

Soil and Ecological Sites of the Santa Rita Experimental Range

Abstract: A soil survey and rangeland resource inventory of the Santa Rita Experimental Range (SRER) was conducted by staff from the Tucson office of the Natural Resources Conservation Service (NRCS) during April and May of 1997. Thirty-two soil series and taxadjuncts were mapped on the SRER and delineated in 24 different mapping units. These soils all occur in an Aridic and Ustic moisture regime and span three precipitation zones, and all soils are in the thermic soil temperature regime. Soil series and mapping unit descriptions are provided. The rangeland inventory and the soil map correlate soils into ecological sites and determine the present day status or condition of the sites by comparing present plant communities with potential plant communities as described by NRCS in their technical ecological site descriptions. Eighteen different ecological sites were identified in two Major Land Resource Areas (MLRA 40 and 41) on the SRER, and eight sites were mapped in the 10- to 13-inch precipitation zone of MLRA 40, the Upper Sonoran Desert. Eight sites were mapped in the 12- to 16-inch precipitation zone of MLRA 41, the Southern Arizona Grassland. Two ecological sites were mapped in the 16- to 20-inch precipitation zone of MLRA 41, the Mexican Oak Savannah.

Acknowledgments: GIS data layers for the soils and ecological sites of the SRER were completed by Debbie Angell and Dr. Mitchel P. McClaran of the University of Arizona, School of Renewable Natural Resources (SRNR). Additional maps were provided by Dawn Browning, Graduate Student in SRNR, using the SRNR Advanced Resource Technology (ART) Laboratory facilities. Field work was conducted by Don Breckenfeld, Dan Robinett, Emilio Carrillo, Rob Wilson, Bill Svetlick, and Chuck Peacock of the NRCS. They were assisted by Sue Muir of the University of Arizona SRNR.

Introduction

The soil survey and rangeland resource inventory of the Santa Rita Experimental Range (SRER) were conducted by the Natural Resources Conservation Service staff, Tucson, AZ. The field work was completed during April and May 1997. This is an update of an older soil survey completed in 1971 (Richardson 1971). The information contained in this report will be used by research scientists and range managers for evaluating and utilizing these rangeland resources.

The Cooperative Soil Survey Procedures described and defined in the Soil Survey Manual, Soil Taxonomy, and the National Soils Handbook (Soil Survey Division Staff 1993, 1999, and 1996) were used to classify and describe the soil morphologic properties of the Santa Rita Experimental Range (SRER). The Major Land Resource Areas (MLRA) are defined in U.S. Department of Agriculture (1981), Agricultural Handbook 296, United States Government Printing Office, Washington, DC. Geomorphic landforms definitions as defined in Peterson (1981) and the Soil Survey Division Staff (1996) National Soil Survey Handbook were used.

Thirty-two soil series and taxadjuncts were found on the SRER and delineated in 24 different mapping units (table 1). Taxadjuncts have soil properties that are outside of the recognized soil series by one or more differentiating characteristics of the series. The three taxadjuncts mapped on the SRER could potentially be new soil series if a significant area is eventually

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In: McClaran, Mitchel P.; Ffolliott, Peter F.; Edminster, Carleton B., tech. coords. Santa Rita Experimental Range: 100 years (1903 to 2003) of accomplishments and contributions; conference proceedings; 2003 October 30–November 1; Tucson, AZ. Proc. RMRS-P-30. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Table 1—Soil and ecological map unit legend for the Santa Rita Experimental Range.

Map unit	Soil properties
1	Agustin sandy loam, 0 to 3 percent slopes
2	Arizo-Riverwash complex, 0 to 3 percent slopes
3	Baboquivari-Combate complex, 1 to 5 percent slopes
4	Bodecker-Riverwash complex, 1 to 3 percent slope
5	Budlamp-Woodcutter complex, 15 to 60 percent slopes
6	Caralampi sandy loam, 1 to 8 percent slopes
7	Cave-Rillino-Nahda complex, 1 to 10 percent slopes
8	Chiricahua-Lampshire complex, 3 to 18 percent slopes
9	Combate loamy sand, 1 to 8 percent slopes
10	Combate-Diaspar complex, 1 to 5 percent slopes
11	Hayhook-Bucklebar soils complex, 0 to 3 percent slopes
12	Hayhook-Pajarito complex, 0 to 5 percent slopes
13	Keysto-Riverwash complex, 1 to 3 percent slopes
24	Lampshire-Pantak-Rock outcrop complex, 10 to 60 percent slopes
14	Lampshire-Budlamp-Woodcutter complex, 15 to 60 percent slopes ^a
15	Mabray-Rock outcrop complex, 10 to 60 percent slopes percent slopes
16	Nahda-Rillino complex, 1 to 30 percent slope
17	Oversight fine sandy loam complex, 1 to 3 percent slopes
18	Pinalino-Stagecoach complex, 3 to 15 percent slopes
19	Sasabe-Baboquivari complex, 1 to 8 percent slopes
20	Tombstone complex, 0 to 5 percent slopes
21	Topawa complex, 1 to 8 percent slopes
22	Tubac complex, 0 to 2 percent slopes
23	White House-Eloma complex, 1 to 10 percent slopes

^aSoils in this map unit are taxadjuncts.

recognized. These soils all occur in an Aridic and Ustic soil moisture regime spanning three precipitation zones, and a thermic soil temperature regime (mean annual soil temperature at 50-cm depth is 15 to 22 °C).

