

SOIL SURVEY

REPUBLIC OF KOREA

SOIL SURVEY IN GWANGSAN GUN, DAMYANG GUN,
GWANGJU SI, JEOLLANAM DO



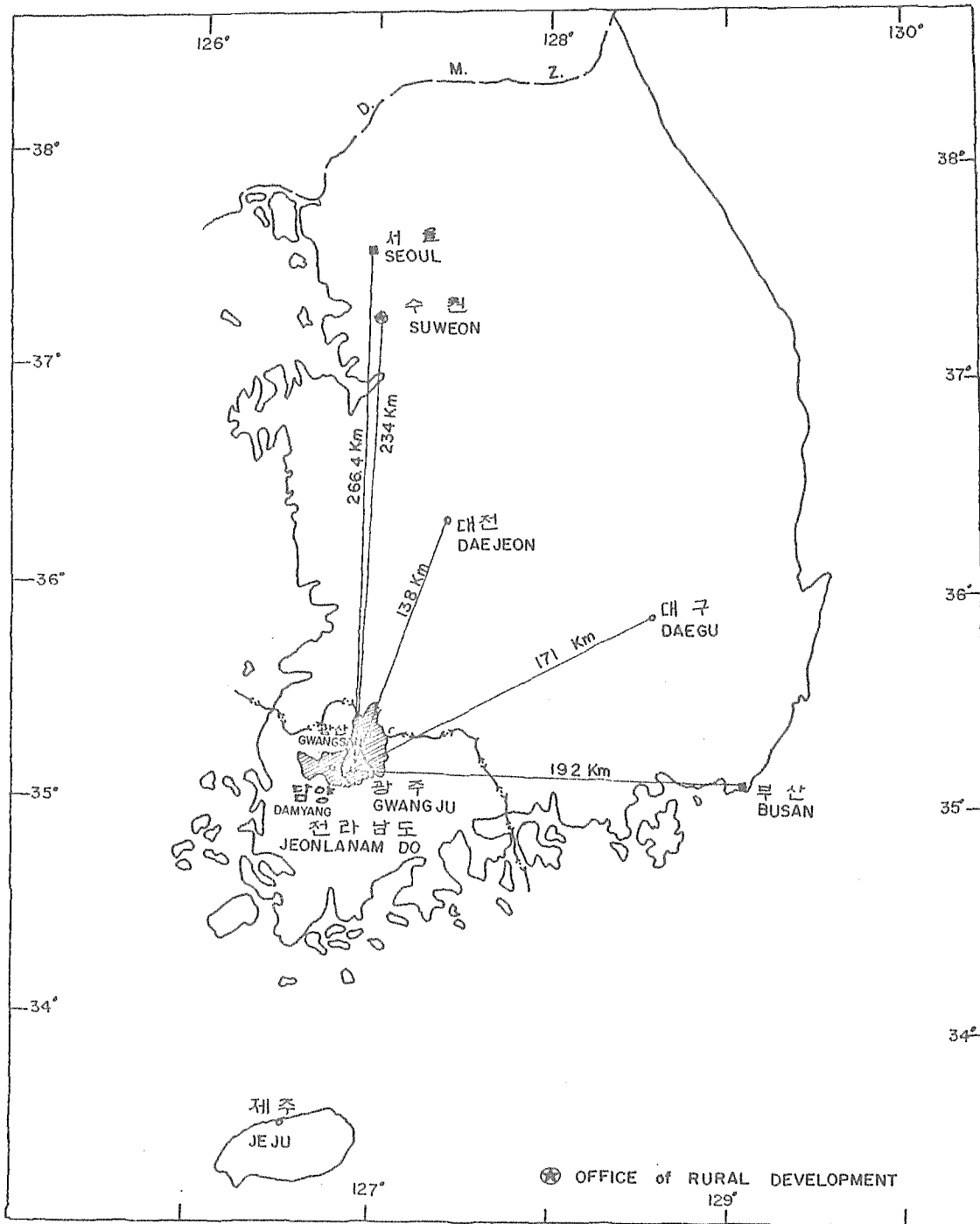
UNITED NATIONS DEVELOPMENT PROGRAMME
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS



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LOCATION MAP OF GWANGSAN GUN, DAMYANG GUN, GWANGJU ST, JEONLANAM DO



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DAMYANG GUN, GWANGJU SI,
JEOLLANAM DO

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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ABSTRACT

This report describes soil survey activities in Gwangsan Gun and Gwangju Si, 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 two Guns and Si (95 453 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 two-thirds of the cultivated land in the survey area (23 470 hectares of a total of 35 344) 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 1965 and was completed in December 1967. It formed 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 Government cooperating agency was the Ministry of Agriculture and Forestry. The executing agency for the United Nations Special Fund was the Food and Agriculture Organization of the United Nations.

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

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

This report is an inventory of research findings, in maps and in writing, of soil and soil conditions in Gwangju Si, Gwangsan Gun and Danyang Gun. It contains important information which will assist the Gun and Si 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

The report has been compiled by the following: Seung-Chae Kim; Jae-Don So 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

The surveyed area consists of Gwangsan and Damyang Guns and Gwangju Si, and is located in the northern part of Jeonlanam Do, one of the southern most provinces of Korea. The area covers 95 453 ha, and is bounded on the northeast by Sunchang Gun, on the southeast by Hwasun and Gogseong Guns, on the southwest by Naju and Hampyeong Guns, and on the northwest by Jangseong Gun. In 1965 the surveyed area had a population of 603 271, approximately 57 percent of which was concentrated in Gwangju, the capital city of Jeonlanam Do.

2.1 PHYSIOGRAPY AND DRAINAGE

The surveyed area includes the upper portions of Yeongsan Gang (river) drainage basin and the associated broad Honam alluvial plain bounded by steep mountains ranging up to 1 168 m on the northwest, north, northeast, and southeast sides. Lower foothills, rolling uplands and pediment slopes, occur throughout the central parts of the area. The slope and drainage of the valley floor is gentle to the southwest, and the flood plains of the valleys become transitional to fluvio-marine plains in adjacent Yeongsan Gun.

This area is drained by Yeongsan Gang and its tributaries. The river originates in the northern parts of the Damyang Gun, and flows southwestward across the western part of Gwangju Si and the eastern part of Gwangsan Gun. The western and northern parts of Gwangsan Gun are drained by Hwangyong and Geungrog Gangs and their tributaries, that flow eastward to join the main stream. The Gwangju Cheon drains the northern and central areas of Gwangju Si, and flows northwestward, also joining it. The Damyang Gun is drained by the upper streams of Yeongsan Gang that consist of the creeks: Bonryang, Changpyeong, and Yong Cheons.

2.2 GEOLOGY

The surveyed area is mainly underlain by granite, andesite porphyry, granite gneiss, crystalline schist, tuff, porphyry, shale, conglomerate, porphyrite, diorite, and limestone.

2.2.1 Parent Material

Parent material is the unconsolidated mass from which a soil is formed. It has much to do with the mineral and chemical composition of the soils. Most soils in Gwangsan Gun, Gwangju City, and Damyang Gun formed from residual material, that is, material that weathered from underlying rocks. Most of the surveyed area is underlain by acidic coarse grained rocks, chiefly granite and granite gneiss. Soils of the

Samgag, Seongsan, Jeonnam, Gwangsan, and Songjeong series are the principal soils derived from these rocks. Generally they are deep, strongly acid, low in fertility and in organic matter content. Less acid andesite and finer grained porphyry underlies about 29 percent of the area, and occurs chiefly in the southeastern part of Gwangju. This is the principal rock in Mt. Mudeung, and was the source of parent material for Mudeung, Jangweon, and Gaghwa soils. The soils derived from porphyry usually have more organic matter, and are higher in available phosphate content in the surface layer than those derived from granite. A small extent of the surveyed area is underlain by shale from which soils of the Habin, Samam and Daegu series have been developed. Conglomerate underlies about 5 percent of the area, and occurs chiefly in the eastern part of the surveyed area.

The Sinjeong soils derived from this material have very thin profiles. Crystalline schist occupies about 3 percent of the surveyed area, and is exposed in the northwestern part. It is the main rock in a chain of mountains extending to Mt. Chilbong from a side of the Hwangryong river north of the Ingog Myeon seat through Mt. Yongjin. These mountains are generally steep, and the soils from this material are very shallow and stony sandy loam. Only one percent of the area is underlain by limestone, and occurs chiefly in the north part of the area in Gwang Ri Gwangsan Gun. Some traces of this rock can be found in gullied areas of crystalline schist. The Jangseong soils are underlain by limestone, are generally steep, and have many rock outcrops. The surveyed area has a very small area of sedimentary rock consisting of crystalline tuff which occurs mainly in the western part of Gwangsan Gun and in the west side of the road leading to Maju from Gwangju.

Alluvium is the parent material of the terrace and flood plain soils which are the most important agricultural soils. These show little profile development and for the most part are still receiving deposition. Those on the old high terraces have been in place long enough to have distinctly developed horizons.

2.3 WATER SUPPLY

Precipitation in the area generally is ample for the crops grown, and is well distributed in the growing season. The Yeosu-san river, one of the five major rivers in the Republic of Korea (south), and its tributaries, such as Hwangryong and Geugrag Gangs, and Gwangju, Bonryang, Changpyeong, and Yong Cheons, are the main sources of surface water. Most rice paddies have been developed along or near those streams, and about 40 percent of land in rice paddy is irrigated by them. In addition, there are many reservoirs, farm ponds and dug wells throughout the area to irrigate rice paddies and furnish water for rural homes.

2.4 CLIMATE

The area has a warm, humid continental climate with slightly cold, dry winters and hot, humid summers. The temperature of the area is lower than that of the coastal areas of the province being less influenced by the warm ocean current.

Temperature, precipitation, evaporation, and sunlight hours in the area are shown in Table 1. As shown there, the average monthly temperature abruptly rises in April and continues through August. The temperature begins to drop down in October to an average of -0.6°C during January. The average daily maximum is 31.1°C in August, and 4.0°C in January. The average daily minimum temperature in August is 22.64°C , and

TEMPERATURE, PRECIPITATION, EVAPORATION, AND SUNLIGHT
HOURS IN AND AROUND GWANGJU SI

Table 1

Item	Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Average Temperature (C)		-0.6	1.13	5.66	11.39	16.85	21.38	25.61	26.09	21.38	14.05	8.23	2.6
Average Humidity (%)		7.42	71.8	71.4	72.2	73.8	77.0	81.9	79.7	79.4	75.9	75.2	75.0
Average Daily Maximum Temperature (C)		4.0	6.25	11.71	18.27	23.57	27.07	29.89	31.11	26.43	21.02	14.5	7.19
Average Daily Minimum Temperature (C)		-4.8	-3.35	0.37	5.39	11.38	17.05	22.59	22.64	16.70	8.42	2.89	-1.86
Average Precipitation (mm)		31.5	34.45	69.06	82.20	91.96	168.78	222.63	201.19	189.5	51.88	42.88	36.8
Evaporation		52.08	60.20	94.60	131.10	163.17	164.65	162.24	173.6	119.04	105.5	68.4	50.77
Sunlight Hours		165.96	170.59	198.85	222.43	204.4	187.24	187.24	234.16	185.47	223.26	184.86	159.52

* Based on a 29-year record, 1940 through 1961, by the Gwangju Meteorological station.

-4.8 C in January. Precipitation begins to rise in June with a peak during July and decreases from October. About 50 percent of the annual rainfall occurs in June, July and August. The first killing frost occurs between October 11 and 16, often on October 16 which is 27 days earlier than in the southern part of Korea. The date of last frost ranges from April 24 to May 2, and is usually April 29 which is 22 days later than in the most southern part of Korea.

The climate of Gwangsan and Damyang Guns is of the characteristic humid, warm-temperature, continental type. Here, the soils are warm enough for micro-organisms to be active from April through October, and are moist and subject to leaching much of the time from April to September. Upland soils are dry to moderately dry much of the time from October through March. Paddy soils except for poorly drained paddy are also moderately dry during the winter. The surface soil is frozen to a depth of about 15 cm for 60 days during the year.

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

2.5 AGRICULTURE

In 1965 in Gwangju City, Gwangsan Gun, and Damyang Gun about 37 percent of the surveyed area or 35 344 ha was in cultivated crops. All of the farms have been owner operated since the Farm Land Reform of 1949. The chief crops grown are rice, barley, wheat, and soybeans. Average rice yields per 10 ares are 360 kg in Gwangsan Gun (including Gwangju) and 330 kg in Damyang Gun. Average yields of barley or wheat are about 220 kg per 10 ares. Seeding rice usually begins early in May, and the transplanting is from mid-June to late in July. The harvest is commonly finished late in October. Barley or wheat is sown during October and early in November for winter crops, and is harvested late in June.

Chapter 3

HOW THE SURVEY WAS MADE

This survey was made to learn what kinds of soils are in Gwangsan and Damyang Guns and Gwangju Si, where they are located, and how they can be used. The entire soil landscape was observed including steepness, length, shape of slope, kinds of native plants or crops and kinds of rock.

Holes were made and profiles were observed at an average interval of about 200 m, depending on the nature of the landscape. Spacing was much closer in the highly productive paddy lands than in the hilly and mountainous areas, where stones, rock outcrops, gullies, and similar features are important indicators of the kind of soil.

Comparisons were made among the profiles studied, and compared with those in other areas where detailed soil surveys have been carried out. 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 Samgag, for example, are the names of two soil series in the survey area. These would have essentially the same characteristics as the Bancheon and Samgag mapped elsewhere 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. Where these differences are important in the use and management of the soils, some soil series have been divided into mapping units.

Other series have only one mapping unit. The Songjeong series, for example, is divided into mapping units based upon slope and also upon the evidence of erosion. Thus there are sloping and moderately steep mapping units of Songjeong soils with severe erosion as well as moderately steep Songjeong soils that are gullied. There is also another difference between the series and the mapping unit. The series includes a group of profiles that have a definite but limited range in their properties. The mapping unit, however, must describe all of the important properties of the soils that are within the actual 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 outcrops obviously does not have a profile. In the Mudeung there are mapping units of Mudeung rocky loam, 30 to 60 percent slopes and Mudeung very rocky loam, 30 to 60 percent slopes. These mapping units vary mainly in the amount of rock outcrop in the area. 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 it 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 rock land, or beach and riverwash, sandy, and are called land types rather than soils.

Chapter 4

DESCRIPTION OF THE GENERAL SOIL MAP

4.1 INTRODUCTION

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

A map showing soil associations is useful for the location of large tracts that are suitable for a certain kind of farming or other land use. For planning the management of a farm or fields such a map is not suitable, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management. Five soil associations are shown on the general soil map.

The Mudeung-Samgag-Rock Land association is the largest in extent, occupying about 54 percent of the area. The second largest is the Honam-Geugrag association, occupying about 20 percent. The other three associations are similar in extent, each one having somewhat less than 10 percent of the total area.

4.2 HONAM-GEUGRAG ASSOCIATION

This association, level to nearly level, imperfectly drained, soils of the Yeongsan river plain, is about 20 percent of the survey area with an extent of 18 800 ha. It is the most important association for agricultural production. The Honam-Geugrag complex covers more than one half of it, mainly in the higher part of the alluvial plains.

These are level or nearly level, fine clayey, imperfectly drained soils that are well suited for rice paddy. The Sinheung and Yeongsan soils each make up more than 10 percent of the area. Other important soils in the association are the Hagsan, Manseong and Sugye. The Honam-Geugrag are slowly permeable and have high available moisture capacities, while the others have moderate permeability and available moisture capacities. Much water is required for rice production, although it is the principal crop in the area and yields are high. The Sinheung, Yeongsan, Hagsan, Manseong soils are usually planted to barley following rice harvest.

All of these soils need the application of lime and other fertilizer for higher production, which will come from better management of the soils, as the entire area is now used for crops. This might include the irrigation of such crops as barley and vegetables.

4.3 HWANGRYONG--HWABONG--HOGYE ASSOCIATION

The association includes about 7 850 ha, or about 8 percent of the area, and is level to gently sloping, very sandy or gravelly, well drained soils on flood plain and stream or river channels. The Hwangryong soils are most extensive, covering about one-third of the association. The Hogye include about 22 percent, and the Bonryang, 20 percent. Riverwash cobbly and sandy units are 15 percent and others, including Hwabong and Togye soils, are about 10 percent.

The Hwangryong soils are excessively well drained, rapidly permeable, very gravelly to cobbly sands, with low available moisture capacities. The Hogye and Bonryang are also rapidly permeable and have low or very low available moisture capacities. The former are well drained, moderately permeable, productive soils.

Rice is the principal crop grown in the area and most yields are medium. The Hogye, Hwangryong, Hwabong, and Togye soils are usually cropped to barley following the rice harvest. Some of the Hogye and Hwangryong are used for sweet potatoes, fruit, and vegetable crops during the summer growing season.

Considerable water is required for rice, and the production of nonirrigated crops is limited by drought. All of these soils need frequent application of lime and other fertilizers for highest yields, which will come from better management of the soils, the entire area except the riverwash, now being cultivated. Better management might include the irrigation of barley, wheat and vegetables.

4.4 JISAN--YONGJI ASSOCIATION

This association mainly includes sloping floodplains soils and is gently sloping to sloping, moderately well to imperfectly drained loamy soils of the small valleys. While this association is only about 9 percent of the survey area and 8 400 ha in extent, it is important for agricultural production.

The Yongji-Jisan complex are the most extensive soils covering about 60 percent of the association, mainly in the upper part of the stream valleys. They are gently sloping to moderately steep, loamy, moderately well drained to poorly drained soils that are well suited for rice production. The Subug are about 15 percent, and Gangdong and Samam 10 percent each. The Subug are poorly drained, sandy over very gravelly sands with low available moisture capacities. Minor soils, including the poorly drained Hyocheon, make up the remainder.

Rice is the principal crop grown and yields vary greatly. Jisan and Yongji are usually cropped to barley following rice. Some better drained areas are in apple trees, and vegetable crops are grown during the summer. All of these soils need frequent application of lime and other fertilizers for highest production, which will come from better management as the entire area is cultivated. This might include the irrigation of crops, such as barley, wheat, and vegetables.

4.5 SONGJEONG--JEONNAM--GWANGSAN ASSOCIATION

Soils with high or moderately high available moisture capacities are dominant in this association and are sloping to moderately steep, deep and very deep, well drained clayey soils of hilly areas. They cover about 9 percent of the survey area,

in the lower mountainous areas of granite rocks. The Songjeong are about 30 percent and are most extensive, the Jeonnam about 15 percent of the total area, while the Gwangsan-Jingog and the Songjeong-Samgag complex have about 10 percent each. A variety of soils including the Bancheon-Banggi, Gaghwa-Jangweon, and Bansan-Baegsan complex; Hwadong, Seogto, Seongsan and Jangweon soils, make up the remaining 35 percent of the area.

The Songjeong are sloping to steep with deep, clay loam or sandy loam subsoils and sandy loam saprolite. Some upland crops are grown in the less eroded places, but generally the land is covered with a thin stand of poorly shaped pine trees and grass. Erosion has been and remains the greatest problem. The Gwangsan soils are severely eroded and gullied, with fine loamy granite saprolite, containing some mica and much quartz.

The fine clayey B horizon of these soils has been mostly washed away, exposing the granite saprolite. The formation of gullies and continuing sheet erosion has lowered the usefulness and possible production. In addition, erosion lowers the potential production of many lower lying soils through depositing infertile materials on them. A thick stand of useful, adapted species of trees would do much to control this and obtain some return from the land.

Some of the less eroded soils are capable of producing some pasture if limed, fertilized, seeded to adapted species, and well managed. Areas of the Gwangsan and other soils with more favourable characteristics could produce moderate yields of upland barley, sweet potatoes, sorghum, millet, melon, soybean, corn, tobacco, and similar crops, but much fertilizer is needed. When these crops are grown, soil erosion is apt to be severe unless the land is properly managed.

4.6 MUDEUNG-SAMGAG-ROCK LAND ASSOCIATION

This association is in the eastern and northern part of the Gun. These soils are steep and very steep, shallow soils of the high mountains, and cover about 54 percent of the survey area. The Mudeung soils are the most extensive and make up roughly 40 percent. The Samgag are about 35 percent, and minor soils including Habin, Sinjeong and Jangseong soils comprise about 25 percent.

The Mudeung are shallow, usually having about 50 cm of loamy material over hard bedrock. These soils have low available moisture capacities and are infertile. The Samgag are moderately deep sandy soils, with low available moisture capacities, and are low in productivity. The area is mainly in forest of pine trees, and there is little possibility of intensive use because of steep slopes and shallow soils. The small area of less sloping, moderately deep soils would produce good fruit and similar crops, as well as pasture and hay crops.

Chapter 5

DESCRIPTION OF SOILS

5.1 INTRODUCTION

This section describes the soil series and mapping units of the survey area. 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 first read the description of the series which describes the general concept of a soil and then the mapping unit, which gives more detailed information about the area mapped such as slope, presence of other soils, rock outcrops, and other factors affecting use.

Additional information about the use of the mapping units can be found in the discussion of Capability Unit and Paddy Suitability Groups. Table 3 lists these groupings for each soil.

5.1.1 Soil Classification

(1) Order

Ten soil orders are recognized in the current system. They are: Entisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, 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.

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

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

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

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

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.

(2) Suborder.

Each soil 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 climate range than the orders. The criteria for suborders chiefly reflect the presence or absence of waterlogging or 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 are the thick dark coloured surface horizons or horizons which have a pan that interferes with water movement or root development. The features are colours of dark brown and dark red that are associated with basic rocks; major differences in chemical composition; and wide differences in base saturation.

(4) Subgroup.

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

(5) Families.

Each subgroup is divided into families, primarily on the basis of properties important to the growth of plants or to the behaviour of soils when used for engineering. Among the properties considered are texture, consistence, permeability, reaction, mineralogy, soil temperature, and thickness of horizons.

(6) Series.

The series consists of a group of soils that formed in a particular kind of parent material, having a genetic horizon that, except for texture of surface soil, is similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are colour, structure, reaction, consistence, and mineralogical and chemical composition. In Table 2 the soil series in this area are classified according to the current system of soil classification.

5.2 BAEGSAN SERIES

The Baegsan series consists of gently sloping to sloping, well drained, deep to very deep soils developed in recent alluvial-colluvial materials eroded from areas underlain by porphyry, granite, and granite-gneiss. This series is a member of the fine loamy family of Dystric Fluventic Entrochrepts.

A typical profile follows:

Apl--O to 17 cm; brown to dark brown (10YR 4/3) loam; very weak, fine granular structure; very friable, slightly sticky,

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	
Baegsan	Fine loamy	Dystric Fluventic Eutrochrepts	Inceptisols	Alluvial soils	
Bancheon	Fine clayey	Typic Hapludalfs	Alfisols	Red-Yellow Podzolic soils	
Banggi	Clay-skeletal	Typic Hapludalfs	Alfisols	Red-Yellow Podzolic soils	
Bansan	Fine clayey	Humic Hapludults	Ultisols	Red-Yellow Podzolic soils	
Bomryang	Coarse loamy over sandy	Typic Udistuvents	Entisols	Alluvial soils	
Changyeong	Fine clayey	Typic Hapludalfs	Alfisols	Red-Yellow Podzolic soils	
Gaghwa	Fine clayey	Typic Hapludalfs	Alfisols	Red-Yellow Podzolic soils	
Gangdoug	Fine loamy over sandy	Fluventic Haplaquepts	Inceptisols	Low-Humic Gley soils	
Gaengrae	Fine clayey	Aeric Ochraqualfs	Alfisols	Red-Yellow Podzolic soils - Low-Humic Gley soils	
Gwangju	Fine clayey	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils	
Gwangsan	Fine clayey	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils	

Table 2 (Cont'd)

Series	Current Classification			1938 Classification Great Soil Group
	Family	Subgroup	Order	
Habin	Coarse loamy	Lithic Entrochrepts	Inceptisols	Lithosols
Hagsan	Fine loamy over sandy	Aquic Fluventic Entrochrepts	Inceptisols	Alluvial soils
Hogye	Loamy skeletal	Fluventic Hapludolls	Mollisols	Alluvial soils
Honam	Fine clayey	Typic Ochraqualfs	Alfisols	Low-Humic Gley soils
Hwabong	Sandy	Typic Udipsamments	Entisols	Alluvial soils
Hwadong	Fine clayey	Aquic Hapludalfs	Alfisols	Red-Yellow Podzolic soils
Hwangryong	Sandy skeletal	Typic Udipsamments	Entisols	Alluvial soils
Hyocheon	Fine loamy	Fluventic Haplaquepts	Inceptisols	Low-Humic Gley soils
Jangseong	Fine loamy	Lithic Udorthents	Entisols	Lithosols
Jangyeon	Fine loamy	Typic Pragiachrepts	Inceptisols	Planosols
Jeongja	Fine loamy	Lithic Entrochrepts	Inceptisols	Lithosols
Jeonnam	Fine clayey	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils
Jingog	Fine clayey	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils
Jisan	Fine loamy	Fluventic Haplaquepts	Inceptisols	Low-Humic Gley soils
Manseong	Fine loamy over sandy skeletal	Aeric Fluventic Haplaquepts	Inceptisols	Low-Humic Gley Alluvial soils

Table 2 (Cont'd)

Series	Current Classification			1938 Classification
	Family	Subgroup	Order	
Mudeung	Fine loamy	Lithic Dystrachrepts	Inceptisols	Lithosols
Sangag	Coarse loamy	Typic Dystrachrepts	Inceptisols	Lithosols
Seogto	Loamy-skeletal	Dystric Fluventic Eutrochrepts	Inceptisols	Regosols
Seongsan	Coarse loamy	Dystric Fluventic Eutrochrepts	Inceptisols	Alluvial soils
Sindab	Sandy	Typic Psammaquents	Entisols	Red-Yellow Podzolic soils
Sinheung	Fine loamy	Aeric Fluventic Haplaqupts	Inceptisols	Low-Humic Gley to Alluvial soils
Sinjeong	Fine loamy	Typic Dystrachrepts	Inceptisols	Lithosols
Songjeong	Fine loamy	Typic Hapludults	Ultisols	Red-Yellow Podzolic soils
Sinbug	Coarse loamy over sandy skeletal	Fluventic Haplaquents	Inceptisols	Low-Humic Gley - Alluvial soils
Sugye	Fine silty	Fluventic Haplaqupts	Inceptisols	Low-Humic Gley soils
Toegy	Sandy skeletal	Typic Udispaments	Entisols	Alluvial soils
Yeongsan	Fine loamy over skeletal	Typic Ochraqualfs	Alfisols	Low-Humic Gley soils
Yongji	Fine loamy	Aquic Fluventic Eutrochrepts	Inceptisols	Alluvial - Red- Yellow Podzolic soils

and plastic; common, fine pores; common, fine roots; clear, smooth boundary; pH 5.2.

