AGL:SF/KOR 13
Technical Report 2

SOIL SURVEY

REPUBLIC OF KOREA

SOIL RECONNAISSANCE OF KOREA

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

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

UNITED NATIONS DEVELOPMENT PROGRAMME

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Rome, 1971

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

FAO. Soil Survey, Republic of Korea. Soil Reconnaissance of Korea. Rome, 1971. 219 p. 3 maps. AGL:SF/KOR 13, Technical Report 2.

ABSTRACT

This report describes a survey conducted by the Government of the Republic of Korea, with the assistance of the United Nations Special Fund 1/ and the Food and Agriculture Organization of the United Nations, for the purpose of conducting a soil reconnaissance survey. It covered an area of 98 000 square kilometres in the southern part of the peninsula.

Air photo-interpretation with ground investigations was the method used. A total of 282 topographic based soil maps (1:25 000) were produced to develop the 1:250 000 cover delineating 22 soil associations. The mapping units employed in the 1:250 000 sheets were grouped into 20 final mapping units which form the basis of the final map, produced at a scale of 1:1 000 000. This map is reproduced in Technical Report 1.

The standard methods of soil description and analysis were employed in the survey and a total of 104 series were recognized and described. Soil classification was based on the USDA system with correlations with the USDA seventh approximation and the UNESCO/FAO World Soil Map Legend.

Land capability classification (dry land and paddy) and other interpretations of the soils lead to the following conclusions.

Areas consisting mainly of Lithosols should be used for forestry with conservation measures being taken in denuded areas. The Acid and Brown Forest Soils associated with the Lithosols are suited to intensive agricultural development where they occur on more gentle tracts. Some of the Volcanic Ash soils in the Lithosol area should be used for grazing.

Pasture development is the optimum land use for the very dark brown and very dark black soils derived from volcanic ash. Special management will be required on the latter, including heavy lime application.

Areas comprising mainly Red-Yellow Podzolic soils are recommended for a wide variety of upland crops. Clearing of the natural vegetation in many areas for further cultivation is a practical possibility.

The soil complex in narrow valleys is usually more suited to upland crops than paddy rice and double cropping is recommended where drainage is imperfect to moderate.

Low-Humic Gley soils are well suited to paddy rice. Most are currently under cultivation of this crop and can achieve high production levels under intensive and skilled management.

The areas of alkaline soils of the tidal flats are at present uncultivated and investigations should be made into the economics of dyke construction and leaching which would remove excess salts, turning such areas into very good agricultural land.

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 thanks are offered to individuals and organizations for their advice, use of facilities, and general assistance in the preparation of this report. The keen interest extended throughout the project towards the soil survey team by the Ministry of Agriculture and Forestry, the Government Cooperating Agency, and by counterpart staff is especially recorded with gratitude.

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Chapter 1

INTRODUCTION AND GENERAL DESCRIPTION

1.1 LOCATION AND GEOGRAPHIC ASPECTS

The soil reconnaissance of Korea formed part of the Korea Soil Survey which began in October 1964 and ended in June 1970. The project was conducted by the Government of the Republic of Korea with the assistance of the United Nations Special Fund 1/. The executing agency was the Food and Agriculture Organization of the United Nations.

The Korean peninsula, covering an area of approximately 220 000 km^2, projects from the mainland of Asia at 42°N and extends south to latitude 34°N. It lies between China and Japan from which it is separated by the Yellow Sea on the west and the East Sea, or Sea of Japan, on the east. The soil reconnaissance covers the southern portion, which comprises the area south of the Demilitarized Zone, and occupies an area of about 98 400 km^2 including the numerous islands lying principally off the southern and western coasts.

Jeju Do, the largest of the islands with and area of 1 792 km^2 , is of relatively recent volcanic origin. It is about 90 km south of the peninsula. Ulneung Do stands as an isolated, single island in the East Sea.

The mainland, despite being dominantly mountainous, shows extensive lowlands in the western portion, which contrast with the sharpness of the relief in the eastern regions.

The relief and geomorphology reflect the complexity of the geology. There is a wide variety of rocks with granites and gneisses being dominant.

The climate of Korea, which is in the temperate zone, is influenced by both temperate and subtropical systems of weather of the Mongolian-Manchurian region and by the marine weather of the Pacific. The climate is of the monsoon type, with very well defined, very cold dry winters, and very hot humid summers.

The remaining natural vegetation is composed mostly of mixed coniferous and broad leaf forest. With the exception of the northeastern region, the greater part of the original vegetation has practically disappeared. However, extensive projects of reforestation are being carried on.

The population of the Republic of Korea, which reached 30 million in 1967, is irregularly and densely distributed chiefly in the western, southern and central regions. It is less dense in the northeast portion, where people are settled along the narrow coastal strip and in scattered inland valleys.

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

Although Korea is essentially an agricultural country with more than 60 percent of its population spread in the numerous farm villages, the major cities like Seoul, Busan, and Daegu show a dense concentration which tends to be increasing owing to recent industrial development.

The country is subdivided administratively into nine provinces: Gyeonggi Do, Gangweon Do, Chungcheongnam Do, Chungcheongbug Do, Jeonlabug Do, Jeonlanam Do, Gyeongsangbug Do, Gyeongsangnam Do and Jeju Do. Gangweon Do is the largest and Jeju Do (island) the smallest. Seoul and Busan cities are government districts independent of the provinces.

1.2 RELIEF

Despite apparently showing a simple and somewhat uniform kind of relief with landforms which repeat frequently, the Korean peninsula presents remarkable contrasts when the west, east and southern regions are compared.

The Korea peninsula has four main mountain ranges, or systems: the Nangrim system in the central north; the Hangyeong in the extreme northeast; the Taebaeg in the middle east and the Sobaeg system in the central south. Between the Nangrim and Hamgyeong systems is the elevated Gaema plateau with altitudes above 1 500 to 2 000 m. Of these only the Taebaeg and Sobaeg systems extend into South Korea.

The Taebaeg system, along the east coast, where parts often drop abruptly into the sea, has peaks dominantly above 1 000 m. Remnants of this mountain range appear farther south, between the lower Nagdong river and the eastern coast. Finally the Sobaeg San system in the central south part appears as an extension to the southwest of the Taebaeg San mountains, forming the main water divides between the Nagdong, Han and Geum rivers.

As result of an uplift or sequence of uplifts, the eastern shore line represents an emergent coast, with sea cliffs and elevated marine terraces which contrast with the submergent landforms of the west and south coasts. The western region comprises extensive areas of coastal lowland with recent fluvio-marine deposits, broad tidal flats, and slightly elevated rolling land. The southern shore has drowned relief with numerous rocky islands.

Three major river basins occur in the southern part of Korea. These are the Han, the Nagdong and the Geum river basins. The Han river occupies the major basin with main tributaries flowing SE-NW and NE-SW. The Nagdong, with tributaries flowing in the S-N and E-W directions, forms the second most important river. The Geum, the third largest river, has initially a direction of SE-NW, then from the middle course to the mouth changes to SW.

The characteristics of these basins are quite distinct, one from the other, regarding their nature and regime. The rivers are very active as shown by the amount of coarse sediments (erosion) along their courses and siltation at the mouths.

With the exception of the lower courses, the major streams and their tributaries are entrenched. Local base levels appear in many places along the middle courses. A study of these basins would indicate a relationship between these features with tectonism (block faulting) and the regional geology.

1.3 GEOMORPHOLOGY

The geomorphology of Korea appears complex and difficult to trace owing to the numerous tectonic movements and concomitant erosion cycles which took place. Very few studies have been made and very little has been published. During the soil reconnaissance the landforms were carefully studied by aerial photo-interpretation, supported by field observations. Very close interrelationship was found between the soils and the various kinds of landforms.

The following major landforms were recognized:

1) Tidal flats, beaches and sand dunes.
2) Marine and fluvio-marine plains.
3) Continental or inland alluvial and floodplains.
4) Young valleys and drainage ways.
5) Subrecent or elevated alluvial plains and terraces.
6) Subrecent and older alluvial fans.
7) Subrecent and older pediment slopes.
8) Marine terraces and older river terraces.
9) Dissected older rolling pediplane system and lower erosion surfaces.
10) Strongly dissected hilly land and intermediate erosion surfaces.
11) Strongly dissected mountainous land and higher plateau remnants or older erosion surfaces.

Broadly the land of Korea can be divided into the following geomorphological units: the Lowlands; the Older Rolling Pediplane System; the Strongly Dissected Intermediate Hilly Lands; the Mountainous Land; and the Plateau Remnants.

1.3.1 The Lowlands

The lowlands comprise both the coastal plains with Recent fluvio-marine deposits of silty and clayey materials, and the continental alluvial plains and valley floodplains of the interior. The coastal plains, occurring most extensively along the west coast, are associated with the lower courses and estuaries of the main rivers.

The largest areas are found along the Han river below Seoul city, an area which could be named "Han plains"; along the Anseong Cheon comprising the "Pyeongtaeg plains"; south of the lower course of the Geum river forming the "Iri plains"; and southwest of Gwangju extending down to Mogpo, forming the "Southwestern plains". These plains were formed by subsidence or a general rise in sea level followed by recent deposition of a great amount of alluvial materials as a result of the strong erosion cycles, which have taken place in Korea since pre-Recent geological times.

The Nagdong river mouth forms the largest area of coastal plains in the southeast. On the east coast, a few relatively scattered discontinuous areas occur from Gangneung north as well as in the Pohang and Ulsan vicinities. Most of these are of marine-lacustrine origin, ending sharply at the sea with sand beaches of the reef type. Along the west coast, extensive tidal flats form a discontinuous and unstable shoreline.

The most extensive continental or inland alluvial plains occur in the lower Nagdong, in the vicinity of Daegu, and down river at Milyang. Near Gwangju, the Yeongsan river also forms extensive alluvial plains, which extend southwards into the fluvio-marine coastal plains of Mogpo as part of the "Southwestern plains". Other broadenings of the valley plains are seen along the middle courses of the main rivers and their tributaries, as isolated alluvial plains which are controlled by local base levels. A sequence of block faultings which took place in the peninsula is believed

to be the main cause of the formation of the numerous local base levels; however the reactivation of geological erosion associated with local geologic events is a possibility that should also be taken into consideration.

The valley floodplains for the most part are narrow and somewhat intricate. There is an excess of recent river wash along many drainage courses, a consequence of the torrential runoff and flows.

The narrow valley systems comprise a dense network spread through the mountainous regions, arranged in different patterns which reflect the regional geology. Although the dendritic pattern is dominant, other patterns such as parallel and radial also appear. Along these valleys, local irregular thin Recent alluvial deposits occur. Alluvial fans, river terraces and alluvial plains are part of the lowlands system. The first one has been formed in connection with the torrential regime, while the last two resulted from the reactivation of the erosion cycles, or perhaps, recent faults. These kinds of landforms are common throughout Korea.

1.3.2 The Older Rolling Pediplane System

A somewhat extensive, rolling land elevated from the present base level is almost continuous, not far from the west coast, and extends inland along the major river basins.

This geomorphological unit, including several kinds of landforms, results from the dissection of older pediplanes and valley floors, formed probably during the late Pliocene and Pleistocene times. It comprises the lowest erosion surfaces of Korea. They have been partially described and defined by Kim 1/ in a study of the pediment slopes and the rolling hilly lands in the lower Han River Valley, west of Seoul, as "low level erosion surfaces". He recognized three main erosion levels within the rolling land; the "Dogog" surface which corresponds to the lowest level, and the "Nang Ri" and "Neungnae" hilly land erosion surfaces which are successively higher levels.

It seems that at least two major cycles of pediplanation, alternated with periods of stabilization and erosion, took place in Korea, probably during the late Pliocene and Pleistocene periods. The present rolling land is comprised principally of relicts of erosion surfaces resulting from these two pediplanations. It includes land that has been denudated, strongly dissected and lowered, by several cycles of erosion.

Relicts of the first major pediplanation comprising the older or intermediate erosion surfaces are restricted to the interior and eastern regions. The highest levels appear intensively eroded as typical "gullied land". The lowest levels occur in continuous areas south of Seoul and Suweon, in the Seosan peninsula, in extensive areas in the lower Geum river and as discontinuous isolated areas in the southwestern corner. Scattered areas related to this same erosion cycle are common along the main valleys. They are less dissected than the highest levels and show relicts of gradational alluvial-pedimentary materials that resulted in part from the reworking of the highest surfaces.

1/ Kim San Ho: Geomorphic Studies of the Low-Level Erosion Surfaces of the Lower Part of the Han River Area. Seoul, Korea, 1966.

In the Seosan peninsula and in the lower Geum river valley facies of this level near the coast have characteristics indicating fluvio-marine deposition. This same state appears also on the elevated marine terraces on the east coast. The differences in altitude of these terraces in comparison with those of the west coast are evidence of the tilting of the peninsula, which resulted from the uplift of the east, and submergence of the west, coasts.

A remarkable sequence of dissected pediments, occurring in several places in Korea, is related to the two major pediplanation cycles.

1.3.3 The Strongly Dissected Intermediate Hilly Lands

In Korea this geomorphological unit occupies the transitional levels between the pediplanes and the mountainous lands. It includes areas of submountainous relief and the strongly dissected relicts of former intermediate erosion surfaces. Terrace remnants of these levels can be found in a few areas. The altitudes range between 160 and 300 m. It appears that deep, intensive weathering took place after the development of these surfaces. A sequence of several erosion cycles has occurred but separation of these several erosion levels is difficult to trace, as the land has been dissected by an intricate and very dense, dominantly dendritic, network of swales, gullies and drainage ways.

The most representative areas of this geomorphological unit are in the Nagdong river basin.

1.3.4 The Mountainous Land

Korea is dominantly a mountainous country, about 80 percent of the land being in regions where the altitudes of the summits range from 300 to more than 1 000 m. The highest peak in South Korea is Mt. Jiri with an altitude of 1 915 m. It is in the extreme south central part. Other peaks of somewhat lower elevation appear in the Sobaeg and Taebaeg mountain system.

This land appears as a strongly dissected and denudated relief reworked by numerous erosion cycles. It shows several aspects, which reflect the degree and stage of the erosion in relationship with the kinds of rocks. Rocky land often occurs on the highest elevations. Hogbacks are common along the main mountains ranges and monadnocks appear in certain areas. Bornhardts outliers, with "sugar-loaf" relief, occur in places, as in Jinan and in the area north of Seoul (Mt. Samgag), indicating changes in climate in the past.

Throughout this unit is an intricate network of narrow active valleys and swales.

1.3.5 Plateau Remnants

A sequence of plateau remnants, which undoubtedly represent relicts of the highest and oldest erosion surfaces of Korea appear within the mountainous land. The "Daegwan" plateau west of Gangneung in the northeastern region, with altitudes of 800 m to 1 000 m is outstanding as the largest. Several others occur at successively lower altitudes of 700, 600 and 500 m. Some of these could be interpreted as remnants of distinct, separate erosion levels, but, if block faulting were assumed, most of these levels could be correlated to the same original erosion cycle. Nevertheless, it appears that several intermediate erosion surfaces were developed between the highest and the Pleistocene pediplanes.

A hypothesis could be proposed that the "Daegwan" plateau relates to the extensive Gaema plateau, in north Korea, but this deduction is based only on studies carried out over the available topographic maps. Additional field observations would be necessary to support a definite conclusion.

1.4 GEOLOGY

1.4.1 Stratigraphy

The relief and geomorphology of Korea are strongly influenced by its geological structure and the large variety of different rocks, which range in age from pre-Cambrian to the most Recent geological times. Most of Korea is occupied by gneisses and granites of the late Archeozoic era, but significant areas of pre-Cambrian metamorphic and Mesozoic sedimentary rocks are distributed irregularly over the mainland. Several plutonic rock intrusions took place both in late and early geological times.

The stratigraphy, based on available data from geological surveys 1/ can be summarized according to the following column.

System		Age
Quaternary	-	Holocene-Pleistocene
Tertiary	-	Eocene-Pliocene
Gyeongsang	-	Upper-Middle Jurassic
Daedong	-	Lower-Middle Jurassic
Pyeongan	-	Upper-Carboniferous-Triassic
		UNCONFORMITY (Hiatus)
Joseon	-	Cambrio-Ordovician
Sangweon	-	Proterozoic
Crystalline Schist	-	Archeo-Proterozoic
Granite-Gneiss	-	Archeozoic

1.4.1.1 Granite-gneiss system

This system, named also "Goguryeo-Granite", of pre-Cambrian age covers more than one-third of the whole of South Korea. It appears mostly in the northern and south-central regions. It comprises a wide assemblage of gneisses, granites and migmatites (granite-gneiss) intensively metamorphosed and folded. The gneisses are mostly granitic containing xenoliths with gradational boundaries indicating assimilation by granitic magma. The main components of these rocks are gray feldspar, quartz

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1/ Geological Survey of Korea, Geologic Map of Korea, at 1:1 000 000 scale, and recently published sheets at 1:50 000 scale. Seoul, Korea, 1956 to 1966.

and biotite mica. The weathering is variable, but excepting those in the high mountainous areas, they are mostly deeply and strongly weathered, especially the granitic rocks.

1.4.1.2 Crystalline schist system

This system, comprising the oldest metamorphic rocks of Korea, consists mainly of mica-schists, hornfels, quartzites, phyllites, amphibolites, dolomites, limestones and slates. Some of these show less metamorphism, which indicates a younger age, possibly upper Paleozoic. The estimated total thickness of this system is between 10 000 to 27 000 m. It presents very complex structural features and is exposed in geosinclinals with the main directions SW-NE, in Gyeonggi Do and Chungju and in north Chungcheong Do. The amount of weathering varies with structural and mineralogical characteristics, but in general, the rocks appear less decomposed than those of the Granite-Gneiss system.

1.4.1.3 Sangweon system

This occurs only in North Korea. The rocks are mainly quartzites, limestones and slates, overlying the Granite-Gneiss system, and under the Joseon system.

1.4.1.4 Joseon system

This consists mainly of metamorphic limestones associated with quartzites, shales and phyllites, with a thickness of about 1 500 m. The limestone layers are often of gray colour with the lower part composed of massive dolomitic limestone. The system lies unconformably over the Granite-Gneiss, and disconformably under the Pyeongan, systems. In South Korea it occurs in the northeastern region in Gangweon Do as part of the Taebaeg San range. The weathering of these rocks varies from slight to strong. Karst relief appears in scattered areas.

1.4.1.5 Pyeongan system

This system includes the main coal beds of South Korea, interstratified with beds of sandstone, shale and conglomerate. The deposition of these sediments started in the upper Carboniferous period. They form a discontinuity with the Joseon system which was formed in the Cambro-Ordovician period. Therefore, the absence of Devonian, Silurian and early Carboniferous rocks, represents a hiatus in the stratigraphy of Korea. With the exception of the lower part of the system, these rocks are mainly of continental origin, and have a thickness of approximately 1 800 m.

The Pyeongan system occurs in Gangweon Do in the Taebaeg San range as well as in relatively small areas in the extreme southwestern region, respectively southeast and east of Mogpo. These rocks are slightly weathered. Rock outcrops are common.

1.4.1.6 Daedong system

The Daedong lies inconformably over the Pyeongan system. It includes metamorphosed hard sediments along with sandstones, shales and conglomerates mostly of continental origin.

The Daedong system is confined to the lower and middle Jurassic period. It is exposed in areas along the west coast in Chungcheong Nam Do, and Gyeonggi Do, in Mangyeong, Gyeongsang Bug Do, and in other scattered areas. The weathering of these rocks appears moderate.

1.4.1.7 Gyeongsang system

This system corresponds to the greater sedimentary basin of Korea in which sediments reach a thickness of more than 7 000 m. It comprises three distinct series: the Nagdong, the Sinla and Bulgugsa series, of intrusive igneous rocks.

The Nagdong with a thickness of 4 000 m consists mainly of shales, sandstones and conglomerates, including thin limestone beds 1/. Mostly they are pale brown to light grayish brown, but in some places are purple in colour. Mud cracks and ripple-marks are common. They are, in part, of subcontinental origin, and their dip is to the southeast and east. The Gyeongsang system is in a zone extending in a north-northeasterly direction from Gyeongsang Nam Do to Gyeongsang Bug Do.

The Sinla series lies over the Nagdong. It commonly has purple shales in the lower part which are intercalated by beds of conglomerate and sandstones. The upper part of the series is composed of mudstones, shales and sandstones alternating with intrusions of tuffs, augiteporphyrites and andesites. The sediments vary in their degree of weathering from slight to moderate, while the intrusive igneous rocks are very slightly weathered, with fresh rock outcropping frequently.

The Bulgugsa series resulted from igneous activities. It comprises granites, quartz porphyry, felsite, liparite, basic and acidic dykes. Biotite granite which occurs within the areas of the Gyeongsang sedimentary basin is supposed to belong to this series.

1.4.1.8 Tertiary system

The Tertiary covers a very limited area along the east coast in the vicinity of Pohang. It consists of soft sandstones, shales, mudstones with lignite accumulations and tuffaceous materials. It represents a sequence of alternate lacustrine and continental and marine sediments resulting from periods of submergence and emergence of the older coast. Some intrusive igneous rocks, including basalts and andesites, are included within this system. These rocks are slightly to moderately weathered.

1.4.1.9 Quaternary period

This period is divided according to the age into two parts: Pleistocene and Recent.

The Pleistocene includes unconsolidated conglomerates, gravels, sands, clays and some peat of continental alluvial and fluvio-marine origin. During the early

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1/ Geological Survey of Korea, The Review of the Mesozoic Sediments in Korea. Seoul, Korea, 1966.

part of the period volcanism occurred in Jeju Do and in other areas of Korea with the deposition of lava and ash. None of these deposits have been observed in continental South Korea. In Jeju Do, however, the volcanic activity apparently continued throughout this period.

The Recent includes accumulations of alluvial gravels, sands and clays deposited under continental and fluvio-marine conditions as well as in pediment slopes. A few eolian sand dunes are found along the coast.

1.5 CLIMATE

1.5.1 General Conditions

Korea is affected by both temperate and subtropical systems of weather, being influenced in addition by the continental climate from the adjoining interior, and by maritime conditions from the Pacific. All these influences tend to accentuate normal seasonal differences, as pressure belts move north and south across the country. During the winter Korea lies in the path of cold Siberian air moving outwards from a central asiatic high pressure area over lake Baikal. In summer, when the reverse is true and the asiatic low pressure system is dominant, warm, moist air moves inland from the Pacific ocean.

There are also periodic variations from high to low pressure throughout the year. As is true in Eastern Asia generally, winter winds are stronger and more regular than summer winds.

Korea is also mildly affected by typhoons, which usually occur off the southern coasts. There is generally at least one a year though rarely more than three. They happen principally in the late summer, being most common in August.

In terms of the temperate regime, South Korea (area below the present Demilitarized Zone near 38° latitude) has a warm summer (from June to August) and a cool winter (from December to February). All weather stations report summer temperatures over 20° with maximum readings in August, and winter temperatures with below 6°C the minimum in January. As a whole, the interior stations have a greater mean range of temperature than the coastal stations.

Table 1 shows the mean monthly temperatures at 14 meteorological stations.

Mean annual precipitation exceeds 1 000 mm throughout the country except for a small area around Daegu. Most of the precipitation is in June, July and August; as a result of the influx of warm moist air from the Pacific ocean where pressure conditions create the summer monsoon. Relatively little precipitation occurs during the remaining nine months. Cold dry continental air, due to high pressure in north China and Mongolia, flows south over Korea during the months of December, January and February.

Table 2 shows the mean amount of precipitation at 14 stations in Korea and Table 3, the main climatic elements.

Table 1

MEAN MONTHLY AIR TEMPERATURES (°C) AND MEAN MONTHLY SOIL TEMPERATURES AT 50 CM. DEPTH (°C) AT 14 STATIONS IN KOREA 1/

Station		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Gangneung	(M)	-1.0	0.3	4.7	11.5	16.7	19.7	23.5	24.3	19.7	14.4	8.8	2.4	12.1
	(S)	2.6	2.2	5.1	10.4	15.7	19.2	22.5	24.5	21.7	17.0	11.8	5.8	13.2
Seoul	(M)	-4.9	-1.9	3.6	10.5	16.3	20.8	24.5	25.4	20.3	13.4	6.3	-1.2	11.1
	(S)	0.5	0.1	3.1	9.5	15.3	20.6	24.4	26.1	22.8	16.9	10.2	3.9	12.8
Incheon	(M)	-4.0	-1.6	3.4	9.7	15.3	19.6	23.9	25.1	20.6	14.2	7.2	-0.4	11.1
	(S)	2.1	1.7	5.1	10.6	16.1	20.5	24.0	25.8	23.0	17.9	11.9	5.5	14.7
Ulneung Do	(M)	0.6	1.1	4.5	10.2	15.0	18.4	22.1	23.9	19.9	15.0	9.7	3.9	12.0
	(S)	3.8	3.2	5.2	9.5	14.1	18.2	21.4	23.8	21.3	17.0	12.1	6.9	13.1
Chupung-lyeong	(M)	-3.1	-0.7	4.5	11.0	16.7	20.6	24.5	24.7	19.4	13.0	6.7	0.2	11.5
	(S)	2.7	2.0	5.4	10.3	15.8	20.3	23.8	25.5	22.2	17.4	11.4	5.8	13.6
Pohang	(M)	0.6	2.2	6.1	12.1	16.8	20.1	23.6	25.0	20.6	15.2	9.9	3.4	13.0
	(S)	2.6	2.6	5.7	10.1	15.4	19.7	23.1	24.9	21.4	16.4	11.1	5.3	13.6
Taegu	(M)	-1.6	0.6	5.7	12.1	17.6	21.6	25.3	25.9	20.5	14.2	7.8	1.4	12.6
	(S)	3.0	3.1	7.4	12.7	18.3	22.5	25.6	27.5	23.7	18.3	12.2	6.2	15.1
Jeonju	(M)	-1.7	0.2	5.0	11.3	16.9	21.4	25.7	25.9	20.6	13.9	7.8	1.7	12.4
	(S)	3.6	3.3	0.4	11.2	16.5	20.9	24.6	26.4	23.3	18.0	12.2	6.8	14.4
Ulsan	(M)	0.4	2.1	6.0	11.5	16.3	20.6	24.3	25.1	20.5	14.8	9.0	3.2	12.8
	(S)	5.0	5.0	7.9	12.0	16.4	19.7	23.1	25.4	22.7	18.2	13.2	8.0	14.7
Gwangju	(M)	-0.6	1.1	5.7	11.4	16.8	21.4	25.6	26.1	20.9	14.0	8.2	2.4	12.8
	(S)	4.2	4.5	7.8	12.4	17.5	21.7	25.0	27.1	24.0	18.6	12.5	7.2	15.3
Busan	(M)	1.8	3.5	7.3	12.5	16.7	19.8	23.7	25.4	21.6	16.6	11.1	5.0	13.8
	(S)	5.0	4.3	8.4	12.8	17.5	21.0	24.2	26.7	23.8	19.3	14.2	8.4	15.6
Mogpo	(M)	1.0	2.1	5.9	11.5	16.5	20.6	24.8	26.1	21.7	16.1	10.3	4.3	13.4
	(S)	6.0	5.7	8.3	12.6	17.5	21.5	24.8	27.0	24.6	20.0	14.7	9.4	16.0
Yeosu	(M)	1.5	3.0	6.8	12.3	16.8	20.2	23.9	25.8	21.9	16.6	10.9	4.5	13.7
	(S)	5.0	4.7	7.4	11.4	15.6	19.3	22.7	25.5	23.5	19.1	14.0	8.9	14.7
Jeju	(M)	4.8	5.2	8.0	12.3	16.2	20.4	25.1	25.8	21.7	16.8	12.1	7.6	14.7
	(S)	5.4	5.1	7.8	12.1	16.7	20.5	24.9	26.8	23.5	18.3	13.4	8.5	15.2

Note: (M) Mean Air Temperature
(S) Mean Soil Temperature

1/ Central Meteorological Office: Climatic Atlas of Korea (1931-1960), 1962, pp. 61 and 148.

Table 2

MEAN AMOUNT OF PRECIPITATION (MM) AT 14 STATIONS IN KOREA 1/

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Gangneung	36.9	73.4	73.1	70.4	64.1	134.9	212.1	190.7	197.5	87.8	88.0	53.2	1 282.1
Seoul	17.1	21.0	55.6	68.1	86.3	169.3	358.0	224.2	142.3	49.2	36.0	32.0	1 259.2
Incheon	15.8	17.9	49.9	66.3	72.5	139.4	303.8	180.4	136.7	45.0	35.1	30.0	1 092.8
Ulneung Do	177.4	107.0	89.4	80.1	69.9	128.8	146.0	98.2	189.7	112.2	120.5	166.1	1 485.3
Chupung-lyeong	25.4	30.1	56.5	71.9	75.4	167.4	267.6	190.8	154.9	40.4	36.5	29.9	1 146.7
Pohang	29.5	40.5	57.4	67.3	74.5	139.3	157.7	134.1	173.0	59.2	59.7	35.6	1 027.8
Daegu	15.8	27.1	45.5	64.4	67.4	132.7	200.2	165.5	161.8	44.0	30.1	24.8	979.3
Jeonju	26.6	32.8	61.0	76.4	84.7	154.6	279.7	239.6	156.4	51.5	41.7	35.5	1 240.5
Ulsan	24.2	46.3	68.0	88.4	106.3	154.1	203.7	166.9	208.7	65.0	46.3	39.8	1 217.7
Gwangju	31.5	34.5	69.1	82.2	92.0	168.8	222.6	201.2	189.5	51.9	42.9	36.8	122.9
Busan	25.3	44.1	88.5	113.5	139.3	197.5	247.6	165.0	205.1	73.1	43.9	38.5	1 381.4
Mogpo	37.4	40.2	58.4	82.9	101.6	136.0	182.8	187.8	156.0	55.4	44.2	43.3	1 126.0
Yeosu	17.1	40.2	80.2	124.2	149.7	179.9	262.6	157.0	188.3	45.3	39.1	30.0	1 313.7
Jeju	59.2	75.6	73.1	82.3	88.8	158.1	209.8	226.6	249.5	87.5	69.2	60.2	1 439.9

1/ Central Meteorological Office: Climatic Atlas of Korea (1931-1960), 1962, p. 1.

Table 3

CLIMATIC ELEMENTS 2/

Climatic Elements	Type of Climatic Region 1/									
	SEc	MWc	SWc	MpRgq	SpRgq	MSiMt	DBn	Sc	UisBgq	JisW
Mean Annual Temp.(°C)	12–13	10–12	11–14	10–12	11–13	10–10	11–13	13–14	12.0	15.0
Mean Annual Max. Temp.(°C)	17–18	15–16	17–18	15–17	17–18.5	14–16	17–18.5	17–18.5	15.3	18.5
Mean Annual Min. Temp.(°C)	7–9	5–8	7–10	5–7	6–9	4–7	5–8	8–11	9.5	11.4
Mean Monthly Temp. of Jan.(°C)	0.0–10	–4—5	1—2	–4—6	0.0—2.0	–3.1	–1.6	0.0–2.0	0.6	4.8
Mean Monthly Temp. of Aug.(°C)	24–25	24–25	26.1	25.4	25–26	24.7	25.9	25–26	23.9	25.8
Mean Annual Precipitation Amount (mm)	1 100–1 300	1 100–1 200	1 000–1 200	1 100–1 300	1 100–1 300	1 000–1 200	900–1 100	1 200–1 500	1 500	1 450
Precipitation Amount(mm) – June through Aug.	400–500	600–700	507	705	600–900	626	498	500–600	373	593
Precipitation Amount(mm) – Nov. through Jan.	100–160	50–70	121	70.1	100	85.4	68	100–160	450.5	195
Mean No. of Days with with Precipitation	100–110	100–110	90–125	110–120	90–125	90–120	85–100	90–110	156	140
Mean No. of Days with Precipitation June through August	34–43	38.6	36.3	41	40	40.4	37	33.8	30.6	34.8
Mean No. of Days with Precipitation Nov. through January	15–17	22.8	33.5	30	30	23.6	16	15.9	52.7	39.8

1/ The symbols are explained in Sections 1.5.2.1–10.

2/ Kim Kwang Sik, The Classification of Korea, Plant Protection, Vol. 1, 1962, pp. 15–16.

Table 3 (Cont'd)

Climatic Elements	Type of Climatic Region									
	SEc	MWc	SWc	MpRgq	SpRgq	MSiMt	DBn	Sc	UisBgq	JisW
Mean No. of Days with Snowcover	30	22–36	24	28	25	29	10	2–4	71	11
Mean Rate of Bright Sunshine	55	58–60	50.9	55.1	54	56.8	58	58–57	45.7	44.5
Mean No. of Cloudy Days	125	110–120	143	117	125–135	127	121	110–130	169	186
Mean No. of Clear Days	100	80–90	64	87	70	78	87	80–100	89	41
Mean No. of Days with Frost	7–20	70–100	44	68	86–106	46.1	66	16	9.4	10
Mean Date of First Frost	XI 4	X 19	XI 13	X 18	X 20	X 14	X 20	XII 6	XI 25	IX 13
Mean Date of Last Frost	IV 3	IV 14	IV 13	IV 14	IV 11	IV 12	IV 11	III 11	III 17	III 12
Mean No. of Calm Days	46	118	55	130	320	236	80	130	100	23

1.5.2 Climatic Regions

Following Köppen's classification, South Korea has three climatic types: Dwa Cool Snow-Forest Climates with hot summers and dry winters; Cfa Warm Temperate Rainy Climates without a dry season, with hot summers; and Cwa Warm Temperate Climates with hot summers and dry winters.

Division Dwa covers the northern region from Seoul to Chupungryeong, and the nearby highlands of the Taebaeg mountain range. As the climate map of South Korea (Map 1) shows, Ulneung Do, Eastern Littoral, Southwestern Littoral, two small regions on the southern coastal inland and Jeju Do are in climatic division Cfa. The remainder of the southern region is in division Cwa.

Agricultural activities and the kinds of farm products are greatly dependent on the local climates. In order to supply more specific local information than given above, meteorologists have made a detailed classification 1/ of the several climatic regions of Korea (Map 2).

1.5.2.1 Southeastern coast (SEc)

In January, the influence of warm ocean currents along the coast and the foehn effect due to westerly winds over the Taebaeg mountain range are so prevailing that the mean January temperature ranges from 0 to -1 degree C, which is 2 or 3 degrees higher than that of the west coast in the corresponding latitudes. The mean annual temperature ranges from 12 to 13 degrees C and there is much snow in winter.

1.5.2.2 Middle western coast (MWc)

Mean annual temperature ranges from 10 to 12 degrees C, and mean daily minimum temperature of the coldest month, January, is -7 to -9 degrees C. The annual precipitation amount is 1 100 to 1 200 mm, nearly equal to that of the northwestern coast.

1.5.2.3 Southwestern coast (SWc)

This region is relatively warm with a mean annual temperature ranging from 11 to 14 degrees C. The mean daily minimum temperature of January is -2 to -6 degrees C.

The annual precipitation amount is 1 000 to 1 200 mm and cloudy days are frequent. Thus clear days are fewer and humidity is high. The mean annual number of cloudy days is 140.

1.5.2.4 Middle rainy plain (MpRgq)

The annual precipitation of 1 100 to 1 300 mm provides rich farm fields along the Han river. Precipitation in summer is more than half of the annual amount, about 750 mm beginning in June and lasting through August. The mean annual temperature

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1/ Kim Kwang Sik: The Classification of Korea, Plant Protection, Vol. 1, 1962, pp. 11-17.

ranges from 10 to 12 degrees C and mean daily minimum temperature of January -9 to -10 degrees C. There is a series of northwest winds in winter with northeast winds being common in summer.

1.5.2.5 Southern rainy plain (SpRgq)

It has an annual precipitation of 1 100 to 1 300 mm with the mean annual temperature ranging from 11 to 13 degrees C. The mean daily minimum temperature of January is -4 to -6 degrees C. The mild weather and the rich water sources from Nagdong, Geum and Seomjin rivers combine to make this region highly productive. It has 125 to 135 cloudy days annually and these cause relatively high humidity with mean values between 75 and 76 percent. Weak northwesterly winds prevail in this area.

1.5.2.6 Middle southern mountainous inland (MsiMt)

This region is composed of a series of middle inland mountain ranges including Taebaeg, Sobaeg, Noryeong, and Charyeong. Mean annual temperature ranges from 10 to 13 degree C. The mean minimum daily temperature of January is -7.2 degrees C. The mean annual precipitation ranges between 1 000 and 1 200 mm. The number of foggy days does not exceed 9 to 15 annually. Frost in this region begins early in autumn and frequently damages farm crops. Westerly winds are prevalent here.

1.5.2.7 Daegu inland basin (DBn)

This inland basin type covers a very small area around Daegu city where the heat and cold are extremely severe. The mean annual temperature ranges from 11 to 13 degrees C and the mean annual precipitation amounts to 900 to 1 000 mm. The mean minimum daily temperature of January is -6.2. The warmest month is August when the mean maximum temperature is 31.2 degrees C. In summer there are easterly winds, and northwesterly winds prevail in winter. The mean annual relative humidity is 66.

1.5.2.8 Southern coast (Sc)

Due to the ocean effect this region has relatively mild weather throughout the year. The mean annual temperature ranges from 13 to 14 degrees C and the mean daily temperature of the coldest month is 0 to 2 degrees C in January. The mean annual precipitation is 1 200 to 1 500 mm. The period of frost is short in winter. Summer typhoons sometimes cause flood damage.

1.5.2.9 Ulneung Do (UisBgq)

This island has relatively warm weather. The mean annual temperature is 12 degree C and the mean monthly temperature of January is above 0 degree C. Annual precipitation of 1 500 mm occurs during 156 days. One of the peculiar features is that 450.5 mm of precipitation comes as snowfall in winter months and only 373 mm as rain in summer months.

1.5.2.10 Jeju Do (JisW)

This, the largest island, has the warmest and mildest weather of all regions. The mean annual temperature is 15 degrees C and the mean monthly minimum temperature of January is 2 degrees C. The precipitation amount is 1 450 mm in 150 days annually. The winds are generally strong and it is the only place where oranges are produced in Korea. The above mentioned climatic regions are delineated in Map 2.

Table 4

LIST OF METEOROLOGICAL STATIONS 1/

Station	Lat. N	Long. E	Height (m)	Period
Gangneung	37.45	128.54	26.0	1931-1960
Seoul	37.34	126.58	85.5	1931-1960
Incheon	37.28	126.38	68.9	1931-1960
Ulneung Do	37.29	130.54	221.1	1939-1960
Chupunglyeong	36.15	128.00	245.9	1937-1960
Pohang	36.03	129.23	42.4	1943-1960
Daegu	35.53	128.37	57.8	1931-1960
Jeonju	35.49	127.09	51.2	1931-1960
Ulsan	35.33	129.19	31.5	1932-1960
Gwangju	35.09	126.54	70.9	1940-1960
Busan	35.06	129.02	69.2	1934-1960
Mogpo	34.47	126.23	31.4	1931-1960
Yeosu	34.44	127.44	67.0	1943-1960
Jeju	33.31	126.32	22.0	1931-1960

1/ Central Meteorological Office: Climatic Atlas of Korea (1931-1960), 1962.

1.6 VEGETATION

The principal native vegetation in Korea is forest. Very little of the original, virgin composition is remaining. Sparse secondary or degradated vegetation and almost bare land occurs around the densely populated areas not under cultivation. Despite government control, illegal cutting is continuing in many places. In recent years there has been much reforestation, but many extensive areas are still barren and badly eroded.

The forest reserves are concentrated mainly in the province of Gangweon Do.

The forest vegetation in Korea is distributed according to climate in two kinds: subtropical forest and temperate zone forest 1/.

1.6.1 Subtropical Forest

Although Korea is in the temperate climatic zone, subtropical forest occurs in the region below the 35°N parallel including the southern islands. The subtropical forest comprises mainly broad leaved evergreen trees with Cyclobalanopsis acuta, Castanopsis cuspidata, with Vaccinium bracteatum as the main species. Presently most of these have disappeared through cutting and have been replaced by deciduous kinds including Carpinus laxiflora, and Quercus serrata, together with coniferous species.

1.6.2 Temperate Zone Forest

The major part of the mainland above the 35°N, and extending into the northern regions, has this cover. The forest is composed of both conifers and broad leaved deciduous trees. The main component species are: Pinus densiflora, Pinus koraiensis, Abies holophylla, Pinus thunbergii, Castanea crenata, Betula devurica, Zelkowa serrata, Fraxinus rhynchophylla, and Betula schmidtii.

In this zone the forest also has been affected by human intervention, which has resulted in the disappearance of several of the original species and the formation of secondary vegetation.

Based on differences in temperatures the temperate forest zone can be subdivided into the following subzones: the south temperate zone, the central temperate zone and the north temperate zone. The first two are in the southern region of the peninsula covered by the soils reconnaissance, and the last in the zone north of the Demilitarized Zone.

1.6.2.1 The south temperate zone

This zone is within approximately the latitudes of 38°N in the east and 37°N in the west to 35°N in the south where it is limited by the subtropical zone. It covers the largest portion of South Korea. Cephalotaxus koreana, black pine, Masakia japonica and Juglans sinensis, are examples of the dominant characteristic species.

1.6.2.2 The central temperate zone

This covers a relatively small area south of the Demilitarized Zone. Its northern limit outside the Republic of Korea is about latitude 40°N. The main species are Albies holophylla, Betula schmidtii, Quercus serrata, Betula devurica, and Betula platyphylla.

1/ Sung-Kyu Cho and Chang-Hyun Yoo, Forestry in Korea. Bureau of Forest Administration, Section of Forest Survey Statistics. Seoul, Korea, 1967.

The secondary vegetation which occurs in extensive areas in the west and southern regions is comprised mostly of shrubs, grasses and conifers, associated with deciduous trees. Grassland with shrubs appears also commonly as a kind of climax type of vegetation in the higher elevations and plateau remnants (see geomorphology).

Among the species used and recommended for reforestation are: Phyllostachys spp, Buxus koreana, Cyclobalanopsis myrsinaefolia, Pinus densiflora (Korean white pine), Quercus acutissima (oak), Zelkowa serrata, Larix kaempferi (larch), Pinus koraiensis, Pinus rigida, Abies holophylla (fir), Castanea crenata (chestnut), Juglans sinensis, Betula schmidtii, Larix olgensis (Korean larch), Robinia pseudacacia, Alnus japonica (alder).

1.7 AGRICULTURE

Agriculture ranks as South Korea's most important economic activity. It provides a means of livelihood for more than 55 percent of the population, and is the source of approximately 34.6 1/ percent of the national income. The farmer is so important both economically and politically that agriculture must be given high priority in any plans for the future development of the economy.

The present government is giving special attention to development of the rural economy of Korea by rapid modernization of agriculture.

Research 2/ in agriculture was initiated 60 years ago at the end of the Yi Dynasty. Up to 1956 several experiment stations and laboratories had been established, and research was undertaken by these governmental organizations. In 1957 the Institute of Agriculture was started. All the experiment stations and laboratories in the field of agriculture, horticulture, sericulture, forestry, livestock and veterinary science, including the provincial institutes, were unified and expanded under its supervision. In this way 29 organizations were brought under the administrative control of a single agency. In 1962 it was reorganized as the Office of Rural Development, attached to the Ministry of Agriculture and Forestry, and was assigned the functions, authority and responsibilities, of developing Korean agriculture through scientific study.

The areas for agricultural research were broadly classified and grouped into six major fields: agronomy, forestry, sericulture, animal husbandry, veterinary science and agricultural engineering. The agronomic and soils research is conducted at the Institute of Plant Environment, which is one of the 12 primary research agencies under the Office of Rural Development.

The total land area of Korea is 9 931 157 jeongbo (9 849 081.5 ha), out of which only 2 275 189.5 jeongbo are cultivated land. Most of that cultivated is distributed on the southwestern plains and pediplane regions of Korea. About 57 percent of the cultivated area is in paddy fields (1 296 914.3 jeongbo), and the remainder (978 275.2 jeongbo) is under upland crops. The land use distribution is given in Table 5.

1/ The Bank of Korea: Economic Statistics Yearbook, 1967, p. 4

2/ Office of Rural Development, Ministry of Agriculture and Forestry: Agricultural Research in Korea, 1964, p. 1.

Table 5

UTILIZATION OF NATIONAL LAND AREA 1/

Land Use	1955		1960		1965		1967	
	Extent	Per-cent	Extent	Per-cent	Extent	Per-cent	Extent	Per-cent
Cultivated Land	2 011 454.2	20	2 041 668.1	21	2 275 189.5	23	2 331 176.8	23
Paddy	1 197 276.6		1 216 298.0		1 296 914.3		1 301 272.4	
Upland	814 177.3		825 370.1		978 275.2		1 029 904.4	
Forest	6 726 382.0	68	6 756 726.0	68	6 710 866.0	68	6 667 570.0	68
Wooded Area	3 380 670.0		3 945 994.0		-		5 484 005.0	
Denuded Forest Land	3 175 927.0		2 637 255.0		-		1 183 565.0	
Area not Directly under Forest Management	196 785.0		173 477.0		-			
Other	1 187 259.8	12	1 126 701.9	11	945 101.5	9	931 066.2	9
Total	9 925 096.0	100	9 925 096.0	100	9 925 096.0	100	9 929 813.0	100

1/ MAF: Yearbook of Agriculture and Forestry Statistics, 1968, pp. 24 - 25.

Table 6

AGRICULTURAL PRODUCTION 1/

		Rice (Polished)	Barley (Polished)	Miscellaneous (Polished)	Pulses (Polished)	Potatoes
1961	Planted Area 2/	1 137 484.0	969 769.2	205 036.4	341 368.8	110 197.1
	Yield Per Danbo	304	186	47	56	348
	Production	3 462 547.9	1 043 548.0	96 367.7	190 097.0	383 480.9
1962	Planted Area	1 148 491.4	1 012 021.3	202 475.9	339 909.8	125 379.7
	Yield Per Danbo	263	167	49	53	399
	Production	3 014 915.3	993 971.3	99 009.7	181 615.6	439 303.5
1963	Planted Area	1 165 021.6	1 070 064.8	204 518.6	338 752.0	137 674.3
	Yield Per Danbo	323	110	53	54	373
	Production	3 785 047.1	304 509.0	107 766.8	181 795.5	513 547.5
1964	Planted Area	1 205 168.3	1 119 244.9	219 337.1	337 700.4	108 948.0
	Yield Per Danbo	328	116	57	56	517
	Production	3 954 490.9	1 081 042.0	125 649.5	190 553.4	935 968.8
1965	Planted Area	1 238 356.7	1 210 906.7	216 337.1	368 396.1	214 388.7
	Yield Per Danbo	283	176	56	55	487
	Production	3 501 132.3	1 218 417.4	120 461.6	202 918.0	1 045 076.1
1966	Planted Area	1 241 589.8	1 148 280.8	171 369.6	344 594.5	210 054.8
	Yield Per Danbo	316	207	63	57	463
	Production	3 919 280.3	2 374 661.1	107 107.2	195 010.7	971 625.2
1967	Planted Area	1 245 551.5	1 150 516.1	162 399.0	380 487.5	196 479.2
	Yield Per Danbo	289	196	70	62	321
	Production	3 603 104.0	2 253 327.2	113 513.5	235 418.7	631 103.8

1/ MAF: Yearbook of Agriculture and Forestry Statistics, 1968, pp. 114 - 115.

2/ Units: Planted area in Jeongbo (1 Jeongbo = 0.99 ha)
Yield per Danbo in kg. (1 Danbo = 9.9 are; 1 are = 100 m^2)
Production in metric tons

Of the total paddy acreage of 1 301 176.8 jeongbo, 54.8 percent was in single crop farming, while the other 45.2 percent was used for double crop cultivation such as rice and barley, or wheat. Most of the upland areas are double cropped. Grain crops are most commonly planted throughout the country and rice is of paramount importance. Since rice and barley comprise the staple food for the people, South Korea has long concentrated on cultivation of these crops.

Table 6 gives the distribution of area and yield per jeongbo for the grain crops and some of the important vegetable crops.

Fertilizer is essential in South Korean agriculture. Accordingly agricultural production depends to a large extent on the supply and application of fertilizers. Use of chemical fertilizers is increasing year by year.

The following table shows the consumption of fertilizers from 1961 to 1967.

Table 7

CONSUMPTION OF FERTILIZER 1/

Year	Fertilizer			
	Nitrogen N	Phosphorus P_2O_5	Potash K_2O	Total Tons
1961	210 867	80 788	16 839	308 494
1962	19 896	39 959	-	59 855
1963	191 729	94 371	20 995	307 095
1964	173 152	153 571	37 422	364 145
1965	217 925	123 489	51 684	393 098
1966	239 693	124 796	58 782	423 271
1967	277 556	132 722	76 213	486 491

1/ MAF: Yearbook of Agriculture and Forestry Statistics, 1968, p. 80.

In addition to chemical fertilizer, Korea utilizes a domestic supply of manures including barnyard manure, green manure, grass, night-soil and ashes. The consumption of these manures was about 31 641 413 metric tons in 1964.

On the basis of the data for 1967, agriculture was practised by 2 586 864.2 farm households with an average allocation of cultivated land amounting to 0.907 ha.

The farm population of the Republic of Korea in 1967 included 16 078 086 persons which was 55 percent of the total population of 29 470 831. The average farm household consisted of 6.3 persons.

The factors which contributed to the more intensive land use appear to have been an expansion in the use of fertilizers and pesticides, an increase in irrigation,

multiple cropping, and the application of modernized machinery. Special attention has been given to irrigation systems for paddy fields, and these systems have been improved year by year. On the basis of irrigation conditions the paddy fields are classified as follows:

Table 8

TYPES OF CLASSIFIED RICE PADDY FIELDS IN 1965 1/

Classification	Extent	Percentage
Irrigated Paddies	743 913.2	57.4
Partially Irrigated Paddies	301 971.0	23.3
Rain-Fed Paddies	251 030.1	19.3
Total	1 296 914.3	100.0

1/ MAF/ULIA: Statistic Yearbook of Irrigation and Reclamation Work, 1966, p.1.

1.7.1 Forestry

Forest land in 1964 covered 6 742 927 ha of which stocked forest land consisted of coniferous forest, 3 419 494 ha, deciduous forest 1 166 484 ha, and mixed forest land 959 983 ha. The area of shifting cultivation in 1962 was mainly in the eastern mountains, and included only 14 289 ha.

1.7.2 Livestock

The livestock industry has been increasing. The numbers of main livestock and poultry at the end of 1967 are shown in Table 9.

Cattle constitute an important part of the farm labour supply, with pigs and chickens being significant reserves for the farm's food.

1.7.3 Sericulture

Sericulture has been increasing in importance owing to the recent emphasis given by the government to developing the silk industry. The number of households producing raw silk in 1967 was 96 703. The work is highly specialized and requires a great deal of hand labour. The silk production in 1967 was 1 547 709 kg.

Table 9

NUMBER OF DOMESTIC ANIMALS 1/

	1963	1964	1965	1966	1967
Livestock					
Cattle	1 367 823	1 356 790	1 320 904	1 229 305	1 255 140
Horses	26 707	26 933	27 683	27 849	24 951
Pigs	1 510 083	1 255 508	1 381 873	1 457 309	1 296 109
Goats	286 421	224 915	177 491	161 343	133 434
Rabbits	1 131 399	794 470	763 033	908 520	833 298
Dogs	921 166	896 531	793 782	701 744	613 731
Poultry					
Chickens	11 907 174	10 281 930	11 892 612	14 007 723	17 079 169
Ducks	172 836	148 622	209 540	232 619	226 722
Turkeys	2 232	2 095	1 927	1 810	1 582
Geese	16 956	12 065	10 374	9 892	8 847
Apiculture (Colonies)	110 707	102 332	123 848	130 802	126 713

1/ MAF: Yearbook of Agriculture and Forestry Statistics, 1968, pp. 216 - 217.

Chapter 2

SURVEY METHODS

The soil reconnaissance of Korea was carried out by aerial photo-interpretation combined with field checking and supported by laboratory analyses of the most representative soils within the main mapping units. The survey methods comprised a sequence of main operations which can be grouped as Aerial Photo-interpretation and Map Compilation, Field Checking, and Soil Analysis. These are discussed below.

2.1 AERIAL PHOTO-INTERPRETATION

2.1.1 Method

Aerial Photo-interpretation, commonly applied to soil reconnaissance at many places in the world, was used as a basis for the soil reconnaissance of Korea. The method applied was the interpretation system of Buringh and Vink 1/ which has been already used successfully in British Guiana, South America, by Braun 2/.

The photo-interpretation units in Korea were based on the commonly recognized specific components of physiographic systems: relief, morphology and parent materials. The integration or overlap of these physiographic components was the basis for setting up the photo-interpretation units. Relief and morphology were primary elements, while parent materials were mostly compiled from the geologic maps available and later confirmed by field checking. However, during the process of photo-interpretation a number of geological contacts were corrected on the available maps.

The field checking legend was developed on the basis of the relationship between the photo-interpretation units and the association of soils, as a development of the former. The mapping units are in effect subdivisions of the photo-interpretation units. The photo-interpretation provided the basic information to guide the field checking, while field checking emphasized the identification and characterization of soils in the field.

2.1.2 Sequence of Work

The aerial photo-interpretation started with a general study of the Korean mainland. The photographs used were at a scale of 1:40 000 and were of fair quality.

1/ Buringh, P. and Vink, A.P.A. The Use of Aerial Photography in Soil Surveys: I.T.C., Delft, Holland, 1961.

2/ FAO: Reports on the British Guiana Soil Survey. Rome, 1964.

Observations including preliminary interpretation were carried out on sample sites selected according to certain special geological and topographic aspects. Following these studies a tentative legend for the photo-interpretation was set up and tested by several exploratory trips across the country. After this, a basic legend was established and gradually developed as the field checking proceeded. In order to facilitate the reconnaissance field operations the country was divided into six individual blocks: Gyeonggi Do, Gangweon Do, Chungcheong Do, Gyeongsang Bug Do, Gyeongsang Nam Do, and Jeonla Do. The systematic photo-interpretation began in the Jeonla Do block and finished in the Gyeonggi Do block.

2.1.3 Photo-interpretation Units

A total of 18 photo-interpretation units were delineated on the aerial photographs, using a mirror stereoscope.

These units can be grouped as follows (symbols are those shown on the aerial photographs):

Coastal Plains

Sb - Beaches and Dunes.
TF - Tidal Flats.
FM - Fluvio-Marine Plains or Estuarine Coastal Plains.
MP - Marine Plains.

Inland Alluvial Plains and Valleys

Ap - Broad Inland Alluvial Plains.
(AL/E) 1/- Elevated Local Alluvial Plains and Lower Terraces.
(AF) 1/- Alluvial Fans.
ALI - River Floodplains with Recent Alluvium and Riverwash.
ALII 2/- Local Alluvial and Floodplains, Young Valleys.
A/Cl - Alluvial-Colluvial Slopes, Local Valleys and Stream-heads.

Dissected Older Pediplane Systems

A/C - Pediment-Debris Slopes.
R/G - Rolling Pediplanes, Gullied Land.
Rl - Rolling Pediplanes, Strongly Dissected.
(Rll) 3/- Rolling Pediplanes and Terraces, Slightly Dissected.