Figure 1 presents the soil and ecological map of the SRER. The approximate boundaries of the MLRA's are also noted. Table 2 lists the soil depth, drainage class, and land form for each of the soil series, and table 3 lists the taxonomic classification for each soil series. A brief description of the soil mapping units are included below. The detailed pedon description and soil interpretations for each soil series are available online at <http://az.nrcs.usda.gov> under technical resources, and a report by Breckenfeld and Robinett (1997) provide additional information about the SRER soil and rangeland resources.

Descriptions of Soil Map Unit _____

1 Agustin sandy loam, 0 to 3 percent slopes—Composition of this unit is approximately 80 percent Agustin and 20 percent inclusions. Typical profile of Agustin has a yellowish brown sandy loam 0 to 14 cm with 5 to 15 percent surface gravel (A). (The horizon designations as defined in Soil Survey Division Staff [1993] are noted in parenthesis for the major horizons in each soil series. For example an A horizon is the surface horizon with an enrichment of organic matter, a Bk, Bt, and Bw are subsurface horizons with an accumulation of carbonates, clay, and minimally changed horizon, respectively. The C horizons are unconsolidated parent material, and the R horizon is consolidated bedrock.) The subsoil is a pale brown calcareous sandy loam to coarse sandy loam from 14 to 107 cm (Bw,

Bk). The substratum is a calcareous yellowish brown loam from 107 to 150 cm (Bk).

2 Arizo-Riverwash complex, 0 to 3 percent slopes—Composition of this unit is approximately 65 percent Arizo, 25 percent Riverwash and 10 percent inclusions. Typical profile of Arizo has a yellowish brown gravelly loamy sand 0 to 46 cm with 5 to 15 percent surface gravel and cobbles (A). The subsoil is a yellowish brown very gravelly loamy sand from 46 to 150 cm (C). Riverwash consists of unconsolidated material in the channel of an ephemeral stream, commonly bordered by steep to vertical banks cut into the alluvium (Arizo soil). It is usually dry but can be transformed into a temporary watercourse or a short-lived torrent after a heavy rain within the watershed.

3 Baboquivari-Combate complex, 1 to 5 percent slopes—Composition of this unit is approximately 60 percent Baboquivari, 25 percent Combate, and 15 percent inclusions. Typical profile of Baboquivari has a dark yellowish brown loamy sand 0 to 8 cm with 5 to 10 percent surface gravel (A). The subsoil is a brown coarse sandy loam to reddish brown sandy clay loam from 8 to 150 cm (Bt). Typical profile of Combate has a brown loamy sand 0 to 5 cm with 5 to 15 percent surface gravel (A). The subsoil is a dark brown coarse sandy loam to sandy loam from 5 to 150 cm (A, C).

4 Bodecker-Riverwash complex, 1 to 3 percent slopes—Composition of this unit is approximately 65 percent Bodecker, 25 percent Riverwash, and 10 percent inclusions. Typical profile of Bodecker has a brown loamy sand 0 to 8 cm with 5 to 25 percent surface gravel (A). The subsoil is a brown stratified gravelly sand and very gravelly coarse sand coarse sandy loam to sandy loam from 8 to 150 cm (C).

