AgRISTARS

E82-10058

CR-161021

A Joint Program for Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing

Supporting Research

October 1980

TAXONOMIC CLASSIFICATION OF WORLD MAP UNITS IN CROP PRODUCING AREAS OF ARGENTINA AND BRAZIL WITH REPRESENTATIVE U.S. SOIL SERIES AND MAJOR LAND RESOURCE AREAS IN WHICH THEY OCCUR

NASA CR-161021

Horace F. Huckle
U.S. Department of Agriculture
Soil Conservation Service
Houston, Texas 77058

(E82-10058) TAXONOMIC CLASSIFICATION OF WORLD MAP UNITS IN CROP PRODUCING AREAS OF ARGENTINA AND BRAZIL WITH REPRESENTATIVE US SOIL SERIES AND MAJOR LAND RESOURCE AREAS IN WHICH THEY OCCUR (Department of Agriculture) HC A03/MF A01 G3/43

N82-19633

Unclas
00058

Lyndon B. Johnson Space Center
Houston, Texas 77058

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
JSC-16824; SR-U0-00497		

4. Title and Subtitle	5. Report Date
Taxonomic Classification of World Map Units in Crop Producing Areas of Argentina and Brazil with Representative U.S. Soil Series and Major Land Resource Areas in Which They Occur	October 1980
	6. Performing Organization Code SF3
7. Author(s) H. F. Huckle	8. Performing Organization Report No.
	10. Work Unit No.
9. Performing Organization Name and Address U.S. Department of Agriculture Soil Conservation Service Houston, Texas 77058	11. Contract or Grant No.
	13. Type of Report and Period Covered Technical Report
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Lyndon B. Johnson Space Center Houston, Texas 77058	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The most probable current U.S. taxonomic classification of the soils estimated to dominate World Soil Map Units (WSM) in selected crop producing states of Argentina and Brazil are presented. Representative U.S. soil series for many of the units are given. The map units occurring in each state are listed with areal extent and Major U.S. Land Resource Areas in which similar soils most probably occur. Soil series sampled in LARS Technical Report 111579 and Major Land Resource Areas in which they occur with corresponding similar WSM units at the taxonomic subgroup levels are given.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
World soil maps Taxonomic Soil Classification Major Land Resource Areas	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price*
Unclassified	Unclassified		

*For sale by the National Technical Information Service, Springfield, Virginia 22161

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
JSC-16824; SR-U0-00497		

4. Title and Subtitle	5. Report Date
Taxonomic Classification of World Map Units in Crop Producing Areas of Argentina and Brazil with Representative U.S. Soil Series and Major Land Resource Areas in Which They Occur	October 1980
	6. Performing Organization Code SF3
7. Author(s) H. F. Huckle	8. Performing Organization Report No.
	10. Work Unit No.
9. Performing Organization Name and Address U.S. Department of Agriculture Soil Conservation Service Houston, Texas 77058	11. Contract or Grant No.
	13. Type of Report and Period Covered Technical Report
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Lyndon B. Johnson Space Center Houston, Texas 77058	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The most probable current U.S. taxonomic classification of the soils estimated to dominate World Soil Map Units (WSM) in selected crop producing states of Argentina and Brazil are presented. Representative U.S. soil series for many of the units are given. The map units occurring in each state are listed with areal extent and Major U.S. Land Resource Areas in which similar soils most probably occur. Soil series sampled in LARS Technical Report 111579 and Major Land Resource Areas in which they occur with corresponding similar WSM units at the taxonomic subgroup levels are given.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
World soil maps Taxonomic Soil Classification Major Land Resource Areas	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price*
Unclassified	Unclassified		

*For sale by the National Technical Information Service, Springfield, Virginia 22161

SR-U0-00497
JSC-16824

TAXONOMIC CLASSIFICATION OF WORLD MAP UNITS IN CROP PRODUCING AREAS OF ARGENTINA AND BRAZIL WITH REPRESENTATIVE U.S. SOIL SERIES AND MAJOR LAND RESOURCE AREAS IN WHICH THEY OCCUR

PREPARED BY

Horace F. Huckle
U.S.D.A. Soil Conservation Service

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER
HOUSTON, TEXAS

October 1980

TAXONOMIC CLASSIFICATION OF WORLD SOIL MAP UNITS IN CROP PRODUCING AREAS OF ARGENTINA AND BRAZIL WITH REPRESENTATIVE U.S. SOIL SERIES AND MAJOR LAND RESOURCE AREAS IN WHICH THEY OCCUR

Prepared By
Horace F. Huckle
U.S.D.A. Soil Conservation Service

Introduction

World soil maps are compiled at a scale of 1:1,000,000 (approximately 16 miles per inch or 10 kilometers per centimeter). Soil classification on the map sheets is that of the 1939-1945 system used in the United States prior to 1965. Map units are associations of phases of great soil groups. In addition to kinds of soil, map units are also characterized by the dominant slope of the soils therein and the nature of the underlaying geologic materials. This combination of soil and topographic setting is considered to have maximum interpretative potential for the scale of the map.

Areas delineated on the maps are soil associations at a high level of generalization, definable in terms of a dominant great soil group and its associated soils, as they occur characteristically on a specified landform from a specified kind of parent material.

The symbol used to identify each delineated area designates the dominant great soil group, landform, and parent material. Each symbol should be considered as a unit, not in terms of its component parts. It represents all of the implications of character and distribution of soils that are inherent in the factors represented.

Commonly, two or more distinct soil associations are included in a single delineation and are identified as a single map unit. Where the identification of such a map unit is necessary, each soil association is indicated by its respective symbol and the map unit is identified by the hypenated compound of the symbols. The symbol of the more extensive soil association occurs on the left of the hypen. Thus, the sumbol G-HB indicates the presence of an association of Gray Acid Soils; Gray Hydromophic and Half Bog Soils.

The goal of this study was to classify, within limits of available information, the World Soil Map units to the current soil taxonomic family level and identify U.S. soil series with like or similar classification. This reclassification is needed to interpretate the map units of the study area through like or similar U.S. soils.

The second goal of this study was to identify Major Land Resource Areas in the United States where soils similar to those in the World Soil Map units most probable occur.

A third goal was to correlate World Soil Map units in the study area with soils reported in Atlas of Soil Reflectance Properties, LARS Technical Report 111579 in order to identify soils with possible similar surface reflectance patterns.

A fourth goal was to geographically locate on the World Soil Maps the four Brazilian soils tested and reported in the LARS report and determine if these soils occur within the major crop producing area of that country and if similar soils occur in the United States.

The Study Area

The study area consists of the major crop producing states of Argentina and Brazil as delineated for corn, soybeans and wheat in SR-J9-C0602, JSC-16340, and the World Atlas of Ariculture (6), (Fig. 1 and 2).

Taxonomic Soil Classification

Taxonomic soil classification of the map units was according to Soil Taxonomy (2). This system was adopted in 1965. Selection of representative soil series was from Classification of Soil Series of the United States, Puerto Rico, and the Virgin Islands, August 1979.

Data for the taxonomic classification of the map units was gleamed from all available sources. The world soil map units descriptions (3), FAO soil map profile descriptions and laboratory data (1), Soil Taxonomy (2), Soil moisture and temperature calculation (5), as well as personal communications[1/] were carefully searched and studied for information about the morphology, genetic factors, and physical characteristics from which kinds of soils could be inferred. The moisture and temperature regimes (regions) (Fig. 1 and 2) which are important to the classification of soils, were those previously calculated from temperature and rainfall records and plotted on maps (5). Then, after consideration of all the above data, a judgment of the probable classification of the map units was made and representative U.S. series selected. For some map units, a series with like taxonomic classification has not been recognized in the United States.