Strongly Dissected Hilly and Mountainous Land

Hl - Hilly Land, Strongly Dissected.
M - Mountainous Lands, Strongly Dissected.
OS - Old Erosion Surfaces and Plateau Remnants.
RO - Rocky Land.

By field checking these units were subdivided according to the soil characteristics.

1/ Used as a subunit for Ap and Rl.

2/ This unit was subdivided according to the adjacent landforms.

3/ This unit was used as a subunit of Rl.

2.2 MAP COMPILATION

The process of map compilation was greatly facilitated by the availability of good topographic base maps. The boundaries of the photo-interpretation units were transferred to acetate overlays over the topographic sheets at 1:50 000 scale. By this process the photo-interpretation maps were prepared for the field checking.

While this took place the photo-interpretation units were subdivided and additional boundaries plotted. After the completion of the field checking these maps were revised in the Cartographic Section, where the boundaries and symbols were inked properly.

By field soil correlation trips and office conferences, the mapping units of the field checking sheets were combined into significant units for the final map at a scale of 1:250 000. This map was prepared by pantographic reduction of 1:50 000 scale field sheets. During the process of compilation at 1:250 000, adjustments and combinations were made as required.

Final drawing was performed on scribe coat material overlaid on stable diapositive copies of the topographic maps produced by the Construction and Research Institute of Seoul.

A total of 282 field checking sheets at 1:50 000 scale and 14 sheets at 1:250 000 cover the total area surveyed.

2.3 FIELD CHECKING

The field checking operation was conducted by identification of the photo-interpretation units and description of the soils within these units in the field.

A preliminary basic field checking legend was set up as a result of the first round of exploratory trips. This legend was developed and expanded gradually with the progress of the field operations. Based on the characteristics of the main soils within the photo-interpretation units, several subunits were recognized. Approximately 85 subunits were identified. The expansion of the field checking legend was necessary in order to cover particular soil conditions pertaining to special areas and to provide the detail required for the Low Productive Rice Paddy Project. After the final soils correlation these field checking units were reduced to 58 for the map at scale 1:50 000 (see Appendix 3).

The field checking operation was started in the middle of 1965 and completed in the autumn of 1967. With the exception of the coldest months, from December to February, this was carried out throughout the year. A maximum of 8 and a minimum of 3 soil surveyors participated. Observations were taken along all accessible roads on each field checking sheet at 1:50 000 scale. Of the total of 282 sheets, all were checked in the field except 26, covering relatively small islands in the south and west, which were not considered because of difficult access. Approximately two and half to three days were necessary to survey one sheet, the total area surveyed per day thus being from 100 to 150 km^2.

The field checking included soil observations and landscape interpretation. The photo-interpretation units were studied and then subdivided with additional boundaries. Symbols and new boundaries were plotted in the field in accordance with the field legend.

The soils were described using the standard method of the "Soil Survey Manual" 1/ together with the "FAO Guidelines for Soil Description" (1966). An Edelman type auger was used for borings, and a pH kit (Hellige-Truog Soil Reaction Tester) was frequently utilized to check soil reaction, particularly in the paddy fields. More than 250 profiles were described and about 220 of them were sampled. Nearly 1 000 samples were physically and chemically analyzed. Special attention was paid to the geology of the parent materials. About 200 rock samples were classified in the office mostly during the early part of the survey. In the latter part, with the training provided, the surveyors were capable of identifying the rocks directly in the field.

2.4 METHODS OF SOIL ANALYSIS

A brief description of the methods of soil analysis followed at the Korea Soil Survey Laboratory is given. References are given with each method to direct the interested readers to the more detailed original methods. Any modifications which have been made in the original methods are also reported.

2.4.1 Physical Methods

2.4.1.1 Preparation of soil samples

The samples received from the field in alkathene bags were air dried in the shade and passed through a 2 mm sieve after gentle crushing with a wooden rolling pin. The greater than 2 mm fraction, which did not pass through the sieve, is reported as percent gravel. The less than 2 mm fraction stored in alkathene bags was used for all physical, chemical, and mineralogical analyses of soils reported here.

2.4.1.2 Hydrometer method of particle-size analysis

The particle size distribution of $\geq$ 2 mm fraction was determined by direct sieving and for $\leq$ 2 mm fraction by the Hydrometer method (Day, 1956) with minor modification. A 50 g sample (100 g in case of sandy soils) was dispersed with 100 ml of 5 percent sodium hexametaphosphate solution allowing 18 hours soaking time. The suspension was stirred in a stirring apparatus for a period of 5 minutes, transferred to a sedimentation cylinder, and then diluted until the total volume was 1 000 ml. The contents were stirred by up and down motion for one minute and kept aside for taking readings at specified intervals using 151-H Hydrometer.

2.4.1.3 Moisture retention, 1/3 atmosphere

The moisture retention at 1/3 atmosphere was determined using a pressure plate apparatus. Duplicate 25 g samples were placed in the retainer rings on the porous plate and allowed to stand for 16 hours with excess water before applying pressure. A pressure of 345 cm of water (25.3 cm of Mercury) was applied. This was released 48 hours after the extraction started or when the reading on the buret indicated that outflow had ceased from all samples. The moisture content was determined by drying the samples overnight at 105°C.

1/ U.S.D.A.: Soil Survey Manual, Handbook No. 18. Soil Survey Staff, USA, 1953.

2.4.1.4 Moisture retention, 15 atmospheres

The moisture retention at 15 atmospheres was determined with a pressure membrane apparatus. Duplicate 25 g samples were placed in the retainer rings on the pressure membrane and allowed to stand for 16 hours with excess water, which was then removed with a pipette or rubber syringe. An air pressure of 15 atmospheres (220 lbs/in^2) was applied to the soil chamber. When the outflow was markedly decreased a 4 lbs per square inch differential pressure was applied to the rubber diaphragm at the top of the soil chamber. The samples were removed from the soil chamber 18 hours after the initial extraction of water or when the reading on an outflow buret indicated that equilibrium had been attained. The moisture content was determined by drying the samples overnight at 105°C.

2.4.2 Chemical Method

2.4.2.1 pH

Soil pH was determined on 5 g samples in 1:5 soil: water ratio. The suspensions were allowed to stand for half an hour with occasional stirring before the pH was read. The samples were well stirred just before taking the readings. A "Zeromatic" Beckman pH meter was used.

2.4.2.2 Exchangeable bases

The exchangeable cations Ca, Mg, K and Na in a neutral N NH_4OAC leachate were determined by a modified method of Peech et al (1947). Ten g of the sample was shaken with 50 ml of N NH_4OAC (pH 6.9) for one-half hour and then filtered through a 5.5 cm Bücher funnel. The soil was leached with three additional 10 ml portions of N NH_4OAC. The leachate was diluted to volume in 100 ml volumetric flask. Ca and Mg were determined by the EDTA method of Gysling and Schwarzenback (1949). K and Na were determined using a Beckman DU Flame Spectrophotometer.

2.4.2.3 Organic matter

Organic matter was discovered by the indirect method of determining organic carbon and multiplying the results by "Van Bemmelen Factor" of 1.724 to obtain the organic matter percentage. The organic carbon was determined using Tiurin's (1931) method.

2.4.2.4 Total nitrogen

The total nitrogen was decided by using a modified Kjeldahl method. Five g of air dried soil was transferred to a Kjeldahl flask, and 5 g of sulphate mixture containing 4.5 g of K_2SO_4, 0.5 g of $CuSO_4$ and 30 ml of concentrated H_2SO_4 was added. The contents were digested for half to one hour until the Kjeldahl flask was clear. The flask was then cooled and 350 ml of H_2O was added. Distillation was carried out by the addition of some Zinc powder and 50 ml of conc. NaOH. The distillate was collected in a flask containing 50 ml of 2 percent boric acid solution and 10 drops of the indicator (mixture of 0.5 percent of bromo cresol green and 0.1 percent Methyl Red in 95 percent ethanol adjusted to pH 4.5). The distillate was titrated with standard 0.1 N H_2SO_4.

2.4.2.5 Cation exchange capacity of soil

The cation exchange capacity was determined by using 1 N NH_4OAC (pH 7.0) solution and a 5 g soil sample. The sample was washed free of salt using ethyl alcohol, and NH_4+ was determined by direct distillation of it with MgO.

2.4.2.6 Extractable acidity

Extractable or exchangeable acidity was determined by Yuan's method (1959) with some modification. Twenty g of air dry soil was extracted with 50 ml N KCl and leached with three additional portions of 50 ml N KCl. The soil was drained thoroughly between successive leachings. The filtrate was titrated with 0.1 N NaOH using phenolthalein as an indicator. The milliequivalents of alkali used were recorded as total exchange acidity. One drop of 0.1 N HCl was added to bring the solution back to colourlessness and 20 ml of 0.5 N NaF was added and the solution back titrated with 0.1 N HCl to colourlessness. The end-point was considered to have been reached if the pink colour did not reappear in half a minute. The milliequivalents of acid used were recorded as exchangeable Al. The difference between total exchange acidity and exchangeable Al was reported as exchangeable H.

2.4.2.7 Free iron oxides

Free iron oxides in the soil were determined using a 2 g sample by the sodium dithionite-citrate-bicarbonate method of Mehra and Jackson (1960). All the samples were subjected to two dithionite treatments and one rinsing with 40 ml of citrate solution.

2.4.2.8 Available P_2O_5

Available P_2O_5 was determined on a 5 g sample by the Lancaster method using 20 ml of extracting solution. A 10 minute shaking time was allowed before filtration. P_2O_5 was determined in the filtrate colorimetrically by developing the colour with ammonium molybdate 1-amino 2-napthol 4-sulphonic acid.

2.4.2.9 Available K_2O

The values obtained for extractable or exchangeable K by the NH_4-acetate method were also used for available K_2O.

2.4.2.10 Cation exchange capacity of clay

The cation exchange capacity of clay was determined by using 1 N Ca-acetate (pH 7.0) solution and 1 g of clay sample mixed with 2 g of quartz sand. In the last treatment with 1 N Ca-acetate, a small portion of 1 N $CaCl_2$ was added. The clay sample after saturation was washed free of salt using ethyl alcohol. The clay sample was then treated with 1 N NaCl to replace absorbed Ca and Ca determined by EDTA titration.

2.4.2.11 Total chemical analysis of clay

The total chemical analysis of clay was carried out on a one g sample by the Na_2CO_3 fusion method (Jackson, 1958).

Silica was determined by gravimetric method after treating the fusion product with conc. HCl and $HClO_4$. Fe was determined by the thiocyanate method, R_2O_3 by gravimetric method after precipitation with NH_4OH. Al_2O_3 was calculated by difference from R_2O_3 and Fe_2O_3. K_2O was determined by the flame spectrophotometer.

In Appendix 1, Section 3, a list of publications is given to which the reader desiring more detailed information on methods is referred.

Chapter 3

SOIL CLASSIFICATION AND INTERPRETATION

3.1 SOIL CLASSIFICATION

Owing to a sequence of geologic erosion cycles, which culminated in the man-induced recent cycle of accelerated erosion, the soils of South Korea appear dominantly truncated, and often weakly developed.

During the soil reconnaissance of Korea the following great soil groups were recognized: Red-Yellow Podzolic soils, Reddish Brown Lateritic soils, Acid Brown Forest soils, Low-Humic Gley soils, Alluvial soils, Lithosols, Regosols, Planosols, Saline Alluvial soils, Acid Sulphate soils, and Organic soils. Tidal flats, dry sands and rocky land formed part of the mapping units.

The most extensive soils in the surveyed area are Lithosols, which dominate most of the uplands of Korea. Red-Yellow Podzolic soils represent the most important great soil group, while Reddish Brown Lateritic soils are in areas with limestone and basic rocks. The Acid Brown Forest soils relate to particular climate and relief conditions and parent materials.

The paddy fields form a complex with a great variety of soils, sometimes difficult to classify, owing to the long special use and management to which they have been submitted. In general these soils range from Alluvial to Low-Humic Gley soils and Planosols in the lowlands, while on the slightly elevated areas, as river terraces, pediment slopes and elevated alluvial plains, they are mostly intergrades between these groups and Red-Yellow Podzolic soils. Changes in the top horizons are noticed after long use as paddy fields.

The Saline Alluvial soils and the Acid Sulphate soils are restricted to scattered areas on the coastal and estuarine plains.

The Organic soils in Korea, with the exception of those which occur on the north-eastern coast, are mostly covered with an overburden of Recent mineral material.

3.1.1 Red-Yellow Podzolic Soils

The main characteristic of this great soil group is the presence of a textural B horizon with blocky structure, which shows illuviated clay coating the ped surfaces or covering the pores and cavities. These soils are acid and generally have low base saturation (less than 35 percent) decreasing with depth. They occur under warm temperate and humid climates on relatively strongly weathered parent materials derived from siliceous rocks.

In Korea this great soil group has a yellowish brown, brown, yellowish red or red textural B horizon with different degrees of development from place to place.

Because of erosion or cultivation the A horizon is generally missing; however, in certain areas a pale colour at the surface indicates the former presence of an A2 horizon (bleached horizon). In severely eroded areas only part of the B2 horizon remains. Depth of these soils is variable, from a few centimetres to more than 150 cm. They correspond to the "Red-Yellow Soils" of the Japanese classification 1/ 2/. Being strongly acid and low in bases these soils normally require special management, with the addition of complete fertilizer and lime.

3.1.2 Reddish Brown Lateritic Soils

These are soils with reddish-brown to dark red textural B horizons with a subangular blocky structure. Clay movement is indicated by coatings on ped surfaces. The base saturation of the B horizon is medium to high. These soils are commonly deep, usually found in humid, subtropical and tropical climates, developed on material rich in ferromagnesian minerals.

In South Korea these soils present a dark surface and a dark red to brown subsoil. They have a higher base status than the Red-Yellow Podzolic Soils. The B horizons are strongly developed, in many places with thick continuous clay cutans. These soils have developed on siliceomafic materials derived from andesite porphyries, gabbro and basalt. Soils developed on limestone occupy a relatively small area in South Korea and some were included in this great soil group, assuming similarities with equivalent soils of the United States. In places these soils show strong similarity to the Red and Brown Mediterranean soils of Europe. A correlation of the soils over calcareous materials in Korea with the Red-Brown Mediterranean soils has been recognized by Kazumi Kawamura and I. Inagaki 3/. On a larger scale, these soils would be distinguished separately. The Reddish Brown Lateritic soils of Korea are very productive under adequate management. Organic matter and erosion control are the most important problems to be considered in their use.

3.1.3 Acid Brown Forest Soils

These soils are brown with prominent and thick dark coloured A horizons. The B horizons are weakly developed, with a subangular or granular structure. There is little evidence of clay illuviation. Base saturation is low and soil reaction is acid. In Korea these soils are definitely related to particular local climatic conditions, as they occur mostly on plateau remnants at altitudes above 500 m. These soils have been classified as "Brown Forest Soils" by Japanese soil scientists who have correlated them with similar soils in Japan 4/ classified as Brown Forest. Despite the low base saturation and strong acidity, they, with proper management including complete fertilizers, can produce high yields of a number of upland crops.

1/ Kamoshita, Y.: Soils in Japan, National Institute of Agricultural Sciences, Japan, 1958.

2/ Institute of Plant Environment, Office of Rural Development: General Soil Map of Chungcheongnam Do, 1962.

3/ Kawamura, K. and Inagaki, I.: On the Terra. Rossalike Soils in Western Chosen, Korea, Journal of the Science of Soil and Manure, Nippon, Vol. XV, 1951.

4/ Omash, D.: Study on the Soil of Beech Forest, Forest Soil Survey Report 1, Japan.

3.1.4 Low-Humic Gley Soils

These are hydromorphic soils developed under poorly drained conditions, and are characterized by the development of gley horizons. In Korea these soils have B horizons with blocky structure. Their colours are gray to grayish brown, frequently mottled, and range from slightly acid in the coastal plains to acid in the inland areas. In tracts near the coast the subsoil reaction is neutral or alkaline. Productivity is high, the land being intensively used for rice paddy.

3.1.5 Alluvial Soils

These undeveloped soils over recent alluvial deposits, are mostly imperfectly drained, but range from poorly to excessively drained. They are on river levees, along streams and drainage ways, and cover a considerable area in the coastal and inland alluvial plains as well as in narrow valleys in various kinds of relief. Near mountains their texture is coarser than in smoother topography, and contains a relatively high amount of gravel and cobbles.

Colours are variable, and related to the nature or composition of the surrounding rocks from which the alluvium originated. In general they are grayish brown to dark brown. The soils near the coast are slightly acid to alkaline in reaction while in the inland areas they are usually acid to strongly acid. Cultivation is intense, dominantly in rice paddy. High yields are obtained with adequate management including complete fertilization.

3.1.6 Lithosols

These are young soils with an A horizon over hard or weathered rocks and rock debris. The A horizon is usually weakly developed and shallow. The transition from this horizon to the rock or parent material can be gradual but normally is abrupt.

The Lithosols are the most extensive soils in Korea. They occupy strongly dissected hilly and mountainous lands and part of the rolling land, over slightly to deeply weathered rocks. The characteristics of these soils vary according to the composition of the rocks from which they were derived.

At high elevations there are areas of Lithosols with thick dark coloured A horizons, usually in association with Acid Brown Forest Soils. These could be classified as Rankers. The Lithosols in Korea mostly support perennial vegetation of trees, shrubs and grasses. In some regions, however, they are being used for agriculture.

3.1.7 Regosols

These are similar to Lithosols, but differ by being developed over locally transported unconsolidated or soft materials, mostly on mountain footslopes and pediment debris slopes. In South Korea they practically overlap the Lithosols and the name Rego-Lithosols has been used to define them. Agriculture varies from scattered to very intensive.

3.1.8 Planosols

These, not extensive, have fragipan horizons, and have developed in small areas in the lower parts of undulating pediplanes and alluvial fans.

3.1.9 Saline Alluvial Soils

In relatively small areas along the coast, near salt pits, and in recently reclaimed tidal flats, these soils are found. They are alkaline and contain some salt.

3.1.10 Acid Sulphate Soils

These soils have formed in fluvio-marine backswamps near the coast in a few relatively small areas. They have extremely acid reaction and sulphurous odour which indicate close similarity to Acid Sulphate Soils as mapped elsewhere.

3.1.11 Organic Soils

Most of the organic soils in Korea are buried by a recent alluvial mantle. Along the northeastern coast they appear at the surface. They have been formed in recent marine lacustrine organic deposits.

3.1.12 Other Great Soil Groups

A few other great soil groups which appear in relatively very small areas were not defined in the mapping units. These are Gray Brown Podzolic, Brown Forest and Brunizems soils. They appear in transition areas near the Demilitarized Zone.

3.2 LAND CAPABILITY CLASSIFICATION AND SOIL INTERPRETATION

This section discusses management requirements, the suitability and limitations of the soils for growing cultivated crops, pasture and wood products.

It explains the system of capability classification used in this report, which is essentially the system of the Soil Conservation Service, United State Department of Agriculture. However, it has been modified to fit the South Korean situation, and the capabilities of land for upland and paddy land cultivation are classified separately.

3.3 CAPABILITY GROUPS OF SOILS

The capability classification is a grouping that shows in a general way the suitability of soils for most kinds of farming. It is a practical grouping based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment. In this system all kinds of soil are grouped at three levels: the capability class, the subclass, and the unit. The eight capability classes for upland and the four capability classes for rice paddy in the broadest grouping are designated by Roman numerals I through to VIII and P1 through to PIV. In Classes I and PI are those that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in other classes have progressively greater natural limitations. In Class VIII are soils and land forms so rough, shallow or otherwise limited that they do not produce worthwhile yields of crops, of forage, or of wood products. The subclass indicates major kinds of limitation within the classes.

Table 10

APPROXIMATE RELATION OF MAP UNITS TO THE REVISED US CLASSIFICATION AND LEGEND OF THE WORLD SOIL MAP

	Reconnaissance Map Units	Revised US Classification (7th Approximation)	World Soil Map Legend
Ft	Tidal Flats	Haplaquents	Shown by symbol
Fb	Sands and Gravels, Coastal Beaches and Dunes	Psamments	Regosols
Fm	Low Humic Gley and Alluvial Soils, Fluvio-Marine Plains	Haplaquepts Haplaquents Ochraqualfs	Eutric Gleysols Eutric Fluvisols Gleyic Luvisols
Ap	Low Humic Gley and Alluvial Soils, Alluvial Plains	Haplaquepts Ochraqualfs	Eutric Gleysols Dystric Gleysols Gleyic Luvisols
Af	Alluvial Soils and Riverwash, Floodplains	Udipsamments Udifluvents	Dystric Regosols Dystric Fluvisols Eutric Fluvisols
An	Complex of Soils, Narrow Valleys	Udifluvents Haplaquepts Dystrochrepts	Dystric Fluvisols Eutric Fluvisols Dystric Gleysols Dystric Cambisols
Lp	Very Dark Brown to Black Volcanic Ash Soils, Lava Plain	Dystrandepts Andic Dystrochrepts	Ochric Andosols Humic Andosols
Lt	Very Dark Brown to Black Volcanic Ash Soils, Shallow and Rocky Phase, Lava Terraces	Dystrandepts Andic Dystrochrepts	Ochric Andosols Humic Andosols
Mj	Volcanic Ash Soils, Cinder Cones	Dystrandepts	Humic Andosols Ochric Andosols
Ra	Red-Yellow Podzolic Soils, Siliceous Crystalline Materials	Hapludults	Orthic Acrisols
Re	Lithosols, Severely Eroded, Siliceous Crystalline Materials	Dystrochrepts	Dystric Cambisols
Rl	Red-Yellow Podzolic Soils and Lithosols, Calcareous Materials	Hapludalfs Rhodudults Eutrochrepts	Orthic Luvisols Eutric Cambisols
Rs	Lithosols, Regosols and Red-Yellow Podzolic Soils, Sedimentary Materials	Dystrochrepts Hapludults	Dystric Cambisols Orthic Acrisols
Rv	Red-Yellow Podzolic and Reddish-Brown Lateritic Soils, Siliceomafic Crystalline Materials	Hapludults Hapludalfs Rhodudults	Orthic Acrisols Orthic Luvisols

Table 10 (Cont'd)

	Reconnaissance Map Units	Revised US Classification (7th Approximation)	World Soil Map Legend
Ma	Lithosols, Siliceous Crystalline Materials	Dystrochrepts Hapludults	Dystric Cambisols Orthic Acrisols
Ml	Lithosols and Red-Yellow Podzolic Soils, Calcareous Materials	Eutrochrepts	Eutric Cambisols Lithosols
Mm	Lithosols, Micaceous and Hard Siliceous Materials	Dystrochrepts	Dystric Cambisols Lithosols
Ms	Lithosols, Sedimentary Materials	Dystrochrepts Eutrochrepts	Dystric Cambisols Eutric Cambisols Lithosols
Mu	Acid Brown Forest Soils and Lithosols, Undifferentiated Materials	Haplumbrepts Hapludults Dystrochrepts	Humic Cambisols Dystric Cambisols Lithosols
Mv	Lithosols, Siliceomafic Materials	Eutrochrepts	Eutric Cambisols Lithosols
R	Rocky Lands		
L	Lava Flows		

Within most of the classes there can be up to four subclasses. The subclass is indicated by adding a small letter, e, w, s or c to the class numeral, for example, IIe. The letter 'e' shows that the main limitation is risk of erosion unless a close growing plant cover is maintained; 'w' that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); 's' that the soil is limited mainly because it is shallow, droughty, or stony, and 'c', used in only some parts of the country, indicates that the chief limitation is a climate either too cold or too dry. Each of these kinds of limitations must be evaluated differently for upland and paddy land types of cultivation.

In Class I and PI there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only the subclasses 'w', 's', and 'c', because the soils in it are subject to little or no risk of erosion but have other limitations that limit their use largely to pasture, range, wood land, or wild life.

Within the subclasses are the capability units, which are groupings of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. The capability units are convenient groupings for making many statements about management of soils. Capability units are generally identified by numbers assigned locally, for example, IIe-1 or IIIe-2. Soils are classifed in capability classes, subclasses and units in accordance with the degree and kind of permanent limitations, but without consideration of major and generally expensive land forming that would change the slope, depth or other characteristics of the soil, and without consideration of possible but unlikely major reclamation projects.

3.4 UPLAND CAPABILITY CLASSES

By upland is meant the cultivation of crops under dryland conditions - i.e. without the maintaining of water on the surface of the land for extended periods as is done in paddy cultivation. In Korea virtually all cultivated plants except rice and a few special plants such as water cress and lotus are upland crops in general.

The characteristics of the eight upland capability classes used by the Korea Soil Survey are as follows:

Class I — Land that can be cultivated safely to a wide variety of upland crops with ordinary good farming methods. Under good management as commonly practised it has few or no limitations, no hazards or risks of soil damage, and will produce moderate to high yields. The soils of this class are nearly level to level, well to moderately well drained, deep, in clayey to fine loamy families. They are suited to all upland crops commonly grown, and produce good yields. They are also suited to rice if adequate irrigation water is supplied. To maintain high yields, it is necessary to apply compost, fertilizers especially nitrogen and phosphate, and lime according to the requirements of crops to be grown and the needs of the soils. The dominant soils of the subunit Apb 1/ and to a lesser extent soils of subunits Raa, Apa, Apc, Afa and Rxa belong to this class.

1/ These subunits are separately mapped on the field sheets at 1:50 000 scale.

Class II — Land that can be cultivated safely to a wide variety of upland crops with easily applied special practices. It has some limitations or hazards, or to some extent, risks of soil damage when good crop yields and proper soil management are pursued.

Subclass IIe — The soils of this subclass are gently sloping, well to moderately well drained, deep clayey to fine loamy families. They are likely to erode if not protected. Contour tillage, mulching and vegetated waterways are needed for erosion control. To maintain good yields, it is necessary to apply compost, fertilizers especially nitrogen and phosphate, and lime according to the requirements of crops to be grown and the needs of the soils. The dominant soils of the subunits Raa, Rxa 1/ and to a lesser extent soils of subunits Apb, Rab, Rea, Rsa, Rva, Rac, and Rvb belong to this subclass.

Subclass IIw — The soils of this subclass are nearly level to gently sloping, moderately well to imperfectly drained, deep, in clayey to fine loamy families. Although relatively wet, they are suited to a wide variety of upland crops if adequately drained. They also are suited to rice and produce good yields. To maintain good yields, it is necessary to apply compost, fertilizers especially nitrogen and phosphate, and lime according to the requirements of crops to be grown and the needs of the soils. The dominant soils of the subunits Fma, Apa 1/ and to a lesser extent soils of subunits Fmb, Afb, Afc, Ana belong to this subclass.

Subclass IIs — The soils of this subclass are nearly level to gently sloping, well to moderately well drained, deep to moderately deep, in coarse loamy families. They are somewhat droughty and more rapidly leached of fertilizer than fine loamy and clayey soils. They are suited to various upland crops and produce good yields, if drought does not occur in the dry season or adequate water is supplied and split applications of fertilizer are used. Rice can grow on those soils which are supplied with enough irrigation water; however yields are generally low. To maintain good yields, it is necessary to apply compost fertilizers and lime according to the requirements of crops to be grown and the needs of the soils. The dominant soils of the subunit Afa and to a lesser extent soils of subunits Afc, Afd, Apc, Afb, Anb belong to this subclass.

Class III — Land that can be used regularly for crops in a good rotation, with intensive treatment. It has larger limitations or hazards, or greater risks of soil damage when good yields and proper soil management are pursued than has land in Class II.

Subclass IIIe — The soils of this subclass are gently sloping to sloping, well to moderately deep, in clayey to fine loamy families. They are very susceptible to erosion, if not protected. Surface runoff is moderately rapid, and erosion is accelerated when these soils are cultivated under management. In many places the original surface layer has been removed by erosion and the plough layer consists of a

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1/ These subunits are separately mapped on the field sheets at 1:50 000 scale.

mixture of the original surface layer and the upper part of the subsoil or entirely of subsoil. Contour tillage, vegetated waterways and terraces provide effective control against erosion. In severely eroded spots, the soil is difficult to cultivate, and it is recommended that mixed seedings of grasses with legumes be made. To maintain fair yields, it is necessary to apply compost, fertilizer, especially nitrogen and phosphate, and lime according to the requirements of the crops to be grown and the needs of the soils. The dominant soils of the subunits Anc, And, Rac, Rlb, Rsb, Rvb and to a lesser extent soils of subunits Rad, Rsc, Rvc, Rab, Rsa, Rva, Rla, Anb belong to this subclass. However, the soils of the subunit And which is on alluvial-colluvial slopes in high mountain regions may belong to Subclass IIIc, because of cold weather. Sweet potatoes, corn, sugar beet and hops are produced on the latter group of soils.

Subclass IIIw The soils of this subclass are nearly level to level, imperfectly to poorly drained, in coarse loamy families and nearly level to gently sloping, moderately well to poorly drained, often cobbly or gravelly fine loamy to clayey families. They have severe limitations because of excess water and high water table. These soils require drainage before they can be used for upland cultivation. Tile drains, open ditches, or a combination of both, can be used to remove excess water. They are suited to paddy rice, but yields are generally low. To maintain fair yields, it is necessary to apply compost, fertilizer and lime according to the requirements of crops to be grown and the needs of the soils. The dominant soils of the subunits Fmb, Ana and to a lesser extent soils of subunits Fmc, Afb, Rxa, Anb belong to this subclass.

Subclass IIIs The soils of this subclass are nearly level to gently sloping, imperfectly to well drained, in gravelly to cobbly fine loamy or coarse loamy families. Limitations are severe in use and management because of the limited moisture capacity and tillage difficulties. They are fairly well suited to various upland crops if adequate water is supplied. They also will produce rice; however yields are generally low. Frequent light applications of water and split applications of fertilizer are recommended as being more efficient. To maintain fair yields, it is necessary to apply compost, fertilizer and lime according to the requirements of crops to be grown and the needs of the soils. The dominant soils of the subunits Apc, Anb and to a lesser extent soils of subunits Fmb, Afb, Afc, Afd, Ana belong this subclass.

Class IV Land which is best maintained in perennial vegetation that can be cultivated occasionally or in a limited way if handled with great care. It has strong limitations or hazards, or great risks of soil damage when cultivated.

Subclass IVe The soils of this subclass are gently sloping to moderately steep, well drained, shallow to moderately deep, often gravelly to cobbly, in loamy families. They are suited to a wide variety of upland crops. However, they need careful management, because of the severe erosion hazard and steep slopes. Orchard, pasture and forest are more suited than upland crops. Contour tillage, terraces, and vegetated waterways help to control runoff. The best way to prevent erosion is to maintain a good ground cover. The soils in this subclass are best used for

timber production and pasture rather than upland cultivation. To maintain fair yields, it is necessary to apply large amounts of compost, fertilizer and lime, according to the requirements of the crops to be grown and the needs of the soils. The dominant soils of the subunits Rab, Rad, Rla, Rsc, Rva, Rvc, Mua and to a lesser extent soils of subunits Rac, Rlb, Rsa, Rsb, Rvb, Rxa, Maa, Mub belong to this subclass. However the soils of the subunit Mua which are in high mountain regions may belong to Subclass IVc, because of cold weather. Sweet potatoes, corn, sugar beet and hops are produced on the latter group of soils.

Subclass IVw — These are nearly level to gently sloping, imperfectly to poorly drained, deep to moderately deep, in coarse loamy to sandy families. They have severe limitations because of low nutrient holding capacity and wetness, and are fairly well suited to upland crops if adequately drained and frequently supplied with fertilizer. In some places their use is restricted because they have permanently high water tables which are difficult to drain. They are more suited to rice even if yields are low, than to upland crops. The dominant soils of subunit Afb and to a lesser extent soils of subunits Apa, Apc, Afc, Afd, Anb, Ana belong to this subclass.

Subclass IVs — This subclass includes the nearly level to gently sloping, excessively to well drained, shallow to moderately deep, soils in loamy families; and nearly level to level, excessively to well drained, deep to moderately deep soils in coarse loamy to sandy families. They have severe limitations because of rapid permeability, limited moisture capacity, and low nutrient holding capacity. They are fairly well suited to upland crops if supplied with adequte water and frequently supplied with fertilizer. They are more suited to orchard and forest than to upland. To maintain fair yields, it is necessary to apply large amounts of compost, fertilizer and lime, according to the requirements of the crops to be grown and the needs of the soils. The dominant soils of the subunits Rab, Rsa, Rva, Afb and to a lesser extent soils of subunits Maa, Mla, Rab, Rea, Afc, Afd belong to this subclass.

Class V — Land that is not suited for cultivation but is suited for grazing and forestry with few or no limitations.

Subclass Vw — The soils of this subclass are nearly level to level, imperfectly to poorly drained, moderately deep to shallow, in loamy families. They are not suited to upland crops, because of excessive wetness and high salt content. Rice can be grown after artificial drainage and leaching of excessive salts. The dominant soils of subunit Fmc and a lesser extent of soils in subunits Fmb, Fta and Fma, are in this subclass. They are slightly to moderately eroded, and suited to forest, with good timber production possibilities. Some areas may be suited to orchard, pasture and mulberry trees. Runoff can be controlled through the maintenance of good ground cover. Contour tillage, terraces and vegetated waterways are needed when they are in orchard and mulberry fields. Large quantities of fertilizers, compost and sometimes lime are also required. The dominant soils of the subunits Maa, Mla, Mma, Mub, Mva and to a lesser extent soils of subunits Mab, Mac, Mlb, Mmb, Msa, Mua, Mvb, Msb, Mac, Rsa, Rva, Rab, Rlm belong to this subclass.

Class VI — Land that is not suited for cultivation but is for grazing or forestry with moderate limitations.

Subclass VIe — The soils of this subclass are gently to steeply sloping, well to excessively drained, moderately deep to shallow, in loamy families.

Class VII — Land not suited for cultivation which is subject to severe limitations or severe hazards under either grazing or forestry use.

Subclass VIIe — The soils of this subclass are sloping to very steeply sloping, excessively drained to well drained, moderately deep to very shallow, in loamy skeletal families. They are suited to forest and should be kept permanently in perennial vegetation. Fertilizer and sometimes lime when planted to trees will be needed. The dominant soils of the subunits Rea, Rsa, Mab, Mac, Mlb, Mmb, Msa, Msb, Mvb and to a lesser extent soils of subunits Maa, Mla, Mma, Mub, Mva belong to this subclass.

Subclass VIIs — This subclass is made up of sandy sandy skeletal, excessively drained riverwash or soils of the floodplains which are subject to frequent overflow especially in the summer rainy season. Only the most drought resistant native species grow on these soils. In some areas they are used to produce upland crops in the dry season, however yields are low and uncertain. The dominant soils of the subunits Afc, Afd and to a lesser extent soils of subunits Afa, Afb, Apc, Anb, Ana, Fta, Rxa belong to this subclass.

Class VIII — Land which is of such unfavourable characteristics as to be unsuited for cultivation, grazing, or forestry. It may be of value for wild life, recreation, or watershed-protection uses.

Subclass VIIIe — This subclass, composed of coastal dunes, produces no useful vegetation and is suitable only for recreation. Drought resistant trees or grasses should be planted to control wind erosion. The dominant soils of the subunit Fba and to a lesser extent soils of subunits Fmc, Fmb, and Fta belong to this subclass.

Subclass VIIIs — This subclass is composed of tidal flats, that produce no useful vegetation. However, after dike construction and leaching of excess salts by fresh water the better lands have the possibility of being developed into cultivated land. The dominant soils of the subunit Fta and to a lesser extent soils of subunits Fba, Fmb, Fma, Fmc and Afc belong here.

3.5 PADDY LAND CAPABILITY CLASSES

Paddy means the cultivation of crops under conditions of controlled flooding (normally 5 to 15 cm of water). Rice is the principal crop so grown. As practised in Korea the paddies are usually flooded before the rice seedlings are transplanted from the nurseries, and water is maintained on the surface until the grain is approaching maturity.

The paddy land capability classes express the suitability, limitations and hazards of the land for producing paddy rice. Soil and land characteristics including climate are the determining factors of classification. The availability of water is not considered.

The four paddy land capability classes used by the Korea Soil Survey are defined briefly below. They are applied only to land being used or having apparent potential for paddy. Steep, rocky, very shallow soils and others not suitable for paddy are not included in the classification.

Class PI — Land that is suitable for paddy without the necessity of special development nor management practices and without special limitations nor hazards. The soils of this class are nearly level to level, moderately well to poorly drained, in deep fine loamy and clayey families. They are well suited to paddy and produce good yields of rice with proper management as they have sufficient nutrient and water holding capacity. They are generally of limited suitability for upland crops because of wetness. However, with improved drainage they can be used for upland crops. To maintain high yields of rice, soil management practices including deep ploughing and the mixing of nitrogen into the soil when applied are recommended. The dominant soils of the subunits Fma, Apa and to a lesser extent soils of subunits Fmb, Afb, Ana, Rxa, Raa belong to this class.

Class PII — Land that is suitable for paddy with the application of simple special development and management practices, and with moderate hazards and limitations for use as rice paddy.

Subclass PIIe — The soils of this subclass are gently sloping, moderately well to poorly drained, in deep fine loamy and clayey families. They are suited to paddy; however, they have some limitations such as workability, irrigation water supply and the need for dike protection against erosion because of slopes. They are generally of limited suitability for upland crops because of wetness, but with improved drainage they can have this use. To maintain good yields of rice, soil management practices including deep ploughing, the mixing of nitrogen into the soil when applied and careful water management are required. The dominant soils of the subunit Apb and to a lesser extent soils of subunits Apa, Apc and Raa belong to this subclass.

Subclass PIIs — The soils of this subclass are nearly level to gently sloping, poorly to well drained, deep to moderately deep, usually gravelly to cobbly, in fine loamy and clayey families. They are suited to paddy, because of sufficient depth, nutrient and water holding capacity. However, they have some difficulties of tillage and irrigation water holding capacity. They are also suited to upland crops because of easily improved drainage. To maintain good yields of rice, soil management practices including careful water management and deep ploughing are recommended. The dominant soils of the subunits Ana, Rxa and to a lesser extent soils of subunits Apa, Afb, Anb and Anc belong to this subclass.

Class PIII — Land that is suitable for paddy with the application of difficult special development and management practices, and with severe hazards and limitations for use as rice paddy.

Subclass PIIIe The soils of this subclass are gently sloping to sloping, moderately well to poorly drained, deep to moderately deep, often gravelly to cobbly, in fine loamy and clayey families. They are suited to paddy; however they have limitations such as workability, irrigation water supply, and the need for dike protection against erosion because of slopes. They are generally of limited suitability for upland crops because of wetness, but with improved drainage they can have this use. To maintain good yields of rice, soil management practices including careful water management and direct-seeding are recommended. The dominant soils of the subunits Anb, Anc, Apc and to a lesser extent soils of subunits Ana, And, Afb and Rxa belong here.

Subclass PIIIs Included in this subclass are nearly level to gently sloping, moderately well to poorly drained, moderately deep to deep soils in coarse loamy families; and nearly level to level, imperfectly to poorly drained, moderately deep to deep soils that are high in salts in loamy to clayey families. They are suited to paddy; however, yields are generally low because soil permeability is relatively rapid, nutrient and water holding capacity are low or sufficient salts are present to affect the yields. They are generally of limited suitability for upland crops because of wetness, but with improved drainage they can be used for them. Soil management practices recommended on coarse loamy soils to maintain good yields of rice include split applications of fertilizer, especially nitrogen and potash, the spraying of urea on the foliage, and the use of silicate fertilizers. Leaching salts by proper continuous irrigation with fresh water, selection of the salt tolerant rice varieties, close spacing and high level fertilization are recommended on saline alluvial soils. The dominant soils of the subunits Fmb, Fmc, Afb and to a lesser extent soils of subunits Fta, Fma, Afa, Afb, Ana, Afc, Afd, Anc and And belong to this subclass.

Class PIV Land that is of limited or questionable suitability for paddy because of very severe hazards and limitations and the need for very difficult special management practices for use as rice paddy.

Subclass PIVe The soils of this subclass are gently sloping to sloping, well to moderately well drained, deep to moderately deep, in fine loamy and clayey families. They are suited to paddy; however, they have severe limitations such as workability, irrigation water supply and the need for dike protection against erosion because of slopes. They are more suited to upland crops than rice paddy. To maintain fair yields of rice, it is necessary to apply large amounts of compost and fertilizers and to follow recommended soil management practices including careful water management and direct-seeding. The dominant soils of the subunits Rad, Rsb, Rsc, Rvb, Rvc, And, Raa, Rac, Rlb and to a lesser extent soils of subunits Rab, Rla, Rsa, Rva belong to this subclass.

Subclass PIVs The soils of this subclass are nearly level to gently sloping, well to moderately well drained, deep to moderately deep, in coarse loamy families. They are suited to paddy, but yields are low, because soil permeability is rapid, and nutrient and water holding capacity is very low. They are much more suited to upland crops than to rice paddy. To maintain fair yields of rice such soil management practices as split applications of fertilizer especially nitrogen and potash, the spraying of urea on the foliage, the use of compost and silicate

fertilizers, and addition of fine soil with high cation exchange capacity are recommended. The dominant soils of the subunit Afa and to a lesser extent soils of subunits Apc, Afb, Afc, and Anb belong to this subclass.

Chapter 4

DESCRIPTION OF THE MAPPING UNITS

4.1 INTRODUCTION

The soils of South Korea were mapped and grouped by correlation on the basis of the relationship within the main physiographic components and the characteristics of the main soils.

The mapping units represent consequently soil associations, which included generally one or two main great soil groups as the most dominant within a specific mapping unit. The degree of generalization was controlled by the defining characteristics of the soils of each mapping unit and the scale factor of the final maps. Certain mapping units due to the scale of the final maps are very complex.

A total of 58 subunits were included in the more detailed maps at 1:50 000 scale. These were generalized to 22 units on the final reconnaissance maps at 1:250 000 scale.

These mapping units and subunits were grouped in the final legend as follows:

Symbol	Mapping Units and Subunits	Area Mapped in km^2
	Soils of the Coastal Plains	
Fb	Sands and Gravels, Coastal Beaches and Dunes	170
Ft	Tidal Flats	4 040 1/
Fm	Low-Humic Gley and Alluvial Soils, Fluvio-Marine Plains	3 050
	Soils of the Inland Alluvial Plains and Valleys	
Ap	Low-Humic Gley and Alluvial Soils, Alluvial Plains	4 900
Af	Alluvial Soils and Riverwash, Floodplains	3 730
An	Complex of Soils, Narrow Valleys	7 300
	Soils of the Dissected Older Pediplane Systems	
Ra	Red-Yellow Podzolic Soils, Siliceous Crystalline Materials	12 220
Re	Lithosols, Severely Eroded, Siliceous Crystalline Materials	2 560

1/ Offshore land, not included in the total area.

Symbol	Mapping Unit and Subunits	Area Mapped in km²
Rl	Red-Yellow Podzolic Soils and Lithosols, Calcareous Materials	340
Rs	Lithosols, Regosols and Red-Yellow Podzolic Soils, Sedimentary Materials	1 280
Rv	Red-Yellow Podzolic and Reddish Brown Lateritic Soils, Siliceomafic Crystalline Materials	2 000
	Soils of the Coastal and Inland Lava Plains	
Lp	Black and Very Dark Brown Volcanic Ash Soil, Lava Plains	
Lt	Very Dark Brown to Black Volcanic Ash Soil, Shallow and Rocky Phase, Lava Terraces	
	Soils of the Strongly Dissected Hilly and Mountainous Lands	
Ma	Lithosols, Siliceous Crystalline Materials	25 100
Mj	Volcanic Ash Soils, Cinder Cones	130
Ml	Lithosols, and Red-Yellow Podzolic Soils, Calcareous Materials	1 940
Mm	Lithosols, Micaceous and Hard Siliceous Materials	6 820
Ms	Lithosols, Sedimentary Materials	9 270
Mu	Acid Brown Forest Soils and Lithosols, Undifferentiated Materials	1 323
Mv	Lithosols, Siliceomafic Materials	6 300
Ro	Rocky Lands, Undifferentiated Materials	8 100
Lf	Lava Flows	61

4.2 SOILS OF THE COASTAL PLAINS

These soils are mostly concentrated in the western and southern regions of Korea, in estaurine deposits of the main rivers as well as in relatively small scattered areas along the coast on fluvio-marine and marine deposits. The largest areas are south of the Geum river mouth, in the "Iri Plains". Other areas are in the Nagdong river mouth and in the vicinity of Pyongtaeg. These soils include the most productive ones of Korea, being under intensive agriculture with mostly rice paddy. Tidal flats and beaches are included in this physiographic group of soils. It comprises three main mapping units in the final map. These are:

Symbol	Mapping Units and Subunits
Fb	Sands and Gravels, Coastal Beaches and Dunes
Ft	Tidal Flats
Fm	Low-Humic Gley and Alluvial Soils, Fluvio-Marine Plains

4.2.1 Fb Sands and Gravels, Coastal Beaches and Dunes

This mapping unit comprises the nearly level to gently sloping Recent and Sub-recent coastal beaches and dunes. It is mostly dry sand with gravel in places. Most of the land is not cultivated. These soils are in upland capability Classes VII and VIII, and are unsuitable for paddy land. They are, in general, unsuitable for agricultural use. Only one subunit (Fba) was recognized in the field checking sheets at 1:50 000 scale.

4.2.1.1 Physiography

This mapping unit includes the coastal beaches and dunes, where Recent and Sub-recent marine and local eolian deposits of dominantly sands and gravels occur. Dissection is predominantly slight. Topography is dominantly nearly level to gently sloping, sometimes undulating, and seldom sloping or rolling. Dominant slopes range from 2 to 6 percent. This land is being partly reworked by wind and tide.

4.2.1.2 Soils

This unit includes mostly well to excessively drained sands with some gravel on marine and eolian reworked deposits, in discontinuous and scattered beaches and dunes along the coast. Small areas of tidal flats and Saline-Alluvial soils are included. These are imperfectly to very poorly drained coarse loamy materials at the lower edges, or between the beaches and dunes. This mapping unit is composed of more than 95 percent dry sands and less than 5 percent of tidal flats and Saline-Alluvial soils. Although generally sandy, the unit includes soils with varying quantities of gravel and cobbles distributed throughout the profile. The colour of the surface layer ranges from light gray or light brownish gray to white. The surface horizons are neutral in reaction to slightly alkaline and are dominantly sandy. The pH increases with depth. The substrata are very deep, pale brown, white and yellowish brown to light olive brown sands.

4.2.1.3 Variation in the mapping unit

Along the east coast, this mapping unit includes numerous areas of gravel and cobbles, with only rare inclusions of tidal flats and Saline-Alluvial soils. Along the west and south coasts tidal flats and Saline-Alluvial soils are more common. Very small tracts have shell fragments, as in Daecheon, Chungcheong Nam Do.

4.2.1.4 Present land use

Agriculture is not usual and only scattered small areas grow upland crops, including barley, sweet potato, sesame, soybean, and asparagus. The yields, however, are very low.

4.2.1.5 Land use, management and recommendation

The soils of this mapping unit are chiefly in upland capability Classes VII and VIII. These soils are in general unsuitable for agricultural use owing to the low fertility status and low water holding capacity.

4.2.2 Ft Tidal Flats

This mapping unit is mainly along the west and south coasts of South Korea, comprising the miscellaneous land formed by recent marine and fluvio-marine deposits covered by the high tides. Materials are mostly silt loam or silty clay loam.

4.2.2.1 Physiography

The unit includes the tidal flats along the coastal shores. They have been formed recently by deposition of silty and clayey materials discharged by the main rivers and reworked by the sea. These have formed nearly flat, barren areas of mud, periodically covered by the tide. The lower parts are covered by water daily, while the higher sections may be covered only at unusually high tides.

4.2.2.2 Soils

Soils are mostly silt loam and silty clay loam materials which do not support vegetation because of periodic inundation by sea water. These are very Recent marine or fluvio-marine sediments, or sometimes sand beaches at the inland side edges. The colour of surface layers ranges from gray or olive gray to dark gray. Although textures are dominantly silt loam and silty clay loam, they range from loamy sand to clay loam. The surface layers range in pH from mild to moderately alkaline. They are deep, olive or gray to dark gray, with a finer texture than the surface layers. Drainage is poor or very poor, for the greater part ranging to imperfect at the higher elevations.

4.2.2.3 Variation in the mapping unit

The materials along the west and southwest coasts are finer in texture than those of the east coast. Tides are also much higher along the west and southwest coasts, with the maximum difference between low and high tide exceeding 9 m at Inchon.

4.2.2.4 Present land use

There is practically no agriculture in this mapping unit; however, some reclamation has been done recently by constructing dykes, leaching the excess salts from the soil, and shaping the land into paddy fields.

4.2.2.5 Land use, management and recommendation

After construction of dykes and leaching by fresh water to remove excess salts these areas can be made into very good agricultural land. The western and southern regions include a considerable extent of this mapping unit which can be reclaimed. However, these operations are difficult and expensive, and the economic feasibility should be taken into consideration, and weighed against the possibilities of increasing production in other areas.

4.2.3 Fm Low-Humic Gley and Alluvial Soils, Fluvio-Marine Plains

This mapping unit is on the level to nearly level, broad, coastal, fluvio-marine plains. It is an association of dominantly Low-Humic Gley and Alluvial soils, with a few Saline and minor areas of Acid Sulphate soils. Texture are mostly fine loamy and clayey, sometimes coarse loamy.

Most of the land is intensively cultivated in rice paddy. These soils are chiefly in paddy land capability Classes I and II, and upland capability Classes III and IV. With the exception of the few areas of Saline and Acid Sulphate soils, high yields of rice and barley are obtained. Seven subunits were recognized as components of this mapping unit. These were separately mapped on the field sheets and are reproduced on the semi-detailed map at 1:50 000 scale.

4.2.3.1 Physiography

This mapping unit is in the coastal plains, where recent fluvio-marine and some lacustrine deposits of dominantly silts and clays occur. The lacustrine type is restricted to the east coast north of Samcheog. Elevation of this unit is only a few metres above sea level. The lowest parts have been reclaimed from tidelands by dyking. Since there is no dissection, relief is very low and the topography is flat or almost flat. The dominant slopes are less than 1 percent. Runoff is very slow.

4.2.3.2 Soils

This is an association predominantly of Low-Humic Gley soils (more than 60 percent) and Alluvial soils (more than 30 percent) developed in fluvio-marine deposits. Saline Alluvial and Acid Sulphate soils are minor components (less than 10 percent). These soils are imperfectly to poorly drained, and clayey to coarse loamy in texture.

The most extensive areas in the mapping unit are Low-Humic Gley soils belonging to clayey and fine loamy families. Their surface horizons range from gray to grayish brown with yellowish brown mottles. They are silt loams to silty clay loams and dominantly neutral in soil reaction. The subsoils, extending to depths of more than 60 cm are gray to dark gray with yellowish brown or dark grayish brown mottles. They are silty clay, silty clay loam or silt loam with prismatic and subangular blocky structure. Silty and coarse clayey cutans are common on the ped faces. Soil reaction is slightly acid to slightly alkaline. The substrata are deep, gray, dark gray or greenish gray stratified fluvio-marine sediments ranging in texture from silty clay to loamy fine sand. They are alkaline in soil reaction and may be slightly saline.

The second important group of soils in this mapping unit consists of the Alluvial soils belonging to coarse and fine loamy families. They differ from the Low-Humic Gley soils in being of somewhat coarser texture, of more massive structure and in lacking strongly gleyed horizons in the upper metre of depth.

The most important inclusions of this mapping unit are the Saline soils, belonging to silty and fine loamy families. These soils are in areas of reclaimed tidelands where adequate leaching has not been completed. They differ from the Low-Humic Gley soils only in having more alkaline reaction and in having sufficient salts to influence crop yields.

The Acid Sulphate soils are of very limited extent, the only recognized areas being near Gimhae on the delta of Nagdong river. They belong to fine loamy and clayey

families. The surface soils, to a depth of about 15 cm, range in colour from olive gray to grayish brown with dark brown or yellowish brown mottles. They are silt loam to silty clay loam in texture and strongly acid in reaction. The subsoils, with a depth of about 50 cm, are dark grayish brown to dark gray mottled with brown to yellowish red silty clay and silty clay loam, with subangular or prismatic structure and strong acid soil reaction. When moist they have a sulphurous odour. The substrata are deep, dark gray and gray silty clay, silty clay loam and silt loam with massive structure.

4.2.3.3 Variation in the mapping unit

The larger areas of the Fm mapping unit are mainly on the west and south coastal plains in the vicinities of Munsan, Pyeongtaeg, Seosan, Geumsan and Gimhae. In other places they appear as scattered small areas. The soils in the western and southern coastal areas are more developed and have finer textures than those in the east coastal areas. Saline soils are adjacent to the coastline.

4.2.3.4 Present land use

Paddy rice is usually cultivated with barley grown to some extent as a winter crop in the southern and southwestern coastal plains. Vegetables and other upland crops are seldom grown.

4.2.3.5 Land use, management and recommendation

The soils of this mapping unit are chiefly in paddy land capability Classes I and II and upland capability Classes III and IV. A few, the Saline and Acid Sulphate soils, are in paddy land Class III. Most of the soils are well suited to paddy, giving moderate to very high yields of rice with proper management. They are generally of limited suitability for upland crops because of wetness. However, with improved drainage and careful water management they can be used for other crops. In general the soils of the Fm unit are among the best in Korea for intensive agricultural development.

4.3 SOILS OF THE INLAND ALLUVIAL PLAINS AND VALLEYS

These soils in the inland alluvial plains and valleys have developed on Recent deposits of continental origin. The most extensive and continuous areas are in the lower Nagdong river basin, in the vicinities of Daegu and Milyang, and also along the lower Yeongsan river near Gwangju. In the middle course of the other main rivers and tributaries these soils occur as discontinuous and isolated tracts. They are also in relatively narrow areas in the valleys within the hills and mountains.

These soils are under intensive agricultural use, dominantly in rice paddy. In some areas barley is grown in the winter. The mapping unit comprises a wide range of different soils. These are being used under special management including

frequent applications of complete fertilizers and compost. A total of three main mapping units comprises this physiographic group. They are:

Symbol	Mapping Unit and Subunits
Ap	Low-Humic Gley and Alluvial Soils, Alluvial Plains
Af	Alluvial Soils and Riverwash, Floodplains
An	Complex of Soils, Narrow Valleys

4.3.1 Ap Low-Humic Gley and Alluvial Soils, Alluvial Plains

This mapping unit is on the nearly level to gently sloping, broad, alluvial plains. It is an association dominantly of Low-Humic Gley and Alluvial soils, with some Red-Yellow Podzolic soils. Textures are mostly fine loamy and clayey, in places coarse loamy. Most of the land is intensively cultivated in rice paddy. These soils are chiefly in paddy land capability Classes I, II and III, and upland capability Classes III and IV. With exception of areas of Alluvial soils, high yields of rice and barley are obtained. Five main subunits are recognized as components of this mapping unit. These were separately mapped on the field sheets and are reproduced on the semi-detailed map at 1:50 000 scale.

4.3.1.1 Physiography

This mapping unit occupies the inland or continental plains, where Recent and Subrecent alluvial deposits of dominantly fine loamy and clay textures have been formed. Part of the older pediplane system is included in certain areas. The dissection is slight. Relief is low to slightly elevated and the topography is almost flat to gently sloping. The dominant slopes are generally less than 7 percent, somewhat greater in small areas of the rolling pediplane. Runoff is slow to medium.