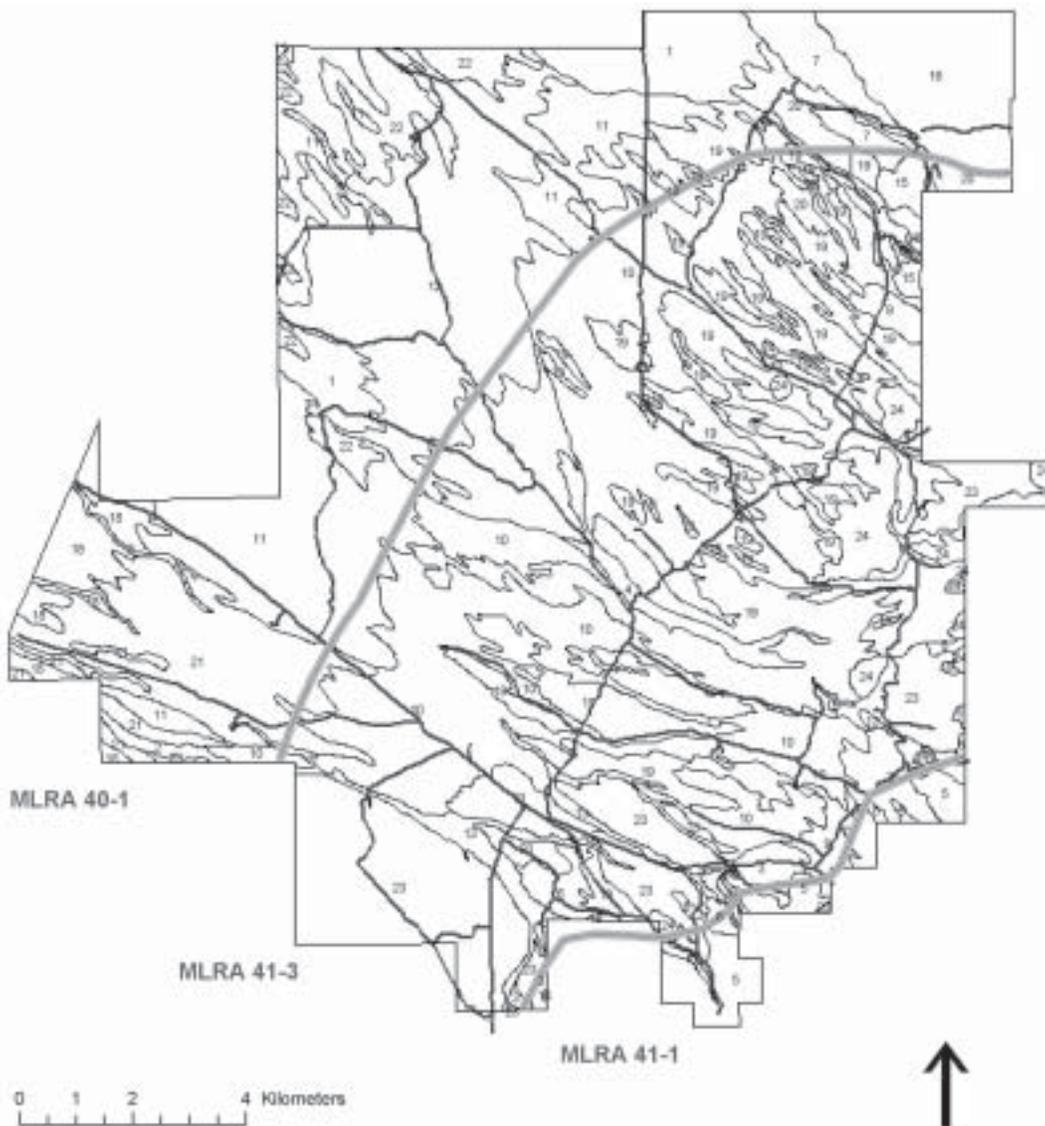


Figure 1—Map of soil and ecological site declinations. this map displays the approximate boundaries of the three MLRAs 40-1, 41-3, and 41-1, and the major roads on the Santa Rita Experimental Range.

Riverwash consists of unconsolidated material in the channel of an ephemeral stream, commonly bordered by steep to vertical banks cut into the alluvium (Bodecker soil). It is usually dry but can be transformed into a temporary water course or a short-lived torrent after a heavy rain within the watershed.

5 Budlamp-Woodcutter complex, 15 to 60 percent slopes—Composition of this unit is approximately 40 percent Budlamp, 30 percent Woodcutter, and 30 percent inclusions. Typical profile of Budlamp has a very dark brown very gravelly sandy loam 0 to 5 cm with 35 to 45 percent surface gravel and cobbles (A). The subsoil is a very dark grayish brown extremely gravelly fine sandy loam dark 5 to 20 cm (C). The next layer is unweathered bedrock at 20 cm (R). Typical profile of Woodcutter has a brown very gravelly fine sandy loam 0 to 5 cm with 35 to 45 percent surface gravel and

cobbles (A). The subsoil is a dark brown to reddish brown very gravelly loam and very gravelly clay loam 5 to 30 cm (Bt). The next layer is unweathered bedrock at 30 cm (R).

6 Caralampi sandy loam, 1 to 8 percent slopes—Composition of this unit is approximately 75 percent Caralampi and 25 percent inclusions. Typical profile of Caralampi has a brown gravelly sandy loam 0 to 15 cm with 5 to 20 percent surface gravel (A). The subsoil is a reddish brown very gravelly sandy clay loam brown coarse sandy loam to a reddish brown extremely cobbly sandy clay loam from 15 to 150 cm (Bt).

7 Cave-Rillino-Nahda complex, 1 to 10 percent slopes—Composition of this unit is approximately 35 percent Cave, 30 percent Rillino, 15 percent Nahda, and 20 percent inclusions. Typical profile of Cave has a brown calcareous gravelly sandy loam 0 to 13 cm (A, Bk) with 30 to

Table 2—Soil depth, drainage class, and geomorphic land forms of 32 soil series mapped on the Santa Rita Experimental Range.

Soil series	Soil depth	Drainage class	Landform
Agustin	Very deep	Well	Fan terrace
Arizo	Very deep	Excessively	Flood plain, Inset fan
Baboquivari	Very deep	Well	Fan terrace
Bodecker	Very deep	Excessively	Flood plain, Inset fan
Bucklebar	Very deep	Well	Fan terrace
Budlamp	Very shallow to shallow	Well	Hills, mountains
Budlamp ^a	Moderately deep	Well	Hills, mountains
Caralampi	Very deep	Well	Fan terrace
Cave	Very shallow to shallow	Well	Fan terrace
Chiricahua	Shallow	Well	Hills, mountains
Combate	Very deep	Well	Alluvial fans
Diaspar	Very deep	Well	Fan terrace
Eloma	Very deep	Well	Fan terrace
Hayhook	Very deep	Well	Fan terrace
Keysto	Very deep	Well	Inset fans, stream terrace
Lampshire	Very shallow to shallow	Well	Hills, mountains
Lampshire*	Moderately deep	Well	Hills, mountains
Mabray	Very shallow to shallow	Well	Hills, mountains
Nahda	Very deep	Well	Fan terrace
Oversight	Very deep	Excessively	Inset fans, stream terrace
Pajarito	Very deep	Well	Fan terrace
Pantak	Very shallow to shallow	Well	Hills, mountains
Pinalino	Very deep	Well	Fan terrace
Rillino	Very deep	Well	Fan terrace
Sasabe	Very deep	Well	Fan terrace
Stagecoach	Very deep	Well	Fan terrace
Tombstone	Very deep	Well	Fan terrace
Topawa	Very deep	Well	Fan terrace
Tubac	Very deep	Well	Basin floor
White House	Very deep	Well	Fan terrace
Woodcutter	Very shallow to shallow	Well	Hills, mountains
Woodcutter ^a	Moderately deep	Well	Hills, mountains

^aAll three soils are taxadjuncts.