Acetate overlay material was superimposed over the soil maps on which state boundaries and approximate soil temperature regime (region) boundaries were drawn. Then, the map units occurring in the states were recorded by moisture and temperature regions (Tables 1a through 1h and 2a through 2g). Also recorded on the tables is approximate acreage of each map unit in the several states and moisture and temperature regions. Acreage measurement was by the grid dot method and was adjusted to the state land area except for those parts of La Pampa, Argentina and Espireto Santa and Minas Gerais, Brazil.

In Tables 3 and 4, the classification of the map units in the study area is given. As can be seen, more than one classification is listed for many of the map units. Where a map unit occurs in more than one temperature region, the proper classification can be determined by the last word of the classification, i.e., thermic soils occur in the thermic temperature region, etc.

[1/] Personal communication H. Edward Bullick, USDA, FAS,CCAD and Dr. Frederick Weston, Professor of Soils, South Dakota State University.

Soil moisture regions are not as easily identified in the classification name as are temperature regions. For many of the soils, the correct moisture region can be identified by <u>us</u> for ustic region or <u>ud</u> for udec region in the subgroup name. Examples are Typic Haplustalls are in the ustic region, and typic Arguidolls are in the udic moisture region. However, for some soils as Typic Torrepsamments, the moisture region is not implied in the name as described above. Then the reader should refer to the appropriate state in Tables 1 and 2 to determine the moisture region the unit occurs in.

For many of the soils, more than one classification within the moisture or temperature region is given. Where this occurs, the soils in the unit may classify in either or both classification because available data was insufficient for a more precise decision. For the most part, unless data indicated otherwise, the central concept or "typic" subgroup was assigned. In some cases data indicated soil properties transitional from "typic" to another great group. Then the map unit was assigned to a subgroup indicative of that property. An example is Plinthic Paleudults.

For all map units, the reader is reminded the classification given is a probable one for the dominant soils of the unit based on judgment of the available information. Many similar or dissimilar soils may occur in the units in varying proportions.

Detailed series descriptions with interpretation of the representative series given are in the respective official series descriptions, National Cooperative Soil Surven, U.S.A.

Major Land Resource Areas (MLRA)

Major land resource areas are geographic areas of land thousands of hectares in extent, that are characterized by particular patterns of soil, climate resources, land use, and type of farming. An area may occur as one continuous area or as several separate but nearby areas.

Land resource regions consist of geographically associated major land resource areas. In grouping major land resource areas into land resource regions, the objective is to preserve as much uniformity as possible in relationships significant to agriculture. Uniformity is much less in land resource regions than in major land resource areas.

On Figure 3, major land resource areas are designated by numbers (4). Number 1 is on the west coast and Number 156 on the east coast. The legend identifies each area by number and by a descriptive name. A few major land resource areas consist of two or more parts separated for short distances by other land resource areas. Land resource regions are designated by capital letters, which are identified in the legend by a descriptive name.

In Tables 3 and 4, the major land resource areas most probable having soils similar to those of the World Soil Map units are given. The resource areas are those in which the representative U.S. soil series occur. Where there are no representative soil series, the resource areas given are the most probable in which they may occur. The numbers in the tables correspond to those on the map.

Reflectance Properties

In Table 5, selected soil series sampled and reported in Atlas of Soil Reflectance Properties, LARS Technical Report 111579 are given with the major land resource areas in which they occur and World Soil Map units that have the same estimated taxonomic subgroup classification. Soils of the map units would most probably be similar to soils in the respective resource areas. The numbers of the resource areas refer to Figure 3.

Location of Brazilian Soils

The four Brazilian soils tested and reported in Atlas of Soil Reflectance Properties, LARS Technical Report 111579 are located in the stata of Parana. Their precise geographic location cannot be plotted on the World Soil Map because map detail is insufficient to locate reference points given in the soil description. However, their general location appears to be within the LTX R/B map unit. These soils are not known to occur in the continental United States. Similar soils occur in Hawaii and Puerto Rico.

Conclusion

In conclusion, the procedure described here whereby the dominant soils of World Soil Map units were taxonomically classified provides a method for selecting similar U.S. soil series. The classifications given are the most probable consistent with available physical and chemical data for the soils in the map units. Reliability of the classifications given is more reliable at the higher levels, ex. subgroup - Typic Argiustolls than at the series level.

In general, there is moderately high similarity between the soils of the study area and the U.S. in the thermic region. In the hyperthermic region, there is more similarity in poorly and very poorly drained soils than in well drained soils. Overall, the similarity of soils in the study area and the U.S. in the hyperthermic region is moderately low. Isohyperthermic soils are not currently recognized in the continental U.S. Some similar isohyperthermic soils occur in Puerto Rico and Hawaii.

Major land resource areas given for the World Soil Map units can be used to identify broad geographic areas in the U.S. where similar soils most likely occur. Estimated acreage of the units can be used to compare the relative extent of the units.

Precise location of the Brazilian soils reported in the LARS study cannot be made on the soil maps because map detail is insufficient to locate reference points given in the soil descriptions. Soils similar to these are not known to occur in the continental United States.

References

1. FAO - UNESCO, Soil Map of the World, Vol. IV, South America, 1971.
2. United States Department of Agriculture, 1975. Soil Taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conservation Service, U.S. Dept. Agric. Handb. 436, 754 pp., illus.
3. United States Department of Agriculture, Unpublished World Soil Map unit descriptions, 1970.
4. United States Department of Agriculture, 1965. Land Resource Regions and Major Land Resource Areas of the United States, Soil Conservation Service, Agriculture Handbook 296, 82 pp.
5. United States Department of Agriculture - Soil Conservation Service, 1976. Unpublished soil moisture regimes developed from the extended record of month-by-month precipitation and PE normals.
6. World Atlas of Agriculture, 1969. Committee for the World Atlas of Agriculture, Institute Geographico De Agostini - Novara.

Figure 1. Location of study area in Brazil and approximate location of soil moisture and temperature regions.