4.3.1.2 Soils

This is an association predominantly of Low-Humic Gley soils (more than 60 percent) and Alluvial soils. Red-Yellow Podzolic soils are minor components (about 10 percent). These are moderately well to poorly drained, sometimes well drained, with fine loamy and clayey textures. The most extensive in the mapping unit are Low-Humic Gley, belonging to fine loamy and clayey families. Their surface horizons range from dark gray to grayish brown with dark yellowish brown mottles. In texture they are sandy loam to clay loam; in soil reaction, slightly acid. The subsoils, extending to depth of one metre or less, are gray to dark gray with dark yellowish brown mottles. They are silty clay, clay loam, sandy clay loam and silty clay loam, with a weak to moderate subangular blocky structure. Silty and coarse clayey cutans are common on ped faces.

Soil reaction is slightly to moderately acid. The substrata are deep, dark gray to gray or greenish gray stratified alluvial materials ranging in texture dominantly from sandy loam to loamy sand. They are acid in soil reaction. The second important group of soils in this mapping unit are the Alluvial soils of coarse loamy and fine loamy families. They differ from the Low-Humic Gley soils in being somewhat coarser, having more massive structure and containing gravel and cobbles in places.

The most important inclusions in this mapping unit are the Red-Yellow Podzolic soils, of fine loamy and clayey families. These are on transitional areas between the alluvial plains and the rolling elevations of the older pediplane, where the mantle of clayey alluvium and pedimentary deposits was relatively deep. Their surface soils range in colour from gray or grayish brown to reddish brown or yellowish red with yellowish brown mottles. They are silt loam in texture and acid in reaction. The subsoils, with a depth of more than 1 m, are yellowish brown with mottles of dark gray to grayish brown silty clay loam, clay loam and silty clay, with an angular or subangular blocky structure. They are acid in reaction and usually have continuous clay cutans.

Some areas have a fragipan-like layer with a platy structure. The substrata are variable in colour, chiefly yellowish red or yellowish brown, fine loamy or clayey, old deep alluvial and pedimentary materials. Gravel, cobbles and stones may be in the lower part. Bedrock is commonly deeply weathered.

4.3.1.3 Variation in the mapping unit

The larger, most typical areas of the Ap mapping unit are mainly in the western and southern parts, especially in the basins of the Nagdong, Han, Geum and Yeongsan rivers. In other places they appear with more variations of textures and degree of development. In Gangweon Do, the northeastern province, these soils are less developed and shallower than the equivalent soils of the southern regions. Inland areas show strong relationship with the regional geology. Thus in areas of crystalline schist these soils have a high amount of mica, and in the granitic areas they are coarser in texture.

4.3.1.4 Present land use

Most of this land is cultivated to paddy rice. Barley is used to some extent as a winter crop in Gyeongsang Do, Jeonla Do, and the southern part of Chungcheong Do. Although not commonly used for vegetables and other upland crops, small areas of a variety of crops are grown, including cabbage, radish, rocamboles, onion, potato, sweet potato, tobacco, corn, wheat, and soybean. Orchard crops are also grown in some of the higher areas.

4.3.1.5 Land use, management and recommendation

The soils of this mapping unit are chiefly in paddy land capability Classes I and II, and upland capability Classes III and IV. A small percentage of Red-Yellow Podzolic soils are in paddy land Classes II and III and upland Classes II and III. Most of the soils are well suited to paddy and give moderate to very high yields of rice. With exception of the well drained Red-Yellow Podzolic and Alluvial soils, they are generally of limited suitability for upland crops because of their present drainage conditions. They are also of limited suitability for winter barley in northern areas, as in Gyeonggi Do and Gangweon Do, because of the short growing season. Improved drainage with careful water management provides adequate conditions to be used for winter crops in the west and southern regions. Generally the soils of the Ap unit are among the best in Korea for intensive agricultural development.

4.3.2 Af Alluvial Soils and Riverwash, Floodplains

This mapping unit is on the nearly level to gently sloping floodplains, including the Recent river levees and riverwash along the channels.

It is an association dominantly of Alluvial soils comprising riverwash (dry sands and gravels) and a few Low-Humic Gley soils. Textures are mostly coarse loamy and sandy, sometimes with gravel, cobbles and stones. More than 30 percent is intensively cultivated in rice paddy; less than 40 percent is in upland crop cultivation, with vegetables and orchards.

The land used for rice is mostly in paddy suitability groups III and IV. Most of the rest is not suitable for paddy and is in upland capability Classes IV to VIII. With the exception of some areas of riverwash, rice is cultivated in wet areas, while upland crops are used in higher areas with better drainage. Four main subunits are recognized as components of this mapping unit.

4.3.2.1 Physiography

This mapping unit is on inland floodplains and river levees where Recent alluvium and riverwash, dominantly of coarse texture, has been deposited along the main rivers and streams. Near the mountains, torrential flows have deposited gravel and cobbles in many places. This land stands at the present base level, with no dissection. Relief is low to slightly elevated and the topography is almost flat to gently sloping. The dominant slopes are less than 3 percent. Permeability is very rapid.

4.3.2.2 Soils

This is an association of riverwash with Alluvial soils (more than 40 percent) developed in very Recent alluvial deposits and riverwash (dry sands and some gravels). Low-Humic Gley soils are minor components (less than 10 percent). Soils of this unit are mostly excessively drained to moderately well drained, with some poorly drained areas. Textures are coarse loamy to sandy. Riverwash is dominant in certain parts. Surface layers range from yellowish brown to brown. They are sandy loam to sand in texture and slightly acid to acid in soil reaction. The substrata, extending to a depth of 2 or more metres, are brown, yellowish brown and dark yellowish brown, with dark yellowish brown mottles. They are sandy loam, loamy sand or sand in texture, and have gravel, cobbles and stones in the substrata in places near the mountains.

The soil reaction is slightly acid. The Alluvial soils, in coarse loamy to sandy families, are an important component of this mapping unit. These soils are on Recent alluvium and slightly elevated river levees. They differ from the riverwash in being somewhat finer and more poorly drained, and in having incipient structure. The most important inclusions of this mapping unit are Low-Humic Gley soils, in coarse loamy and sandy families. These are on areas of floodplains, with nearly level to gentle slopes, where the mantle of alluvial sandy deposits is relatively deep. Their surface soils range in colour from gray to very dark gray with sometimes yellowish brown or yellowish red mottles. They are sandy loam, loamy sand to sand in texture and slightly acid in reaction.

The subsoils, with a depth of more than 1 m, are olive or gray to bluish gray, sometimes mottled with yellowish brown, sandy loam and loamy sand with massive structure. The soil reaction is acid. Occasionally they have gravel and cobbles throughout the profile.

4.3.2.3 Variation in the mapping unit

The larger areas of the Af mapping unit are mainly in the western and southern parts of Korea, especially in the drainage basins of the Nagdong, Han, Yeongsan and Geum rivers. In many other places they appear as small widely distributed areas. The poorly drained, coarse loamy Low-Humic Gley soils may be on both sides of the river channels.

4.3.2.4 Present land use

With exception of the Recent riverwash, this land is used for vegetables and upland crops, such as cabbages, radish, soybean, melons, tobacco, Chinese onion, wheat, and orchard. About 30 percent is in paddy. Barley is used to some extent as a winter crop in Gyeongsang Do, Jeonla Do and the southern part of Chungcheong Do. Along the lower river courses these areas are highly productive under very intensive cultivation.

4.3.2.5 Land use, management and recommendation

The soils of this mapping unit are chiefly in upland capability Classes IV and VIII and are not suitable for rice paddy.

The poorly drained to imperfectly drained Low-Humic Gley soils and Alluvial soils are in paddy land Classes III or IV. The majority of the soils of this mapping unit are not suited to paddy fields, being low in water holding capacity, very rapid in permeability and subjected to periodic floodings. They are better suited to vegetables than grain crops. A few areas of imperfectly drained, alluvial soils can be used for winter crops such as barley.

4.3.3 An Complex of Soils, Narrow Valleys

This mapping unit is on nearly level to sloping narrow floodplains and alluvial-colluvial slopes, within hilly and mountainous lands in areas of undifferentiated materials. It is an association of Alluvial soils and Low-Humic Gley soils with a complex of Regosols, Rego-Lithosols, riverwash, Lithosols, Red-Yellow Podzolic soils and a few areas of Acid Brown Forest soils. Textures are coarse loamy to clayey but dominantly are coarse loamy. Gravel and cobbles are common. An estimated 50 percent of this land is in rice paddy, and about 30 percent is intensively cultivated in upland crops. The remainder is in forest and scattered natural vegetation. These soils are chiefly in paddy land capability Classes IVw to IIIw and upland capability Class IIIw. Four main subunits were recognized as components of this mapping unit.

4.3.3.1 Physiography

This mapping unit includes the somewhat dense network of narrow valleys and alluvial-colluvial slopes within hilly and mountainous lands, where Recent alluvium has been derived from undifferentiated materials. There is slight to moderate dissection and the topography is gently sloping to sloping. Although these valleys are at the present time under active erosion, the relief is variable according to the present stage of geological erosion. Lengthwise the relief shows areas of moderately steep slopes at the valley heads, turning into gently sloping and nearly level at

several local base levels. Crosswise the relief varies, showing concave, moderately steep slopes at the foot of the hills and mountains related to Recent alluvium-colluvium accumulations. In the local base levels small alluvial plains appear. Here the relief is nearly level to gently sloping, ending sharply with hilly slopes in the side edges of the valleys. Dominant slopes range from 2 to 20 percent. In the narrowest places at the headwaters, the local conditions of relief and soils are mostly man-made. Runoff is medium to very rapid.

4.3.3.2 Soils

This is an association predominantly of Alluvial soils (more than 50 percent) and Low-Humic Gley soils (less than 30 percent) developed in Recent alluvial deposits. A complex of Regosols, riverwash, Rego-Lithosols, Red-Yellow Podzolic soils and Acid Brown Forest soils is a minor component. In this unit soils are mostly moderately well to imperfectly drained, but include areas that are well drained or poorly drained Textures are mostly coarse loamy to fine loamy. Cobbles and gravel are common. The most extensive in this mapping unit are Alluvial soils, dominantly in gravelly or cobbly coarse loamy and fine loamy families. The surface horizons range from dark grayish brown to gray, dark brown to yellowish brown in better drained areas. They are usually gravelly or cobbly sandy loam, loamy sand, loam, clay loam or sandy clay loam in texture, and slightly acid to strongly acid in reaction. The substrata, extending to a depth of 40 to 100 cm, are grayish brown to gray, in places brown or dark brown to dark yellowish brown; with yellowish brown, strong brown and yellowish red mottles. They are sandy loams, loamy sands and loams with a massive structure. The substrata commonly are more gravelly and cobbly than surface layers and are slightly acid to strongly acid in reaction.

The second important group of soils in this mapping unit includes the Low-Humic Gley soils in coarse loamy to fine loamy families. They differ from the Alluvial soils in having a finer texture, a more developed blocky and prismatic structure, and gley horizons. The most important inclusion in this mapping unit is a complex of Regosols, riverwash, Rego-Lithosols, Lithosols, Red-Yellow Podzolic soils, and Acid Brown Forest soils.

4.3.3.3 Variation in the mapping unit

This An mapping unit appears as an intricate network within the mainland. The soils in the eastern mountains, in Gangweon Do, are less developed with coarser texture, better drainage and steeper slopes, than soils of western and southern regions in a corresponding position. Areas of Acid Brown Forest soils are in the vicinity of Daegwan plateau, in Gangweon Do. These appear as scattered small areas within the mountains at altitudes of more than 500 m.

4.3.3.4 Present land use

An estimated 50 percent of this land is cultivated to paddy rice. Barley is used to some extent as a winter crop in regions south of the 37° parallel. More than 30 percent of the area is used for upland crops such as barley, wheat, millet, soybean, tobacco, sweet potato, hop, red pepper, corn, and potato. Natural vegetation comprises varieties of grasses and shrubs; sometimes scattered pine trees appear at the headwaters and at the foot of the hills and mountains. Particularly in the Daegwan plateau, Gangweon Do, these soils are used for special upland crops such as radish, hop, corn, and potato, which are well adapted to the climate at high altitudes.

4.3.3.5 Land use, management and recommendation

The soils of this mapping unit are chiefly in paddy land capability Classes IIIw to IVw and upland capability Class IIIw. Some areas with steep slopes are in paddy land Class IVe, and a few areas of Low-Humic Gley and Alluvial soils are placed in paddy land Class IIe. Most produce only moderate to low yields of rice. An estimated 25 percent of the land is suitable for rice paddy. Upland crops are cultivated in about 30 percent. Double cropping is recommended in areas with imperfectly to moderately well drained soils. In general the soils of the An unit are better suited for upland crops than paddy rice. Particularly in the eastern regions of Gangweon Do, these soils could produce higher yields of corn, potato, radish, sugar beet and hops.

4.4 SOILS OF THE DISSECTED OLDER PEDIPLANE SYSTEMS

This physiographic group comprises the soils which occur over the rolling older pediplanes of Korea. It corresponds to a quite extensive rolling land, elevated from the present base level, and covers almost continuously areas near the coast as well as inland in the major river basins. It includes the most important upland mapping units for agricultural development in Korea.

These soils are acid in reaction, and low in plant nutrients, but with adequate management, including frequent additions of complete fertilizers and organic matter, they can produce moderate to high yields of a wide variety of crops. Special attention must be paid to soil erosion. Therefore bench terracing and contour cultivation are recommended. In the mapping units where Lithosols are dominant, reforestation is necessary. This group comprises a total of five main mapping units. They are:

Symbol	Mapping Unit and Subunits
Ra	Red-Yellow Podzolic Soils, Siliceous Crystalline Materials
Re	Lithosols, Severely Eroded, Siliceous Crystalline Materials
Rl	Red-Yellow Podzolic Soils and Lithosols, Calcareous Materials
Rs	Lithosols, Regosols and Red-Yellow Podzolic Soils, Sedimentary Materials
Rv	Red-Yellow Podzolic and Reddish Brown Lateritic soils, Siliceomafic Crystalline Materials

4.4.1 Ra Red-Yellow Podzolic Soils, Siliceous Crystalline Materials

This mapping unit is on undulating to rolling areas of the older pediplane system with alluvial-pedimentary underlaid by residual siliceous crystalline materials, and on the older sloping pediments at the mountain foot slopes covered by outwash pedimentary derived from siliceous crystalline materials. It is an association predominantly of Red-Yellow Podzolic soils, with some of Lithosols and an interfingering network of Low-Humic Gley and Alluvial soils. Textures are mostly fine loamy to clayey. The land is generally used for upland crops, with rice paddy

being grown in some places. The soils are chiefly in upland capability Classes III and IV, and where paddies can be made, paddy capability Classes III and IV. With exception of the areas of Lithosols, with proper management, high yields should be obtained from a wide variety of crops. Five main subunits are recognized as components of this mapping unit.

4.4.1.1 Physiography

This mapping unit is in the rolling to undulating areas of the older pediplane system, where the mantle of fine loamy or clayey residual and alluvial pedimentary materials is moderately deep to deep. Dissection is predominantly moderate to strong. Topography is principally undulating to rolling with some more steeply sloping areas. Dominant slopes range from 5 to 25 percent. In certain areas there is a network of interfingered dendritic narrow valleys within the rolling pediplane system. These valleys have a concave shape. The steepest areas are at the edges and heads of the valleys. The geology comprises granites, gneisses and schists. The materials which occur in these valleys are predominantly Recent alluvium or outwash, originated from these rocks or undifferentiated materials. In a few areas there are dissected and elevated tracts of older sloping pediments. There the relief is normal to excessive. Topography is sloping, sometimes undulating and moderately steep, with insertion of relatively small channels or drainage ways and swales. The dominant slopes range from 15 to 30 percent.

4.4.1.2 Soils

This is an association predominantly of well drained, clayey to fine loamy Red-Yellow Podzolic soils (more than 50 percent of total area) with some Lithosols (about 25 percent). Included are Low-Humic Gley and Alluvial soils (about 20 percent), Regosols and Rego-Lithosols (about 5 percent). Red-Yellow Podzolic soils, the most extensive soils in this unit, are developed mostly in residuum and old alluvium. In some places the parent material is entirely weathered like saprolite. Erosion has been moderate to severe.

The colour of the existing surface horizons ranges from dark brown or dark yellowish brown to yellowish red in the upland areas, while in the paddy fields the surface colour is grayish because of the the effect of reduction processes. Surface textures range from fine loamy to fine silty. Reaction is acid. Subsoils, extending to a depth of 80 cm or more, are yellowish brown to yellowish red or red silty clay loams, clay loams, silty clays or clays, with a moderate to strong subangular and angular blocky structure, and a usually continuous clay cutan. Soil reaction is acid. The substrata are variable and strongly weathered siliceous crystalline rocks or old alluvial materials. Gravel, cobbles and stones are usually found in the lower part of the soil but may appear throughout the profile. The Lithosols are of minor importance. They are generally over deeply weathered rocks, on the rolling pediplane.

The erosion of these soils has been strong to severe. They have a light yellowish brown to dark yellowish brown to red loamy surface, commonly overlying a yellowish brown or brown to pale brown or strong brown coarse loamy substratum. The moderately well to imperfectly drained Low-Humic Gley and Alluvial soils are in narrow valleys and swales and represent the second important inclusion in this mapping unit. They differ from the Red-Yellow Podzolic soils in being imperfectly drained, in having mottled subsoils dominated by near neutral grays and grayish browns. The surface of the Low-Humic Gley soils is gray to dark grayish brown or dark yellowish brown with

fine loamy texture, while their subsoils are centred on gray to very dark gray with mottles, and are fine loamy to clayey in texture. Clay movement is indicated in the B horizon. The Alluvial soils tend to be somewhat coarser. They are under rice paddy cultivation. There are a few areas of gently sloping to moderately steep, well drained, dark brown or yellowish brown loamy Regosols and Rego-Lithosols on hill and mountain foot slopes. Many soils in this unit are intergrades between the great soil groups mentioned above.

4.4.1.3 Variation in the mapping unit

These soils are the most extensive within the rolling older pediplane system, and are concentrated mostly in Chungcheong Nam Do, Gyeonggi Do, and the western part of Jeonla Do. In other places they appear as scattered small areas. In Jeonla Do, in the southwestern region of Korea, they appear to be more developed, deeper less eroded, and redder than their equivalent in other regions.

4.4.1.4 Present land use

Most of the land is under cultivation. Where water is available for irrigation, paddy rice and barley in a double crop system are the principal crops. The higher areas, which cannot be irrigated, are used for the production of crops such as barley, wheat, bean, potatoes, and tobacco. Areas under perennial cover support pines, acacia, poplar, shrubs and grasses.

4.4.1.5 Land use, management and recommendation

The soils of this mapping unit are chiefly in upland capability Classes II to IV. Less than 40 percent of the unit is suitable only for forest. An estimated 20 percent of the land is in paddy land capability Classes II and III. With good management, high yields could be obtained on these soils from a wide variety of crops. Some percentage of present forest land could be converted into cultivation by practices such as contour cultivation terracing and the protection of waterways.

4.4.2 Re Lithosols, Severely Eroded, Siliceous Crystalline Materials

This mapping unit is on severely eroded and gullied areas of the oldest rolling pediplane system, underlaid by siliceous crystalline rocks. It is an association predominantly of Lithosols with some Red-Yellow Podzolic soils and an interfingering network of Low-Humic Gley and Alluvial soils. Textures are mostly coarse loamy. Much of the land supports a sparse cover of forest and weedy vegetation. Scattered areas are in upland crops. Some land is entirely bare. A few areas have been reforested recently. The soils are chiefly in upland capability Classes VI and VII, with a few small tracts of Classes III and IV. For the most part this land is not suitable for agriculture, but only for forest and grass. Reforestation is urgently required. Two main subunits which were separately mapped on the field sheets at 1:50 000 scale, are recognized as components of this mapping unit.

4.4.2.1 Physiography

This mapping unit is on strongly dissected, recently denuded and eroded areas of the older pediplane system with mantles of saprolite of varying thickness. Gully erosion is active. The underlying rock is dominantly granitic. Dissection is predominantly strong and in places extremely active. Relief is moderate. Topography is rolling with small steeply sloping areas. Dominant slopes range from 15 to 30 percent or more. Runoff is very rapid. In some areas there is a network of interfingered dendritic narrow valleys within the rolling pediplane system. The slope in these valleys range from 2 to 10 percent and are concave in shape. The materials in these valleys are predominantly Recent alluvium or outwash, mostly from siliceous crystalline rocks.

4.4.2.2 Soils

This is an association predominantly of excessively drained coarse loamy Lithosols over strongly weathered granitic bedrocks. These soils occupy more than 75 percent of the total area in the mapping unit. Included are Red-Yellow Podzolic soils (less than 15 percent) and Alluvial and Low-Humic Gley soils (less than 10 percent). Lithosols, the most extensive in the unit, are over weathered granite, gneiss and schists. Erosion has been strong to severe, sometimes extreme. They have light yellowish brown to dark yellowish brown sandy to loamy surface layers commonly overlying yellowish brown or brown to pale brown or strong brown sandy, usually coarse substrata, of strongly weathered siliceous crystalline rocks. The most important inclusion in this mapping unit is moderately well to imperfectly drained Alluvial and Low-Humic Gley soils in the narrow valleys and swales. Their surfaces are gray to dark grayish brown or dark yellowish brown, sandy loams and loams. The substrata are grayish with dark yellowish brown mottles, coarse loamy in texture, with some gravel. This land is mostly under rice paddy cultivation.

The second important inclusion in this mapping unit is made up of Red-Yellow Podzolic soils on relatively smooth slopes. These have grayish brown or strong brown, fine loamy surface layers, overlying strong brown to yellowish red fine loamy subsoils, with a moderate subangular blocky structure. Regosolic phases occur in transitional areas in the lower part of the rolling relief. They are dominantly well to moderately well drained, coarse loamy soils.

4.4.2.3 Variation in this mapping unit

Typical areas are concentrated mostly in the vicinities of Yeongju, Gyeongsangbug Do, and near the coast, in Chuncheon, in Gangweon Do; and in the vicinity of Yicheon in Gyeonggi Do. In the last, they appear as more scattered than in other provinces. Variations in the mapping unit are due primarily to the kinds of rocks, their texture and degree of weathering. In areas where crystalline schist occurs, these soils have silty fine textures with abundant mica flakes. In the Jeonla Do and Yeongju, Gyeongbug Do areas, erosion seems to be more recent and the soils are dominantly Lithosols.

4.4.2.4 Present land use

Most of the land, when not bare, is under sparse natural vegetation consisting of pine trees, acacias, poplars, shrubs and grasses. Some has been reforested recently to protect the soils. Some small areas are used for agriculture with the cultivation of upland crops and paddy rice, the latter being grown in swales and bottom slopes.

4.4.2.5 Land use and management recommendation

These soils are chiefly in upland capability Class VII. Most are not suitable for agriculture, and have only a limited suitability for forest because of advanced erosion, with resulting low productivity. The use of soil conservation practices should be followed to stop erosion, which is extremely rapid in many places. In some extremely eroded areas reforestation is urgently needed.

4.4.3 R1 Red-Yellow Podzolic Soils and Lithosols, Calcareous Materials

This mapping unit is on rolling areas of the older pediplane system underlaid by residual materials derived from limestone, and older pedimentary and colluvial materials at the mountain foot slopes. It is an association dominantly of Red-Yellow Podzolic soils and Lithosols with inclusions of Rego-Lithosols, Reddish Brown Lateritic soils, Low-Humic Gley, and Alluvial soils.

Much of the land is used for upland crops, in a few places rice paddy, and the remaining part is under natural vegetation. The soils are chiefly in upland capability Classes IV to VI with smaller areas of Class III. It is mostly not suited for paddy but a few areas are in paddy suitability groups III and IV. Excluding the severely eroded areas, relatively high yields should be obtained from a wide variety of crops with proper management. Three main subunits are recognized as components of this mapping unit.

4.4.3.1 Physiography

This mapping unit is in the moderately to strongly dissected undulating to rolling pediplane system where the rock is composed dominantly of limestone. Dissection is predominantly strong to moderate. Relief is normal to excessive, with some karst relief in places. Topography is dominantly rolling with small areas more steeply sloping. Dominant slopes range from 15 to 30 percent and in places to 35 percent. Runoff is very rapid. In some areas there are older rolling dissected pediment slopes at the mountain foot with soils that are relatively shallow, fine loamy to clayey in texture, and have considerable amounts of gravel and cobbles. Dissection is predominantly slight or moderate. Relief is normal to excessive. Topography is sloping, sometimes undulating and moderately steep, with insertion of relatively small channels or drainage ways and swales. The dominant slopes range from 15 to 35 percent. In a few areas there is an interfingered, dendritic narrow valley network within the rolling pediplane system. Relief in these valleys shows a concave shape. Topography is nearly level to gently sloping; the steepest areas are located at the edges and heads of the valleys. Slopes are rolling.

4.4.3.2 Soils

This is an association predominantly of Reddish Brown Lateritic soils (more than 40 percent) and Lithosols (more than 30 percent) developed on rolling areas of the older pediplane system. Areas of Rego-Lithosols, Red-Yellow Podzolic soils and Low-Humic Gley or Alluvial soils are also included. The most extensive Reddish Brown Lateritic soils are clayey in texture and have developed on older rolling pediplanes and older rolling pediment slopes. They are dominantly well drained. Their surface colours range from yellowish red to dark reddish brown and textures from silty clay loam to clay. They commonly have a granular structure. The subsoils are relatively

deep, dark red clayey in texture, having a strong or moderate angular blocky structure with continuous thick clay cutans. The substrata are slightly to strongly weathered limestone, or hard metamorphic limestone with clay accumulation in places along the cracks.

The second important group of soils in this mapping unit includes Lithosols of fine loamy textures. They have developed over weathered limestone on the middle and higher parts of the slopes. These have yellowish brown fine loamy surface layers commonly overlying light yellowish brown to pale brown fine loamy substrata with slightly to moderately weathered gravel and cobbles.

The important inclusions of soils in this mapping unit are Rego-Lithosols and Red-Yellow Podzolic soils developed on older rolling pediment slopes or in the transitional areas between the rolling relief and colluvial pediments in the mountain foot slopes. The erosion of the Rego-Lithosols has been moderate. They have dark brown to dark yellowish brown, fine loamy surface layers and yellowish brown to brown, mostly gravelly to cobbly loamy substrata. They are somewhat excessively to well drained.

The surface colours of the Red-Yellow Podzolic soils are centred on yellowish brown. Textures are clayey to fine loamy. Their subsoils are yellowish brown, strong brown, yellowish red or red, silty clay loam or silty clay with a moderate subangular blocky structure and continuous clay cutans. Substrata are slightly to moderately weathered limestone.

Small areas of dominantly moderately well to imperfectly drained, fine loamy textured Low-Humic Gley and Alluvial soils are included. In general these are neutral or nearly neutral in reaction.

4.4.3.3 Variation in this mapping unit

The larger areas of the R1 mapping unit are mainly on the rolling areas of the Joseon system in the southern region of Gangweon Do. In other places they appear as scattered small areas. At high altitudes some tracts of Acid Brown Forest soils have formed on rolling areas and pediment slopes.

4.4.3.4 Present land use

Most land is covered by natural forest such as pine trees, acacias, poplars and shrubs. About 40 percent of this mapping unit is under cultivation, being used for the production of upland crops such as barley, wheat, millet, potato, soybean, and corn.

4.4.3.5 Land use, management and recommendation

The soils of this mapping unit are chiefly in upland capability Classes IV to VII, and are not suitable for paddy fields. A few small areas of Low-Humic Gley and Alluvial soils are in paddy land Classes II, III and IV. More than 50 percent of the mapping unit is suitable only for perennial vegetation such as forest. The use of soil conservation practices such as contour cultivation, terracing and the protection of water ways, are advisable to counteract the hazards of erosion and runoff. Some soils are suitable for intensive agricultural development, despite being low in organic matter and in natural fertility. Drainage is adequate and with good management a high response to crops can be expected.

4.4.4 Rs Lithosols, Regosols and Red-Yellow Podzolic Soils, Sedimentary Materials

This mapping unit is on rolling areas of the older pediplane system underlaid by residual materials derived from sedimentary rocks, and on the older, sloping pediments in mountain foot slope position mantled by pedimentary materials, derived from the same kinds of rocks. It is an association dominantly of Lithosols and Red-Yellow Podzolic soils, with some areas of Low-Humic Gley, Alluvial soils and Rego-Lithosols. Textures are mostly fine loamy to clayey.

A considerable amount of land is used for upland crops, and in some places paddy rice is grown, but most is in native vegetation. The soils are chiefly in upland capability Classes VI and VII, with small areas in Classes III and IV. Where the latter classes occur, with proper management, relatively good yields of a wide variety of crops should be obtained. Four main subunits were recognized as components of this mapping unit.

4.4.4.1 Physiography

This mapping unit is on moderately to strongly dissected and denuded areas of the older pediplane system, where the bedrock is dominantly composed of hard shale interbedded with sandstones and conglomerates. Metamorphism has taken place to some extent in these formations, bringing these rocks closer to meta-sediments. Dissection is predominantly strong, but in places moderate. Relief is moderate. Topography is rolling with small areas more steeply sloping. Dominant slopes range from 15 to 30 percent sometimes up to 35 percent. Runoff is very rapid. In many areas there is a concordance of drainage divides clearly marking the original surface of the pediplanes. This mapping unit is interfingered by an intricate network of swales and relatively narrow valleys showing a subparallel to dendritic pattern. The relief in these valleys is concave and slopes are nearly level to gently sloping or somewhat steeper at the edges and heads of the valleys. The materials in these valleys is dominantly relatively shallow Recent alluvium derived from sedimentary and undifferentiated rocks. In a few areas, moderately steep dissected colluvial, or debris slopes at the foot of the mountain, have been included.

4.4.4.2 Soils

This is an association predominantly of Lithosols (60 - 70 percent) and Red-Yellow Podzolic soils (20 - 30 percent) developed on rolling areas of the older pediplane system. Low-Humic Gley soils (5 - 10 percent), Alluvial soils (5 - 10 percent) and Regosols (less than 5 percent) are included in this mapping unit.

The most extensive soils in the mapping unit are Lithosols belonging to fine loamy families. They are underlaid at shallow depths by slightly to moderately weathered rocks. In a few places these soils show a weakly developed B horizon. Their surface horizons range rather widely in colour from light brownish gray or brown to dark brown. Textures are mostly gravelly or rocky silt loam and clay loam. The substrata are comprised of slightly to moderately weathered shales, sandstones and conglomerates of different kinds. Their colours include yellowish brown, olive brown, grayish brown and red. Textures are mostly fine loamy with abundant moderately to slightly weathered gravel. Rock outcrops are common. Erosion has been moderate to severe.

The second important group are Red-Yellow Podzolic soils in clayey and fine loamy families. Erosion of these has been moderate to severe. Surface colours range around grayish brown and their textures are mostly silt loam and silty clay loam.

The subsoils, extending to a depth of about 70 cm, are strong brown or yellowish red silty clay loam or silty clay, with a moderate subangular blocky structure and usually continuous clay cutans. The underlying horizons are moderately deep, fine loamy and clayey residual materials over slightly to moderately weathered sedimentary rocks.

The most important inclusions in this mapping unit are Low-Humic Gley soils of dominantly silty, fine loamy and clayey families. Their surface colours vary around grayish brown, while the subsoil colours range from very dark gray to gray with olive mottles. The textures vary from loam to clay loam and are usually silty. The depth ranges from moderately deep to very deep. Clay movement is apparent in the B horizon. Drainage is imperfect to poor.

The second most important inclusion in this mapping unit is made up of Alluvial soils. They are moderately well to imperfectly drained, loamy in texture, and in many places contain gravel and cobbles. Commonly as a result of irrigation, the surface soils are gray. The substrata are a grayish brown, sometimes mottled, loamy material with or without gravel and cobbles.

A few areas of well drained, coarse loamy Regosols are also included in this unit. Erosion of these soils has been moderate. Their surface colours range from dark brown to dark yellowish brown. The substrata, extending to a depth of 100 cm or more are yellowish brown to brown, usually gravelly to cobbly coarse loamy materials.

4.4.4.3 Variation in this mapping unit

In the vicinity of Daegu city, Gyeongsang Bug Do, the rolling relief areas are mostly Lithosols, associated with small areas of Red-Yellow Podzolic or other soils. In areas dominated by sandstones, as in the vicinity of Nagdong Myeon, the textures are consequently sandier than elsewhere.

4.4.4.4 Present land use

Most of the land is covered by natural vegetation dominated by grass and shrubs. In recent years trees have been planted in some places to control erosion. Land under cultivation, less than 25 percent of the unit, is used for the paddy rice and upland crops such as barley, wheat, millet, soybean, corn, tobacco, sweet potatoes, potatoes, and red peppers.

4.4.4.5 Land use and management recommendation

The soils are chiefly in upland capability Classes III to VI, and are not generally suitable for paddy fields. Areas of Low-Humic Gley and Alluvial soils are in paddy land Classes II, III and IV. The major portion of the unit is suitable only for perennial vegetation such as forest and grass. Some soils are suitable for intensive agricultural development. Despite being low in organic matter and in natural fertility they have adequate drainage and give a high response to good management. The use of conservation practices, such as contour cultivation, terracing and the protection of waterways, is advisable to counteract the hazards of erosion and runoff.

4.4.5 Rv Red-Yellow Podzolic and Reddish Brown Lateritic Soils, Siliceomafic Crystalline Materials

This mapping unit is on the undulating to rolling areas of the older pediplane system with alluvial-pedimentary materials underlaid by siliceomafic crystalline materials, and on the older sloping pediments at mountain foot slopes. It is an association predominantly of Red-Yellow Podzolic and Reddish Brown Lateritic soils, with some Lithosols and an interfingering network of Low-Humic Gley and Alluvial soils in small valleys. Textures are mostly fine loamy to clayey. Most of the land is under natural vegetation, but some is used for upland crops and in places, rice paddy. The soils are chiefly in upland capability Classes III and IV, and those areas on which paddies can be made are in paddy capability Classes III and IV. Excluding the areas of Lithosols, good yields should be obtained on these soils from a wide variety of crops with proper management. Five main subunits were recognized as components of this mapping unit.

4.4.5.1 Physiography

This mapping unit is in moderately to strongly dissected and denudated areas of the older pediplane system, where there is a moderately deep to deep mantle of fine loamy to clayey residual and pedimentary materials. Dissection is predominantly moderate to strong. Relief is subnormal to normal. Topography is generally rolling with some undulating and more steeply sloping areas. Dominant slopes range from 15 to 25 percent, in places to 30 percent. There is an interfingered dendritic pattern of narrow valleys within the rolling slopes. These valleys are concave in shape and have nearly level to gently sloping topography. Near the mountains the dissected and elevated areas of sloping pediments and debris are included in this mapping unit. On these areas relief is normal to excessive and topography is sloping to moderately steep with insertion of relatively small channels or drainage ways and swales. The geology consists of andesite porphyries, gabbro, basalt, etc.

4.4.5.2 Soils

This is an association predominantly of well drained, clayey to fine loamy Red-Yellow Podzolic and Reddish Brown Lateritic soils (more than 50 percent of total area), with some Lithosols (about 25 percent). Low-Humic Gley and Alluvial soils (about 20 percent), Regosols and Rego-Lithosols (about 5 percent) are included. Red-Yellow Podzolic and Reddish Brown Lateritic soils, the most extensive in this mapping unit, are developed mostly in residual materials with some areas on thin old alluvial-pedimentary mantle. Erosion has been moderate to severe, and surface colours range from brownish yellow to brown and dark brown, the latter more common in the Reddish Brown Lateritic soils. In cultivated areas the colours range from yellowish brown to yellowish red. Textures vary from loams to clay loams. Their subsoils extend to a depth of 100 cm or more, with the Reddish Brown Lateritic soils the deepest. The colours are yellowish brown to red in the Red-Yellow Podzolic soils, and brown in the Reddish Brown Lateritic soils. Textures are loam, silty clay loam, or silty clay, with a moderate subangular blocky structure and usually with continuous clay cutans. The soil reaction is slightly acid to acid. The substrata are variable strongly to moderately weathered siliceomafic crystalline bedrocks.

Lithosols are of minor importance. The erosion in these tracts has been strong to severe. The Lithosols show a light yellowish brown to dark yellowish brown (red), loamy surface commonly overlying yellowish brown or brown to pale brown or strong

brown coarse loamy substrata. Some areas which might be described as lithic phases of Red-Yellow Podzolic and Reddish Brown Lateritic soils are included as well as intergrades between these great soil groups.

Another inclusion in this unit comprises moderately well to imperfectly drained Low-Humic Gley and Alluvial soils in the narrow valleys and swales. The Low-Humic Gley soils have gray to dark grayish brown or dark yellowish brown surface horizons with a fine loamy texture. Their subsoils are centred on gray to very dark gray mottled colours and fine loamy to clayey textures. The loamy substrata are increasingly gray with depth. The Alluvial soils tend to be somewhat coarser, and are all under rice paddy cultivation. In a few places well drained dark brown to yellowish brown loamy Regosols and Rego-Lithosols occur in gently sloping to moderately steep areas on the hill or mountain footslopes.

4.4.5.3 Variation in the mapping unit

These soils are concentrated mostly in the vicinities of Yeongcheon in Gyeonggi Do, Jaecheon in Chungbug Do, Muan, Boseong, and Haenam in Jeonnam Do, and near Busan. In other places they are widely distributed in small areas. Although dominant soils in the unit are Red-Yellow Podzolic, tracts in the southern provinces also have considerable amounts of Reddish Brown Lateritic soils.

4.4.5.4 Present land use

Most of the land is under natural vegetation of pine trees, acacia, poplar, shrub and grasses. About 40 percent of this mapping unit is in cultivation, growing such upland crops as barley, wheat, millet, potato, bean, corn, and some paddy rice. The soils of this subunit are chiefly in upland capability Classes III, IV, and VI.

4.4.5.5 Land use, management and recommendation

With the exception of areas of basalt along the Imjin river, it appears that about 40 percent of this subunit is suitable only for perennial vegetation. Part of the present land now in natural vegetation could be converted to agriculture. With proper management, good yields of a wide variety of crops should be obtained from capability Classes III and IV.

4.5 SOILS OF THE COASTAL INLAND AND LAVA PLAINS

The soils of this physiographic group are in Jeju Do, which is the largest island in Korea, about 120 km off the continental coast directly south of the south-western end of the peninsula. Formed in volcanic ash, they occupy most of the coastal plains, undulating terraces, and gently sloping intermountain areas excluding the Hala mountain slopes which comprise the highest part and some of the western part of the island.

They are high in humus content because of the large amount of accumulated organic matter, and have a loose, soft, mellow, and dark-coloured surface layer. These soils are strongly acid, and low in natural fertility.

Most tracts on the coastal plains are planted to barley, sweet potato, upland rice, and similar crops. Mandarin orange and pineapple are growing in some parts of the plains in the southern part of the island.

The gently sloping intermountain areas and undulating terraces are usually in grassland or woodland, and some are being used for pasture. This group is considered to offer good opportunity for pasture development.

These soils have formed under nearly uniform climate and in the same parent material, but their characteristics differ from place to place depending on their topography. It is thought that the nature of the soil and the soil fertility depend on the amount of organic matter content. Consequently, this group of soils was divided into the following two main units on the basis of their topography and the content of humus and coarse fragments.

Lp Black and Very Dark Brown Volcanic Ash Soil, Lava Plains.

Lt Very Dark Brown to Black Volcanic Ash Soil, Shallow and Rocky Phase, Lava Terraces.

4.5.1 Lp Black and Very Dark Brown Volcanic Ash Soils, Lava Plains

The soils of this mapping unit occupy about 40 percent of Jeju Do, chiefly in its coastal plains, gently sloping intermountain areas, and some of the islets surrounding the island. They have been formed in volcanic ash over the primary lava-flow.

This mapping unit consists mainly of black and very dark brown fine loamy to clayey, volcanic ash soils with some rock land. The soils are generally deep, but in places are very shallow.

Most areas on the coastal plains are cultivated, and on the gently sloping intermountain areas they are in grassland or woodland. Grazing is practised to some extent. Paddy rice is not suited and the land may be classified as capability unit III to VI for dry land crops.

4.5.1.1 Physiography

The topography of this unit, with level to nearly level coastal plains and slightly dissected, undulating land is the result of volcanic ash being deposited over the primary lava-flow. The slope ranges from 0 to 10 percent.

4.5.1.2 Soils

This mapping unit consists of well drained, generally deep, clayey to fine loamy volcanic ash soils with rocky land covering about 5 percent of the surface.

The surface layer is black or very dark brown, loose loam to clay loam, with a fine granular structure. It is strongly acid, and high in organic matter content. The subsoil, about 100 cm thick, is yellowish brown to dark brown, very sticky and very plastic clay to clay loam with a subangular to angular blocky structure and with some very thin clay cutans. The subsoil is strongly acid. Generally the soils of this unit contain gravel.

The porosity and water holding capacity is extremely high and density is very low. Consequently, the crop damage from wetness or drought is small unless the rainy or dry season is prolonged. The base exchange capacity is high as this soil is rich in humus, with the principal mineral of the clay fraction being allophane. The plants growing here lack phosphate because of the strong fixation of this fertility element in the soil. (The phosphate absorption coefficients are about twice higher than those of other soils).

4.5.1.3 Variation in the mapping unit

The soils of this mapping unit are distributed over the coastal plains and the intermountain areas, except for some parts of the western coastal plains of the island. The black coloured soils are chiefly in the intermountain areas and in the eastern coastal plains, and the very dark brown soils are mainly in the southern and northern coastal plains.

The surface layers of cultivated soils are less deep and contain less humus and more gravel that those in the uncultivated land, because they have been eroded.

4.5.1.4 Present land use

Most of the coastal plains are cultivated to barley, sweet potato, millet, vegetables, and similar crops. The intermountain areas generally are in grassland or woodland.

4.5.1.5 Land use, management and recommendation

The soils of this unit are not suited to paddy rice, and are in capability Classes III to VI. About 50 percent is suitable only for pasture and woodland.

Special management is required to improve the volcanic ash soils. A large amount of lime is needed to neutralize the strong acidity, and adequate amounts of phosphate and potassium should be applied to improve yields of crops. Windbreaks of trees surrounding the cultivated land will help control wind erosion.

4.5.2 Lt Black and Very Dark Brown Volcanic Ash Soil, Shallow and Rocky Phase, Lava Terraces

The soils of this mapping unit have been formed in volcanic ash over the secondary lava flow. They are on undulating terraces and gently sloping lands, chiefly in intermountainous areas and coastal plains.

These soils are commonly shallow to bed rock. The textures range from fine to loamy to clayey, with high gravel content. Bedrock and stones are exposed in some areas.

The soils on the coastal plains are cultivated for various dry land crops, and most of the soils on the intermountain areas are in grassland or woodland. Some areas are used for grazing. These soils are not generally suited to paddy rice, and are usually in capability Class IV.

4.5.2.1 Physiography

The soils of this unit developed in volcanic ash deposited over secondary lava flow. The undulating terraces are slightly to moderately dissected and have gentle slopes, ranging from 5 to 15 percent.

4.5.2.2 Soils

This mapping unit consists of shallow, well to excessively drained, volcanic ash soils, with rock land on about 10 percent of the surface.

The surface soil layer contains much humus, and ranges from black to very dark brown in colour. The texture of the layer is loose loam to clay loam. Many areas have bedrocks exposed. The subsoil is yellowish brown, dark brown or reddish brown, very sticky and very plastic clay or clay loam. These soils, generally containing much gravel, are strongly acid both in the surface layer and in the subsoil. Physical and chemical characteristics are very similar to those described for the mapping unit Lp.

4.5.2.3 Variation of the mapping unit

The soils of this unit are chiefly in the intermountain areas, but some of them occupy the coastal plains of the island. The surface layers of those cultivated have been worked by wind, and are shallower than those uncultivated. This layer also contains less humus and many stones. Bedrocks are common.

4.5.2.4 Present land use

Most of the soils in the coastal plains are cultivated for barley, sweet potato, millet, vegetables and similar crops. There, some pine trees are growing in small areas. The intermountain areas are mostly in grassland and woodland, with some parts used for grazing. Citrus orchards have been established at the southern end of the island.

4.5.2.5 Land use and management recommendation

The soils of this mapping unit belong to capability Class IV. They are better suited for pasture than for agricultural crops. Management for this soil is similar to that described for the unit Lp. Special attention should be paid to establishment of tree stands surrounding the cultivated soils to protect the soil from wind erosion.

4.6 SOILS OF THE STRONGLY DISSECTED HILLY AND MOUNTAINOUS LANDS

This group includes the most extensive mapping units, comprising the soils of the hilly and mountain lands. These are dominantly Lithosols with young and eroded soils on strongly dissected relief with very steep slopes. With few exceptions, most of them are shallow, stony and subject to strong erosion. They are best suited for forest. Only a very small percentage, requiring special

management, can be used for crops. This includes practices to prevent severe erosion. This physiographic group comprises a total of seven main mapping units. They are:

Symbol	Mapping Units and Subunits
Ma	Lithosols, Siliceous Crystalline Materials
Mj	Volcanic Ash Soils, Cinder Cones
Ml	Lithosols and Red-Yellow Podzolic Soils, Calcareous Materials
Mm	Lithosols, Micaceous and Hard Siliceous Materials
Ms	Lithosols, Sedimentary Materials
Mu	Acid Brown Forest Soils and Lithosols, Undifferentiated Materials
Mv	Lithosols, Siliceomafic Materials

4.6.1 Ma Lithosols, Siliceous Crystalline Materials

This mapping unit, the most extensive in Korea, includes a wide variety of soils on the strongly dissected mountainous land or isolated mountains and hilly land, on areas with siliceous crystalline materials derived mainly from granites and gneisses.

It is an association predominantly of stony Lithosols, with some areas of Rego-Lithosols, Red-Yellow Podzolic soils, and others being included. Gullied land complex is common, and rocky land and rock outcrop occupy significant areas. Soils are mostly moderately coarse to medium textured. Most of the land is recommended for forest only.

The soils are chiefly in upland capability Classes VI to VIII. With proper management, including bench terracing, a very small part at the bottom of slopes could be used for agriculture. Three main subunits were recognized as components of this mapping unit.

4.6.1.1 Physiography

This mapping unit comprises the very strongly dissected mountain land and isolated mountain ranges of Korea. It extends from the northern region at the Demilitarized Zone to the extreme southern end of the peninsula. The dominant slopes are from 20 to 65 percent or more, and in many places exceed 100 percent. The unit represents a moderately young mountainous relief which has been submitted to numerous erosion cycles. In certain areas there is still a concordance of the drainage divides, indicating former erosion levels or surfaces. An intricate dendritic pattern of swales and relatively narrow valleys is found within the mountains, the largest of which are separated as the "An" mapping unit. Most of these valleys are in the degradation stage, with very active geological erosion. The geology comprises granites, gneisses and migmatites. Rock outcrops and areas of rocky land are common on the strongly dissected, very steep, high mountain land, as serrated irregular ridges, mountain peaks, and in particular areas of bornhardt or "sugar loaf" relief. Crests and hogbacks are common.

4.6.1.2 Soils

This association comprises a wide range of soils. They are predominantly excessively to well drained, light olive brown to yellowish brown, coarse loamy to loamy textured, mostly gravelly to stony, severely to extremely eroded, Lithosols. These soils occupy more than 75 percent of the mapping unit, in moderately to strongly dissected steep mountains. They consist of fine to coarse sandy loams, shallow over hard rock.

Red-Yellow Podzolic soils (less than 20 percent in this mapping unit Ma) are mostly in strongly weathered materials on slightly dissected terrace slopes and on normal bottom slopes. They are well to somewhat excessively drained, fine loamy to clayey in texture, and moderately deep. The surface horizons range from dark brown to yellowish brown, in colour, and from loam to clay loam in texture. They are slightly acid in soil reaction and have a fine to medium granular structure. The subsoils, extending to depths of more than 45 cm, are reddish yellow to brown silty clay loam or sandy clay loam to clay, with a weak moderately fine to coarse subangular blocky structure. Soil reaction is slightly acid. The substrata are deep, fine loamy to coarse loamy textured, strongly to slightly weathered parent materials.

Minor areas of Rego-Lithosols are also included, as well as some areas of Acid Brown Forest soils in the highest mountains.

4.6.1.3 Variation in the mapping unit

This mapping unit is extensive throughout Korea, and shows considerable variation from place to place, owing to difference in the nature of the parent material and the climate. In general the soils in the western regions are over more weathered parent materials than those in the northeastern region (Gangweon Do).

4.6.1.4 Present land use

Most of the land is in natural vegetation, with evidence of cultivation in scattered areas. However, parts of the southern islands are intensively cultivated and in Gangweon Do shifting cultivation is spreading extensively in the headwaters of the Han and Nagdong rivers. The natural vegetation ranges from grasses and shrubs to moderately dense forest. The forest land is mainly in the northern region, Gangweon Do, and is composed mainly of fir and larch, with some acacia, willow, alder and deciduous shrubs. Some extensive areas are being reforested. A large number of upland crops are cultivated on bottom slopes in narrow valleys, including barley, wheat, soybean, cabbage, potatoes, sweet potatoes, tobacco, millet, corn, Indian millet, red peppers, sesame and water melons.

4.6.1.5 Land use, management and recommendation

The Lithosols are mainly in upland capability Classes VI and VII. Forest use is recommended, because of the very steep slopes, shallowness, lack of water, coarse texture, stoniness and poor workability. However, a minor percentage of these soils on the bottom slopes and in the narrow valleys between the mountains, can be used for agriculture. The gullied land complex areas are chiefly in upland capability Class VII. They are recommended for forest. In areas with sparse natural vegetation, reforestation is an urgent priority. The weakly developed Red-Yellow Podzolic soils

are chiefly in upland capability Classes IV to VII. In most cases they are best exploited for forest. Only those on bottom slopes or in less sloping areas are recommended for agricultural use. A minor percentage of these soils is now being used for agriculture in the valleys under shifting cultivation. The most important problem to be considered in the use of this land is erosion control. Shifting cultivation on the steepest slopes should be discontinued.

4.6.2 Mj Volcanic Ash Soils, Cinder Cones

The volcano of Jeju, active during the Tertiary period, erupted a number of times between stages of dormancy before finally becoming extinct.

4.6.2.1 Physiography

The physiography of this unit is the result of the volcanic action which left nearly 300 cinder cones scattered over the island. They have a characteristic cone shape.

4.6.2.2 Soils

This mapping unit consists of shallow, somewhat excessively to excessively drained soils formed in ejecta of volcanoes on extremely steep hills. The surface layer is very dark brown to very dark reddish brown loose loam with a fine granular structure. It is high in organic matter content, has low bulk density and a high moisture holding capacity. The substrata are mostly layers of pumice and unweathered volcanic cobbles and gravel, but in some places there is a thin layer of reddish yellow to reddish brown clay. In places bedrock underlies the surface layer.

4.6.2.3 Present land use

Most areas of this soil are in natural vegetation of trees, shrubs and grass, with some tracts being grazed.

4.6.2.4 Land use, management, and recommendation

The soils of this unit are in land capability Class VII. They are not suitable for cultivation and should be kept in trees or grass. Some areas could produce moderate amounts of grazing if given good management.

4.6.3 Ml Lithosols and Red-Yellow Podzolic Soils, Calcareous Materials

This mapping unit comprises soils derived from calcareous (limestone) materials on strongly dissected mountain land or isolated mountains and hills.

It is an association predominantly of stony Lithosols, with Reddish-Brown Lateritic-like soils, Red-Yellow Podzolic soils or Gray-Brown Podzolic soils and rock outcrop being included. Textures are dominantly coarse loamy to loamy with some fine loamy to clayey. Most of this land should be used for forest. The soils are mainly in upland capability Classes VI and VII, with small areas of Class IV.

Two main subunits were recognized as components of this mapping unit.

4.6.3.1 Physiography

This mapping unit includes strongly dissected mountain land and isolated mountains and hills. Dominant slopes range from 35 to more than 65 percent. These areas have a moderately young mountainous relief. In some hilly parts a concordance of the drainage divides, indicating former erosion levels, is found. There is also an intricate dendritic pattern of valleys, the largest of which are separated in the "An" mapping unit. Most of these valleys are in the degradation stage with a very active geological erosion.

Rock outcrops and rocky land are common in the highest sites and on crests. Karst type of relief appears in certain areas related to former erosion levels.

Reddish-Brown Lateritic-like 1/ soils or Red-Brown Mediterranean-like 1/ soils are developed mostly in strongly weathered parent materials on smooth slopes of hills or at the mountain foot.

4.6.3.2 Soils

This is an association of predominantly excessively to well drained stony Lithosols, with light olive brown to yellowish brown colours and loamy textures. Gravel and cobbles are abundant and erosion is severe or very severe. Some reddish brown soils with clay accumulation in the B horizon, such as Reddish-Brown Lateritic-like soils, Red-Yellow Podzolic soils, and Acid Brown Forest soils have been included. The most extensive are Lithosols, dominantly fine sandy loam or loam in texture, varying in depth from 10 to 50 cm over a substratum of generally hard rock. Soil reaction is slightly acid to slightly alkaline.

The most important in this mapping unit are Reddish Brown Lateritic-like soils. They are well drained, strongly developed, and have fine loamy to clayey textures. Surface soils are dark reddish brown to dark brown, friable, with a fine and medium granular structure. Subsoils are reddish brown, clayey textured, with a strong fine and medium angular or subangular blocky structure, thick clay cutans, and slickenside surfaces. They are slightly acid in reaction. These soils are deep or very deep (about 50 cm to 100 cm or more) over substrata, having lighter colours with fine loamy and clayey textures, which are slightly alkaline in reaction. They are mostly in strongly weathered parent materials on slightly dissected old surface remnants, on terrace slopes, and in normal bottom slopes.

4.6.3.3 Variation in the mapping unit

This unit is related to the Chosun System, which is found mainly in the southern part of Gangweon Do. In other places it appears in scattered areas. The soil depth, the percentage of rock outcrop, and the karst type of relief, are the most important variations.

1/ See Section 3.1.2 for explanation or both terms.

4.6.3.4 Present land use

Most of this land is dominantly forest, mainly conifers, with some deciduous shrubs and grasses. Some parts have been reforested recently.

A minor percentage of soils in this mapping unit are under cultivation, on bottom slopes and in the narrow valleys between the mountains. The principal crops, if water is available for irrigation, are paddy rice and barley. The higher tracts which cannot be irrigated are used for upland crops such as wheat, beans, sweet potatoes, millet, and corn.

4.6.3.5 Land use, management and recommendation

The soils are chiefly in upland capability Classes IV to VIII. Most land is now under forest. Because of rockiness, shallow depth, very steep slopes, and lack of water, it is not generally suited for agriculture and should be used for forest.

With proper management including bench terracing some small areas on bottom slopes can be used for agriculture. Some areas urgently need forestation.

4.6.4 Mm Lithosols, Micaceous and Hard Siliceous Materials

This mapping unit comprises soils, over micaceous and hard siliceous materials, in the strongly dissected mountainous land or isolated mountain ranges and hilly lands.

It is an association predominantly of stony Lithosols, with some weakly developed soils and inclusions of Rego-Lithosols and Red-Yellow Podzolic soils. Hard rocks outcrop in several places. The textures are mostly moderately coarse loamy to loamy. Most land should be used exclusively for forest.