40 percent surface gravel. The next layer is an indurated calcium carbonate cemented hardpan from 13 to 25 cm thick (Bkm). Typical profile of Rillino has a pinkish gray sandy loam 10 cm thick with 35 to 40 percent surface gravel (A). The subsoil is a brown to light brown calcareous sandy loam from 10 to 150 cm (Bw, Bk). Typical profile of Nahda has a reddish brown sandy loam 0 to 8 cm with 45 to 55 percent surface gravel and cobbles (A). The subsoil is a dark reddish brown gravelly sandy clay to very gravelly clay from 8 to 61 cm (Bt, Btk). The next layer is a light reddish brown calcareous very gravelly sandy loam from 61 to 87 cm (Bk) and a calcium carbonate cemented hardpan from 87 to 100 cm (Bkm).

8 Chiricahua-Lampshire complex, 3 to 18 percent slopes—Composition of this unit is approximately 60 percent Chiricahua, 20 percent Lampshire, and 20 percent inclusions. Typical profile of Chiricahua has a dark brown cobbly sandy loam 0 to 8 cm with 10 to 35 percent surface

gravel, cobbles, and stones (A). The subsoil is a dark reddish brown very gravelly clay to a gravelly clay loam 8 to 48 cm (Bt). The next layer is weathered bedrock from 48 to 71 cm (Cr) and unweathered bedrock at 71 cm (R). Typical profile of Lampshire has a dark grayish brown very gravelly sandy loam 0 to 20 cm with 15 to 35 percent surface gravel, cobbles, and stones (A, C). The next layer is unweathered bedrock at 20 cm (R).

9 Combate loamy sand, 1 to 8 percent slopes—Composition of this unit is approximately 90 percent Combate and 10 percent inclusions. Typical profile of Combate has a brown loamy sand 0 to 5 cm with 5 to 15 percent surface gravel (A). The subsoil is a dark brown coarse sandy loam to sandy loam from 5 to 150 cm (A, C).

10 Combate-Diaspar complex, 1 to 5 percent slopes—Composition of this unit is approximately 65 percent Combate, 25 percent Diaspar, and 15 percent inclusions.

Table 3—Taxonomic classification of the soil series mapped on the Santa Rita Experimental Range.**Typic Aridic^a: 10- to 12-inch precipitation zone**

Agustin	Coarse-loamy, mixed, superactive, thermic Typic Haplocalcids
Arizo	Sandy-skeletal, mixed, thermic Typic Torriorthents
Bucklebar	Fine-loamy, mixed, superactive, thermic Typic Haplargids
Cave	Loamy, mixed, superactive, thermic, shallow Typic Petrocalcids
Hayhook	Coarse-loamy, mixed, superactive, thermic Typic Haplocambids
Nahda	Clayey-skeletal, mixed, superactive, thermic Typic Petroargids
Pajarito	Coarse-loamy, mixed, superactive, thermic Typic Haplocambids
Pinalino	Loamy-skeletal, mixed, superactive, thermic Typic Calcargids
Rillino	Coarse-loamy, mixed, superactive, thermic Typic Haplocalcids
Stagecoach	Loamy-skeletal, mixed, superactive, thermic Typic Haplocalcids
Topawa	Loamy-skeletal, mixed, superactive, thermic Typic Haplargids
Tubac	Fine, mixed, superactive, thermic, Typic Paleargids

Ustic Aridic^b: 12- to 16-inch precipitation zone

Baboquivari	Fine-loamy, mixed, superactive, thermic Ustic Haplargids
Bodecker	Sandy-skeletal, mixed, thermic, Ustic Torriorthents
Caralampi	Loamy-skeletal, mixed, superactive, thermic Ustic Haplargids
Chiricahua	Clayey, mixed, superactive, thermic, shallow Ustic Haplargids
Combate	Coarse-loamy, mixed, superactive, nonacid, thermic Ustic Torrifluvents
Diaspar	Coarse-loamy, mixed, superactive, thermic Ustic Haplargids
Eloma	Clayey-skeletal, mixed, superactive, thermic Ustic Haplargids
Keysto	Loamy-skeletal, mixed, superactive, nonacid, thermic Ustic Torriorthents
Lampshire	Loamy-skeletal, mixed, superactive, nonacid, thermic Lithic Ustic Torriorthents
Mabray	Loamy-skeletal, carbonatic, thermic Lithic Ustic Torriorthents
Pantak	Loamy-skeletal, mixed, superactive, thermic Lithic Ustic Haplargids
Sasabe	Fine, mixed, superactive, thermic Ustic Paleargids
Tombstone	Loamy-skeletal, mixed, superactive, thermic Ustic Haplocalcids
White House	Fine, mixed, superactive, thermic Ustic Haplargids

Aridic Ustic^c: 16- to 20-inch precipitation zone

Budlamp	Loamy-skeletal, mixed, superactive, thermic Lithic Haplustolls
Budlamp ^d	Loamy-skeletal, mixed, superactive, thermic Aridic Haplustolls
Lampshire ^d	Coarse-loamy, mixed, superactive, thermic Aridic Ustochrepts
Oversight	Loamy-skeletal, mixed, superactive, thermic Aridic Ustochrepts
Woodcutter	Loamy-skeletal, mixed, superactive, thermic Lithic Argiustolls
Woodcutter ^d	Loamy-skeletal, mixed, superactive, thermic Aridic Argiustoll

^aTypic Aridic soils are the soils on the drier end of the aridic moisture regime and are also in thermic temperature regime. Average annual precipitation is 7 to 12 inches.