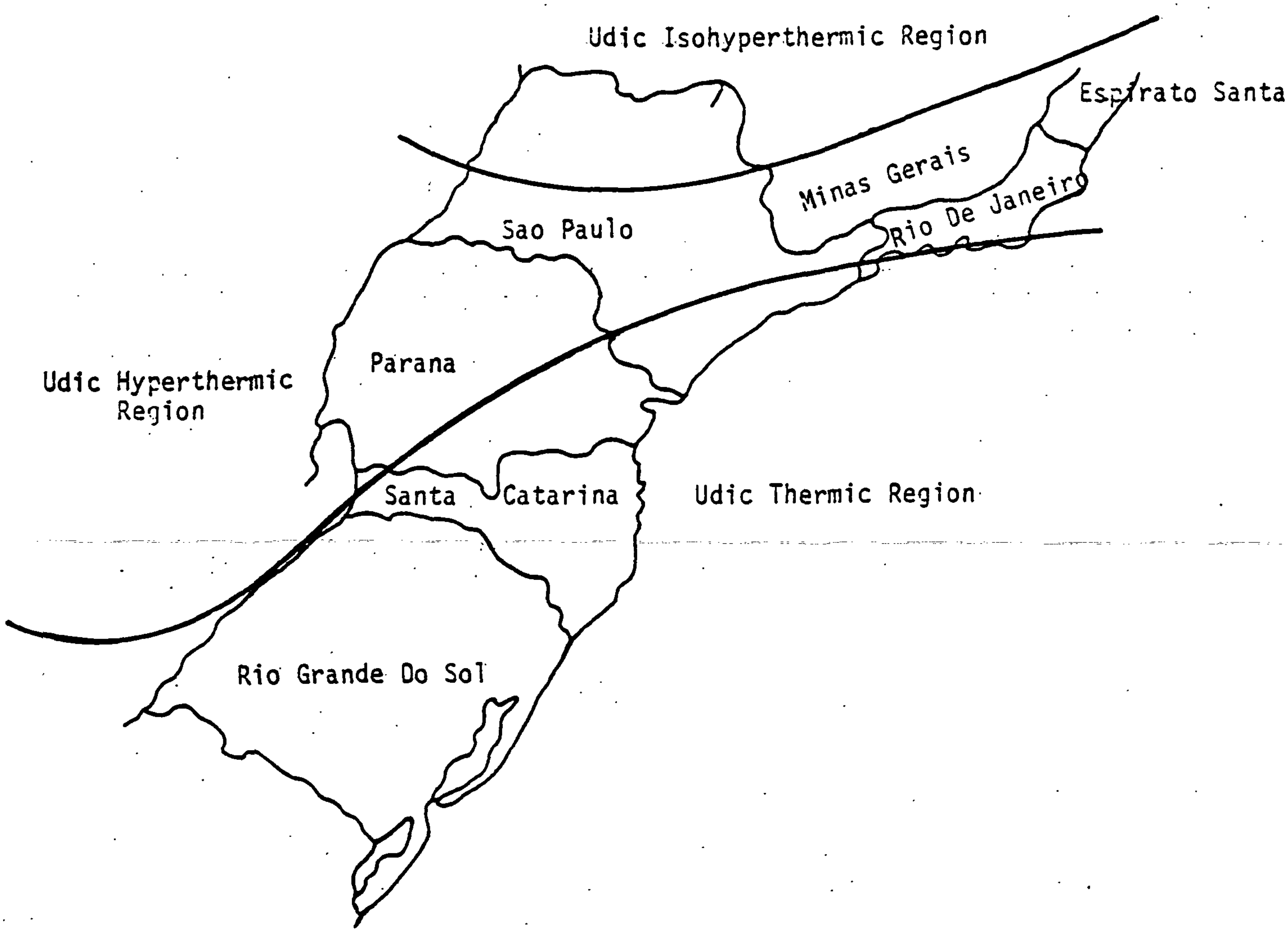
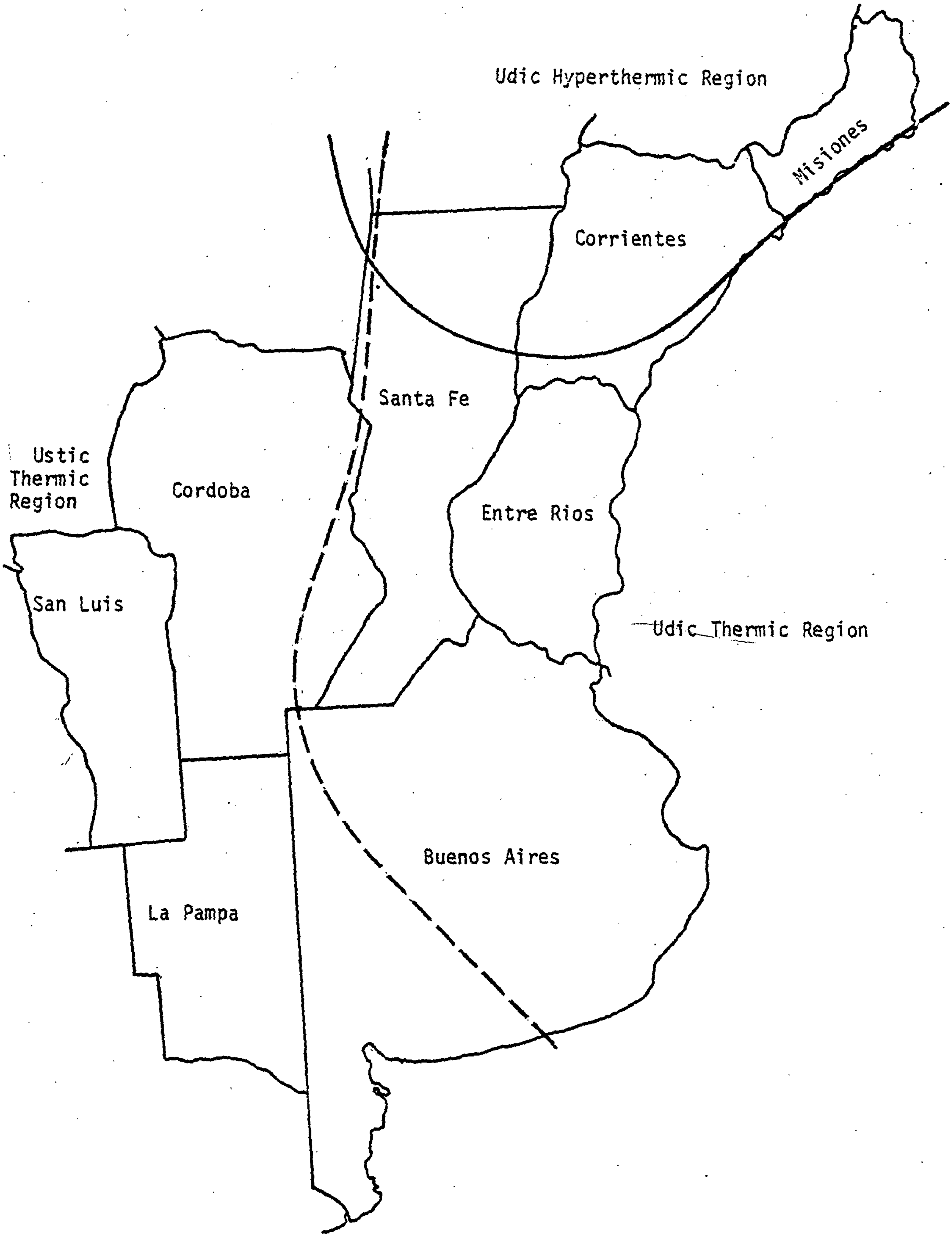


Figure 2. Location of study area in Argentina and approximate location of soil moisture and temperature regions.