The soils are chiefly in upland capability Classes VI to VII. Two main subunits were recognized as components of this mapping unit. With adequate management, including bench terracing, a very small portion of this land, on the bottom slopes, could be used for agriculture.

4.6.4.1 Physiography

This mapping unit includes strongly dissected mountainous land or isolated mountain ranges and hilly lands of micaceous and hard siliceous materials. Dominant slopes ranges from 35 to 65 percent, with some areas of 16 to 35 or more than 65 percent. Relief is very rough with many crests, hogbacks and monadnocks. An intricate subparallel and dendritic pattern of swales and relatively narrow valleys is also found within the mountains. The largest of these is separated by the "An" mapping unit. Most valleys are in the degradation stage, with very active geological erosion. Rock outcrops or rocky land occur as usual at the top part of the relief.

Red-Yellow Podzolic soils, and Acid Brown Forest soils have formed in strongly weathered parent materials, on slightly dissected small old surface remnants, as well as in terrace slopes in the normal bottom slopes. Gullied land occurs in areas where the parent materials are strongly weathered, and in the very strongly dissected steep sloping areas. The geology comprises crystalline schists, quartzites and metasediments of various kinds.

4.6.4.2 Soils

This association includes predominantly excessively to well drained soils with light olive brown to yellowish brown, coarse loamy to loamy textures. In many places gravelly to cobbly Lithosols, and some moderately or weakly developed Rego-Lithosols, on micaceous and hard siliceous materials, are also found.

The Lithosols, the most extensive soils, more than 75 percent of the unit, are located in moderate to strongly dissected steep mountainous land. They are fine sandy loam to coarse sandy loam in texture. Soil depth varies from 10 to 50 cm and the substrata are mainly hard rocks.

Red-Yellow Podzolic soils and others, cover less than 25 percent in the mapping unit, and are found mostly in strongly weathered materials on slightly dissected old surface remnants, in terrace and normal bottom slopes. They are well to somewhat excessively drained, with fine loamy to clayey textures, and are moderately deep. The surface horizons range from dark brown to yellowish brown, loamy to fine loamy, and have a moderate fine to medium granular structure. Reaction is slightly acid. The subsoils, extending to a depth of more than 45 cm, are reddish yellow to grayish brown, clayey to fine loamy, with a weak to moderate fine to coarse subangular blocky structure. Their reaction is slightly acid. The substrata are deep, fine loamy to coarse loamy textured, mostly moderately weathered to unweathered hard parent materials.

The most important inclusions in this mapping unit are Rego-Lithosols, seen in concave positions within the mountainous land. Gullied land complex is located where the parent material is strongly weathered.

In the highest mountains, above 500 m, dark coloured soils similar to Acid Brown Forest soils appear on old surfaces or plateau remnants.

This mapping unit is over schistose rocks, scattered in larger areas in South Korea. It shows considerable variations from place to place, owing to the nature of the parent material, its degree of weathering, and the climate variability.

4.6.4.3 Present land use

Most of the land is under forest, mainly conifers, with some deciduous shrubs and varieties of grasses. Some areas are being reforested.

A minor percentage is cultivated on the bottom slopes and in narrow valleys between the mountains. The principal crops where water is available for irrigation are paddy rice and barley. The higher areas which cannot be irrigated are used for upland crops, such as wheat, bean, sweet potatoes, millet, and corn.

4.6.4.4 Land use, management and recommendation

The soils of this mapping unit are chiefly in upland capability Classes IV and VIII. Most are under forest. Only a minor percentage on the bottom slopes is being used for agriculture. Most land is not suitable because of shallowness, very steep slopes, lack of water and low fertility levels. The gullied areas, with scattered natural vegetation, urgently need reforestation.

4.6.5 Ms Lithosols, Sedimentary Materials

This mapping unit consists of soils on the strongly dissected mountain land or isolated mountain ranges and hills, over sedimentary rocks.

It is an association predominantly of stony Lithosols, with some Rego-Lithosols, Red-Yellow Podzolic soils and others.

They are chiefly in upland capability Classes V to VII. Two main subunits were recognized as components of this mapping unit.

4.6.5.1 Physiography

This mapping unit is extensive, comprising the very strongly dissected mountain land or isolated mountain ranges of Korea, and some denudated hilly land and isolated hills or inselbergs, derived from sedimentary rocks. Dominant slopes range from 35 to 65 percent or more. Relief is a moderately young mountainous type. In some parts there is still a concordance of the drainage divides indicating former erosion levels. An intricate dendritic pattern of swales and relatively narrow valleys is within the mountains. The largest of these are separately shown by the "An" mapping unit. Most valleys are in the degradation stage, with very active geological erosion. Rock outcrops and rocky land are common in the top part of the land, generally forming crests and hogback; very seldom table land or mesas. Small areas of Red-Yellow Podzolic soils have formed in strongly weathered parent materials on slightly dissected terrace slopes and in normal bottom slopes. The geology comprises shales, sandstones and conglomerates.

4.6.5.2 Soils

This association comprises a wide range of soils including Lithosols, Red-Yellow Podzolic, Rego-Lithosols, and gullied land. Lithosols are most extensive in this mapping unit, (more than 75 percent) on moderate to strongly dissected steep mountain land. They are shallow, gravelly to stony fine sandy loam to coarse sandy loam. The Red-Yellow Podzolic soils (less than 15 percent), are mostly in strongly weathered materials. They are well to somewhat excessively drained with fine loamy to clayey textures, and are moderately deep. The surface layers are reddish brown to dark yellowish brown, loamy textured, and have a moderate to strong, fine to medium granular structure. They are slightly acid in reaction. The subsoils, extending to depths of more than 30 cm, are reddish yellow, reddish brown, dark brown to yellowish red, clayey to fine loamy textured, and have a weak to moderate medium to coarse subangular blocky structure. Soil reaction is slightly acid. The substrata are fine loamy, strongly to slightly weathered parent materials.

Small but important areas of Rego-Lithosols are in concave positions of the mountains as in mountain footslopes and small valleys between the mountains. Gullied land, the result of extreme erosion, is found in areas where the parent material is strongly weathered on strongly dissected steeply sloping land.

4.6.5.3 Variation in the mapping unit

This unit, extensive in the Nagdong river basin, is confined dominantly to the Gyeongsang sedimentary basin (Sinla and Nagdong series), and includes some Tertiary

sediments. In Gyeongsangbug Do it is comprised mainly of Lithosols (more than 80 percent) and is rarely associated with Red-Yellow Podzolic soils. In Gyeongsangnam Do the Red-Yellow Podzolic soils (less than 25 percent) are more common. The variations among the soils' characteristics are closely related to the nature of the sedimentary rocks and the degree of weathering.

4.6.5.4 Present land use

The natural vegetation varies from grasses and shrubs to poorly stocked forest, composed mainly of fir and larch, with some deciduous shrubs. Some areas are being reforested. In a minor percentage of this mapping unit the soils are under cultivation, on the bottom slopes and in the narrow valleys. Where water is available for irrigation the principal crops are paddy rice and barley. Higher areas which cannot be irrigated are used for upland crops, such as wheat, bean, sweet potatoes, millet, corn, and Indian millet.

4.6.5.5 Land use, management and recommendation

The soils of this mapping unit are chiefly in upland capability Classes IV to VIII. Most areas are now in forest. Because of shallow depth, stoniness, very steep slopes, lack of water, and low natural fertility, these soils are not generally suited for agriculture and are recommended for forest. A minor percentage on bottom slopes is used for crops. The gullied land complex areas, with very sparse natural vegetation, urgently require reforestation.

4.6.6 Mu Acid Brown Forest Soils and Lithosols, Undifferentiated Materials

This mapping unit is on moderately dissected plateau remnants, or old erosion surfaces and adjacent surrounding high mountains on residual materials of undifferentiated rocks. It is an association predominantly of Acid Brown Forest soils and some Lithosols. Smaller areas of Alluvial and Low-Humic Gley soils are in elevated valleys. Textures are mostly fine loamy and clayey. Forest predominates with some parts being under cultivation. The soils are chiefly in upland capability Classes IV and VII. On the smoother slopes in this unit, good yields should be obtained from a wide variety of crops if satisfactory management, including bench terracing, is practiced. Two main subunits were recognized as components of this mapping unit.

4.6.6.1 Physiography

This mapping unit is on moderately dissected plateau remnants or old surfaces and the adjacent strongly dissected high mountainous land. Elevations range from 500 to 1 000 m, with most of the land lying between 700 and 800 m. At the top of these plateaus the relief is rolling to hilly, ending abruptly, sometimes by escarpments, in mountains. Dissection is moderate to strong. Dominant slopes range from 35 to 65 percent or more in the mountainous land and 7 to 16 percent in the plateau remnants with rolling relief. In certain areas there is still a concordance of the drainage divides and elevations, indicating former erosion levels.. These divides are interfingered by a complex network of swales and relatively narrow valleys which show a dendritic pattern. Rocky land is common at the highest elevations in this land, forming some areas of bornhardts hogbacks in the mountainous parts and escarpments at the edges of the plateaus. A thin mantle of alluvial pedimentary materials covers the undissected remnants of the original surface. The underlying rocks are mostly granites and gneisses.

4.6.6.2 Soils

This is an association of predominantly well drained, dark brown to yellowish brown, fine loamy and clayey Acid Brown Forest soils (more than 50 percent of total area), and some Lithosols (about 30 percent). Rocky land occupies the steepest and most sharply convex parts of the landscape. Red-Yellow Podzolic soils (about 10 percent) have formed in strongly weathered materials on slightly weathered materials on slightly dissected old surface remnants with rolling relief, as well as on terrace slopes and in normal bottom slopes. Thick or "cumulic" Acid Brown Forest soils (about 1 percent) occupy the mountain footslopes, the swales and narrow valleys. These are predominantly moderately well to imperfectly drained loamy and clayey soils.

The most extensive in the Mu unit are Acid Brown Forest soils. They have developed, mostly on the rolling relief of the plateau remnants, at high altitudes, and occupy the smoothest slopes. Erosion has been slight to moderate, and the colour of the existing surface horizons ranges from very dark brown to dark yellowish brown. Textures are dominantly silty, varying from fine loamy to clayey. Soil reaction is slightly to strongly acid.

The subsoils, extending to depths of 1 m or more, are yellowish brown to dark brown or strong brown, silty clay, silty clay loam, clay loam or clay with a weak to moderate subangular blocky structure, and in some cases clay cutans. The soil reaction is slightly to strongly acid. The substrata are variable. Chiefly they are deep, loamy residual materials from granitic rocks. The Lithosols, excessively drained to well drained, light olive brown to yellowish brown, loamy textured soils, include severely to extremely eroded stony phases. The Red-Yellow Podzolic soils are like those described in the mapping unit Ra, with soil textures dominantly loam and sandy loam. There are many areas which are intergrades between the great soil groups mentioned above. Except for the Lithosols, these soils are high in organic matter.

4.6.6.3 Variation in the mapping unit

This mapping unit is mostly in the northeastern regions of South Korea in Daegwanryeong and in the nearby high mountain area of Gangweon Do. In other places they appear as scattered very small areas. These soils near Daegwanryeong are deeper, more developed, and higher in organic matter content than those in other areas.

4.6.6.4 Present land use

Most of this land is in natural forest and grasses, but a considerable percentage is cultivated to various upland crops, such as potato, corn, bean, hop, Chinese cabbage and radish. Areas under forest cover support dominantly conifers with some acacias, shrubs and grasses.

4.6.6.5 Land use, management and recommendation

The soils are generally very permeable, having a moderately high to high organic matter content and moderately low fertility. The pattern of land use, divided between forest and arable land, is closely related to the relief. In general the more sloping tracts are in forest. Crops are grown on the smoother ground. The soils of this mapping unit are chiefly in upland capability Classes IV and VII, with

some small areas in Class III. Many areas are used for agriculture under shifting cultivation in Gangweon Do. The more gently sloping tracts of this mapping unit are suitable for intensive agricultural development. The short growing season, poor workability and lack of access in certain areas remain as limiting factors for development. The use of soil conservation practices such as contour cultivation and terracing are advisable to counteract the hazards of erosion and runoff. The Lithosols areas with only scattered natural vegetation urgently need reforestation.

4.6.7 Mv Lithosols, Siliceomafic Materials

This mapping unit consists of soils on strongly dissected mountain land isolated mountain ranges and hilly land in areas with siliceomafic materials derived from volcanic rocks. It is an association of predominantly stony Lithosols with some Rego-Lithosols, Red-Yellow Podzolic soils, and Reddish Brown Lateritic soils. Textures are mostly loamy to coarse loamy, sometimes fine loamy. Most of the land is recommended for use exclusively as forest. The soils are chiefly in upland capability Classes VI and VII. With adequate management including bench terracing a very small part of this land, on the bottom slopes, could be used for agriculture. Two main subunits were recognized as components of this mapping unit.

4.6.7.1 Physiography

This mapping unit includes strongly dissected mountainous land or isolated mountain ranges and hilly land with siliceomafic materials derived from volcanic rocks (andesites, porphyries, gabbro, basalt, etc). The dominant slopes range from 35 to 65 percent. In certain areas within the hilly land there is still a concordance of the drainage divides, which indicate former erosion levels. There is intricate dentritic and sometimes radial pattern of swales and relatively narrow valleys within the mountains; the largest of which are separated in the "An" mapping unit. Most of these valleys are in the degradation stage under very active geological erosion.

Rock outcrops and rocky land are common at the top of the mountains, in some areas forming crests and hogbacks.

4.6.7.2 Soils

This association comprises a wide range of excessively drained and well drained soils, including Lithosols, Rego-Lithosols, Red-Yellow Podzolic soils, Reddish-Brown Lateritic soils, and gullied land on siliceomafic materials derived from volcanic rocks, such as andesites porphyries, basalt, and gabbro.

The Lithosols are the most extensive in this mapping unit, comprising more than 75 percent of the total area, in strongly dissected steep mountainous land. The textures are gravelly to cobbly fine sandy loam to loam with many stones. Many areas are severely or very severely eroded. Soil depth is about 10 to 40 cm over hard rock. Weakly developed Red-Yellow Podzolic and Reddish Brown Lateritic soils occupy smaller areas (less than 15 percent) mostly in strongly weathered materials, on slightly dissected old surface remnants within the hilly land and at the mountain foot. They are well to somewhat excessively drained with fine loamy to clayey textures, and are moderately deep. The surface horizons are reddish brown, dark yellowish brown or dark brown in colour, loamy or fine loamy textured, slightly acid in soil reaction and have moderate to strong fine or a medium granular structure. The subsoils

extending to depths of more than 30 cm, are brown, yellowish brown and yellowish red in colour, fine loamy to clayey in texture, and have weak to moderate medium or a coarse subangular blocky structure. They are slightly acid in soil reaction. The substrata are fine loamy to loamy, strongly weathered to unweathered parent materials. Polygenetic profiles are found at the foot of the mountains.

Rocky land is common on highest parts of the strongly dissected mountain land. Other important inclusions of this mapping unit are the Rego-Lithosol and gullied land complex. The Rego-Lithosols are in concave positions of the mountain land as on the mountain footslopes and in valleys between the mountains. Gullied land is in steeply sloping areas where the parent materials are strongly and deeply weathered.

There are numerous areas of soils which are intergrades between the main great soil groups.

4.6.7.3 Variation in the mapping unit

These soils are distributed widely, and show considerable variation from place to place because of differences in the composition of the parent material and the degree of weathering, as well as the climatic variability.

In general the soils in the western regions are over more deeply weathered parent materials than those of the eastern and northern regions. The soils of the highest mountains are over dominantly unweathered parent materials.

4.6.7.4 Present land use

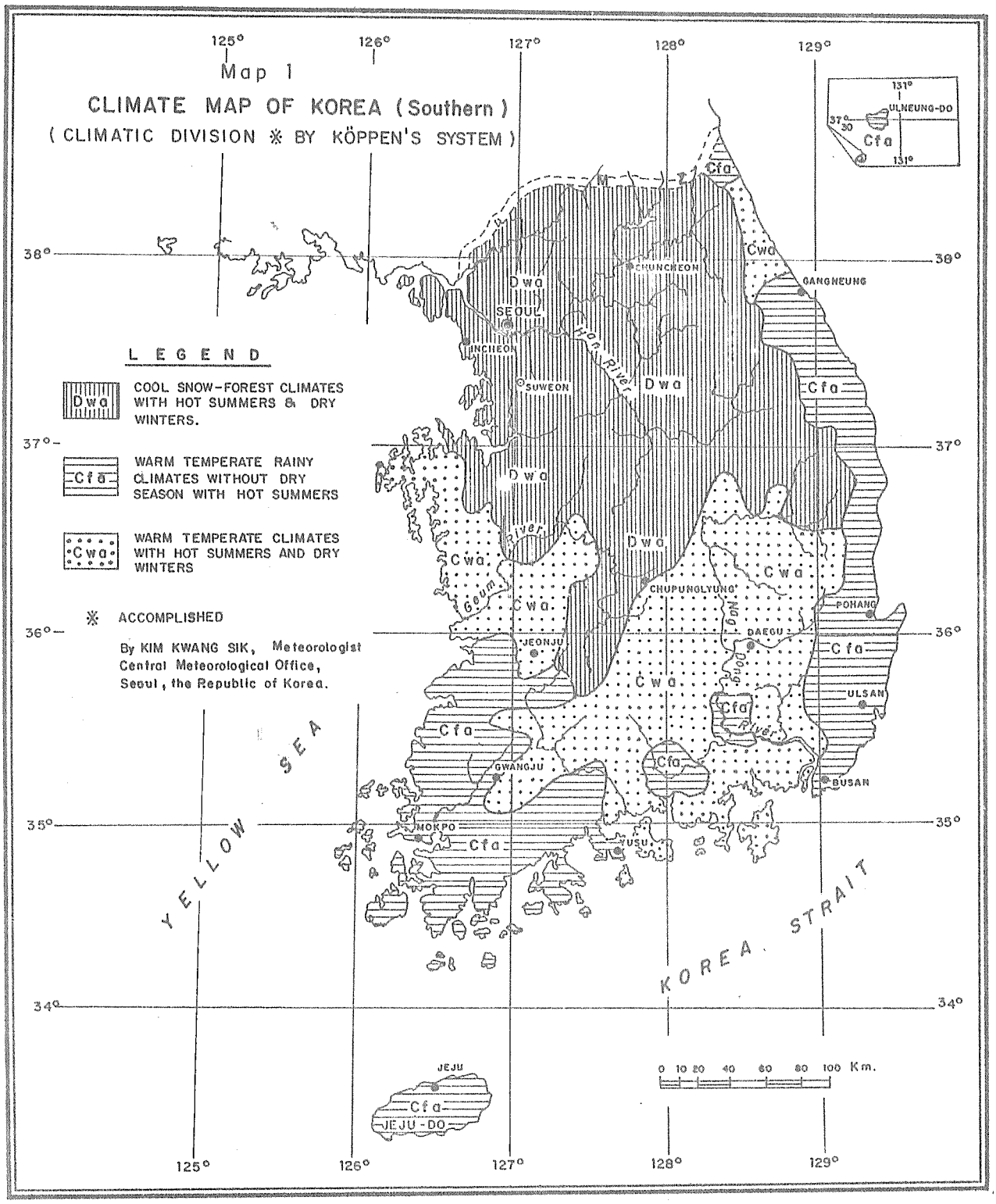
Much of the land shows evidence of scattered cultivation. The natural vegetation varies from grasses and shrubs to moderately dense forest in places. The forest land is composed mainly of fir, larch and some deciduous shrubs. Some areas are being reforested. In a small part of this mapping unit, on bottom slopes and in the narrow valleys between the mountains cultivation is practised. Some areas in the southern islands are intensively cultivated, and in others shifting cultivation is spreading extensively. The principal crops are paddy rice and barley where water is available for irrigation. The higher areas which cannot be irrigated are used for upland crops such as wheat, bean, sweet potatoes, millet, corn, and Indian millet.

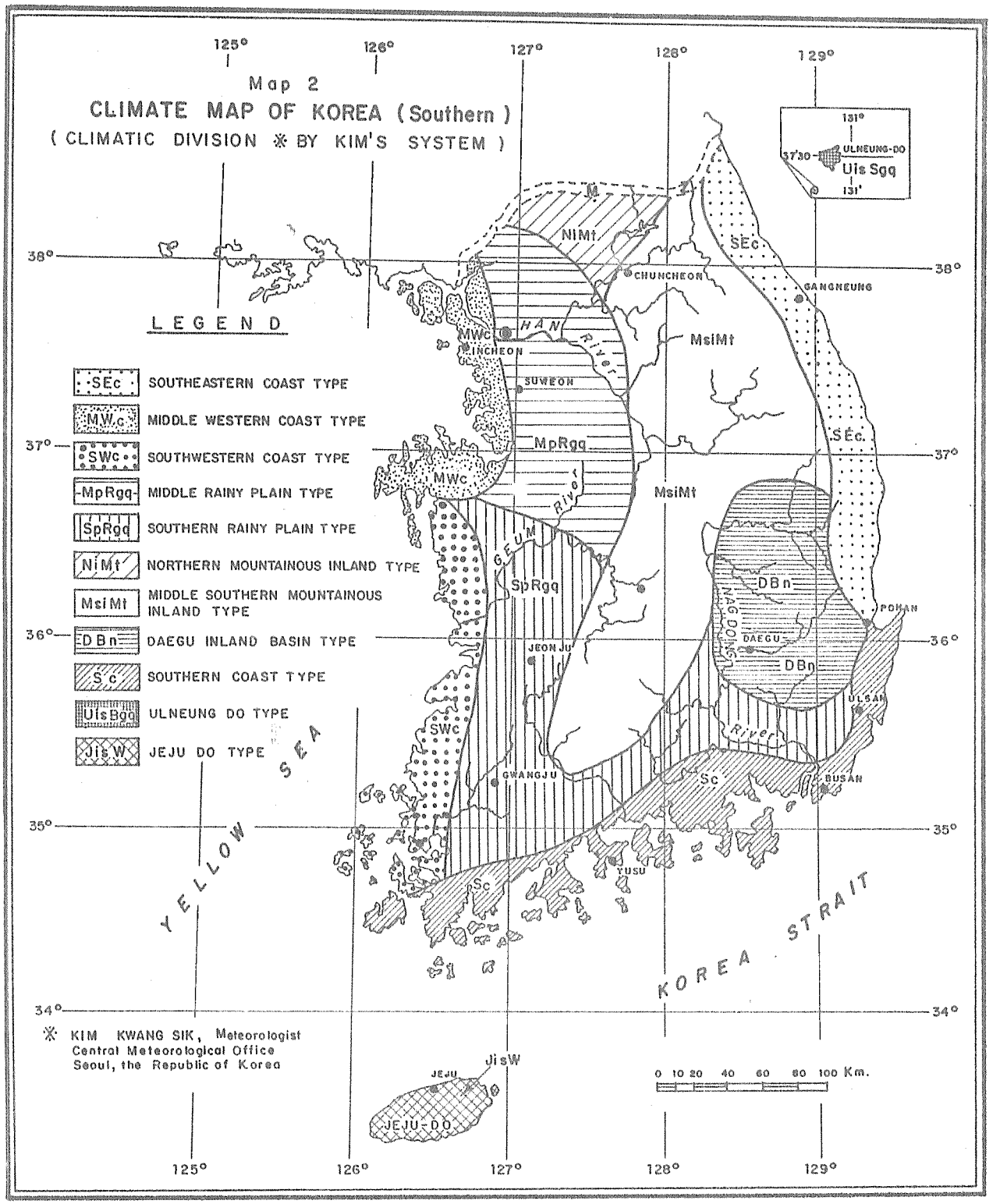
4.6.7.5 Land use, management and recommendation

The soils of this mapping unit are chiefly in upland capability Classes IV to VIII. They are recommended for use as forest, because of the very steep slopes, shallow soil depth, lack of water, coarse textures, stoniness and poor workability. A minor percentage can be used for agriculture on the bottom slopes and in the narrow valleys.

Erosion control is the most important consideration in the use of this land. Shifting cultivation on steep slopes greatly increases erosion and should be discontinued.

The gullied land complex areas, with sparse natural vegetation, urgently need reforestation.


Map 1
CLIMATE MAP OF KOREA (Southern)
(CLIMATIC DIVISION ※ BY KÖPPEN'S SYSTEM)
LEGEND
Dwa COOL SNOW-FOREST CLIMATES WITH HOT SUMMERS & DRY WINTERS.
Cfa WARM TEMPERATE RAINY CLIMATES WITHOUT DRY SEASON WITH HOT SUMMERS
Cwa WARM TEMPERATE CLIMATES WITH HOT SUMMERS AND DRY WINTERS
※ ACCOMPLISHED
By KIM KWANG SIK, Meteorologist
Central Meteorological Office,
Seoul, the Republic of Korea.
YELLOW SEA
KOREA STRAIT
SEOUL
INCHEON
SUWEON
CHUNCHEON
GANGNEUNG
CHUPUNGLYUNG
POHANG
DAEGU
JEONJU
GWANGJU
MOKPO
YEOSU
BUSAN
ULSAN
JEJU
JEJU-DO
ULNEUNG-DO
Han River
Geum River
Nakdong River
0 10 20 40 60 80 100 Km.
125°
126°
127°
128°
129°
131°
38°
37°
36°
35°
34°
37°30


Map 2
CLIMATE MAP OF KOREA (Southern)
(CLIMATIC DIVISION ※ BY KIM'S SYSTEM)
LEGEND
SEc SOUTHEASTERN COAST TYPE
MWc MIDDLE WESTERN COAST TYPE
SWc SOUTHWESTERN COAST TYPE
MpRgq MIDDLE RAINY PLAIN TYPE
SpRgq SOUTHERN RAINY PLAIN TYPE
NiMt NORTHERN MOUNTAINOUS INLAND TYPE
MsiMt MIDDLE SOUTHERN MOUNTAINOUS INLAND TYPE
DBn DAEGU INLAND BASIN TYPE
Sc SOUTHERN COAST TYPE
UlsBgq ULNEUNG DO TYPE
JisW JEJU DO TYPE
※ KIM KWANG SIK, Meteorologist
Central Meteorological Office
Seoul, the Republic of Korea
YELLOW SEA
KOREA STRAIT
HAN RIVER
GEUM RIVER
NAKDONG RIVER
INCHEON
SUWEON
CHUNCHEON
GANGNEUNG
JEONJU
DAEGU
GWANGJU
POHAN
ULSAN
BUSAN
YUSU
JEJU
JEJU-DO
ULNEUNG-DO
Uls Sgq
0 10 20 40 60 80 100 Km.
125°
126°
127°
128°
129°
131°
37°30
38°
37°
36°
35°
34°

GLOSSARY

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

Consistence, Soil — The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

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

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

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

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

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

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

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

Cutan — A coating or film, on the outside of a soil aggregate or mass. It may consist of clay, silt, oxides of iron or manganese, organic matter, or other materials.

Depth of Soil — Thickness of soil over a specified layer, generally a layer that does not permit the growth of roots. Classes used in this soil survey to indicate depth are the following: deep - 1 m or more; moderately deep - 50 cm to 1 m; and shallow - less than 50 cm.

Erosion — The washing of soil from the soil surface. It includes washing of a continuous thin layer from the surface, known as sheet erosion, as well as the formation of small valleys, known as gully erosion.

Family (soil) — A level of classification of closely related soils immediately above the series level. The soils of a family are usually very similar in their management characteristics.

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

Fragipan — A dense and brittle pan, or layer, that owes its hardness mainly to extreme density or compactness rather than to content of much clay or cementation. Fragments that are removed are friable, but the material in places 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 bund capable of retaining a shallow depth of water. Paddies are used principally for growing rice.

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

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

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

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

Silt — As a soil separate, individual mineral particles in a soil that range from the upper limit of clay (0.002 mm) in diameter to the lower limit of very fine sand (0.05 mm). As a textural class, soil material that is 80 percent or more silt and less than 12 percent clay.

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

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

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

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

Terrace — An alluvial plain that has elevation above the present floodplain.

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

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

Appendix 1

PROJECT DOCUMENTATION

1. Technical Reports

The list of reports, including the present volume, is given below.

Technical Report	1	The Soils of Korea
Technical Report	2	Soil Reconnaissance of Korea
Technical Report	3	Soil Survey in Ulju Gun and Ulsan Si
Technical Report	4	Soil Survey in Gimhae Gun, Gyeongsangnam Do
Technical Report	5	Soil Survey in Dalseong Gun and Daegu Si, Gyeongsangbug Do
Technical Report	6	Soil Survey in Gwangsan Gun, Damyang Gun, Gwangju Si, Jeollanam Do
Technical Report	7	Soil Survey in Sangju Gun, Gyeongsangbug Do
Technical Report	8	Soil Survey in Pyeongchang Gun, Gangweon Do
Technical Report	9	Soil Survey in Gimje Gun, Jeonlabug Do
Technical Report	10	Soil Survey in Buyeo Gun, Chungcheongnam Do

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Appendix 2

SUMMARY OF MAPPING UNITS

MAPPING UNIT: Ft - Tidal Flats

1.	Area mapped	4 040 km^2 (Approx. 4 percent)
2.	Occurrence	Small areas along the west and south coast
3.	Climate	All main climates of Korea
4.	Physiography	Recent broad tidal flats along the coastal shore
5.	Geology & parent materials	Holocene silty and clayey marine sediments
6.	Vegetation	None
7.	Depth	More than 1 m
8.	Colour & texture	Olive gray to dark gray silty surface and silty substrata
9.	Drainage	Poorly drained
10.	Structure	Massive
11.	Organic matter	Medium to relatively high
12.	Reaction	pH above 8
13.	Erosion	None
14.	Base saturation	Moderate
15.	Productivity and use	Low yields initially. After reclamation can become high with good management
16.	Limitation	Tidal flooding and high salt content
17.	Land class	VIII

MAPPING UNIT: Fb - Sands and Gravels, Coastal Beaches and Dunes

1.	Area mapped	170 km^2
2.	Occurrence	Only narrow strips in the extreme northwest and very small scattered areas in the east, south and to a less extent along the west coast
3.	Climate	Dominantly warm temperate climate with hot summers, with or without dry winters; rainfall ranges from 1 000 mm to 1 3 000 mm
4.	Physiography	Recent and subrecent beaches with some low dunes
5.	Geology & parent material	Holocene, sandy and gravelly marine deposits

6.	Vegetation	None, or very few shrubs and pine trees
7.	Depth	1 m or more
8.	Colour and texture	Gray to light brown to white sandy surface with pale dark to yellowish brown to white sandy substrata
9.	Drainage	Well to excessively drained
10.	Structure	None
11.	Organic matter	None
12.	Reaction	pH near 8
13.	Erosion	None, or by wind
14.	Base saturation plant nutrients	Low and poor
15.	Productivity and use	Low yield when cultivated (Sub-recent beaches) in the northeast with upland crops
16.	Limitations	Loose sand and gravel. Extremely low water holding capacity and fertility
17.	Land class	VIII

MAPPING UNIT: Fm - Low Humic Gley and Alluvial Soils Fluvio-Marine Plains

1.	Area mapped	3 050 km^2
2.	Occurrence	Relatively extensive areas in the west coast, particularly south of the Kum river mouth, along the Han and Nagdong rivers and in areas near Pyeongtaeg. Along the east coast this unit is in small scattered areas
3.	Climate	All main climates of Korea
4.	Physiography	Recent broad and flat estuarine and marine plains
5.	Geology and parent material	Holocene, dominantly silty and clayey deposits
6.	Vegetation	The dominant crop is rice paddy, sometimes in rotation with barley. Scattered upland crops
7.	Depth	From 60 cm to more than 1 m
8.	Colour and texture	Dark grayish brown to dark gray silty clay surface, over gray silty clay and in places loam substrata
9.	Drainage	Poorly to imperfectly drained
10.	Structure	Subangular blocky, but in many areas structureless (massive)
11.	Organic matter	Relatively low, in back swamp areas may be higher
12.	Reaction	Neutral to alkaline, or slightly acid. pH varies from 6.5 to 8.
13.	Erosion	None

14.	Base saturation & plant nutrients	Commonly medium to high; plant nutrients are medium to high.
15.	Productivity and use	Relatively high to medium fertility status; extensively used for many years as rice paddy, in some areas in rotation with barley
16.	Limitations	Poor drainage and occasionally salinity near the coast, and in some areas acid sulphate toxicity
17.	Land class	Paddy; I to III, Uplands; III to V

MAPPING UNIT: Ap - Low Humic Gley and Alluvial Soils, Alluvial Plains

1.	Area mapped	4 900 km^2
2.	Occurrence	Irregularly distributed over all the peninsula with exception of the central and northeastern mountainous region; along the main rivers of South Korea as well as in isolated areas related to local base level. The most extensive areas are in the lower Nagdong and Han river valleys
3.	Climate	All main climates of South Korea
4.	Physiography	Extensive inland broad, nearly level, alluvial plains usually related to local base levels
5.	Geology & parent material	Holocene, Recent and Sub-recent silty, clayey and sandy alluvial deposits
6.	Vegetation	The dominant crop is rice paddy, sometimes in rotation with barley. Upland crops are small in area
7.	Depth	More than 1 m
8.	Colour & texture	Gray to dark grayish brown mottled sandy loam to clay loam surface, with dominantly gray, dark yellowish brown to sometimes yellowish red mottles and manganese concretions
9.	Drainage	Dominantly poor to imperfect, but including some well drained areas
10.	Structure	Subangular blocky, sometimes structureless (massive)
11.	Organic matter	Low with few exceptions
12.	Reaction	Acid to slightly acid; pH usually between 4.5 to 6
13.	Erosion	None
14.	Base saturation & plant nutrients	Low to medium; medium to poor in plant nutrient content
15.	Productivity and use	The productivity depends on management and the availability of irrigation water. Under good management, productivity is high

16.	Limitations	Drainage, low fertility status, and sometimes water holding capacity are the major limitations
17.	Land class	Rice paddy; II to VI, Upland crops; III to V

MAPPING UNIT: Af - Alluvial Soils and Riverwash, Floodplains

1.	Area mapped	3 730 km^2
2.	Occurrence	With exception of the north eastern mountainous region, this unit is irregularly distributed over the peninsula. The most extensive areas are located in the drainage basins of the Nagdong, Han, Geum, and Yeongsan rivers
3.	Climate	All main climates of South Korea
4.	Physiography	Extensive broad, nearly level, continental alluvial plains; frequently related to local base levels
5.	Geology & parent material	Holocene, Recent sandy alluvial deposits
6.	Vegetation	Generally none. Wild grass and weeds in places
7.	Depth	More than 1 m
8.	Colour and texture	Yellowish brown to brown sandy loam surface and yellowish brown dark yellowish brown sandy substrata
9.	Drainage	Dominantly excessively to moderately well drained, and some imperfectly and poorly drained
10.	Structure	Usually massive; some weak subangular blocky structure
11.	Organic matter	Low
12.	Reaction	Acid to slightly acid
13.	Erosion	None
14.	Base saturation & plant nutrients	Low and relatively poor in plant nutrients
15.	Productivity and use	The productivity of these soils is low, even with good management
16.	Limitations	Excessive drainage, low fertility and low water holding capacity are the major limitations
17.	Land class	Rice paddy; III to VI, Upland crops; II to V

MAPPING UNIT: An - Complex of Soils, Narrow Valleys

1.	Area mapped	7 300 km^2
2.	Occurrence	With exception of the west coastal region it forms a dense network over Korea, within mountainous areas

3.	Climate	All the main climates of South Korea
4.	Physiography	It comprises the narrow young valley network within the mountainous uplands. Some of these valleys, despite being under active geological erosion, have thin alluvial deposits
5.	Geology & parent material	Holocene Recent alluvial deposits including some local pedimentary outwash and torrential riverwash
6.	Vegetation	Where not cultivated, shrubs, conifers and deciduous trees
7.	Depth	From 30 cm to 1 m
8.	Colour and texture	Dominantly brown to gray loam surface over dark, yellowish brown to gray mottled sandy loam to clay loam substrata. Gravel and cobbles are usual throughout the profile
9.	Drainage	Imperfectly to poorly drained
10.	Structure	Generally structureless (massive); some weak subangular blocky
11.	Organic matter	Low to relatively higher in the highest altitude headwaters
12.	Reaction	Acid; pH between 5 and 6
13.	Erosion	Slight to moderate
14.	Base saturation & plant nutrients	Moderately low and with moderate content in plant nutrients.
15.	Productivity and use	Variable under intensive cultivation; moderately to highly productive. Used chiefly for rice paddy. In the head waters and valley edges, upland crops are cultivated
16.	Limitations	Water holding capacity for rice paddy, workability poor due to presence of gravel, erosion in certain areas, and low fertility status of some soils
17.	Land class	Rice paddy; I to III, Upland; III to VI

MAPPING UNIT: Lp - Very Dark Brown to Black Volcanic Ash Soils, Lava Plain

1.	Area mapped	794 km^2
2.	Occurrence	Limited to the island of Jeju
3.	Climate	Warm temperate rainy climate
4.	Physiography	Coastal plains, undulating terraces, and gently sloping intermountain areas
5.	Geology & parent material	Volcanic ash over lava flow
6.	Vegetation	Largely grassland; some trees and shrubs
7.	Depth	Usually 1 m or more, some shallow areas

8.	Colour and texture	Black or very dark brown loamy soils, with dark reddish or yellowish brown clayey subsoils
9.	Drainage	Well drained
10.	Structure	Granular and blocky
11.	Organic matter	High
12.	Reaction	Strongly acid to medium acid, pH 5.5 to 6.0
13.	Erosion	Slightly eroded. Some wind erosion
14.	Base saturation & plant nutrients	Low and poor
15.	Productivity and use	Moderate yields of upland crops and forage crops under good management
16.	Limitations	Strong acidity, low fertility, high phosphate requirements, loose soils subject to blowing by wind
17.	Land class	III

MAPPING UNIT: Lt - Very Dark Brown to Black Volcanic Ash Soils, Lava Terraces

1.	Area mapped	435 km^2
2.	Occurrence	Limited to the island of Jeju
3.	Climate	Warm temperate rainy climate
4.	Physiography	Slightly to moderately dissected undulating terraces and slopes
5.	Geology & parent material	Volcanic ash over primary lava flow
6.	Vegetation	Grassland or forest
7.	Depth	Shallow, usually about 30 to 50 cm
8.	Colour and texture	Very dark brown to black loam, with yellowish brown to dark brown loamy to clayey subsoils
9.	Drainage	Well to excessively drained
10.	Structure	Granular and blocky
11.	Organic matter	High
12.	Reaction	Strongly acid to medium acid pH 5.5 to 6.0
13.	Erosion	Moderately eroded. Some wind erosion
14.	Base saturation & plant nutrients	Low and poor
15.	Productivity and use	Not production for crops. Suitable for grass and forest, and in places for citrus trees
16.	Limitations	Shallow depth, stoniness, acidity, low fertility, lack of water
17.	Land class	VIs

MAPPING UNIT: Mj - Volcanish Ash Soils, Cinder Cones

1.	Area mapped	130 km^2
2.	Occurrence	Limited to the island of Jeju
3.	Climate	Warm temperate rainy climate
4.	Physiography	Sloping to very steep cinder cones
5.	Geology & parent material	Volcanic ejecta
6.	Vegetation	Grass land, trees and shrubs
7.	Depth	Very shallow over pumice, unweathered gravel and cobbles
8.	Colour and texture	Dark brown to very dark brown loam
9.	Drainage	Somewhat excessively or excessively drained
10.	Structure	Fine granular
11.	Organic matter	High
12.	Reaction	Strongly acid
13.	Erosion	Severely eroded
14.	Base saturation & plant nutrients	Low and poor
15.	Productivity and use	Suitable only for forest and grassland
16.	Limitations	Shallow depth, stoniness, acidity,low fertility, lack of water
17.	Land class	VIs

MAPPING UNIT: Ra - Red Yellow Podzolic Soils, Siliceous Crystalline Materials

1.	Area mapped	12 220 km^2
2.	Occurrence	Extensive in the west coastal region from the Demilitarized Zone to the extreme south of Jeonlanam Do and penetrating inland along the main valleys up to Daejeon and Gwangju. In other areas it is less extensive, in small areas
3.	Climate	Dominantly warm temperate climate with or without dry seasons and hot summers; rain fall ranges between 1 000 to 1 300 mm
4.	Physiography	Strongly dissected and denudated pediplane and correlated pediments; rolling to undulating relief
5	Geology & parent material	Relatively thin older alluvial pedimentary deposits overlying deeply weathered crystalline bedrock (granite, gneiss)
7.	Depth	Approx. 50 cm to more than 1 m

8.	Colour & texture	Yellowish brown to red silt loam, over yellowish red to red clay, with loam to sandy loam deeply weathered bedrocks
9.	Drainage	Well drained soils
10.	Structure	Subangular blocky, sometimes weakly developed
11.	Organic matter	Very low or none
12.	Reaction	Acid, pH around 5 to 5.5
13.	Erosion	Moderate to slight
14.	Base saturation & plant nutrients	Relatively low, and poor in plant nutrients
15.	Productivity and use	These soils produce moderate to high yields of upland crops under good management
16.	Limitations	Low fertility status, some erosion and lack of irrigation water are the major limitations
17.	Land class	Rice paddy; III to VI, Upland; II to VI

MAPPING UNIT: Re - Lithosols, Severely Eroded, Siliceous Crystalline Materials

1.	Area mapped	2 560 km^2
2.	Occurrence	Inland areas north of Daejeon and around Chuncheon, and along the northeast coast near Gangneung
3.	Climate	The main climates of South Korea
4.	Physiography	Strongly dissected, denudated and recently eroded rolling pediplane with gullies
5.	Geology & parent material	Acidic crystalline rocks, mostly granite, deeply weathered with small scattered thin alluvial pedimentary materials overburden
6.	Vegetation	Few sparse pine trees, shrubs and grasses
7.	Depth	Shallow soil, less than 30 cm
8.	Colour & texture	Yellowish brown sandy to loamy surface over yellowish brown to pale brown sandy substrata, when not eroded. Same as the unit Ra
9.	Drainage	Well to excessive
10.	Structure	Structureless or weak subangular blocky
11.	Organic matter	None
12.	Reaction	Acid, pH about 5
13.	Erosion	Severe
14.	Base saturation & plant nutrients	Low and poor in plant nutrients
15.	Productivity & use	Poor soils; not suitable for agriculture, mostly under reforestation. Agriculture is very scattered
16.	Limitations	Non-agricultural land
17.	Land class	Upland; V-VII

MAPPING UNIT: Rl - Reddish Brown Lateritic Soils and Lithosols, Calcareous Materials

1.	Area mapped	340 km^2
2.	Occurrence	Gangweon Do, southwest of Gangneung, and relatively small areas in the headwater valleys of the Han river and tributaries in the Taebaeg San region
3.	Climate	Cool-snow forest climate to warm rainy temperate with hot summers and dry winters; annual rain fall between 1 000 and 1 100 mm
4.	Physiography	Moderate to strongly dissected rolling pediplane, pedislope and terraces
5.	Geology & parent material	Thin alluvial-pedimentary material covering Cambro-Ordovician limestone and related rocks associated with schist and others (Chosun system)
6.	Vegetation	When not cultivated, sparse conifers, deciduous trees and shrubs
7.	Depth	Generally 50 cm to more than 1 m
8.	Colour & texture	Dark yellowish brown to dark brown clay loam to clay over reddish-brown to brown clay subsoils
9.	Drainage	Well drained
10.	Structure	Strongly subangular blocky and prismatic
11.	Organic matter	Relatively low
12.	Reaction	Slightly acid, pH commonly above 6
13.	Erosion	Moderate
14.	Base saturation & plant nutrients	Medium to high; soils relatively high in calcium and magnesium
15.	Productivity and use	These soils are considered to be among those with higher productivity and are used for the production of several upland crops including barley
16.	Limitations	For rice, lack of water for irrigation. For upland crops organic matter and erosion are the major limitations
17.	Land class	III to IV

MAPPING UNIT: Rs - Lithosols, Regosols and Red Yellow Podzolic Soils, Sedimentary Materials

1.	Area mapped	1 280 km^2
2.	Occurrence	Extensive in southeastern region Gyeongsang Do, and in the vicinities of Yeosu, Hwasun, Hampyeong and Imsil, Jeonlabug Do
3.	Climate	Main climates of South Korea

4.	Physiography	Strongly dissected and denudated pediplane and correlated pediments of rolling relief
5.	Geology & parent material	Sedimentary rocks, mostly shale, and deeply weathered sandstone conglomerate with thin alluvial pedimentary overburden
6.	Vegetation	When not cultivated dominantly conifers, with deciduous shrubs and grasses
7.	Depth	Approximately 30 to 70 cm
8.	Colour & texture	Brownish yellow to yellowish brown loamy surface over yellowish brown to strong brown silty clay loams and brown loamy deeply weathered bedrock
9.	Drainage	Well to somewhat excessively drained
10.	Structure	Weak subangular blocky or structureless
11.	Organic matter	Very low or none
12.	Reaction	Acid, pH approximately 5.5
13.	Erosion	Moderate to severe
14.	Base saturation & plant nutrients	Low and poor in plant nutrients
15.	Productivity and use	Poor soils, not well suited for agriculture. Used for production of some upland crops and forests
16.	Limitations	Low fertility status, erosion and lack of irrigation water are the major limitation
17.	Land class	Upland; IV to VI

MAPPING UNIT: Rv - Red Yellow Podzolic and Reddish Brown Lateritic Soils, Siliceomafic Crystalline Materials

1.	Area mapped	2 000 km^2
2.	Occurrence	In the vicinities of Yeoncheon in Gyeonggi Do, Jaecheon in Chungcheong Bug Do, Muan, Boseong, Haenam in Jeonla Nam Do, and Busan
3.	Climate	All main climates of South Korea
4.	Physiography	Moderate to strongly dissected rolling pediplane, pedislopes and terraces
5.	Geology & parent materials	Thin alluvial pedimentary material covering siliceomafic rocks
6.	Vegetation	When not cultivated, sparse conifers, deciduous, shrubs and grass
7.	Depth	Generally 50 cm to more than 1 m
8.	Colour & texture	Dark yellowish brown to dark brown, fine loamy or loamy surface soils over reddish brown to yellowish red clayey subsoils
9.	Drainage	Well

10.	Structure	Moderate subangular blocky
11.	Organic matter	Relatively low
12.	Reaction	Acid; about pH 5.5
13.	Erosion	Moderate
14.	Base saturation & plant nutrients	Low to medium, and poor in plant nutrients
15.	Productivity & use	These soils are moderately productive of several upland crops
16.	Limitations	Lack of water for irrigation, organic matter and erosion
17.	Land Class	III to IV

MAPPING UNIT: Ma - Lithosol Siliceous Crystalline Materials

1.	Area mapped	25 100 km^2
2.	Occurrence	Extensive throughout South Korea with exception of the southeastern region, Gyeongsang Nam Do, where it occurs in scattered areas
3.	Climate	Warm temperate with hot summers and dry winters in the south, to cool-snow forest climate in the northern regions; rain fall ranges from 1 000 mm to 1 300 mm and temperatures from very cold in the northeast and some areas in the central regions to mildly cold in the south
4.	Physiography	Strongly dissected mountainous land with young narrow valleys and swales. Altitudes are generally above 300 m and range to more than 1 000 m
5.	Geology & parent materials	PreCambrian and supposedly younger rocks, mainly siliceous crystalline materials such as granite and granite gneiss
6.	Vegetation	Shrubs, grasses, deciduous and coniferous forest
7.	Depth	Relatively shallow, ranging from dominantly 10 cm to 50 cm; few areas deeper
8.	Colour & texture	Bron to yellowish brown coarse loamy to loamy surface soils over brown to yellowish brown or yellowish red loamy to coarse loamy or coarse sandy substratum, or variable hard bedrock
9.	Drainage	Dominantly excessive, some well
10.	Structure	Chiefly granular
11.	Organic matter	Ranges from dominantly very low to some areas of moderate
12.	Reaction	Ranges from pH 5.5 to 6.5

13.	Erosion	Dominantly strongly to extremely; some moderate
14.	Base saturation & plant nutrients	Relatively low and poor
15.	Productivity & use	Agriculturally very low, dominantly used for forest
16.	Limitation	This mapping unit has severe limitations for agricultural use, due to the steep slopes and shallow soils, difficult workability, and severe erosion
17.	Land class	VI to VII

MAPPING UNIT: M1 - Lithosols, Calcareous Materials

1.	Area mapped	1 940 km^2, about 2 percent
2.	Occurrence	Dominantly in south part of Gangweon Do, in other places in scattered areas
3.	Climate	Warm temperate climate with hot summers and dry winters, in the south; to cool-snow forest climate in the northern regions; ranges to very cold in the northeastern section
4.	Physiography	Strongly dissected mountainous land with young narrow valleys and swales. Altitudes are generally above 300 m, and range to more than 1 000 m
5.	Geology and parent materials	Calcareous materials such as limestone
6.	Vegetation	Shrubs, grasses, deciduous and coniferous forest
7.	Depth	Relatively shallow, ranging from dominantly 10 to 50 cm; some more deep
8.	Colour & texture	Light olive brown to yellowish brown fine loamy to coarse loamy, and some reddish brown fine loamy texture
9.	Drainage	Dominantly excessively, some well drained
10.	Structure	Blocky, sometimes granular. Only minor percentage of B horizon have subangular blocky structure
12.	Reaction	Ranging from pH 6.5 to 7.5
13.	Erosion	Ranging from dominantly strongly to extremely eroded; some moderate.
14.	Base saturation & plant nutrients	Relatively low and poor
15.	Productivity & use	Agriculturally very low. Dominantly in forest
16.	Limitations	Severe for agriculture, owing to the steep slopes and shallow soils; workability is difficult and erosion is severe
17.	Land class	VI to VII

MAPPING UNIT: Mm - Lithosol, Micaceous and Hard Siliceous Materials

1.	Area mapped	Approx. 6 820 km^2
2.	Occurrence	Scattered, with concentration in Gangweon Do and Chungcheong Do
3.	Climate	Warm temperate climate with hot summers and dry winters in the south, to cool-snow forest climate in the northern regions; rain fall ranges from 1 000 mm to 1 300 mm
4.	Physiography	Strongly dissected mountainous land with young narrow valleys and swales. Altitudes are generally 300 m to more than 1 000 m
5.	Geology & parent materials	Micaceous and hard siliceous materials
6.	Vegetation	Shrubs, grasses, deciduous and coniferous forest.
7.	Depth	Relatively shallow, ranging mostly from 10 cm to 50 cm; some areas are deeper
8.	Colour & texture	Light olive brown to yellowish brown coarse loamy to loamy
9.	Drainage	Dominantly excessive, some well drained
10.	Structure	Granular over bedrock
11.	Organic matter	Dominantly very low; some moderate
12.	Reaction	Ranging from pH 5.5 to 6.5
13.	Erosion	Dominantly strong to extremely eroded; some moderate
14.	Base saturation & plant nutrients	Relatively low and poor
15.	Productivity & use	Agriculturally very low productivity. Fair for forest
16.	Limitation	This mapping unit has severe limitations for agricultural use, owing to the steep slopes and shallow soils, difficult workability, and severe erosion
17.	Land class	VI to VII

MAPPING UNIT: Ms - Lithosols, Sedimentary Materials

1.	Area mapped	Approx. 9 270 km^2, about 11.5 percent
2.	Occurrence	Throughout Gyeongsang Do
3.	Climate	Warm temperate with hot summers and dry winters, or cool-snow forest climate. Rain fall ranges from 1 000 mm to 1 300 m
4.	Physiography	Strongly dissected mountainous land with young narrow valleys and swales. Altitudes range from 200 m to more than 800 m

5.	Geology & parent materials	Sedimentary materials (shales, mudstones, fine textured sandstones)
6.	Vegetation	Shrubs, grasses, deciduous and coniferous forest
7.	Depth	Relatively shallow, ranging dominantly from 10 to 30 cm
8.	Colour & texture	Brown to yellowish brown fine loamy to coarse loamy
9.	Drainage	Dominantly excessive, some well drained
10.	Structure	Mostly granular. No subsoil horizon
11.	Organic matter	Ranges dominantly from very low to some moderate
12.	Reaction	Ranges from pH 5.0 to 6.5
14.	Base saturation & plant nutrients	Relatively low and poor
15.	Productivity and use	Agriculturally very low, and forest
16.	Limitations	Severe limitations for agricultural use owing to the steep slopes and shallow soils, difficult workability, and severe erosion
17.	Land class	VI to VII

MAPPING UNIT: Mu - Acid Brown Forest Soils and Lithosols, Undifferentiated Materials

1.	Area mapped	1 323 km^2
2.	Occurrence	Extensive areas in the northeastern mountainous region and the highest altitudes in the south
3.	Climate	Dominantly under cool-snow forest climate, with an average of 1 000 to 1 100 mm of rain fall. The plateaus are covered by snow for long periods in winter
4.	Physiography	Dissected plateaus and a sequence of older erosion surfaces, mainly above 400 m, including the elevated valley system in the northeast and the adjacent mountains. Karst relief appears in the areas of limestone formations
5.	Geology & parent material	Undifferentiated, dominantly preCambrian granites and gneisses
6.	Vegetation	Forest on the mountainous slopes, grading into shrubs and grasses on less dissected plateaus
7.	Depth	Variable, from very deep with more than 150 cm (subunit/Mua) to very shallow, less than 30 cm on mountainous slopes (subunit/Mub)
8.	Colour & texture	Dark grayish brown loam surfaces over dark to strong brown silty clay to silty clay loam subsoils (subunit Mua), and light brown loam to sandy loam (subunit Mub)

9.	Drainage	Well to excessively drained
10.	Structure	Subangular blocky in the unit Sl, to weak and structureless in the subunit Mub
11.	Organic matter	Relatively high, about 15 percent
12.	Reaction	Acid to very acid; slightly acid in areas of limestones, pH between 4.5 and 6
13.	Erosion	Slight to moderate in subunit Mua, strong and potentially severe in subunit Mub
14.	Base saturation & plant nutrients	Relatively low and poor in plant nutrients with exoeption of limestone areas; high to medium in organic matter
15.	Productivity	With adequate management, including complete fertilizers, these soils are able to produce high yields of a large variety of crops. Used for the cultivation of corn, soybeans, potatoes, etc.
16.	Limitations	Low fertility status, lack of water for irrigation (subunit Mua), shallowness and erosion in the subunit Mub
17.	Land class	Mapping subunit Mua; II to IV, mapping subunit Mub; III to VII

MAPPING UNIT: Mv - Lithosols, Siliceomafic Materials

1.	Area mapped	Approx. 6 300 km^2
2.	Occurrence	Scattered throughout with concentrations in Gyeongsang Do, and western Jeonla Do
3.	Climate	Warm temperate climate with hot summers and dry winters in the south, to cool-snow forest climate in the northern regions. Rain fall ranges from 1 000 mm to 1 300 mm.
4.	Physiography	Strongly dissected mountainous land with young narrow valleys and swales. Altitudes range from 300 to more than 1 000 m
5.	Geology & parent materials	Siliceomafic materials
6.	Vegetation	Shrubs, grasses, deciduous and coniferous forest
7.	Depth	Relatively shallow, ranging dominantly from 10 to 50 cm. Some areas are deeper
8.	Colour & texture	Light olive brown to yellowish brown, loamy and coarse loamy
9.	Drainage	Dominantly excessive, some well drained
10.	Structure	Granular, some weak blocky
11.	Organic matter	Ranging from dominantly very low to some moderate
12.	Reaction	Ranging from pH 5.5 to 6.5

13.	Erosion	Ranging from dominantly strong to extreme erosion; some moderate
14.	Base saturation & plant nutrients	Relatively low and poor
15.	Productivity & use	Agriculturally very low; dominantly used for forest with fair production
16.	Limitation	Severe for agricultural use owing to the steep slopes, shallow soils, difficult workability and severe erosion
17.	Land class	VI to VII

Appendix 3

MAP AT SCALE 1:50 000

During the field checking of the 1:50 000 soil reconnaissance a considerable amount of detail was recognized which could not be included in the 1:250 000 reconnaissance map. Approximately 85 subunits were identified and described, based on the main characteristics of soils within the photo-interpretation units. This expansion of the field checking legend was necessary in order to cover particular soil conditions in areas of importance and to provide the detail required for the Low Production Rice Paddy Project. After final correlation the number of subunits was reduced to 58.