^bUstic Aridic soils are the soils on the moist end of the aridic moisture regime and are also in thermic temperature regime. Average annual precipitation is 12 to 16 inches.

^cAridic Ustic soils are the soils on the drier end of the ustic moisture regime and are also in thermic temperature regime. Average annual precipitation is 16 to 20 inches.

^dSoils are taxadjuncts.

Typical profile of Combate has a brown loamy sand 0 to 5 cm with 5 to 15 percent surface gravel (A). The subsoil is a dark brown coarse sandy loam to sandy loam from 5 to 150 cm (A, C). Typical profile of Diaspar has a brown loamy sand 0 to 13 cm with 5 to 20 percent surface gravel (A). The subsoil is a brown coarse sandy loam to sandy loam from 13 to 150 cm (Bt).

11 Hayhook-Bucklebar soils complex, 0 to 3 percent slopes—Composition of this unit is approximately 50 percent Hayhook, 40 percent Bucklebar (thin and thick surface), and 10 percent inclusions. Typical profile of Hayhook has a yellowish brown loamy sand 0 to 4 cm with 5 to 15 percent surface gravel (A). The subsoil is a pale brown coarse sandy loam to gravelly coarse sandy loam from 4 to 150 cm (Bw, C). Typical profile of Bucklebar (thin surface) has a brown sandy loam 0 to 8 cm with 5 to 20 percent surface gravel (A). The subsoil is a brown to yellowish red sandy clay loam coarse sandy loam from 8 to 150 cm (Bw, Bt). Typical

profile of Bucklebar (thick surface) has a brown sandy loam 0 to 38 cm with 5 to 15 percent surface gravel (A). The subsoil is a brown to yellowish red sandy clay loam coarse sandy loam from 38 to 150 cm (Bw, Bt).

12 Hayhook-Pajarito complex, 0 to 5 percent slopes—Composition of this unit is approximately 50 percent Hayhook, 30 percent Pajarito, and 20 percent inclusions. Typical profile of Hayhook has a yellowish brown loamy sand 0 to 4 cm with 2 to 15 percent surface gravel (A). The subsoil is a pale brown coarse sandy loam to gravelly coarse sandy loam from 4 to 150 cm (illuvial calcium carbonate below 50 cm and noneffervescent above 50 cm) (Bw, Bk). Typical profile of Pajarito has a brown sandy loam 0 to 11 cm with 5 to 15 percent surface gravel (A). The subsoil is a brown to yellowish brown fine sandy loam from 11 to 150 cm (illuvial calcium carbonate above 50 cm and effervescent) (Bw, Bk).

13 Keysto-Riverwash complex, 1 to 3 percent slopes—Composition of this unit is approximately 65 percent Keysto, 25 percent Riverwash, and 10 percent inclusions. Typical profile of Keysto has a brown sandy loam 0 to 7 cm with 5 to 25 percent surface gravel (A). The subsoil is a brown very cobbly sandy loam to extremely cobbly loamy sand from 7 to 150 cm (C). Riverwash consists of unconsolidated material in the channel of an ephemeral stream, commonly bordered by steep to vertical banks cut into the alluvium (Keysto soil). It is usually dry but can be transformed into a temporary watercourse or a short-lived torrent after a heavy rain within the watershed.

24 Lampshire-Pantak-Rock outcrop complex, 10 to 60 percent slopes—Composition of this unit is approximately 40 percent Lampshire, 30 percent Pantak, and 10 percent inclusions. Typical profile of Lampshire has a very dark gray cobbly loam 0 to 20 cm with 15 to 35 percent surface gravel, cobbles, and stones (A). The subsoil is a dark reddish brown very gravelly clay to a gravelly clay loam 8 to 48 cm (Bt). The next layer is unweathered bedrock at 48 cm (R). Typical profile of Pantak has a very brown very gravelly to gravelly sandy loam 0 to 10 cm with 35 to 55 percent surface gravel, cobbles, and stones (A). The subsoil is a brown very gravelly sandy clay loam 10 to 36 cm (Bt). The next layer is unweathered bedrock at 6 cm (R). Rock outcrop consists of barren rock that occurs as ledges and nearly vertical cliffs of tilted and folded formations of bedrock. Rock outcrop also includes areas where the soil depth to bedrock is less than 10 cm. The higher percentage of rock outcrop is in areas near the summit and on steeper slope areas.