A12--17 to 30 cm; dark yellowish brown (10YR 4/4) loam; weak, fine granular structure; friable, slightly sticky, and slightly plastic; common, medium to coarse pores; very few, fine roots; clear, smooth boundary; pH 5.6.

B--30 to 68 cm; brown to dark brown (7.5YR 4/4) loam; weak, coarse blocky structure; firm, sticky, and plastic; common, medium pores; very few, very fine roots; clear, smooth boundary; pH 5.8.

C--68 to 120 cm; brown to dark brown (7.5YR 4/4) and strong brown (7.5YR 5/6) loam; very weak, medium blocky structure; firm, sticky, and plastic; few, fine pores; some weathered gravels; pH 5.8.

The Ap horizon is brown, dark brown, or yellowish brown sandy loam or silt loam. The B horizon is brown, dark brown or strong brown loam or silty clay loam with blocky structure. The C is similar to the B except that it lacks structure.

The Baegsan soils, associated with the Bansan and Seongsan, are finer-textured than the Seongsan and have a weak structure in the subsoil and a lighter coloured surface horizon than the Bansan which possess a moderate structure in their clayey subsoil.

The soils of Baegsan series are medium to strongly acid, high in natural fertility, and medium in organic matter. Permeability is moderate, and available moisture capacity is high. Cation exchange capacity is medium, and base saturation medium to high.

Cultivated crops predominate, and their yields are high.

5.3 BANCHEON SERIES

The soils, gently sloping to moderately steep, well drained, deep, were formed in old alluvium on slightly to moderate dissected stream terraces in the northeastern part of the survey areas. This series is a member of the fine clayey family of Typic Hapludalfs.

A typical profile follows:

Ap--0 to 11 cm; brown to dark brown (10YR 4/3) silty clay loam with few, fine mottles of strong brown (7.5YR 5/6); weak, coarse subangular blocky and weak, fine to medium granular blocky and weak, fine to medium granular structure; friable, sticky, and plastic; clear, smooth boundary; pH 5.3.

B21t--11 to 21 cm; yellowish brown (10YR 5/6) silty clay loam with common, fine, prominent mottles of brown to dark brown (7.5YR 4/4); moderate, medium subangular blocky structure; firm; abrupt, smooth boundary; pH 5.6.

B22t--21 to 40 cm; reddish brown (5YR 4/4) silty clay; moderate, coarse prismatic breaking to coarse blocky structure; firm, sticky, and plastic; thick, clay cutans; few, medium, soft manganese concretions; few, fine roots; clear, smooth boundary; pH 6.4.

B23t--40 to 80 cm; reddish brown (5YR 4/4) silty clay; weak, coarse prismatic, breaking to weak, medium subangular blocky structure; firm; thick clay cutans; clear, smooth boundary; pH 6.5.

B3t--80 to 110 cm; mottled strong brown (7.5YR 5/6) and yellowish red (5YR 5/8) silty clay loam; weak, coarse blocky structure; firm; common, medium soft manganese concretion; some gravels; pH 6.3.

The Ap horizon is brown or dark brown silty clay loam, silty clay, or loam. The B2 horizon is yellowish red, reddish brown, or red silty clay to clay loam. The B3 horizon is strong brown or yellowish red silty clay loam or clay loam.

The Bancheon, occurring with the Gwangju, Jeonnam, and Banggi, are similar to the Gwangju in many respects, but lack gravel that is present in the Banggi soils. In contrast to the Jeonnam the Bancheon soil formed in alluvium, whereas the Jeonnam developed in residuum weathered from granite and porphyrite.

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

Most areas recently in forest, been cleared for agricultural crops.

5.3.1 Bancheon-Banggi Complex, 15 to 30 Percent Slopes, Eroded (BBD2)

These soils are on moderately steep boundaries of the higher old alluvial plains and the present lower alluvial plain. They occur as small areas mostly in Daejeon Myeon in the western part of Danyang Gun. The soils, consisting of about 80 percent Bancheon and 20 percent Banggi, have similar profiles, except the former are very gravelly.

The profiles of the two are similar to the ones described for their respective series, but small areas of less or greater slopes than the described range have been included.

The Banggi soil of this complex is difficult to till in places because of the gravel and the cobbles in the surface layer. The main management problem is erosion control. The soils are used for common crops except rice, and are best suited to pasture and mulberry.

Capability unit IVe.
Paddy suitability group P4ac.

5.4 BANGGI SERIES

The Banggi series, consisting of moderately steep, deep, well drained soils formed in gravelly to cobbly alluvial material, is on the slopes between the older, higher terrace level and the lower alluvial plain. This series is a member of the loamy skeletal family of Typic Hapludalfs.

A typical profile follows:

Ap--0 to 18 cm; brown to dark brown (7.5YR 4/4) gravelly clay loam; weak, fine to medium granular structure; friable, slightly sticky, and slightly plastic; many, fine roots; clear, smooth boundary; pH 5.4.

B2t--18 to 35 cm; yellowish red (5YR 4/6) gravelly clay loam; weak, medium to coarse blocky breaking to medium to coarse granular structure; firm, sticky, and plastic; common, fine roots; gradual, smooth boundary; pH 5.6.

B3t--35 to 65 cm; yellowish red (5YR 5/6) gravelly to cobbly sandy clay loam; weak, medium to coarse blocky breaking to medium to coarse granular structure; slightly firm, sticky, and plastic; few, fine roots; clear, smooth boundary; pH 5.8.

Cl--65 to 120 cm; strong brown (7.5YR 5/6) gravelly to cobbly sandy clay loam; weak, fine to medium granular structure; slightly firm; few, fine roots; pH 5.8.

The Ap horizon is brown, dark brown, grayish brown, or dark grayish brown, or dark grayish brown clay loam, silty clay loam or silt loam. It generally contains a few gravel, and in some places is gravelly or cobbly. The B is yellowish red, strong brown, yellowish brown gravelly clay loam, gravelly silty clay loam, or gravelly silty clay. The C is very gravelly to cobbly sandy clay loam or stony silty clay loam. The gravel content increases with depth.

The Banggi, occurring with the Bancheon and Hwadong, and differing from the Seogto soils in having much more clay, are strongly to medium acid, moderate in natural fertility, and medium to low in organic matter. Permeability is moderate, and available moisture capacity is moderate to low. Cation exchange capacity is medium, and base saturation high. The soils occur as small areas at the edges of alluvial plains, and generally are in poor pine forest with a few small cultivated areas.

5.5 BANSAN SERIES

The Bansan series consists of gently sloping to sloping, dark coloured, well and moderately well drained deep soils formed in mainly residuum of granite and porphyrite. Alluvium washed from adjacent, slightly higher soils may have contributed to their dark surfaces. Hard bedrock depth ranges from 3 to 5 m below the surface. This series is a member of the fine clayey family of Humic Hapludults.

A typical profile follows:

Ap--0 to 9 cm; dark brown (10YR 3/3) silt loam; very weak, fine to medium subangular blocky and fine to medium granular structure; friable, slightly sticky, and slightly

plastic; common, fine, pores; common, fine roots; gradual, smooth boundary; pH 5.2.

Ap2—9 to 16 cm; dark yellowish brown (10YR 3/4) silt loam; very weak, fine to medium granular structure; friable, slightly sticky, and plastic; common, fine pores; common, fine roots; clear, smooth boundary; pH 4.8.

A3—16 to 39 cm; dark yellowish brown (10YR 3/4) silt loam; weak, medium to coarse subangular blocky structure; friable, slightly sticky, and plastic; common, fine pores; common, very fine roots; clear, smooth boundary; pH 4.8.

E1—39 to 42 cm; dark brown (7.5YR 3/2) silt loam with few, fine distinct mottles of dark reddish brown (5YR 2/2); moderate, medium to coarse subangular blocky structure; firm, sticky, and plastic; many, fine to medium pores; clear, smooth boundary; pH 5.0.

IIB21t—42 to 71 cm; dark reddish brown (5YR 3/4) silty clay loam; strong, medium to coarse subangular blocky structure; firm, sticky, and plastic; thin, clay cutans; many, fine to medium pores; very few, very fine roots; clear, smooth boundary; pH 5.9.

IIB22t—71 to 100 cm; yellowish red (5YR 4/8) clay; moderate, medium to fine subangular blocky structure; friable, very sticky, and very plastic; thin clay cutans; few, fine to medium pores; very few, very fine roots; pH 5.1.

The surface layer is brown to very dark brown, dark yellowish brown loam to silty clay loam. The subsoil is yellowish red or dark reddish brown to strong brown silty clay loam, clay loam or silty clay, and occasionally with mottles of grayish brown. The C horizon is strongly weathered granitic saprolite, and ranges in texture from sandy loam to silty clay loam. It usually begins at depth of 150 cm below the surface.

The Bansan are associated with the Seongsan, Jeonnam, and Baegsan soils. These are similar to the Seongsan in topography, but are more developed and have a darker surface layer. The Bansan are less drained, and have a darker surface than the Jeonnam that formed in residual material. These soils are moderately developed, while the Baegsan are undeveloped or weakly developed.

The Bansan are medium to strongly acid, high in natural fertility and medium in organic matter content. Permeability is slow, available moisture capacity is high, cation exchange capacity is low, and base saturation is medium to high. They are found chiefly in the concave areas between the alluvial soil of the valleys and the soil on the mountain slopes.

Most of the areas are cultivated to barley, wheat, soybean, vegetables and other similar crops. A few small areas are cultivated only to paddy rice each year. Yields are generally high.

5.5.1 Bansan-Baegsan Complex, 2 to 7 Percent Slopes (BEB)

These soils occur on gently sloping pediplains or concave areas between the alluvial soil of the valleys and the soil on the mountain footslopes.

The complex consists of about 60 percent Bansan and 40 percent Baegsan soil.

Profiles are as described in their respective series, but included are small areas of soils with lighter coloured surfaces soils, and a few areas of less or greater slopes than the described range.

The soils are mostly in cultivated crops, and are best suited to those commonly grown in the areas. However, if cultivated to paddy rice, they are subject to drought.

Capability unit IIe.
Paddy suitability group P2ac.

5.5.2 Bansan-Baegsan Complex, 7 to 15 Percent Slopes (BEC)

These soils are on sloping concave areas, swales of the slightly dissected old bedrock pediplains, and on the depressions chiefly between the alluvial soil of the local valleys and the soil on the mountain slopes. About 70 percent of this complex is Bansan, and the rest is Baegsan soils. The profiles are similar to those described as representative for their respective series, but, a few small areas of greater slopes than the described range, and small areas with lighter coloured surfaces, have been included.

Cultivation is generally suitable and crops in the area, such as barley, wheat, upland rice, soybean and vegetables grow well. These soils are subject to drought, and the main management concern is erosion control.

Capability unit IIIe.
Paddy suitability group P3ac.

5.6 BONRYANG SERIES

This series, consisting of nearly level, deep, well drained soils developed in recent alluvium, is found in floodplains chiefly along the Yeongsan river and its tributaries, and is a member of the coarse loamy over sandy nonacid family of Typic Udifluvents.

A typical profile follows:

Ap--0 to 12 cm; dark brown (10YR 3/3) fine sandy loam; weak, fine to medium granular structure; friable, slightly sticky, and slightly plastic; common, fine roots; clear, smooth boundary; pH

Cl--12 to 60 cm; brown to dark brown (10YR 4/3) fine sandy loam; weak, medium blocky breaking to fine to medium granular structure; slightly firm, slightly sticky, and slightly plastic; few, fine roots; clear, smooth boundary;

IIC2--60 to 100 cm; brown (10YR 5/3) loamy sand; few gravel.

The Ap horizon is brown, dark brown, yellowish brown, or dark yellowish brown fine sandy loam or loam. The Cl horizon is brown, dark brown, yellowish brown, or strong brown fine sandy loam and contains some gravel in places. The IIC2 horizon is brown or yellowish brown loamy sand. Gray mottles are common in the upper horizon of the soils used for paddy rice.

The Bonryang occurring with the Hagsan soils, are better drained and less mottled than the Hagsan, and are generally low in organic matter, moderately low in natural fertility, and medium to strongly acid. Permeability is rapid, and available moisture capacity low. Cation exchange capacity is low, but base saturation high. Most of the areas are cultivated for crops such as barley, wheat, Indian millet, soybean, potatoes, and vegetables. Paddy rice is grown on a few small areas. Crop yields are generally low.

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

This soil is on level to nearly level flood plains, mainly along the Yeongsan river and its tributaries. Most areas have a profile similar to that described for the series, with some areas of 3 percent slopes, small areas with loamy sand textures throughout the profile, and some soils with gray colours in the lower subsoil, being included.

This soil generally is in good tilth. Runoff is slow, and infiltration rapid. The Bonryang soil is generally best cropped to barley, wheat, soybean, and vegetables. Leaching of crop nutrients and droughtiness are the principal management problems.

Capability unit IIs.
Paddy suitability group P4bc.

5.7 CHANGPYEONG SERIES

The Changpyeong series, including gently sloping to sloping, very deep, well drained soils developed in old alluvium on terraces, is a member of the fine clayey family of Typic Hapludalfs.

A typical profile follows:

Ap--0 to 9 cm; yellowish red (5YR 4/6) silty clay; moderate, medium to fine blocky structure; friable, sticky, and plastic; few, medium pores; common, fine roots; abrupt, smooth boundary; pH 4.6.

B2lt--9 to 40 cm; yellowish red (5YR 4/8) silty clay; strong, fine to coarse angular blocky structure; firm, sticky, and plastic; common, medium pores; few, fine roots; gradual, smooth boundary; pH 5.0.

B22t--40 to 60 cm; yellowish red (5YR 4/6) silty clay with common, medium, prominent black spots; strong to moderate, medium angular blocky breaking to moderate fine granular structure; very firm, sticky, and plastic; moderately thick

clay cutans; few, medium pores; very few, fine roots; gradual, smooth boundary; pH 5.0.

B3t--60 to 132+ cm; yellowish red (5YR 4/6) silty clay loam; strong, medium angular blocky structure; friable, slightly sticky, and slightly plastic; few, fine pores; common, medium blocky manganese oxide mottles; pH 5.2.

The Ap horizon is brown, strong brown, yellowish red, or dark reddish brown silty clay to silty clay loam or clay. The B2 horizon is yellowish red or red to dark red silty clay or clay with continuous clay cutans. The substratum, not described in the profile, usually begins at a depth of 1.5 to 3 m, and is alluvium ranging in texture from silty clay to sandy clay loam. Buried paleosols are frequently with the lower strata that are cobbly or gravelly.

The Changpyeong are in the same general areas as the Bancheon, Gwangsan, and Gwangju soils. These are finer textured, and have a stronger structure than the Bancheon, differing from the Gwangsan in parent material, and from the Gwangju soils in the lack of silty upper horizons.

The Changpyeong are usually medium in organic matter content, but the newly cleared or uncultivated soils contain only small amounts of this. These soils are medium to strongly acid, and moderately high in natural fertility. Permeability is very slow, and available moisture capacity is moderate to high. Cation exchange capacity is medium to high, and base saturation high.

Crops, such as barley, wheat, soybean, and sweet potato are general and paddy rice is grown in a few areas.

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

This soil is on gently sloping, slightly dissected pediplains. The profile generally is similar to that described for the series, but includes some areas of only slightly eroded soil, and silty clay loam to silty clay subsoils.

It generally is in poor tilth, the root zone is thick, and the hazard of further erosion, moderate. A few small areas are in rice paddy, with the cultivation of barley, wheat, potato, and other similar crops, being usual. The main management problem is erosion control.

Capability unit IIe.
Paddy suitability group P2ac.

5.7.2 Changpyeong Silty Clay, 7 to 15 Percent Slopes, Eroded. (CpC2)

This very deep and well drained soil is on sloping and dissected pediplains. The profile is similar to that described for the series but includes some areas of only slightly eroded soil with a surface layer of brown to strong brown silty clay loam, small areas of greater slopes than the described range, and a few small areas with heavy silty clay loam to light silty clay subsoils.

The root penetration is poor because of high clay content. Cultivated crops are usual but some areas at a higher elevation are in forest. The soil is suited to a wide range of non-irrigated crops, but special management is needed to control erosion. Paddy rice is grown on some of the lower areas.

Capability unit IIIe.
Paddy suitability group P3ac.

5.8 GAGHWA SERIES

The series, consisting of sloping to moderately steep, well drained, deep soils formed in old colluvial material weathered from granite, porphyry, and schist, occupies colluvial, and mountain footslopes, and is a member of the fine clayey family of Typic Hapludults.

A typical profile follows:

A11--0 to 7 cm; brown to dark brown (7.5YR 4/4) gravelly or cobbly clay loam; moderate, very fine to fine granular structure; friable, sticky, and plastic; many, fine to medium roots; clear, smooth boundary; pH 6.7.

A12--7 to 22cm; strong brown (7.5YR 5/6) cobbly clay loam; moderate, fine to medium granular structure; friable, sticky, and plastic; common, fine pores; common, fine roots; clear, wavy boundary; pH 5.7.

A3--22 to 50 cm; strong brown (7.5.YR 5/6) cobbly clay loam; weak, medium to coarse subangular blocky and moderate, very fine to medium granular structure; firm; common, medium pores; few, fine roots; clear, wavy boundary; pH 6.0.

B21--50 to 75 cm; yellowish red (5YR 4/8) very cobbly clay; strong, fine to medium subangular blocky and fine, angular blocky structure; firm, very sticky, and plastic; few, very fine pores; continuous reddish brown (5YR 4/4) clay cutans; very few, very fine roots; diffuse smooth boundary; pH 6.3.

B22--75 to 150 cm; reddish brown (5YR 4/4) cobbly to stony clay; strong, medium to coarse subangular blocky structure; few, fine pores; common, medium and coarse manganese concretions; diffuse, wavy boundary; pH 6.6.

Where only slightly eroded, the surface layer is brown to dark brown, and where eroded, it is yellowish brown to dark yellowish brown. Its texture is gravelly clay loam to gravelly loam, but it is free of gravel in some places. The surface soil ranges from 6 to 20 cm in thickness. The subsoil is yellowish red, reddish brown or strong brown very stony clay to clay loam. The C horizon is yellowish brown to brown very stony loamy soil or bouldery coarse sandy granitic material.

The Gaghwa, associated with the Jangweon and Seogto soils are more clayey and redder than them and lack the fragipans that distinguish the Jangweon.

The Gaghwa are medium to strongly acid, and moderately low to medium in organic matter content. The available moisture capacity is moderate to high, and permeability is moderately slow. Cation exchange capacity is low, and base saturation high.

These soils occupy about 2 percent of the surveyed area, and occur in small areas on mountain footslopes. Most of the areas are cultivated for crops usually grown on upland soils, but about 30 percent is Korean pine. Chestnut and persimmon also grow in some places.

5.8.1 Gaghwa-Jangweon Complex, 7 to 15 Percent Slopes (GJC)

This complex of soils is on sloping, dissected mountain footslopes. About 80 percent of the mapping unit is Gaghwa, and 20 percent, Jangweon soils. The profiles are similar to those described for their respective series, but included are some areas with a slightly gravelly or gravel-free surface layer, a few small areas of less or greater slopes than the described range, and small areas of very stony soils. Infiltration is slow, and runoff is medium to rapid. The root zone is relatively thick, and the tilth, poor.

The soils of this complex occur as small areas, and are on the mountain foot-slopes throughout the Guns. Barley, wheat, soybean, red pepper, potato, and similar crops are suited. About 70 percent of the Gaghwa is cultivated, and the rest is wooded. The Jangweon soil is mostly in grassland. The main management problems are erosion control and stone removal from the surface layer.

Capability unit IIIe.
Paddy suitability group P3ac.

5.8.2 Gaghwa-Jangweon Complex, 7 to 15 Percent Slopes, Eroded (GJC2)

These soils, occurring in sloping, dissected mountain footslopes, consist of about 85 percent Gaghwa and 15 percent Jangweon soils. Profiles are similar to the ones described for the respective series except that these soils have a generally eroded surface layer. With these soils are included small areas of shallow and deep gullies, a few small areas of less or greater slopes than the described range, and small areas of very cobbly to stony soils.

The soils are well suited to cultivation, such as soybean, red bean, sorghum, red pepper and other deep rooted crops with some areas in forest. The main management problem is erosion control.

Capability unit IIIe.
Paddy suitability group P3ac.

5.8.3 Gaghwa-Jangweon Complex, 15 to 30 Percent Slopes (GJD)

These soils are in moderately steep, dissected mountain footslopes. About 80 percent of this mapping unit is Gaghwa, and 20 percent Jangweon soils. The profiles are similar to those described for their respective series, but included, are: many areas with a gravel-free loam surface layer, small areas of greater slopes than the described range, and a few small areas of very cobbly to stony soils.

These soils are suited to cultivation, such as barley, wheat, soybean, potato, and similar crops. About 70 percent of the unit is cultivated, and the rest is in forest or grassland. The main management problem is erosion control and the removal of gravels from the surface.

Capability unit IVe.
Paddy suitability group P4ac.

5.8.4 Gaghwa-Jangweon Complex, 15 to 30 Percent Slopes, Eroded (GJD2)

About 75 percent of the unit is Gaghwa and 25 percent Jangweon soils. The profiles are as described for their respective series, but include many areas of a very cobbly

and stony soil, some gullied areas, a few small areas of greater slopes than the described range, and small areas of Seogto soils.

Most areas were only recently cleared and now are cultivated to wheat and soybean. Chestnut and persimmon trees grow in some places and about 30 percent is still in pine forest. These soils are suitable for growing such crops as soybean, barley, wheat, sorghum, red pepper, potato and cotton. The main management problem is erosion control and the removal of stones from the surface.

Capability unit IVe.

Paddy suitability group P4ac.

5.9 GANGDONG SERIES

The series consists of nearly level, poorly drained, deep soils formed in alluvium. These soils occurring in small valleys and alluvial plains, are members of the fine loamy over sandy nonacid family of Fluventic Haplaquepts.

A typical profile follows:

Apl—0 to 12 cm; olive gray (5Y 5/2) loam with many, fine to medium prominent yellowish brown (10YR 5/4) mottles; massive; slightly sticky, and slightly plastic; few, fine yellow mica; common, fine roots; abrupt, smooth boundary; pH 5.6.

Ap2—12 to 24 cm; gray (5YR 5/1) loam with many, medium to coarse, prominent mottles of reddish brown (5YR 4/4); massive; slightly sticky and slightly plastic; few, fine pores; few, fine roots; abrupt, smooth boundary; pH 5.7.

B21g—24 to 37 cm; dark gray (5Y 4/1) loam with few, medium distinct mottles of olive brown (2.5Y 4/4) weak, coarse prismatic structure; sticky and plastic; few, fine pores; diffuse, smooth boundary; pH 5.7.

B22g—37 to 90 cm; very dark gray (5Y 3/1) loam; massive; sticky and plastic; ground water table occurs 90 cm below the surface; some partially decomposed pieces of wood; pH 5.7.

Cg—90 to 190 cm; very dark gray (5Y 3/1) loamy sand; massive; no mottles; many, partially decomposed pieces of wood; pH 6.3.