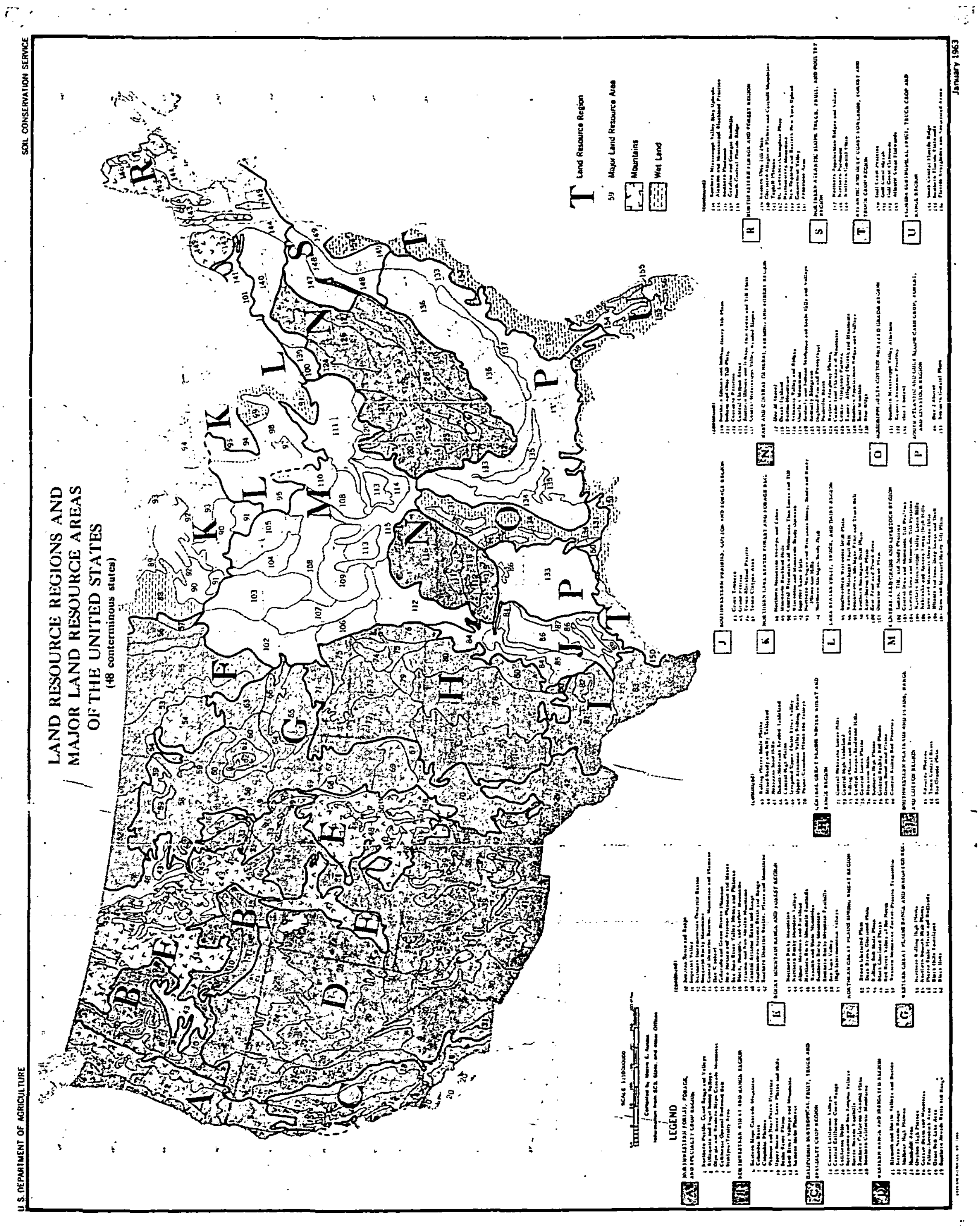


Figure 3. Land Resource Regions and Major Land Resource Areas of the United States (48 conterminous states)

Table 1 a. Estimated acreage by soil moisture and temperature regions, of World Soil Map units occurring in the state of Buenos Aires, Argentina

USTIC THERMIC REGION 9,771,000 hectares

WSM Unit	Hectares
A_N - A_S	327,000
Bg	1,048,000
B R/TS	65,000
B_S R/TS	1,016,000
B_{TS}	16,000
$CT^{\underline{M}}$	229,000
CT/R/U	180,000
CT R/TS	115,000
CT_S	2,346,000
CT U/L	3,371,000
CT_S-S_D	82,000
CT_S-SK	225,000
PCH_{LA}-W	327,000
SB	33,000
SD	16,000
SK	65,000
SM	245,000
SRg	65,000

UDIC THERMIC REGION 20,931,000 Hectares

WSM Unit	Hectares
AH	573,000
CH H/C	229,000
CH_S	2,177,000

USN Unit	Hectares
CH U/L	13,845,000
CH_S-S_S	16,000
PCH_{LA}	426,000
PCH U/L-SK	33,000
PCH_{LA}-W	917,000
PCH U/L-W	638,000
SB	82,000
WP	1,995,000

Table 1 b. Estimated acreage by soil moisture and temperature, regions of World Soil Map units occurring in the state of Cordoba, Argentina

USTIC THERMIS REGION 12,366,000 Hectares

WSM Unit	Hectares
Bf	414,000
B DF/D	207,000
B H/C	172,000
$B^{\underline{M}}$	638,000
B R/C	138,000
B_S	448,000
B_U	52,000
CT H/C	466,000
CT_{LA}	224,000
CT R/U	17,000
CT^S	811,000
CT_S	3,967,000
CT U/L	1,190,000
CT_S-SK	3,156,000
RM_D	207,000
SK	259,000

UDIC THERMIC REGION 4,450,000 Hectares

WSM Unit	Hectares
CH_{LA}	414,000
PCH_{LA}-SK	2,225,000
PCH U/L-SK	1,811,000

Table 1 c. Estimated acreage by soil moisture and temperature regions of World Soil Map units occurring in the state of Corrientes, Argentina

UDIC THERMIC REGION	118,000 Hectares
WSM Unit	Hectares
PR R/U	17,000
RL H/B	101,000
UDIC HYPERTHERMIC REGION	8,772,000 Hectares
WSM Unit	Hectares
A_H	439,000
G-HB	1,957,000
M	1,046,000
RL R/B	169,000
RYP R/TS	658,000
RYP R/sd-M	2,310,000
RYP T/A-M	1,704,000
RYP_S T/A-M	489,000

Table 1 d. Estimated acreage by soil moisture and temperature regions of World Soil Map units occurring in the state of Entre Rios, Argentina

UDIC THERMIC REGION 7,833,000 Hectares

WSM Unit	Hectares
A_H	1,653,000
A_N	50,000
CH_L T/A	534,000
CH R/L	5,345,000
RYP R/Sd-M	100,000
SG	84,000
SM	67,000

Table 1 e. Estimated acreage by soil moisture and temperature regions of World Soil Map units occurring in the state of La Pampa, Argentina.[1)]

USTIC THERMIC REGION 9,137,000 Hectares

WSM Unit	Hectares
A_N-A_S	129,000
Bg	1,306,000
B H/C	16,000
B R/RS	210,000
B_S	1,435,000
B_{TS}	81,000
B_S-S_D	3,032,000
CTg	129,000
CT_S	1,734,000
CT R/S	16,000
CT U/L	65,000
CT_S-S_D	758,000
CT_S- SK	48,000
SK	16,000
SRg	97,000
SR_S	65,000

1) That part east of longitude 66.

Table 1 F. Estimated acreage, by soil moisture and temperature regions, of World Soil Map units occurring in the state of Misiones, Argentina.

UDIC HYPERTHERMIC REGION 3,043,000 Hectares

WSM Unit	Hectares
LR H/S	298,000
LR R/U	368,000
PR R/U	53,000
RL H/B	1,149,000
RL R/B	1,070,000
RZ R/B	105,000

Table 1 g. Estimated acreage by soil moisture and temperature regions, of World Soil Map units occurring in the state of San Luis, Argentina.

USTIC THERMIC REGION 7,692,000 Hectares

WSM Unit	Hectares
A_N-A_S	394,000
$B^{\underline{M}}$	269,000
B DF/D	466,000
B H/C	307,000
B H/TS	143,000
B_S	2,294,000
B_S-S_D	1,901,000
CT H/C	34,000
CT^S	377,000
CT_S	1,381,000
RM_D	18,000
SK	108,000

Table 1 h. Estimated acreage, by soil moisture and temperature regions, of World Soil Map units occurring in the state of Santa Fe, Argentina.