14 Lampshire-Budlamp-Woodcutter complex, 15 to 60 percent slopes—Composition of this unit is approximately 40 percent Lampshire, 20 percent Budlamp, 20 percent Woodcutter, and 20 percent inclusions. All three soils in this map unit are taxadjuncts. Typical profile of Lampshire has a brown very cobbly fine sandy loam 0 to 26 cm with 35 to 50 percent surface gravel and cobbles (A). The subsoil is a brown to reddish brown gravelly fine sandy loam and loam 26 to 71 cm (Bw). The next layer is weathered bedrock from 71 to 100 cm (Cr) and unweathered bedrock at 100 cm (R). Typical profile of Budlamp predominately on north slopes has a dark yellowish brown cobbly fine sandy loam 0 to 8 cm with 35 to 55 percent surface gravel and cobbles (A). The subsoil is a dark yellowish brown cobbly loam 8 to 61 cm (C). The next layer is weathered bedrock from 61 to 75 cm (Cr) and unweathered bedrock at 75 cm (R). Typical profile of Woodcutter has a dark brown very gravelly fine sandy loam 0 to 10 cm with 35 to 45 percent surface gravel and cobbles (A). The subsoil is a brown to reddish brown very gravelly sandy clay loam to extremely gravelly fine sandy loam 10 to 64 cm (Bt, B/C). The next layer is weathered bedrock from 64 to 71 cm (Cr) and unweathered bedrock at 71 cm (R).

15 Mabray-Rock outcrop complex, 10 to 60 percent slopes—Composition of this unit is approximately 60 percent Mabray, 30 percent Rock outcrop, and 10 percent inclusions. Typical profile of Mabray has a dark gray brown cobbly to very gravelly calcareous loam 0 to 31 cm with 45 to 55 percent surface gravel, cobbles, and stones (A, Bk). The

next layer is unweathered bedrock at 31 cm (R). Rock outcrop consists of barren rock that occurs as ledges and nearly vertical cliffs of tilted and folded formations of bedrock. Rock outcrop also includes areas where the soil depth to bedrock is less than 10 cm. The higher percentage of rock outcrop is in areas near the summit and steeper slope areas.

16 Nahda-Rillino complex, 1 to 30 percent slopes—Composition of this unit is approximately 45 percent Nahda, 35 percent Rillino, and 20 percent inclusions. Typical profile of Nahda has a reddish brown sandy loam 0 to 8 cm with 45 to 55 percent surface gravel and cobbles (A). The subsoil is a dark reddish brown gravelly sandy clay to very gravelly clay from 8 to 61 cm (Bt). The next layer is a light reddish brown calcareous very gravelly sandy loam from 61 to 87 cm (Btk). The calcium carbonate cemented hardpan is from 87 to 100 cm (Bkm). Typical profile of Rillino has a pinkish gray gravelly sandy loam 0 to 10 cm with 35 to 50 percent surface gravel (A). The subsoil is a brown to light brown calcareous gravelly sandy loam to very gravelly sandy loam from 10 to 150 cm (Bw, Bk).

17 Oversight fine sandy loam complex, 1 to 3 percent slopes—Composition of this unit is approximately 75 percent Oversight and 25 percent inclusions. Typical profile of Oversight has a brown fine sandy loam 0 to 10 cm with 5 to 35 percent surface gravel and cobbles (A). The subsoil is a brown cobbly fine sandy loam to very cobbly sandy loam from 10 to 150 cm (C).

18 Pinalino-Stagecoach complex, 3 to 15 percent slopes—Composition of this unit is approximately 45 percent Pinalino, 40 percent Stagecoach, and 15 percent inclusions. Typical profile of Pinalino has a brown gravelly sandy loam 0 to 5 cm with 45 to 55 percent surface gravel and cobbles (A). The subsoil is a reddish brown extremely cobbly sandy clay loam from 5 to 76 cm (Bt, Btk). The next layer is a calcareous pink extremely gravelly sandy clay loam from 76 to 150 cm (Bk). Typical profile of Stagecoach has a light brown gravelly sandy loam 0 to 10 cm with 35 to 45 percent surface gravel (A). The subsoil is a brown light brown calcareous very gravelly sandy loam to very gravelly loam from 10 to 150 cm (Bw, Bk).

19 Sasabe-Baboquivari complex, 1 to 8 percent slopes—Composition of this unit is approximately 55 percent Sasabe, 35 percent Baboquivari, and 10 percent inclusions. Typical profile of Sasabe (thick surface) has a brown sandy loam 0 to 13 cm with 0 to 10 percent surface gravel (A). The subsoil is a dusky red clay to sandy clay from 13 to 150 cm (Bt). Sasabe (thin surface) has a brown sandy loam 0 to 5 cm with 5 to 15 percent surface gravel (A). The subsoil is a dusky red clay to sandy clay from 5 to 150 cm (Bk). Typical profile of Baboquivari has a dark yellowish brown coarse sandy loam 0 to 20 cm with 0 to 10 percent surface gravel (A). The subsoil is a dark brown gravelly sandy clay loam to sandy clay loam from 20 to 150 cm (Bt).

20 Tombstone complex, 0 to 5 percent slopes—Composition of this unit is approximately 85 percent Tombstone and 15 percent inclusions. Typical profile of Tombstone has a brown calcareous gravelly sandy loam 0 to 23 cm with 35 to 45 percent surface gravel (A, Bw). The subsoil is a brown calcareous very gravelly sandy loam to very gravelly loamy sand from 23 to 150 cm (Bk).

21 Topawa complex, 1 to 8 percent slopes—Composition of this unit is approximately 40 percent Topawa (thick surface), 35 percent Topawa (thin surface), and 25 percent inclusions. Typical profile of Topawa (thick surface) has a brown coarse sandy loam 0 to 15 cm with 5 to 20 percent surface gravel (A). The subsoil is a reddish brown gravelly to very gravelly sandy clay loam from 15 to 150 cm (Bt). Typical profile of Topawa (thin surface) has a brown coarse sandy loam 0 to 10 cm with 5 to 20 percent surface gravel (A). The subsoil is a reddish brown gravelly to very gravelly sandy clay loam from 10 to 150 cm (Bt).