The A horizons are grayish brown to dark grayish brown or gray to dark gray silt loam, loam, or sandy loam with mottles of olive brown, strong brown or yellowish brown. The subsoil is gray, dark gray, or very dark gray clay loam, silty clay loam or silt loam.

It is sometimes stratified with fine sandy loam, and usually contains some gravels. The C horizon is dark gray loamy sand or sand. It begins at depth of 50 to 100 cm, and sometimes extends to a depth of 150 cm.

The Gangdong occur with the Sugye, Sindab, and Subug soils. The last mentioned have sandy loam or coarse loam upper horizons. The Sugye lack the very sandy lower

horizons, and the Sindab are sandy throughout the profile.

The Gangdong are slightly to strongly acid, and medium in natural fertility. Permeability is moderate in the upper horizons, rapid in the lower horizons, and available moisture capacity is very high. Cation exchange capacity is medium and base saturation high.

These soils occupy very small tracts of the area and are generally in paddy.

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

This is a deep, poorly drained soil in the low lying areas of the alluvial plains of the small to medium sized streams. The profile is generally similar to the one described for the series, and includes some areas of gently sloping soil, and small areas with loam or sandy loam textures throughout.

The very high ground water table, shallow root zone and poor drainage, limit productivity. Paddy rice is best suited and is the only cultivated crop.

Capability unit IIw.
Paddy suitability group P2b.

5.10 GEUGRAG SERIES

The Geugrag series consisting of nearly level to gently sloping, deep, imperfectly drained soils formed in alluvium on low terraces, is a member of the fine clayey family of Aeric Ochraqualfs.

A typical profile follows:

Ap1--0 to 10 cm; gray (5Y 5/1) silt loam with common, fine, distinct mottles of brown to dark brown (7.5YR 4/4); weak, fine to medium granular structure; friable, sticky, and plastic; many, fine roots; abrupt, smooth boundary; pH 5.5.

Ap2--10 to 21 cm; dark gray (5Y 4/1) silt loam with common, fine to medium prominent mottles of reddish brown (5YR 4/4); weak, medium subangular blocky structure; friable, sticky, and plastic; patchy thin clay cutans; common, fine roots; abrupt, smooth boundary; pH. 6.5.

B1--21 to 45 cm; grayish brown (2.5Y 5/2) silt loam; moderate, coarse prismatic structure; firm, sticky, and plastic; moderately thick clay cutans; common, medium, distinct, soft dark brown (7.5YR 3/2) concretion; few, fine pores; very few, fine roots; abrupt, smooth boundary; pH 7.0.

B21--45 to 82 cm; mottled yellowish brown (10YR 5/6) and light gray (5Y 7/1) silty clay loam; moderate, coarse prismatic structure; firm, very sticky, and plastic; moderately thick clay cutans; common, medium, hard black (N2/) concretions; very few, fine pores; clear, smooth boundary; pH 7.0.

B22--82 to 117 cm; strong brown (7.5YR 5/6) silty clay loam; weak, coarse prismatic, breaking to medium subangular blocky structure; friable, very sticky, and very plastic; patchy moderately thick clay cutans; abrupt, smooth boundary; pH 6.8.

The Ap horizon ranges from 12 to 18 cm in thickness, and is gray, dark gray, or dark grayish brown silt loam or silty clay with mottles of yellowish red, strong brown, brown, or dark brown. The B horizon is gray, grayish brown in the upper part and strong brown, yellowish brown, or dark yellowish brown mottled with gray colours in the lower part. It is heavy silty clay loam or silty clay. Clay cutans are common throughout the profile.

The Geugrag, occurring with the Honam and Hwadong soils, differ from the Honam in being less gray, in having more mottles, and occurring on a slightly higher elevation than the latter. These soils are more gray, and occur too on a somewhat lower positions than the Hwadong.

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

The soils cover about 5 percent of the surveyed area, and are in rice paddy, with about half planted to barley or wheat for a winter crop.

5.11 GWANGJU SERIES

The Gwangju series, consisting of gently sloping to sloping, very deep, well drained soils developed in silty material over old alluvium, occurs on terraces mainly in Pyeongdong Myeon of the southwestern part of Gwangsan Gun, and is a member of the fine clayey family of Typic Hapludults.

A typical profile follows:

All--0 to 5 cm; brown to dark brown (7.5YR 4/4) silty clay loam; moderate, very fine to fine granular structure; very friable, slightly sticky, and slightly plastic; many roots; clear, smooth boundary; pH 4.5.

A12--5 to 15 cm; brown to dark brown (7.5YR 4/4) silty clay loam; weak, fine to medium subangular blocky breaking to moderate, fine granular structure; friable, sticky, and plastic; few, very fine pores; many roots; clear, smooth boundary; pH 4.5.

B21t--15 to 55 cm; yellowish red (5YR 4/6) silty clay; moderate, fine to medium subangular blocky structure; slightly firm, sticky, and plastic; common, very fine to fine pores; patchy, thin clay cutans; few roots; gradual, wavy boundary; pH 5.0.

B22t--55 to 69 cm; yellowish red (5YR 4/8) silty clay; moderate, fine to coarse subangular blocky structure; slightly firm, sticky, and plastic; common, very fine pores; few roots; clear, wavy boundary; pH 5.0.

B23t--69 to 115 cm; yellowish red (5YR 4/6 to 5/6) silty clay loam; strong, fine to coarse angular and subangular blocky structure; firm, very sticky, and very plastic; very few pores; continuous thin clay cutans; very few roots; gradual, wavy boundary; pH 5.0.

B36--115 to 170 cm; red (2.5YR 4/8) to yellowish red (5YR 5/8) silty clay loam; moderate, very coarse prismatic structure breaking to moderate angular and subangular blocky structure; very firm, very sticky, and very plastic; continuous fine clay cutans; very few pores; gradual, wavy boundary; pH 4.5.

B3t--115 to 170 cm; red (2.5YR 4/8) to yellowish red (5YR 4/8) silty clay loam; moderate, very coarse prismatic structure breaking to moderate angular and subangular blocky structure; very firm, very sticky, and very plastic; continuous fine clay cutans; very few pores; gradual, wavy boundary; pH 4.5.

C--170+ cm; brownish yellow (10YR 6/6) silty clay loam; massive; firm, very sticky, and very plastic; common, continuous clay cutans; pH 4.5.

Where not eroded, the surface layer is generally brown to dark brown silty clay loam or silty clay. The B2 horizons range from yellowish red to yellowish brown or strong brown in colour, and from silty clay to silty clay loam in texture. The B3 horizons are yellowish red, red, or dark red silty clay loam, silty clay, or clay.

The Gwangju occur with the Bancheon and Changpyeong soils, and differ from the latter in having a surface layer developed in a silty material. The Gwangju are similar to the Jingog, but the latter were formed in silty material over residuum derived from granite.

These soils are strongly to very strongly acid, and low both in natural fertility and organic matter. Permeability is slow, and available moisture capacity high. Cation exchange capacity is medium to high, and base saturation low. Most areas have been cleared for cultivation.

5.11.1 Gwangju-Bancheon Complex, 2 to 7 Percent Slopes (GBB)

These soils are in gently sloping, slightly dissected terraces or alluvial fans chiefly in the northwestern part of Gwangsan Gun. The complex consists of about 70 percent Gwangju and 30 percent Bancheon soils. The profiles are similar to those described for their respective series and include a few small eroded areas, and small areas with clay subsoils.

These soils, sticky and plastic when wet, dry very hard and commonly produce wide cracks. Tilt is generally fair and infiltration is very slow. Most of the areas are cultivated, and under good management the soils are well suited to wide range of crops. But, erosion is a problem, if cropping is regular.

Capability unit IIe.
Paddy suitability group P2ac.

5.11.2 Gwangju-Bancheon Complex, 7 to 15 Percent Slopes, Eroded (GBC2)

These soils occur on sloping, slightly to moderately dissected terraces, fans and footslopes, mainly in the northwest of Gwangsan Gun. About 80 percent of the complex has a profile like the Gwangju, and 20 percent like the Bancheon series. Small areas of greater slope than the described range, some areas of a only slightly eroded soil, and a few small areas of soils with heavy silty clay to clay B horizons, are included.

Cultivation to nonirrigated crops is suitable and general. The slope and slow infiltration make the hazard of further erosion severe.

Capability unit IIIe.

Paddy suitability group P3ac.

5.12 GWANGSAN SERIES

The Gwangsan series consists of sloping to moderately steep, well drained, very deep soils formed in residuum weathered from granite, granite gneiss, porphyry, and sometimes schist. These soils occupy dissected bedrock pediplains. Bedrock depth is from 2 to 7 m from the surface. The series is a member of the fine clayey family of Typic Hapludults.

A typical profile follows:

Ap--0 to 10 cm; reddish yellow (7.5YR 6/8) silty clay loam; weak, fine to medium subangular blocky and moderate, fine to medium granular structure; friable, slightly sticky, and plastic; few, very fine pores; many, fine roots; clear, smooth boundary; pH 4.9.

B2lt--10 to 22 cm; yellowish red (5YR 4/8) silty clay loam; moderate, fine to medium subangular blocky and moderate, fine granular structure; firm, sticky, and plastic; thin, clay cutans; few, very fine pores; common, fine roots; some quartz; abrupt, smooth boundary; pH 5.0.

B22t--22 to 54 cm; dark red (2.5YR 3/6) clay; strong, fine to medium subangular blocky structure; very firm, very sticky, and very plastic; thin, clay cutans; few, fine pores; few, fine roots; some quartz; abrupt, smooth boundary; pH 4.9.

B23t--54 to 93 cm; red (2.5YR 4/6) clay; moderate, medium to coarse subangular blocky structure; firm, sticky, and plastic; few, fine pores; thin, clay cutans; very few, fine roots; clear, smooth boundary; pH 4.9.

B3t--93 to 150 cm; yellowish red (5YR 4/8) silty clay; moderate, fine to medium subangular blocky structure; firm, sticky, and plastic; thick, clay cutans; many, fine yellow and white mica; pH 4.9.

The A horizon is reddish yellow, yellowish red, yellowish brown, or strong brown silty clay loam to silty clay. The upper B2lt horizon is red to dark red or

yellowish red silty clay loam, silty clay, or clay, and the B22t and B23t horizons are yellowish red to red clay or silty clay. The C horizon, not described in the profile, is saprolite of silt loam, silty clay loam, sandy loam, or sandy clay loam. It begins at depth of about 150 cm and extends to below 200 cm. Coarse quartz sands and fine gravels may be present.

The Gwangsan, associated with the Jeonnam and Changpyeong, are finer textured, have a darker and redder subsoil than the Jeonnam and differ from the Changpyeong in parent material.

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

The Gwangsan soils cover about 2 percent of the area, mainly in the central part. Vegetation consists chiefly of pines with an understory of azalea, but alder, acacia, or grasses, were recently planted to protect the soils. Most areas have been cleared for cultivation, but about 30 percent is still forested.

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

These soils are on low hills of old bedrock pediplains. The Jingog are small areas on the less sloping ridge tops and the Gwangsan are on the slopes between the Jingog soils and the alluvial plain. The Gwangsan cover about 80 percent of the area, and the Jingog, the remaining 20 percent. Most areas of the latter have slope gradients of less than the described range and are not as eroded as are the Gwangsan. These soils have profiles that are similar to the one described in the series.

Because of lesser slope and erosion the Jingog have fewer problems, in obtaining a high yield level and continuing a high production, than the more sloping and eroded Gwangsan soils. Wheat, barley, sorghum, upland rice, and millet, are suitable and cultivated. This is 70 percent of the area, with the rest being wooded or in grassland. A severe management problem is erosion control.

Capability unit IIIe.
Paddy suitability group P3ac.

5.12.2 Gwangsan-Jingog Complex, 7 to 15 Percent Slopes, Severely Eroded (GGC3)

The Jingog soils, about 20 percent of this unit area, occupy small areas on ridge tops that have slope gradients of less than the described range. The Gwangsan soils are distributed on the slopes between the ridge tops and alluvial plains and occupy the remaining 80 percent. The Jingog are not so eroded as the Gwangsan. The surface layer of these soils is very shallow, and the subsoil is exposed in most places. Shallow gullies are common throughout the unit area. Otherwise, profiles are similar to those described for their respective series.

The complex is suited to cultivation, but 30 percent is still wooded or in grassland. Erosion is severe hazard to management if cropping is regular.

Capability unit IIIe.
Paddy suitability group P3ac.

5.12.3 Gwangsan-Jingog 15-30 Percent Slopes, Eroded (GGD2)

These soils are on low hills of the bedrock pediplain. The Jingog are small areas on the less sloping ridge tops and the Gwangsan are on the moderately steep slopes from the ridge tops to the lower alluvial plain. The Gwangsan soils, the most extensive, cover about 80 percent of the area, and the Jingog the remaining 20 percent. These soils have profiles similar to those described for the series.

Because of their lesser slope and erosion, the Jingog have fewer and less severe problems in use. At present the soil is in poor pine forest, although with proper attention some crops may be profitably grown, and hay and pasture, with liming and fertilization will give high yields.

Capability unit IVe.
Paddy suitability group P4ac.

5.12.4 Gwangsan-Jingog Complex, 15 to 30 Percent Slopes, Severely Eroded (GGD3)

This complex consists of gullies (5 percent), Jingog soils (20 percent) and Gwangsan soils (75 percent). The Jingog soils occupy ridge tops and have slope gradients less than the described range while the Gwangsan soils occupy the slopes between the ridge tops and the alluvial plains. In most places the subsoil is exposed, otherwise, the profiles are as described for their series. Included in this unit are small areas of greater slopes than the described range.

These soils are poorly suited to cultivation because of the steep slopes and severe erosion hazard. Most areas are in poor forest.

Capability unit IVe.
Paddy suitability group P4ac.

5.13 HABIN SERIES

The Habin series consists of moderately steep to steep, shallow, somewhat excessively drained soils developed in residuum derived from red shale. These soils occupy strongly dissected mountainous areas. Hard bedrock ranges from 30 to 50 cm, from the surface. This series is a member of the coarse loamy family of Lithic Eutrochrepts.

A typical profile follows:

A--0 to 6 cm; dark reddish brown (5YR 3/3) slightly gravelly loam; moderate, fine to medium granular and very weak, fine subangular blocky structure; friable, slightly sticky, and slightly plastic; many, fine to medium roots; abrupt, smooth boundary; pH 5.6.

C1--6 to 12 cm; reddish brown (2.5YR 4/4) very gravelly clay loam; moderate, fine to medium, subangular blocky structure; firm, sticky, and plastic; many, fine to medium roots; abrupt, smooth boundary; pH 5.6.

C2--12 to 25 cm; slightly weathered red shale bedrock.

R--25+ cm; red shale bedrock.

Where eroded, the surface layer is usually weak red to reddish brown, or dusky red, gravelly to cobbly loam, silt loam, or clay loam. Hard bedrock is exposed at the surface in some places, and the C horizon is very gravelly to cobbly clay loam to loam.

The Habin, occurring with the Jeongja soils, are also shallow and somewhat reddish brown in colour and developed in tuff material. They both differ from the Samgag in underlying materials and greater gravel content and are similar to the Mudeung in texture and depth. But, they are redder in colour, have different underlying rocks, and are in lower topographic positions.

The Habin soils are strongly acid, low in natural fertility and low in organic matter content. Permeability is rapid in upper horizons but the underlying shale is not permeable, and available moisture capacity is very low. Cation exchange capacity is low, and base saturation medium to high.

The Habin soils occupy small tracts of the surveyed area, and occur chiefly in the hilly areas of the western part of Samdo Myeon, Gwangsan Gun. Most of the areas are in pine forest.

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

About 35 percent of the area of this soil is rock outcrops. In most other areas the profile is similar to that described for the series, but here the subsoil is exposed in most places and the original loam surface layer was washed away by the erosion. With this soil are included: some areas of less or greater slopes than the described range, small areas of Jeongja soils, a few small areas of only slightly eroded soil with a dark reddish brown surface layer, and with a gravelly to cobbly clay loam surface layer.

The slope and thin root zone limit productivity, but the soil is suitable to woodland, and a few small sloping areas can be cultivated to shallow rooted crops. Some grazing may be obtained from this soil if well managed. At present poor pine forest predominates. The main management concern is erosion control.

Capability unit VIe.

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

The original surface layer of this soil has been eroded, the subsoil is exposed in most places, and between 30 to 40 percent is rock outcrops. The remainder of the mapped areas generally have a profile similar to that described for the series. Included with this soil are many areas with a gravelly to cobbly clay loam surface layer, and small areas of Jeongja soils.

The areas covered by this soil are small, and mostly are in poor pine forest. It is only suitable for woodland and the main management problem is erosion control.

Capability unit VIe.

5.14 HAGSAN SERIES

The Hagsan is nearly level to gently sloping, moderately well drained and deep soils on alluvial plains, footslopes and alluvial fans, chiefly near the Yeongsan river and its tributaries. This series is a member of the fine loamy over sandy family of Aquic Fluventic Eutrochrepts.

A typical profile follows:

Apl--0 to 12 cm; dark gray (5Y 4/1) loam; massive; slightly sticky and plastic; common, fine roots; clear, smooth boundary; pH 5.8.

Ap2--12 to 19 cm; gray (5Y 5/1) loam with common, fine, distinct dark grayish brown (10YR 4/2) mottles; weak, medium to fine, subangular blocky; few, fine rice roots; common, fine pores; few, fine round gravel (6.0 percent); slightly sticky and slightly plastic; abrupt, smooth boundary; pH 5.6.

B21--18 to 25 cm; yellowish brown (10YR 5/8) clay loam with common, fine distinct red (2.5YR 4/8) and few, fine, distinct olive gray (5Y 5/2) mottles; weak, coarse prismatic breaking to fine and medium, weak subangular blocky; crushed yellowish brown to dark yellowish brown (10YR 5/6-4/4) firm, slightly sticky, and plastic; few, fine roots; common, fine pores; clear, smooth boundary; pH 5.8.

B3--25 to 57 cm; dark yellowish brown (10YR 4/4) sandy clay loam with common, medium faint dark grayish brown (10YR 4/2) mottles; weak, coarse prismatic breaking to weak, medium and coarse subangular blocky; firm, sticky, and plastic; continuous, thin, dark gray (10YR 4/1) coatings; very few, fine roots; few, fine pores; clear, smooth boundary.

IIC--57 to 103 cm; dark grayish brown (10YR 4/2) loamy coarse sand; few, fine faint brown to dark brown mottles; single grain; round gravel (10%); gradual, smooth boundary; pH 6.5.

The Ap horizon is grayish brown, dark grayish brown, gray or dark gray silt loam to loam. The B2 horizon is grayish brown or gray, and is mottled with strong brown, yellowish brown or yellowish red. Its texture includes silt loam, silty clay loam or fine sandy loam, and is occasionally stratified with light clay loam. The lower substratum is brown to dark brown or grayish brown loamy sand, and contains gravel in some places.

The soils of this series occur with the Bonryang and Hwangyong but are less drained and more mottled in the upper horizons than the former, and do not have high content of gravel like the Hwangyong. They are strongly acid, moderate in natural fertility, and medium in content of organic matter. Permeability is moderate in the upper part, rapid in the lower part, and available moisture capacity is moderate to low. Cation exchange capacity is medium, and base saturation high.

Rice paddy is general with a few small areas cultivated to other crops.

5.14.1 Hagsan Loam, 0 to 2 Percent Slopes (Hs)

The profile resembles that described for the series, but in many places, has a silt loam surface layer. With this soil are included small areas of the Hwangyong and Bonryang.

The surface layer is in good tilth, the root zone is thick, and infiltration is rapid.

All of the areas are in paddy, are suited to a limited number of crops, and could be used intensively if drainage is provided. About half grow paddy rice during the summer and barley or wheat in the winter.

Capability unit I.
Paddy suitability group P2c.

5.14.2 Hagsan Loam, 2 to 7 Percent Slopes (HsB)

These soils are on footslopes and fans with dominant slopes of less than 4 percent. Most areas have a profile similar to that described for the series, but in some areas this soil has a silt loam surface layer. With this soil are included small areas of better drained, and very gravelly soils.

The surface layer is easy to till and the root zone is thick. Infiltration is moderate. The Hagsan soil is suited to wide range of crops if well managed. Most of the areas are cultivated to barley or wheat in the winter and paddy rice during the summer. Some areas near towns are used for growing vegetable crops.

Capability unit IIe.
Paddy suitability group P3ac.

5.15 HOGYE SERIES

The Hogye series consists of nearly level to sloping, deep, well drained soils formed in alluvium. These soils, occupying alluvial fans and small valleys chiefly in mountainous areas, belong to the loamy skeletal family of Fluventic Hapludolls.

A typical profile follows:

Ap--0 to 11 cm; very dark grayish brown (10YR 3/2) gravelly loam; moderate, fine to medium granular structure; friable, sticky, and plastic; clear, smooth boundary; pH 5.2.

A1--11 to 26 cm; very dark grayish brown (10YR 3/2) gravelly silt loam; weak, medium to coarse subangular blocky and moderate, fine to medium granular structure; friable, sticky, and plastic; clear, smooth boundary; pH 5.8.

C--26 to 60 cm; brown to dark brown (7.5YR 4/4) very gravelly loam; weak, medium to coarse subangular blocky structure; firm, sticky, and plastic; pH 6.3.

The A horizon is dark brown or very dark grayish brown, but it is dark grayish brown to very dark gray in paddy soils. Its texture is slightly gravelly to gravelly silt loam, loam, or fine sandy loam. It ranges in thickness from 25 to 60 cm. The C horizon is brown to dark brown or dark yellowish brown very gravelly loam, or very gravelly sandy loam.

The Hogye soils, differing from the Seogto soils chiefly in having darker colours in the surface layer, occur in alluvial fans rather than in mountain footslopes. They also differ from the Hagsan soils in having much gravel and darker colours.

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

They occur chiefly on small valleys in mountainous areas of the Guns, and are cultivated for many kinds of crops including rice.

5.15.1 Hogye Gravelly Loam, 0 to 2 Percent Slopes (Hg)

Most areas have a profile similar to that described for the series. Included are many areas with a silt loam surface layer, and small areas of sandy loam surface soil.

The soil is well suited to cultivated crops other than paddy rice. Most areas are cropped to barley, wheat, cotton, soybean, and vegetables, with some areas in paddy rice. The main management problem is droughtiness, due to the limited available moisture capacity. This soil is easier to till when gravel is removed from the surface.

Capability unit IIs.
Paddy suitability group P3bc.

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

The profile generally is as described for the series, but gravels have been removed from the plough layer in many parts for easier cultivation. Some areas of silt loam or sandy loam surface layer, are also included.

The mapping unit is the largest one of the Hogye series, with most areas being cultivated. The soil is well suited to a wide range of crops if well managed, and may be cultivated to paddy rice in summer and barley or wheat in winter. Droughtiness is the main problem. The removal of gravel from the plough layer is the main management concern.

Capability unit IIs.
Paddy suitability group P4abc.

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

The profile in most areas resembles that described for the series. Many parts are gravel free in the surface layer because of the industry of farmers. With this soil are included a few areas of clayey soil recently washed from adjacent uplands, and small areas with a sandy loam surface layer.

The soil of this unit is suited, and cultivated to a wide range of crops. Paddy rice is grown in many areas after harvest of winter crops, such as wheat or barley. Droughtiness and surface gravel removal are the principal management problems. Erosion is only a slight management hazard.

Capability unit IIIe.

Paddy suitability group P4abc.

5.16 HONAM SERIES

The Honam series, consisting of nearly level to gently sloping, deep, poorly drained soils formed in alluvium on alluvial plains, is a member of the fine clayey family of Typic Ochraqualfs.

A typical profile follows:

Apl--0 to 15 cm; gray (5Y 5/1) silty clay loam with many, fine to medium distinct mottles of brown to dark brown (7.5YR 4/4); massive; sticky and plastic; many, fine roots; clear, smooth boundary; pH 5.7.

Ap2--15 to 32 cm; gray (5Y 5/1) silty clay with many, fine to medium distinct mottles of strong brown (7.5YR 5/8) and dark reddish brown (5YR 3/4); weak, medium subangular blocky structure; sticky and plastic; patchy moderately thick cutans; few, fine pores; common, fine roots; abrupt, smooth boundary; pH 6.8.

Blir--32 to 50 cm; olive gray (5Y 5/2) silty clay loam with many, medium distinct mottles of yellowish brown (10YR 5/6); moderate, coarse, prismatic structure; firm, very sticky, and very plastic; moderately thick clay cutans; few, fine roots; clear, smooth boundary; pH 6.6.

B2lir--50 to 85 cm; gray (5Y 5/1) silty clay loam with many, medium distinct mottles of strong brown (7.5YR 5/8); moderate, coarse to very coarse, prismatic structure; firm, very sticky, and very plastic; moderately thick clay cutans; clear, smooth boundary; pH 6.6.