The map at scale of 1:50 000 is in effect a semi-detailed survey of the entire country. It is to be issued in nine folio volumes, one for each province. The accompanying report is in the Korean language.

This semi-detailed map includes 58 mapping units, from which the soil reconnaissance units were generalized. They were made on the basis of soil characteristics and physiography. Areas mapped are of sufficient homogeneity to permit general interpretations for agriculture and forestry. Land capability and suitability for specific crops cannot be determined for individual fields or farms, but can be determined for communities or landscape units in areas down to 25 ha or less in size. The map provides very useful information for use in Government programmes for development of land areas for specific crops.

The legend and descriptions of units for the semidetailed map follow. The legend shows the relationship of these units to those of the 1:250 000 Soil Reconnaissance Map, and to the 1:1 000 000 General Soil Map 1/. It also lists representative soil series 1/ for each of the associations shown on the maps. Table 11, following, gives the legend and map symbols.

Afa: Coarse Loamy to Sandy Alluvial Soils, Moderately Well to Well Drained

This subunit is on nearly level to gently sloping areas of very Recent flood-plains and river levees. It is an association predominantly of moderately well to well drained, coarse loamy soils. The surface horizons are brown to grayish brown in colour and dominantly sandy loam ranging to loamy sand. They are slightly acid to medium acid in reaction. The substrata are dominantly brown, dark brown and yellowish brown sandy loam, loam and silt loam. This land is used for upland crops except where water is available for irrigation and it is used for paddy rice. Most of these

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1/ The Soils of Korea, Technical Report 1, Soil Survey Project, Republic of Korea, FAO/UNDP, Rome.

soils are in upland capability Classes II to III and are best suited for vegetable production. Limiting factors for rice paddy are the rapid permeability, low water holding capacity and low plant nutrient content. Most of the subunit used for paddy is in paddy capability Class IV because of these limitations.

With protection from floods, the application of adequate fertilizers and good management, these soils would produce satisfactory yields of upland crops.

Subunit: Afa
Profile: Recon. Stop 173

This is a moderately well drained, moderately coarse textured Alluvial soil developed on Recent alluvium in a slightly elevated plain, cultivated in soybean and barley.

The profile described is on a roadside in Midang Ri, Cheongnam Myeon, Cheongyang Gun, Chungcheong Nam Do.

Ap—0 to 20 cm; Dark grayish brown (2.5Y 4/2), loam; structureless (massive); slightly sticky and slightly plastic; faint few, fine brown (10YR 4/3) mottles; many, fine and medium rice roots; few, fine pores; common, fine mica; clear, smooth boundary; pH 5.5.

C1—20 to 30 cm; Dark gray (10YR 4/1) loamy sandy loam; structureless (massive); slightly sticky and slightly plastic; many, prominent medium and coarse strong brown and yellowish red (3.5YR 5/6 to 5YR 4/6) mottles; crushed colour very dark grayish brown (10YR 3/2-2.5Y 3/2); common, fine and medium pores; common, fine roots; common, fine mica; clear, smooth boundary; pH 5.0.

C2—30 to 75 cm; Very dark grayish brown (10YR 3/2) to dark brown (10YR 3/3) sandy loam; structureless (massive); slightly sticky and slightly plastic; many, fine and medium pores; no roots; mica as above; clear, smooth boundary; pH 6.5.

C3—75 to 100 cm; Dark brown (10YR 3/3) loamy coarse sand; structureless (single grain); nonsticky and nonplastic; no pores or mottles; abrupt, smooth boundary; pH 6.5.

C4—100+ cm; Very gravelly to cobbly sand layer.

Subunit: Afa
Profile: Recon. Stop 173

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textual Class
1	S-676	Ap	0- 20	4.5	2.2	7.6	11.1	14.1	9.0	40.5	15.5	L
2	677	C1	20- 30	0.4	3.0	8.6	13.0	16.6	10.8	37.5	10.4	SL
3	678	C2	30- 75	2.9	2.6	12.1	17.1	18.1	10.1	28.1	11.9	SL
4	679	C3	75-100	3.0	6.6	25.0	23.0	15.5	6.6	17.8	5.5	LCS

1/ Pipette Method, Sodium Hexameta Phosphate.

	International				Moisture Retention	pH		1/
	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	1/3 atm.	H_2O (1:5)	O.M. %	CEC m.e.
1	24.9	31.4	28.2	CL	35.5	6.0	1.7	9.0
2	28.9	37.7	22.9	SL	26.3	6.4	1.7	7.7
3	37.1	34.6	16.4	SL	22.1	6.4	1.6	9.3
4	60.0	23.9	10.6	CoSL	12.7	6.6	0.8	5.5

	Exchangeable Cations m.e./100 gm				
	Ca	Mg	Na	K	Sum of Cations
1	4.2	0.3	0.32	0.30	5.12
2	4.0	0.3	0.16	0.14	4.60
3	4.8	0.0	0.14	0.22	5.16
4	2.5	0.7	0.16	0.14	3.50

1/ Ammonium Acetate Method.

Afb: Coarse Loamy to Sandy Alluvial Soils, Imperfectly to Poorly Drained

This subunit is on nearly level to gently sloping areas of Recent floodplains and river levees. It is an association predominantly of imperfectly to poorly drained, coarse loamy and sandy soils on Recent alluvial deposits. The surface horizons are dark grayish brown to dark gray or very dark gray sandy loam, loam and silt loam with medium acid reaction.

The substrata are deep, dominantly sandy loam, loamy sand and loam. They are dark gray to dark yellowish brown and in the poorly drained places olive and gray to very dark gray. They usually have brown mottles. Reaction is medium to slightly acid. Almost all of this land is in paddy and used for the production of rice. The better drained areas are double cropped, with barley or vegetables. Most of the land is in paddy capability Class IV.

Productivity in general is low to moderate. However, in some areas, as in the vicinity of Incheon, these soils produce high yields of paddy rice. The principal

limiting factors are their rapid permeability, low level of plant nutrients, periodic floodings, and in some cases high watertables. The predominant upland capability Classes are III to V because of poor drainage. These soils are not generally well suited for upland crops, and in some areas are suited only for paddy rice.

Subunit: Afb
Profile: Recon. Stop 168

This is a moderately well drained, moderately coarse textured, Alluvial soil developed in Recent alluvium, occurring on a gently sloping alluvial plain in rice paddy.

The profile described is in a broad alluvial plain at Jugjang Ri, Daecheong Eub, Boryeong Gun, Chungcheong Nam Do.

Ap—0 to 18 cm; Dark grayish brown (2.5Y 4/2); single grain silt loam; no mottles; nonsticky and slightly plastic; many, fine roots; gradual, smooth boundary.

C1—18 to 35 cm; Dark gray to dark grayish brown (2.5Y 4/0 to 4/2); gravelly and cobbly sandy loam; structureless (single grain); many prominent fine strong brown (7.5YR 5/6) mottles; crushed colour dark yellowish brown (10YR 4/4); common, fine roots; common fine pores; nonsticky and slightly plastic; clear, smooth boundary.

C2—35 to 70 cm; Dark yellowish brown (10YR 4/4) very gravelly to cobbly sandy loam.

Subunit: Afb
Profile: Recon. Stop 168

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture							
					VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-658	Ap	0-18	4.3	2.0	8.3	16.2	23.9	13.7	27.3	8.6	SL
2	659	C1	18-35	8.6	2.4	9.8	16.4	24.1	14.0	24.5	8.8	SL
3	660	C2	35-70	4.2	3.3	14.4	24.5	22.2	9.8	18.1	7.7	SL

1/ Pipette Method, Sodium Hexameta Phosphate.

	International				Moisture Retention	pH	1/	Base	
	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	1/3 atm.	H_2O (1:5)	CEC m.e.	Saturation %	O.M. %
1	33.2	42.5	15.7	FSL	23.6	5.6	5.5	53.1	2.4
2	35.4	40.0	15.8	FSL	19.4	5.9	5.0	60.8	1.5
3	49.0	31.2	12.1	CSL	13.9	6.4	4.2	72.4	0.5

	Exchangeable Cations m.e./100 gm				
	Ca	Mg	Na	K	Sum of Cations
1	2.3	0.0	0.50	0.12	2.92
2	2.5	0.3	0.18	0.06	3.04
3	2.6	0.2	0.16	0.08	3.04

1/ Ammonium Acetate Method.

Afc: Sandy to Coarse Loamy Riverwash and Alluvial Soils, Moderately Well to Excessively Drained

This subunit is in the same landscape position as subunit Afd. It is comprised mostly of excessively to moderately well drained coarse loamy and sandy Recent alluvial deposits. They differ from the Afd subunit chiefly in lacking gravel and cobbles. The land is chiefly in upland capability Classes IV and VIII. Like the subunit Afd, agriculture in this land is scattered. Where the land is relatively well protected from flooding, it is used for upland crops and vegetables. About 30 percent of the land grows these. Because of rapid permeability, very low natural fertility and water holding capacity, yields of most crops are low.

Subunit: Afc
Profile: Recon. Stop 213

This is an excessively drained, sandy Alluvial soil developed in Recent alluvium. It is in elevated riverwash topography, growing upland crops such as corn, wheat and rye, and some wild grass.

The profile described is near the Sinyeong river, Sindong, Chunseong Gun, Gangweon Do.

Ap--0 to 12 cm; Brown to dark brown (10YR 4/3), sand; structureless (single grain); loose, nonsticky and nonplastic; many, fine living grass and corn roots; many, medium and fine mica flakes; clear, smooth boundary.

C--12 to 72 cm; Dark yellowish brown (10YR 4/4), sand; structureless (single grain); loose, nonsticky and nonplastic; many, medium and fine mica flakes; abrupt, smooth boundary.

IIC--72 to 84 cm; Dark brown (10YR 3/3), fine, loamy sand; structureless (massive); friable, nonsticky and nonplastic; very few, fine roots; many, medium and fine mica flakes; abrupt, smooth boundary.

IIIC--84 to 150+ cm; Dark yellowish brown (10YR 4/4); sand, structureless (single grain); loose, nonsticky and nonplastic; no roots; many, fine and medium mica flakes.

Subunit: Afc
Profile: Recon. Stop 213

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-882	Ap	0- 12	1.7	0.6	3.3	22.8	42.4	17.7	9.9	3.3	S
2	883	C	12- 72	1.7	0.9	8.7	44.5	32.2	6.3	6.3	1.1	S
3	884	IIC	72- 84	10.01	←	5.3	→	41.9	34.0	14.7	4.1	LS
4	885	IIIC	84-150	0.0	←	5.9	→	51.2	26.6	12.6	3.7	LFS

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	pH H_2O (1:5)	O.M. %	2/ m.e.	Base Saturation %
1	39.5	51.0	6.2	S	6.1	1.0	3.8	40.0
2	68.6	26.2	4.0	S	6.3	0.3	2.0	61.0
3	15.9	70.4	9.6	LFS	6.6	0.8	5.8	64.5
4	14.2	75.6	6.5	LFS	6.8	0.5	4.4	68.2

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

	Exchangeable Cations m.e./100 gm				
	Ca	Mg	Na	K	Sum of Cations
1	1.3	0.0	0.08	0.14	1.52
2	0.9	0.0	0.18	0.14	1.22
3	3.5	0.0	0.08	0.16	3.74
4	2.5	0.3	0.10	0.10	3.0

Afd: Cobbly to Gravelly Sandy to Coarse Loamy Riverwash and Alluvial Soils, Moderately Well to Excessively Drained

This subunit comprises the nearly level to gently sloping riverwash along the main river channels, at the present level. It includes excessively well to moderately well drained, gravelly and cobbly, coarse loamy soil materials on very Recent alluvial deposits. The surface horizons are yellowish brown to brown loamy sand and sand with medium acid reaction. The substrata, extending to depths of 2 m or more, are brown or yellowish brown loose sand or loamy sand, containing varying amounts of gravel and cobbles. Reaction is slightly to medium acid. Most of the land of this subunit is not cultivated. In a few scattered places it is used for orchards. Most of the soils or materials are in upland Class VIII. They are not suited to crops, being very low in moisture holding capacity, very poor in plant nutrients, and having very rapid permeability.

With flood control, removal of the gravel and cobbles, and adequate management, some of these soils could be made suitable for agriculture.

Ana: Usually Cobbly or Gravelly Fine Loamy or Fine Silty Low Humic Gley and Alluvial Soils, Moderately Well to Poorly Drained, Nearly Level to Sloping

This subunit is on nearly level alluvial plains and slopes within the hills and mountains. It is an association predominantly of moderately well drained to imperfectly drained generally cobbly or gravelly fine loamy to clayey soils developed in Recent local alluvial deposits. They are predominantly Low-Humic Gley, with some Alluvial, soils. A few areas of Regosols, Rego-Lithosols, riverwash, Red-Yellow Podzolic soils and Lithosols are included as scattered areas within this subunit.

The surface soils are dark grayish brown to dark yellowish brown in colour, sandy loam, loam to sandy clay in texture loam. They are slightly acid to strongly acid. Their subsoils are very dark gray to gray, with yellowish brown and olive mottles. Subsoil textures range from clay loam to sandy clay loam and loam. Manganese mottles and soft concretions are common. Structure is usually coarse prismatic and blocky, with coarse clay cutans on the faces. These soils are dominantly moderately deep to deep. Reaction is mostly medium to strongly acid, but is neutral to slightly alkaline in the limestone areas. The substrata below 60 to 100 cm are gray, dark yellowish brown and greenish gray. Textures of substrata are usually coarser than in the upper

subsoils. Gravel and cobbles are common. Most of this land is under cultivation, with paddy rice the principal crop, except for eastern regions in Gangweon Do. In these areas, upland crops such as corn, potato, radish, and hops are cultivated. The soils of this subunit are chiefly in paddy capability Classes II and III, and upland capability Class III. Most of the soils have sufficient depth, and water holding capacity and suitable slopes for rice paddy. Double cropping (rice and barley) is recommended on the imperfectly to moderately well drained soils in the southern regions of Korea. Bench terracing and contour cultivation are recommended for areas not in paddies to protect the soils against erosion. Water reservoirs should be built at the head waters to supply irrigation water.

Subunit: Ana
Profile: Ulsan Stop 50

This is a moderately well to imperfectly drained, fine textured Low-Humic Gley soil on alluvium derived from granite, in gently sloping valleys in hilly lands. The profile described is at Gyo Dong, Samnam Myeon, Ulju Gun, Gyeongsangnam Do.

Ap1—0 to 18 cm; Dark gray (10YR 4/1), friable, silty clay loam with moderate, fine and medium granular structure; many fine and medium mottles of brown to dark brown (7.5YR 4/4); sticky and plastic; few, very fine and fine continuous and discontinuous random exped and imped dendritic vesicular and tubular pores; many, very fine to medium living and dead rice and wild grass roots; clear, smooth boundary; 17 to 18 cm thick; pH 5.5.

Ap2—18 to 27 cm; Dark gray (10YR 4/1), strong brown (7.5YR 5/8), brown to dark brown (10YR 4/4) crushed; slightly firm, silty clay loam with strong medium and coarse subangular blocky structure; continuous thin and moderately thick clay cutans; sticky and plastic; common, very fine to medium continuous vertical imped simple tubular pores; common rice roots; as above; clear, wavy boundary; 4 to 9 cm thick; pH 6.5.

B1—27 to 70 cm; Dark gray (10YR 4/1), firm, silty clay loam (clay loam) with strong coarse and medium subangular blocky structure; common, medium and coarse mottles of strong brown (7.5YR 5/8); continuous moderately thick and thick clay cutans; very sticky and very plastic; pores as above; few, very fine and fine dead rice roots; clear, smooth boundary; 40 to 45 cm thick; pH 6.8.

B2—70 to 120+ cm; Strong brown (7.5YR 5/6); very firm, silty clay loam; structureless (massive); many, fine to coarse mottles of light brownish gray (10YR 6/2); common, fine to coarse mottles of black (7.5YR 2/0); patchy thin clay cutans; very sticky and very plastic; few, very fine to coarse discontinuous and continuous random imped and exped dendritic vesicular and tubular pores; no roots; pH 7.0.

Subunit: Ana
Laboratory Data: Ulsan Stop 50

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	U-286	Ap1	0- 18	2.1	0.5	1.7	2.8	4.7	2.8	53.1	34.4	SiCL
2	287	Ap2	18- 27	0.5	0.4	1.2	2.4	3.9	3.3	54.2	34.6	SiCL
3	288	B1	27- 70	0.0	0.3	1.2	2.4	4.6	3.7	52.6	35.2	SiCL
4	289	B2	70-120+	0.0	1.3	0.7	1.7	1.1	3.6	54.4	37.2	SiCL

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	S.G.	Atterberg Limits Lw	Pw	Moisture Retention 1/3 atm.	15 atm.	Clay and Clay Minerals SiO_2/R_2O_3	SiO_2 %
1	6.0	16.6	43.0	LiC	2.59	53.2	30.1	44.94	24.73	2.645	57.12
2	4.8	19.2	41.4	LiC	2.65	54.2	26.8	39.80	22.60	2.485	55.71
3	4.8	21.9	38.1	LiC	2.72	45.4	23.0	32.90	15.62	2.424	53.58
4	4.2	15.3	43.3	LiC	2.75	50.3	24.9	36.14	19.15	2.460	55.68

	Clay and Clay Minerals Fe_2O_3 %	Al_2O_3 %	CEC m.e.	Free Fe_2O_3	pH H_2O (1:5)	C	Organic Matter O.M. %	N %	C/N	2/ CEC m.e.
1	8.38	31.31	37.48	1.59	5.2	2.5	4.3	0.35	7.1	18.8
2	10.61	31.28	26.46	2.25	5.1	1.9	3.3	-	-	18.1
3	11.25	30.32	35.45	2.58	6.6	0.6	1.1	-	-	14.2
4	10.67	31.61	35.10	2.68	6.6	0.2	0.3	-	-	20.2

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

	Exchangeable Cations m.e./100 gm					Available
	Ca	Mg	Na	K	Sum of Cations	P_2O_5
1	6.90	3.00	0.13	0.18	10.21	29
2	10.00	4.30	0.12	0.16	14.58	12
3	8.70	4.10	0.12	0.15	13.07	4
4	13.50	6.50	0.04	0.19	20.23	3

Anb: Generally Cobbly or Gravelly Coarse Loamy Alluvial and Low-Humic Gley Soils, Moderately Well to Imperfectly Drained, Nearly Level to Sloping Local Alluvial Plains and Slopes

This subunit is on nearly level to sloping Recent local alluvial plains and slopes, in the valleys within the hills and mountains. It includes moderately well to imperfectly drained, generally cobbly or gravelly coarse loamy soils, developed in Recent local alluvial deposits derived from undifferentiated or mixed materials. Alluvial soils are predominant. In some areas Low-Humic Gley soils are found in pockets within the local base levels. Areas of Regosols, Lithosols, and Red-Yellow Podzolic soils also are included on gently sloping to sloping colluvial and pedimentary slopes. Surface horizons are dark grayish brown to gray, usually gravelly or cobbly sandy loam, loam and loamy sand of medium acid reaction. The substrata are dark grayish brown dark yellowish brown and dark brown, and usually gravelly or cobbly sandy loam, loamy sand, or loams with a massive structure. Yellowish brown mottles, manganese mottles and soft concretions are few to common. Reaction is slightly acid to strongly acid. There are many areas of soils which are intergrades between Low-Humic Gley and Alluvial soils. Most of the land is in paddy and is used for production of rice. The better drained parts are used for a two crop system of rice and barley or vegetables. Most of the soils are in paddy land capability Classes III and IV. In general they are of low to medium productivity. The principal limiting factors are rapid permeability, low nutrient supplying capacity, and the periodic floodings associated with torrential flows. The predominantly upland capability Class is III because of their wetness. Paddy land is not suited to the sloping areas because of poor water holding capacity.

Subunit: Anb
Profile: Recon. Stop 163

This is an imperfectly drained, moderately coarse textured alluvial soil on Recent alluvium derived from granite porphyry.

The profile described is on a gently sloping narrow alluvial plain in the mountains near Hae Ri, Naesan Myeon, Buyeo Gun, Chungcheongnam Do.

Ap—0 to 12 cm; Very dark gray (5Y 3/1); fine sandy loam; friable, slightly sticky and slightly plastic; many, fine and medium dead

rice roots; many, fine pores; many, fine mica; few, unweathered fine gravel derived from granitic porphyry; gradual, wavy boundary; pH 6.5.

Ap12--12 to 22 cm; Very dark gray (5Y 3/1); fine sandy loam; massive to weak coarse platy structure; faint common, fine to medium; dark yellowish brown (10YR 3/4) mottles; firm, slightly sticky and nonplastic; common, fine dead rice roots; many, fine pores; many, fine yellow mica; few unweathered gravel derived from granitic porphyry; abrupt, smooth boundary; pH 6.5.

C1--22 to 41 cm; Dark gray (5Y 4/1); gravelly sandy loam; structureless (massive) distinct common coarse and medium dark yellowish brown (10YR 4/4) mottles; few coarse dead roots; many, fine yellow mica flakes; clear. smooth boundary; pH 6.5.

C2--41 to 100 cm; Very dark gray (5Y 3/1); sandy loam; few distinct coarse dark yellowish brown (10YR 4/4) mottles; few, unweathered subangular pebbles derived from granitic porphyry; many, fine yellow mica; abrupt, smooth boundary; pH 6.5.

C3--100 to 120+ cm; Black to very dark gray (5YR 2/1 to 3/1); sandy loam; structureless (massive); sticky and plastic; many unweathered subangular pebbles derived granitic porphyry; pH 7.0.

Subunit: Anb
Soil Description: Recon. No. 163

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-640	Ap	0- 12	3.9	1.5	4.7	13.6	23.2	14.2	37.2	5.6	SL
2	641	Ap	12- 22	10.6	1.0	5.8	17.9	25.0	11.9	34.6	3.8	SL
3	642	C1	22- 41	11.9	1.6	8.1	21.8	28.4	11.6	25.2	3.3	SL
4	643	C2	41-100	8.5	1.4	8.2	22.4	28.8	10.7	25.4	3.1	SL

1/ Pipette Method, Sodium Hexameta Phosphate.

	International				pH		1/	Exchangeable Cations m.e./100 gm				
	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	H_2O (1:5)	O.M. %	CEC m.e.	Ca	Mg	Na	K	Sum of Cations
1	25.6	47.5	21.3	FSL	6.2	3.2	6.6	3.4	0.9	0.18	0.14	4.62
2	32.4	43.9	19.8	FSL	6.1	2.0	5.4	1.8	0.5	0.36	0.10	2.76
3	41.0	40.7	15.0	FSL	5.9	1.5	3.2	1.2	0.0	0.18	0.08	1.46
4	41.5	39.9	15.5	SL	5.8	0.9	3.0	1.5	0.0	0.14	0.10	1.74

1/ Ammonium Acetate Method.

Anc: Complex of Coarse Loamy, Loamy Skeletal, Fine Clayey and Fine Loamy Undifferentiated Materials, Moderately Well to Well Drained Alluvial-Colluvial Slopes

This subunit is on sloping to moderately steep Recent local alluvial-colluvial or pedimentary accumulations derived from undifferentiated or mixed materials, in steep narrow valleys within the mountains. They comprise the slopes from the bottom of the valley floors to the foot of the mountains, defined as an alluvial-colluvial sedimentary complex. This is an association of predominantly moderately well to well drained, fine to coarse loamy soils with smaller areas of imperfect drainage. These soils form a complex of Alluvial, Low-Humic Gley soils, Regosols, Lithosols and Red-Yellow Podzolic soils on sloping to moderately steep areas of alluvium-colluvium.

Surface soils are dark brown to dark grayish brown in wet areas, and dark yellowish brown in well drained areas. Textures vary from sandy loam, or loam to silt loam, and clay loam. The subsoils, extending to depths of 50 cm or more, are dark gray to grayish brown in wet areas and dark brown to yellowish brown in well drained areas with yellowish brown to strong brown mottles. They are massive and have a weak blocky structure. Reaction is mostly strongly acid to medium acid, but is neutral to slightly acid in limestone areas in the vicinity of Samcheong and Yeongweol. Gravel, cobbles and stones are common throughout the profiles. About 50 percent of the land is in paddy and used for the production of rice. The better drained part is used for upland crops and some forest. Most of the soils are in paddy land capability Classes III to IV and upland capability Class III. Productivity is moderately low. The principal limiting factors are rapid permeability; runoff and erosion of surface soils, and low nutrient supplying capacity. Terracing and contour cultivation help control erosion.

Subunit: Anc.
Profile: Recon. Stop 171

This is an imperfectly to moderately well drained, medium textured Alluvial soil in alluvium-colluvium derived from granite-gneiss.

The profile described is at Gwangweon Ri, Daechi Myeon, Cheongyang Gun, Chungcheongnam Do.

Ap--0 to 11 cm; Dark gray to dark grayish brown (5Y 4/1 to 2.5Y 4/2) loam; structureless (massive), few faint, fine and brown (2.5Y 4.4) mottles; slightly sticky and slightly plastic; few, fine pores and root holes; common, fine mica; many, fine to medium rice roots; gradual smooth boundary; pH 5.5.

A3--11 to 22 cm; Dark gray (5Y 4/1), loam; very weak coarse platy structure; distinct common, fine yellow brown (10YR 5/6) mottles; slightly sticky and slightly plastic; common, fine pores and root holes; common, fine mica; common, fine roots; abrupt, smooth boundary; pH 5.5.

B--22 to 42 cm; Mottled dark gray (5Y 4/1); yellowish brown (10YR 5/6); yellowish red (5YR 4/8), crushed colour dark grayish brown to olive brown (5Y 4/2 to 4/4) loam; weak coarse platy structure; sticky and plastic; many, fine pores; few very fine roots; common, fine mica; clear, smooth boundary; pH 5.5.

C1--42 to 80 cm; Dark gray to very dark gray (10YR 4/1-3/1), friable loam; structureless (massive); no mottles; sticky and plastic; few, fine mica; few, fine pores; no roots; abrupt, smooth boundary; pH 6.0.

C2--80 to 100+ cm; Dark gray to dark grayish brown (10YR 4/1-2.5Y 4/2) gravelly to cobbly sandy loam; structureless; slightly sticky and slightly plastic; no pores; pH 6.0.

Subunit. Anc
Soil Description: Recon. No. 171

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-668	Ap	0- 11	0.0	1.6	7.1	7.3	9.8	6.1	46.4	20.8	L
2	669	A3	11- 22	3.6	2.7	10.1	9.9	9.1	5.0	45.2	18.0	L
3	670	B	22- 42	0.3	1.6	10.4	7.7	7.8	6.9	45.7	20.0	L
4	671	C1	42- 80	0.7	2.6	10.0	11.3	12.1	4.1	39.4	20.5	L
5	672	C2	80-100+	14.0	4.6	15.3	25.6	15.9	4.6	22.7	11.3	SL

1/ Pipette Method, Sodium Hexameta Phosphate.

	International				pH		1/	Exchangeable Cations m.e./100 gm					Base Saturation
	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	H_2O (1:5)	O.M. %	CEC m.e.	Ca	Mg	Na	K	Sum of Cations	%
1	19.9	24.4	34.9	CL	5.8	4.6	10.7	3.6	0.0	0.36	0.18	4.14	38.7
2	25.3	24.7	32.0	CL	5.7	4.6	9.2	2.9	0.0	0.28	0.14	3.32	36.1
3	21.7	27.9	30.4	CL	6.3	2.7	10.8	4.7	0.3	0.20	0.14	5.34	49.4
4	28.0	25.1	26.4	CL	6.5	2.5	12.4	6.2	1.8	0.20	0.20	8.40	67.7
5	51.9	22.3	14.5	CoSL	6.5	1.1	7.0	3.3	0.5	0.10	0.12	4.02	57.4

1/ Ammonium Acetate Method.

And: Fine Loamy Coarse Loamy and Loamy Skeletal Soils with Dark Surfaces, Moderately Well to Well Drained, Undifferentiated Materials, Alluvial-Colluvial Slopes

This subunit is on sloping to moderately steep Recent alluvial-colluvial accumulations of undifferentiated or mixed materials, in steep valleys or heads of narrow valleys within high mountains above 500 m. It comprises an association of moderately well to well drained fine to coarse loamy soils. Acid Brown Forest soils predominate, with inclusions of Lithosols, Regosols and Red-Yellow Podzolic soils on sloping to moderately steep areas. The Acid Brown Forest soils are mostly deep to very deep. Their surfaces range from very dark brown to very dark grayish brown or very dark yellowish brown, fine sandy loam, loam, clay loam, silt loam, and fine sand. The substrata to a depth of about 50 cm, are brown, dark grayish brown, and dark yellowish brown loam, clay loam or sandy clay loam with weak blocky structure. Generally the soils are strongly acid in reaction and are high in organic matter content. Most of this land in the eastern region of Korea, Gangweon Do, is under intensive cultivation in upland crops. The soils are chiefly in paddy land capability Classes III to IV, and upland capability Class III. In spite of relatively steep slopes these soils are considered to be among the most suitable in the country for intensive agricultural development. Soil conservation practices such as contour cultivation, terracing, and protection of waterways are necessary to control erosion. Part of the area, not now cultivated, could be converted into agriculture by clearing and terracing.

Subunit: And
Profile: Recon. Stop 201

This is an imperfectly drained, moderately fine textured, Humic Alluvial soil in Alluvium-Colluvium derived from granite.

The profile described is at Godan, Wangsang Myeon, Meongju Gun, Gangweon Do.

Ap--0 to 15 cm; Very dark grayish brown to very dark brown (10YR 3/2-2/2) loam; few, fine and medium faint brown to dark brown (10YR 4/3) mottles; sticky and plastic; common, fine mica; many, fine rice roots; structureless (massive); clear, smooth boundary.

C1--15 to 27 cm; Black (10YR 2/1), cobbly clay loam; structureless (massive); sticky and plastic; common, fine mica; common, fine roots; no pores; abrupt, smooth boundary.

C2--27 to 37 cm; Mottled, gray (5Y 5/1), dark gray (10YR 4/1), crushed colour gray to dark gray (5Y 5/1-10YR 4/1), gravelly and slightly plastic; cobbly loamy sand; structureless (single grain); nonsticky; many medium and coarse semiround gravel pieces and cobbles derived from granite and schist; few, fine roots; abrupt, smooth boundary.

C3--37 to 55 cm; Gray (5Y 5/1), very gravelly to cobbly clay loam; structureless; sticky and plastic; (massive); thin, clay skins around gravel and cobbles; no roots; abrupt, smooth boundary.

C4--55 to 100 cm; Mottled, gray (5Y 5/1), olive (5Y 4/3), crushed colour olive (5Y 5/3); very gravelly sandy clay loam; structureless; sticky and plastic; no roots; abrupt, smooth boundary.

C5--100 to 120+ cm; Mottled, dark yellowish brown (10YR 4/4), gray (5Y 5/1), yellowish brown (10YR 5/4), crushed colour dark yellowish brown to yellowish brown (10YR 4/4 to 5/4), gravelly and cobbly sandy clay loam; structureless (massive); no roots.

Subunit: And
Profile: Recon. Stop 201

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-820	Ap	0- 15	5.3	5.5	10.1	10.2	11.2	9.4	36.2	17.4	L
2	821	C1	15- 27	10.4	4.6	8.3	9.3	11.0	8.4	40.5	17.9	L
3	822	C2	27- 37	38.3	8.1	12.8	15.1	16.5	15.1	27.4	5.0	SL
4	823	C3	37- 55	24.9	2.8	5.6	8.0	12.3	15.8	47.4	8.1	L
5	824	C4	55-100	1.6	8.7	11.1	10.7	12.2	9.1	26.9	12.1	L
6	825	C5	100-120+	19.6	5.7	9.9	9.7	11.1	7.4	26.4	19.8	L

1/ Pipette Method, Sodium Hexametaphosphate.

	International				F.M.	pH	O.M.	1/ CEC	Base
	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class		H_2O (1:5)	%	m.e.	Saturation %
1	28.3	27.2	27.1	CL	40.4	5.7	7.1	17.6	66.4
2	25.3	27.7	29.1	CL	40.9	5.9	6.4	16.6	58.8
3	40.3	40.6	14.1	FSL	17.6	6.0	0.8	5.2	73.8
4	19.1	42.2	30.6	L	18.0	5.9	1.2	6.5	57.5
5	34.0	28.6	25.3	L	17.9	6.0	0.4	6.1	76.1
6	27.8	23.2	29.2	CL	18.3	6.3	0.4	9.6	99.4

	Exchangeable Cations m.e./100 gm				
	Ca	Mg	Na	K	Sum of Cations
1	10.2	1.1	0.22	0.16	11.68
2	8.2	1.2	0.26	0.10	69.76
3	2.2	1.2	0.30	0.14	3.84
4	2.8	0.6	0.24	0.10	3.74
5	2.8	1.5	0.20	0.14	4.64
6	6.8	2.4	0.18	0.16	9.54

1/ Ammonium Acetate Method.

Apa: Fine Loamy, Fine Silty, and Clayey Low-Humic Gley and Alluvial Soils, Imperfectly to Poorly Drained

This subunit is on nearly level to gently sloping areas of the broad alluvial plains. It is an association of imperfectly to poorly drained, fine loamy and fine silty to clayey soils, developed in Recent to Subrecent alluvial deposits. Low-Humic Gley soils are predominant. Some Alluvial soils are along streams and river channels. The surface horizons are very dark gray to grayish brown loam, clay loam, silty clay loam, silt loam and sandy loam with a slightly acid reaction. The subsoils are gray to dark gray with yellowish brown mottles. Manganese mottles and soft concretions are common. Textures include clay loam, loam, silt loam and silty clay loam. Structure is coarse prismatic and blocky, with gray silty and coarse clayey cutans on the faces.

Reaction is slightly acid to acid. The substrata below 100 cm are greenish gray or gray stratified clayey to loamy sediments becoming more frequent sandy layers with depth. They are same as layers above in reaction. The soils within this subunit ir the eastern part of Korea tend to be less developed and somewhat coarser in texture than those in the southern and western parts. There are many areas of soils which are intergrades between Alluvial and Low-Humic Gley soils. Almost all of the lands within this subunit are in paddy and are used for the production of rice. In southern regions of Korea, barley is grown as a winter crop, but in the other regions this practice is not common. Most of this land is in paddy capability Class I or II. These are excellent soils for production of rice, having sufficient depth and adequate moisture holding capacity to give conditions for high yields under intensive management with complete fertilization. These soils are in upland capability Classes III and IV. However, with sufficient water supply, deep ploughing and good management, these soils could be improved to the highest yield in paddy rice production. In general low yields, when they occur, are due to poor management.

Subunit: Apa
Soil Description No. : Gwangju Stop 138

This is an imperfectly drained, fine textured Low-Humic Gley soil developed in alluvium. The profile described below is on a broad alluvial plain in rice paddy in Weoljeong Ri, Pyeongdong Myeon, Gwangsan Gun, Jeonlanam Do.

AP—0 to 9 cm; Gray (5Y 5/1); friable, silty clay loam; structureless (massive); common, fine distinct mottles of olive brown (2.5Y 4/4); common, fine pores; many, fine to medium rice roots; wet, sticky and plastic; abrupt, smooth boundary.

AC—9 to 18 cm; Dark gray (5Y 4/1); friable, silty clay loam; structureless (massive); common, fine to medium prominent mottles of dark yellowish brown (10YR 4/4); few, fine pores; common, fine rice root ; moist, sticky and plastic; clear, smooth boundary.

B1—18 to 26 cm; Gray (5Y 5/1); friable, silty clay; common, fine to medium prominent mottles of strong brown (7.5YR 5/6); strong coarse prismatic structure, breaking to medium to coarse subangular blocky; few, fine rice roots; thin, continuous clay cutans; common, fine continuous pores; very sticky and very plastic; clear, smooth boundary.

B21—26 to 40 cm; Mottled yellowish brown (10YR 5/6) strong brown (7.5YR 5/8); dark yellowish brown (10YR 4/4); gray (10YR 5/1); crushed colour brown to dark brown (10YR 4/3); friable silty clay; strong coarse prismatic breaking to moderate coarse angular blocky structure; moderately thick, continuous clay cutans; few, fine rice roots; common, fine continuous pores; moist, very sticky and very plastic; abrupt, smooth boundary.

B22—40 to 57 cm; Mottled, dark yellowish brown (10YR 3/4); brown to dark brown (7.5YR 4/4), gray (10YR 5/1), firm clay; crushed colour is dark grayish brown (10YR 4/2); strong coarse prismatic structure; very sticky and very

plastic; very few, fine rice roots; common, fine continuous pores; few, fine very dark brown (10YR 2/2) concretions; clear, smooth boundary.

BG--57 +- 76 cm; Dark gray (10YR 4/4); firm clay; structureless (massive); many coarse prominent mottles of strong brown (7.5YR 5/6) very sticky and very plastic; few, fine continuous pores; abrupt, smooth boundary.

C--76 to 100 cm; Very dark gray (10YR 3/1); firm clay; few, fine continuous pores; very sticky and very plastic; structureless (massive).

Subunit: Apa
Laboratory Data: Gwangju Stop 138

	Lab. No.	Horizon	Depth cm	Gravel >2mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture							
					VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	K-396	AP	0- 9	0.5	0.7	1.9	3.8	6.1	4.7	61.1	21.7	SiL
2	397	AC	9- 18	0.01	←	6.4	→	7.0	2.7	59.6	24.3	SiL
3	398	B1	18 26	0.01	←	1.2	→	1.5	1.7	52.2	43.4	SiC
4	399	B2(1)	26- 40	0.01	←	1.1	→	1.4	1.4	52.3	43.8	SiC
5	400	B2(2)	40- 57	0.0	←	2.4	→	2.7	1.7	46.1	47.1	SiC
6	401	BG	57- 76	0.01	←	0.7	→	1.0	1.3	51.1	45.9	SiC
7	402	C	76-100+	0.3	←	0.7	→	1.0	1.7	48.1	48.5	SiC

	International				Moisture Retention		pH		2/
	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	1/3 atm.	15 atm.	H_2O (1:5)	O.M. %	CEC m.e.
1	7.8	33.3	37.2	CL	37.5	10.9	5.9	2.3	9.16
2	7.9	26.0	41.8	CL	34.6	11.7	5.8		9.86
3	1.5	11.7	43.4	LiC	37.5	20.4	6.7		16.06
4	1.4	11.8	43.0	LiC	36.8	20.7	6.6		15.14
5	3.0	10.8	39.1	HC	37.2	22.4	6.2		18.52
6	0.9	13.0	40.2	HC	41.0	22.6	5.8		18.02
7	0.9	7.0	43.6	HC	37.5	18.5	5.5		21.56

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

	Exchangeable Cations m.e./100 gm				Base Saturation %
	Ca	Mg	Na	K	
1	3.9	0.7	0.22	0.16	54.4
2	5.1	1.9	0.28	0.16	74.8
3	8.3	5.7	0.38	0.14	90.0
4	8.5	4.1	0.42	0.14	87.4
5	10.0	5.7	0.42	0.20	88.2
6	8.8	4.2	0.48	0.14	75.6
7	10.8	5.6	0.56	0.20	79.7

Apb: Fine Loamy to Clayey Red-Yellow Podzolic Soils, Moderately Well to Well Drained

This subunit comprises the elevated areas within the alluvial plains and corresponds to the transitional landscapes between these and the elevations of the older pediplane. Dissection is predominantly slight, ranging from slight to moderate. Relief is low. The topography is gently sloping to rolling slopes. Dominant slope range is from 3 to 10 percent. The divides are interfingered by swales and relatively narrow valleys. This is an association of moderately well to well drained clayey and fine loamy Red-Yellow Podzolic soils under paddy with Lithosols on the steeper and more sharply convex parts of the landscape. A complex of Low-Humic Gley, Alluvial soils and Regosols, is also included. The surface soils are gray or grayish brown in areas cultivated in paddy, to reddish brown or yellowish red in areas with upland crops. The surface textures are dominantly silty, but vary from silt loam or loam to clay loam. The subsoils, extending to depth of 1 m or more, are red or yellowish red clay, silty clay loam, clay loam or silty clay, with moderate to strong blocky structure, and usually continuous clay cutans. Iron and manganese mottles with soft concretions are common. Reaction is slightly acid to acid. The substrata, chiefly deep, are variable, with a complex of yellowish brown, dark yellowish brown, brown or dark brown and black coarse loamy to clayey old alluvial and pedimentary materials. Gravel, cobbles and stones are common in the lower parts. In many places the substrata appears as strongly weathered rocks. Most of the lands in this subunit are in paddy and are used for the production of rice under irrigation. Generally in this land barley is grown as a winter crop. Most of the soils are in paddy capability Class II. Under proper management with adequate fertilizers they could be excellent soils for production of both rice and upland crops, having sufficient depth and moisture holding capacity. The use of soil conservation practices such as contour cultivation, terracing and the protection of waterways are advisable to control the erosion and runoff. About 25 percent of the subunit is under upland crop cultivation. A percentage of the area is now in forest and could be converted to cropland by terracing and contour cultivation.

Subunit: Apb
Profile: Recon. Stop 184

This is a well drained, fine textured, slightly eroded, Red-Yellow Podzolic soil developed in old alluvium derived from granite. It is on a gently sloping, continental alluvial plain, in rice paddy. The profile described below is in Sindo Ri, Gongdo Myeon, Anseong Gun, Gyeonggi Do.

Ap--0 to 10 cm; Yellowish red (5YR 4/6), friable loam; moderate, very fine and fine granular structure; sticky and plastic; common, fine pores; many, fine grass roots; many, fine yellow mica; clear, smooth boundary.

B1--10 to 40 cm; Yellowish red (5YR 4/8), firm loam; moderate medium coarse and fine granular structure; sticky and plastic; common, fine pores; common, fine roots; few, fine yellow mica; clear, smooth boundary.

B21--40 to 48 cm; Red (2.5YR 5/8), firm clay loam; moderate, fine and medium subangular blocky structure with thin continuous clay skins; sticky and plastic; few, fine pores; few, fine grass roots; clear, smooth boundary.

B22--48 to 79 cm; Red (2.5YR 4/6), to yellowish red (5YR 4/6) clay loam; strong coarse and medium subangular blocky structure; with thick continuous clay skins; sticky and plastic; no pores; few, fine mica; few, fine grass roots; clear, smooth boundary.

B23--79 to 94 cm; Mottled, dark red (2.5YR 3/6), red (2.5YR 4/3), yellowish red (5YR 4/8), crushed colour yellowish red (5YR 4/8), strong coarse and medium subangular blocky structure with thick continuous clay skins, breaking to strong coarse, medium and fine angular blocky; very sticky and very plastic; few, fine black (5YR 2/1), Mn concretions, common, fine and medium yellow mica; clear, smooth boundary.

B3--94 to 100+ cm; Mottled, yellowish red (5YR 5/8), dark reddish brown (2.5YR 3/4), black (5YR 2/1), crushed colour, yellowish red (5YR 4/6), firm sandy loam; massive; sticky and plastic; many, fine yellow mica; common, thick, vertical clay accumulation veins.

Subunit: Apb
Soil Description: Recon. Stop No. 184

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/(mm) Percent US Department of Agriculture							
					VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-732	Ap	0- 10	1.0	0.8	8.4	15.3	15.0	8.1	34.4	18.0	L
2	733	B1	10- 40	0.0	0.4	4.8	13.7	14.2	8.4	34.4	24.1	L
3	734	B21	40- 48	0.4	0.1	2.5	9.0	6.9	5.4	43.3	30.8	CL
4	735	B22	48- 79	0.4	0.1	2.2	9.1	9.2	6.6	41.4	31.4	CL
5	736	B23	79- 94	0.0	1.2	8.3	10.3	9.1	6.7	26.9	37.5	CL
6	737	B3	94-100+	0.7	0.2	6.4	14.5	14.6	17.8	31.6	14.9	CL

	International				Moisture Retention	Clay and Clay minerals				
	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	1/3 atm.	SiO_2 / R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	K_2O %
1	29.1	26.0	26.9	CL	23.7	..72	47.65	12.74	38.33	2.14
2	22.8	30.8	22.3	CL		2.35	60.11	11.50	35.99	2.19
3	14.2	21.2	33.8	LiC	30.2					
4	13.6	25.8	29.2	LiC	31.2					
5	22.7	16.9	22.9	LiC	31.6					
6	25.6	37.7	21.8	L	28.8					

1/ Pipette Method, Sodium Hexameta Phosphate

	pH H_2O (1:5)	O.M. %	1/ CEC m.e.	Exchangeable Cations m.e./100 gm					Available
				Ca	Mg	Na	K	Sum of Cations	P_2O_5 Pm
1	5.6	2.3	8.2	2.2	1.0	0.38	0.16	3.74	14
2	5.8	1.7	7.1	1.8	1.0	0.06	0.06	2.92	10
3	6.0	0.6	7.5	1.4	1.0	0.42	0.22	3.04	11
4	5.8	0.3	8.4	1.7	1.8	0.18	0.14	3.82	
5	6.1	0.4	10.1	1.7	2.8	0.20	0.20	4.90	
6	6.0	0.2	7.7	0.8	2.7	0.26	0.20	3.96	

1/ Ammonium Acetate Method

Apc: Cobbly or Gravelly Loamy Alluvial Soils, Imperfectly to Well Drained

This subunit is on nearly level to gently sloping local outwash or young alluvial fans, and includes soils along streams in local alluvial plains. It is an association predominantly of imperfectly to well drained, gravelly and cobbly, loamy to coarse loamy soils on Recent or Subrecent alluvium. Alluvial soils are predominant. Some Low-Humic Gley soils are in pocket areas or former back swamps, and Red-Yellow Podzolic soils have formed on Subrecent alluvial fans which are related to the pediplane system. Surface horizons range from yellowish brown to grayish brown or gray in colour. Texture ranges from sandy loam to loam. Reaction is slightly acid to acid. The substrata range from yellowish brown to dark grayish brown or dark brown in colour. Their texture range includes gravelly to cobbly sandy loam and gravelly to cobbly loam. Structure is massive or weak blocky. Gravel and cobbles are common throughout the substrata. Reaction is slightly acid to acid. A few slightly elevated well drained areas are included in this subunit. Most areas are under cultivation for the production of rice. The better drained parts are also used for barley or vegetables. Most of these soils are paddy land capability Classes III and IV. The few slightly elevated better drained areas are in upland Classes II and III. These soils generally are of moderate to low productivity. The limiting factors are relatively rapid permeability, presence of gravel and cobbles, and low plant fertility levels.

Subunit: Apc
Profile: Ulsan Stop 62

This is a well drained, gravelly to cobbly, medium textured Alluvial soil in Subrecent alluvium.

It is in a slightly elevated fluvial fan with upland cultivation of barley. The profile described is 100 m north of Changpyeong Ri, Neungsu Myeon, Ulju Gun, Gyeongnam Do.

Ap—0 to 12 cm; Dark yellowish brown (10YR 3/4), slightly gravelly loam; moderate, very fine and medium granular structure; friable, slightly sticky and slightly plastic; few, very fine and fine pores; approx. 8 percent of gravel slightly weathered shale; common, fine living and dead oak and barley roots; clear, wavy boundary; pH 5.5.

A1—12 to 19 cm; Dark brown (10YR 3/3), gravelly silt loam; weak, medium to coarse subangular blocky structure breaking to weak, fine to medium granular; no cutans; firm, slightly sticky and slightly plastic; common, fine and coarse pores; fragments as above; few roots as above; clear, wavy boundary; pH 6.0.

Weak B—19 to 60 cm; Dark brown (7.5YR 3/2), gravelly to cobbly silt loam; weak, medium and fine subangular blocky structure; patchy thin clay skins; firm, sticky and plastic; many, fine and coarse pores; approx. 40 percent of gravel and cobbles of firm, slightly weathered shale and some sandstone; few roots as above; gradual, wavy boundary; pH 5.5.

C—60 to 120 cm; Dark brown (10YR 3/3), very gravelly to cobbly silt loam; structureless; very firm, slightly sticky and plastic; pores as above; approx. 70 percent of gravel and cobbles as above; few, fine and medium oak roots; pH 5.5.

Subunit: Apc
Laboratory Data: Ulsan Stop 62

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	U-349	AP	0- 12	0.0	4.2	4.6	5.1	9.4	8.2	53.7	14.8	SiL
2	350	A1	12- 19	20.6	3.9	4.2	4.8	9.1	7.0	57.9	12.4	SiL
3	351	B2	19- 60	15.4	2.5	3.8	4.3	7.4	5.7	56.0	20.3	SiL
4	352	B3	60-120+	11.5	2.3	2.6	3.0	7.8	7.6	54.7	22.0	SiL

1/ Pipette Method, Sodium Hexameta Phosphate.

	International				S.G.	Moisture Retention		Clay and Clay Minerals				
	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class		1/3 atm.	15 atm.	SiO_2 / R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	CEC m.e.
1	15.8	40.2	29.2	L	2.60	28.65	10.05	3 038	58.79	9.17	27.07	30.53
2	14.7	37.5	35.4	L	2.65	26.32	8.94	-	-	-	-	-
3	12.0	31.5	36.2	CL	2.68	25.23	9.90	-	-	-	-	-
4	9.1	37.7	31.2	CL	2.71	26.70	9.70	2 351	52.83	9.85	31.83	42.54

	pH H_2O (1:5)	O.M. %	CEC 1/ m.e.	Exchangeable Cations m.e./100 gm					Base saturation %
				Ca	Mg	Na	K	Sum of Cations	
1	6.1	3.2	11.3	4.95	2.05	1.18	0.08	8.26	73.1
2	5.7	2.2	8.9	3.10	1.40	0.15	0.53	5.18	58.2
3	6.0	1.9	10.6	4.60	1.65	0.20	0.33	6.78	64.0
4	5.9	1.2	11.5	5.10	1.40	0.20	0.08	6.78	59.0

1/ Ammonium Acetate Method

Apd: Fine Loamy, Fine Silty and Clayey Low Humic Gley and Alluvial Soils, Poorly Drained

This subunit is on nearly level to very gently sloping broad continental alluvial plains. It is an association of predominantly poorly drained fine silty and fine loamy Low Humic Gley soils.

Surface layers are gray or olive gray to grayish brown or olive brown silt loam, loam or clay loam. Subsoils are gray to olive gray or bluish gray silt loam to clay loam.

This subunit is in paddy Class I and almost all of the subunit is in paddy and used for production of one annual crop of rice. It is generally highly productive, but improvement could be made by better drainage systems and use of fertilizers, with subsurface application of nitrogen. Use for crops other than rice would require construction of drainage systems.

Apg: Cobbly to Gravelly Loamy to Coarse Loamy Alluvial Soils, Well Drained

This subunit is on alluvial fans and footslopes, and very gently sloping alluvial plains in mountain valleys. Soils are colluvial, and contain much gravel and many cobbles.

Surface layers are grayish brown, brown or dark brown gravelly and cobbly sandy loam or silt loam. Substrata are brown to dark brown sandy loam to loam and silty clay loam. They commonly contain more than 40 percent gravel, cobbles and stones, the content increasing with depth. These soils are in paddy Class IV and upland capability Class II. The more gently sloping areas near water supplies are used for paddy rice, but the rapid permeability and the large amount of gravel and cobbles are limitations. These soils are highly productive for upland crops.

Fma: Fine Silty to Clayey Low-Humic Gley and Alluvial Soils, Imperfectly to Poorly Drained

This subunit is on nearly level, broad fluvio-marine plains rising from the coastline. It is an association of imperfectly to poorly drained clayey fine silty and fine loamy soils developed in Recent silty fluvio-marine deposits. Low-Humic Gley soils predominate. Some Alluvial soils are along stream channels.

The surface horizons are gray or dark gray to grayish brown silty clay loam, silt loam and in places, fine sandy loam with slightly acid reaction. The subsoils are gray or dark gray with yellowish brown and dark grayish brown mottles. Manganese mottles and soft concretions are common. Subsoil textures include silt loam, silty clay loam, silty clay, clay loam and loam. Structure is coarse prismatic and blocky with gray silt or clay coatings on the faces. Reaction is slightly acid to slightly alkaline. The substrata below 60 to 100 cm are gray or greenish gray stratified clayey to loamy sediments, becoming more sandy with depth. They are alkaline in reaction and may be slightly saline. The soils on the east coast tend to be less developed and somewhat coarser in texture.

Almost all of the lands in this subunit are in paddy and are used for the production of rice under irrigation. In some places barley is grown as a winter crop, but this practice is not universal. Most of the soils are in paddy Class I. They are excellent soils for the production of rice, having sufficient depth, and nutrient and moisture holding capacity to give high yields under intensive management with adequate fertilizer. These soils are in upland capability Classes III and IV because of wetness. However, they can be made very productive for such crops as barley by improvement in drainage. This subunit includes some of the most suitable lands in Korea for intensive agricultural development.

Subunit: Fma
Profile: Recon. Stop 157

This is imperfectly drained, fine textured, Low Humic Gley soil developed on fluvio-marine deposits. It is in level fluvio-marine plains under rice cultivation.

The following description is from the central part of the fluvio-marine plain at Janghwa Ri, Chaewoon Myeon, Nonsan Gun, Chungnam Do.

Ap---0 to 10 cm; Grayish brown to dark grayish brown (2.5Y 5/2-4/2), firm, silty clay loam; massive; common, distinct fine to medium strong brown (7.5YR 5/6) mottles; sticky and plastic; many, fine pores; many, fine rice roots; clear, smooth boundary; pH 6.0.

A12---10 to 15 cm; Colour as above, firm, silty clay loam; massive; distinct few, fine strong brown (7.5YR 5/6) mottles; sticky and plastic; common, fine pores; common, fine rice roots; abrupt, smooth boundary; pH 7.0.

B21--15 to 30 cm; Gray to dark gray (5Y 5/1-4/1), firm, silty clay with coarse prismatic structure, breaking to moderate coarse and medium subangular blocky structure; many faint, medium to coarse yellowish brown (10YR 5/4) mottles; thin, continuous clay skins; sticky and plastic; many, fine pores; few, fine roots; many, fine white mica; wavy boundary; pH 7.5.

B22--30 to 45 cm; Dark gray (5Y 4/1), firm, silty clay; strong coarse prismatic structure; many, distinct, coarse yellowish brown (10YR 5/6) mottles and common, medium and coarse very dark brown black (10YR 2/2 and 2/1) Mn mottles and concretions; many, thick vertical clay accumulation veins; few earthworms; clear, smooth boundary; pH 7.5.