22 Tubac complex, 0 to 2 percent slopes—Composition of this unit is approximately 40 percent Tubac silt loam, 30 percent Tubac sandy loam, and 20 percent inclusions. Typical profile of Tubac silt loam has a brown silt loam 0 to 15 cm with 0 to 10 percent surface gravel (A). The subsoil is a brown to reddish brown clay to sandy clay from 15 to 150 cm (Bt). Typical profile of Tubac sandy loam has a brown sandy loam 0 to 10 cm with 0 to 15 percent surface gravel (A). The subsoil is a brown to reddish brown clay to sandy clay from 15 to 150 cm (Bt).

23 White House-Eloma complex, 1 to 10 percent slopes—Composition of this unit is approximately 45 percent White House, 35 percent Eloma, and 20 percent inclusions. Typical profile of White House has a brown sandy loam 0 to 5 cm with 5 to 15 percent surface gravel (A). The subsoil is a brown to dark reddish brown clay to clay loam from 5 to 150 cm (Bt, C). Typical profile of Eloma has a brown sandy loam 0 to 5 cm with 5 to 15 percent surface gravel (A). The subsoil is a brown to dark reddish brown very gravelly clay to extremely cobbly clay from 5 to 150 cm (Bt).

Description of the Ecological Sites

Eighteen ecological sites were identified in two Major Land Resource Areas (MLRAs) on the SRER in the 1997 inventory. Table 4 lists the soil series and ecological sites found in the MLRA. Eight sites were mapped in the 10- to 13-inch precipitation zone (PZ) of MLRA 40, the Upper Sonoran Desert (D40-1). Soils mapped in this area have typic aridic moisture regimes and thermic temperature regimes. This area occurs below 3,200 ft elevation on the SRER with the exception of the extreme northeast corner where elevations run to 3,700 ft in this MLRA. Eight sites were mapped in the 12- to 16-inch PZ of MLRA 41, the

Southeast Arizona Basin and Range (D41-3). Soils mapped in this zone have an ustic aridic moisture regime and a thermic temperature regime. This area occurs at elevations ranging from 3,200 ft to 4,400 ft. A few steep southern aspects carry up as high as 4,900 ft. Two sites were mapped in the 16- to 20-inch PZ of MLRA 41, the Mexican Oak Savannah (D41-1). Elevations in this zone range from 4,200 ft on north aspects up to the highest elevations on the SRER at 5,150 ft. Soils mapped in this zone have an aridic ustic moisture regime and a thermic temperature regime.

Table 5 shows the ecological sites found on the SRER. The common plant species of the present day plant community are shown for each ecological site. The NRCS Field Office Technical Guide contains more detailed ecological site descriptions with information about climate, soils, potential plant communities, Major Land Resources Areas, and Official Series Descriptions. It is located online at <http://az.nrcs.usda.gov> under technical resources. Several of the older enclosures (fenced on or before 1937) on the SRER are used by NRCS as reference areas for ecological sites in these MLRAs. These include: Enclosure #44, at Gravelly Ridge Station—Loamy upland and Limy slopes D40-1; Enclosure #22—Sandy loam, Deep D41-3; Enclosure #96 at Northwest Station—Sandy loam, Deep D40-1; and Enclosure #8—Sandy loam upland D41-3.

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Table 4—Major Land Resource Areas and the soil series and ecological sites in the MLRA.**MLRA 40-1, 10- to 13-inch precipitation zone**

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| 1 | Agustin sandy loam, 0- to 3-percent slopes
Agustin-Limy Fan, 10- to 13-inch precipitation zone |
| 2 | Arizo-Riverwash complex, 0- to 3-percent slopes
Arizo-Sandy Bottom, 10- to 13-inch precipitation zone |
| 7 | Cave-Rillino-Nahda complex, 1- to 10-percent slopes
Cave and Rillino-Limy Upland, 10- to 13-inch precipitation zone
Nahda-Loamy Upland, 10- to 13-inch precipitation zone |
| 11 | Hayhook-Bucklebar complex, 0- to 3-percent slope
Hayhook-Sandy Loam, Deep, 10- to 13-inch precipitation zone
Bucklebar-Sandy Loam Upland, 10- to 13-inch precipitation zone and Loamy Upland, 10 to 13-inch precipitation zone |
| 12 | Hayhook-Pajarito complex, 0- to 5-percent slopes
Hayhook-Sandy Loam, Deep, 10- to 13-inch precipitation zone
Pajarito-Sandy Loam, Deep, 10- to 13-inch precipitation zone and Limy Fan, 10- to 13-inch precipitation zone |
| 16 | Nahda-Rillino complex, 1- to 30-percent slopes
Nahda-Loamy Upland, 10- to 13-inch precipitation zone
Rillino-Limy Slopes, 10- to 13-inch precipitation zone |
| 18 | Pinalino-Stagecoach complex, 3- to 15-percent slopes
Pinalino-Loamy Upland, 10- to 13-inch precipitation zone
Stagecoach-Limy Slopes, 10- to 13-inch precipitation zone |
| 21 | Topawa complex, 1- to 8-percent slopes
Topawa-Sandy Loam Upland, 10- to 13-inch precipitation zone and Loamy Upland, 10- to 13-inch precipitation zone |
| 22 | Tubac complex, 0- to 2-percent slopes
Tubac-Clay Loam Upland, 10- to 13-inch precipitation zone and Loamy Upland, 10- to 13-inch precipitation zone |