B22ir--85 to 112 cm; very dark gray (5Y 3/1) silty clay with very faint olive (5Y 5/4) mottles; massive; firm; clear, smooth boundary; pH 5.6.

The Ap horizon is 15 to 18 cm thick, and is gray to dark grayish brown silty clay loam, or clay loam with many mottles of strong brown or yellowish red. The B2 horizon is gray, olive gray, or grayish brown silty clay loam or silty clay with many mottles of yellowish brown and strong brown.

The Honam soils are associated with the Geugrag although the latter are less gray in colour, and occur on higher elevated positions than the former.

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

The Honam are most extensive in the Guns, and all of the areas are in rice paddy. Some better drained areas of these soils are cultivated to barley during the winter.

5.16.1 Honam-Geugrag Complex, 0 to 2 Percent Slopes (HG)

These soils, on level to nearly level broad alluvial plains, consist of about 80 percent Honam and 20 percent Geugrag. The profiles are similar to those described for their respective series. With the soils of this complex are included some areas of a soil with fine sandy loam or silt loam surface layer.

Single cropping of paddy rice, because of poor drainage, is best suited. Most of the areas are in rice paddy, and some of the better drained parts in winter crops, such as barley. The installation of a well designed drainage system would allow a greater variety of crops.

Capability unit IIIw.
Paddy suitability group Pl.

5.16.2 Honam-Geugrag Complex, 2 to 7 Percent Slopes (HGB)

The soils occur on gently sloping broad alluvial plains. The slope ranges dominantly from 2 to 4 percent. About 60 percent is Honam soil and the rest is Geugrag. The profiles are similar to those described for their respective series.

Tilth generally is poor because of the high clay content in the surface layer. The root zone is thick, and runoff, very slow. The hazard of erosion is slight.

The soils are in, and best suited to, paddy rice, but if drainage were provided, could be used intensively for many crops.

Capability unit IIw.
Paddy suitability group P2a.

5.17 HWABONG SERIES

The Hwabong series, consisting of nearly level, excessively drained, deep soils that formed in recent alluvium, occupies flood plains chiefly along the Yeongsan river and its tributaries, and is a member of the sandy family of Typic Udipsamments.

A typical profile follows:

Ap--0 to 19 cm; yellowish brown (10YR 5/4-5/6) loamy sand;
single grain; very friable; common, fine roots; gradual,
smooth boundary; pH 5.2.

Cl--19 to 38 cm; yellowish brown (10YR 5/4) sandy loam;
single grain; very friable; few, fine roots; abrupt, smooth
boundary; pH 5.5.

C2--38 to 56 cm; yellowish brown (10YR 5/6) loamy sand; single grain; very friable; few, fine roots; abrupt, smooth boundary; pH 6.0.

C3--56 to 87 cm; strong brown (7.5YR 5/6) fine sandy loam; single grain; very friable; very few, fine roots; abrupt, smooth boundary; pH 6.3.

C--87 to 120 cm; yellowish brown (10YR 5/8) very friable sand.

The soils are yellowish brown, brown, or strong brown coarse loamy sand or sand. Some thin strata of sandy loam and gravelly sand are present in many profiles.

The Hwabong are usually with the Bonryang soils that have sandy loam upper horizons over coarse sand lower horizons, very similar to the lower profile of the Hwabong.

The Hwabong, strongly to very strongly acid, are low both in natural fertility and organic matter. Permeability is very rapid, and available moisture capacity, very low. Cation exchange capacity is low, and base saturation variable but mainly high.

These soils are not extensive in the Guns, and most of the areas are in cultivated crops, such as rye, wheat, peanuts, and other vegetables. Some areas are used as a nursery to grow seedling trees, such as poplar.

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

Most areas of this soil have a profile similar to that described for the series.

This soil is easy to work with a moderately thick root zone, but it is subject to overflow and drought. Paddy rice is not suitable but some horticultural crops are. Most areas are cultivated, with some used for a nursery to grow seedling trees, such as poplar. Main management concerns are flood control, and the leaching of plant nutrients.

Capability unit IVs.
Paddy suitability group P4bc.

5.18 HWADONG SERIES

The Hwadong series, consisting of nearly level to gently sloping, deep, moderately well drained soils developed in old alluvium, occurs in slightly dissected low terraces and is a member of the fine clayey family of Aquic Hapludalfs.

A typical profile follows:

Apl--0 to 10 cm; grayish brown (2.5Y 5/2) silt loam with few, fine prominent mottles of strong brown (7.5YR 5/6); weak, coarse subangular blocky breaking to moderate, fine to medium granular structure; friable, sticky, and plastic; clear; smooth boundary; pH 5.7.

Ap2—10 to 21 cm; grayish brown (2.5YR 5/2) silty clay loam with common, fine prominent mottles of strong brown (7.5YR 5/6); weak, coarse subangular blocky breaking to moderate, fine to medium granular structure; friable, sticky, and plastic; abrupt, smooth boundary; pH 5.9.

B21t—21 to 50 cm; mottled brown to dark brown (7.5YR 4/2) strong brown (7.5YR 5/6), brown to dark brown (10YR 4/3), and yellowish red (5YR 5/6) silty clay loam; strong, medium prismatic structure; very firm, very sticky, and very plastic; thick clay cutans; few, fine roots; common, fine soft manganese concretions; clear, smooth boundary; pH 6.6.

B22t—50 to 110 cm; reddish brown (5YR 4/4) silty clay; weak, coarse prismatic breaking to weak, very coarse prismatic structure; very firm, very sticky, and very plastic; thin gray (10YR 5/1) clay cutans; few, granite and porphyry gravel; clear, smooth boundary; pH 6.0.

B23t—110 to 160 cm; reddish brown (5YR 4/4) sandy clay loam; weak, coarse prismatic structure; with thin gray (10YR 5/1) clay cutans; very firm, very sticky, and very plastic; few granite and porphyry gravel; clear, smooth boundary; pH 6.2.

The Ap horizons range from 12 to 24 cm in thickness, and are commonly gray, grayish brown, or dark grayish brown in paddy. Texture ranges from silt loam to silty clay loam or silty clay. The B2 horizons are mottled, yellowish brown, yellowish red, brown, dark brown, heavy silty clay loam, silty clay, or sandy clay loam. The C horizon is very deep, and dominantly silty clay loam, silty clay or silt loam, with a wide range in colour and mottling.

The Hwadong soils, in the general areas of the Bancheon and Geugrag soils, are found in lower physiographic positions than the Bancheon. They are neutral to medium acid, moderate in natural fertility, and medium in organic matter content. Permeability is slow, and available moisture capacity high. Cation exchange capacity is high to medium, and base saturation high. These soils are not extensive and most are in rice paddy.

5.18.1 Hwadong Silty Clay Loam, 0 to 2 Percent Slopes (Hd)

The profile is generally similar to that described for the series, but included are small areas of Honam and Geugrag soils.

This soil has a moderately thick root zone, and generally is in good tilth. Erosion is not a management problem and the soil is best suited to cultivation. Paddy is general, being used for growing rice in summer and barley or wheat in winter.

Capability unit I.
Paddy suitability group P2c.

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

This very deep and moderately well drained soil occurs on gently sloping, moderately to slightly dissected low terraces. Most areas have a profile similar to that described for the series.

With this soil are included some areas of only slightly eroded soil that have a surface layer of yellowish brown silty clay loam or olive gray silt loam, small areas of Bancheon and Geugrag, and a few areas of severely eroded soil with a silty clay surface layer.

Tilth is generally good except in eroded areas. The erosion hazard, however, is moderate, and the soil is well suited to cultivation, being used for growing rice, with some areas cropped to barley or wheat after the harvest.

Capability unit IIe.
Paddy suitability group P2ac.

5.19 HWANGRYONG SERIES

The Hwangryong series, consisting of nearly level, deep, excessively drained soils that formed in alluvium, occupies flood plains and small valleys, and is a member of the sandy skeletal family of Typic Udipsamments.

A typical profile follows:

Apl--0 to 12 cm; light olive brown (2.5Y 5/4) sandy loam with few, fine distinct mottles of strong brown (7.5YR 5/6); single grain; friable; few, very fine yellow mica; many pores; many, fine roots; clear, smooth boundary; pH 5.2.

Cl--12 to 32 cm; mottled strong brown (7.5YR 5/8) and pale olive (5Y 6/4) coarse sandy loam; weak, medium to coarse blocky breaking to fine to medium granular structure; friable; few, fine mica; few, fine pores; few, fine roots; abrupt, smooth boundary; pH 5.9.

C2--32 to 100 cm; light olive brown (2.5Y 5/4) very gravelly sand; single grain, very friable.

The Hwangryong soils have a brown to dark gravelly to very gravelly loamy sand or a sandy loam surface layer, 12 to 20 cm thick, gray to grayish brown in paddy soils. The C horizon is yellowish brown to dark yellowish brown, very gravelly loamy coarse sand or sand.

The Hwangryong soils occur with the Hwabong and Hogye, differing from the former in having a gravelly profile, and from the latter by being coarser textured and more permeable.

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

The soils are mostly in the flood plains along the rivers in the Guns, and grow crops, such as paddy rice, wheat, rye, and potato.

5.19.1 Hwangryong Sandy Loam, 0 to 2 Percent Slopes (Hy)

Most areas have a profile similar to that described for the series, but included some areas with a loamy sand and gravelly loam textures.

The soil of this unit is suited to cultivation, and most areas are used for paddy rice as irrigation is available. Areas where water is not available are cultivated to other crops. The main management problem is the application of clayey soil to minimize leaching of fertilizers.

Capability unit IVs.
Paddy suitability group P4bc.

5.19.2 Hwangryong Gravelly Sandy Loam, 0 to 2 Percent Slopes (HL)

This soil is gravelly to very gravelly throughout the profile, otherwise it is like that described as representative for the series. Included with this soil are areas of a loamy sand and some areas of a gravelly loam.

Many areas are in paddy, where irrigation is available, but rice is poorly suited. Because of the lack of water in some areas, crops other than rice are grown, and drought resistant varieties are needed here. Main management concerns are removal of gravels from the plough layer and lessening the effect of leaching.

Capability unit IVs.
Paddy suitability group P4bc.

5.20 HYOCHEON SERIES

The Hyocheon series consisting of nearly level, deep, poorly drained soils that formed in alluvium, occupies broad alluvial plains and small valleys, and is a member of the fine loamy nonacid family of Fluventic Haplaquepts.

A typical profile follows:

Ap--0 to 9 cm; olive gray (5Y 4/2) silt loam with common, fine prominent yellowish red (5YR 4/8) mottles; weak, coarse subangular blocky structure; friable, sticky, and plastic; very few, fine pores; many, fine roots; diffuse, smooth boundary.

B1g--9 to 21 cm; dark grayish brown (2.5Y 4/2) loam with common, fine to medium prominent mottles of strong brown (7.5YR 5/8); moderate, coarse subangular blocky structure; firm, sticky, and plastic; common, fine roots; clear, smooth boundary.

B21g--21 to 32 cm; olive gray (5Y 4/2) clay loam with common, coarse distinct mottles of dark yellowish brown (10YR 4/4); moderate, coarse prismatic breaking to moderate coarse to medium subangular blocky structure; firm, sticky, and plastic; very thin clay cutans; abrupt, smooth boundary.

B22g—32 to 47 cm; olive gray (5Y 5/2) clay loam with many, coarse, prominent mottles of strong brown (7.5YR 5/6); moderate, very coarse prismatic breaking to coarse, sub-angular blocky structure; firm, sticky, and plastic; thin clay cutans; very few, fine roots; abrupt, smooth boundary.

B23g—47 to 77 cm; gray (5Y 5/1) clay loam with few, fine very dark brown (10YR 2/2) manganese mottles and many, coarse to medium mottles of strong brown (7.5YR 5/6); very weak, coarse to medium subangular blocky structure; firm, very sticky, and very plastic; very few, very fine roots; abrupt, smooth boundary.

B3g—77 to 95 cm; dark gray (5Y 4/1) clay loam with common, fine strong brown (7.5YR 5/6) mottles and pale yellow (5Y 7/3) FeCO₃ concretion; very weak, very coarse prismatic structure; firm, very sticky, and very plastic; some clay skin.

C—95 to 120 cm; dark gray (5Y 4/1) silty clay loam with few, fine to medium white FeCO₃ mottles; massive; firm, very sticky, and very plastic.

The Ap horizon ranges from 9 to 15 cm in thickness, and is gray, dark gray, olive gray silt loam, silty clay loam, silty clay with mottles of yellowish red or yellowish brown. The B2g horizons are olive gray, gray, or grayish brown clay loam or clay with strong brown or dark yellowish brown mottles. The C horizon is gray to dark gray clay loam to silty clay loam or loam with strong brown mottles and pale yellow or white ferrous carbonate concretions.

The Hyocheon soils are similar to the Honam except in having ferrous carbonate, less gray mottles, and a finer texture.

These soils are medium to strongly acid, moderately high in natural fertility, and medium in content of organic matter. Permeability is moderate, and available moisture capacity is medium. Cation exchange capacity is medium and base saturation high. The Hyocheon soils are not extensive in the Guns, and usually are in paddy. Single cropping of paddy rice is practised each year because of poor drainage.

5.20.1 Hyocheon Loam, 0 to 2 Percent Slopes (He)

This deep and imperfectly drained soil is on level to nearly level alluvial plains and narrow valleys. Most areas have a profile similar to that described for the series, but included in this unit are a few areas of a soil with a sandy loam surface layer deposited by flood along the small streams, and small areas of soils with silty clay or sandy loam.

The surface runoff is mostly slow.

The soil is not suited to a wide range of crops, and is cultivated and best suited, only to paddy rice because of poor drainage and high ground water table. But many other crops could be grown if drainage were provided.

Capability unit IIw.
Paddy suitability group Pl.

5.21 JANGSEONG SERIES

The series consists of steep, shallow, somewhat excessively drained soils developed in residuum derived chiefly from limestone. These soils, chiefly near or at Gwangsan Ri, Rimgog Myeon in the northern part of the Gwangsan Gun, are also scattered on the valleys and footslopes of Mt. Yongjin and Mt. Chilbong in the west. Bedrock ranges from 10 to 30 cm from the surface. This series is a member of the fine loamy family of Lithic Udorthents.

A typical profile follows:

A--0 to 10 cm; dark reddish brown (5YR 3/4) slightly gravelly clay loam; moderate, fine to medium granular and weak, fine subangular blocky structure; friable, slightly sticky, and slightly plastic; many, fine roots; clear, smooth boundary; pH 6.0.

B1--10 to 31 cm; dark reddish brown (2.5YR 3/4) gravelly clay loam; moderate, very fine to medium subangular blocky structure; firm, sticky, and plastic; few, medium pores; common, fine roots; limestone gravel; clear, smooth boundary; pH 5.9.

B2--31 to 48 cm; dark reddish brown (2.5YR 2/4) gravelly clay; moderate, coarse to medium subangular blocky structure; very firm, very sticky, and very plastic; few, medium pores; common, fine roots; pH 5.7.

R--62+ cm; limestone.

Where only slightly eroded, the A horizon is brown to dark brown or dark reddish brown, slightly gravelly to gravelly clay loam or gravelly silt loam. The B horizon is dark brown or dark reddish brown gravelly clay loam or gravelly loam. The R horizon is a hard limestone layer. These soils differ from the Mudeung because of their development in limestone.

They are slightly acid though the bedrocks are alkaline. Natural fertility is moderate, and organic matter content is medium. Permeability is moderate and available moisture capacity low. Cation exchange capacity is medium, and base saturation high.

Forest consisting chiefly of Korean pines mixed with some oaks is general with chestnut trees growing in some places.

5.21.1 Jangseong Rocky Silt Loam, 30 to 60 Percent Slopes (JsE)

About 30 to 40 percent of the areas are rock outcrops, and the profile is usually similar to that described for the series. Included with this unit are many small areas of soils that are deeper than the described range, and a few small areas of acid soils overlying acid rocks.

The surface runoff is very rapid, and erosion hazard is severe. Root zone is thin.

Poor pine forest mixed with some oaks, is general and woodland is best suited, but, with good grazing management, moderate yields of forage could be obtained.

Capability unit VIe.

5.21.2 Jangseong Rocky Clay Loam, 30 to 60 Percent Slopes, Eroded (JsE2)

This soil is on steep to very steep, strongly dissected hills and mountainous areas, with about 30 to 40 percent of bedrock exposed. The profile otherwise is as described for the series.

However, included with this soil are small areas of only slightly eroded soil, areas that have a clay loam or sandy loam surface layer, and a few small areas of Mudeung soils.

Surface runoff is very rapid, and erosion hazard severe.

The soil is not suited to cultivation, but well suited to woodland, and poor pine forest mixed with some oaks predominates. The main management concern is the control of accelerated erosion.

Capability unit VIe.

5.22 JANGWEON SERIES

The series, consisting of sloping to moderately steep, moderately deep, moderately well drained soils with fragipan, occupies dissected footslopes and colluvial fans, and is a member of the fine loamy family of Typic Fragiochrepts.

A typical profile follows:

Ap—0 to 15 cm; brown to dark brown (10YR 4/3) gravelly loam; very weak, medium subangular blocky breaking to moderate, fine to medium granular structure; friable, slightly sticky, and slightly plastic; common, fine roots; clear, smooth boundary.

B21—15 to 22 cm; light yellowish brown (10YR 6/4) gravelly loam; weak, fine to medium subangular blocky breaking to medium granular structure; friable, sticky, and plastic; common, fine roots; abrupt, smooth boundary.

B22—22 to 70 cm; brown (7.5YR 5/4) gravelly loam with few, fine pale brown (10YR 6/3) or dark reddish brown (5YR 3/3) mottles; moderate coarse prismatic breaking to weak medium platy; very firm, sticky, and plastic.

The surface layer is brown to dark brown or grayish brown to dark grayish brown, and ranges from gravelly silt loam to gravelly loam or gravelly silty clay loam in texture. The subsoil is yellowish brown, brown, strong brown or pale brown, gravelly silt loam to gravelly silty clay loam with mottles of pale brown, dark reddish brown or grayish brown. The C horizon is pale grayish brown, strong brown, or pale brown, variably weathered gravelly silt loam to gravelly silty clay loam.

The Jangweon soils are associated with the Seogto and Gaghwa soils, are similar in texture, but have fragipan horizons and more developed profiles than the Seogto, and a more yellow subsoil than the Gaghwa.

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

These soils occupy small tracts of the Gun, and are cultivated chiefly to soybean, buckwheat, and potato. About 10 percent of these soils is still in forest of mixed pine and oak, or in grassland.

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

This moderately deep and moderately well drained soil occurs on mountain foot-slopes. Its profile is similar to that described for the series, but includes many areas that have a surface layer of gravelly clay loam with mottles of grayish brown to dark grayish brown, some areas of a gravel free soil throughout the profile, a few small areas of sandy loam surface soil, and small areas of the Seogto and Gaghwa soils.

The surface layer has a poor tilth, and the root zone is generally thin. Runoff is medium to rapid, and erosion hazard is moderate.

The soil, generally cultivated, is not suited to a wide range of crops, but is well suited to soybean, buckwheat or potato. A few small areas are in poor pine forest and grassland. The main management problem is erosion control and gravel removal from the surface.

Capability unit IVe.
Paddy suitability group P3ac.

5.22.2 Jangweon Gravelly Loam, 15 to 30 Percent Slopes, Eroded (JwD2)

This soil, on moderately steep footslopes of the Mudeung mountains in the south-eastern part of the Gwangju city, has a profile similar to that described for the series. With this soil are included small areas of greater slopes than the described range, some areas with a gravelly clay loam surface layer, a few small areas of a gravelly sandy loam surface layer, small areas of a subsoil with grayish brown mottles, and small areas of Seogto and Gaghwa soils.

Surface runoff is rapid, and erosion hazard is moderate to severe.

The areas are small and generally cultivated to nonirrigated crops. But, because of the high gravel content and relatively shallow soil depth, fruit trees, grapes, or woodland are better suited. The main management problem is erosion control and the removal of stones from the plough layer.

Capability unit IVe.
Paddy suitability group P4ac.

5.23 JEONGJA SERIES

The Jeongja series, consisting of steep, shallow, excessively drained soils developed in residuum weathered from basic crystalline rocks, is in strongly dissected

hilly to mountainous areas chiefly in a part of Samdo Myeon, Gwangsan Gun and is a member of the fine loamy family of Lithic Entrochrepts.

A typical profile follows:

A--0 to 11 cm; dark reddish gray (5YR 4/2) stony loam moderate, medium to coarse subangular blocky breaking to fine granular structure; friable, slightly sticky, and slightly plastic; common, fine to medium pores; many roots; pH 6.0; gradual, smooth boundary.

B2--11 to 38 cm; dark reddish brown (5YR 3/2) gravelly to cobbly clay loam; weak, fine to medium subangular blocky breaking to fine granular structure; friable, slightly sticky, and slightly plastic; few, fine pores; many roots; pH 6.0; abrupt, smooth boundary.

R--38+ cm; hard bedrock.

Where only slightly eroded, the A horizon ranges from brown to dark brown or dark reddish brown in colour, but in the eroded areas it is dusky red to reddish brown. Its texture ranges from stony loam to stony clay loam or stony silt loam. The B horizon is dark reddish brown, brown, or dark brown gravelly or cobbly clay loam or gravelly loam. The R horizon begins at depth of 20 to 50 cm.

The Jeongja are slightly to medium acid, moderately low in natural fertility, and medium to low in organic matter content. Permeability is moderate and available moisture capacity is low. Cation exchange capacity is medium, and base saturation low.

Most of the areas are in forest consisting chiefly of pines, with some oaks and alders.

5.23.1 Jeongja Rocky Loam, 30 to 60 Percent Slopes (JjE)

About 7 percent of the areas of this soil is rock outcrops, but the rest has a profile much like that described for the series, except the bedrock in many areas is somewhat deeper ranging up to 70 cm or more. Included with this soil are some areas that have an unweathered tuff bedrock layer 33 cm below the surface, small areas of shallow soil over shale, and soils consisting of mainly granite saprolite.

Surface runoff is rapid, erosion hazard severe, and the root zone thin. This soil is not suited to cultivation, but well suited to woodland. Most areas are in forest.

Capability unit VIIe.

5.23.2 Jeongja Rocky Loam, 30 to 60 Percent Slopes, Eroded (JjE2)

Rock outcrops occupy about 10 percent of the area, but the profile is otherwise similar to that described for the series. Included with this soil are a few small gullied areas, small areas of shallow soils over shale, and soils consisting mainly of saprolite.

Surface runoff is rapid, and the erosion hazard severe.

Woodland is suited with most areas in poor forest.

Capability unit VIIe.

5.24 JEONNAM SERIES

The Jeonnam series, consisting of sloping and moderately steep, deep, well drained soils formed in residuum weathered chiefly from granite and granite gneiss, is in dissected old bedrock pediplains, and is a member of the fine clayey family of Typic Hapludults. Depth to bedrock ranges from 2 to 8 m.

A typical profile follows:

A1--0 to 6 cm; strong brown (7.5YR 5/6) silty clay loam; weak, medium to coarse subangular blocky structure; friable, sticky, and plastic; few, fine pores; some quartz; many, fine roots; clear, smooth boundary; pH 4.9.

A3--6 to 18 cm; strong brown (7.5YR 5/6) silty clay loam; weak, medium to coarse subangular blocky structure; firm, sticky, and plastic; many, thin clay cutans; common, medium to coarse pores; some quartz; common, fine roots; clear, smooth boundary; pH 5.7.

B1t--18 to 35 cm; yellowish red (5YR 5/8) silty clay loam; moderate, medium to coarse subangular blocky structure; firm, sticky, and plastic; thin clay cutans; common, medium to coarse pores; few quartz; few, fine roots; gradual, smooth boundary; pH 6.0.

B21t--35 to 67 cm; yellowish red (5YR 4/8) silty clay; moderate, fine to medium subangular blocky structure; firm, very sticky, and very plastic; thin, clay cutans; common, medium to coarse pores; very few, very fine roots; abrupt, smooth boundary; pH 5.3.

B22t--67 to 94 cm; strong brown (7.5YR 5/8), yellowish red (5YR 5/8) silty clay loam; moderate, fine to medium subangular blocky structure; firm, very sticky, and very plastic; thin clay cutans; common, medium to coarse pores; very few, very fine roots; abrupt, wavy boundary; pH 5.2.

B22t--94 to 140 cm; reddish brown (5YR 5/4) silty clay loam with many, coarse faint mottles of strong brown (7.5YR 5/6); moderate, fine to medium angular blocky structure; thin, clay cutans; very few roots; pH 5.1.

Where only slightly eroded, the A horizon is brown, strong brown, or yellowish brown, but where severely eroded, is reddish brown or yellowish red. The texture is silt loam, silty clay loam, or silty clay. The B horizon is yellowish red, reddish brown, strong brown or red silty clay loam or silty clay, and ranges from 80 to 200 cm in thickness. Mica flakes are common in all horizons.