USTIC THERMIC REGION	17,000 Hectares
WSM Unit	Hectares
CT_S-SK	17,000
UDIC THERMIC REGION	8,009,000 Hectares
WSM Unit	Hectares
A_H	618,000
CH_{LA}	918,000
CH U/L	1,951,000
CH_S	985,000
CT-SK	17,000
PCH_{LA}-SK	2,969,000
PCH U/L-SK	551,000
USTIC HYPERTHERMIC REGION	400,000 Hectares
WSM Unit	Hectares
B_U	100,000
CT_{LA}	300,000
UDIC HYPERTHERMIC REGION	5,057,000 Hectares
WSM Unit	Hectares
A_H	236,000
CT-SK	978,000
PCH_{LA}-SK	2,629,000
RB_U	607,000
RB_U-SK	236,000
SK	371,000

Table 2 a. Estimated acreage, by soil moisture and temperature regions of World Soil Map units accurring in the state of Espirato Santa, Brazil. [1)]

UDIC HYPERTHERMIC REGION 17,097,000 Hectares

WSM Unit	Hectares
$LR\underline{M}$	16,815,000
LR R/S	40,000
LR R/U	186,000
$SM\text{-}A_{HS}$	56,000

1) That part below Latitude 20.

Table 2 b. Estimated acreage, by soil moisture and temperature regions, of World Soil Map units occurring in the state of Minas Gerais, Brazil 1)

UDIC HYPERTHERMIC REGION	6,000,000 Hectares
WSM Unit	Hectares
LR$\underline{M}$	2,710,000
LR H/C	3,290,000
UDIC ISOHYPERTHERMIC REGION	4,677,000 Hectares
WSM Unit	Hectares
LR$\underline{M}$	1,080,000
LR H/C	3,581,000
LTX R/B	16,000

1) That part below latitude 20.

Table 2 c. Estimated acreage, by soil moisture and temperature regions, of World Soil Map units accurring in state of Parana, Brazil

UDIC THERMIC REGION 7,513,000 Hectares

WSM Unit	hectares
A_H	53,000
$LR^{\underline{M}}$	1,081,000
LR H/C	248,000
LTX R/B	1,170,000
RZ H/B	833,000
RZ R/B	1,807,000
RZ R/S	2,321,000

UDIC HYPERTHERMIC REGION 12,387,000 Hectares

WSM Unit	hectares
A_H	169,000
LTX R/B	6,255,000
RL R/B	44,000
RZ H/B	177,000
RZ R/B	2,960,000
RZ R/S	2,782,000

Table 2 d. Estimated acreage, by soil moisture and temperature regions, of World Soil Map units occurring in state of Rio Grande Do Sol, Brazil

UDIC THERMIC REGION 26,800,000 Hectares

WSM unit	hectares
A_H-A	309,000
G-HB	1,226,000
LR H/S	124,000
LR R/U	441,000
$LR^{\underline{M}}$	664,000
PR R/S	44,000
RG_{fu}	740,000
RG R/B	2,433,000
RL H/B	1,323,000
RL R/B	185,000
RYP H/C	1,623,000
RZ H/B	2,010,000
RZ R/B	4,497,000
RZ R/S	3,615,000
RZ RH/C	7,433,000
SB	71,000
SM-A_{HS}	62,000

Table 2 e. Estimated acreage, by soil moisture and temperature regions, of World Soil Map units accurring in state of Rio DeJaneiro, Brazil.

UDIC HYPERTHERMIC REGION 4,200,000 Hectares

WSM Unit	Hectares
A_H	72,000
LA T/A	129,000
$LR^{\underline{M}}$	2,680,000
LR H/C	531,000
LR R/U	209,000
SM-A_{HS}	579,000

Table 2 f. Estimated acreage, by soil moisture and temperature regions, of World Soil Map units occurring in state of Sao Paulo, Brazil

UDIC THERMIC REGION 2,790,000 Hectares

WSM Unit	hectares
A_H	46,000
$LR^{\underline{M}}$	1,648,000
LR H/C	268,000
LR R/U	15,000
RZ H/B	522,000
$RM\text{-}A_{HS}$	291,000

UDIC HYPERTHERMIC REGION 8,249,000 Hectares

WSM Unit	hectares
LA T/A	230,000
LF_S R/C	176,000
LF_S R/Sd	146,000
$LR^{\underline{M}}$	1,089,000
LR H/C	1,763,000
LR R/C	1,610,000
LTX R/B	2,453,000
RZ R/S	782,000

UDIC ISOHYPERTHERMIC REGION 13,661,000 Hectares

WSM Units	hectares
A_H	31,000
LF_S R/C	9,690,000
LR H/C	169,000
LR R/C	84,000
LTX R/B	3,687,000

Table 2 g. Estimated acreage, by soil moisture and temperature regions, of World Soil Map units occurring in state of Santa Catarina, Brazil

UDIC THERMIC REGION 9,500,000 Hectares

WSM Unit	hectares
A_H	207,000
G-HB	391,000
$LR^{\underline{M}}$	2,558,000
RL H/B	128,000
RL R/B	64,000
RZ H/B	677,000
RZ R/B	3,387,000
RZ R/S	1,562,000
RZ RH/C	526,000

Table 3. Taxonomic Classification of Dominant Soils in World Soil Map Units Occuring in Selected Argentina States With Estimated Acreage of Units and Representative U.S. Series With Major Land Resource Areas [1/]

WSM Unit	Estimated Acreage (Thousand Hectares)	Taxonomic Classification	Representative Series	Major U.S. Land Resource Area(s)
A_H	2,844	Typic Fluvaquents, fine-silty,mixed, acid, thermic	Rosebloom	134
		Typic Fluvaquents, fine, montmorillonitic, acid, thermic	--	134[2/]
	675	Typic Fluvaquents, fine-silty, mixed, acid, hyperthermic	--	150[2/]
		Typic Fluvaquents, fine, mortmorillonitic, nonacid, hyperthermic	Palacedo	150
A_N	50	Typic Udifluvents, fine-loamy, mixed, nonacid, thermic	Congaree	133
A_N-A_S	850			
A_N part		Typic Ustifluvents, fine-loamy, mixed (calcareous), thermic	Colorado, Energy	78,84,85
		Typic Ustifluvents, coarse-loamy, mixed (calcareous), thermic	Santo, Yahola	78,80
		Ustic Torrifluvents, fine-loamy, mixed (calcareous), thermic	--	70[2/]
		Ustic Torrifluvents, coarse-loamy, mixed (calcareous), thermic	San Jose	70
A_N part		Typic Salorthids, fine-loamy, mixed, thermic	Stutzville	78,84,85
B DF/D	673	Aridic Argiustolls, fine-loamy over sandy or sandy skeletal, mixed, thermic	Brenda	42
		Aridic Argiustolls, fine-loamy, mixed, thermic	--	41,42[2/]
B_f	414	Aridic Argiustolls, fine, mixed, thermic	Kinkead, Musquiz	42
		Aridic Argiustolls, fine, montmorillonitic, thermic	Sontag, Wampoo	41
B_g	2,354	Aridic Haplustolls, loamy-skeletal, mixed, thermic	--	42[2/]
		Aridic Argiustolls, loamy-skeletal, mixed, thermic	Hurds, Earp, Eicks	41,42

Table 3. Taxonomic Classification of Dominant Soils in World Soil Map Units Occuring in Selected Argentina States With Estimated Acreage of Units and Representative U.S. Series With Major Land Resource Areas[1/]