B23--45 to 70 cm; Gray (5Y 5/1) firm, silty clay, strong, coarse prismatic structures; very many coarse and medium very dark brown and black (10YR 2/2 and 2/1) Mn mottles and concretions; clear, smooth boundary; pH 7.5.

B3--70 to 100 cm; Gray (5Y 5/1), firm, silty clay loam; massive; many, prominent, coarse and medium dark brown (7.5YR 4/4) mottles; sticky and plastic; few, fine pores; few, thick vertical clay accumulation veins; many, very fine white mica; clear, smooth boundary; pH 7.5.

C1--100 to 120 cm; Gray (5Y 5/1), friable, silty loam to silty clay loam; distinct, few, medium yellow brown (10YR 5/6) mottles; massive; sticky and plastic; pH 7.5; gradual, smooth boundary.

C2--120+ cm; Gray (5Y 5/1), firm, silty clay; structureless, massive; few prominent, medium to fine yellowish red to strong brown (5YR 5/8-7.5YR 5/6) mottles.

Subunit: Fma
Laboratory Data: Recon. Stop 157

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture							
					VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-613	Ap	0- 10	0.0	←	0.3	→	0.6	1.1	78.4	19.6	SiL
2	614	A12	10- 15	0.0	←	0.6	→	0.3	0.9	79.0	19.2	SiL
3	615	B21	15- 30	0.0	←	2.3	→	0.6	0.8	75.1	21.2	SiL
4	616	B22	30- 45	0.0	←	0.9	→	0.7	0.7	75.0	22.7	SiL
5	617	B23	45- 70	0.0	←	1.2	→	0.7	1.1	75.2	21.8	SiL
6	618	B3	70-100	0.0	←	1.1	→	0.6	1.6	75.7	21.0	SiL
7	619	C1	100-120	0.0	←	1.5	→	1.8	2.2	75.5	19.0	SiL

1/ Pipette Method, Sodium Hexameta Phosphate.

	International				pH	O.M.	1/ CEC	Exchangeable Cations m.e./100 gm					Base
	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	H_2O (1:5)	%	m.e.	Ca	Mg	Na	K	Sum of Cations	Saturation %
1	0.5	25.6	54.3	SiCL	5.3	1.7	8.8	3.3	1.4	0.24	0.20	5.14	58.4
2	0.7	27.9	52.2	SiCL	6.2	1.2	9.1	5.4	1.2	0.74	0.22	7.56	83.1
3	2.5	26.5	49.8	SiCL	6.8	0.7	11.1	6.9	3.6	0.24	0.18	10.92	98.4
4	1.1	29.9	46.3	SiCL	7.0	0.5	13.3	7.8	5.2	0.54	0.20	13.74	103.3
5	1.4	30.2	46.6	SiCL	7.1	0.5	14.7	7.7	7.3	0.66	0.24	15.90	108.2
6	1.3	36.9	40.8	CL	7.2	0.4	16.0	7.5	7.0	0.68	0.20	15.38	96.1
7	1.6	50.1	29.3	CL	7.2	0.4	12.9	6.0	6.7	0.62	0.22	13.54	105.0

1/ Ammonium Acetate Method.

Representative Soil Profile

Subunit: Fma
Profile: Recon. Stop 175

This is imperfectly drained, fine textured, Low-Humic Gley soil developed on fluvio-marine deposits. This profile is in the central part of the fluvio-marine plain at Sinsong Ri, Seocheong Myeon, Seocheon Gun, Chungnam Do.

Ap--0 to 11 cm; Dark gray (10YR 4/1 to 2.5Y 4/0) slightly firm, silty clay loam; massive; distinct common fine, and medium yellowish brown (10YR 5/6) mottles; sticky and plastic; few, fine pores; many, fine dead rice and grain roots; clear, smooth boundary; pH 6.5.

A12--11 to 19 cm; Dark gray (10YR 4/1), firm, silty clay loam; weak coarse prismatic structure with thin, continuous clay cutans; distinct common, fine and medium yellowish brown (10YR 5/6) and brown to dark brown (7.5YR 4/4) mottles; crushed colour dark gray to dark grayish brown (10YR 4/1 to 4/2); sticky and plastic; many fine pores; common, fine roots; clear, smooth boundary; pH 6.5.

B1--19 to 27 cm; Dark gray (10YR 4/1), firm, silty clay with moderate coarse prismatic structure with thin, continuous clay skins, breaking to weak coarse angular blocky structure; distinct common yellowish brown (10YR 5/6), dark gray (2.5Y 4/0) mottles; very sticky and very plastic; many, fine pores; few, fine pores; few, fine roots; gradual, smooth boundary.

B21--27 to 38 cm; Dark gray (10YR 4/1) firm silty clay with thick, continuous clay skins breaking to moderate, coarse angular blocky with thin, continuous clay skins; mottles same as above; common, fine brown to dark brown (7.5YR 4/2) Mn mottles, very sticky and very plastic; pores as above; roots as above; clear, smooth boundary; pH 7.0.

B22--38 to 66 cm; Dark gray (2.5Y 4/0), firm, clay; moderate coarse prismatic structure with moderate thick, discontinuous clay skins breaking to moderate coarse angular blocky; many prominent coarse yellowish brown (10YR 5/6) mottles; Mn as above, crushed colour, dark grayish brown (10YR 4/2); very sticky and very plastic; common, fine pores; no roots; clay flows along the root holes; clear, smooth boundary; pH 7.8.

G--110 to 200+ cm; Gray to dark gray (2.5Y 4/0 to 5/0), silt clay; massive; very sticky and very plastic; no mottles; no pores; pH 8.0.

Subunit: Fma
Laboratory Data: Recon. Stop 175

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-684	Ap	0- 11	1.8	←	3.0	→	2.0	1.9	68.9	24.2	SiL
2	685	A12	11- 19	0.8	←	1.6	→	0.9	1.3	70.9	25.3	SiL
3	686	B1	19- 27	0.0	←	1.4	→	0.8	1.1	70.7	25.8	SiL
4	687	B21	27- 38	0.0	←	0.7	→	0.6	0.5	64.7	33.5	SiCL
5	688	B22	38- 66	0.0	←	0.2	→	0.4	0.5	69.2	29.7	SiCL
6	689	B3	66-110	0.0	←	0.2	→	0.3	0.7	73.9	24.9	SiCL
7	690	C	110-200+	0.0	←	0.2	→	0.2	2.0	69.8	27.8	SiCL

1/ Pipette Method, Sodium Hexameta Phosphate.

	International				Moisture Retention	pH	O.M.	1/ CEC
	CS 2- .2	FS .2- .02	Silt .02- .002	Text- ural Class	1/3 atm	H_2O (1:5)	%	m.e.
1	3.4	23.1	49.3	SiCL	45.3	5.4	3.4	15.3
2	1.8	21.5	51.4	SiC	36.3	7.1	1.7	12.4
3	1.6	23.2	49.2	SiC	33.0	7.9	1.1	16.0
4	0.9	11.6	54.0	SiC	31.2	8.1	1.1	12.5
5	0.3	27.3	42.7	LiC	33.1	8.1	0.2	13.7
6	0.3	31.6	43.2	CL	30.2	8.0	0.8	15.1
7	0.3	35.6	36.3	LiC	36.2	7.1	0.8	7.3

	Exchangeable Cations m.e./100 gm				Sum of Cations	Base Saturation %
	Ca	Mg	Na	K		
1	5.1	1.9	1.00	0.18	8.18	53.5
2	8.1	3.4	1.40	0.24	13.14	106.0
3	7.6	4.1	1.36	0.14	13.20	82.5
4	8.8	6.2	2.00	0.24	17.24	137.9
5	6.7	7.6	2.10	3.34	19.74	144.1
6	5.0	7.0	2.08	0.40	14.48	95.9
7	4.0	8.4	2.96	1.28	16.64	227.9

1/ Ammonium Acetate Method.

Fmb: Coarse Loamy and Coarse Silty Alluvial and Low-Humic Gley Soils, Imperfectly to Poorly Drained

This subunit occupies young fluvio-marine plains adjacent to stream channels but little above sea level. It is an association of imperfectly to poorly drained coarse silty and coarse loamy soils with minor amounts of sandy and fine loamy soils. Predominantly they are Alluvial soils, with some areas of Low-Humic Gley soils. Bits of unreclaimed tidelands and beaches are included but are not definitive of the unit.

The surface soils and upper subsoils of the more extensive soils range from dark gray to grayish brown in colour. Their textures range from loamy fine sand to silt loam but dominantly are fine sandy loams. They are slightly acid to neutral in reaction. The substrata below 50 to 100 cm dominantly are fine sands, loamy sands and sandy loams. They are gray to greenish gray and where better drained grayish brown. Reaction is neutral to alkaline. Particularly along the West and South coasts of the mainland there are many inclusions of finer textured soils in this subunit. A few slightly elevated moderately well drained areas are included.

Like the subunit Fma, almost all of the lands are in paddy and used for the production of rice. The better drained parts are usually double cropped to barley or vegetables. Most of the soils are in paddy land capability Class II. They are mostly of moderately high productivity, ranging to low in some cases. The principal limiting factors are their relatively rapid permeability and low nutrient supplying capacity. Irrigation water requirements are moderately high. The predominant upland capability Classes are IIw and IIIw because of restricted drainage. Most of the land can be managed for barley and other seed crops. The better drained areas are also suitable for vegetables.

Subunit: Fmb
Profile: Recon. Stop 188

This is poorly drained, moderately coarse textured, alluvial soil, formed from fluvio-marine deposit. The location is in the central part of the fluvio-marine plain at Seongun Ri, Anmyeon Myeon, Seosan Gun, Chungcheongnam Do.

Ap—0 to 12 cm; Gray to dark gray (5Y 5/1 to 4/1), friable fine sandy loam (distinct few fine and medium brown to dark brown (7.5YR 4/4) mottles, nonstructure; nonsticky and slightly plastic; many, fine rice dead roots; common, fine pores; abrupt, smooth boundary.

C1—12 to 45 cm; Gray (2.5Y 5/0 to 5Y 5/1), slightly firm sandy loam, distinct, few, fine and medium to coarse dark yellowish brown (10YR 4/4) mottles, nonstructure (massive), few, fine pores, few, fine rice dead roots; gradual, smooth boundary; pH 8.0.

C2—45 to 70 cm; Gray (5Y 5/1) slightly fine sandy loam; none mottles; nonstructure (massive), slightly sticky and slightly plastic; diffuse smooth boundary; pH 8.0.

C3—70 to 120+ cm; Gray to dark gray (5Y 5/1 to 4/1) fine sandy loam ditto; pH 8.0.

Subunit: Fmb
Profile: Recon. Stop 188

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-758	Ap	0- 12	0.9	←	17.9	→	35.9	8.7	32.2	5.3	FSL
2	759	C1	12- 45	1.4	0.1	0.2	13.1	35.5	8.7	36.9	5.5	FSL
3	760	C2	45- 70	2.1	0.1	0.3	14.9	36.3	8.8	33.7	5.9	FSL
4	761	C3	70-120+	1.9	0.1	0.3	14.9	37.4	9.1	31.4	6.8	FSL

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	Moisture Retention 1/3 atm	pH H_2O (1:5)	O.M. %	2/ CEC m.e.
1	34.0	54.0	6.7	FSL	10.8	6.4	1.5	4.4
2	27.9	54.5	12.1	FSL	12.7	6.9	0.3	4.3
3	30.5	53.3	10.3	FSL	12.1	7.4	0.2	4.6
4	30.3	53.2	9.7	FSL	12.7	7.4	0.2	7.6

	Exchangeable Cations m.e./100 gm Ca	Mg	Na	K	Sum of Cations	Base Saturation %
1	2.9	2.7	3.14	0.36	9.10	206.8
2	1.8	2.0	0.48	0.38	4.66	108.3
3	1.8	2.2	0.78	0.48	5.26	114.3
4	1.4	2.6	1.14	0.62	5.76	75.8

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

Fmc: Coarse Silty to Fine Clayey Saline Alluvial Soils, Imperfectly to Poorly Drained

This subunit occupies the lowest parts of the fluvio-marine plains. Most areas were reclaimed from tidelands by diking. They differ from the Fma subunit chiefly in being neutral to alkaline in reaction and in having excess salts within 50 to 75 cm of the surface. Some areas are more sandy, like the Fmb subunit. There are also a few spots of Acid Sulfate soils with extremely acid reactions.

These lands are mostly used for paddy rice. They are not much used for barley or other upland crops because of the wetness and salinity. The predominant paddy land Classes are IIs and IIIs and upland Class V. With improvement in drainage and leaching, most of these lands can be converted into highly productive paddy. The Acid Sulfate soils require large amounts of lime, and other soil amendments.

Subunit: Fmc
Profile: Recon. Stop 115

This is imperfectly drained, fine textured Acid sulfate soils formed from fluvio-marine deposits. The following description is from a profile in the central part of the fluvio-marine plain at Bongrim Ri, Galag Myeon, Gimhae Gun, Gyeongsangnam Do.

Apg—0 to 10 cm; Dark gray to gray (10YR 4/1), firm, silty clay loam; structureless (massive); common, fine prominent strong brown (7.5YR 5/8) mottles; sticky and plastic; many, fine roots; clear, smooth boundary; pH 4.0.

Ab—10 to 20 cm; Dark gray to gray (10YR 4/1), silty clay loam; massive, breaking to weak fine and medium subangular blocky structure; sticky and plastic; common, fine and medium prominent strong brown (7.5YR 5/8) mottles; many undecomposed reeds; common, fine roots; clear, smooth boundary; pH 4.0.

B—20 to 50 cm; Dark gray to very dark gray (10YR 4/1 - 3/1) firm, loam, with moderate coarse prismatic structure; sticky and plastic; common, coarse prominent strong brown (7.5YR 5/8) mottles and common, medium and coarse, yellow (10YR 8/8) soft concretions; clear, smooth boundary; pH 4.0.

C—50 to 60 cm; Dark gray (2.5Y 4/0) silty clay loam; structureless (massive); few, fine prominent strong brown (7.5Y 5/8) mottles; sticky and plastic; abrupt, wavy boundary; pH 4.0.

IIC—60 to 80+ cm; Dark gray (2.5Y 4/0) friable sandy loam; structureless (massive); slightly sticky and slightly plastic; no mottles; pH 5.0.

Subunit: Fmc
Soil Description: Recon. Stop 115

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-452	Apg	0-10	0.0	←	1.5	→	5.7	3.6	52.6	36.6	SiCL
2	453	Ab	10-20	0.0	←	0.7	→	3.8	2.4	55.6	37.5	SiCL
3	454	B	20-50	0.0	←	1.2	→	19.4	18.7	38.7	22.0	L
4	455	C	50-60 (Low Layer)	0.0	←	0.8	→	8.8	8.9	51.6	29.9	SiCL

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	Core No.	B.D. gm/cc	pH H_2O (1:5)	O.M. %	2/ CEC m.e.
1	2.3	18.8	42.3	LiC	16.17	1.1	4.9	3.4	11.7
2	1.2	13.3	48.0	SiC	18.19	1.2	4.5	1.1	13.2
3	2.7	47.4	27.9	CL	20.21	1.2	4.2		8.9
4	1.5	23.7	44.9	LiC			4.4		12.3

	Exchangeable Cations m.e./100 gm Ca	Mg	Na	K	Sum of Cations	Base Saturation %
1	2.9	3.6	1.75	0.34	8.59	73.4
2	2.5	4.2	2.18	0.35	9.23	69.9
3	2.6	5.0	2.60	0.20	10.40	112.8
4	3.3	4.5	2.25	0.35	10.40	84.6

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

Subunit: Fmc
Profile: Recon. Stop 169

These are poorly drained, medium textured saline soils formed from fluvio-marine deposits. The following description is from a profile in the central part of the fluvio-marine plain at Daecheon Ri, Daecheon Eub, Boryeong Gun, Chungcheongnam Do.

0 to 15 cm; Mottled black (2.5Y 2/0), olive gray (5Y 4/2), crushed colour black (2.5Y 2/0), silt loam; structureless (massive); many, fine mica and roots; abrupt, smooth boundary; pH 8.0.

15 to 35 cm; Light bluish gray, silt loam structureless (massive), many, fine mica and no roots; diffuse smooth boundary; pH 8.0.

35 to 100+ cm; Bluish gray; very fine sandy loam; pH 8.0.

Subunit: Fmc
Soil Description: Recon. Stop 169

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-662		0- 15	0.0	←	0.5	→	2.9	24.3	64.9	7.4	SiL
2	663		15- 35	0.0	←	0.2	→	1.7	31.5	56.5	10.5	SiL
3	664		35-100+	0.0	←	0.2	→	5.7	53.8	33.0	7.3	VFSL

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	pH H_2O (1:5)	O.M. %	2/ CEC m.e.	Exchangeable Cations m.e./100 gm Ca	Mg	Na	K	Sum of Cations
1	0.8	76.0	15.8	FSL	6.4	0.7	7.2	3.2	6.8	7.04	1.76	18.80
2	0.3	77.7	11.5	FSL	7.6	0.6	8.5	2.3	4.2	7.04	2.56	16.10
3	0.4	84.3	8.0	FSL	8.0	0.5	6.8	2.3	3.8	6.64	2.38	15.12

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

Fmd: Fine Silty to Clayey Alluvial and Low-Humic Gley Soils, Poorly to Very Poorly Drained

This subunit is on nearly level, broad fluvio-marine plains near the coast, and differs from subunit Fma in being somewhat lower, and very poorly to poorly drained. Low Humic Gley soils and Alluvial-Low Humic Gley intergrades predominate, with some Alluvial soils.

Surface horizons are gray or dark gray in colour, silty or loamy in texture, and slightly acid or neutral in reaction. Subsoils are mostly gray, mottled silt loam or silty clay loam, with a coarse prismatic structure, and nearly neutral to slightly alkaline in reaction. Substrata are greenish gray stratified silty, very fine sandy and clayey materials. They are alkaline in reaction and may contain varying amounts of salt.

Almost all of these areas are in paddy Class I and are being used for paddy, giving excellent yields of rice under good management. These soils are in upland capability Classes III and IV because of wetness. Improved drainage would permit the growing of barley in the winter.

Fmg: Coarse Loamy and Coarse Silty Alluvial and Low Humic Gley Soils, Poorly to Very Poorly Drained

This subunit is not extensive, consisting of nearly level to level, mostly poorly drained soils, on the marine plains near the coast. Alluvial soils and Alluvial-Low Humic Gley intergrades predominate.

Surface layers are gray to grayish brown sandy loam to very fine sandy loam, neutral in reaction. Subsoils and substrata are gray to bluish gray sandy loam or very fine sandy loam, neutral to alkaline in reaction.

Most of the soils in this subunit are in paddy Class III, and give comparatively low yields. With good management, including split applications of fertilizers, the addition of finer textured materials from the sea, and silicates, the yields can be improved. Most of these soils are in upland capability Class III, because of wetness. Barley is grown on better drained areas in the winter, and could be grown over much of the area if drainage were improved.

Fmk: Fine Loamy, Fine Silty and Clayey Acid Sulfate Soils, Imperfectly to Poorly Drained

This inextensive subunit is on the nearly level fluvio-marine plain in the mouths of rivers in the southern part of the country, and includes the Acid Sulfate soils.

These are extremely acid to strongly acid and contain iron sulfates. They have surface layers of gray to grayish brown very fine sandy loam to clay loam, and subsoils of gray or grayish brown silt loam, silty clay loam or clay loam.

These soils are in paddy capability Class III because of the extreme acidity. Some areas are used for paddy, but give moderately low yields. Management required for rice production includes a good drainage system, flooding with large amounts of fresh water, addition of lime, and addition of silicates. Upland crops are not grown on these soils, because of wetness and extreme acidity. The soils are in upland capability Class V.

Fml: Clayey Muck Soils, Poorly to Very Poorly Drained, Lacustrine Materials

This minor subunit includes organic soils which have formed in lacustrine deposits in old craters. They consist of a surface layer of black clay loam over deep or very deep black muck. Natural drainage is very poor and soil reaction strongly acid.

Soils of this subunit are in paddy capability Class III and upland Class III. Most areas are in paddy rice, although production is comparatively low. Management to improve production should include construction of drainage systems, early planting, additions of fine-textured mineral materials, use of lime and heavy applications of fertilizers, including silicates.

Maa: Lithosols and Red-Yellow Podzolic Soils, Siliceous Crystalline Materials, Strongly Dissected Hilly Land

This subunit is in moderately to strongly dissected hilly areas of siliceous materials derived from rocks such as granites, gneisses and migmatites. It is an association of well drained, fine loamy to clayey, moderately deep Red-Yellow Podzolic soils (about 50 to 60 percent) and excessively to somewhat excessively drained loamy or coarse loamy textured stony Lithosols (less than 50 percent). An interfingering network of Alluvial soils is included. The Red-Yellow Podzolic soils are in strongly weathered parent materials on smooth slopes of hills or on the rounded relief of the hilly land. The surface horizons are yellowish red, brown, dark brown, and dark yellowish brown in colour, fine loamy in texture, with moderate fine and medium granular structure. They are slightly acid in reaction. The subsoils are red, reddish brown, brown or yellowish red clay, silty clay or clay loam to loam with blocky structure. They are slightly to strongly acid in reaction. The substrata are brownish yellow, yellowish red, brown or strong brown fine loamy materials. They are slightly to strongly acid in reaction. Most of the land in this subunit is in upland capability Classes IV to VII. About 75 percent of the unit is suitable only for perennial vegetation. These soils are recommended for forest, because of very steep slopes, lack of water and low natural fertility. When these soils are used for agriculture they should be planted in contour strips to protect them from erosion. Limestone, compost, and complete fertilizers are beneficial. The gullied land complex areas urgently need reforestation.

Subunit: Maa
Profile: Recon. Stop 186

This is a well drained yellowish brown to yellowish red or red fine textured deep weakly developed Red-Yellow Podzolic soil on colluvium over residuum derived from granite-gneiss. It is located in a strongly dissected hilly area at Seo Weon Ri, Yeom Chi Myeon, Asan Gun, Chungcheongnam Do.

A--0 to 10 cm; Dark yellowish brown (10YR 3/4 to 4/4); heavy loam; moderate, fine and medium granular structure; friable, sticky and plastic; many, fine to medium pores; many, coarse, medium and fine grass and plant roots; clear, smooth boundary.

Weak B11--10 to 21 cm; Yellowish red (5YR 4/6); silt loam; weak, coarse and medium subangular blocky structure; breaking to strong medium and fine granular structure; slightly firm, sticky and plastic; many, fine pores; many, fine, medium and coarse roots; abrupt, smooth boundary.

Weak B12--21 to 42 cm; Reddish brown (5YR 4/4); loam; very weak, coarse subangular blocky structure, breaking to moderate fine and medium granular structure; firm, sticky and plastic; many, fine pores; few, coarse slightly weathered angular gravel derived from granite-gneiss; common, medium and fine roots; clear, smooth boundary.

Weak B13--42 to 52 cm; Yellowish red (5YR 5/); loam; moderate coarse and medium subangular blocky structure; very thin, discontinuous clay skins; firm, sticky and plastic, common, fine and medium roots; common, fine pores; few, coarse slightly weathered angular gravel, derived from granite-gneiss; clear, smooth boundary.

IIB21--52 to 67 cm; Red (2.5YR 5/8); silt loam; moderate, medium and fine angular blocky structure; thin, continuous clay skins; firm, sticky and plastic; few, fine pores; few, fine roots; clear, smooth boundary.

IIB22--67 to 96 cm; Mottled, red (2.5YR 5/8), strong brown (7.5YR 5/6), black (7.5YR 2/0), crushed colour yellowish red (5YR 5/8); silt loam; moderate, fine and medium subangular blocky structure; thin, continuous clay skins; firm, sticky and plastic; few, fine roots; few, fine pores; clear, smooth boundary.

IIB23--96 to 150 cm; Yellowish red (5YR 4/8) to red (2.5YR 5/8); silt loam; moderate, coarse subangular blocky structure; thick, discontinuous clay skins; sticky and plastic; few, coarse pores; more roots; few coarse moderately weathered subangular gravels derived from granite-gneiss.

IIB3--150 to 200+ cm; Mottled, strong brown (7.5YR 5/6), yellowish red (5YR 4/6), crushed colour, yellowish red (5YR 5/8); silt loam; many strongly weathered subangular gravels derived from granite-gneiss.

Subunit: Maa
Laboratory Data: Recon. Stop 186

	Lab. No.	Horiz-zon	Depth cm	Gra-vel	Particle Size Distribution 1/(mm) Percent US Department of Agriculture							
				>2 mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Text-ural Class
1	S-747	A	0- 10	7.8	2.4	7.2	7.1	8.8	5.0	44.7	24.8	L
2	748	WeakB11	10- 21	4.7	3.0	8.5	6.7	9.9	6.9	51.4	13.4	SiL
3	749	B12	21- 42	4.3	3.2	8.5	9.0	10.5	7.8	38.5	22.5	L
4	750	B13	42- 52	9.3	4.1	8.1	7.7	8.6	6.3	40.6	24.6	L
5	751	IIB21	52- 67	1.7	1.9	4.5	4.2	5.5	5.2	53.6	25.1	SiL
6	752	IIB22	67- 96	0.2	2.1	4.9	4.6	5.5	5.5	55.9	21.5	SiL
7	753	IIB23	96-150	0.5	1.7	5.3	5.1	5.8	5.3	52.3	24.5	SiL

	International				Moisture Retention	pH	O.M.	2/ CEC	Base
	CS 2-.2	FS .2-.02	Silt .02-.002	Text-ural Class	1/3 atm.	H_2O (1:5)	%	m.e.	Satura-tion %
1	18.5	22.6	34.1	CL	25.4	5.7	2.8	8.8	53.9
2	20.5	28.3	37.8	L	26.0	5.5	1.6	8.9	38.9
3	23.1	38.0	26.4	CL	25.5	5.5	1.4	8.8	29.1
4	22.0	25.4	28.0	CL	26.2	5.5	1.0	9.4	26.8
5	11.7	23.7	39.5	LiC	32.7	5.3	0.6	9.3	26.5
6	12.7	23.7	42.1	CL	33.0	5.6	0.4	9.8	30.4
7	13.6	22.2	39.7	CL	33.4	6.0	0.3	10.0	63.6

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

	Exchangeable Cations m.e./100 gm			
	Ca	Mg	Na	K
1	3.0	1.3	0.24	0.20
2	1.5	1.5	0.34	0.12
3	0.8	1.2	0.44	0.12
4	0.6	1.4	0.42	0.10
5	0.6	1.6	0.16	0.10
6	0.7	2.0	0.20	0.08
7	2.0	4.0	0.24	0.12

Mab: Lithosols, Siliceous Crystalline Materials, Strongly Dissected Hilly Land

This subunit is in strongly dissected hilly areas and isolated hills or inselbergs These tracts have the same material as subunit Mab above. It is an association of excessively to somewhat excessively drained loamy or coarse loamy Lithosols (more than 75 percent), with some gullied land complex (less than 10 percent), and Red-Yellow Podzolic soils (less than 10 percent). The Lithosols are in the most strongly dissected parts of the hilly land. Surface horizons are yellowish brown, yellowish red, reddish yellow and dark brown to dark yellowish brown coarse loamy soils, with a moderate very fine and fine granular structure. They are slightly acid in reaction. The substrata are brownish yellow, to yellowish brown, structureless loamy materials. They are slightly acid in reaction. The Red-Yellow Podzolic soils are similar to those in the "Maa" subunit. Dominantly slopes range from 16 to 35 percent, with the cover being mostly sparse forest. Only a small part of it is used for agriculture, dominantly upland crops. These soils are placed in upland capability Classes IV to VIII. They are recommended principally for forest. Only a very minor percentage at the bottom of slopes and in small valleys between the hills should be used for agriculture. Contour strip cultivation and bench terracing are advisable for dry land farming.

Subunit: Mab
Profile: Gwang Ju Stop 92

This is a well drained coarse loamy textured, shallow Lithosol developed on residuum from Granite. It is in a slightly dissected slightly convex hilly side area at Shin An Dong, Gwang Ju city, Jeonla Nam Do.

AP—0 to 19 cm; Brown to dark brown (7.5YR 4/4) moist, sandy loam, weak very fine and fine granular structure, nonsticky and nonplastic, very friable, common fine grass roots, abrupt smooth boundary.

C1--19 to 53 cm; Mottled yellowish red (5YR 4/3, approx 70 percent), olive brown (2.5Y 4/4, approx 10 percent), very dark brown (10YR 2/2, approx 20 percent), crushed colour yellowish red (5YR 5/6) moist, sandy loam, structureless (massive breaking easily to single grain), nonsticky and nonplastic, frequent fine yellow and white mica, few very fine roots, abrupt smooth boundary.

C2--53 to 200+ cm; Mottled brownish yellow (10YR 6/6, approx 60 percent), olive (5Y 5/2, approx 25 percent), very dark brown (10YR 2/2, approx 15 percent) moist, sandy loam, structureless (single grain), nonsticky, nonplastic, common fine yellow and white mica, no roots.

Subunit: Map
Laboratory Data: Gwangju Stop 92

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	K-189	AP	0- 19	6.7	1.6	11.7	18.1	19.8	11.1	26.3	11.4	SL
2	190	C1	19- 53	1.8	0.8	12.6	19.5	19.6	12.4	24.0	11.1	SL
3	191	C2	53-200	2.3	1.1	14.8	19.2	20.9	15.8	24.0	4.2	SL

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	B.D. gm/cc	Atterberg Limits FM	FMC	Permeability cm/Dry	Moisture Retention Core 1/3	1/3 atm	15 atm	pH H_2O (1:5)
1	36.0	40.0	12.0	FSL	1.33	10.1	30.7	101.8	18.2	17.8	7.5	5.0
2	38.5	28.3	12.1	SL	1.45	16.5	24.5	35.7	18.5	18.9	6.2	4.9
3	40.8	43.7	11.3	SL	1.34	17.6	31.0	22.2	15.5	15.5	6.0	5.1

1/ Pipette Method, Sodium Hexameta Phosphate.

	O.M.	1/ CEC	Exchangeable Cations m.e./100 gm				Base Saturation
	%	m.e.	Ca	Mg	Na	K	%
1	1.1	5.86	2.0	0.5	0.20	0.52	55
2		4.58	0.9	0.8	0.26	0.20	47
3		4.18	0.8	1.0	0.44	0.18	58

1/ Ammonium Acetate Method.

Mac: Lithosols, Siliceous Crystalline Materials, Strongly Dissected Mountains

This subunit is the most extensive in the country including about 20 percent of the area. It is in moderately to strongly dissected mountainous land or isolated mountain ranges with the same kinds of materials as in subunits Mab and Mac. It is an association of excessive to somewhat excessively drained loamy to coarse loamy Lithosols (more than 75 percent), and Red-Yellow Podzolic soils. Rocky land and rock outcrop make up about 10 percent of the total area. Some areas of Acid Brown Forest soils at high elevations are included.

Subunit: Mac
Profile: Recon. Stop 67

This is a somewhat excessively drained, shallow moderately fine textured stony Lithosol, over granite bedrocks, in a concave position. It is located in a steep mountain area at Gangyang, Jeonnam Do.

A—0 to 15 cm; Dark brown (10YR 4/3), sandy clay loam; moderate, fine and very fine granular structure; friable, sticky and plastic; many, fine and medium living roots; clear, smooth boundary; pH 5.0.

B-C—15 to 35 cm; Dark brown (7.5Y 4/2), clay loam, weak, fine and medium subangular blocky structure; friable, sticky and plastic; many, fine pores; slightly weathered angular gravel and cobbles; pH 6.0.

D—35+ cm; Granite bedrock.

Subunit: Mac
Laboratory Data: Recon. Stop 67

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-230	A	0-15	17.3	10.9	10.3	5.8	7.0	4.7	41.8	19.5	L
2	231	B-C	15-35	14.2	10.2	10.5	6.1	6.9	4.6	39.0	22.7	L

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	Atterberg Limits Lw	Pw	Moisture Retention 1/3 atm.	15 atm.	Field No. Wet %	Dry %
1	28.5	23.8	28.2	CL	46.4	27.6	27.34	12.01	12.4	14.2
2	28.2	21.1	28.0	CL	45.0	26.8	25.60	12.65	15.2	17.9

	H_2O (1:5)	O.M. %	Organic Matter C %	N %	C/N	2/ CEC m.e.	Exchangeable Cations m.e./100 gm Ca	Mg	Na	K	Base Saturation %
1	5.7	3.2	1.9	0.153	12.4	7.1	1.10	0.40	0.05	0.14	9.71
2	5.8	2.8	1.65	0.136	12.1	9.0	0.90	0.05	0.02	0.06	11.44

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

M1a: Lithosols and Red Yellow Podzolic Soils, Limestone Materials, Strongly Dissected Hilly Land

This subunit is in moderately to strongly dissected hilly areas and in continuous or isolated hills on limestone. It is an association of excessively well drained, coarse loamy Lithosols and well drained fine loamy to clayey deep Red-Yellow Podzolic soils, with some Red and Brown soils with an argillic B horizon, or Reddish Brown Lateritic soils.

The Lithosols are light olive brown to yellowish brown in surface soil colour, on the steeper and more sharply convex parts of the hilly landscape. The Red Yellow Podzolic soils and the Reddish Brown Lateritic soils are found in strongly weathered parent materials on smooth slopes of hills or round relief of the hilly areas, and are derived from different kinds of limestones. The surface horizons are fine loamy to clayey, with a moderate fine to coarse granular structure. The subsoils are red to brown, clayey, with strong fine to medium angular to subangular blocky structure and thick continuous clay cutans. Reaction is slightly acid to slightly alkaline. The substrata below 100 cm or more than 100 cm are lighter in colour than the subsoil, fine loamy in texture, and slightly alkaline.

Most of the land in this subunit is in upland capability Classes IV to VII, and is used for forest. Relatively small areas are cultivated. Soil conservation practices such as contour strips and terraces are necessary for dry land farming, in order to help control erosion. Some areas urgently need reforestation.

Subunit: M1a
Profile: Recon. Stop 136

This is a well drained fine loamy to clayey moderately deep Red and Brown soil with textural B (Red-Brown Lateritic-like soils or Red-Brown Mediterranean-like soils).

It is located in a strongly dissected round ridge hilly area at the road cut, Youngweol Eup, Yeongweon Gun, Gangweon Do.

A--0 to 5 cm; Red to dark red (2.5YR 4/6 to 3/6, moist), yellowish red (5YR 4/6, dry), yellowish red (5YR 4/6, wet), silty clay; moderate very fine and fine granular structure; friable, very sticky and very plastic; many, fine roots; clear, wavy boundary; pH 5.5.

B11--5 to 20 cm; Red to yellowish red (2.5YR 4/6 to 5YR 4/6) moist, yellowish red (5YR 4/6, wet), silty clay; weak, medium subangular blocky structure; breaking to a moderate, fine granular structure; friable, very sticky and very plastic; many, fine and medium roots; common, fine moderately to strongly weathered gravels; gradual, wavy boundary.

B12--20 to 30 cm; Red (2.5YR 4/6, moist), yellowish red (5YR 4/6, wet), clay, weak, medium subangular blocky structure; slightly firm, very sticky and very plastic; common medium and coarse roots; common, medium strongly to moderately weathered gravel and cobbles; clear, wavy boundary; pH 4.0.

B2--30 to 60 cm: Dark red (2.5YR 3/6, moist), yellowish red (5YR 4/6, wet), common, medium very dark brown Mn mottles; clay, moderately strong medium and fine angular blocky structure with thin, continous cutans; firm, very sticky and very plastic; few coarse roots; clear, wavy boundary; pH 4.5.

B3C--60 to 70 cm; Red (2.5YR 4/6) moist, yellowish red (5YR 4/6, wet), clay, many moderate to strongly weathered gravels with moderately thick to thick clay accumulation on the ped of gravels; clear, smooth boundary; pH 4.5.

C--70+ cm; Yellowish red (5YR 4/6, moist), many moderately weathered gravels with a moderately thick clay accumulation on the ped.

Subunit: M1a
Laboratory Data: Recon. Stop 136

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-528	A	0- 5	14.5	←	2.4	→	1.3	1.0	40.0	55.3	C
2	529	B11	5-20	15.2	←	1.6	→	1.4	1.3	27.2	68.5	C
3	530	B12	20-30	9.0	←	3.1	→	1.8	1.5	34.0	59.6	C
4	531	B2	30-60	4.2	←	3.2	→	2.7	2.6	29.3	62.2	C
5	532	B3C	60-70	21.9	0.8	4.1	3.5	2.7	2.4	24.3	62.2	C

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	Clay and Clay Minerals H_2O %	Ignition Loss %	SiO_2 R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	K_2O %	CEC 2/ m.e. %
1	2.7	9.3	32.7	HC	4.23	9.57	1.96	43.50	12.35	29.81	2.50	39.92
2	1.8	3.0	26.7	HC								
3	3.5	10.7	26.2	HC	3.91	9.53	2.02	43.47	12.55	28.49	2.80	41.16
4	3.6	13.5	20.7	HC								
5	9.2	8.3	20.3	HC								

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

	pH H_2O (1:5)	O.M. %	1/ CEC m.e.	Exchangeable Cations m.e./100 gm Ca	Mg	Na	K	Base Saturation %
1	6.6	3.1	18.8	12.8	2.7	0.26	0.9	88.0
2	4.9		12.8	2.7	2.3	0.52	0.28	45.0
3	4.8		10.6	0.8	1.2	0.08	0.20	22.0
4	5.1		10.1	1.2	0.4	0.18	0.20	20.0
5	5.2		10.0	1.2	0.0	0.26	0.22	17.0

1/ Versence Method, CaoAC Saturated.

M1b: Lithosols, Limestone Materials, Strongly Dissected Mountains

The extent of this subunit represents more than 75 percent in the mapping unit M1. It occupies the strongly dissected mountainous land or isolated mountain ranges, on areas with limestone. This is an association of excessively to well drained, coarse loamy to loamy, moderately shallow, light olive brown to yellowish-brown, mostly gravelly or cobbly, severely to extremely eroded stony Lithosols, with inclusions of Rego-Lithosols. Rock outcrops are common. This subunit is nearly all in forest, mainly conifers, with some deciduous shrubs and varieties of grasses. These soils are placed in land capability Classes V to VIII. They are recommended for forest, because of shallowness, very steep slopes, lack of water and low natural fertility.

A small proportion of this mapping unit is used for agriculture, at the bottom of slopes. Soil conservation practices such as contour strip cultivation and terraces are advisable for dry land farming in order to prevent erosion. Reforestation in certain areas is urgently needed. With good management fair to good yields of many wood products could be obtained.

Subunit: M1b
Profile: Stop No. 130

These are well drained fine loamy textured moderately shallow stony Lithosols developed on residuum derived from limestone.

They are located in a strongly dissected low part of steep mountain area at Sungodeog, Taecheon.

Ap—0 to 7 cm; Brown to dark brown (10YR 4/3 to 5/3), gravelly clay, moderately fine granular structure; friable, sticky and plastic; many, fine and medium living grass roots; abrupt, smooth boundary; pH 8.5.

Weak B3-1---7 to 20 cm; Reddish brown to dark reddish brown (5YR 4/3 to 3/3), clay, weak fine and a medium subangular blocky structure; breaking to a moderately fine granular structure; common, fine living grass roots; gradual, smooth boundary; pH 8.5.

Weak B3-2---20 to 40 cm; Reddish brown to yellowish red (5YR 4/4 to 4/6), clay moderately, fine and medium subangular blocky structure; few, fine living grasses; common, strongly weathered limestone; pH 8.5.

40+ cm; Bedrock.

Subunit: M1b
Laboratory Data: Recon. Stop 130

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent — US Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-509	Ap Weak	0- 7	16.8	3.8	2.7	3.1	7.2	7.3	38.8	37.1	CL
2	510	B3-1	7-20	1.7	2.6	2.5	2.7	7.6	8.0	35.8	40.8	C
3	511	B3-2	20-40	7.1	1.7	1.9	4.5	9.5	7.7	36.3	38.4	CL

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	pH H_2O (1:5)	O.M. %	2/ CEC m.e.	Exchangeable Cations m.e./100 gm Ca	Mg	Na	K	Sum of Cations	Base Saturation %
1	10.8	27.0	25.1	LiC	8.0	3.2	34.8	46.8	1.7	0.08	0.50	49.08	141.0
2	9.0	27.1	23.1	LiC	8.0		35.2	47.2	2.1	0.08	0.40	49.78	141.4
3	10.1	29.6	21.9	LiC	8.2		30.0	46.5	2.8	0.10	0.33	49.73	165.8

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

Subunit: M1b
Profile: Recon. Stop 137

These are somewhat excessively drained fine loamy shallow stony Lithosols developed on residuum derived from limestone.

They are located in a strongly dissected round ridged mountain at road cut, So Myeon, Yeongweol, Gangweon Do.

A--0 to 10 cm; Dark reddish brown (5YR 3/3, moist), silty clay; moderate, fine and very fine and medium granular structure; friable, very sticky and very plastic; few, fine gravels; many, fine and medium living roots; abrupt, wavy boundary; pH 7.5.

AC--10 to 40 cm; Colour ditto (moist); silty clay or clay; moderate, fine subangular blocky structure with discontinuous thin cutans; friable, very sticky and very plastic; many gravels and cobbles derived from limestones; common, fine and medium living roots; abrupt, wavy boundary; pH 7.5.

C--40+ cm; Bedrock.

Subunit: M1b
Laboratory Data: Recon. Stop 137

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture							
					VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-533	A	0-10	8.6	←	1.3	→	2.5	4.5	39.7	52.0	C
2	534	AC	10-40	16.5	←	1.1	→	1.9	3.9	50.5	42.6	SiC

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	pH H_2O (1:5)	O.M. %	2/ CEC m.e.	Exchangeable Cations m.e./100 gm Ca	Mg	Na	K	Sum of Cations	Base Saturation %
1	1.6	21.7	24.7	HC	7.7	4.3	23.6	20.5	8.2	0.58	0.40		130.0
2	1.4	23.8	32.2	LiC	7.8		24.6	24.6	6.3	0.34	0.68		130.0

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

Mma: Lithosols, Micaceous and Naro Siliceous Materials, Strongly Dissected Hilly Land

This subunit occupies moderately to strongly dissected hilly areas and isolated hills on schist and metasedimentary rocks. It is an association of excessively to well drained fine loamy to coarse loamy moderately shallow stony Lithosols (about 75 percent), and some well drained, fine loamy to clayey moderately deep Red-Yellow Podzolic soils (less than 25 percent), with inclusions of Alluvial soils and Rego-Lithosols. The Lithosols are brown or yellowish brown sandy loam or loam, over slightly to moderately weathered schist.

The Red-Yellow Podzolic soils are in strongly weathered parent materials on smooth slopes or rounded hilly relief. Their surface horizons are red, yellowish red, brown to dark brown or dark yellowish brown, fine loamy and friable, and have a moderate fine and medium granular structure. They are slightly acid in soil reaction. The subsoils are red, reddish brown, brown to dark brown or yellowish red, clayey in texture, and have blocky structure. They are slightly to strongly acid in reaction.

The substrata below 100 cm or more are brownish yellow, yellowish red, brown or strong brown fine loamy materials with no structure (massive). They are slightly to strongly acid in soil reaction.

Most of the land in this subunit is in upland capability Classes IV to VII. More than 75 percent of the unit is suitable only for perennial vegetation such as forest, because of very steep slops, lack of water and low natural fertility. Some areas, less than 25 percent, are used for agriculture, with contour strips to protect against erosion. Limestone, compost and complete fertilizer are beneficial. The gullied land complex areas urgently require reforestation.

Subunit: Mma
Profile: Recon. Stop 153

This is an excessively drained coarse loamy very shallow Lithosol, developed on residuum derived from schist.

It is in a moderately dissected, moderately steep hilly area at Seongdong Ri, Seongdong Myeong, Igsan Gun, Jeonbug Do.

A--0 to 8 cm; Dark brown to dark grayish brown (10YR 4/3 to 4/2), sandy loam, weak, fine and very fine granular structure; many, fine to medium grass roots; many, fine to medium pores; friable, slightly sticky and slightly plastic; clear, smooth boundary.

C--5 to 18 cm; Strong brown (7.5YR 5/6), gravelly sandy clay loam; moderate, medium to fine granular structure; common, fine and medium grass roots; friable sticky and slightly plastic; many, fine and medium pores; common, moderately weathered light yellowish brown angular gravels derived from fine yellow mica; abrupt, wavy boundary.

D--184 cm; Slightly to moderately weathered parent material derived from schist.

Subunit: Mma
Laboratory Data: Recon. Stop 153

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-599	A	0-5	23.5	13.2	17.0	12.4	12.6	5.8	32.9	6.1	CoSL
2	600	C	5-18	<0.01	11.2	15.0	10.6	11.5	9.0	35.5	7.2	CoSL

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	Moisture Retention 1/3 atm.	pH H_2O (1:5)	O.M. %	2/ CEC m.e.
1	46.5	30.3	17.1	CoSL	17.0	6.0	1.1	6.0
2	39.0	25.1	28.7	SL	21.0	5.9	2.3	7.7

	Exchangeable Cations m.e./100 gm Ca	Mg	Na	K	Sum of Cations	Base Saturation %
1	1.5	0.7	0.1	0.38	2.68	44.7
2	3.4	1.0	0.30	0.92	5.62	73.0

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

Mmb: Lithosols, Micaceous and Hard Siliceous Materials, Strongly Dissected Mountains

This subunit is in strongly dissected mountainous land or isolated mountain ranges on areas of schistose and metasedimentary rocks. It is an association of excessively to somewhat excessively drained loamy to coarse loamy Lithosols (more than 75 percent), Red-Yellow Podzolic soils (less than 10 percent), and Rego-Lithosols (less than 7 percent).

The Lithosols are mostly in the strongly dissected mountainous lands. The surface horizons are brown to reddish yellow, loamy to coarse loamy, with a moderate very fine and fine granular structure, and slightly acid soil reaction. The substrata below a depth of 10 cm to 40 cm from the surface, are brownish yellow to yellowish brown, structureless, and slightly acid in soil reaction.

The Red-Yellow Podzolic soils are similar to those described in subunit Mma. The subunit Mmb has slopes ranging from 35 to 65 percent. This land is mostly under sparse forest cover. Only a minor percentage is used for agriculture, mostly in upland crops. These soils are in upland capability Classes from V to VIII. Use for forest is recommended. Only a minor percentage on the bottom slopes and in the valleys between the mountains can be used as agricultural land. Soil building is necessary in many places. Contour strip cultivation and bench terracing are advisable for dry land farming, in order to help erosion control.

Subunit: Mmb
Profile: Recon. Stop 28

This is an excessively to well drained, coarse loamy shallow stony Lithosol on colluvium over residuum derived from granitic materials.

It is in a mountain area at Tabdong, Dongbog, Hwasoon, Jeonnam Do.

A—0 to 8 cm; Reddish brown (5YR 4/4), sandy loam; weak, fine and very fine granular structure; friable, slightly sticky and slightly plastic; many, fine and medium plant roots; few, fine and medium white mica; few, fine fragments derived from Pyeongan System granite; clear, wavy boundary.

A3—8 to 22 cm; reddish brown (5YR 4/4), friable sandy loam; moderate fine and medium granular structure; sticky and plastic; common, fine and medium plant roots; few, fine and medium white mica; few, fine and medium fragments derived from Pyeongan System granite; gradual, smooth boundary.

C1—22 to 43cm; Dark brown (7.5YR 4/4), reddish brown (5YR 4/4), friable, sandy loam; nonstructure; slightly sticky and slightly plastic; common, fine and medium plant roots; many, medium and coarse fragments derived from Pyeongan System granite; few, fine and medium white mica; abrupt, smooth boundary.

IIC—43 to 400+ cm; Brownish yellow (10YR 5/8), yellow (10YR 7/6), white (5Y 8/1), weathered materials (Pyeongan System granite).

Subunit: Mmb
Laboratory Data: Recon. Stop 28

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-88	A	0-8	21.90	7.4	15.9	14.3	11.5	4.9	44.4	1.6	SL
2	89	A3	8-22	14.93	5.0	14.8	15.9	13.2	5.6	41.2	4.3	SL
3	90	C	22-43	16.81	4.2	14.2	20.0	19.3	7.0	31.1	4.2	SL

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	S.G.	Atterberg Limits Lw	Pw	Moisture Retention 1/3 atm.	15 atm.
1	40.9	27.3	30.2	SL	2.69	none		22.80	7.23
2	29.4	25.0	31.3	L	2.70			24.36	6.91
3	44.9	32.2	18.7	SL	2.71			19.62	5.13

	Clay and Clay Minerals SiO_2 R_2O_3	SiO_2	Fe_2O_3	Al_2O_3	pH H_2O (1:5)	Organic Matter C %	N %	C/N	Exchangeable Cations m.e./100 gm Ca	Mg	Na	K
1	2.146	51.34	10.29	34.04	5.9	1.08	0.068	15.9	0.64	0.16	0.08	0.12
2	2.003	50.05	11.47	35.10	5.7				0.20	0.04	0.08	0.08
3	1.918	48.65	12.27	35.22	5.5				0.28	0.04	0.10	0.08

1/ Pipette Method, Sodium Hexameta Phosphate

Msa: Lithosols, Sedimentary Materials, Strongly Dissected Hilly Land

This subunit is in the strongly dissected hilly land and isolated hills or inselbergs on areas of sedimentary rocks. The soils of this subunit are predominantly excessively to well drained, fine loamy to coarse loamy, moderately shallow and stony Lithosols (about 75 percent). They include some well drained, fine loamy to clayey, moderately deep Red-Yellow Podzolic soils (less than 25 percent), and an interfingering network of Alluvial soils and Rego-Lithosols. The surface horizons of the Lithosols are pale brown, yellowish brown and dark brown, loamy with a moderate very fine to fine granular structure, and a slightly acid soil reaction. The substrata below 10 cm to 40 cm, are pale brown, yellowish brown and brownish yellow, structureless and slightly acid in soil reaction. The Red-Yellow Podzolic soils have formed in strongly weathered parent materials on the smooth slopes of rounded relief within the hilly areas. The surface horizons are dark brown, yellowish brown and pale brown, fine loamy textured, friable, with a moderate very fine to fine granular structure. They are slightly acid in reaction. The subsoils are dark brown, reddish brown and yellowish red, fine loamy to clayey in texture, with a moderate subangular blocky structure. They are slightly to strongly acid in reaction. The substrata, below 100 cm or more, are yellowish red, reddish yellow, pale yellow, pale brown and brownish yellow, fine loamy to coarse loamy structureless (massive) materials. They have a slightly acid reaction. Almost all of the land in this subunit is in upland capability Classes IV to VII.

Most of the land is not cultivated. It is dominantly in forest of conifers with some deciduous shrubs and varieties of grasses. These soils are recommended principally for forest. Pasture could be developed in some areas. A small part of this land is being used for agriculture, in contour strips to protect from erosion. Limestone, compost and complete fertilizers are beneficial, as these soils are low in organic matter, acid in reaction and low in natural fertility. The gullied land complex areas urgently need reforestation.

Subunit: Msa
Profile: Recon. Stop 80

This is a well drained, moderately fine to medium textured stony Lithosol developed on residual materials derived from hard shale in a strongly dissected hilly area. The vegetation is dominantly coniferous forest with some deciduous shrubs and grasses.

Location is at Gamsan, Sannae, Weolseong, Gyeongsangbug Do.

A11--0 to 8 cm; Yellowish brown (10YR 5/4), gravelly loam; moderately fine and very fine granular structure; friable, slightly sticky and plastic; many, fine and medium; living grass roots; clear, wavy boundary; pH 5.0.

A12--8 to 27 cm; Pale brown (10YR 6/3), clay loam; strong medium and fine granular structure; friable, sticky and plastic; common, fine and medium living grass roots; common moderately weathered pale yellow (10YR 5/6) angular cobbles and gravel, derived from shale and sandstone; abrupt, wavy boundary.

C1--27 to 80 cm; Very pale brown (10YR 7/4), very gravelly and cobbly; clay loam or clay; moderate, fine and medium subangular blocky structure; firm, sticky and plastic; many, fine and medium pores; few, coarse and medium dead plant roots; many moderately and strongly weathered angular gravels and cobbles derived from shale; abrupt, wavy boundary; pH 4.3.

C2--80 to 100 cm; Pale yellow (10YR 5/6); strongly weathered angular cobbles and gravels; with yellowish red (5YR 4/6) cutans around them.

Subunit: Msa
Laboratory Data: Recon. Stop 80

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	295	A11	0-8	8.1	4.7	7.4	7.6	7.4	2.4	49.9	20.6	L
2	296	A12	8-27	6.3	5.7	7.1	7.1	7.1	2.3	49.7	21.0	L
3	297	C1	27-80	0.5	1.1	4.1	7.1	11.0	5.8	33.9	36.9	CL
4	298	C2	80-100	1.3								

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	Moisture Retention 1/3 atm.	15 atm.	H_2O (1:5)	Organic Matter O.M. %	C %	2/ CEC m.e.
1	21.8	23.2	34.4	CL	27.8	11.5	5.3	3.1	1.8	8.3
2	21.7	21.2	36.1	CL	27.6	11.5	5.5	2.0	1.2	7.1
3	15.4	22.9	24.8	LC	30.0	16.0	5.9	0.8	0.5	10.2
4					24.4	12.8	5.4	0.4	0.2	9.3

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

	Exchangeable Cations m.e./100 gm					Base Saturation
	Ca	Mg	Na	K	Sum of Cations	%
1	0.65	0.50	0.18	0.59	1.52	18.3
2	0.55	0.0	0.16	0.14	0.85	12.0
3	6.40	2.15	0.31	0.25	9.11	89.3
4	0.40	0.6	0.11	0.13	1.24	13.3

Msb: Lithosols, Sedimentary Materials, Strongly Dissected Mountains

This subunit is in strongly dissected mountainous land or isolated mountain ranges on areas of sedimentary rocks. It is an association of excessively to somewhat excessively drained, loamy to coarse loamy Lithosols (more than 75 percent) with Red-Yellow Podzolic soils (less than 20 percent), Rego-Lithosols and Gullied land complex.

The Lithosols occupy strongly dissected mountainous land. Their surface horizons are dark grayish brown, and pale brown, loamy to coarse loamy, with a moderate very fine to fine granular structure. They are slightly acid in reaction. The substrata, below 10 cm to 40 cm, are brownish yellow, light yellowish brown, dark brown, loamy to coarse loamy soil materials, with a moderate very fine to fine granular structure, or structureless (massive). They are slightly acid in reaction. The Red-Yellow Podzolic soils are similar to those described in subunit Msa. The dominant slopes range from 35 to 65 percent. Soils are mostly under a sparse forest cover. Only a minor percentage of this land is used for agriculture, growing mostly on upland crops. The soils of this subunit are in upland capability Classes V to VIII. They are recommended for forest. A minor percentage at the bottom slopes, and in the valleys between the mountains, can support some agriculture. Soil building is necessary in many places. Contour strip cultivation and bench terracing should be used for dry land farming, in order to prevent erosion.

Subunit: Msb
Profile: Recon. Stop 92

This is an excessively drained moderately coarse textured very shallow stony Lithosol developed on residuum derived from sandstone and shale complex.