The Jeonnam soils are associated with the Gwangsan, Bansan, and Jingog soils, and are less red in the subsoil and lower in clay content than the Gwangsan. The Bansan soils occupy a concave position, and have a darker surface layer.

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

The Jeonnam soils cover extensive areas mostly in the control part, but also are in smaller areas throughout the Guns. About 40 percent is cultivated, the remainder being in forest consisting of Korean pines and scattered alders.

5.24.1 Jeonnam Silty Clay Loam, 7 to 15 Percent Slopes, Eroded (JnG2)

Most areas have a profile as described for the series. Included with this soil are some areas of only slightly eroded soil, the surface layer is generally brown to dark brown or yellowish brown silt loam, loam or clay loam, some areas with light clay loam subsoils, and a few small areas of less and greater slopes than the described ranges.

Surface runoff is medium to rapid, and erosion hazard. This soil has a thick root zone. The areas of this soil are small and well suited to cultivation. The main management concern is erosion control.

Capability unit IIIe.
Paddy suitability group P3ac.

5.24.2 Jeonnam Silty Clay Loam, 15 to 30 Percent Slopes, Eroded (JnD2)

This very deep, well drained soil occurs on moderately steep, dissected hill sides and foot slopes of the old bedrock pediplains. The profile is generally similar to that described for the series. Included in this unit are some areas with a light clay loam B horizon, a few greater slopes than the described range, and some gullied areas.

The soil is not suited to cultivation except for some of lower slopes, but is well suited to pasture, hayland, or woodland. Forest is widespread with some parts in cultivated crops. Erosion is the main management problem.

Capability unit IVe.
Paddy suitability group P4ac.

5.25 JINGOG SERIES

The Jingog series consists of gently sloping to moderately steep, deep, well drained soils developed in silty material over a soil developed from granite saprolite. These soils occur in slightly dissected old bedrock pediplains in Bia Myeon of Gwangsan Gun. Bedrock ranges from 2 to 8 m below the surface. This series is a member of the fine clayey family of Typic Hapludults.

A typical profile follows:

A11--0 to 5 cm; strong brown (7.5YR 5/6) silt loam; moderate, fine granular structure; friable, sticky, and plastic; common, fine pores; many, fine roots; gradual, smooth boundary; pH 5.7.

A12--5 to 28 cm; strong brown (7.5YR 5/6) silty clay loam; massive breaking to weak, fine and medium subangular blocky structure; friable, sticky, and plastic; few, fine pores; common, fine to medium roots; abrupt, smooth boundary; pH 5.5.

IIB21--28 to 57 cm; yellowish red (5YR 4/6) silty clay; moderate, fine to medium subangular blocky structure; firm, very sticky and plastic; thin, clay cutans; common, fine to medium pores; clear, smooth boundary; pH 5.6.

IIB21--57 to 99 cm; red (2.5YR 4/6) silty clay with few, fine prominent mottles of dark reddish brown (5YR 2/2); strong, fine to medium, angular blocky structure; very firm, very sticky, and plastic; moderately thick clay cutans; common pores; few, very fine roots; clear, smooth boundary; pH 5.7.

IIB23--99 to 130 cm; dark red (2.5YR 3/6) silty clay with many, coarse prominent mottles of strong brown (7.5YR 5/6) and many, fine to medium, prominent mottles of black (10YR 2/1); moderate, fine to medium, subangular blocky structure; very fine, very sticky, and plastic; moderately thick clay cutans; pH 5.9.

The A horizon is strong brown to light yellowish brown silt loam or silty clay loam. The B2 horizon is yellowish red to red silty clay or silty clay loam, and the lower subsoil is red to dark red or yellowish red silty clay to clay. The B horizon is very thick. The C horizon, not shown in the profile is red, yellowish red, or yellowish brown silty clay or silty clay loam.

The Jingog, associated with the Gwangsan soils, are medium acid, and are low both in natural fertility and organic matter. Permeability is slow, and available moisture capacity is medium or high. Cation exchange capacity is medium to high, and base saturation low.

Most of the soils are in pine forest with an understory of shrubs. A few small areas are cultivated to nonirrigated crops.

5.26 JISAN SERIES

The series consists of gently sloping to sloping, deep, poorly drained soils developed in alluvium, occupying small valleys and alluvial fans. The depth of deposited alluvium ranges from 1 to 1.5 m. This series is a member of the fine loamy nonacid family of Fluventic Haplaquepts.

A typical profile follows:

Ap--0 to 12 cm; olive gray (5Y 5/2) loam with few, fine distinct mottles of strong brown (7.5YR 5/8); massive breaking to moderate, medium granular structure; friable, slightly sticky, and slightly plastic; common, fine roots; abrupt, smooth boundary; pH 5.5.

B1r--12 to 28 cm; light olive gray (5Y 6/2) loam with many, fine to medium distinct mottles of strong brown (7.5YR 5/8); moderate, coarse prismatic structure; friable, slightly sticky, and slightly plastic; moderately thick clay cutans; few, fine roots; clear, smooth boundary; pH 7.4.

B21r--28 to 50 cm; grayish brown (5Y 5/2) loam with many, medium mottles of yellowish brown (10YR 5/6); moderate, coarse prismatic structure; friable, slightly sticky, and slightly plastic; few, fine pores; moderate, thick clay cutans; clear, smooth boundary; pH 7.4.

B22ir--50 to 62 cm; dark gray (5Y 4/1) loam with common, fine distinct mottles of strong brown (7.5YR 5/8); coarse prismatic structure; firm, sticky, and plastic; gradual, smooth boundary; pH 7.3.

B31--62 to 82 cm; mottled, gray (5Y 5/1) and strong brown (7.5YR 5/8) loam; weak, medium prismatic structure; friable, sticky, and plastic; few, fine quartz; clear, smooth boundary; pH 7.3.

B32--82 to 112 cm; mottled dark gray (5Y 4/1) and brown to dark brown (10YR 4/3) sandy loam; friable; few quartz; gradual, smooth boundary;

C--112+ cm; mottled gray (5Y 5/1) and strong brown (7.5YR 5/6) loam; friable, sticky, and plastic; weathered fine gravels and moderately weathered coarse gravels; pH 7.0.

The Ap horizon ranges from 10 to 18 cm in thickness, and is gray to dark gray or grayish brown to dark grayish brown loam to silt loam or silty clay loam with strong brown or yellowish brown mottles. The B horizon is gray to dark gray or grayish brown loam or clay loam to silty clay with mottles of strong brown, yellowish brown, or reddish brown. The C horizon, gray, olive gray, or grayish brown loam, silty clay loam, or sandy loam, has gravels in some profiles.

The Jisan are usually in narrow valleys, whereas the Honam are in broad alluvial plains, and both differ from the Subug in being finer textured.

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

The Jisan soils cover about 6.5 percent of the surveyed area, and are scattered throughout the Guns. Rice paddy is general with some areas growing barley or wheat after its harvest.

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

Most areas have a profile similar to that described for the series. Included in the areas are some nearly level soils, and small areas of better drained soils. This soil is fair in workability, and has a thick root zone. Surface runoff is slow.

Paddy rice is best suited, and nonirrigated crops such as barley or wheat will grow better if adequately drained. Paddy predominated, and about 60 percent of the area is planted to winter barley or wheat.

Capability unit IIw.
Paddy suitability group P2a.

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

Most areas have a profile similar to that described for the series. In this unit are included some areas of silty clay loam to clay loam surface, small areas of a gently sloping, and small areas of better drained soils.

The soil is easy to work, and has a thick rooting zone. Surface runoff is slow, and erosion hazard moderate. Paddy rice is well suited, as would be other crops, if adequate drainage were provided. About 80 percent of the area is used to grow rice, and winter barley or wheat. Erosion control is the main problem.

Capability unit IIIe.
Paddy suitability group P3a.

5.26.3 Jisan-Yongji Complex, 2 to 7 Percent Slopes (JYB)

The complex consists of about 80 percent poorly drained Jisan soils and 20 percent moderately well drained Yongji soils. This unit is on gently sloping narrow valleys throughout the surveyed area.

Profiles are similar to those described for their respective series, and include some areas of level to nearly level soil, and small areas of soils with coarse loam and sandy loam texture.

Surface runoff is slow, and the root zone is thick. Only paddy rice grows, to which the land is best suited. Some of the areas, mainly Yongji soils, are cultivated to rice and barley. There is no problem in growing rice, but poor drainage limits the use.

Capability unit IIw.
Paddy suitability group P2a.

5.26.4 Jisan-Yongji Complex, 7 to 15 Percent Slopes (JYC)

These soils occur on sloping narrow valleys and fans. About 70 percent is poorly drained Jisan, and the rest, moderately well drained Yongji soils. Most areas have profiles as described for the respective series. With these soils are included some areas of a soil that contains sand and some gravel, and small areas of well drained soils with coarse loam or sandy loam subsoils.

The root zone of these soils is thick and workability is fair. Surface runoff is slow, and erosion hazard slight. They are best suited to cultivation, and about 80 percent grow rice and barley. The rest is cultivated only to paddy rice because of poor drainage. The main management problem is erosion control and drainage for other crops.

Capability unit IIIe.
Paddy suitability group P3a.

5.27 MANSEONG SERIES

The Manseong series, consisting of nearly level, moderately deep, imperfectly drained soils, formed in recent alluvium on broad, alluvial plains adjacent to river channels, is a member of the fine loamy over sandy skeletal nonacid family of Aeric Fluventic Haplaquepts.

A typical profile follows:

Ap--0 to 12 cm; dark gray (5Y 4/1) loam with few, fine to medium prominent mottles of dark yellowish brown (10YR 4/4); weak, fine to medium granular structure; friable, slightly sticky, and slightly plastic; few, fine pores; many, fine roots; clear, smooth boundary; pH 5.3.

A12--12 to 18 cm; olive gray (5Y 5/2) loam with few, fine to medium prominent mottles of yellowish brown (10YR 5/4); weak, coarse platy structure; firm, sticky, and plastic; few, fine pores; few, fine roots; abrupt, smooth boundary; pH 5.4.

Bg--18 to 52 cm; olive gray (5Y 5/2), silt loam with many, fine to medium prominent mottles of yellowish brown (10YR 5/6); weak, coarse prismatic structure; firm, sticky, and plastic; many, fine pores; few, fine roots; abrupt, smooth boundary; pH 6.3.

IIC1--52 to 70 cm; light olive gray (5Y 6/2) gravelly sand with common, coarse prominent mottles of strong brown (7.5YR 5/6); single grain; abrupt, smooth boundary; pH 6.7.

IIC2--70 to 120 cm; light olive gray (5Y 6/2) gravelly sand; ground water table occurs below 100 cm; pH 6.7.

The surface layer is olive gray, gray or grayish brown to dark grayish brown loam, silt loam or fine sandy loam with dark yellowish brown or yellowish brown mottles. The C horizon is light olive gray or dark gray gravelly sand or gravelly loamy sand with strong brown mottles. The gravel content increases with depth.

The Manseong, associated with the Honam and Hwangyong, are less drained than the Hoggye, and are deeper before the gravelly sand layer than the Subug. They are also different physiographically from those two soils.

The Manseong are strongly acid, moderately low in natural fertility and low to medium in organic matter content. Permeability is rapid, and available water capacity high. Cation exchange capacity is low, and base saturation high.

They cover about 2 percent of the surveyed areas, most of them are in rice paddy; with some barley or wheat grown in the winter.

5.27.1 Manseong Loam, 0 to 2 Percent Slopes (Ms)

This is the only Manseong soil mapped in these Guns, and is moderately deep and imperfectly drained, occurring on level to nearly level broad alluvial plains chiefly adjacent to river channels. In places the surface layer is silt loam or fine sandy loam, but the profile otherwise is similar to that described for the series.

With this soil are included small areas of sand deposited by floods, and small areas of the Honam and Hwangyong soils too small to be mapped separately.

The ground water table is high and ponded and the root zone thick.

Most areas are in rice paddy to which the soil alone is suited because of poor drainage and the high ground water table. Wetness and coarse texture in the C horizon is the chief management hazard.

Capability unit IIIw.
Paddy suitability group P2b.

5.28 MUDEUNG SERIES

The Mudeung series consists of moderately steep and very steep, shallow, somewhat excessively drained soils, formed in residuum derived from porphyry and porphyrite, and occupying strongly dissected hills or mountainous areas. From the surface to bedrock is less than 50 cm. This series is a member of the fine loamy family of Lithic Dystrochrepts.

A typical profile follows:

A1--0 to 6 cm; dark grayish brown (10YR 4/2) stony loam; moderate, very fine to fine granular structure; very friable, slightly sticky, and slightly plastic; many, fine to medium roots; clear, smooth boundary; pH 5.7.

C--6 to 30 cm; brown to dark brown (10YR 4/3) stony clay loam; moderate, fine subangular blocky structure; friable, slightly sticky, and plastic; many, fine to medium roots; few, fine pores; abrupt, smooth boundary; pH 5.6.

R--30+ cm; bedrock.

Where only slightly eroded, the A horizon is brown to very dark brown or dark grayish brown, very gravelly to stony loam, or silt loam, but it is yellowish brown to dark yellowish brown gravelly to rocky sandy loam in severely eroded areas. The C horizon is yellowish brown to strong brown or brown to dark brown gravelly clay loam or loam.

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

The Mudeung soils occur mostly on Mt. Mudeung and the related ridges of Bonryang Myeon, and some areas to the north of Ringog Myeon.

Forest of Korean pines mixed with some oaks, alders, shrubs and maples, is the usual cover.

5.28.1 Mudeung Rocky Loam, 15 to 30 Percent Slopes (MdD)

About 25 to 50 percent of the areas are rock outcrops, and in some places, the surface layer is sandy loam with many stones and gravels. The profile otherwise is similar to that described for the series. With this soil are included a few small areas of mainly granite saprolite, and small areas with greater slopes than the described range.

This soil has a thin root zone, surface runoff rapid, and erosion hazard severe. Because of the shallow soil depth and high stone content, it is well suited only to woodland, and when well managed for grassland, moderate amounts of grazing may be obtained.

Capability unit VIe.

5.28.2 Mudeung Rocky Loam, 15 to 30 Percent Slopes, Eroded (MdD2)

About 25 to 50 percent of the areas are rock outcrops. The profile is usually similar to that described for the series. Included with this soil are small areas of greater slopes than the described range and a few small areas of soils that are mainly granite saprolite. Surface runoff is rapid, erosion hazard severe to very severe, and the root zone very thin.

The soil is well suited only to woodland, and poor pine forest, with an under-story of azaleas, which now covers it. The main management problem is erosion control. Moderate yields of pasture could be obtained if the soil were well managed for grazing.

Capability unit VIe.

5.28.3 Mudeung Rocky Loam, 40 to 60 Percent Slopes (MdE)

About 25 to 50 percent of the areas are rock outcrops, but between the rocks the profile is like that described for the series. With this soil are included some areas underlain by shale rocks having a profile similar to the Mudeung except for the thin C horizon, small areas of greater slopes than the described range, and small areas of soils consisting mainly of granite saprolite.

Surface runoff is rapid, but erosion hazard is slight in the areas with grass cover. This would be severe to very severe if the soil were cultivated. The areas are large, and suited only to the present forest. Well managed pastures would produce moderate amounts of grazing.

Capability unit VIe.

5.28.4 Mudeung Rocky Loam, 30 to 60 Percent Slopes, Eroded (Mde2)

About 25 to 50 percent of the areas are rock outcrops. Most areas have a profile similar to that described for the series. With this soil are included small areas of greater slopes than the described range, and small areas consisting mainly of granite saprolite.

Surface runoff is rapid, and erosion is severe to very severe.

Poor pine forest with some alders and an understory of azalea is general and only suitable. Severe erosion is the chief management hazard. Low yields of grazing may be obtained if the soil is well managed.

Capability unit VIe.

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

This soil on steep slopes in the mountainous areas, has between 50 to 90 percent of rock outcrops, with bedrock generally less than 50 cm. In places the surface layer is brown to very dark brown or dark yellowish brown sandy loam with many stones and gravels. The nonrocky areas have a profile similar to that described for the series. With this soil are included small areas of greater slopes than the described range, and a few areas of soils consisting mainly of granite saprolite.

Surface runoff is rapid, and erosion hazard is severe to very severe.

All areas are in forest consisting chiefly of pines with an understory of azalea and shrub, to which alone it is suited.

Capability unit VIIe.

5.28.6 Mudeung Soils, 15 to 30 Percent Slopes, Gullied (MdD4)

This mapping unit consists mostly of 50 to 90 percent rock outcrops and shallow or deep gullies. In most places the soil profile has been destroyed by severe erosion, and remains only between rocks, but in those areas the profile is similar to that described for the series. Included with this soil are many areas that have a surface layer of yellowish brown to very dark yellowish brown, stony or gravelly sandy loam, and small areas of less or greater slopes than the described range.

The areas are small, and are mostly in forest with poor pines growing between rocks. This soil is suited to woodland. The main management problem is soil conservation.

Capability unit VIIe.

5.28.7 Mudeung Soils, 30 to 60 Percent Slopes, Gullied (Mde4)

The mapping unit consists chiefly of rock outcrops and shallow or deep gullies, with about 50 to 90 percent being composed of the former. The soil profile in most places has been destroyed by severe erosion, and many shallow and deep gullies have been formed.

However, the profile remaining between rocks and gullies is as described for the series. In this unit are included a few small areas of greater slopes than the described range. The soil is not suited to cultivation, but it is to woodland. Most areas are in poor pine forest with an understory of shrub.

Capability unit VIIe.

5.29 RIVERWASH, COBBLY (RC)

This unit, consisting of areas with only stones and cobbles mixed with sand, occurs mainly along the tributaries of the Hwangyong river, one of the upper streams of the Yeongsan river, and along the streams beginning in Mudeung.

Most areas are frequently flooded in the rainy season. The cobble materials are sometimes used for construction materials for building and road pavement.

Capability unit VIII.

5.29.1 Riverwash Sandy (RS)

This mapping unit consists of fine to coarse sand and gravel, and occupies areas along the main stream of the Yeongsan river. Sand in the riverbed generally is gravel free. With this unit are included small areas of waterwash sand along the small tributaries, too small to be mapped separately. In the rainy season flooding is general, and the land type is not suited to agricultural use. Sand, however, may be used for construction materials.

Capability unit VIII.

5.30 ROCK LAND (RL)

The land consists of areas with rock outcrops, talus of porphyry, and shale, on steep to very steep mountainous areas chiefly in Mudeung mountain. More than 90 percent is rock outcrop and talus, and in many places severe erosion has exposed the bedrock. In this land type are included small areas of crystalline schist, crystalline tuff and granite on hilly areas. Plants in the rock land area generally do not grow well. Some poor pine trees are growing between rocks. This land type may be a source of rock for construction purposes.

Capability unit VIII.

5.31 SAMAM SERIES

The Samam series, consisting of gently sloping, deep, moderately well drained soils, was formed in alluvium washed from the areas underlain by red shale, and occupies small valleys in Sando Myeon of the western Gwangsan Gun. The series is a member of the fine loamy family of Aquic Dystric Eutrochrepts.

A typical profile follows:

Ap--0 to 14 cm; brown (7.5YR 5/2) silt loam with common, fine to medium prominent mottles of yellowish red (5YR 5/6); massive; friable, sticky, and plastic; few, fine pores; common, fine to medium roots; clear, smooth boundary; pH 5.6.

B1--14 to 22 cm; reddish brown (5YR 5/3-4/3) silt loam with common, fine to medium prominent mottles of yellowish red (5YR 4/6); moderate, medium to coarse subangular blocky structure; friable, sticky, and plastic; common, fine pores; few, fine roots; clear, smooth boundary; pH 6.6.

B21--22 to 36 cm; reddish brown (5YR 4/3) silty clay loam with common, fine to medium distinct mottles of strong brown (7.5YR 5/6); moderate, fine to medium prismatic structure; firm, sticky, and plastic; common, fine pores; fine gravel; few, fine roots; abrupt, smooth boundary; pH 6.8.

B22--36 to 49 cm; brown (7.5YR 5/2) silty clay loam with common, fine to medium prominent mottles of strong brown (7.5YR 5/6); strong, coarse prismatic structure; firm, very sticky, and very plastic; moderately thick clay cutans; common, fine pores; few, fine roots; clear, smooth boundary; pH 7.0.

B23--49 to 67 cm; grayish brown (10YR 5/2) silt loam with common, fine prominent mottles of yellowish brown (10YR 5/6); moderate, coarse prismatic structure; firm, very sticky, and very plastic; thin clay cutans; common, fine pores; few, weathered fine gravels; few, fine roots; clear, smooth boundary; pH 7.2.

B3--67 to 83 cm; light brownish gray (10YR 6/2) loam with common, fine to medium prominent mottles of brown to dark brown (7.5YR 4/4) and strong brown (7.5YR 5/6); weak, coarse prismatic structure; firm, sticky, and plastic; thin, clay cutans; common, fine pores; few, strongly weathered fine gravels; very few, fine roots; abrupt, smooth boundary; pH 7.2.

C--83 to 100 cm; mottled brown (7.5YR 5/4), strong brown (7.5YR 5/8), and dark brown (7.5Yr 3/2) gravelly loam; very weak, coarse prismatic structure; firm, sticky, and plastic; common, fine pores; pH 7.2.

The Samam soils have a brown to reddish brown or pale red silt loam or silty clay loam A horizons 12 to 15 cm thick. The surface layer is mottled with yellowish red or gray to reddish gray. The B2 horizon is reddish brown, reddish brown, brown or grayish brown silt loam to silty clay loam or clay loam with mottles of strong brown or yellowish brown. The C horizon is gray to grayish brown gravelly loam or silty clay loam, and is mottled with brownish yellow brown to very dark brown or strong brown.

The Samam soils differ from the Baegsan chiefly in having hues of 5YR in the upper part. The Baegsan too, are better drained.

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

Most of the areas are in rice paddy, with about 40 percent planted to winter barley after rice harvest.

5.31.1 Samam Loam, 2 to 7 Percent Slopes (SaB)

Most areas have a profile as described for the series. The surface runoff is slow, and erosion is a minor problem. The root zone is thick.

The areas of this soil, small, mostly in paddy, are well suited to paddy rice cultivation. About 40 percent of that used for rice is planted to barley in the winter. The main management concern is drainage for a wider range of crops.

Capability unit IIe.
Paddy suitability group P2ac.

5.32 SAMGAG SERIES

The Samgag series consists of moderately steep to steep, deep, somewhat excessively drained soils formed in granite and granite gneiss saprolite. These soils are on strongly dissected, hilly to mountainous areas. Bedrock is from one to three metres or more, from the surface. The series is a member of the coarse loamy family of Typic Dystrochrepts.

A typical profile follows:

Ap--0 to 20 cm; yellowish brown (10YR 5/6) sandy loam; fine to medium granular structure; friable, slightly sticky, and slightly plastic; many, fine roots; abrupt, smooth boundary; pH 5.5.

B1--20 to 80 cm; mottled, white (10YR 8/1), yellowish brown (10YR 5/6), gray (2.5Y N5/), and dark reddish brown (5YR 2/2) crushed colour; light yellowish brown to yellowish brown (10YR 6/4 to 5/4) sandy loam; saprolite massive; diffuse, smooth boundary; pH 6.3.

The Samgag soils have a brown to dark brown or yellowish brown to strong brown sandy loam or gravelly to stony sandy loam surface layer 5 to 15 cm thick. The B horizon is granitic saprolite of yellowish brown to pale brown or strong brown loamy sand, sandy loam, or sand. The C horizon, not described in the profile, begins at 50 to 100 cm and is similar to the B, but has a paler colour.

The Samgag soils differ from the Mudeung in having coarser texture and a more light coloured surface layer, and from the Songjeong soils in being less developed.

The soils are strongly acid, low both in natural fertility and in organic matter. Permeability is very rapid, and available water capacity is low. Cation exchange capacity and base saturation are low.

The Samgag cover very extensive areas of the Guns, and are widely distributed throughout the surveyed area. Forest, consisting chiefly of Korean pines, mixed with some alders and an understory of azalea, is general, with some small lower slopes being cultivated to paddy rice.

5.32.1 Samgag Rocky Sandy Loam, 15 to 30 Percent Slopes, Eroded (SmD2)

Rock outcrops occupy about 25 to 50 percent of the areas of this unit, and in most places the surface layer is stony to gravelly. The profile otherwise is usually similar to that described for the series. With this soil are included some areas of only slightly eroded soil having a surface layer of brown to dark brown silt loam, a few small areas of less or greater slopes than the described range, small areas of shallow soil to hard rock, and soils with yellowish red thick clay loam B horizons.

Surface runoff is moderate to rapid, and erosion is a severe hazard.

Pine forest with some alders and an understory of azalea, is general and suited, but some lower slope areas have been cultivated to potato. Erosion is the chief hazard to management. Moderate yields of hay and pasture could be obtained if these soils were well fertilized and managed.

Capability unit VIe.

