained, rapidly permeable, sandy soils with very low available moisture capacity and low water tables. They have low clay content and low cation exchange capacity, and are subject to droughtiness. Paddy rice is grown only in a few small areas where water is available, as the land is poorly suited to cultivated crops other than peanuts, melons, mulberry, and some orchard.

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

Table 3

GUIDE TO MAPPING UNITS

Map Symbol	Mapping Unit	Described on Page	Capability Unit	Paddy Suit. Group
BcB	Bancheon silty clay loam, 2 to 7 percent slopes.		IIe	P2ac
BcC2	Bancheon silty clay loam, 7 to 15 percent slopes, eroded.		IIIe	P3ac
BsC	Bansan clay loam, 7 to 15 percent slopes.		IIIe	P3ac
ByD	Bonggye silt loam, 15 to 30 percent slopes.		IVe	P4ac
BuC	Buyeo rocky loam, 7 to 15 percent slopes.		IVe	
BuD2	Buyeo rocky loam, 15 to 30 percent slopes, eroded.		VIe	
Bg	Buyong silty clay loam, 0 to 1 percent slopes.		IIIw	P1
DcC2	Dalcheon silt loam, 7 to 15 percent slopes, eroded.		IIIe	P3ac
GaB2	Gaghwa cobbly loam, 2 to 7 percent slopes, eroded.		IIe	P2ac
GaC2	Gaghwa cobbly loam, 7 to 15 percent slopes, eroded.		IIIe	P3ac
GaD2	Gaghwa cobbly loam, 15 to 30 percent slopes, eroded.		IVe	P4ac
Gd	Gangdong loam, 0 to 2 percent slopes.		IIw	P2b
GdB	Gangdong loam, 2 to 7 percent slopes.		IIw	P3ab
Gy	Gyuam silt loam, 0 to 2 percent slopes.		I	P2c
HbE2	Habin rocky loam, 30 to 60 percent slopes, eroded.		VIIe	

Table 3 (Cont'd)

Map Symbol	Mapping Unit	Described on Page	Capability Unit	Paddy Suit. Group
HgB	Hogye gravelly loam, 2 to 7 percent slopes.		IIs	P4abc
HgC	Hogye gravelly loam, 7 to 15 percent slopes.		IIIe	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
Hr	Hwangryong gravelly sandy loam, 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
JiC	Jisan loam, 7 to 15 percent slopes.		IIIe	P3a
Mg	Mangyeong silt loam, 0 to 1 percent slopes.		IIw	P2b
Ms	Manseong loam, 0 to 2 percent slopes		IIw	P2b
MdE	Mudeung rocky loam, 30 to 60 percent slopes.		VIe	
Nd	Nagdong loamy fine sand, 0 to 2 percent slopes.		IIIs	P4bc
OsE	Oesan channery loam, 30 to 60 percent slopes.		VIIe	
RC	Riverwash cobbly.		VIII	
RS	Riverwash sandy.		VIII	
RL	Rock Land.		VIII	
SaB	Samam loam, 2 to 7 percent slopes.		IIe	P2ac
SgE2	Samgag sandy loam, 30 to 60 percent slopes, eroded.		VIe	
SmE3	Samgag rocky sandy loam, 30 to 60 percent slopes, severely eroded.		VIIe	

Table 3 (Cont'd)

Map Symbol	Mapping Unit	Described on Page	Capability Unit	Paddy Suit. Group
SgE4	Samgag soils, 30 to 60 percent slopes, gullied.		VIIe	
StC	Seogto gravelly loam, 7 to 15 percent slopes.		IIIe	P4abc
StD	Seogto gravelly loam, 15 to 30 percent slopes.		IVe	P4abc
SsE	Seogto stony loam, 30 to 60 percent slopes.		VIe	
Sn	Sindab sandy loam, 0 to 2 percent slopes.		IVw	P3b
Sh	Sinheung loam, 0 to 2 percent slopes.		IIw	P1
SoC2	Songjeong loam, 7 to 15 percent slopes, eroded.		IIIe	P3ac
SoC3	Songjeong loam, 7 to 15 percent slopes, severely eroded.		IIIe	P3ac
SoD2	Songjeong loam, 15 to 30 percent slopes, eroded.		IVe	P4ac
SoD3	Songjeong loam, 15 to 30 percent slopes, severely eroded.		IVe	
SoE2	Songjeong loam, 30 to 60 percent slopes, eroded.		VIe	
SoE3	Songjeong loam, 30 to 60 percent slopes, severely eroded.		VIe	
SoE4	Songjeong soils, 30 to 60 percent slopes, gullied.		VIIe	
TS	Tidal marsh		VIII	
TgB	Togye loamy coarse sand, 2 to 7 percent slopes.		IVs	P4abc
TgC	Togye loamy coarse sand, 7 to 15 percent slopes.		IVs	P4abc
YjB	Yongji loam, 2 to 7 percent slopes.		IIe	P2ac
YjC	Yongji loam, 7 to 15 percent slopes.		IIIe	P3ac

Appendix

GLOSSARY

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

Consistence, Soil — 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 millimetres 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 ground water; the highest part of the soil or underlying rock that is wholly saturated with water.

GENERAL SOIL MAP

BUYEO GUN SURVEY AREA, CHUNG CHEONG NAM DO

Scale 1: 250,000

LEGEND

1 Jeonbug-Buyong Association nearly level g nerally acid soils of the broad alluvial

2 Jisan-Yongji Association gently sloping and sloping soils of small valleys and fans.

3 Manseon-Hogye Association, local alluvial plain and gently sloping, dark colored loamy skeletal soils.

4 Nagdong-Ihyeon Association, nearly level soils of Gum River plain.

5 Songjeong-Dalcheon Association, sloping to steep deep soils of the hilly area.

6 Habin-Buyeo Association, sloping to steep, moderately deep and shallow, rocky loamy soils.

7 Samgag soils steep, sandy soils overlying coarse textured granitic rocks.

8 Mudeung-Oesan Association, steep, moderately deep and shallow rocky loam and loamy skeletal soils.