WSM Unit	Estimated Acreage (Thousand Hectares)	Taxonomic Classification	Representative Series	Major U.S. Land Resource Area(s)
B H/C	495	Lithic Haplustolls, loamy, mixed, thermic	Shidler, Renish	78,86,112
B H/TS	143	Entic Haplustolls, loamy, mixed, thermic, shallow	Acme, Cornick	78
$B^{\underline{M}}$	907	Lithic Haplustolls, loamy-skeletal, mixed, thermic	Brewster, Eckert, Kiti	42,82,85
		Lithic Haplustolls, loamy-skeletal, siliceous, thermic	Woodford	85
B R/C	138	Aridic Argiustolls, loamy-skeletal, mixed, thermic	Hurds, Earp, Eicks	42
		Aridic Argiustolls, fine-loamy, mixed, thermic	---	42[2/]
B R/TS	275	Aridic Haplustolls, coarse-loamy, mixed, thermic	---	77,78[2/]
		Aridic Haplustolls, fine-loamy, mixed, thermic	Paloduro, Zita	77,78
		Aridic Argiustolls, coarse-loamy, mixed, thermic	---	77[2/]
		Aridic Argiustolls, fine, loamy, mixed, thermic	---	77
B_S	5,193	Typic Torripsamments, mixed, thermic	Bluepoint, Brazito, and others	42
		Typic Torripsamments, siliceous, thermic	Kermit	42
B_S-S_D	4,933			
B_S part		Typic Torripsamments, mixed, thermic	Bluepoint, Brazito and others	42
		Typic Torripsamments, siliceous, thermic	Kermit	42
S_D part		Not classified	Sand dunes	
B_{TS}	97	Aridic Haplustolls, fine-loamy, mixed, thermic	Paloduro, Zita	77,78
		Aridic Argiustolls, fine-loamy, mixed, thermic	---	77,78[2/]
B_U	52	Typic Argiustolls, fine-loamy, mixed, thermic	Ost	78,79,80
		Typic Haplustolls, fine-loamy, mixed, thermic	Velow	80
	100	Typic Argiustolls, fine-loamy, mixed, hyperthermic	Tela, Pernitas and others	83
		Typic Haplustolls, fine-loamy, mixed, hyperthermic	---	83[2/]

Table 3. Taxonomic Classification of Dominant Soils in World Soil Map Units Occuring in Selected Argentina States With Estimated Acreage of Units and Representative U.S. Series With Major Land Resource Areas 1/

WSM Unit	Estimated Acreage (Thousand Hectares)	Taxonomic Classification	Representative Series	Major U.S. Land Resource Area(s)
CH H/C	229	Typic Argiudolls, coarse-loamy, mixed, thermic, shallow	---	112[2/]
$CH^{\dagger}_{LA}$	1,332	Cumlic Hapludolls, fine-loamy, mixed, thermic	Cannon, Gowker, Bowton, Staser	87,122,123 128,133
CH_L T/A	534	Typic Argiudolls, fine-loamy, mixed, thermic	Fitzhugh, Okay	85,112
CH R/L	5,345	Typic Argiudolls, fine-silty, mixed, thermic	Catoosa, Mason, Deepwater	85,112
CH_S	3,162	Typic Argiudolls, coarse-loamy, mixed, thermic	---	85,112[2/]
CH U/L	15,796	Typic Argiudolls, fine-silty, mixed, thermic	Catoosa, Mason, Deepwater	85,112
CH_S-SS	16			
CH_S part		Typic Argiustolls, coarse-loamy, mixed, thermic	---	85,112
SS part		Not classified	Sand dunes	
CTg	129	Typic Haplustolls, loamy-skeletal, mixed, thermic	---	80[2/]
CT H/C	500	Typic Haplustolls, fine-loamy, mixed, thermic, shallow	---	80[2/]
CT_{LA}	224	Typic Haplustolls, fine-loamy, mixed, thermic	Velow	80
		Typic Argiustolls, fine-loamy, mixed, thermic	Ost	78,79,80
	300	Typic Haplustolls, fine-loamy, mixed, hyperthermic	---	83[2/]
		Typic Argiustolls, fine-loamy, mixed, hyperthermic	Prenites, Tela and others	83
$CT^{\underline{M}}$	229	Lithic Haplustolls, loamy, mixed, thermic	Renish, Shidler	78,86,112
CY R/S	16	Typic Haplustolls, fine, mixed, thermic	Missler	
		Typic Argiustolls, fine, mixed, thermic	Luckenback, Rowden	78,81,82,85

Table 3. Taxonomic Classification of Dominant Soils in World Soil Map Units Occuring in Selected Argentina States With Estimated Acreage of Units and Representative U.S. Series With Major Land Resource Areas 1/

WSM Unit	Estimated Acreage (Thousand Hectares)	Taxonomic Classification	Representative Series	Major U.S. Land Resource Area(s)
CT R/U	197	Typic Haplustolls, fine-loamy, mixed, thermic	Velow	80
		Typic Argiustolls, fine-loamy, mixed, thermic	Ost	78,79,80
CT R/TS	115	Typic Haplustolls, fine, mixed, thermic	Missler	72,73,78
		Typic Argiustolls, fine, mised, thermic	Luckenback, Rowden	78,81,82,85
CT_S	9,428	Typic Haplustolls, coarse-loamy, mixed, thermic	Gerlane	80
CT^S	1,188	Typic Haplustolls, loamy, mixed, thermic, shallow	Loco, Lucien	80
CT U/L	4,626	Typic Haplustolls, fine-silty, mixed, thermic	---	78[2]
		Typic Argiustolls, fine-silty, mixed, thermic	Carey	78
CT_S-S_D	840			
CT_S part		Typic Haplustolls, coarse-loamy, mixed, thermic	Gerlane	80
S_D part		Not classified	Sand dunes	
CT-SK				
CT part	17	Typic Haplustolls, coarse-loamy, mixed, thermic	Gerlene	80
		Typic Hapludolls, coarse-loamy, mixed, thermic	---	80[2]
	978	Typic Haplustolls, coarse-loamy, mixed, hyperthermic	---	81,83[2]
		Typic Hapludolls, coarse-loamy, mixed, hyperthermic	---	81,83[2]
SK part		Typic Salorthids, fine-loamy, mixed, thermic	Stutzville	80,81,83
		Typic Salorthids, fine-loamy, mixed, hyperthermic	Arrada	83,150
CT_S-SK	3,446			
CT_S part		Typic Haplustolls, coarse-loamy, mixed, thermic	Gerlane	80
SK part		Typic Salorthid, fine-loamy, mixed, thermic	Stutzville	80

Table 3. Taxonomic Classification of Dominant Soils in World Soil Map Units Occuring in Selected Argentina States With Estimated Acreage of Units and Representative U.S. Series With Major Land Resource Areas 1/

WSM Unit	Estimated Acreage (Thousand Hectares)	Taxonomic Classification	Representative Series	Major U.S. Land Resource Area(s)
G-HB	1,957			
G part		Typic Albaqualfs, fine, mixed, hyperthermic	Eureka	138,154
		Typic Albaqualfs, fine, montmorillonitic, hyperthermic	Paisley	138,154
HB part		Histic Humaquepts, fine-loamy, siliceous, hyperthermic	---	154,155 2/
LR H/S	298	Tropetic Haplorthox, fine-loamy, oxidic, thermic	---	--- 3/
LR R/U	368	Tropetic Haplorthox, fine-loamy, oxidic, thermic	---	--- 3/
M	1,046	Typic Medisaprists, evic, hyperthermic	Terra Ceoz	148,154,155,156
		Typic Medihemists, evic, hyperthermic	Everglades	154,155,156
		Typic Argiaquolls, fine-loamy, siliceous, hyperthermic	Chobee	155,156
		Typic Medisaprists, dysic, hyperthermic	Hontoon	155
		Typic Medihemists, hysic, hyperthermic	Istokpoga	155,156 2/
		Typic Umbraquults, fine-loamy, siliceous, hyperthermic	---	154,155 2/
PCH_{LA}	426	Typic Argiabolls, fine, mixed, thermic	Hartwell, Leanna	76,112
PCH_{LA}-SK				
PCH_{LA} part	5,194	Typic Argialbolls, fine, mixed, thermic	Hartwell, Leanna	76,112 2/
	2,629	Typic Argialbolls, fine, mixed, hyperthermic	---	83,150 2/
SK part		Typic Salorthids, fine-loamy, mixed, thermic	Stutzville	150
		Typic Salorthids, fine=loamy, mixed, hyperthermic	Arrada	83,150
PCH U/L-SK	2,395			
PCH U/L part		Typic Argialbolls, fine-loamy, mixed, thermic	Stowell	150
SK part		Typic Salorthids, fine-loamy, mixed, thermic	Stutzville	150
PCH_{LA}-W	1,244			
PCH_{LA} part		Typic Argialbolls, fine, mixed, thermic	Hartwell, Leanna	76,112
W part		Typic Argiaquolls, fine-loamy, mixed, thermic	Stono	133