MLRA 41-3, 12- to 16-inch precipitation zone

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| 3 | Baboquivari-Combate complex, 1- to 5-percent slopes
Baboquivari-Sandy Loam Upland, 12- to 16-inch precipitation zone
Combate-Sandy Loam, Deep, 12- to 16-inch precipitation zone |
| 4 | Bodecker-Riverwash complex, 1- to 3-percent slopes
Bodecker-Sandy Bottom, 12- to 16-inch precipitation zone |
| 6 | Caralampi sandy loam, 1- to 8-percent slopes
Caralampi-Sandy Loam Upland, 12- to 16-inch precipitation zone |
| 8 | Chiricahua-Lampshire complex, 3- to 18-percent slopes
Chiricahua and Lampshire, Shallow Upland, 12- to 16-precipitation zone |
| 9 | Combate loamy sand, 1- to 8-percent slopes
Combate, Sandy Loam, Deep, 12- to 16-inch precipitation zone |
| 10 | Combate-Diaspar complex, 1- to 5-percent slopes
Combate-Sandy Loam, Deep, 12- to 16-inch precipitation zone
Diaspar-Sandy Loam Upland, 12- to 16-inch precipitation zone |
| 13 | Keysto-Riverwash complex, 1- to 3-percent slope
Keysto-Sandy Bottom, 12- to 16-inch precipitation zone |
| 24 | Lampshire-Pantak complex, 10- to 60-percent slope
Lampshire and Pantak-Granitic Hills, 12- to 16-inch precipitation zone |
| 15 | Mabray-Rock outcrop complex, 10- to 60-percent slopes
Mabray-Limestone Hills, 12- to 16-inch precipitation zone |
| 19 | Sasabe-Baboquivari complex, 1- to 8-percent slopes
Sasabe-Sandy Loam Upland, 12- to 16-inch precipitation zone and Loamy Upland, 12- to 16-inch precipitation zone
Baboquivari-Sandy Loam Upland, 12- to 16-inch precipitation zone |
| 20 | Tombstone complex, 0- to 5-percent slopes
Tombstone-Limy Fan, 12- to 16-inch precipitation zone |
| 23 | White House-Eloma complex, 1- to 10-percent slopes
White House and Eloma-Loamy Upland, 12- to 16-inch precipitation zone |

MLRA 41-1, 16- to 20-inch precipitation zone

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| 5 | Budlamp-Woodcutter complex, 15- to 60-percent slopes
Budlamp and Woodcutter-Shallow Hills, 16- to 20-inch precipitation zone |
| 14 | Lampshire-Budlamp-Woodcutter complex, 15- to 60-percent slopes ^a
Lampshire, Budlamp and Woodcutter-Shallow Hills, 16- to 20-inch precipitation zone |
| 17 | Oversight fine sandy loam, 1- to 3-percent slopes
Oversight-Sandy Bottom, 16- to 20-inch precipitation zone |

^aSoils are taxadjuncts.

Table 5—Descriptions of the ecological sites mapped on the Santa Rita Experimental Range.

Ecological site^a	MLRA^a	Site number^a	Important plant species
Limy fan 10-13	40-1	040XA108AZ	Creosotebush, bush muhly, pappusgrass, fluffgrass
Sandy Bottom 10-13	40-1	040XA115AZ	Mesquite, catclaw, annuals, paloverdes, dropseed spp.
Limy upland 10-13	40-1	040XA111AZ	Creosote, zinnia, ratany, bush muhly, threeawn spp.
Loamy upland 10-13	40-1	040XA114AZ	Ratany, false mesquite, snakeweed, threeawn spp.
Sandy loam upland 10-13	40-1	040XA118AZ	Mesquite, burroweed, Arizona cottontop, threeawns
Sandy loam, deep 10-13	40-1	040XA117AZ	Mesquite, burroweed, bush muhly, threeawns
Limy slopes 10-13	40-1	040XA110AZ	Whitethorn acacia, ocotillo
Clay loam upland 10-13	40-1	040XA120AZ	black grama, bush muhly
Sandy loam upland 12-16	41-3	041XC319AZ	Tobosa, prickly pear annual forbs and grasses
Sandy loam, deep 12-16	41-3	041XC318AZ	Mesquite, Lehmann love, burroweed, threeawn spp.
Sandy bottom 12-16	41-3	041XC316AZ	Mesquite, Lehmann love, burroweed, threeawn spp.
Shallow upland 12-16	41-3	041XC322AZ	Mesquite, catclaw, desert willow, blue paloverde
Granitic hills 12-16	41-3	041XC306AZ	Mesquite, Lehmann love, prickly pear, grama spp.
Limestone hills 12-16	41-3	041XC307AZ	Grama spp., buckwheat, plains love, mimosa spp.
Loamy upland 12-16	41-3	041XC313AZ	Tridens spp., rosewood, ocotillo, whitethorn
Limy fan 12-16	41-3	041XC325AZ	Mesquite, false mesquite, Lehmann love, grama spp.
Sandy bottom 16-20	41-1	041XA112AZ	Creosote, bush muhly, threeawns, pappusgrass
Shallow hills 16-20	41-1	041XA102AZ	Oak spp, catclaw, mesquite hackberry, sycamore, ash
			Oak spp, grama spp, plains lovegrass, bluestem spp.

^aDescription located online at <http://az.nrcs.usda.gov> under technical resources.