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

This deep and somewhat excessively drained soil with many outcrops that occupy about 25 to 50 percent, is in hilly to mountainous areas. The C horizon has been exposed in many places, but otherwise, the profile is as described for the series. Included with this soil are small areas of deep gullied land, a few small areas of the soils shallow to rock, and some areas of less or greater slopes.

The root zone is thick, surface runoff rapid, and erosion a very severe hazard. The areas of this unit are small, and mostly in forest, to which it is suited if well managed. The chief management hazard is erosion. Some areas are capable of producing fair yields of hay and pasture crops if heavily fertilized and well managed.

Capability unit VIe.

5.32.3 Samgag Rocky Sandy Loam, 30 to 60 Percent Slopes, Eroded (SmE2)

About 25 to 50 percent of the area of this unit is rock outcrops. In the non-rocky areas the profile is similar to that described for the series. Included with this soil are some areas of only slightly eroded soil that have a brown to dark brown sandy loam or silt loam surface layer, a few small areas of greater slopes, small scattered areas of gullied land, and severely eroded soil.

Surface runoff is rapid, and erosion hazard severe. Available moisture capacity is low. The soil is not suited to cultivation, but is to woodland if well managed. Most areas are in poor pine forest mixed with some alders and an understory of shrub and azalea. The main management concern is erosion control.

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

Rock outcrops occupy about 30 to 50 percent of the area of this unit, and the C horizon has been exposed by severe erosion. In other respects the profile resembles that described for the series. Included with this unit are small scattered areas of rock land and gullied land, a few small areas of soil shallow to hard rock, and a soil with a thick yellowish red clay loam subsoils.

The soil has a thick root zone, but available moisture capacity is low. Runoff is rapid, and erosion is a very severe hazard to management. This very large area is mostly in poor pine forest.

Capability unit VIIe.

5.32.5 Samgag Soils, 15 to 30 Percent Slopes, Gullied (SgD4)

The unit consists of Samgag rocky and stony to gravelly sandy soil with many deep or shallow gullies. This soil is in moderately steep, strongly dissected hills and mountainous areas, with many areas strongly dissected by an intricate pattern of deep and shallow gullies. Bedrocks are exposed in many places, but otherwise, the profile is as described for the series.

Only woodland is suitable, comprising now of scattered poor pine trees, growing in large areas that are otherwise left idle.

Capability unit VIIe.

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

This soil, distributed over the steep, strongly dissected slopes throughout hilly and mountainous areas of the Guns, has many deep and shallow gullies and rock outcrops. In most places the original A and B horizons have been eroded away, and the coarse sandy loam C horizon is exposed. Otherwise the profile is similar to that described for the series. Many areas are also strongly dissected by an intricate pattern of gullies.

This soil is usually bare, but where grass cover has been developed, the soil is not eroded. Only some retarded pines now grow between gullies. The soil is not suited to cultivation, but suitable for woodland and the main management problem is soil conservation.

Capability unit VIIe.

5.33 SEOGTO SERIES

The Seogto series, consisting of sloping to moderately steep, deep, well drained soils formed in colluvium washed from areas underlain by porphyry, granite and granite gneiss, are in dissected mountain footslopes and terrace edges. The bedrock ranges from 100 to 250 cm from the surface. This series is a member of the loamy skeletal family of Dystric Fluventic Eutrochrepts.

A typical profile follows:

Ap--0 to 10 cm; brown to dark brown (10YR 4/3) very gravelly silt loam; weak, fine granular structure; friable, slightly sticky, and slightly plastic; common, fine to medium pores; common, fine roots; gradual, smooth boundary; pH 5.2.

B1--10 to 19 cm; yellowish brown to brown (10YR 5/4 to 10YR 5/3) very gravelly silty clay loam; weak, fine granular structure and weak, fine to medium subangular blocky structure; friable, sticky, and plastic; common, fine to medium pores; few, fine roots; clear, smooth boundary; pH 5.0.

B21--19 to 34 cm; yellowish brown (10YR 5/4) very gravelly to cobbly silty clay loam; weak, fine to medium subangular blocky and weak, fine granular structure; friable, sticky, and plastic; few, fine to medium pores; clear, smooth boundary; pH 5.1.

B22--34 to 52 cm; yellowish brown (10YR 5/6) very gravelly to cobbly silt loam; weak, fine to medium subangular blocky structure; friable, sticky and plastic; very few, fine roots; clear, smooth boundary; pH 5.2.

B3--52 to 80 cm; mottled, brown to dark brown (7.5YR 4/2), pale brown (10YR 6/3), and very dark brown (10YR 2/2) very gravelly to cobbly silt loam; moderate, fine to medium subangular blocky structure; friable, sticky, and plastic; few, fine pores; pH 5.2.

The Ap horizon is brown, dark brown or, dark yellowish brown very gravelly silt loam, very gravelly clay loam or gravelly loam. The B horizon is yellowish brown to brown or brownish yellow, very gravelly to stony silty clay loam, silt loam or loam. The C horizon, not described in the profile, is similar to the B but lacks structure. These soils, stony sandy loam throughout the profile, in some places have developed in material of granite and crystalline schist.

The Seogto soils associated with the Jangweon, Gaghwa, and Hogye soils, differ from the Gaghwa in having higher gravel content and in lacking a B horizon rich in clay.

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

The Seogto soils occupy small tracts of the surveyed area, and generally are in cultivated crops. Some 20 percent of the area is in forest consisting chiefly of Korean pines mixed with some oaks and shrubs. Chestnut and persimmon trees grow in many places.

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

Most areas have a profile similar to that described for the series. With this soil are included small areas that have a gravelly silt loam surface layer, a few

small areas of soils with compact fragipans, more clayey soils, some dark coloured soils, and small areas of greater slopes than the described range.

The surface runoff is medium to rapid, and erosion hazard is slight to moderate. The root zone is thick, but the high stone content may be a barrier here.

A wide range of crops will grow if well managed. Most of the areas were recently cleared and are in cultivated crops. Chestnut and persimmon trees grow in many places; some 20 percent of the areas are still in pine forest. The main management problem is erosion control and the removal of cobbles and stones from the plough layer.

Capability unit IIIe.
Paddy suitability group P4abc.

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

Most areas have a profile as described for the series, but also included are many areas of eroded soil having a yellowish brown to dark yellowish brown or strong brown stony silty clay loam surface layer 10 to 20 cm thick, small areas of soil with a dense compact fragipan, some areas of more clayey soils, some dark coloured soils, and small areas of greater slopes than the described range.

The surface runoff is rapid, the erosion hazard is moderate to severe.

Many areas of this soil are suitably in forest, and some were recently cleared and are in cultivated crops. Chestnut and persimmon trees grow in places. Erosion and high stone content are the chief management hazards.

Capability unit IVe.
Paddy suitability group P4abc.

5.34 SEONGSAN SERIES

The series consists of gently sloping to sloping, deep, well drained soils developed in recent alluvium-colluvium washed from the adjacent areas of Jeonnam, Samgag, Songjeong, and similar soils. These soils occur in colluvial slopes and concave areas. Depth to bedrock is very deep, ranging from 5 to 10 m. This series is a member of the coarse loamy family of Dystric Fluventic Eutrochrepts.

A typical profile follows:

Ap--0 to 17 cm; strong brown (7.5YR 5/6) sandy loam; very weak, fine granular structure; loose; few, fine roots; abrupt, smooth boundary; pH 5.5.

B1--17 to 67 cm; strong brown (7.5YR 5/8) sandy loam; single grain; very friable, slightly sticky, and slightly plastic; few, fine pores; very few, fine roots; abrupt, smooth boundary; pH 5.5.

B2--67 to 130 cm; strong brown (7.5YR 5/8) sandy loam; single grain; very friable; pH 5.5.

The Ap horizon is somewhat variable in colour depending on the age of deposits. It is red to yellowish red in recent deposits and is strong brown, dark yellowish brown or brown to dark brown in older deposits. Its texture is sandy loam, silt loam or loam. The B horizon is strong brown, yellowish red or brownish yellow sandy loam or loam to clay loam. The C horizon, not described in the profile, is brown to pale brown sandy loam. In the depression areas the lower part of the C horizon is occasionally mottled with grayish brown or strong brown.

The Seongsan soils associated with the Songjeong soils, differ from the Bansan in having lighter coloured surface and in lacking the silty clay loam subsoil. They are coarser textured, more friable, and more permeable than the Baegsan, and are finer textured and deeper than the Togye that occupy low terraces and fans.

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

These soils cover about 2 percent of the surveyed area, and are mainly in the northern and central parts of the Guns. Most areas are in cultivated crops, such as potato, radish, water melon or upland rice. A few small areas are in pine forest or grassland.

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

This deep, well drained soil is on gently sloping concave areas chiefly in the northern and central parts of the surveyed area. The profile is as described for the series, but included are many areas that have a surface layer of brown to dark brown or red to yellowish red loam or sandy clay loam, small areas of soil with thick clay loam or silty clay loam subsoils, and small areas of eroded soils.

This soil has a thick root zone, with the surface runoff medium to slow, and erosion hazard slight.

The soil is well suited to cultivation, but not for paddy rice. In some places orchards have been established. The main management concern is erosion control.

Capability unit IIs.
Paddy suitability group P4abc.

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

This deep and well drained soil is found on sloping narrow valleys, with a profile generally similar to that described for the series. Included with this soil are many areas having a loam or sandy clay loam surface layer 30 to 50 cm thick, small areas with a thick silty clay loam to clay loam B horizon, and a few areas of greater slopes than the described range.

This soil has a thick root zone, with surface runoff medium to slow, and erosion hazard severe.

The areas of this soil are small, and are mostly cultivated to crops other than rice, to which it is well suited. Some parts are in forest. Erosion is the chief

management hazard, but well fertilized and managed pastures should produce moderate amounts of grazing.

Capability unit IIIe.
Paddy suitability unit P4abc.

5.35 SINDAB SERIES

The series, consisting of level, deep, poorly drained soils developed in alluvium on depressed areas of flood plains, is a member of the sandy family of Typic Psammaquents.

A typical profile follows:

Ap--0 to 9 cm; grayish brown (2.5Y 5/2) sandy loam with common, fine prominent mottles of brown to dark brown (7.5YR 4/2.4) massive; friable, slightly sticky, and slightly plastic; common, fine pores; many, fine roots; abrupt, smooth boundary.

Ag--9 to 17 cm; dark gray (5Y 4/1) sandy loam with many fine to medium mottles of reddish brown (5YR 4/4); massive; friable, slightly sticky, and slightly plastic; common, fine pores; common, fine roots; abrupt, smooth boundary.

Clg--17 to 31 cm; dark gray to gray (5Y 4/1 to 5/1) sandy loam with few, fine prominent mottles of strong brown (7.5YR 5/6); massive; very friable; very few, fine pores; few, fine roots; abrupt, smooth boundary.

C2g--31 to 120+ cm; dark gray (5Y 4/1) sand to loamy sand; single grain; very friable.

The A horizon is gray, dark gray, or grayish brown coarse sandy loam or loamy sand with mottles of brown to dark brown or reddish brown. The C horizon is gray, dark gray, or bluish gray sand, sandy loam or loamy sand with mottles of strong brown or yellowish red, and contains gravels in some places.

The Sindab are associated with the Gangdong and Hwangyong. These are sandy throughout the profile, while the Gangdong have loamy upper horizons.

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

The Sindab cover very small tracts of the area, and are in rice paddy.

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

This deep and poorly drained soil is the only one in this surveyed area, and occurs in level to nearly level depressions of the flood plains. Most areas have a profile similar to that described for the series, but included are small areas that have a thin surface layer of brown silt loam to clay loam.

This soil has a high ground water table and a thick root zone. The surface runoff is very slow. Because of the poor drainage and coarse texture, it is not suited to cultivation, and only will be really suited to paddy rice if clayey soil is added. Even if drained these small areas are a poor prospect for other crops because of the low available moisture capacity.

Capability unit IVw.

Paddy suitability group P3b.

5.36 SINHEUNG SERIES

The Sinheung series, consisting of nearly level, deep, imperfectly drained soils formed in recent alluvium on broad alluvial plains, is a member of the fine loamy nonacid family of Aeric Fluventic Haplaquents.

A typical profile follows:

Ap--0 to 15 cm; very dark grayish brown (2.5Y 3/2) loam; weak, fine to coarse granular structure; friable, slightly sticky, and slightly plastic; few, fine pores; many, fine roots; abrupt, smooth boundary; pH 6.0.

A1--15 to 35 cm; grayish brown (2.5Y 5/2) loam with many, fine to medium prominent mottles of dark brown (10YR 3/3); massive; slightly firm, slightly sticky, and slightly plastic; common, fine pores; common, very fine roots; abrupt, smooth boundary; pH 6.3.

A3--35 to 55 cm; grayish brown (2.5YR 5/2) loam with common, fine to medium distinct mottles of dark brown (10YR 3/3); massive; firm, slightly sticky, and slightly plastic; many, very fine to medium pores; common, very fine roots; abrupt, smooth boundary; pH 6.3.

B22--55 to 75 cm; grayish brown (10YR 5/2) loam with common, fine to coarse distinct mottles of dark brown (10YR 3/3); moderate, very coarse prismatic structure; firm, sticky, and plastic; clay cutans; many, fine to medium pores; very fine roots; abrupt, smooth boundary; pH 7.0.

B22--75 to 100 cm; yellowish brown (10YR 5/8) silt loam with many, coarse faint mottles of grayish brown (10YR 5/2); moderate, very coarse prismatic structure; sticky and very plastic; common, very fine to fine pores; few, very fine roots; gradual, smooth boundary; pH 7.0.

B3--100 to 130 cm; yellowish brown (10YR 5/8) loam with common, coarse faint mottles of pale brown (10YR 6/3); massive; friable, slightly sticky, and nonplastic; common, fine to coarse pores; abrupt, smooth boundary; pH 7.0.

C--130+ cm; dark grayish brown (2.5Y 4/2) fine sandy loam; single grain; loose; pH 6.5.

The Sinheung soils have a grayish brown to dark grayish brown or olive gray silt loam, sandy loam or loam A horizon. The B horizon is yellowish brown but has mottles of grayish brown to dark grayish brown, and its texture is loam, silt loam, or sandy loam. In rice paddy the upper B horizon is mainly gray. Fine white and yellow mica is generally present throughout the profile.

The C horizon is dark grayish brown sandy loam or silt loam to silty clay loam, which may be coarser with depth.

The Sinheung occur as small areas along the river sides of the surveyed area with the Hagsan and Yeongsan soils. These are less drained than the Hagsan, and are deeper, finer textured, and higher in clay content than the Subug.

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

Most areas are in rice paddy, which is cultivated to barley or wheat in the winter.

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

This deep and imperfectly drained soil is on level to nearly level, broad alluvial plains. The surface layer is generally grayish brown to dark grayish brown fine sandy loam or silt loam, and ranges in thickness from 15 to 25 cm. Otherwise, the profile is generally as described for the series. Included with this soil are a few small areas with coarse sand throughout the profile, small areas of three percent slopes, and small areas of better drained soils.

The soil is easy to work, has a thick root zone, and surface runoff is slow. It is in, and best suited to, paddy rice. It may also be used to grow barley or wheat in the winter. Additional drainage is needed for maximum crops of barley.

Capability unit IIw.
Paddy suitability group Pl.

5.37 SINJEONG SERIES

The Sinjeong series, consisting of sloping, deep, well drained, moderately permeable soils formed in residuum derived chiefly from tuff conglomerate, is distributed on the lower hills or mountain footslopes in the western part of Gwangsan Gun, and is a member of the fine loamy family of Typic Dystrochrepts.

A typical profile of Sinjeong series, on 10 percent slope of cultivated land in Taeya Ri, Sando Myeon follows:

A--0 to 8 cm; dark reddish gray (5YR 4/2) loam; weak, fine to medium, granular structure; friable, nonsticky and nonplastic; few, very fine pores; many, fine to medium roots; clear, smooth boundary.

B1--8 to 26 cm; dark reddish gray (5YR 4/2) loam; weak, coarse subangular and weak, fine to medium granular

structure; firm, nonsticky, and slightly plastic; few, fine pores; common, fine roots; abrupt, smooth boundary.

B2--26 to 70 cm; mottled weak red (10R 4/2), very dark gray (7.5YR N3/), white (7.5YR N8/) and pink (7.5YR 1/4) sandy loam; weak, medium subangular blocky structure; firm, gradual, smooth boundary.

C--70 to 150 cm; very firm sandy loam.

The A horizon is dark reddish gray, reddish brown to dark reddish brown or brown to dark brown loam, silt loam or fine sandy loam. The B horizon is various in colour, dark reddish gray, weak red, pale red, very dark gray, white loam, silt loam, fine sandy loam or clay loam. The C horizon is saprolite of very firm sandy loam, loamy sand, or clay loam with various colours.

In the relatively smooth simple slopes, these soils are usually associated with the Habin, and at high elevations, occur with the Jeongja.

They are strongly to medium acid, moderately low in natural fertility, and low in organic matter content. Available moisture capacity is medium or low. Cation exchange capacity is medium and base saturation low.

Cultivated crops, such as barley, wheat, potato, soybeans, and vegetables predominate with a few small areas in pine. Erosion control is the main management problem.

5.37.1 Sinjeong Silt Loam, 7 to 15 Percent Slopes, Eroded (SjC2)

The profile of the soil is as described for the series, but included are some areas of brown to dark brown, noneroded soil, and a few small areas of less or greater slopes than the described range. The rooting zone is moderately thick and surface runoff rapid.

This soil is moderately suited, and used, for crops such as soybean, potato, barley, wheat and vegetables. The two main management problems are erosion, and droughtiness due to the low available moisture capacity.

Capability unit IIIe.
Paddy suitability group P3ac.

5.38 SONGJEONG SERIES

The Songjeong series, consisting of sloping to moderately steep, deep, well drained soils formed over granite and granite-gneiss saprolite, occur in dissected old bedrock pediplane of mountainous areas, chiefly in the central part of the surveyed area. Bedrock ranges from 2 to 5 m from the surface. This series is a member of the fine loamy family of Typic Hapludults.

A typical profile follows:

Ap--0 to 16 cm; brown to dark brown (7.5YR 4/4) loam;
weak, medium to coarse subangular blocky breaking to weak,

fine to medium granular structure; friable, sticky, and plastic; few, fine to medium pores; many, fine roots; abrupt, smooth boundary; pH 5.1.

B21t--16 to 34 cm; reddish brown (5YR 4/4) clay loam; moderate, coarse prismatic breaking to moderate, medium subangular blocky structure; firm, sticky, and plastic; thin, clay cutans; common, fine to medium pores; common, fine roots; clear, smooth boundary; pH 5.8.

B22t--34 to 50 cm; yellowish red (5YR 4/6 to 4/8) clay loam; moderate, medium to coarse subangular blocky structure; friable, slightly sticky, and slightly plastic; thin clay cutans; common, fine white and yellow mica; few, fine pores; clear, smooth boundary; pH 5.9.

C3--50 to 90 cm; yellowish red (5YR 5/8) clay loam; massive; friable, slightly sticky, and slightly plastic; common, fine white and yellow mica; clear, smooth boundary; pH 5.9.

C2--90 to 150 cm; crushed colour strong brown (7.5YR 5/6) clay loam; massive; friable, slightly sticky, and slightly plastic; common, fine mica.

The Songjeong soils have a brown to dark brown or yellowish brown, friable loam or silt loam Ap horizon in the only slightly eroded areas, but the severely eroded surface layer ranges from red to yellowish red. The B2 horizon is yellowish red, reddish brown, or red clay loam, sandy clay loam or silt loam. The C horizon is yellowish brown to strong brown or yellowish red clay loam or sandy loam acidic crystalline saprolite. White and yellow mica are common throughout the profile.

The Songjeong, mainly associated with the Jeonnam soils, are somewhat coarser textured, and more permeable, having more mica than the latter.

They are strongly acid, moderate to moderately low in natural fertility, and medium in organic matter content. Permeability is moderate, and available water capacity is medium. Cation exchange capacity is medium, and base saturation low.

About 60 percent of the area is in cultivated crops, such as wheat, potato, and other vegetables, while the remainder is still in forest of pines, alders, acacia, and an understory of azalea.

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

In most places the surface layer is red to yellowish red clay loam to sandy clay loam or loam 8 to 12 cm thick. The profile otherwise is generally similar to that described for the series, but includes some areas with silty clay to clay B horizons, small areas of less or greater slopes than the described range, and some areas of slightly eroded soils.

The surface runoff is rapid, and erosion is a severe hazard. The root zone is generally thick, and the plough layer friable and easy to work.

Of these small areas about 70 percent have been cleared for cultivated crops, and the rest is in forest. This soil is suited to cultivation if severe erosion, the

main management problem is controlled. Production of pasture and hay crops can expect high yields if lime and fertilizer are used, and good management practised.

Capability unit IIIe.
Paddy suitability group P3ac.

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

In most areas this soil has a red to yellowish red or yellowish brown clay loam, loam or sandy clay loam surface layer. Otherwise, most areas have a profile similar to that described for the series.

Included in areas mapped as this soil are some areas with silty clay or clay B horizons, with the B horizon eroded from the soil exposing the underlying saprolite, small areas of greater slopes than the described range, and a few areas of gullied land.

This soil has a thick root zone. Surface runoff is rapid, and erosion is a very severe hazard. This soil is difficult to work because of steep slopes.

These small areas are mostly in pine forest with some alders and acacia, with some recently cleared parts in cultivated crops. Main problem in managing the soil is to control erosion. Moderate to high yields of forage crops may be expected when this soil is limed, fertilized, and planted to an adapted species.

Capability unit IVe.
Paddy suitability group P4abc.

5.38.3 Songjeong Soils, 15 to 30 Percent Slopes, Gullied (SoD4)

The unit consists of areas from which erosion has removed all of the original surface soil and most of the original subsoil. There are intricate patterns of shallow and deep gullies in many areas. Included in this mapping unit are some areas of the Samgag soils, and small areas of less or greater slopes than the described range.

Surface runoff is rapid, and the erosion hazard is very severe. The root zone is thin. This soil, of small extent and poorly suited to cultivation, may be suitable for pasture plants if the severe erosion is controlled. Some of the areas are protected by grasscover, but generally the land is bare and idle. Erosion control is the main management problem. Some tree growth could be obtained if planted.

Capability unit VIIe.

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

The soils, occurring as small areas in gently sloping mountainous areas throughout the Guns, have 80 percent Songjeong and 20 percent Samgag soil. They occur in such an intricate pattern that they could not be mapped separately at the scale used. Most have profiles similar to that described for their respective series, but generally the surface layer of the Songjeong soil is yellowish red to red loam or clay loam to sandy clay loam. With this complex are included small areas of less or greater slopes than the described range, some areas of only slightly eroded soils where the surface layer is brown to dark brown, or strong brown loam to silt loam or fine sandy loam.

Surface runoff is rapid, and erosion hazard severe. These soils have a thick root zone, but are poorly suited to cultivation. The areas are small and are mostly in pine forest mixed with some alders and acacia. A few small parts are cultivated to such crops as rye, potato and radish. Properly limed, fertilized and managed, forage crops would produce moderate yields. Erosion is the chief management problem.

Capability unit IIIe.

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

This complex, consisting of about 75 percent Songjeong and 25 percent Samgag soil, occurs as small areas in the mountainous areas of the Guns.

These soils have profiles like those described for the series.

With the soils of this complex are included a few small areas of gullied land, and small areas of greater slopes than the described range.

The root zone is generally thick, surface runoff rapid, and the erosion hazard severe.

Pine forest mixed with some alders and acacia predominates in these small areas, with about 10 percent in cultivated crops. These soils are poorly suited to cultivation and the main management concern is erosion control. Areas limed, fertilized, seeded to adopted forage crops, and properly managed, would produce moderate yields.

Capability unit IIIe.

5.38.6 Songjeong-Samgag Complex, 15 to 30 Percent Slopes, Eroded (SSD2)

The soils, occurring as small areas in moderately steep slopes of the mountainous areas throughout the surveyed areas, are about 60 percent Songjeong and 40 percent Samgag. Profiles are similar to those described for their respective series. Bedrock is more than 150 cm from the surface. With this complex are included small areas of greater slopes than the described range, and a few small areas of only slightly eroded soil.

Surface runoff is rapid, and the erosion hazard severe. These soils are poorly suited to cultivation, but are better suited to woodland or pasture. Forest is general with a few small areas in crops, but properly fertilized, limed, seeded and managed, pasture will produce moderate yields. The chief management hazard is erosion.

Capability unit IVe.

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

This complex, consisting of about 60 percent Songjeong and 40 percent Samgag soil, occurs as small areas in moderately steep slopes of the mountainous areas. In most places the original surface layer has been eroded, with some shallow and deep gullies being found. The present surface layer is red to yellowish red or yellowish brown loam, clay loam or sandy clay loam 5 to 8 cm thick. Bedrock is more than 150 cm from the surface. The profiles otherwise are similar to those described for their respective series.