Table 3. Taxonomic Classification of Dominant Soils in World Soil Map Units Occuring in Selected Argentina States With Estimated Acreage of Units and Representative U.S. Series With Major Land Resource Areas 1/

WSM Unit	Estimated Acreage (Thousand Hectares)	Taxonomic Classification	Representative Series	Major U.S. Land Resource Area(s)
PR R/U	70	Udic Argiustolls, fine-silty, mixed, thermic	Grant, Kingfisher, Vanoss	
RB_U	670	Typic Paleudalfs, coarse-loamy, siliceous, hyperthermic	---	154 2/
		Typic Hapludalfs, coarse-loamy, siliceous, hyperthermic	---	154 2/
RB_U-SK	236			
RB_U part		Typic Paleudalfs, coarse-loamy, siliceous, hyperthermic	---	
		Typic Hapludalfs, coarse-loamy, siliceous, hyperthermic	---	154 2/
SK part		Typic Salorthids, fine-loamy, mixed, hyperthermic	Arrada	83,150
RL H/B	1,250	Typic Hapludults, fine-loamy, siliceous, thermic	Cahabe and others	133
RL R/B	1,070	Rhodic Paleudults, fine-loamy, siliceous, thermic	Pine Flat	133
		Rhodic Paledults, clayey, kaolonitic, thermic	Davidson, Greenville	133,136
	169	Rhodic Paleudults, fine-loamy, siliceous, hyperthermic	---	154 2/
		Rhodic Paleudults, clayey, kaolonitic, hyperthermic	---	154 2/
RM_D	225	Lithic Ustorthents, loamy, carbonitic, thermic	Maloterre	85
		Lithic Haplustalfs, loamy, mixed, thermic	Kokernot	42
RYP R/TS	658	Typic Paleudults, coarse-loamy, siliceous, hyperthermic	---	154 2/
		Typic Paleudults, coarse-silty, mixed, hyperthermic	---	154 2/
RYP R/Sd-M				
RYP R/Sd part	100	Typic Paleudults, clayey, kaolonitic, thermic	Faceville and others	133
	2,310	Typic Paleudults, clayey, kaolonitic, hyperthermic	---	154 2/
M part		Typic Medisaprists, evic, thermic	Hobonny, Maurepas	
		Typic Medihemists, evic, thermic	Kingsland	153
		Typic Argiaquolls, fine-loamy, mixed, thermic	Stono	133

Table 3. Taxonomic Classification of Dominant Soils in World Soil Map Units Occuring in Selected Argentina States With Estimated Acreage of Units and Representative U.S. Series With Major Land Resource Areas 1/

WSM Unit	Estimated Acreage (Thousand Hectares)	Taxonomic Classification	Representative Series	Major U.S. Land Resource Area(s)
M part		Typic Medisaprists, dysic, thermic	Dorovan, Dare, Pungo	133,153
		Typic Medihemists, dysic, thermic	Dasher	133,153
		Typic Umbraquults, fine=loamy, silicenous, thermic	Paxville	133,153
		Typic Medisaprists, evic, hyperthermic	Terra Ceiz	138,154,155,156
		Typic Medihemists, evic, hyperthermic	Everglades	154,155,156
		Typic Argiaquolls, fine-loamy, siliceous, hyperthermic	Chobee	155,156
		Typic Medisaprists, dysic, hyperthermic	Hontoon	155
		Typic Medihemists, evic, hyperthermic	Istokpoga	155,156
		Typic Umbraquults, fine-loamy, siliceous, hyperthermic	---	154,155 2/
RYP T/A-M	1,704			
RYP T/A part		Typic Paleudults, clayey, kaolonitic, hyperthermic	---	154,155 2/
M part		See M part of RYP R/Sd-M, hyperthermic part		
RYP_s T/A-M	489			
RYP_s T/A part		Psammentic Paleudults, sandy, siliceous, hyperthermic	---	154 2/
M part		See M part of RYP R/SD-M, hyperthermic part		
RZ R/B	105	Rhodic Paleudalts, fine, mixed, thermic	Fayetteville	117
SB	115	Not classified	Beaches	
S_D	16	Not classified	Sand dunes	
SG	84	Typic Quartzipsamments, thermic, coated	Lakeland, Alaga and others	133,134, 152,153
SK	448	Typic Salorthids, fine-loamy, mixed, thermic	Stutzville	
	371	Typic Salorthids, fine-loamy, mixed, hyperthermic	Arrada	80,150

Table 3. Taxonomic Classification of Dominant Soils in World Soil Map Units Occuring in Selected Argentina States With Estimated Acreage of Units and Representative U.S. Series With Major Land Resource Areas 1/

WSM Unit	Estimated Acreage (Thousand Hectares)	Taxonomic Classification	Representative Series	Major U.S. Land Resource Area(s)
SM	312	Typic Sulfihemists, euic, thermic	Handsboro	153
		Typic Sulfiaquents, fine, mixed, nonacid, thermic	Bohicket, Capers	153
		Typic Hydraquents, very-fine, mixed, acid, thermic	Levy	153
SRg	162	Ustollic Camborthids, loamy-skeletal, mixed, thermic	Gallegos, Gilland	42,70
SR_S	65	Typic Ustipsamments, mixed, thermic	Crevasse	133
WP	1,995	Typic Humaquepts, fine, montmorillonitic, nonacid, thermic	---	---2/
		Typic Argiabolls, fine-loamy, mixed, thermic	Stowell	150

1/ States of Buenos Aires, Cordoba, Corrientes, Entre Rios, La Pampa*, Missiones, San Luis, and Sante Fe. *That part east of longitude 66.

2/ Soils with this classification have not been described in the U.S. The MLR(s) given are the most probable in which they may occur.

3/ These soils do not occur in the continental U.S. Similar soils occur in Hawaii and Puerto Rico.

Table 4. Taxonomic Classification of Dominant Soils in World Soil Map Units Occuring in Selected Brazilian States [1] With Estimated Acreage of Units and Representative U.S. Series With Major Land Resource Areas