The location is in a strongly dissected steep sloping middle part of a mountainous area with forest vegetation, at Sindong, Daecheon, Chigog, Gyeongbug Do.

A--0 to 12 cm; Pale brown (10YR 6/3), sandy loam; weak, fine and very fine granular structure; friable, slightly sticky and plastic; common, fine and medium roots; few, moderately weathered gravels and cobbles mainly from sandstone and some from shale; abrupt, wavy boundary.

C1--12 to 60 cm; Light yellowish brown (10YR 6/4) to brownish yellow (10YR 6/6), sandy loam; weak, medium subangular blocky structure; breaking to moderate, fine and medium granular structure; friable, slightly sticky and plastic; many, medium and fine pores; common, coarse and medium plant roots; many (90 percent) moderately weathered light brownish gray (2.5Y 6/2) gravels and cobbles; derived mainly from shale; abrupt wavy boundary.

C2--60 to 500 cm; Bedrock (dark brown (10YR 4/3)

Subunit: Msb
Laboratory Data: Recon. Stop 92

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-365	A	0-12	3.0	1.6	4.4	15.2	24.1	11.4	36.2	7.1	SL
2	366	C1	12-60	0.0	-	8.3	-	15.0	17.9	50.0	8.8	L

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	Moisture Retention 1/3 atm.	15 atm.	H_2O (1:5)	O.M. %	2/ CEC m.e.
1	27.3	47.5	18.1	FSL	14.1	5.3	6.5	0.2	8.4
2	10.9	57.0	23.3	FSL	21.4	7.6	6.0	0.4	13.1

	Exchangeable Cations m.e./100 gm Ca	Mg	Na	K	Sum of Cations	Base Saturation %
1	3.50	3.50	0.24	0.14	7.38	87.8
2	2.50	5.40	0.15	0.24	8.29	63.3

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

Mua: Acid Brown Forest Soils and Lithosols, Undifferentiated Materials, Strongly to Moderately Dissected Plateau Remnants

This subunit occurs on moderately dissected plateau remnants, with rolling to hilly relief, underlain by undifferentiated materials. It is an association predominantly of Acid Brown Forest soils, with inclusions of Red-Yellow Podzolic soils and Lithosols, and some Alluvial and Low-Humic Gley soils in the elevated valleys of the plateaus. Dissection is predominantly moderate. Relief is high. Topography is undulating to rolling, with local more steeply inclined areas. Dominant slopes range from 7 to 16 percent. Erosion has been slight to moderate, and surface layers are very dark brown to dark yellowish brown, fine loamy and silty, and slightly to strongly acid in reaction. Subsoils, extending to a depth of more than 1 m, are yellowish brown or strong brown, clay, silty clay, silty clay loam or clay loam, with a weak to moderate subangular blocky structure and in some cases clay cutans. They are slightly to strongly acid in reaction. The substrata are variable and deep, according to the kind of rock and its degree of weathering.

The Red-Yellow Podzolic soils are of minor importance. They are like those described in mapping unit Ra. "Cumulic" Acid Brown Forest soils have developed mostly in swales and narrow valleys. They have thick dark loamy surface layers. This subunit is concentrated mostly in the vicinity of Daegwanryeong. Most of the land is under natural forest and grass, but some is cultivated with various upland crops such as potato, corn, bean, hop, Chinese cabbage and radish. The soils of this mapping unit are chiefly in upland capability Classes IV and VII, with some in Class VI. Perhaps 35 percent of the unit is suitable for upland crops. It is suitable for intensive agricultural development, having a high content of organic matter, but low natural fertility. The use of conservation practices such as contour cultivation and terracing are advisable to help erosion control and runoff.

Subunit: Mua
Profile: Recon. Stop 122

This is a well drained, fine textured, slightly eroded, Acid Brown Forest soil developed in residuum from granitic rocks in moderately dissected old surface remnants.

The location is on top of high altitute lands in Songsan, Gyeochang, Deochang, Gangweon Do.

AP—0 to 10 cm; Very dark brown (10YR 2/2), silt loam; weak coarse granular structure breaking to moderate very fine and fine granular; friable, slightly sticky and slightly plastic; common, fine dead roots; few, fine white mica; no gravel; abrupt, smooth boundary; the A horizon in this profile is slightly thicker than in more convex positions.

A1—10 to 35 cm; Brown (10YR 4/3), light silty clay loam or heavy silt loam; heavy silty loam; weak coarse granular structure breaking readily to moderate fine granular; friable, slight increase in stickiness and plasticity; no grit; roots as above; clear boundary.

B1--35 to 45 cm; Yellowish brown (10YR 5/6), almost firm, silty clay loam may be silty clay; moderate medium and fine subangular blocky structure; continuous yellowish brown clay cutans; friable, sticky and plastic; common, very fine white mica; no grit; few, fine living roots; clear, wavy boundary; pH 5.0.

B22--45 to 70 cm; As above, with slight increase in chroma, light clay with weak coarse subangular blocky structure breaking to strong medium subangular blocky; continuous clay cutans.

IIB23cn--70 to 100 cm; Strong brown (7.5YR 5/6); light clay with a moderate medium prismatic structure breaking to moderate coarse subangular blocky; common, fine soft black Mn concretions; continuous moderately thick yellowish brown (10YR 5/6) clay cutans on prism faces, less thick on subangular blocky faces; firm, sticky and plastic; few, angular quartz grains about coarse sandsize; few pale brown mottles; crushed colour reddish yellow (7.5YR 6/6); gradual boundary.

IIB3-B24--100 to 130 cm; As above with massive structure, increase in angular quartz grit and hue.

Subunit: Mua
Soil Description: Recon. No. 122

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-468	Ap	0-10	0.3	←	2.8	→	1.5	0.8	61.7	33.2	SiCL
2	469	A1	10-35	<0.01	←	2.7	→	1.5	0.7	58.5	36.6	SiCL
3	470	B1	35-45	<0.01	←	2.2	→	1.4	0.4	57.1	38.9	SiCL
4	471	B22	45-70	<0.01	←	1.4	→	0.9	0.5	57.1	40.1	SiC
5	472	IIB23	70-100	<0.01	←	2.7	→	1.5	0.8	48.9	46.1	SiC

1/ Pipette Method, Sodium Hexameta Phosphate.

	International				pH		1/
	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	H_2O (1:5)	O.M. %	m.e.
1	3.2	15.8	47.8	SiC	5.1	7.7	20.9
2	3.1	10.2	50.1	SiC	5.3		15.4
3	2.6	13.8	44.7	LiC	5.4		12.1
4	1.6	15.6	42.7	LiC	5.5		11.5
5	3.0	11.7	39.2	HC	5.6		13.8

	Exchangeable Cations m.e./100 gm					Base Saturation %
	Ca	Mg	Na	K	Sum of Cations	
1	2.5	0.7	0.05	0.25	3.5	16.7
2	1.6	0.6	0.08	0.18	2.46	16.0
3	1.6	0.7	0.05	0.15	2.5	20.7
4	2.4	1.1	0.10	0.18	3.78	32.9
5	3.2	2.1	0.10	0.18	5.58	40.4

1/ Ammonium Acetate Method.

Mub: Lithosols and Acid Brown Forest Soils, Undifferentiated Materials, Strongly Dissected Mountains

This subunit is on strongly dissected high mountainous land on areas of undifferentiated rocks. It is an association of Lithosols and Acid Brown Forest soils. Dissection is predominantly strong. Dominant slopes range from 35 to 65 percent. Elevations range from 500 to 1 000 m with most of the land, between 700 and 800 m. Lithosols are like those described in mapping unit Ma, but include locally some organic matter on the surface. Acid Brown Forest soils are similar to those mentioned above in subunit Mua. The erosion of these soils has been moderate to strong. "Cumulic" Acid Brown Forest soils have formed in the mountain footslopes, swales or narrow valleys, and are included in this subunit. They, predominantly moderately well drained, loamy soils, are under cultivation. There are a few areas of Red-Yellow Podzolic soils, mostly in strongly weathered materials. Largest areas of this subunit are in the western region of Daegwanryeong, in Gangweon Do. The land is mostly under natural forest and grasses, with an estimated 20 percent of the total area being cultivated to various upland crops such as potato, corn, bean,

tobacco, and hop. The soils of this subunit are chiefly upland capability Classes VI to VII, with smaller areas of Class IV. The smoothest slopes are recommended for upland crops. Erosion control is important in the use of this land, and tracts with scattered natural vegetation urgently need reforestation. The present remaining forest should be preserved.

Subunit: Mub
Profile: Recon. Stop 193

This is well drained, fine textured, Acid Brown Forest soils over limestone. The locale is in the moderately dissected, lower middle mountain slope, at Saeing Gae Ryeong, Imgae Myeon, Jeonseon Gun, Gangweon Do.

Ap---0 to 18 cm; Very dark brown (10YR 2/2), friable, silty clay loam; moderate, fine to medium granular structure; many, fine and some medium wild grass living roots; sticky and plastic; few, very fine pores; clear, smooth boundary.

A3-1---18 to 34 cm; Very dark brown (10YR 2/3), friable, silty clay loam; weak, medium subangular blocky breaking to weak medium granular structure; sticky and plastic; common, fine and medium pores; common, fine wild grass living roots; clear, smooth boundary.

A3-2---34 to 43 cm; Very dark brown (10YR 2/3), friable, silty clay loam; moderate coarse subangular blocky structure breaking to moderate fine subangular structure with thin, discontinuous clay film; sticky and plastic; many, very fine pores; sometimes medium pores; common, fine wild grass living roots; abrupt, smooth boundary.

B1---43 to 56 cm; Dark brown (10YR 3/3), slightly firm; silty clay; moderate coarse subangular blocky structure with moderate thick, discontinuous clay skin; very sticky and very plastic; common, fine pores; few, fine roots; clear, smooth boundary.

B2---56 to 140 cm; Brown to dark brown (10YR 4/3), slightly firm, silty clay; strong, medium and coarse angular blocky structure with a moderate thick discontinuous clay skin; common, fine and medium pores; clay cutan colour is dark brown (10YR 3/3), few, fine roots.

Subunit: Mub
Laboratory Data: Recon. Stop 193

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/(mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-788	Ap	0-18	0.0		3.9		5.3	7.5	50.9	32.4	SiCL
2	789	A3-1	18-34	0.0		4.0		6.0	7.5	51.5	31.0	SiCL
3	790	A3-2	34-43	0.01		4.1		6.0	8.6	54.9	26.4	SiL
4	791	B1	43-56	0.01		5.1		5.5	7.8	55.6	26.0	SiL
5	792	B2	56-140	0.8		1.5		4.9	8.5	46.9	38.2	SiCL

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	F.M.	Permeability cm/hr	Moisture Retention 1/3 atm.	Clay and Clay Minerals SiO_2 RwO_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %
1	-4.7	25.2	37.7	LiC	47.3		44.9	1.82	46.57	14.91	33.98
2*	-4.9	22.0	42.1	LiC	41.2		42.7	1.85	47.14	14.72	33.75
3	5.0	28.2	40.4	LiC	38.4		42.2	1.80	46.54	15.32	34.10
4	6.0	28.5	39.5	CL	32.5		38.6	1.84	46.71	15.53	33.23
5	2.0	25.5	34.3	LiC	32 [illegible]		35.2	1.83	46.62	16.07	32.95

	pH H_2O (1:5)	IN KCl	Organic Matter O.M. %	2/ CEC m.e.	Exchangeable Cations m.e./100 gm Ca	Mg	Na	K	H	Sum of Cations	Base Saturation %
1	6.50	4.89	11.1	14.9	8.1	6.3	0.08	0.3	0.10	14.78	99.2
2	5.90	4.21	7.2	5.9	3.1	0.8	0.05	0.1	0.40	4.05	58.6
3	5.85	4.18	6.0	4.3	1.1	1.1	0.04	0.1	0.26	2.34	54.4
4	5.71	4.20	3.3	3.2	1.0	0.4	0.04	0.1	0.20	1.54	48.1
5	5.80	4.05	1.6	5.9	2.1	1.1	0.07	0.2	0.35	3.47	58.8

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

Mva: Lithosols, Siliceomafic Materials, Strongly Dissected Hilly Land

This subunit occurs in the strongly dissected hilly land and isolated hills or inselbergs on areas with siliceomafic materials derived from volcanic rocks. The soils of this subunit are predominantly excessively to well drained, fine loamy to coarse loamy, moderately shallow stony Lithosols (about 75 percent), and some well drained fine loamy to clayey, moderately deep Red-Yellow Podzolic and Reddish Brown Lateritic soils (less than 25 percent). Small areas of Alluvial soils and Rego-Lithosols in the valleys, swales and bottom slopes are included. The surface horizons of the Lithosols are pale brown, yellowish brown or dark brown loamy, with a moderate very fine and fine granular structure. They are slightly acid in soil reaction. The subsoils are dark red, red, yellowish brown or reddish brown, fine loamy to clayey, with a moderate fine and medium to coarse subangular blocky structure. They are slightly to strongly acid in reaction. The substrata, below 100 cm, are red to light olive gray or yellowish red to reddish yellow, fine loamy to coarse loamy, structureless (massive), and slightly acid in soil reaction.

Almost all of the land in this subunit is in upland capability Classes IV to VII. Most of the land is in conifer forest, with some deciduous shrubs, and varieties of grasses. Because of very steep slope, lack of water, very shallow depth, poor workability and low natural fertility, most areas are suitable only for forest. Some of these soils with finer textured, Red-Yellow Podzolic or Reddish Brown Lateritic soils in bottom slopes or on rounded relief with smooth slopes can be used for agriculture, with contour strips to protect them against erosion. Limestone, compost and complete fertilizers are beneficial. The gullied land complex areas and areas with scattered vegetation urgently need reforestation.

Subunit: Mva
Profile: Recon. Stop 95

This is a well to somewhat excessively drained fine loamy to loamy texture, moderately deep, weakly developed Red-Yellow Podzolic soil.

It is located in the moderately dissected middle part of a hilly area at Jangje, Sancheong, Gyeongnam Do.

A--0 to 4 cm; Pale olive (5Y 6/3), silty clay loam; moderate, fine and very fine granular structure; friable, slightly sticky and plastic; many, fine and medium plant roots; clear, wavy boundary; pH 6.5.

B1--4 to 14 cm; Light yellowish brown (2.5Y 6/4), clay loam; moderate fine and medium granular subangular blocky structure; thin, discontinuous clay cutans; friable, sticky and plastic; common, fine plant roots; abrupt, wavy boundary; pH 6.5.

B2--14 to 31 cm; Pale brown (10YR 6/3), clay; strong coarse and medium angular blocky structure; continuous thick, clay cutans; firm, sticky and plastic; few, fine plant roots; abrupt, wavy boundary; pH 7.0.

B3--31 to 40 cm; Mottled, white (10YR 8/2), blue green, yellowish brown (10YR 5/6), crushed colour, light olive gray (5YR 6/2) (wet), sandy clay loam; strong, coarse prismatic

structure; thick, continuous clay skins; firm, slightly sticky and plastic; few, fine plant roots; many, strongly weathered materials derived from gabbro; abrupt, wavy boundary; pH 7.0.

C—40 to 300 cm; Mottled, white (2.5Y 8/2), blue green, light yellowish brown (10YR 6/4), crushed colour, white (2.5Y 8/2), sandy loam; structureless (massive); friable, nonsticky and nonplastic; many, strongly weathered materials derived from gabbro; pH 6.5.

Subunit: Mva
Laboratory Data: Recon. Stop 95

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-374	A	0-4	4.3	←	6.6	→	9.4	8.4	53.4	22.2	SiL
2	375	B1	4-14	0.7	←	5.1	→	6.8	4.1	60.8	23.2	SiL
3	376	B2	14-31	0.5	←	3.0	→	6.4	4.4	38.5	51.7	C
4	377	B3	31-40	0.0	←	6.2	→	11.7	5.7	29.6	46.8	C
5	378	C	40-300	0.8	8.7	-	19.1	21.9	7.8	28.2	14.3	SL

	International CS 2-.2	FS	Silt .02-.002	Textural Class	Moisture Retention 1/3 atm.	15 atm.	H_2O (1:5)	O.M. %	2/ CEC m.e.
1	8.3	38.3	31.2	CL	30.0	16.1	6.2	2.1	9.8
2	6.4	31.7	38.7	CL	29.8	15.1	6.3	1.5	8.8
3	3.9	23.4	21.0	HC	43.0	30.7	6.5	1.2	17.3
4	8.5	26.0	18.7	HC	40.5	27.4	7.2	0.4	15.3
5	34.0	34.7	17.0	SL	24.3	13.7	7.3	0.1	8.5

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

	Exchangeable Cations m.e./100 gm					Base Saturation
	Ca	Mg	Na	K	Sum of Cations	%
1	6.90	1.55	0.20	0.14	8.79	89.7
2	6.40	1.10	0.26	0.36	8.12	92.3
3	10.7	0.15	1.15	0.18	12.18	70.4
4	11.9	0.25	1.25	0.14	13.54	88.5
5	7.0	0.0	0.96	0.10	7.86	92.5

Mvb: Lithosols, Volcanic Siliceomafic Materials, Strongly Dissected Mountainous Land

This subunit corresponds to the strongly dissected mountainous land or isolated mountain ranges on areas of siliceomafic materials derived from volcanic rocks. It is an association of excessively to somewhat excessively drained, coarse loamy, commonly gravelly, cobbly and stony Lithosols (more than 75 percent), with inclusions of Red-Yellow Podzolic soils, Reddish brown Lateritic soils and Rego-Lithosols. Areas of gullied land are scattered throughout and rocky land occupies many of the highest elevations.

The Lithosols have dark grayish brown, dark brown and pale brown, loamy to coarse loamy surface horizons with a moderate very fine and fine granular structure and slightly acid reaction. The substrata, below depths from 10 to 40 cm, are yellowish brown, dark brown, loamy to coarse loamy materials, structureless (massive) or with a fine granular structure. They are slightly acid in soil reaction. The Red-Yellow Podzolic and Reddish Brown Lateritic soils are similar to those described in subunit Mva.

The subunit Mvb has a dominant slope range from 35 to 65 percent. These soils are mostly under sparse forest cover, with only a minor percentage used for agriculture, mainly upland crops. These soils are in upland capability Classes VI to VIII. At the bottom slopes and in small valleys between the mountains they can be used as agricultural land. Contour strip cultivation and bench terracing are advisable for dry land farming to help control erosion.

Subunit: Mvb
Profile: Recon. Stop 167

This is a somewhat excessively drained fine loamy textured shallow Lithosol developed on residuum from porphyry.

It is located in a strongly dissected steep mountain area at a road side at Balon Jae, Naryong Ri, Umsan Myun, Puyeo Gun, Chungnam Do.

A1—0 to 10 cm; Brown to dark brown (7.5YR 4/2), clay loam; a moderate, fine and medium granular structure; friable, sticky and plastic; many, fine and medium plant roots; few unweathered subangular gravel derived from porphyry, many, fine and medium pores; clear, smooth boundary; pH 6.0.

Weak B—10 to 30 cm; Brown to dark brown (7.5YR 4/4), silty clay loam; a moderate, fine and medium granular structure; friable, sticky and plastic; many, medium and coarse plant roots; many, medium coarse and fine pores common unweathered subangular gravel, derived from porphyry; abrupt, wavy boundary; pH 6.0.

D—30 to 40+ cm; Hard rock.

Subunit: Mvb
Laboratory Data: Recon. Stop 167

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/(mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-656	A1	0-10	15.4	0.6	3.9	6.7	9.6	7.6	54.5	17.1	SiL
2	657	Weak B	10-30	0.9	0.6	2.6	6.2	9.9	8.2	52.8	19.7	SiL

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	pH H_2O (1:5)	O.M. %	2/ CEC m.e.
1	13.7	33.2	36.0	CL	5.8	3.7	9.8
2	11.2	38.4	30.7	CL	5.5	2.3	7.7

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

	Exchangeable Cations m.e./100 gm					Base Saturation %
	Ca	Mg	Na	K	Sum of Cations	
1	2.2	0.7	0.22	0.26	3.38	34.5
2	0.5	0.3	0.12	0.18	1.10	14.3

Raa: Clayey to Fine Loamy Red-Yellow Podzolic Soils, Undifferentiated Alluvial and Residual Materials, Gently Undulating Moderately Dissected Older Pediplanes and Terraces

This subunit is on undulating to rolling areas of the older pediplane system and correlated terraces underlaid by old alluvial pedimentary materials. In places the parent materials are partially or entirely weathered rock materials. Dissection is predominantly moderate. Relief is low. The topography is undulating to rolling, with relatively small more steeply sloping areas. Dominant slopes range from 5 to 15 percent. Major soils in this subunit are well to moderately well drained clayey Red-Yellow Podzolic soils. These soils occupy the smoothest slopes. Lithosols, mostly in weathered materials, occupy the steeper and more sharply convex parts of the landscape. Areas of Low-Humic Gley soils, Alluvial soils and Regosols are in the swales and narrow valleys. Erosion of the Red Yellow Podzolic soils has been moderate to severe. The colour of the present surface layer ranges from reddish brown or yellowish red in areas cultivated with upland crops, to grayish brown and usually mottled, in areas of paddy fields. Textures vary from loam to clay loam. The soil reaction is acid.

The subsoils, extending to depths of 1 m or more, are red or yellowish red clay, silty clay, silty clay loam or clay loam with a moderate to strong blocky structure, and usually continuous clay cutans. The soil reaction is acid. In many places there are buried soils similar to Planosols. The substrata are variable, chiefly deep, fine loamy or clayey old alluvial pedimentary materials. Gravel, cobbles and stones are common in the lower part and may appear throughout. In many places the substrata are weathered bedrock of various kinds rather than transported materials. The Alluvial and Low-Humic Gley soils are dominantly fine loamy to clayey, and are all in rice paddy fields.

This subunit is mostly in the southeastern region of the country. In other places it appears as scattered areas. Most of the land is under cultivation. Where water is available for irrigation, paddy rice in summer and barley in the winter are the principal crops. The areas which cannot be irrigated are used for the production of upland crops such as barley, wheat, bean, cabbage, sweet potato, and tobacco. Areas with a perennial cover support pines, acacia, poplars, shrubs and grasses. The soils of this subunit are chiefly in upland capability Classes II and III. About 10 percent is suitable only for perennial vegetation such as forest. Most areas have sufficient depth, nutrients, and water holding capacity, to be suitable for rice paddy if water is available for irrigation. An estimated 20 percent of the land belongs in paddy capability Classes II and III.

The soils of this mapping unit are considered to be among those most suitable for intensive agricultural development, in spite of low organic matter content and natural fertility. They have good drainage and give a high response to good management. Limestone, compost and complete fertilizer are beneficial. The use of soil conservation practices such as contour cultivation, terracing and protection of waterways, are necessary to control erosion and runoff. With good management, these soils can produce high yields of a wide variety of crops. Part of the area, now in forest, could be converted into cultivation by clearing and terracing.

Subunit: Raa
Profile: Recon. Stop 108

This is a well drained, fine to moderately fine textured, moderately eroded, Red-Yellow Podzolic soil developed in old alluvium derived from granitic rock, in rolling topography. It is used for upland cultivation of soybean, and has some perennial deciduous vegetation such as acacia, undifferentiated shrubs and grasses. The profile described is along a roadside in Songsan, Kochang, Keochang, Gyeongnam Do.

Ap—0 to 16 cm; Reddish brown (5YR 4/4); silty clay; moderate, fine and medium granular structure; friable, sticky and plastic; many, medium and fine plant roots; clear, wavy boundary.

B1—16 to 32 cm; Strong brown (7.5YR 5/6); silty clay; moderate, medium and fine subangular blocky structure; thin, discontinuous clay skins; firm, sticky and plastic; common, medium and coarse plant roots; abrupt, smooth boundary.

B21—32 to 80 cm; Brownish yellow (10YR 6/6) silty clay; strong medium and fine angular blocky structure; thick, continuous clay skins; firm, sticky and plastic; few, medium and coarse plant roots; clear, smooth boundary.

B22—80 to 115 cm; Mottled, brownish yellow (10YR 6/6); dark brown (7.5YR 4/2), very dark gray (10YR 3/1), crushed colour, yellowish brown (10YR 5/6); silty clay; strong, a coarse and medium angular blocky structure; thick, continuous clay skins; firm, sticky and plastic; common, medium black (10YR 2/1) Mn concretions; clear, smooth boundary.

B23—115 to 180 cm; Mottled, brownish yellow (10YR 6/6), brown (7.5YR 5/2), very dark gray to black (10YR 3/1 to 2/1), Mn concretion, crushed colour, yellowish brown (10YR 5/6); silty clay; strong, medium and fine angular blocky structure; very thick, continuous clay skins; firm, sticky and plastic; many, medium and coarse black (10YR 2/1) Mn concretion and clay flows; abrupt, smooth boundary.

B24—180 to 220 cm; Mottled brownish yellow (10YR 6/6), light grayish brown (10YR 6/2), light gray (10YR 7/1), crushed colour, brownish yellow (10YR 7/8) clay; strong, coarse prismatic structure; thick, continuous clay skins; light gray (10YR 7/1), light brownish gray (10YR 6/2); firm, sticky and plastic; clear wavy boundary.

B3—220 to 235 cm; Mottled yellowish brown (10YR 5/6), brown (7.5YR 5/4), light gray (2.5Y 7/2), black (10YR 2/1) Mn concretions; crushed colour, brownish yellow (10YR 6/6) clay loam; slightly sticky and plastic; friable; many, fine white and yellow mica; thick, accumulated clay flows (light gray (10YR 7/1), light brownish gray (10YR 6/2); abrupt, smooth boundary.

C--235+ cm; Mottled, brownish yellow (10YR 6/6), reddish yellow (2.5YR 6/8) crushed colour, brownish yellow (10YR 6/6); coarse sandy loam; friable, slightly sticky and plastic; many, strongly weathered white (10YR 8/1) gravels and cobbles derived from granite.

Subunit: Raa
Laboratory Data: Recon. Stop 108

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/(mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-420	Ap	0- 16	1.2	←	1.3	→	2.2	0.9	49.4	43.2	SiC
2	421	B1	16- 32	0.3	←	2.3	→	1.2	0.7	45.2	50.6	SiC
3	422	B21	32- 80	0.2	←	1.2	→	0.9	0.6	45.2	51.4	SiC
4	423	B22	80-115	0.4	1.0	2.0	2.3	2.5	1.3	40.9	40.0	SiC
5	424	B23	115-180	0.9	←	4.8	→	2.7	1.3	44.8	46.4	SiC
6	425	B24	180-220	0.1	←	6.8	→	4.9	2.1	36.4	49.8	C
7	426	B3	220-235	0.7	←	6.7	→	16.2	7.1	38.1	31.9	CL
8	427	C	235+	17.8	10.5	17.2	14.5	11.5	4.5	26.6	15.2	CoSL

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	pH H_2O (1:5)	O.M. %	2/ CEC m.e.	Base Saturation %
1	4.9	12.6	39.3	LiC	5.4	2.6	13.9	52.7
2	2.5	10.3	36.6	HC	5.7	1.4	13.8	45.2
3	1.4	10.7	36.5	HC	5.7	0.2	15.1	30.9
4	5.9	13.9	40.2	LiC	5.7	0.3	10.6	43.2
5	5.4	9.8	38.4	HC	6.0	0.1	12.7	46.5
6	2.8	14.2	28.2	HC	5.9	0.1	-	-
7	10.5	32.6	25.0	LiC	5.8	0.2	15.0	58.9
8	45.7	18.9	20.0	CL	1.0	6.4	2.75	71.3

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

	Exchangeable Cations m.e./100 gm				
	Ca	Mg	Na	K	Sum of Cations
1	4.70	1.8	0.03	0.8	7.33
2	4.15	1.45	0.06	0.58	6.24
3	0.85	3.5	0.11	0.21	4.67
4	1.05	3.25	0.13	0.15	4.58
5	2.15	3.45	0.16	0.15	5.91
6					
7	5.60	2.6	0.33	0.30	8.83
8	1.50	0.18	0.13	0.13	4.56

Rab: Clayey to Fine Loamy Red-Yellow Podzolic Soils and Lithosols, Siliceous Crystalline Materials, Undulating to Rolling Strongly Dissected Older Pediplane

This subunit is on rolling areas of the older pediplane system underlaid by residual materials. A thin mantle of old alluvial-pedimentary materials covers parts of the landscape. Dissection is predominantly strong. Relief is normal to subnormal. Topography is predominantly rolling, with some more steeply sloping areas. Dominant slopes range from 15 to 25 percent, sometimes up to 30 percent. Major soils are well drained, clayey and fine loamy, Red-Yellow Podzolic soils (more than 55 percent of total area). Some Lithosols, mostly in weathered materials, are on the steeper and more sharply convex slopes of the landscape (less than 35 percent of total area). Areas of Alluvial soils, Low-Humic Gley soils, and Regosols occupy the swales and narrow valleys (10 percent of total area). These are predominantly moderately well to imperfectly drained, clayey and fine loamy soils.

Surface colours of Red-Yellow Podzolic soils range from dark brown to dark yellowish brown; in the cultivated areas from yellowish brown to yellowish red. Their subsoils, extending to a depth of about 80 cm, are yellowish brown to yellowish red clay loam, silty clay loam or clay with a moderate subangular blocky structure and usually continuous clay cutans. The soil reaction is acid. Substrata are strongly weathered siliceous crystalline rocks. In the western regions of Korea, in schistose rocks, these soils appear more developed, less eroded and redder. Alluvial and Low-Humic Gley soils are dominantly fine loamy and clayey and are used for rice paddy.

Part of the land is under cultivation, used for the production of upland crops, such as barley, wheat, beans, potato, tobacco, and orchard. Areas under perennial cover support pine trees, acacia, and poplar, in association with shrubs and grasses. The soils of this subunit are chiefly in upland capability Classes III and IV. About 40 percent is suitable only for forest, with an estimated 15 percent in paddy capability Class III. Part of the present forest land could be converted to agriculture by adequate management including bench terracing, as the soils are relatively suitable for intensive agricultural development.

Subunit: Rab
Profile: Recon. Stop 8

This is a well drained, fine textured moderately eroded Red-Yellow Podzolic soil developed in residual material derived from granite, on rolling topography. This area is in pine trees. The profile described is in Doducg, Samdo, Kwangsan, Jeonnam Do.

A1-1--0 to 3 cm; Dark brown (10YR 4/3) silt loam; moderate, fine and medium granular structure; friable, slightly sticky and slightly plastic; many, fine roots; abrupt, smooth boundary.

A1-2--3 to 12 cm; Reddish yellow (7.5YR 6/6) loam; moderate, fine and medium granular structure; friable; slightly sticky and slightly plastic; common, fine roots; abrupt, smooth boundary.

B1--12 to 22 cm; Yellowish red (5YR 5/6) clay loam; weak, fine and medium subangular blocky structure; thin, discontinuous clay skins; firm, sticky and plastic; few, fine white and yellow mica; clear, wavy boundary.

B2--22 to 35 cm; Red (2.5YR 5/6) clay; moderate, medium and fine subangular blocky structure; thin, continuous clay skins; firm, sticky and plastic; few, fine, white and yellow mica; clear, wavy boundary.

B3--35 to 65 cm; Red (2.5YR 5/6) and yellow (10YR 5/6) crushed colour, yellowish red (5YR 5/8), clay loam; moderate, medium and fine subangular blocky structure; thin, continuous clay skins; firm, sticky and plastic; common, fine white and yellow mica; clear, wavy boundary.

C--65+ cm; Reddish yellow (5YR 6/8) loam; structureless.

Subunit: Rab
Laboratory Data: Recon. Stop 8

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture							
					VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.005	Clay <.002	Textural Class
1	S- 6	A1-1	0- 3	9.75	8.3	11.2	9.6	8.4	5.3	49.3	7.9	SL
2	7	A1-2	3-12	11.75	9.3	13.6	11.8	9.5	4.6	36.9	14.3	L
3	8	B1	12-22	8.21	5.3	8.1	7.8	6.9	3.6	38.7	29.6	CL
4	9	B2	22-35	4.26	3.2	6.0	6.7	6.7	3.5	41.9	32.0	CL
5	10	B3	35-65	2.28	3.5	6.0	6.9	7.5	4.0	39.7	32.4	CL
6	11	C	65+	2.17	2.8	6.7	8.4	9.5	5.0	44.9	22.7	L

1/ Pipette Method, Sodium Hexameta Phosphate.

	International				S.C.	Moisture Retention		Atterberg Limits	
	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class		1/3 atm.	15 atm.	WL	WP
1	31.1	30.2	30.8	L	2.67	23.23	8.49	32.7	23.3
2	37.3	25.9	22.5	L	2.72	19.39	9.08	35.4	24.5
3	23.2	19.2	28.0	LiC	2.73	28.68	16.20	53.4	28.1
4	17.7	22.8	27.5	LiC	2.73	33.74	19.16	59.2	29.8
5	18.2	18.4	31.0	LiC	2.74	34.58	19.25	56.4	30.7
6	20.6	21.2	35.5	CL	2.73	33.95	16.23	49.2	28.1

	pH	Clay and Clay Minerals				CN		Exchangeable Cations m.e./100 gm			
	H_2O (1:5)	SiO_2 R_2O_2	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	C %	N %	Ca %	Mg %	Na %	K %
1	5.6	2.03	50.46	10.29	35.43	1.34	0.082	0.24	1.16	0.28	0.26
2	5.3	1.99	50.24	10.28	36.28	-	-	0.68	0.72	0.30	0.16
3	5.1	1.98	50.67	10.75	36.50	-	-	0.8	0.28	0.28	0.14
4	5.0	1.89	49.75	11.75	37.18	-	-	0.48	0.32	0.36	0.14
5	5.1	1.83	49.11	12.12	37.74	-	-	0.48	0.72	0.50	0.14
6	5.2	-	-	-	-	-	-	0.48	0.64	0.34	0.14

Rac: Clayey to Fine Loamy, Red-Yellow Podzolic Soils, Siliceous Crystalline Materials, Rolling Dissected Pediment Slopes

This subunit occupies the older, sloping pediments and debris at the mountain foot slopes covered by outwash pedimentary materials derived from siliceous crystalline rocks. It is an association predominantly of well drained, clayey to fine loamy Red-Yellow Podzolic soils. These soils are on the smoother, simple slopes. Some Regosols occupy the more elevated slopes near the mountain foot. A complex of Alluvial and some Low-Humic Gley soils (less than 15 percent) occupies the swales and small drainage ways within the dissected pediments. These are predominantly moderately well to imperfectly drained, clayey to fine loamy soils. Erosion on the major soils of this subunit has been mainly moderate.

Surface layers are brown to very dark grayish brown loam to clay loam. Subsoils are yellowish brown to red or strong brown, clay loam to silty clay loam, with a moderate subangular blocky structure and continuous clay cutans. The soil reaction is acid. Gravel and cobbles derived from siliceous crystalline rocks are common in

the substrata. There are some soils included which might be described as Regosol, Red-Yellow Podzolic intergrades between other great soil groups mentioned.

Cultivation is general with upland crops, such as barley, bean, potato, tobacco and fruit trees. A small part where water is available is used as rice paddy. Areas under natural cover support pines. The soils of this subunit are chiefly in upland capability Classes III and IV, with some Class VI. About 20 percent of the subunit is suitable only for perennial vegetation. Less than 15 percent of the land is in paddy capability Classes III and IV. With proper management moderate yields should be obtained on these soils from a wide variety of crops.

Subunit: Rac
Profile: Recon. Stop 216

This a well drained, fine loamy, well developed Red-Yellow Podzolic soil, on pedimentary material, overlying granite and schist (near the geologic contact). It is on gently sloping relief, at the middle of a pediment, and is now in soybean, corn and natural vegetation of pine trees and grasses, in Shinpuk Myeon, Chungun Ri, Chunseong Gun, Gangweon Do.

Ap—0 to 6 cm; Dark yellowish brown (10YR 4/4), silt loam; weak, fine and medium granular structure; friable, sticky and plastic; common, fine pores; many, fine grass roots; clear, smooth boundary; pH 4.8.

B21—17 to 38 cm; Yellowish red (5YR 5/8), silty clay loam; moderate, medium and fine subangular blocky structure; slightly firm, sticky and plastic; thin, discontinuous cutans; few, fine roots; clear, smooth boundary; pH 4.3.

B22—38 to 75 cm; Yellowish red (5YR 4/8); common, medium soft black Mn (7.5YR 2/1) concretions; silty clay loam; strong medium and fine angular blocky structure; thin, continuous cutans; friable, sticky and plastic; few, fine pores; few, fine roots; clear, wavy boundary; pH 4.3.

B-C—75 to 102 cm; Mottled, strong brown (7.5YR 5/8), brown (7.5YR 5/2), light brownish gray (10YR 6/2); crushed colour, strong brown (7.5YR 5/6) clay loam; moderately thin clay flows; firm, sticky and plastic; no pores; Mn as above; no roots; abrupt, wavy boundary; pH 4.5.

C—102+ cm; Brown or dark brown (7.5YR 4/4); very gravelly very cobbly clay loam; structureless; no roots; no pores; pH 4.5.

Subunit: Rac
Laboratory Data: Recon. Stop 216

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-866	Ap	0-6	4.3	1.2	3.0	4.6	5.8	3.7	50.7	31.0	SiCL
2	867	Ba	6-17	7.4	1.1	2.4	3.7	4.7	3.0	47.7	37.4	SiCL
3	868	B21	17-38	3.4	0.7	1.4	2.3	3.9	3.3	43.3	45.1	SiC
4	869	B22	38-75	1.2	0.5	1.5	2.6	4.0	3.4	44.0	44.0	SiC
5	870	BC	75-102	5.5	1.0	3.6	5.7	6.9	4.2	42.0	36.6	CL

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	pH H_2O (1:5)	O.M. %	2/ CEC m.e.	Base Saturation %
1	10.0	18.9	40.1	LiC	5.7	0.7	12.9	56.3
2	8.2	11.3	43.1	LiC	5.4	2.0	9.2	15.9
3	5.2	15.3	34.4	HC	5.6	1.2	10.6	11.5
4	5.4	13.5	37.1	LiC	5.9	0.6	11.4	20.9
5	5.4	13.5	37.1	LiC	5.6	0.5	11.0	40.5

	Exchangeable Cations m.e./100 gm Ca	Mg	Na	K	Sum of Cations	Available P_2O_5
1	4.0	1.7	0.42	1.14	7.26	28
2	0.9	0.3	0.08	0.18	1.46	16
3	0.7	0.2	0.14	0.18	1.22	12
4	0.4	1.6	0.12	0.26	2.38	
5	0.5	3.3	0.42	0.24	4.46	

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

Rad: Cobbly and Gravelly Loamy Rego-Lithosols and Red-Yellow Podzolic Soils, Siliceous Crystalline Materials, Older Rolling Dissected Pediment Slopes

This subunit is at the foot of mountains on sloping colluvium or debris derived from siliceous crystalline rocks. Rego-Lithosols predominate, with some Red-Yellow Podzolic soils. Included is a network of small valleys with Alluvial soils and some Low-Humic Gley soils. The Rego-Lithosols have very dark brown to brown loam to sandy loam surface layers over yellowish red to brown, gravelly to cobbly coarse loamy to sandy, substrata. The soil reaction is acid. In high altitudes in tracts within the mountains there are important inclusions of dark coloured soils similar to Acid Brown Forest soils (cumulic phase). These are fine loamy. In Gyeongsangbug Do, the soils of this subunit contain more gravel and cobbles than in areas farther south. Almost all of this land is used for paddy fields, usually with paddy rice in the summer and barley in the winter. Upland crops are cultivated on some colluvial slopes. The soils of this subunit are chiefly in paddy land capability Classes II and III, and upland capability Classes II and III. These soils are considered to be suitable for intensive agricultural development.

Subunit: Rad
Profile: Recon. Stop 101

This is a well drained, coarse loamy to fine loamy Rego-Lithosol on colluvial-debris materials derived from granitic rock on sloping topography. The area is now in natural vegetation. The profile described is in the middle part of a mountain foot slope, in Sinhyeon-Ri, Geonam Myeon, Jangsu Gun, Jeonlabug Do.

A--0.35 cm; Very dark grayish brown (10YR 3/2), gravelly loam; moderate, fine and very fine granular structure; friable, slightly sticky and plastic; many, fine and medium plant roots; abrupt, wavy boundary.

C1--35 to 43 cm; Dark yellowish brown (10YR 4/4), gravelly loam; moderate, fine and very fine granular structure; friable, slightly sticky and slightly plastic; many, fine and medium plant roots; abrupt, wavy boundary.

C2--43 to 55 cm; Yellowish brown (10YR 5/8), gravelly coarse sandy loam; moderate, fine and medium granular structure; friable, slightly sticky and slightly plastic; common, fine and medium plant roots; abrupt, wavy boundary.

C3--55 to 85 cm; Yellowish brown (10YR 5/6), very gravelly coarse sandy loam; structureless; friable, nonsticky and nonplastic; few, fine roots; many slightly weathered angular pieces of gravel derived from granite; gradual, wavy boundary.

C4--85 to 100 cm; Yellowish brown (10YR 5/6), very gravelly and cobbly coarse sandy loam; structureless; friable, nonsticky and nonplastic; many slightly weathered gravel pieces and cobbles and few stones derived from granite; abrupt, smooth boundary.

II Weak B (textural)--100 to 120 cm; Yellowish brown (10YR 5/4) to dark yellowish brown (10YR 4/4) coarse sandy loam; structureless; firm, sticky and plastic; common, fine and medium quartz; abrupt, smooth boundary.

IIC--120+ cm; Slightly weathered materials.

Subunit: Rad
Laboratory Data: Recon. Stop 101

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-400	A	0- 35	23.1	12.9	12.2	9.9	9.4	3.8	32.2	19.6	L
2	401	C1	35- 43	25.0	11.9	12.2	11.3	11.1	4.5	33.8	15.0	L
3	402	C2	43- 55	29.8	11.9	14.2	11.7	12.7	5.4	29.1	14.0	CoSL
4	403	C3	55- 85	38.3	15.9	16.4	14.5	13.1	5.1	26.3	8.7	CoSL
5	404	C4	85-100	51.6	19.6	21.8	16.6	12.2	5.1	17.2	7.5	CoSL
6	405	IIB	100-120	5.9	7.2	7.2	6.8	8.6	4.5	41.8	23.7	CoSL

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	pH H_2O (1:5)	O.M. %	2/ CEC m.e.	Base Saturation %
1	37.9	18.8	23.7	Cl	5.7	3.9	8.2	16.6
2	38.5	21.1	25.4	L	5.6	2.3	6.0	19.2
3	42.2	25.3	18.5	SL	5.8	1.2	4.7	21.7
4	50.6	20.8	19.9	CoSL	5.9	0.8	2.9	26.8
5	61.9	19.3	11.3	CoSL	6.0	0.2	1.7	50.6
6	23.5	22.2	30.4	CL	6.4	0.2	9.6	59.3

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

	Exchangeable Cations m.e./100 gm				
	Ca	Mg	Na	K	Sum of Cations
1	0.2	0.4	0.28	0.48	1.36
2	0.2	0.45	0.05	0.45	1.15
3	0.2	0.35	0.04	0.43	1.02
4	0.25	0.05	0.05	0.43	0.78
5	0.2	0.2	0.06	0.40	0.86
6	4.5	0.9	0.11	0.18	5.69

Rea: Coarse Loamy Sandy and Fine Loamy Lithosols, Severely Eroded, Siliceous Crystalline Materials, Strongly Dissected Undulating to Rolling Pediplane

This subunit is on rolling severely eroded and gullied areas of the older pediplane system. It is an association predominantly of excessively drained, coarse loamy Lithosols, mostly over strongly weathered, mainly granitic rocks. These soils occupy more than 80 percent of the total area. Smaller areas of Red-Yellow Podzolic soils are included (about 10 - 15 percent) as well as minor areas of Regosols on smooth lower slopes, and valleys too narrow to map (5 - 10 percent). Lithosols, the most extensive soils in the unit, are over weathered granite, gneiss and various kinds of crystalline schist. They occupy the middle and higher slopes. The erosion of these soils has been strong to severe, sometimes extreme. Surface layers are yellowish brown, sandy or loamy soils, commonly overlying yellowish brown or brown to pale brown substrata of the same texture, showing the original rock structure.

Most of the land is in forest with a sparse cover of pine trees, acacias, poplars, shrubs, and grasses. Some bare land occurs. Scattered areas are being used for agriculture with upland crops.

The soils of this subunit are chiefly in upland capability Classes VI and VII. An estimated 5 percent of the land is in capability Classes III and IV. The use of soil conservation practices should be followed carefullly in areas under cultivation, to control erosion. Adequate amounts of fertilizer and lime must be used. A very minor percentage of the present land which is under natural vegetation could be converted to agricultural use.

Subunit: Rea
Profile: Recon. Stop 55

This is a well drained, moderately coarse to coarse textured Lithosol derived from strongly weathered granite in rolling topography, in pine trees. The profile described is at a road cut, in the lower part of rolling elevation, Yulcheon, Sayul Ri, Deoghwa Myeon, Namweon, Jeonbug Do.

Ap---0 to 11 cm; Light yellowish brown to yellowish brown (10YR 5/4) coarse sandy loam; structureless; very friable, nonsticky and nonplastic; many, medium and fine living plant roots; clear, smooth boundary.

C1---11 to 53 cm; Pale brown to yellow (10YR 7/5); coarse sandy loam; structureless; this layer includes thin brownish yellow (10YR 6/6) and pale brown (10YR 6/3) finer textured layers; very friable, nonsticky and nonplastic; common, very fine and fine yellow mica; many, fine and medium living plant roots; gradual, smooth boundary.

C2---53 to 75 cm; Ditto; no plant roots.

C3---75 to 103 cm; Light yellowish brown (10YR 6/4); coarse sandy loam; structureless; very friable, nonsticky and nonplastic; no plant roots; common, very fine and fine yellow mica; clear, smooth boundary.

C4---103 to 111 cm; Strong brown (7.5YR 5/6); sandy loam; weak, medium and fine subangular blocky structure; friable, slightly sticky, and slightly plastic; clear, wavy boundary.

C5 or D---111 to 150+ cm; Very pale brown (10YR 7/4) loamy coarse sand; structureless; very friable, nonsticky and nonplastic; many, fine biotite flakes; strongly weathered granite saprolite.

Subunit: Rea
Laboratory Data: Recon. Stop 55

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture							
					VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-177	Ap	0- 11	1.3	9.6	19.4	18.3	18.2	8.2	16.7	9.6	CoSL
2	178	C1	11- 53	8.3	6.9	22.9	20.7	18.1	8.5	14.7	8.2	CoSL
3	179	C2	53- 75	7.9	7.3	21.5	20.9	20.3	8.7	14.3	7.0	LCoS
4	180	C3	75-103	11.5	8.7	20.2	16.6	16.1	9.2	18.1	11.1	CoSL
5	181	C4	103-111	7.3	6.2	15.5	12.8	11.8	5.7	28.5	19.5	SL
6	182	C5 or D	111-150+	9.3	6.9	22.2	20.3	19.3	9.7	18.6	3.0	LCoS

1/ Pipette Method, Sodium Hexameta Phosphate.

	International				pH		1/	Base
	CS 2-1	FS .2-.02	Silt .02-.002	Textural Class	H_2O (1:5)	O.M. %	CEC m.e.	Saturation %
1	51.6	29.4	9.4	CoSL	5.7	1.1	4.8	59.4
2	55.5	27.9	8.4	CoSL	5.8	0.3	2.8	34.4
3	55.4	29.3	8.3	CoSL	5.7	0.3	4.5	21.3
4	49.2	29.2	10.5	CoSL	5.8	0.2	3.3	25.1
5	37.3	22.5	20.7	CL	5.8	0.2	1.9	46.3
6	55.0	32.2	9.8	CoSL	6.0	0.1	2.3	24.3

	Exchangeable Cations m.e./100 gm				
	Ca	Mg	Na	K	Sum of Cations
1	0.95	0.20	0.95	0.15	2.85
2	0.70	0.05	0.08	0.03	0.86
3	0.50	0.35	0.09	0.02	0.96
4	0.60	0.15	0.06	0.02	0.83
5	0.45	0.30	0.10	0.03	0.88
6	0.40	-	0.11	0.05	0.56

1/ Ammonium Acetate Method.

R1a: Fine Loamy to Clayey Red-Yellow Podzolic Soils and Lithosols, Limestone Materials, Strongly Dissected Undulating to Rolling Pediments

This subunit occupies undulating to rolling areas of the older pediplane system underlain by residuum. It is an association of Red-Yellow Podzolic soils, Reddish Brown Lateritic soils and Lithosols with an interfingering network of Low-Humic Gley and Alluvail soils. Red-Yellow Podzolic and Reddish Brown Lateritic soils are developed mostly in residuum and are in clayey families.

These soils are dominantly silty clay loam to clay with a granular structure. Surface colours range from yellowish red to dark reddish brown. The subsoils are moderately deep to very deep, yellowish red, red or dark red clayey materials with a strong to moderate angular blocky structure and continuous clay cutans. Substrata

are slightly weathered limestone materials or hard metamorphic limestone with clay accumulation along the cracks, or with part of the subsoil horizon inserted between the rock joints. Other most important soils in this mapping unit are Lithosols, in the fine loamy family. They occupy middle and higher elevations in rolling topography. They usually have yellowish brown fine loamy surface layers over light yellowish brown to pale brown fine loamy substrata, with slightly moderately weathered gravel and cobbles in many places. Also included in this subunit are small scattered areas of Acid Brown Forest soils at high altitudes. Most areas of this subunit are covered by natural vegetation such as pines, oaks, poplars, shrubs and grasses. Under cultivation, these areas are used for upland crops such as, barley, potato, corn and beans. Almost all of these soils are in upland capability Classes IV to VII and are not suitable for paddy. About 60 percent is suitable only for perennial vegetation, such as forest. When cultivated, management should include contour strips, bench terracing, and protection of the water ways to help control erosion and runoff.

Subunit: Rla
Profile: Recon. Stop 128

This is a well drained, fine textured slightly to moderately eroded, Red-Yellow Podzolic soil developed in residuum derived from limestone rock in undulating to sloping topography. Present land use is upland crops and forest (grass). The profile described is at Gugog, Jeumcheon Myeon, Mungyeong Gun, Gyeongbug Do (Stop 128).

Ap--0 to 18 cm; Yellowish red (5YR 4/6) friable silty clay loam; moderately fine and medium granular structure and moderate fine angular blocky structure; sticky and plastic; few, very fine mica; many, fine pores; many, fine grass roots; clear, smooth boundary; pH 8.0.

B1--18 to 27 cm; Yellowish red to red (5YR 4/6 to 2.5YR 4/6), slightly firm, silty clay; moderate, fine and medium angular blocky structure with thin, continuous clay cutans; some fine and very fine granular structure; sticky and plastic; few, very fine mica; common, fine pores; clear, smooth boundary; pH 5.5.

B21--27 to 60 cm; Red to yellowish red (2.5YR 4/6 to 5YR 4/6) slightly firm clay; strong medium to coarse angular blocky structure with moderately thick, continuous clay cutans; breaking to a strong fine and medium angular blocky structure with moderately thick, continuous clay cutans; very sticky and very plastic; few, fine pores; some medium and coarse pores; common, fine grass roots; few, very fine mica; few, fine Mn concretions; clear, wavy boundary; pH 5.5.

B22--60 to 145 cm; Colour as above; firm clay; strong coarse angular blocky structure with thick continuous clay cutans; breaking to strong, medium and fine angular blocky structure with thick, continuous clay cutans; very sticky and very plastic; few, fine pores; common, medium and coarse Mn mottles; few, fine grass roots; clear, smooth boundary; pH 6.0.

Subunit: Rla
Stop: Recon. 128

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-494	Ap	0- 18	1.1	←	3.4	→	6.6	8.3	48.1	33.6	SiCL
2	495	B1	18- 27	0.5	←	2.5	→	5.0	7.6	44.8	40.3	SiC
3	496	B21	27- 60	0.2	←	2.0	→	3.8	5.6	36.6	52.0	C
4	497	B22	60-145	0.01	←	2.2	→	3.5	6.2	28.5	59.6	C
5	498	B23	145-200	0.01	←	2.3	→	3.9	3.7	15.9	74.0	C

	International CS 2-.2	FS 2-.02	Silt .02-.002	Textural Class	Clay and Clay Minerals SiO_2 / R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	K_2O %	H_2O-	H_2O+
1	4.3	32.2	29.9	LiC	(2.51)	44.83	11.87	30.33	2.32	4.77	10.02
2	2.9	28.6	28.2	LiC	2.01						
3	2.5	21.0	24.5	HC	(2.41)	44.13	12.16	31.13	2.40	5.47	10.22
4	2.7	21.7	16.1	HC	2.93						
5	3.1	12.3	10.6	HC	(2.66) 2.28	47.20	11.17	28.07		5.37	9.03

1/ Pipette Method, Sodium Hexameta Phosphate.

	pH H_2O (1:5)	O.M. %	1/ CEC m.e.	Exchangeable Cations m.e./100 gm					Base Saturation %
				Ca	Mg	Na	K	Sum of Cations	
1	7.0	1.3	9.7	7.3	1.7	0.03	0.33	9.4	96.9
2	5.9		10.5	4.7	2.0	0.05	0.15	6.9	65.7
3	5.8		12.0	3.3	3.2	0.05	0.15	6.7	55.8
4	5.8		13.7	4.8	4.2	0.08	0.28	9.4	68.6
5	6.0		15.1	5.3	4.6	0.05	0.25	10.2	67.5

1/ Ammonium Acetate Method.

R1b: Clayey to Fine Loamy Reddish Brown Lateritic Red-Yellow Podzolic Soils and Rego-Lithosols, Limestone, Rolling Dissected Pediment Slopes

This subunit occupies the older sloping pediments and debris at the mountain foot. It is an association predominantly of Reddish Brown Lateritic soils and Red-Yellow Podzolic soils with some Rego-Lithosols. Reddish Brown Lateritic and Red-Yellow Podzolic soils are similar to those of R1a subunit. Rego-Lithosols are on moderately dissected areas of sloping colluvium or debris where the fine loamy soils are moderately shallow over gravel and cobbles. Erosion has been moderate. Surface layers are brown to dark brown loam or clay loam. Substrata are brown to dark yellowish brown gravelly to cobbly loamy materials. Very small areas at higher altitudes are occupied by Acid Brown Forest soils. Most of the land is in upland crops such as barley, soybean, potato, millet, corn and fruit. Almost all of the soils are chiefly in upland capability Classes III and IV. The more sloping areas are in Class VI. Less than 15 percent of the land is used for paddy rice. Parts, at present under natural vegetation, could be converted to cropland. Soil conservation practices such as contour strip cultivation, terracing, and the protection of water ways are necessary to help control runoff and erosion.

Subunit: R1b
Profile: Recon. Stop 202

This is a well drained, fine textured, slightly eroded, Red-Yellow Podzolic soil in colluvium derived from limestone.

The profile described is 100 m south from the road, Suggyeo, Jeongseon Myeon, Jeongseon Gun, Gangweon Do.

A--0 to 10 cm; Yellowish brown (10YR 5/4), friable silty clay loam; moderate, fine and medium granular structure; many, fine roots; sticky and plastic; clear, smooth boundary.

B1--10 to 30 cm; Strong brown (7.5YR 5/6), silty clay; weak, medium subangular blocky structure; many, fine pores; very sticky and very plastic; friable; gradual, smooth boundary.