With this complex are included small areas with silty clay or clay subsoils, small areas of greater slopes than the described range, and a few small areas of eroded soil where the surface layer is brown to dark yellowish brown. The root zone is thick, surface runoff rapid, and erosion hazard very severe.

Most areas in forest are well suited to woodland, but not for most agricultural crops. The main management problem is erosion control, but this is usually low in well managed pastures. Moderate yields of forage crops can be obtained when the soil is well managed.

Capability unit IVe.

5.39 SUBUG SERIES

The Subug series, consisting of gently sloping to sloping, deep, poorly drained soils formed in alluvium on small valley flood plains, is a member of the coarse loamy over sandy skeletal acid family of Fluventic Haplaquepts.

A typical profile follows:

Ap--0 to 16 cm; dark grayish brown (10YR 4/2) gravelly sandy loam with few, fine, distinct dark yellowish brown (10YR 4/4) mottles; massive; friable, slightly sticky, and slightly plastic; few, fine pores; common, fine roots; abrupt, smooth boundary; pH 5.1.

B21g--16 to 35 cm; very dark grayish brown (2.5Y 3/2) gravelly sandy loam with common, fine prominent mottles of dark yellowish brown (10YR 3/4); massive; friable; slightly sticky, and slightly plastic; common, fine pores; few, fine roots; abrupt, smooth boundary; pH 5.8.

B22g--39 to 56 cm; gray to olive gray (5Y 5/1-5/2) cobbly to gravelly loamy coarse sand with common, fine, prominent mottles of dark yellowish brown (10YR 3/4); abrupt, smooth boundary; pH 5.5.

B23g--56 to 100 cm; gray (5Y 5/1) very gravelly to cobbly sand with few, fine, distinct olive brown (2.5Y 4/4) mottles.

The surface layer is gray to dark gray or grayish brown to dark grayish brown loam, silt loam or sandy loam usually mottled with yellowish brown or reddish brown. It contains gravels in some places. The B horizon is gravelly sandy loam or gravelly sand, and begins at a depth of 15 to 50 cm.

The Subug, occurring as small areas with the Gangdong and Jisan soils, have gravelly textures, while the Gangdong and Jisan have only small amounts of gravel. They are also grayer and lacking in the dark surface present in the Hogye.

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

The Subug are mostly in paddy, being used only for rice because of poor drainage.

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

In many places the surface layer is free of gravel, but most areas have a profile similar to that described for the series. With this soil are included many areas that have a loam surface layer, a few small areas of river level with gravelly surface soil, and small areas of gravel free soils.

Surface runoff is medium to slow.

The areas of this soil are small, and are mostly in paddy rice, to which it is well suited, for, if drained to grow other crops it would be droughty. The main management concerns are flood control, removal of gravels from the plough layer, and drainage.

Capability unit IVw.
Paddy suitability group P3ab.

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

Most areas have a profile similar to that described for the series, but included are small areas that lack gravel in the profile.

Surface runoff is medium to slow.

The small areas of this soil are mostly in paddy, and probably unsuited to a wide range of crops, even if drainage is provided, because of the low available moisture capacity. The main management problem is soil drainage and the removal of gravels from the plough layer.

Capability unit IVw.
Paddy suitability group P3ab.

5.40 SUGYE SERIES

The Sugye series, consisting of nearly level, moderately deep, poorly drained soils developed in alluvium on alluvial plains or on small valleys, is a member of the fine silty acid family of Fluventic Haplaquepts.

A typical profile follows:

Ap--0 to 10 cm; light olive brown (2.5Y 5/4) silty clay loam with many, fine to medium prominent mottles of reddish brown (5YR 4/4) and common, medium faint mottles of dark gray (5Y 4/1); massive; friable, very sticky, and very plastic; few, fine pores; many, fine to medium roots; abrupt, smooth boundary; pH 4.9.

B2lg--10 to 29 cm; dark gray (5Y 4/1) silty clay loam with common, fine to medium, prominent mottles of yellowish brown (10YR 5/6); massive; friable, very sticky, and very plastic; common, fine pores; common, fine roots; clear, smooth boundary; pH 5.5.

B22g—29 to 51 cm; dark gray silty clay loam with common, fine, prominent mottles of reddish yellow (5YR 6/8) or brown (7.5YR 5/4); weak, very coarse prismatic structure; friable, very sticky, and very plastic; common fine pores; few, fine roots; abrupt, smooth boundary; pH 5.3.

Cg1—51 to 65 cm; dark gray (5Y 4/1) or bluish gray silty clay loam with few, fine distinct mottles of grayish brown (2.5Y 5/2); massive; friable, very sticky and very plastic; few, fine pores; few, very fine roots; abrupt, smooth boundary; pH 5.2.

Cg2—65 to 120 cm; dark gray (5Y 4/1) or bluish gray silty clay loam; massive; very sticky and very plastic; few, fine pores; few, very fine roots; pH 5.1.

The Sugye soils have an Ap horizon of gray to dark grayish brown or olive brown silty clay loam to silty clay with mottles of reddish brown. The B horizon is dark gray, or olive gray silty clay loam mottled with reddish brown or yellowish brown. The C horizon is gray, olive, or bluish gray, sometimes dark silty clay loam or clay loam, and begins at a depth of less than 50 cm. It is mottled in some places.

The Sugye soils, occurring as small areas with the Honam and Geugrag soils, have less clay and less mottles in the B horizon than the latter two.

The Sugye are medium to strongly acid, and moderately high both in natural fertility and organic matter. Permeability is moderate, and available moisture capacity is high. Cation exchange capacity is medium, and base saturation medium to high. All of the areas are in paddy, and used for rice because of the poor drainage and high ground water table.

5.40.1 Sugye Silty Clay Loam, 0 to 2 Percent Slopes (SK)

The profile generally is similar to the one described for the series, but includes small areas of gently sloping soil, and a few small areas of soils with heavy silty clay and silty clay texture.

The ground water table is on or near the surface during wet season, and is found about 50 cm below the surface in the dry season. This soil has a thin root zone.

These small areas are mostly in paddy rice, to which it is best suited as the poor drainage and high ground water table limit the alternatives. However, the installation of a well designed system of drainage would permit the growing of a wide variety of crops, and high yields could be expected.

Capability unit IIw.
Paddy suitability group P1.

5.41 TOGYE SERIES

The Togye series, consisting of gently sloping, well drained, moderately deep soils formed in alluvial-colluvial materials washed from areas underlain by granite,

is in alluvial footslopes, fans, and low terraces. This series is a member of the sandy family of Typic Udipsamments.

A typical profile follows:

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

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

The Ap horizon is brown to dark brown or dark grayish brown loamy coarse sand to loam, containing fine gravels in some places. The C horizon is strong brown, brown, or yellowish brown loamy coarse sand to sand or coarse sand with fine gravel.

The Togye are associated with Samgag and Seongsan soils in the lower position, but differ from the Bonryang and Hwabong in being on fans and terraces rather than on flood plains.

These soils are medium to strongly acid, moderately low in natural fertility, and moderately low to medium in content of organic matter. Permeability is rapid, and available moisture capacity very low. Cation exchange capacity is very low, and base saturation high.

The Togye soils, scattered as small areas over the surveyed area, are all cultivated to crops other than rice.

5.41.1 Togye Loamy Coarse Sand, 2 to 7 Percent Slopes (ToB)

The profile is as described for the series, but includes a few small areas of lesser slopes.

The ground water table occurs two metres below the surface. Surface runoff is slow. This soil has a thick root zone, and is suited for horticulture crops, mostly other than rice. The main management concern is to lessen leaching, resulting from the coarse texture.

Capability unit IVs.

5.42 YEONGSAN SERIES

The Yeongsan series, consisting of level, moderately deep, poorly drained soils developed in alluvium on the broad alluvial plains, is a member of the fine loamy over sandy family of Typic Ochraqualfs.

A typical profile follows:

Ap--0 to 12 cm; gray (5Y 5/1) loam with few, fine prominent mottles of brown to dark brown (7.5YR 4/4); massive; friable, sticky, and plastic; few, fine pores; common, fine roots; clear, smooth boundary; pH 5.1.

Ag--12 to 23 cm; gray loam with common, fine to medium prominent mottles of yellowish red (5YR 5/6) and dark reddish brown (2.5YR 3/4) weak, coarse subangular blocky structure; friable, sticky, and plastic; common, fine pores; few, fine roots; abrupt, smooth boundary; pH 6.5.

B1--23 to 36 cm; olive gray (5Y 5/2) clay loam with many, medium to coarse distinct mottles of yellowish brown (10YR 5/6) and yellowish red (5YR 4/6); moderate, coarse prismatic structure; firm, sticky, and plastic; thin clay cutans; many, fine pores; few, fine roots; clear, smooth boundary; pH 6.7.

B2--36 to 55 cm; gray (5R 5/1) clay loam with few, fine to medium prominent mottles of yellowish brown (10YR 5/6); strong, coarse, prismatic structure; moderately thick clay cutans; firm, very sticky, and very plastic; many, fine pores; very few, fine roots; abrupt, smooth boundary; pH 6.3.

B3--55 to 72 cm; olive gray (5Y 5/2) loam with many, fine to medium distinct mottles of yellowish red (10YR 5/8) moderate, coarse prismatic structure; sticky and plastic; many, fine pores; few, fine roots; abrupt, smooth boundary; pH 6.3.

C1--72 to 100 cm; grayish brown (10YR 5/2) sandy loam with few, fine prominent mottles of dark reddish brown (5YR 3/4); single grain; very friable, sticky, and non-plastic; common, fine pores; pH 5.7.

C2--120+ cm; grayish brown (10YR 5/2) sand.

The Yeongsan soils have a grayish brown to dark grayish brown or gray loam to silt loam or silty clay loam surface layer 15 to 20 cm thick. The subsoil is gray, olive gray or grayish brown clay loam to loam. The C horizon is dark gray to grayish brown sandy loam to sand, and begins at a depth of 60 to 80 cm.

The Yeongsan soils occur as small areas on the broad alluvial plains with the Honam soils, but are shallower, and coarser in texture than them. They also differ from the Jisan soils, in lacking gravel and in having a shallower, and coarser textured C horizon.

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

Most areas are cultivated only to paddy rice with a few small areas being used for barley or wheat.

5.42.1 Yeongsan Loam, 0 to 2 Percent Slopes (Ys)

This soil is the only one mapped in this surveyed area, and occurs on level to nearly level broad alluvial plains. The profile is as described for the series.

With this soil are included many areas of a grayish brown to dark grayish brown silty clay loam or silt loam surface soil, a few small areas of a brown sandy loam surface layer recently washed from adjacent uplands, some areas with a silty clay subsoil, a few small areas having a substratum beginning at depth of 40 to 50 cm, and small areas of gently sloping soil.

Surface runoff is slow, and permeability is moderate in the upper layer and rapid in the lower layer. The root zone is thick, and the ground water table high.

This extensive soil is best suited, and in, paddy rice. It is also suited, if well drained, to nonirrigated crops, such as barley and wheat. The only management problem is an adequate drainage system, required to cultivate other crops.

Capability unit IIw.
Paddy suitability group Pl.

5.43 YONGJI SERIES

The Yongji series consists of gently sloping to sloping, deep, moderately well drained soils. These soils are in narrow valleys and fan terraces, and the depth of alluvial deposits ranges from 100 to 150 cm. The series is a member of the fine loamy family of Aquic Fluventic Eutrochrept.

A typical profile follows:

Ap—0 to 10 cm; olive brown (2.5Y 4/4), silt loam with few, fine distinct iron mottles of yellowish brown; weak, fine granular structure; friable; many, fine roots; clear, smooth boundary; pH 5.5.

Air—10 to 19 cm; gray to dark gray (5Y 5/1-4/1) clay loam with common, fine distinct yellowish brown (10YR 5/6) mottles; moderate, coarse prismatic structure breaking to moderate, very coarse subangular blocky structure; firm, slightly sticky, and slightly plastic; thin clay cutans; few, fine roots; clear, smooth boundary; pH 5.8.

B21—37 to 53 cm; dark gray (5Y 4/1) clay loam with mottles of dark yellowish brown (10YR 4/4); moderate, coarse prismatic structure breaking to moderate, very coarse subangular blocky structure; very firm; continuous clay cutans; abrupt, smooth boundary; pH 7.8.

B22—53 to 85 cm; mottled, gray (5Y 5/1), strong brown (7.5YR 5/8), and very dark brown (10YR 2/2) clay loam; moderate, coarse, prismatic structure breaking to moderate, very coarse subangular blocky structure; firm; thick clay cutans; clear, smooth boundary.

C1—85 to 150 cm; light gray (5Y 7/1) sandy loam with common, medium to coarse prominent reddish brown (5YR 4/3) iron mottles; massive; friable, clear, smooth boundary; pH 6.5.

IIB—150 to 170 cm; mottled gray (5Y 5/1), brown to dark brown (7.5YR 4/4) and reddish brown (5YR 3/4) firm, silty clay.

The surface layer of these soils ranges in colour from grayish brown to dark grayish brown or olive brown to light gray, and in texture from silt loam to loam. The subsoil is gray to dark gray or variously mottled clay loam to silty clay loam or loam. The C horizon is pale gray or gray silty clay to silty clay loam with yellowish red and reddish brown mottles. Gravels occur in some places.

The Yongji occur with the Jisan soils in the lower slopes, but are better drained than them. They are medium to strongly acid, moderately high in natural fertility and medium in organic matter content. Permeability is moderate, and available moisture capacity high. Cation exchange capacity is low, and base saturation high.

Paddy predominates, with rice grown in summer and barley or wheat in winter.

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, the soils in each capability unit are given, the suitability and limitations of the soils for cultivated crops and pasture are described, and the management practices required for higher yields are shown.

Soil characteristics favourable for paddy rice differ from those for other crops. These characteristics are considered in the discussion of capability groups, but are expanded in greater detail in the following section on paddy suitability groups. The subsection on capability groups also describes the suitability of some soils for woodland.

6.2 CAPABILITY GROUPS OF SOILS

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

Capability classes

The broadest grouping, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitation and narrower choices for practical use. There are no soils placed in Class V in this surveyed area. Classes are defined 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 without special management and irrigation. These soils are too wet to produce good yields of other crops without additional drainage. The IVs soils produce good crops of melon and peanut, but they are too droughty to grow most other crops. In Class I there are no subclasses because the 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. Some management suggestions are given in the mapping unit description of this report. Detailed information on the management of paddy soils is given in the paddy suitability section.

6.2.1 Class I. Soils That Have Few Limitations

This capability unit consists of level to nearly level, deep, moderately well drained, slowly or moderately permeable soils that have high or moderate available moisture capacities. These soils are:

Hagsan loam, 0 to 2 percent slopes.

Hwadong silty clay loam, 0 to 2 percent slopes.

Natural fertility and organic matter content are moderate. They have few limitations that restrict use, and are well suited to a wide range of crops, including paddy rice. Paddy predominates, being cultivated to winter barley after paddy rice each year. In the Hwadong soils, water remains on the surface after a rainfall because of its slow permeability, and drainage ditches are required. If sand and a large amount of compost are applied, this will improve the fine soil texture. Good management practices include proper fertilization, liming as needed, and all available crop residues turned in.

6.2.2 Class II. Soils That Have Moderate Limitations

6.2.2.1 Subclass IIe

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

Bansan-Baegsan complex, 2 to 7 percent slopes.

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

Gwangju-Bancheon complex, 2 to 7 percent slopes.

Hagsan loam, 2 to 7 percent slopes.

Hwadong silty clay loam, 2 to 7 percent slopes.

Samam loam, 2 to 7 percent slopes.

The soils of this unit are suited to a wide range of crops, such as soybean, rice, corn, barley, and wheat, but are subject to moderate erosion hazard when ploughed and not protected by soil conservation practices. Strong soil acidity is common.

Erosion can be controlled by contour farming, grassed waterways, and diversion channels. Many areas have been level-terraced and diked to grow paddy rice, and in the 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, crop residues turned in, liming as needed, and proper fertilization.

6.2.2.2 Subclass IIs

In this capability unit are level to nearly level or gently sloping, deep, well drained, rapidly permeable, light and dark-coloured, coarse textured, gravelly soils that have low available moisture capacity. These soils are:

Bonryang sandy loam, 0 to 2 percent slopes.

Hogye gravelly loam, 0 to 2 percent slopes.

Hogye gravelly loam, 2 to 7 percent slopes.

Seongsan sandy loam, 2 to 7 percent slopes.

They are well suited for a wide range of crops, such as soybean, barley, potato, and vegetables, and to orchard and mulberry field.

Rapid permeability and gravel content are the chief limiting factors and therefore, they are subject to moderate droughtiness because of the high water loss. Removal of gravel will make cultivation easier, but it is a difficult process. Frequent application of fertilizer rather than a large single application will lessen effects of the leaching of plant nutrients.

6.2.2.3 Subclass IIw

This capability unit consists of level and gently sloping, poorly to imperfectly drained, moderately or moderately rapidly permeable soils that have a high water table. These soils are:

- Gangdong loam, 0 to 2 percent slopes.
- Honam-Geugrag complex, 2 to 7 percent slopes.
- Hyocheon loam, 0 to 2 percent slopes.
- Jisan loam, 2 to 7 percent slopes.
- Jisan-Yongji complex, 2 to 7 percent slopes.
- Sinheung loam, 0 to 2 percent slopes.
- Sugye silty clay loam, 0 to 2 percent slopes.
- Yeongsan loam, 0 to 2 percent slopes.

The unit generally has high available moisture capacities except for the Gangdong soils which are loamy over sand. Paddy rice is suited, but special management practices are needed to grow other crops. Installations such as drainage ditches are required to lower the water table to grow such crops as barley, soybeans, and corn. Because most of the soils have been shaped into paddy, no special measures to control erosion are necessary, and soil losses are low if the paddy dikes are properly maintained. If they are drained, winter grain crops such as barley would grow well after the rice harvest, and drainage would also permit a good growth of crops other than rice during the summer. Proper fertilization, and liming as needed, will increase crop yields. In this context, the Gangdong soils should be given a split application of fertilizer to reduce the leaching of plant nutrients.

6.2.3 Class III. Soils That Have Severe Limitations

6.2.3.1 Subclass IIIe

In this capability unit are mostly sloping, deep, well drained or poorly drained, gravelly to cobbly, eroded soils. These soils are:

- Bansan-Baegsan complex, 7 to 15 percent slopes.
- Changpyeong silty clay, 7 to 15 percent slopes, eroded.
- Gaghwa-Jangweon complex, 7 to 15 percent slopes.
- Gaghwa-Jangweon complex, 7 to 15 percent slopes, eroded.
- Gwangju-Bancheon complex, 7 to 15 percent slopes, eroded.
- Gwangsang-Jingog complex, 7 to 15 percent slopes, eroded.
- Gwangsang-Jingog complex, 7 to 15 percent slopes, severely eroded.

Hogye gravelly loam, 7 to 15 percent slopes.
Jeonnam silty clay loam, 7 to 15 percent slopes, eroded.
Jisan loam, 7 to 15 percent slopes.
Jisan-Yongji complex, 7 to 15 percent slopes.
Seogto gravelly loam, 7 to 15 percent slopes.
Seongsan sandy loam, 7 to 15 percent slopes.
Sinjeong silt loam, 7 to 15 percent slopes, eroded.
Songjeong loam, 7 to 15 percent slopes, severely eroded.
Songjeong-Samgag complex, 7 to 15 percent slopes, eroded.
Songjeong-Samgag complex, 7 to 15 percent slopes, severely eroded.

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

Erosion is the chief hazard in cultivated areas. Contour tillage, terraces, grassed waterways, and weir dams will help retard runoff and control erosion. Wetness or high water table in the Jisan soil is another severe limitation in growing crops other than rice. For these a system of ditches is needed to remove excess surface water, and to lower the water table during the wet seasons.

Yields are somewhat reduced after dry seasons, but some areas can be used for rice and other crops when water sources 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 yields.

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

For orchards and mulberry fields, the construction of bench terraces will assist in erosion control. Growing of green manure as an intercrop between orchards or mulberry trees will improve soil fertility, reduce erosion and increase yields.

6.2.3.2 Subclass IIIw

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

Honam-Geugrag complex, 0 to 2 percent slopes.
Manseong loam, 0 to 2 percent slopes.

Available moisture capacity is high, permeability in Honam-Geugrag soils slow, but moderate to moderately rapid in the Manseong soils.

Paddy rice is grown each year, with some soils planted to winter barley after its harvest.

The high water table is the chief hazard in growing crops other than rice, and a system of ditches and other installations are needed to remove excess surface water, 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 will improve drainage and permit the growing of general crops on the Honam-Geugrag soils.

Cover 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.

6.2.4 Class IV. Soils With Very Severe Limitations

6.2.4.1 Subclass IVe

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

Bancheon-Banggi complex, 15 to 30 percent slopes, eroded.

Gaghwa-Jangweon complex, 15 to 30 percent slopes.

Gaghwa-Jangweon complex, 15 to 30 percent slopes, eroded.

Gwangsang-Jingog complex, 15 to 30 percent slopes, eroded.

Gwangsang-Jingog complex, 15 to 30 percent slopes, severely eroded.

Jangweon gravelly loam, 7 to 15 percent slopes.

Jangweon gravelly loam, 15 to 30 percent slopes, eroded.

Jeonnam silty clay loam, 15 to 30 percent slopes, eroded.

Seogto gravelly loam, 15 to 30 percent slopes.

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

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

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

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

The areas are generally in poor pine forest, with some crops grown. Cultivation is not well suited, but pasture, orchards, and trees, are. Erosion is only a small problem when these soils are covered with a good grass pasture, and high yields can be expected if fertilizer and lime are used. Orchards established on bench terraces will produce well without danger of erosion. Cover crops and other erosion control measures are necessary in clean-tilled orchards, while the maintaining of grassed waterways will prevent gullying. Many areas with sparse stand of trees are eroded very rapidly mainly because of the removal of leaves and other surface litter.

For higher yields of the general agricultural crops, the soils could be treated with much lime, phosphorus, and compost. Crop residue left on the surface provides cover, promotes the infiltration of water, and reduces loss from erosion.

6.2.4.2 Subclass IVs

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

Hwabong loamy sand, 0 to 2 percent slopes.

Hwangryong sandy loam, 0 to 2 percent slopes.

Hwangryong gravelly sandy loam, 0 to 2 percent slopes.

Togye loamy coarse sand, 2 to 7 percent slopes.

They are low both in natural fertility and in organic matter, are generally poorly suited to most cultivated crops, but well suited to peanut, melon, tobacco, some vegetables, poplar, mulberry, and orchards. Some of the Hwangryong soils are in paddy rice as water is readily available from the nearby streams. Droughtiness or low available moisture capacity is the chief hazard, with damage from erosion on the more sloping soils being a limiting factor. Flooding is only for short periods of time, when most damage is done by the rapidly moving water.

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

6.2.4.3 Subclass IVw

In this capability unit are level to nearly level or gently sloping to sloping, poorly drained, deep, rapidly permeable, coarse textured soils that have high water table. These soils are:

Sindab sandy loam, 0 to 2 percent slopes.

Subug sandy loam, 2 to 7 percent slopes.

Subug sandy loam, 7 to 15 percent slopes.

The Sindab is on the depressed flood plains that have poor drainage outlets. The Subug soils are in small valleys in the general areas of the Samgag. The soils of this unit are low in available moisture capacity, natural fertility and organic matter content.

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

These soils are also subject to droughtiness when drained because of the rapid permeability. The Subug can be properly drained, and cultivated to many kinds of crops, but the Sindab are difficult because of their lower elevations than the stream bed. Proper fertilization by split application is needed because of the leaching of fertility elements through the coarse-textured soils.

6.2.5 Class VI. Soils Suitable Only for Pasture and Woodland

6.2.5.1 Subclass VIe

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

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

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

Jangseong rocky silt loam, 30 to 60 percent slopes.

Jangseong rocky clay loam, 30 to 60 percent slopes, eroded.

Mudeung rocky loam, 15 to 30 percent slopes.

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

Mudeung rocky loam, 30 to 60 percent slopes.

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

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

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

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

Because of the steep slopes, shallow soil depth, advanced erosion, rockiness or stoniness, they are unsuitable for cultivation, but are for pasture and woodland if properly managed. Poor pine forest or grassland predominates, 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.

Farmers should select areas best suited to trees or pasture, and improve the wooded parts by protecting them from grazing. Trees can be planted where necessary, or the areas can be cleared and improved for pasture. Many of these soils have a surface layer that is strongly acid in reaction. This is favourable to pine trees, but not to pasture which will require, as a result, much liming. Some of the soils can be developed into orchard or mulberry fields.

6.2.6 Class VII. Soils Limited to Woodland

6.2.6.1 Subclass VIIe

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

Jeongja rocky loam, 30 to 60 percent slopes.

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

Mudeung soils, 15 to 30 percent slopes, gullied.

Mudeung very rocky loam, 30 to 60 percent slopes.

Mudeung soils, 30 to 60 percent slopes, gullied.