WSM Unit	Estimated Acreage (Thousand Hectares)	Taxonomic Classification	Representative Series	Major U.S. Land Resource Area(s)
A_H	306	Typic Fluvaquents, fine-silty, mixed, acid, thermic.	Rosenbloom	134
	241	Typic Fluvaquents, fine, montmorillonitic, nonacid hyperthermic.	Palacedo	150
	31	Tropic Fluvaquents, fine, mixed, acid, isohyperthermic.	Fortuna	--[2]
A_H-A	309			
AH part		Typic Fluvaquents, fine-silty, mixed, acid, thermic	Rosenbloom	134
A part		Typic Udifluvents, coarse-silty, mixed, acid, thermic	Vicksburg	131,134
G-HB	1,617			
G part		Typic Albaqualfs, fine, mixed, thermic	Meggett, Cherokee	112, 133, 153
		Typic Albaqualfs, fine, montmorillonitic, thermic	Alusa, Falba	87, 133
HB part		Histic Humaquepts, fine-loamy, mixed, nonacid thermic	Wasda	153
LA T/A	359	Typic Haplohumox, fine-loamy, oxidic, hyperthermic	--	--[2]
		Typic Haplohumox, clayey, kaolonitic, hyperthermic	--	--[2]
LF_SR/C	176	Plinthic Paleudults, fine-loamy, mixed hyperthermic	--	--[2]
	9,690	Plinthic Tropudults, fine-loamy, siliceous, isohyperthermic	--	--[2]
LF_SR/Sd	146	Plinthic Paleudults, fine-loamy, siliceous, hyperthermic	--	--[2]
LR H/C	516	Tropetic Haplorthox, clayey, kaolonitic, thermic	--	--[2]
	5,584	Tropetic Haplorthox, clayey, kaolonitic, hyperthermic	--	--[2]
	3,750	Tropetic Haplorthox, clayey, kaolonitic, isohyperthermic	Coto	--[2]
LR H/S	124	Tropetic Haplorthox, fine-loamy, oxidic, thermic	--	--[2]
$LR^{\underline{M}}$	5,951	Lithic Udorthents, clayey, mixed, acid, thermic	--	--[2]
	23,294	Lithic Udorthents, clayey, kaolonitic, acid, hyperthermic	--	--[2]
	1,080	Lithic Udorthents, clayey, kaolonitic, acid isohyperthermic	--	--[2]

Table 4. Taxonomic Classification of Dominant Soils in World Soil Map Units Occuring in Selected Brazilian States[1] With Estimated Acreage of Units and Representative U.S. Series With Major Land Resource Areas

WSM Unit	Estimated Acreage (Thousand Hectares)	Taxonomic Classification	Representative Series	Major U.S. Land Resource Area(s)
LR R/C	1,610	Typic Haplorthox, fine-loamy, oxidic, hyperthermic	--	--[2]
		Typic Haplorthox, clayey, kaolonitic, hyperthermic	--	--[2]
	84	Typic Haplorthos, fine-loamy, oxidic, isohyperthermic	--	--[2]
		Typic Haplorthox, clayey, kaolonitic, isohyperthermic	Delicas	--[2]
LR R/S	40	Typic Haplorthox, fine-loamy, siliceous, hyperthermic	--	--[2]
		Typic Acrothox, fine-loamy, siliceous, hyperthermic	--	--[2]
LR R/U	671	Typic Haplorthox, fine-loamy, oxidic, thermic	--	--[2]
		Typic Haplorthox, clayey, kaolonitic, thermic	--	--[2]
LTX R/B	1,170	Tropetic Eutrorthox, clayey, kaolonitic, thermic	--	--[2]
	8,708	Tropetic Eutrorthox, clayey, kaolonitic, hyperthermic	--	--[2]
	3,703	Tropetic Eutrorthox, clayey, kaolonitic, isohyperthermic	--	--[2]
PR R/X	44	Udic Arguistolls, fine-silty, mixed, thermic	Grant, Kingfisher Vanoss	80
RG_{fu}	740	Typic Pelluderts, fine, montmorillonitic, thermic	Lake Charles, Hollywood	128,150
RG R/B	2,433	Typic Pelluderts, fine, montmorillonitic, thermic	Lake Charles, Hollywood	128,150
RL H/B	1,451	Typic Hapludults, fine-loamy, siliceous, thermic	Nectar, Vaucluse	133,137
RL R/B	249	Rhodic Paleudults, fine-loamy, siliceous, thermic	Red Bay, Lucedale	133
	44	Rhodic Paleudults, fine-loamy, siliceous, hyperthermic	--	154[3]
RYP H/C	1,623	Typic Hapludults, fine-loamy, siliceous, thermic	Cowarts, Marvyn	133
RZ H/B	4,042	Typic Hapludalfs, fine, mixed, thermic	Bradyville, Mimosa	123,128
	177	Typic Hapludalfs, fine, mixed, hyperthermic	Williston	138,154
RZ R/B	9,691	Rhodic Paleudalfs, fine, mixed, thermic	Cumberland, Tadlock	122,123,133
	2,960	Rhodic Paleudalfs, fine, mixed, hyperthermic	--	154[3]

Table 4. Taxonomic Classification of Dominant Soils in World Soil Map Units Occuring in Selected Brazilian States [1] With Estimated Acreage of Units and Representative U.S. Series With Major Land Resource Areas

WSM Unit	Estimated Acreage (Thousand Hectares)	Taxonomic Classification	Representative Series	Major U.S. Land Resource Area(s)
RZ R/S	7,498	Rhodic Paleudalfs, fine-loamy, mixed, thermic	Fayetteville	117
	3,564	Rhodic Paleudalfs, fine-loamy, siliceous, hyperthermic	--	154[3]
RZ RH/C	7,959	Rhodic Paleudalfs, coarse-loamy, siliceous, thermic	--	122,123,133[3]
SB	71	Not classified	Beaches	
SM-A_{HS}	979			
SM part		Typic Sulfihemists, evic, thermic	Handsboro	152
		Typic Sulfiaquents, fine, mixed, nonacid, thermic	Bohicket, Capers	153
		Typic Hydraquents, very-fine, mixed, acid, thermic	Levy	153
A_{HS} part		Typic Fluvaquents, coarse-loamy, siliceous, acid thermic	Bibb	132,152

1/ States of Espirito Santa*, Minas Gerais*, Parana, Rio De Janeiro, Rio Grande Do Sol, Santa Catarina, and Sao Paulo. *That part below latitude 20.

2/ These soils do not occur in the continental U.S. Similar soils occur in Hawaii and Puerto Rico.

3/ Soils with this classification have not been described in the U.S. The MLR(s) given are the most probably in which they may occur.

Table 5. Soil Series Sampled in LARS Technical Report 111579 and Major Land Resource Area(s) in Which They Occur With Corresponding Similar WSM Units.[1]

SOIL SERIES	MRLA(s)	SIMILAR WSM UNITS
Appling	136	RL H/B
		RYP H/C
Bodine	122,126	RYP R/TS
		RYP T/A part of RYP T/A-M
Cecil	136	RL H/B
		RYP H/C
Cumberland	122,123	RZ R/B
		RZ R/S
		RZ RH/C
Elrose	133	RB_U
		RYP R/TS
		RYP R/sd part of RYP R/sd-M
Enders	117,118,128	RL H/B
		RYP H/C
Hidalogo	80	B_{U_S}
		CT^S
		CT_S
		CTg
		CT_{LA}
		CT H/C
		CT R/S
		CT R/U
		CT R/TS
		CT U/L
Kervin	133	RL H/B
		RYP H/C
Linker	117,118	RL H/B
		RYP H/C
Mountview	122	RYP R/TS
		RYP T/A part of RYP T/A-M
Pacolet	136	RL H/B
		RYP H/C
Red Bay	133	RL R/B
Rilla	131	RB_U
		RB_U part of RB_U-SK
		RS H/B
Ruston	133	RYP R/TS
		RYP T/A part of RYP T/A-M
Saffell	133,134	RL H/B
		RYP H/C
Talbott	123,128	RB_U
		RB_U part of RB_U-SK
		RZ H/B
Terra Ceia	138,154, 155,156	M
		M part of RYP R/sd-M
Toquop	30	B_S
		B_S part of B_S-S_D
Trinity	86	RG_{fu}
		RG R/B

Table 5. Soil Series Sampled in LARS Technical Report 111579 and Major Land Resource Area(s) in Which They Occur With Corresponding Similar WSM Units.[1/]

SOIL SERIES	MRLA(s)	SIMILAR WSM UNITS
Willacy	83,150	PR R/S
Zaneis	80,84	PR R/S

1/ The named series and corresponding WSM units are similar at the taxonomic subgroup level.