B21--30 to 51 cm; Yellowish red (5YR 5/8), silty clay; moderate, fine and medium angular blocky structure with thin, discontinuous clay skins; slightly firm, very sticky and very plastic; common, fine pores; many, medium gravels and cobbles; clear, wavy boundary.

B22--51 to 65 cm; Yellowish red (5YR 5/6 - 4/6), silty clay; moderate, fine and medium angular blocky structure with thin, discontinuous clay skins; firm, very sticky and very plastic; common, fine pores; many, medium gravels and cobbles; clear, wavy boundary.

B23--65 to 117 cm; Mottled yellowish red (5YR 4/6), dark red (2.5YR 3/6), yellowish red (5YR 5/8), crushed colour yellowish red (5YR 4/6), silty clay; strong medium and fine angular blocky structure with thick, continuous clay films (dark red (2.5YR 3/6)) common, fine and medium cobbles and stones (semiangular); few, fine pores; few, fine roots; abrupt, wavy boundary.

B3--117 to 142 cm; Mottled, yellowish red (7.5YR 7/8), yellowish red (5YR 5/8), crushed colour yellowish red (5YR 5/6), firm, sandy clay loam; moderate, medium and coarse platy structure with thick, discontinuous clay skins ; yellowish red (5YR 4/6); sticky and plastic; few, fine roots.

Subunit: R1b
Laboratory Data: Recon. Stop 202

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-826	A	0- 10	13.9	1.8	2.9	3.8	4.5	2.8	56.0	28.2	SiCL
2	827	B1	10- 30	16.2	2.1	3.3	3.4	3.4	2.2	55.5	30.1	SiCL
3	828	B21	30- 51	17.3	1.9	2.6	3.6	6.1	2.8	48.8	34.2	SiCL
4	829	B22	51- 65	18.9	3.0	5.5	8.1	9.0	6.1	28.1	40.4	C
5	830	B23	65-117	17.5	3.4	3.8	6.3	8.8	7.5	24.2	47.0	C
6	831	B3	117-142	0.0	0.2	1.4	7.7	18.7	10.3	24.5	37.2	CL

1/ Pipette Method, Sodium Hexameta Phosphate.

	International				pH		1/
	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	H_2O (1:5)	O.M. %	CEC m.e.
1	9.5	15.8	46.5	SiC	5.5	2.3	9.8
2	9.6	15.4	44.9	LiC	5.4	2.0	7.9
3	10.8	13.6	41.4	LiC	5.3	0.7	7.1
4	18.6	18.0	23.0	LiC	5.4	0.6	8.5
5	14.7	19.4	18.9	HC	5.6	0.4	11.9
6	14.2	30.3	18.3	LiC	5.5	0.4	10.0

	Exchangeable Cations m.e./100 gm				Base Saturation %	Available
	Ca	Mg	Na	K		P_2O_5
1	1.4	1.4	0.08	0.24	31.8	21
2	0.4	0.4	0.10	0.10	12.7	18
3	0.1	0.3	0.06	0.08	7.6	15
4	0.0	0.5	0.08	0.06	7.5	-
5	0.0	0.6	0.10	0.10	6.7	-
6	0.1	0.5	0.10	0.08	7.8	-

1/ Ammonium Acetate Method.

Rsa: Fine Loamy to Clayey Lithosols and Red-Yellow Podzolic Soils, Sedimentary Materials, Undulating to Rolling Strongly Dissected Older Pediplanes

This subunit is on rolling areas of the older pediplane system underlaid by sedimentary materials. It is made up predominantly of Lithosols and Red-Yellow Podzolic soils with an interfingering network of Low-Humic Gley soils, Alluvial soils and Regosols. The surface horizons, where not eroded, are grayish brown and brown or dark brown, usually silty and in many places gravelly loam and clay loam. In the Red-Yellow Podzolic soils, the subsoils are yellowish brown, strong brown or yellowish red, silty clay loam or silty clay with a moderate subangular blocky structure and usually continuous clay cutans. The substrata are slightly to moderately weathered clayey to loamy shales, silt stones and sandstones. The Lithosols differ from the Red-Yellow Podzolic soils in lacking developed subsoils. In areas dominated by sandstones, as in the vicinity of Nagdong Myeon, the texture is coarser. In Changryeong Gun Lithosols occupy more than 90 percent of the rolling relief areas.

The natural vegetation is dominated by shrubs and grasses but scattered pines, acacia and poplars occur. The areas under cultivation are used for upland crops such as, barley, wheat, soybeans, cabbage, sweet potato and tobacco. The soils of this subunit are in upland capability Classes III to VII, and cannot be considered for paddy. More than 80 percent of the unit is in Classes VI and VII and should be used only for perennial vegetation such as forest and grasses. Less than 20 percent is in Classes III and IV and suitable for cultivation. Special management, including contour strips, bench terracing and the protection of water ways is required to help control erosion and runoff when this land is cultivated.

Subunit: Rsa
Profile: Recon. Stop 81

This is a well drained, fine textured, slightly eroded Red-Yellow Podzolic soil developed in thin old alluvium over residual material from shales interbedded by sandstones. It occupies rolling topography and is used for upland crops. The profile described is in Dongsan, Jeonbug, Weolseong, Gyeongbug Do.

Ap-(B1)--0 to 14 cm; Yellowish brown (10YR 5/4); silty clay loam; weak, coarse subangular blocky structure breaking to moderate, fine and medium granular; common, fine and medium pores; thin, discontinuous cutans; firm, sticky and plastic; many, fine and medium roots.

B21--14 to 30 cm; Strong brown (7.5YR 5/6), silty clay loam; strong, medium and coarse subangular blocky structure; common, fine and medium pores; firm, sticky and plastic; contains extremely weathered gravel and cobbles derived from tertiary rocks; few, fine living roots; clear, smooth boundary.

B22--30 to 50 cm; Mottled, strong brown (7.5YR 5/8), light gray (2.5Y 7/2), crushed colour, yellowish brown (10YR 5/6), silty clay; strong, medium and coarse subangular blocky structure; thick, continuous cutans; firm, sticky and plastic; few, extremely weathered gravels and cobbles derived from tertiary rocks; few, fine living roots; clear, smooth boundary.

B3--50 to 70 cm; Mottled, dark brown (7.5YR 4/4), brownish yellow (10YR 6/8), light gray (2.5Y 7/2), crushed colour, yellowish brown (10YR 5/8) clay; moderate, coarse and medium subangular blocky structure; thick, discontinuous clay accumulations, firm, sticky and plastic; common, extremely weathered gravel and cobbles; clear, smooth boundary.

C1--70 to 120 cm; Mottled, light gray (5Y 7/1), brownish yellow (10YR 6/8), crushed colour, pale yellow (5Y 7/3) clay loam; moderate, coarse and medium subangular blocky structure; thick, discontinuous clay accumulations; black (7.5YR 2/0) Mn concretion; sticky and plastic; many extremely weathered gravels and cobbles; abrupt, smooth boundary.

C2--120+ cm; As above; very thin, discontinuous clay skins on the surface of many, moderately and slightly weathered gravel and cobbles derived from tertiary rocks.

Subunit: Rsa
Laboratory Data: Recon. Stop 81

					Particle Size Distribution 1/ (mm) Percent							
	Lab. No.	Horizon	Depth cm	Gravel >2 mm	US Department of Agriculture							
					VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-299	Ap	0- 14	1.6	1.1	3.4	4.3	5.3	2.3	54.6	29.0	SiCL
2	300	B21	14- 30	0.7	←6.2	———	→	6.1	3.5	48.0	36.2	SiCL
3	301	B22	30- 50	1.3	←3.2	→	4.8	6.7	3.3	42.0	40.0	SiC
4	302	B3	50- 70	3.7	2.3	4.5	5.3	0.4	3.5	36.0	42.0	C
5	303	C1	70-120	5.4	2.7	4.9	7.9	10.5	5.2	36.3	32.5	CL

	International				pH		2/		Base Saturation
	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	H_2O (1:5)	O.M. %	CEC m.e. %	Sum of Cations	%
1	10.0	22.9	38.1	LiC	5.9	1.6	10.5	7.72	73.5
2	7.4	21.4	35.0	LiC	5.4	0.5	8.5	5.80	68.2
3	9.6	19.6	30.8	LiC	5.3	0.5	9.7	6.05	62.4
4	13.4	19.5	25.1	LiC	5.5	0.5	10.1	7.18	71.1
5	18.1	26.2	23.2	LiC	5.7	0.3	9.6	7.95	82.8

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

	Exchangeable Cations m.e./100 gm			
	Ca	Mg	Na	K
1	5.85	1.40	0.14	0.33
2	4.0	1.50	0.16	0.14
3	3.85	1.90	0.20	0.10
4	4.55	2.15	0.34	0.14
5	5.15	2.35	0.31	0.14

Rsb: Clayey to Fine Loamy Red-Yellow Podzolic Soils, Sedimentary Rocks, Older Rolling Dissected Pediment Slopes

This subunit occupies the older sloping pediments on the mountain foot slopes covered by outwash pedimentary materials derived from sedimentary rocks. It is an association predominantly of well drained, clayey to fine loamy Red-Yellow Podzolic soils with some Regosols. Most of the land is under cultivation with upland crops such as barley, soybeans, sweet potato, tobacco and fruit. A small part where water is available is used as rice paddy. The soils of this subunit are chiefly in upland capability Classes III to IV. Soil conservation practices such as contour cultivation, terracing and the protection of water ways, are necessary to help control erosion and runoff. A small part of the land which is now in natural vegetation could be converted to cropland by bench terracing.

Subunit: Rsb
Profile: Recon. Stop 91

This is a well drained, fine textured, Red-Yellow Podzolic soil developed on pedimentary materials derived from shales, in an undulating slope used for paddy. The profile described is at the road side, in Damyeong Dong, Daegu City, Gyeongsangbug Do.

A11--0 to 6 cm; Dark brown (10YR 5/3), gravelly silt loam; moderate very fine and fine granular structure; friable, sticky and plastic; many, fine roots; gradual, smooth boundary; pH 6.0.

A12--6 to 30 cm; Dark yellowish brown (10YR 4/4), gravelly silt loam; moderate, fine and very fine granular structure; friable, slightly sticky and slightly plastic; common, fine roots; few, fine and medium pores; clear, smooth boundary; pH 6.5.

B1--30 to 55 cm; Yellowish brown (10YR 5/4), gravelly silt loam; weak, medium and fine subangular blocky structure; thin, discontinuous clay cutans; firm, sticky and plastic; few, fine roots; common, very fine and fine pores; few, moderately weathered white (2.5Y 8/0), pale yellow (2.5Y 7/4), very dark grayish brown (10YR 3/2) round gravels derived from shale; clear, wavy boundary; pH 6.5.

B21--55 to 75 cm; Mottled, dark brown to brown (10YR 4/3), yellow (10YR 7/8), very dark grayish brown (10YR 3/2), crushed colour, yellowish brown (10YR 5/8) (wet) silty clay loam; moderate, coarse and medium; subangular blocky structure; thin, discontinuous clay skins; firm, sticky and plastic; few, moderately weathered white (2.5Y 7/4), very dark grayish brown (10YR 3/2) round gravels derived from shale; common, medium and fine pores; clear, wavy boundary; pH 6.5.

B22--75 to 100 cm; Mottled, yellowish brown (10YR 5/4) yellow (10YR 7/8), dark grayish brown (10YR 3/2), crushed colour, yellowish brown (10YR 5/6), silty clay loam; strong, medium and fine angular blocky structure; thick, continuous clay skins; common, fine black Mn concretions (7.5YR 2/0); firm, sticky and plastic; common, moderately weathered fine white (2.5Y 8/0), pale yellow (2.5Y 7/4), very dark grayish brown (10YR 3/2) round gravel derived from shale; common, fine pores; clear, smooth boundary; pH 6.5.

IIB21--100 to 135 cm; Mottled, dark brown to brown (7.5YR 4/2), light gray (10YR 7/2), very dark gray (10YR 3/1), crushed colour, yellowish brown (10YR 5/4), silty clay loam; strong, coarse and medium subangular blocky structure; thick, continuous clay cutans; common, black (7.5YR 2/0) Mn concretions; firm, sticky and plastic; common, fine pores; few moderately weathered white (2.5Y 8/0), pale yellow (2.5Y 7/4), very dark grayish brown (10YR 3/2), fine round gravels derived from shale; abrupt, wavy boundary; pH 6.0.

IIB2--135 to 170 cm; Mottled, dark brown to brown (10YR 4/3), light gray (2.5YR 7/2), dark brown to brown (7.5YR 4/2), crushed colour, yellowish brown (10YR 5/4), silty clay; strong, coarse and medium angular blocky structure; thick, continuous clay skins; common black (7.5YR 7/2) Mn concretions; firm, sticky and plastic; few, medium and fine pores; common, moderately weathered white (2.5Y 8/0), pale yellow (2.5Y 7/4), very dark grayish brown (10YR 3/2) round gravel derived from shales; clear, wavy boundary; pH 6.5.

IIC (IIB3)--170 to 300 cm; Mottled brown (10YR 5/3), dark brown to brown (7.5YR 4/4), white (7.5YR 8/0), crushed colour, light yellowish brown (10YR 6/4); silt loam; structureless; very thick, clay accumulation around gravel; common black (7.5YR 2/0) Mn concretion; firm, sticky and plastic; a lot of weathered white (2.5Y 8/0), pale yellow (2.5Y 7/4), very dark grayish brown (10YR 3/2) round and angular gravels and cobbles derived from shale; pH 6.5.

Subunit: Rsb
Laboratory Data: Recon. Stop 91

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/(mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-357	A11	0- 6	12.7	3.4	7.0	8.7	9.2	3.2	52.7	15.8	SiL
2	358	A12	6- 30	15.3	3.9	5.6	6.6	9.2	5.5	55.3	13.9	SiL
3	359	B1	30- 55	15.0	2.4	5.3	7.5	8.8	2.9	50.6	22.5	SiL
4	360	B21	55- 75	4.3	4.1	4.3	3.9	3.9	1.2	54.0	28.6	SiCL
5	361	B22	75-100	3.0	2.4	3.7	4.0	4.6	2.5	54.0	28.8	SiCL
6	362	IIB21	100-135	0.6	-	6.3	-	3.9	2.0	59.4	28.4	SiCL
7	363	IIB22	135-170	2.0	-	6.8	-	3.8	1.8	65.0	22.6	SiL
8	364	IIC(IIB3)	170-300	3.5	2.0	3.5	4.4	4.7	1.6	63.4	20.4	SiL

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	pH H_2O (1:5)	O.M. %	2/ CEC m.e. %	Base Saturation %
1	21.6	30.0	32.6	CL	5.9	0.5	10.0	89.7
2	18.0	36.4	31.7	L	6.3	1.0	8.5	86.0
3	17.2	23.5	36.8	CL	6.3	0.7	9.6	90.9
4	13.3	16.4	41.7	LiC	6.1	0.6	9.1	67.8
5	11.2	17.6	42.4	LiC	6.1	0.2	8.4	86.3
6	7.3	21.2	43.1	LiC	6.2	0.3	9.2	94.3
7	7.7	22.4	47.3	SiCL	6.5	0.3	9.5	95.7
8	11.0	20.4	48.0	SiCL	6.9	0.2	9.6	93.5

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

	Exchangeable Cations m.e./100 gm				
	Ca	Mg	Na	K	Sum of Cations
1	5.75	2.35	0.7	0.17	8.97
2	5.75	1.25	0.21	0.1	7.31
3	6.6	1.55	0.45	0.13	8.73
4	5.1	0.75	0.19	0.13	6.17
5	5.15	1.80	0.15	0.15	7.25
6	6.2	2.15	0.20	0.13	8.68
7	5.5	3.20	0.27	0.15	9.09
8	5.3	3.35	0.21	0.12	8.98

Rsc: Cobbly and Gravelly Loamy Rego-Lithosols and Red-Yellow Podzolic Soils, Sedimentary Materials, Rolling Dissected Pediment Slopes.

This subunit occupies the sloping pediments of colluvium derived from sedimentary rocks. It is made up predominantly of well drained, coarse loamy to fine loamy Rego-Lithosols, with some Red-Yellow Podzolic soils. The soils are chiefly in upland capability Classes III to VII. Most of the land is under cultivation, although the workability is considered to be poor, because of the high content of gravel and cobbles. About 20 percent of this subunit is in natural vegetation.

Subunit: Rsc
Profile: Ulsan Stop 26

This is a well drained, moderately fine textured, slightly eroded, Regosol on an Alluvial-Colluvial slope, derived from shale, on a mountain foot slope, occupied by pine trees, wild grasses and shrubs. The location is 200 m west from Banho Ri, Eonyang Myeon, Uljin Gun, Kyeong Sang Bug Do.

A31--0 to 24 cm; Yellow (10YR 8/6) slightly firm silt loam; moderate fine to coarse subangular blocky structure; slightly sticky and slightly plastic; many, very fine and fine continuous horizontal exped, simple tubular pores; many fine and medium living roots and some dead roots; clear smooth boundary; pH 5.2.

A32--24 to 43 cm; Light yellowish brown (10YR 6/4) slightly firm silty clay loam; moderate fine and medium angular blocky breaking to very fine and fine granular structure; sticky and plastic; random pores as above; approx. 5 percent, generally strongly weathered shale materials; common roots as above; abrupt wavy boundary; pH 5.5.

C1--43 to 78 cm; Very pale brown (10YR 7/3) very firm silt loam; massive or structureless; consistence as above; many coarse and medium discontinuous, random, exped, simple tubular pores; continuous moderately thick brown to dark brown (7.5YR 4/4) clay cutans; few, very fine living tree roots; gradual smooth boundary; pH 5.8.

C2--78 to 160 cm; Brown (7.5YR 5/2) slightly firm silty clay loam; structureless; sticky and plastic; continuous thick red (2.5YR 4/6) clay cutans; common coarse and medium discontinuous random exped simple tubular pores; roots as above; pH 5.8.

Subunit: Rsc
Laboratory Data: Ulsan Stop 26

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	U-172	A31	0- 24	7.5	3.0	2.9	3.5	7.9	8.7	52.1	21.8	SiL
2	173	A32	24- 43	4.6	3.7	3.0	2.9	5.5	6.0	52.0	27.9	SiCL
3	174	C1	43- 78	2.4	3.4	3.3	2.2	4.5	6.2	60.8	19.8	SiL
4	175	C2	78-160	2.8	2.3	3.2	2.2	4.0	5.6	53.5	29.2	SiCL

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	S.G.	Atterberg Limits Lw	Pw	Moisture Retention 1/3 atm.	15 atm.	Clay and Clay Minerals SiO_2 / R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %
1	10.7	41.3	26.2	CL	2.71	27.0	18.7	22.87	9.50	2.814	58.51	8.17	30.08
2	10.5	30.6	32.0	LiC	2.73	33.6	18.4	25.98	11.7	2.890	59.78	7.95	30.04
3	9.5	31.2	39.5	CL	2.74	25.8	17.1	26.52	9.70	-	-	-	-
4	8.3	30.5	32.0	LiC	2.73	35.0	20.6	29.34	13.05	-	-	-	-

1/ Pipette Method, Sodium Hexameta Phosphate.

	pH		Organic Matter			1/ CEC	Exchangeable Cations m.e./100 gm					Base Saturation
	H_2O (1:5)	O.M. %	C %	N %	C/N	m.e. %	Ca	Mg	Na	K	Sum of Cations	%
1	5.2	0.7	0.4	0.04	10.0	5.9	0	0.10	0.24	0.10	0.44	7.5
2	5.5	0.4	0.3	-	-	5.5	0.05	0	0.15	0.08	0.28	5.1
3	5.8	0.2	0.1	-	-	5.2	0.15	0.35	0.14	0.10	1.11	21.3
4	5.8	0.02	0.1	-	-	8.4	0.2	1.60	0.21	0.10	2.11	25.1

1/ Ammonium Acetate Method.

Rva: Fine Loamy, Reddish Brown Lateritic Soils, Red-Yellow Podzolic Soils and Lithosols; Gabbro, Diorite and Similar Materials, Strongly Dissected Undulating to Rolling Pediplanes

This subunit is on undulating to rolling areas of the older pediplane system, with the alluvial-pedimentary mantle underlaid by residual siliceomafic crystalline materials. It is an association predominantly of well drained Red-Yellow Podzolic and Reddish Brown Lateritic soils. Some areas of Lithosols are on the steeper and more sharply convex parts of the landscape. A complex of Alluvial soils, Low-Humic Gley soils and Regosols occupies the swales and narrow valleys. The Red-Yellow Podzolic and Reddish Brown Lateritic soils occupy the smooth slopes, on middle and lower parts of the rolling relief, which represent about 60 percent of this subunit. Their surface colours range from brownish yellow to brown and dark brown; the darker colours are more common in the Reddish Brown Lateritic soils. In cultivated areas the colours range from yellowish brown to yellowish red. Textures of surface layers vary from loam to clay loam. The subsoils extend to a depth of more than 100 cm, Reddish Brown Lateritic being the deepest. Subsoil colours are yellowish brown to red in the Red-Yellow Podzolic and brown in the Reddish Brown Lateritic soils. Their textures are clay loam, silty clay loam, or silty clay, with a moderate subangular blocky structure and usually with continuous clay cutans. Soil reaction is slightly acid to acid. The substrata are moderately to strongly weathered diorite, gabbro and similar rocks. Most of the land is under natural vegetation, of pine trees, acacia, poplar, shrub and grasses. About 40 percent is used for upland crops such as barley, wheat, millet potato, bean, corn, and some paddy rice. The soils of this subunit are chiefly in upland capability Classes IV and VI, with some areas in Class III. About 40 percent of this subunit is suitable only for perennial vegetation. Part of the present land in natural vegetation could be converted to agriculture by bench terracing. With proper management, good yields should be obtained on these soils from a wide variety of crops.

Subunit: Rva
Profile: Recon. Stop 83

This is a well drained, fine textured, Reddish Brown Lateritic soil developed on thin old alluvium over residuum derived from basalt.

The profile described is in Byongpo, Kuryongpo, Yeongil, Gyeongbug Do.

Ap(B1)—0 to 10 cm; Very pale brown to light yellowish brown (10YR 6.5/4)dry, yellowish brown (10YR 5/4), clay loam; moderate, fine and medium granular structure; friable, sticky and plastic; many, fine and medium roots; many, fine and medium pores; abrupt, smooth boundary.

B2-1—10 to 17 cm; Mottled, dark brown to brown (7.5YR 4/2), strong brown (7.5YR 5/6), crushed colour strong brown (7.5YR 5/6); silty clay loam; strong, medium and coarse angular blocky structure; thick, discontinuous cutans; firm, sticky and plastic; common, medium and fine pores; common, fine and medium roots;

B2-2—17 to 25 cm; Mottled reddish brown (5YR 4/3), reddish yellow (7.5YR 6/6) crushed colour strong brown (7.5YR 5/6) silty clay; strong, medium and fine angular blocky structure; thick, discontinuous clay skins; firm, sticky and plastic; common, medium and fine pores; few, fine roots; clear, smooth boundary.

B2-3—25 to 42 cm; Mottled, dark reddish brown (2.5YR 3/4), strong brown (7.5YR 5/8), crushed colour strong brown (7.5YR 5/6) silty clay; strong medium and fine angular blocky structure; thick, discontinuous clay skins, firm, sticky and plastic; few, medium pores; few, fine roots; few, medium pores; few, strongly weathered red (2.5YR 5/8) gravel and cobbles derived from basalt; abrupt, smooth boundary.

IIC1—42 to 95 cm; Mottled, red (2.5YR 5/8), reddish yellow (7.5YR 3/8), crushed colour, red (2.5YR 5/8), reddish brown (5YR 4/4); thick, clay skins; clay; structureless; firm, slightly sticky and slightly plastic; very thick cutans around much gravel and cobbles derived from basalt which is strongly weathered.

IIC2—95 to 125+ cm; Ditto; clay loam; mottled, light yellowish brown (2.5Y 6/4), brownish yellow (10YR 6/6), dark brown to brown (7.5YR 4/4); extremely weathered cobbles and gravel with reddish brown (5YR 4/4) thick cutans.

Subunit: Rva
Soil Description: Recon. No. 83

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-312	Ap(B1)	0- 10	1.0	2.8	5.1	6.6	8.5	3.0	46.0	28	CL
2	313	B2-1	10- 17	2.5	1.8	3.6	4.4	5.9	1.9	44.1	38.3	SiCL
3	314	B2-2	17- 25	0.3	1.1	2.1	2.6	4.1	1.2	43.1	45.8	SiC
4	315	B2-3	25- 42	3.7	1.8	2.1	2.4	4.0	1.7	42.2	45.3	SiC
5	316	IIC1	42- 95	10.9	-	1.8	3.0	6.1	4.1	30.7	54.3	C
6	317	IIC2	95-125+	13.2	1.5	2.9	6.6	12.4	4.7	32.2	39.7	CL

	National Method CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	pH H_2O (1:5)	O.M. %	2/ CEC m.e.	Base Saturation %
1	17.3	20.3	34.4	LiC	6.2	3.5	15.0	85.5
2	11.7	16.1	33.9	LiC	-	1.5	15.2	89.9
3	7.1	12.1	35.0	HC	7.3	0.8	11.3	107.7
4	7.5	10.9	36.3	HC	7.3	0.6	10.4	110.3
5	6.1	18.8	20.8	HC	5.9	0.4	16.9	83.3
6	14.2	22.7	23.4	LiC	6.0	0.4	14.5	86.0

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

	Exchangeable Cations m.e./100 gm				
	Ca	Mg	Na	K	Sum of Cations
1	9.4	2.6	0.23	0.59	12.82
2	10.25	2.85	0.3	0.25	13.65
3	8.5	2.9	0.63	0.15	12.18
4	7.75	2.75	0.89	0.08	11.47
5	8.3	4.55	1.05	0.18	14.08
6	6.2	5.05	1.08	0.14	12.47

Subunit: Rva
Profile: Recon. Stop 151

This is a well drained, fine textured, Red-Yellow Podzolic soil developed in residuum derived from andesite-porphyry.

The profile described is at the top of a rolling elevation in Gyeonggjae, Songho Ri, Hwangsan Myeon, Haenam, Jeonnam Do.

A1-1--0 to 7 cm; Pale brown (10YR 6/3) loam; moderately fine to very fine granular structure; friable, slightly sticky and slightly plastic; common, fine and medium grass roots; clear, wavy boundary; pH 6.0.

A1-2--7 to 16 cm; Light yellowish brown to brownish yellow (10YR 6/4 to 6/6) clay loam; weak, medium to coarse subangular blocky structure; breaking to moderate, medium granular structure; friable, sticky and plastic; common, fine pores; few, medium to fine roots; clear, wavy boundary; pH 4.5.

B1--16 to 24 cm; Reddish yellow to yellowish red (5YR 6/6 - 5/6) clay loam; weak, medium to coarse subangular blocky structure breaking to moderate, medium granular structure; firm, sticky and plastic; common, fine pores; few, medium to fine roots; clear, wavy boundary; pH 4.5.

B2--24 to 50 cm; Mottled, red (2.5YR 5/8), strong brown (7.5YR 5/6); crushed colour, yellowish red (5YR 4/8) clay; moderate, coarse subangular blocky structure; thick, discontinuous clay skins; firm, sticky and plastic; few, fine pores; very few, fine roots; clear, smooth boundary; pH 4.5.

B3--50 to 60 cm; Mottled, red (2.5YR 5/6), strong brown (7.5YR 5/8), white (10YR 8/1), crushed colour, reddish yellow (7.5YR 6/8) gravelly clay; weak, very coarse platy structure; thick, discontinuous clay cutans; fine and medium pores; firm, sticky and plastic; many, strongly weathered gravels derived from porphyry; clear, smooth boundary; pH 4.5.

C--60 to 100+ cm; Mottled, pink (7.5YR 7/4), crushed, reddish yellow (7.5YR 6/8) gravelly clay loam; friable, sticky and plastic; many strongly to slightly weathered gravels derived from porphyry; pH 4.5.

Subunit: Rva
Soil Description: Recon. No. 151

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/(mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	S-582	A1-1	0- 7	14.2	3.9	6.3	6.4	7.1	3.9	59.9	12.5	SiL
2	583	A1-2	7- 16	25.8	5.6	7.2	6.5	2.3	5.1	57.6	15.7	SiL
3	584	B1	16- 24	18.7	2.8	3.3	2.8	5.4	2.7	56.4	26.6	SiL
4	585	B2	24- 50	11.0								
5	586	B3	50- 60	10.6								
6	587	C	60-100+	45.2								

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	pH H_2O (1:5)	2/ CEC m.e.	O.M. %	Exchangeable Cations m.e./100 gm Ca	Mg	Na	K	Base Saturation %
1	18.3	29.2	40.0	L	5.6	8.6	2.0	1.7	1.5	0.22	0.30	43.0
2	21.0	22.7	40.6	CL	5.0	5.0		1.3	1.5	0.40	0.18	69.0
3	11.5	20.5	41.4	LiC	5.0	7.4		0.8	1.5	0.46	0.20	41.0
4					5.0	7.9		1.2	2.7	0.38	0.30	58.0
5					5.0	8.0		1.2	3.1	0.64	0.46	68.0
6					5.0	5.2		1.3	2.7	0.38	0.40	92.0

1/ Pipette Method, Sodium Hexameta Phosphate.

2/ Ammonium Acetate Method.

Rvb: Clayey to Fine Loamy Red-Yellow Podzolic, Reddish Brown Lateritic Soils, Siliceomafic Crystalline Materials, Rolling Dissected Pediment Slopes

This subunit occupies the older and subrecent sloping pediments or mountain footslopes covered by outwash pedimentary materials derived from siliceomafic crystalline rocks. These soils occupy relatively smooth simple slopes. It is an association predominantly of well drained, clayey to fine loamy Red-Yellow Podzolic and Reddish Brown Lateritic soils (about 60 percent of total area). Some Regosols are in the more elevated slopes near the mountain foot (less than 30 percent of the total area). A complex of Alluvial and some Low-Humic Gley soils (about 10 percent of the mapping unit) is in swales and local small drainage ways within the dissected pediment slopes Red-Yellow Podzolic and Reddish Brown Lateritic soils are the most extensive in this subunit. These have dominantly brown to very dark grayish brown fine loamy surface layers over yellowish red to red to yellowish brown clay loam, silty clay loam, or silty clay subsoils with a moderate to strong subangular blocky structure and usually continuous clay cutans. The soil reaction is slightly acid to acid. Gravel and cobbles derived from andesite-porphyry, rhyolite, dacite, gabbro and basalt are common in the lower horizons. In some parts of the mountains there are areas of Acid Brown Forest soils (Cumulic phase). Most of the land in the subunit is under cultivation, used for the production of upland crops such as barley, potato, bean, tobacco and fruit. The soils of this subunit are chiefly in upland capability Classes III and IV. They are suitable for intensive agricultural development. With good management relatively high yields could be obtained on these soils from a large variety of crops.

Subunit: Rvb
Profile: Gwangju Stop 109

This is a well drained, moderately fine textured, Red-Yellow Podzolic soil developed on alluvial-colluvial complex slopes derived from porphyrite. The location is Jisan Dong, Gwangju City, Jeonlanam Do.

Ap--0 to 10 cm; Brown to dark brown (10YR 4/3) firm gravelly loam; moderate fine and medium subangular blocky structure, slightly sticky and slightly plastic; slightly weathered porphyry gravel; common fine random interstitial exped pores; many, fine grass roots; abrupt, smooth boundary.

Weak B--10 to 24 cm; Mottled dark reddish brown (5YR 3/3), red (2.5YR 5/6 - 5YR 4/6) reddish yellow (7.5YR 6/6) wet crushed colour yellowish red (5YR 4/8) firm, clay loam; structureless (massive); strong weathered porphyrite gravel; slightly sticky and plastic; few, medium and coarse open tubular oblique pores; abrupt, smooth boundary.

B2--24 to 46 cm; Yellowish red (5YR 5/8) firm gravelly loam; structureless (massive); thick broken clay cutans; few medium and coarse oblique tubular open pores; slightly sticky and slightly plastic; clear, smooth boundary.

B3--46 to 108 cm; Red (2.5YR 4/8) firm gravelly loam; structureless (massive) thick broken clay; cutans; common, medium prominent mottles of strong brown (7.5YR 5/8); few, fine and coarse discontinuous random vesicular pores; slightly sticky and plastic; no roots; abrupt, smooth boundary.

IIB--108 to 120 cm; Pale brown (10YR 6/3) very firm clay loam; structureless (massive) strongly weathered gravel (white 7.5YR 8/0) and yellow (10YR 7/6); sticky and plastic; no pores; no roots; abrupt, smooth boundary.

IIIB--120 to 150 cm; Yellowish brown (10YR 5/4); friable gravelly loam; slightly sticky and plastic; few, fine prominent mottles of dark reddish brown (2.5YR 3/4).

Subunit: Rvb
Laboratory Data: Gwangju Stop 109

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class
1	K-260	Ap1	0- 10	10.2	5.2	7.1	8.3	11.3	7.4	38.3	22.4	L
2	261	B1	10- 24	4.7	2.7	4.1	5.8	7.9	4.4	41.7	33.4	CL
3	262	B2	24- 46	3.6	2.1	4.9	7.0	12.1	9.0	44.1	20.8	L
4	263	B3	46-108	4.2	2.8	8.7	10.2	14.1	10.2	35.9	18.1	L
5	264	IIB1	108-120	4.9	1.6	5.5	5.3	5.3	3.3	45.1	33.9	CL
6	265	IIIB1	120-150	1.3	2.9	8.1	8.6	9.7	5.5	48.2	17.0	L

	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	Moisture Retention 1/3 atm.	15 atm.
1	23.7	29.5	24.4	CL	23.2	11.2
2	14.4	23.3	28.9	LiC	23.4	14.9
3	16.6	34.4	28.2	CL	30.8	13.3
4	24.9	30.2	26.8	CL	27.8	11.0
5	13.6	19.9	32.6	LiC	28.8	13.8
6	22.1	25.9	35.0	CL	28.3	10.0

1/ Pipette Method, Sodium Hexameta Phosphate.

	pH		1/	Exchangeable Cations m.e./100 gm				Base Saturation
	H_2O (1:5)	O.M. %	CEC m.e.	Ca	Mg	Na	K	%
1	5.4	1.6	16.06	7.0	2.0	0.36	0.16	59
2	5.9		13.14	7.4	2.3	0.86	0.16	89
3	5.8		9.58	5.8	1.5	1.02	0.16	89
4	5.4		7.84	2.7	1.8	0.68	0.24	69
5	5.3		11.90	4.3	4.7	0.70	0.44	85
6	5.3		8.32	2.4	2.6	0.40	0.28	68

1/ Ammonium Acetate Method.

Rvc: Cobbly and Gravelly Loamy Rego-Lithosol and Red-Yellow Podzolic Soils, Siliceomafic Crystalline Materials, Older Rolling Dissected Pediment Slopes

This subunit is at the foot of mountains on sloping colluvium or debris derived from siliceomafic crystalline rocks. It is an association predominantly of Rego-Lithosols, with some Red-Yellow Podzolic soils, with inclusion of an interfingering network of Alluvial and some Low-Humic Gley soils. Rego-Lithosols have very dark brown to brown to brown loam to sandy loam surface layers over yellowish red to brown gravelly to cobbly coarse loamy to sandy substrata. At high altitudes there are areas of dark coloured soils (Acid Brown Forest). A great part of the land in this subunit is under cultivation. The soils are chiefly in upland capability Classes III and IV, with about 20 percent in Classes VI and VII, suitable only for perennial forest and grasses. With good management, moderate yields should be obtained from a wide variety of crops.

Subunit: Rvc
Profile: Gwangju Stop 114

This is a well drained, medium textured Regosol developed on alluvial-colluvial complex slopes derived from andesite-porphyrite. The location is Hwa San Ri, Ji Wang Dong, Gwangsan Gun, Jeonlanam Do.

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

C1--10 to 19 cm; Yellowish brown to brown (10YR 5/4 - 10YR 5/3), friable very gravelly silty clay loam; weak, fine granular structure and weak fine to medium subangular blocky structure; common, fine to medium discontinuous random inped vesicular pores; worm casts; sticky and plastic; few, fine roots; slightly weathered gravel; clear, smooth boundary.

C2--19 to 34 cm; Yellowish brown (10YR 5/4) friable very gravelly to cobbly silty clay loam; weak fine to medium subangular blocky and some weak fine granular structure; few, fine and medium discontinuous random inped oblique pores; sticky and plastic; few fine roots; slightly weathered gravel and cobbles; clear, smooth boundary.

C3--34 to 52 cm; Yellowish brown (10YR 5/6) friable very gravelly to cobbly silt loam; weak, fine to medium subangular blocky structure; thin clay cutans; few, fine discontinuous random closed inped interestitial pores; very few fine roots; sticky and plastic; clear, smooth boundary.

C4--52 to 80 cm; Mottled dark brown to brown (7.5YR 4/2), pale brown (10YR 6/3) very dark brown (10YR 2/2) friable very gravelly to cobbly silt loam; crushed colour yellowish brown (10YR 5/6) moderate fine to medium subangular blocky; few, fine discontinuous inped pores; sticky and plastic.

Subunit: Rvc
Laboratory Data: Gwangju Stop 114

	Lab. No.	Horizon	Depth cm	Gravel >2 mm	Particle Size Distribution 1/ (mm) Percent US Department of Agriculture							
					VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .25-.10	Silt .10-.05	Clay <.002	Textural Class
1	K-284	Ap	0-10	35.8	1.7	4.2	4.5	4.5	2.3	58.0	24.8	SiL
2	285	C1	10-19	23.8	1.6	4.8	3.9	2.9	1.0	55.7	31.1	SiCL
3	286	C2	19-34	17.2	← 3.7 →		3.0	3.2	2.2	55.4	32.4	SiCL
4	287	C3	34-52	9.4	← 3.8 →		3.2	3.9	2.9	59.7	59.7	SiL
5	288	C4	52-80	22.4	1.1	3.7	4.8	6.1	4.3	62.1	62.1	SiL

1/ Pipette Method, Sodium Hexameta Phosphate.

	International				Moisture Retention	
	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class	1/3 atm.	15 atm.
1	11.5	22.8	40.9	CL	32.5	13.1
2	10.3	19.4	39.2	LiC	31.3	15.5
3	7.5	17.7	42.4	LiC	32.0	14.4
4	7.8	24.5	41.2	LiC	32.3	12.7
5	10.9	26.5	44.7	CL	30.7	9.9

	pH		1/	Exchangeable Cations m.e./100 gm				Base Saturation
	H_2O (1:5)	O.M. %	CEC m.e.	Ca	Mg	Na	K	%
1	5.2	3.4	8.94	2.9	1.2	0.24	0.20	50.6
2	5.0		9.22	2.2	0.4	0.12	0.12	30.8
3	5.1		8.72	1.6	0.3	0.32	0.12	26.5
4	5.2		7.70	1.8	0.9	0.26	0.12	40.3
5	5.5		12.86	5.0	3.5	0.28	0.12	68.5

1/ Ammonium Acetate Method.

Rvd: Fine Loamy to Clayey Red-Yellow Podzolic and Reddish Brown Lateritic Soils, Siliceomafic Materials (Dominantly of Basalts), Moderately Dissected Undulating to Subrolling Pediplanes and Lava Plains

This mapping unit occupies undulating to subrolling areas of the moderately dissected Pediplanes and Lava Plains underlaid by siliceomafic crystalline materials (dominantly of Basalts). It is an association predominantly of Red-Yellow Podzolic and Reddish Brown Lateritic soils with some Alluvial soils. Textures are mostly fine loamy to clayey. Most of the land is used for rice paddy. The soils are chiefly in upland capability Class II, and paddy land capability Classes II to III. These soils have dominantly brown to dark brown fine loamy surface soils, with a fine to medium granular structure, silty clay subsoils with a moderate to strong subangular blocky structure, and usually continuous clay cutans. Soil reaction is neutral. Basalt is found in the lower horizons below about 2 m. The soils of this subunit occur only on Lava Plains along Imjin river of Yeoncheon Gun and Cheolweon Gun areas near the Demilitarized Zone. They are considered to be suitable for intensive agricultural development. With good management relatively high yields could be obtained from a large variety of crops.

Appendix 4

Table 11

LEGEND AND MAP SYMBOLS

Reconnaissance Quadrangles					Soil Series 1/	
Scale 1: 1 000 000	Scale 1: 250 000	Scale 1: 50 000	Field Check Symbol	Soils Names	Representative	Subordinate
	Fb	Fba	Sb-1	Sands and Gravels, Coastal Beaches and Dunes.		
		Fbb	Sb-2	Black Sands and Gravels, Coastal Beaches and Dunes.		
	Ft	Fta	Tf	Tidal Flats.		Gwanghwal, Deogha.
A	Fm	Low-Humic Gley and Alluvial Soils, Fluvio-Marine Plains.				
		Fma	Fml-l Mpl-l	Fine Silty to Clayey Alluvial and Low-Humic Gley Soils Imperfectly to Poorly Drained.	Buyong, Bongnam, Gimje, Jeonbug.	Mangyeong, Deogha, Daldong.
		Fmd	Fml-p Mpl-p	Fine Silty to Clayey Alluvial and Low-Humic Gley Soils Poorly to Very Poorly Drained.	Gongdug, Gimje.	Baeggu.
		Fmb	Fm2-l Mp2-l	Coarse Loamy and Silty Alluvial and Low-Humic Gley Soils Imperfectly to Poorly Drained.	Hagseong.	Gimje, Bongnam, Buyong.
		Fmg	Fm2-p Mp2-p	Coarse Loamy and Coarse Silty Alluvial and Low-Humic Gley Soils, Poorly to Very Poorly Drained.	Mangyeong.	Hagseong, Deogha, Jeonbug.
		Fmc	Mp3-F Mp3-M	Coarse Silty to Fine Clayey Saline Alluvial Soils, Imperfectly to Poorly Drained.	Gwanghwal.	
		Fmk	Fm4	Fine Loamy and Fine Silty to Clay Acid Sulfate Soils, Imperfectly to Poorly Drained.	Gimhae, Haechang.	Bongrim.
		Fml		Clayey Muck Soils, Poorly to Very Poorly Drained, Lacustrine Materials.		
A2		Low-Humic Gley and Alluvial Soils, Alluvial Plains and Flood Plains				
	Ap	Low-Humic Gley and Alluvial Soils, Alluvial Plains.				
		Apa	Apl-l	Fine Loamy, Fine Silty and Fine Clayey Low Humic Gley and Alluvial Soils, Imperfectly to Poorly Drained.	Honam Sinheung, Kyocheon.	Yeongsan, Hwadong.
		Apd	Apl-p	Fine Loamy, Fine Silty and Fine to Clayey Low-Humic Clay and Alluvial Soils, Poorly Drained	Sugye, Gangdong	Honam, Baeggu, Sinheung.
		Apb	Ap2-F	Fine Loamy and Fine Silty to Clayey Red-Yellow Podzolic Soils, Moderately Well to Well Drained.	Hwadong, Ihyeon, Geugrag, Yongji.	Gyuam, Gongseong.
		Apc	Ap3-l Ap5	Cobbly or Gravelly Loamy Alluvial Soils, Imperfectly Drained	Seogge, Yeongsan, Tongcheon.	Subug, Manseong, Hagsan.
		Apg	Ap3-W Ap5-W	Cobbly to Gravelly Loamy to Coarse Loamy Alluvial Soils, Well Drained.	Hogye, Tongcheon	Seoggye, Bonryang.
	Af	Alluvial Soils and Riverwash, Flood Plains.				
		Afa	An2-M	Coarse Loamy to Sandy Alluvial Soils, Moderately Well to Well Drained	Hwabong, Nagdong, Gundong.	Tongcheon, Yeongsan, Seoggye, Hagsan, Hwangryong, Maryeong, Bonryang, Inyeon, Honam, Hyocheon, Sadu.
		Afb	Ap4 Ap6	Coarse Loamy to Sandy Alluvial Soils, Imperfectly to Poorly Drained.	Hamchang, Sindab, Gangdong.	Subug, Hwabong, Hwangryong, Hagsan, Ihyeon, Seoggye.
		Afc	AL1-3	Sandy to Coarse Loamy Riverwash and Alluvial Soils, Moderately Well to Excessively Drained.	Riverwash. (Sand)	Hwabong, Nagdong.
		Afd	AL1-4	Cobbly or Gravelly Sandy to Coarse Loamy Riverwash and Alluvial Soils, Moderately Well to Excessively Drained.	Riverwash. (Gravelly)	Bonryang, Jungdong.
C1-C5	An	Complex of Soils, Narrow Valleys.				
		ma	AL11/H5 AL11/M5	Often Cobbly or Gravelly Fine Loamy, or Fine Silty Low-Humic Gley and Alluvial Soils, Moderately Well to Poorly Drained, Nearly Level to Sloping.	Jisan, Yuga, Daeneung, Samam, Yongji.	Hyocheon, Banho.
		Anb	AL11/ H1-H4 AL11/ M1-M4	Often Cobbly or Gravelly Coarse Loamy Alluvial and Low-Humic Gley Soils Moderately Well to Imperfectly Drained, Nearly Level to Sloping Local Alluvial Plains and Slopes.	Sachon, Subug, Seoggye.	Jisan, Samam.
		Anc	Acl-l Acl-5 Acl-6 Acl-L	Complex to Coarse Loamy, Loamy Skeletal, Fine Clayey and Fine Loamy Soils Undifferentiated Materials, Moderately Well to Well Drained Alluvial-Colluvial Slopes.	Seogto, Iweon, Gaghwa, Jangweon.	Maji, Samam, Seongsan, Banho, Anyong.

1/ Technical Report 1, The Soils of Korea. Minor variations in nomenclature and spelling result from later correlation of soils in Technical Report 1.

Reconnaissance Quadrangles					Soil Series	
Scale 1: 1 000 000	Scale 1: 250 000	Scale 1: 50 000	Field Check Symbol	Soils Names	Representative	Subordinate
		And	Ac1-k	Fine Loamy, Coarse Loamy and Loamy Skeletal Soils With Dark Surface Moderately Well to Well Drained Undifferentiated Materials, Alluvial-Colluvial Slopes.	Sinbul, Imog, Mangsil, Maji, Hogye, Mui.	Seongsan, Iweon, Seogto.
B1	Ra	Soils of The Dissected Older Pediplane System Red-Yellow Podzolic				
		Soils, Siliceous Crystalline and Diluvial Materials				
		Raa	R1-1	Fine Clayey to Fine Loamy Red-Yellow Podzolic Soils, Undifferentiated Alluvial and Residual Materials, Gently Undulating Moderately Dissected Older Pediplanes and Terraces.	Gwangsan, Jingog, Jeonnam, Gwangju, Buncheon, Dalcheon, Changpyeong, Songjeong.	Hwadong, Banggi, Jangyu, Gongseong, Yongji, Baegsan, Bansan, Seongsan.
		Rab	R1-2	Fine Clayey to Fine Loamy Red-Yellow Podzolic Soils and Lithosols. Granitic Materials, Undulating to Rolling Strongly Dissected Older Pediplanes.	Songjeong, Gimpo, Dalcheon.	Samgag, Ulsan, Yesan, Taehwa, Chahang.
		Rac	Ac-1	Fine Clayey to Fine Loamy Red-Yellow Podzolic Soils, Granitic Materials, Rolling Dissected Pediment Slopes.	Gaghwa, Anyong, Dalcheon, Bansan.	Songjeong, Cheongog.
		Rad	Ac-2	Cobbly and Gravelly Loamy Rego-Lithosols and Red-Yellow Podzolic Soils, Granitic Materials, Rolling Dissected Pediment Slopes.	Jangweon, Gaghwa, Mangsil.	Iweon, Chundo, Seogto.
B2	Re	Lithosols, Severely Eroded, Siliceous Crystalline Material.				
		Rea	R1-2L R/G	Coarse Loamy Sandy and Fine Loamy Lithosols, Severely Eroded, Granitic Materials, Strongly Dissected Undulating to Rolling Pediplanes.	Samgang, Taehwa, Ulsan, Andong.	Dalcheon, Songjeong.
	Rs	Lithosols, Regosols and Red-Yellow Podzolic Soils, Sedimentary Materials.				
		Rsa	R1-3 R1-3L	Fine Loamy to Fine Clayey Lithosols and Red-Yellow Podzolic Soils, Shale, Fine Grained Sandstone and Andesite Materials, Undulating to Rolling Strongly Dissected Older Pediplanes.	Daegu, Sirye, Habin, Buyeo.	Jeongja, Sinjeong,
		Rsb	Ac-8	Fine Clayey to Fine Loamy Red-Yellow Podzolic Soils, Shale, Fine Grained Sandstone and Andesite Materials, Rolling Dissected Pediment Slopes.	Imdong, Sirye, Buyeo.	Daegu, Habin, Cheongsim, Mudeung.
		Rsc	Ac-3	Cobbly and Gravelly Loamy Rego-Lithosols and Red-Yellow Podzolic Soils, Shale, Fine Grained Sandstone and Andesite Materials, Rolling Dissected Pediment Slopes.	Jangweon, Gaghwa.	Daegu, Habin.
B3	Rv	Red-Yellow Podzolic and Reddish Brown Lateritic Soils, Silicomafic Materials.				
		Rva	R1-7	Fine Loamy, Reddish Brown Lateritic Soils, Red-Yellow Podzolic Soils and Lithosols, Gabbro, Diorite and similar Materials. Strongly Dissected Undulating to Rolling Pediplanes.	Cheongog.	Jeongja.
		Rvb	Ac-6	Clay to Fine Loamy Red-Yellow Podzolic Soils and Reddish Brown Lateritic Soils, Gabbro Diorite and Similar Materials, Rolling Dissected Pediment Slopes.	Cheongog.	Jeongja.
		Rvc	Ac-5	Cobbly and Gravelly Loamy Rego-Lithosols and Red-Yellow Podzolic Soils, Gabbro, Diorite and Similar Materials, Rolling Dissected Pediment Slopes.	Jeongja.	Sinjeong.
		Rvd		Fine Loamy to Clayey, Red-Yellow Podzolic and Reddish Brown Lateritic Soils, Silicomafic Materials, Moderately Dissected, Undulating to Rolling Pediplanes and Lava Plains.		
	Rl	Red-Yellow Podzolic Soils and Lathosols, Calcareous Materials.				
		Rla	Rl-m	Fine Loamy to Clayey Red-Yellow Podzolic Soils and Lithosols, Limestone, Strongly Dissected Undulating to Rolling Pediplanes.	Pyeongchang, Jangseong.	Jangseong.
		Rlb	Ac-6L	Clayey to Fine Loamy Soils and Lithosols, Limestone, Rolling Dissected Pediment Slopes,	Mitan, Pyeongan.	
B1, B2, B3	Ra, Re, Rs, Rv, Rl	Alluvial and Low-Humic Gley Soils, Narrow Valleys Between Rolling Lands, Undifferentiated Materials.				
		Rxa	AL11/ R1-R5	Fine Loamy to Clayey Alluvial and Low-Humic Gley Soils Imperfectly to Moderately Well Drained, Colluvial Alluvial Slopes and Swales.	Sachon, Subug, Jisan, Yuga, Saman, Maji.	Suggae, Anmi.

Reconnaissance Quadrangles					Soil Series	
Scale 1: 1 000 000	Scale 1: 250 000	Scale 1: 50 000	Field Check Symbol	Soils Names	Representative	Subordinate
B4				Volcanic Ash Soils, Lava Plains and Terraces.		
	Lp			Very Dark Brown to Black Volcanic Ash Soils, Lava Plain.		
		Lpa		Clayey Black Volcanic Ash Soils, Well Drained, Lava Plains.		
		Lpb		Clayey Very Dark Brown Volcanic Ash Soils, Well Drained, Lava Plains.		
	Lt			Very Dark Brown to Black Volcanic Ash Soils, Lava Terraces.		
		Lta		Shallow and Stony, Clayey to Loamy Black Volcanic Ash Soils, Well to Excessively Drained, Lava Terraces.		
		Ltb		Shallow and Stony, Loamy to Clayey, Very Dark Brown Volcanic Ash Soils, Well to Excessively Drained, Lava Terraces.		
C1	Ma			Soils of the Strongly Dissected Hilly and Mountainous Lands Lithosols, Siliceous Crystalline Materials.		
		Maa	Hl-4	Lithosols and Red-Yellow Podzolic Soils, Granitic Materials, Strongly Dissected Hilly Lands.	Dalcheon, Songjeong.	Samgag.
		Mab	Hl-1	Lithosols, Granitic Materials Strongly Dissected Hilly Lands.	Samgag, Gwanag.	Dalcheon.
		Mac	Ml M5	Lithosols, Granitic Materials, Strongly Dissected Mountains.	Gwanag, Samgag.	Odae, Dalcheun, Nagseo.
C4	Ms			Lithosols, Sedimentary Materials With Instrusions of Igneous Rocks.		
		Msa	Hl-2 Hl-6	Lithosols, Shale, Sandstone, Andesite, Tuff and Conglomerate, Strongly Dissected Hilly Lands.	Daegu, Taehwa, Habin, Mudeung.	Sirye, Bongye, Buyeo, Ulsan.
		Msb	M3	Lithosols, Shale, Sandstone, Adesite, Tuff and Conglomerate, Strongly Dissected Mountaines.	Daegu, Mudeung, Habin.	Taehwa.
C5	Mv			Lithosols, Siliceomafic Materials.		
		Mva	Hl-3 Hl-5	Lithosols, Gabbro and Diorite, Strongly Dissected Hilly Lands.	Jeongja Mudeung.	Taehwa, Cheongog, Bonggye, Ulsan.
		Mvb	M2 M6	Lithosols, Gabbro and Diorite, Strongly Dissected Mountains.	Mudeung, Jeongja.	Taehwa.
C2	Ml			Lithosols and Red-Yellow Podzolic Soils, Calcareous Materials.		
		Mla	Hl-7	Lithosols and Red-Yellow Podzolic Soils, Limestone, Strongly Dissected Hilly Lands	Jangseong, Pyeongchang.	
		Mlb	M8	Lithosols, Limestone, Strongly Dissected Mountains.	Jangseong	
C3	Mm			Lithosols, Micaceous and Hard Siliceous Materials.		
		Mma	Hl-8	Lithosols, Schist and Gneisses, Strongly Dissected Hilly Land.	Oesan, Nagseo.	Seongjeong.
		Mmb	M9	Lithosols, Schist and Gneisses, Strongly Dissected Mountains.	Nagseo, Oesan.	
Dw	Mu			Acid Brown Forest Soils and Lithosols, Undifferentiated Materials.		
		Mua	OSl-4	Acid Brown Forest Soils and Lithosols, Undifferentiated Materials, Strongly to Moderately Dissected Plateau Remnants.	Chahang, Sinbul, Mangsil.	
		Mub	M7K	Lithosols and Acid Brown Forest Soils. Undifferentiated Materials, Strongly Dissected Mountains.	Weoljeong, Mangsil, Cheongsim.	Mudeung, Shinbul.
D2	Mj			Volcanic Ash Soils, Cinder Cones.		
		Mja		Lithosols and Volcanic Ash Soils, Volcanic Pumice Materials, Excessively Drained Rolling to Mountainous Cinder Cones.		
		Ro	Rol-4	Rocky Lands, Undifferentiated Materials.		
		Lf	Lfl	Lava Flows.		