Samgag soils, 15 to 30 percent slopes, gullied.

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

Samgag soils, 30 to 60 percent slopes, gullied.

Songjeong soils, 15 to 30 percent slopes, gullied.

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

6.2.7 Class VIII. Non Productive Soils

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

Riverwash, sandy.

Riverwash, cobbly.

Rock land.

6.3 PADDY LAND SUITABILITY GROUP

Rice is the most important crop in Korea, and grows well on soils that are too wet for growing most other things. These wet soils are classified as IIw or IIIw in the capability classification. About 23 470 ha or 66 percent of the total cultivated areas (35 344 ha in the survey area) are used for paddy rice. In this section, the use and management of the soils suitable for growing it 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 the surveyed areas 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 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 has severe hazards and limitations.

P4 Poorly suited:

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

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

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

6.3.1 Group P1. Very Well Suited

6.3.1.1 Paddy suitability group P1

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

Honam-Geugrag complex, 0 to 2 percent slopes.

Hyocheon loam, 0 to 2 percent slopes.

Sinheung loam, 0 to 2 percent slopes.

Sugye silty clay loam, 0 to 2 percent slopes.

Yeongsan loam, 0 to 2 percent slopes.

This group is dominantly fine textured, and generally has high available moisture capacities. Most of the soils are high in natural fertility and high or medium in organic matter content.

Few management practices other than proper fertilization and good cultural practices are required. Deep ploughing will help obtain somewhat higher yields and 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 sensible measures in order that high yields may be obtained.

6.3.2. Group P2. Well Suited

6.3.2.1 Paddy suitability group P2a

Soils in this group are gently sloping, deep, poorly drained, moderately permeable, and have high water table and moderate to high available moisture capacity. These soils are:

Honam-Geugrag complex, 2 to 7 percent slopes.

Jisan loam, 2 to 7 percent slopes.

Jisan-Yongji complex, 2 to 7 percent slopes.

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

6.3.2.2 Paddy suitability group P2ac

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

Bansan-Baegsan complex, 2 to 7 percent slopes.

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

Gwangju-Bancheon complex, 2 to 7 percent slopes.

Hwadong silty clay loam, 2 to 7 percent slopes.

Samam loam, 2 to 7 percent slopes.

The available moisture capacity in these soils is mostly high or moderately high, and natural fertility is dominantly moderate or moderately low. Hwadong and Samam soils mostly in rice paddy, are also cultivated to barley or wheat during the winter-spring. The rest are used for barley, wheat, soybeans, and other summer crops except for rice, and are well suited to paddy rice if paddy is established, water sources developed, and cobbles removed.

The slope and low water table are chief limitations, and therefore, this group is subject to some droughtiness. Because of the low water table, frequent irrigation is needed to supply rice plants with enough water. Paddy systems require well constructed weir dams to protect the dykes from damage by overflow. Deep ploughing and application of calcium silicate are good cultural practices, and the Hwadong should have sandy soils applied because of the high clay content. Winter grain crops like barley or wheat grow well during the winter and spring after paddy rice. Crops other than rice will do well during the summer.

6.3.2.3 Paddy suitability group P2b

This group consists of level to nearly level, poorly drained to moderately well drained, loamy soils over sandy soils. These soils, having high water tables, are:

Gangdong loam, 0 to 2 percent slopes.

Manseong loam, 0 to 2 percent slopes.

Available moisture capacities are low and permeability rapid, but the high water table is favourable for the growth of paddy rice. Natural fertility is moderate to low and organic matter content, low to moderately low.

Because water is available, most of the soils are used, and are well suited to paddy rice, but if drained, because of their rapid permeability and low available moisture capacity, drought will be a hazard. The addition of fine clay, compost, and the split application of nitrogen, are necessary to reduce leaching effects. Occasional green manure crops will improve soil fertility.

6.3.2.4 Paddy suitability group P2c

Soils in this group are level to nearly level, deep, moderately well drained, and have a low water table. They are:

Hagsan loam, 0 to 2 percent slopes.

Hwadong silty clay loam, 0 to 2 percent slopes.

The Hagsan soil, moderately permable in the upper, and rapidly permeable in the lower horizons, has a moderate to low available moisture capacity. The Hwadong soils are fine textured, have slow permeability and high available moisture capacities.

Paddy rice is well suited, but the low water table requires a good irrigation system to maintain the necessary water level. In the Hagsan soil, losses of water and dissolved plant nutrients are a moderate problem. The loss of nitrogen fertilizer can be reduced by making several small applications during the growing season. In the Hwadong, sand applied to surface layers will improve the texture, while a large amount of compost will improve soil tilth and fertility. Barley grows well in the winter-spring, and summer crops such as soybean may be grown well instead of paddy rice.

6.3.3 Group P3. Moderately Suited

6.3.3.1 Paddy suitability group P3a

Soils in this group are sloping, poorly drained, deep, moderately permeable, having high water tables and high available moisture capacities. They are:

Jisan loam, 7 to 15 percent slopes.

Jisan-Yongji complex, 7 to 15 percent slopes.

Paddy rice, because of the high water table, is suitable, but strong slopes limit size and shape, and leave the soils subject to dike damage and loss of irrigation water following excessive rains. Weir dams are needed to control the runoff and regulate the water level required for rice growth. Deep ploughing and proper fertilization will increase yields.

6.3.3.2 Paddy suitability group P3ab

This group consists of gently sloping to sloping, moderately well drained and poorly drained, deep, rapidly permeable, medium and coarse textured soils that have high water tables and low available moisture capacities. These soils are moderate in natural fertility and organic matter. They are:

Subug sandy loam, 2 to 7 percent slopes.

Subug sandy loam, 7 to 15 percent slopes.

Paddy rice, because of the high water table, is suitable, but the slope and low available moisture capacities 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. This will be assisted by the addition of fine clay and a large amount of compost. 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:

Bansan-Baegsan complex, 7 to 15 percent slopes.

Changpyeong silty clay, 7 to 15 percent slopes, eroded.

Gaghwa-Jangweon complex, 7 to 15 percent slopes.

Gaghwa-Jangweon complex, 7 to 15 percent slopes, eroded.

Gwangju-Bancheon complex, 7 to 15 percent slopes, eroded.

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

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

Hagsan loam, 2 to 7 percent slopes.

Jangweon gravelly loam, 7 to 15 percent slopes.

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

Sinjeong loam, 7 to 15 percent slopes, eroded.

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

General crops other than rice, and some areas in forest or orchard are usual, but paddy rice could be developed with the application of difficult special development and management practices. For the paddy land use of the soils, they should be level-terraced, diked, and have an adequate water supply. Paddies constructed on these soils will need weir dams to protect dykes from overflow damage following intense rains, as the slopes make them subject to erosion. The paddy system also permits other general crops to grow on the soils without erosion loss. Deep ploughing and application of compost will be good management practices.

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 a low available moisture capacity and a high water table. This soil is usually on lower positions than the stream bed. It is Sindab sandy loam, 0 to 2 percent slopes.

Paddy rice is general, and because of the high water table, suitable. But the land is subject to droughtiness if drained because of the rapid permeability and very low available moisture capacity. Application of clayey soil, compost, and the split application of fertilizer, will reduce the leaching of plant nutrients and increase crop yields. The occasional growing of green manure crops will improve soil fertility.

6.3.3.5 Paddy suitability group P3bc

The soil is level to nearly level, deep, well drained, moderately rapidly permeable, gravelly, and dark coloured, and has a low water table. The group consists of Hogyé gravelly loam, 0 to 2 Percent slopes.

The soil is only moderately suited to paddy rice because of the gravel content, low water table, and rapid permeability. Most areas are now used for corn, potato, soybean, barley, vegetables and some other crops, with a few small areas in rice paddy.

To grow the last, a dependable water supply is required, as losses of water and plant nutrients in paddies would be high. If not removed, the gravel content interferes with cultivation.

Fine clayey soil and a large amount of compost if applied, will lessen the effects of leaching and improve the available moisture capacity. Proper fertilization, thick planting, and dryland direct seeding are good cultural practices.

6.3.4 Group P4. Poorly Suited

6.3.4.1 Paddy suitability group P4abc

This group consists of gently sloping to sloping, well drained, deep, moderately to moderately rapid permeable, gravelly soils with moderate to low available moisture capacities. These soils, having low or no water table, 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.

Seongsan sandy loam, 2 to 7 percent slopes.

Seongsan sandy loam, 7 to 15 percent slopes.

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

Togye loamy coarse sand, 2 to 7 percent slopes.

Very few areas have been developed into paddy systems, the majority being cultivated to other crops. They are poorly suited to rice because of the slope, high water requirements, and the lack of a dependable water supply. Construction costs would be high, as would losses of water and plant nutrients. The gravel too would interfere with cultivation if not removed.

Good weir dams to control paddy wall erosion are necessary, as is the addition of fine clayey soils to reduce leaching effects of plant nutrients. Proper fertilization, thick planting, and dryland direct seeding are good rice cultural practices, while compost added to the soil will 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:

Bancheon-Banggi complex, 15 to 30 percent slopes, eroded.

Gaghwa-Jangweon complex, 15 to 30 percent slopes.

Gaghwa-Jangweon complex, 15 to 30 percent slopes, eroded.

Gwangsang-Jingog complex, 15 to 30 percent slopes, eroded.

Gwangsang-Jingog complex, 15 to 30 percent slopes, severely eroded.

Jangweon gravelly loam, 15 to 30 percent slopes, eroded.

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

At present, most of the soils are in forest of low productivity, and some areas are in cultivated crops other than rice. Paddy rice is poorly suited because of strong slopes and lack of water. These need to be level-terraced for paddy systems and require a dependable source of water. Strong slopes will also affect paddy size and shape, and those made on the moderately steep slopes will be small and irregular in shape. Dryland direct seeding may be a way of growing rice on these soils, but cobbles and gravel must be removed for easier cultivation.

Deep ploughing, application of calcium silicate and compost, are good management practices, while the occasional green manure crop will improve soil fertility. Erosion of paddy walls would be controlled by weir dams. Winter grain crops will grow well following the rice harvest.

6.3.4.3 Paddy suitability group P4bc

Soils of this group are level to nearly level, deep, well drained, rapidly permeable, sandy soils with very low available moisture capacity and low water tables. These soils are:

Bonryang sandy loam, 0 to 2 percent slopes.

Hwabong loamy sand, 0 to 2 percent slopes.

Hwangryong sandy loam, 0 to 2 percent slopes.

Hwangryong gravelly sandy loam, 0 to 2 percent slopes.

They have low clay content and low cation exchange capacity, and are subject to droughtiness. Paddy rice is grown in a few small areas where water is available, but the rest is poorly suited to cultivated crops other than peanut, melons, mulberry, and some orchard. To grow paddy rice an irrigation system should be installed.

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

Table 3
GUIDE TO MAPPING UNITS

Map Symbol	Mapping Unit	Capability Unit	Page	Paddy Suit. Group	Page
BBD2	Bancheon-Banggi complex, 15 to 30 percent slopes, eroded.	IVe		P4ac	
BEB	Bancheon-Baegsan complex, 2 to 7 percent slopes.	IIe		P2ac	
BEC	Bansan-Baegsan complex, 7 to 15 percent slopes.	IIIe		P3ac	
Bo	Bonryang sandy loam, 0 to 2 percent slopes.	IIs		P4bc	
CpB2	Changpyeong silty clay loam, 2 to 7 percent slopes, eroded.	IIe		P2ac	
CpC2	Changpyeong silty clay, 7 to 15 percent slopes, eroded.	IIIe		P3ac	
GJC	Gaghwa-Jangweon complex, 7 to 15 percent slopes.	IIIe		P3ac	
GJC2	Gaghwa-Jangweon complex, 7 to 15 percent slopes, eroded.	IIIe		P3ac	
GJD	Gaghwa-Jangweon complex, 15 to 30 percent slopes.	IVe		P4ac	
GJD2	Gaghwa-Jangweon complex, 15 to 30 percent slopes, eroded.	IVe		P4ac	
Gd	Gangdong loam, 0 to 2 percent slopes.	IIw		P2b	
GBB	Gwangju-Bancheon complex, 2 to 7 percent slopes.	IIe		P2ac	
GBC2	Gwangju-Bancheon complex, 7 to 15 percent slopes, eroded.	IIIe		P3ac	
GGC2	Gwangsan-Jingog complex, 7 to 15 percent slopes, eroded.	IIIe		P3ac	
GGC3	Gwangsan-Jingog complex, 7 to 15 percent slopes, severely eroded.	IIIe		P3ac	

Table 3 (Cont'd)

Map Symbol	Mapping Unit	Capability Unit	Page	Paddy Suit. Group	Page
GGD2	Gwangsan-Jingog complex, 15 to 30 percent slopes, eroded.	IVe		P4ac	
GGD3	Gwangsan-Jingog complex, 15 to 30 percent slopes, severely eroded.	IVe		P4ac	
HbD2	Habin rocky loam, 15 to 30 percent slopes, eroded.	VIe			
HbE2	Habin rocky loam, 30 to 60 percent slopes, eroded.	VIe			
Hs	Hagsan loam, 0 to 2 percent slopes.	I		P2c	
HsB	Hagsan loam, 2 to 7 percent slopes.	IIe		P3ac	
Hg	Hogye gravelly loam, 0 to 2 percent slopes.	IIIs		P3bc	
HgB	Hogye gravelly loam, 2 to 7 percent slopes.	IIIs		P4abc	
HgC	Hogye gravelly loam, 7 to 15 percent slopes.	IIIe		P4abc	
HG	Honam-Geugrag complex, 0 to 2 percent slopes.	IIIw		P1	
HGB	Honam-Geugrag complex, 2 to 7 percent slopes.	IIw		P2a	
Hw	Hwabong loamy sand, 0 to 2 percent slopes.	IVs		P4bc	
Hd	Hwadong silty clay loam, 0 to 2 percent slopes.	I		P2c	
HdB	Hwadong silty clay loam, 2 to 7 percent slopes.	IIe		P2ac	
Hk	Hwangryong sandy loam, 0 to 2 percent slopes.	IVs		P4bc	
HL	Hwangryong gravelly sandy loam, 0 to 2 percent slopes.	IVs		P4bc	
He	Hyocheon loam, 0 to 2 percent slopes.	IIw		P1	

Table 3 (Cont'd)

Map Symbol	Mapping Unit	Capability Unit	Page	Paddy Suit. Group	Page
JsE	Jangseong rocky silt loam, 30 to 60 percent slopes.	VIe			
JsE2	Jangseong rocky clay loam, 30 to 60 percent slopes, eroded.	VIe			
JwC	Jangweon gravelly loam, 7 to 15 percent slopes.	IVe		P3ac	
JwD2	Jangweon gravelly loam, 15 to 30 percent slopes, eroded.	IVe		P4ac	
JjE	Jeongja rocky loam, 30 to 60 percent slopes.	VIIe			
JjE2	Jeongja rocky loam, 30 to 60 percent slopes, eroded.	VIIe			
JnC2	Jeonnam silty clay loam, 7 to 15 percent slopes, eroded.	IIIe		P3ac	
JnD2	Jeonnam silty clay loam, 15 to 30 percent slopes, eroded.	IVe		P4ac	
JiB	Jisan loam, 2 to 7 percent slopes.	IIw		P2a	
JiC	Jisan loam, 7 to 15 percent slopes.	IIIe		P3a	
JYB	Jisan-Yongji complex, 2 to 7 percent slopes.	IIw		P2a	
JYC	Jisan-Yongji complex, 7 to 15 percent slopes.	IIIe		P3a	
Ms	Manseong loam, 0 to 2 percent slopes.	IIIw		P2b	
MdD	Mudeung rocky loam, 15 to 30 percent slopes.	VIe			
MdD2	Mudeung rocky loam, 15 to 30 percent slopes, eroded.	VIe			
MdD4	Mudeung soils, 15 to 30 percent slopes, gullied.	VIIe			
MdE	Mudeung rocky loam, 30 to 60 percent slopes.	VIe			

Table 3 (Cont'd)

Map Symbol	Mapping Unit	Capability Unit	Page	Paddy Suit. Group	Page
MdE2	Mudeung rocky loam, 30 to 60 percent slopes, eroded.	VIe			
MvE	Mudeung very rocky loam, 30 to 60 percent slopes.	VIIe			
MdE4	Mudeung soils, 30 to 60 percent slopes, gullied.	VIIe			
RC	Riverwash, cobbly	VIII			
RS	Riverwash, sandy	VIII			
RL	Rock land	VIII			
SaB	Samam loam, 2 to 7 percent slopes	IIe		P2ac	
SmD2	Samgag rocky sandy loam, 15 to 30 percent slopes, eroded.	VIe			
SmD3	Samgag rocky sandy loam, 15 to 30 percent slopes, severely eroded.	VIe			
SgD4	Samgag soils, 15 to 30 percent slopes, gullied.	VIIe			
SmE2	Samgag rocky sandy loam, 30 to 60 percent slopes, eroded.	VIe			
SmE3	Samgag rocky sandy loam, 30 to 60 percent slopes, severely eroded.	VIIe			
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	
SzB	Seongsan sandy loam, 2 to 7 percent slopes.	IIs		P4abc	
SzC	Seongsan sandy loam, 7 to 15 percent slopes.	IIIe		P4abc	

Table 3 (Cont'd)

Map Symbol	Mapping Unit	Capability Unit	Page	Paddy Suit. Group	Page
Sn	Sindab sandy loam, 0 to 2 percent slopes.	IVw		P3b	
Sh	Sinheung loam, 0 to 2 percent slopes.	IIw		P1	
SjC2	Sinjeong loam, 7 to 15 percent slopes, eroded.	IIIe		P3ac	
SoC3	Songjeong loam, 7 to 15 percent slopes, severely eroded.	IIIe		P3ac	
SoD3	Songjeong loam, 15 to 30 percent slopes, severely eroded.	IVe		P4abc	
SoD4	Songjeong soils, 15 to 30 percent slopes, gullied.	VIIe			
SSC2	Songjeong-Samgag complex, 7 to 15 percent slopes, eroded.	IIIe			
SSC3	Songjeong-Samgag complex, 7 to 15 percent slopes, severely eroded.	IIIe			
SSD2	Songjeong-Samgag complex, 15 to 30 percent slopes, eroded.	IVe			
SSD3	Songjeong-Samgag complex, 15 to 30 percent slopes, severely eroded.	IVe			
SpB	Subug sandy loam, 2 to 7 percent slopes.	IVw		P3ab	
SpC	Subug sandy loam, 7 to 15 percent slopes.	IVw		P3ab	
Sk	Sugye silty clay loam, 0 to 2 percent slopes.	IIw		P1	
ToB	Togye loamy coarse sand, 2 to 7 percent slopes.	IVa		P4abc	
Ys	Yeongsan loam, 0 to 2 percent slopes.	IIw		P1	

Appendix

GLOSSARY

Acidity	See reaction, soil.
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 - <u>Loose.</u> - Noncoherent; will not hold together in a mass.

	<p><u>Friable.</u> - When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.</p> <p><u>Firm.</u> - When moist, crushed under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.</p> <p><u>Plastic.</u> - When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.</p> <p><u>Sticky.</u> - When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.</p> <p><u>Hard.</u> - When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.</p> <p><u>Soft.</u> - When dry, breaks into powder or individual grains under very slight pressure.</p>
Cutan	A coating or film, on the outside of a soil aggregate or mass. It may consist of clay, silt, oxides or 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.
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: <table><thead><tr><th></th><th>pH</th></tr></thead><tbody><tr><td>Extremely acid</td><td>Below 4.5</td></tr><tr><td>Very strongly acid</td><td>4.5 to 5.0</td></tr><tr><td>Strongly acid</td><td>5.1 to 5.5</td></tr><tr><td>Medium acid</td><td>5.6 to 6.0</td></tr><tr><td>Slightly acid</td><td>6.1 to 6.5</td></tr><tr><td>Neutral</td><td>6.6 to 7.3</td></tr><tr><td>Mildly alkaline</td><td>7.4 to 7.8</td></tr><tr><td>Moderately alkaline</td><td>7.9 to 8.4</td></tr><tr><td>Strongly alkaline</td><td>8.5 to 9.0</td></tr><tr><td>Very strongly alkaline</td><td>9.1 and higher</td></tr></tbody></table>		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
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Extremely acid	Below 4.5																						
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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																						

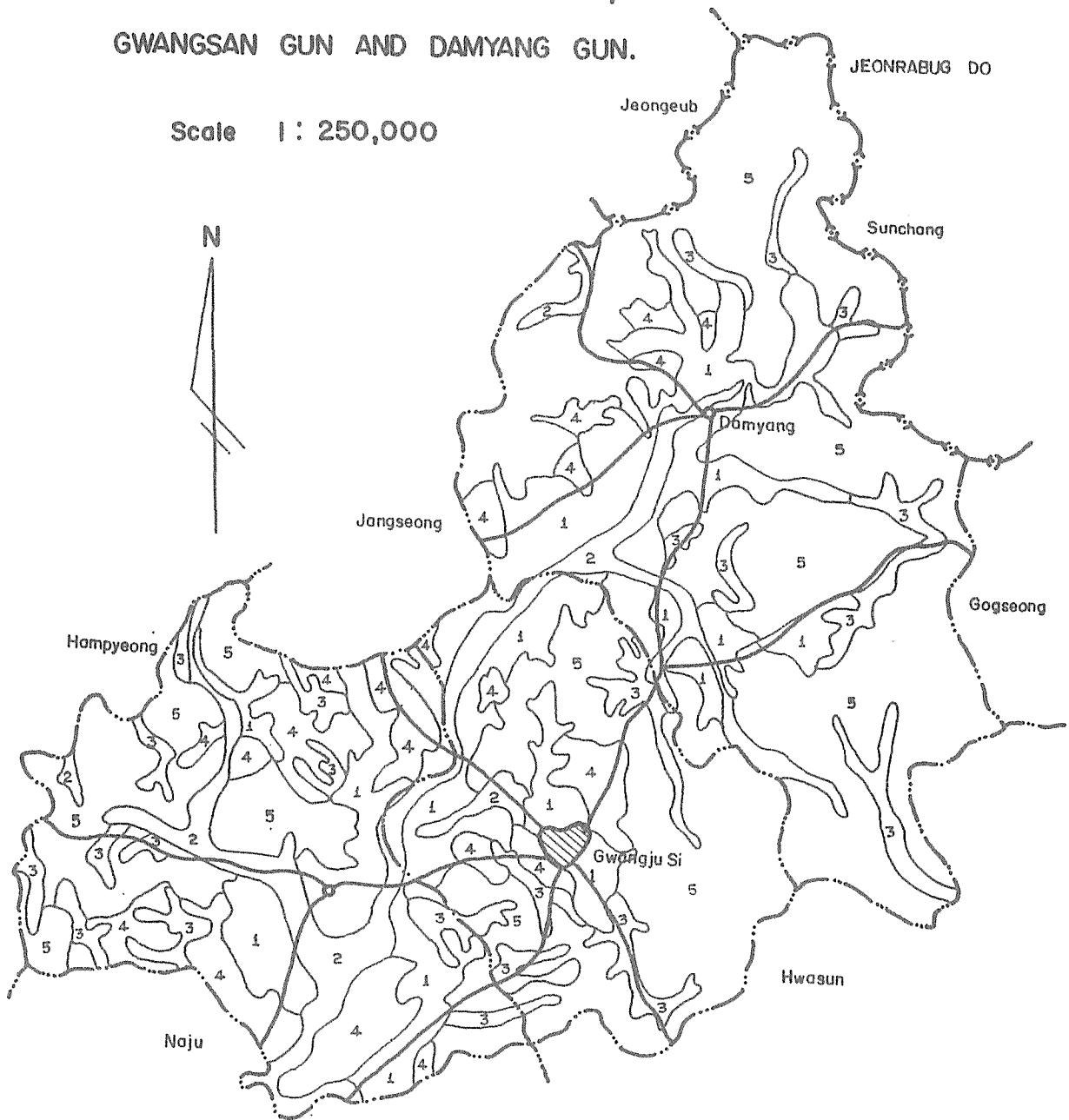
of the horizontal distance. Slope classes and terms used to describe them are as follows:

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 OF GWANGJU SI,
GWANGSAN GUN AND DAMYANG GUN.

Scale 1 : 250,000



Soil Associations

- | | |
|---|---|
| <p>1 Honam-Geugrag Association:
Level to nearly level soils
of the Yeongsan river plain.</p> | <p>4 Songjeong-Jeonnam-Gwangsan
Association:
Sloping to Mod. steep, deep,
and very deep, soils of the
hilly areas.</p> |
| <p>2 Hwangryong-Hwabong-Hogye
Association:
Level to gently sloping
soils of flood plains and
stream or river channels.</p> | <p>5 Mudeung-Sangang-rook Land Area:
Steep and very steep, shallow
and deep soils of high
mountain.</p> |
| <p>3 Jisan-Yongji Association:
Gently sloping to sloping
soils of the small valleys.</p> | |

