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States. Thanks to a number of observers, particularly Shreve (80:8; 19:II, 164-65), Spalding (84:59-66), and MacDougal (58:132), we have detailed information regarding the range and ecology of this species.

As may be seen from the accompanying map, its range extends from the Yaqui River in southern Sonora northward to the southern corner of the Colorado Plateau in central Arizona. To the east and north its occurrence is limited by the minimum temperature of the coldest winters at an altitude of about twelve hundred meters. Westward the area reaches to the Colorado River and extends beyond in only three places, where the boundary appears to be determined as much by the fact that the rain falls only in the cold months as by the fact that the deserts of California, in which the cacti seldom occur, are unusually dry. The plant is much more abundant in the northern than in the southern part of its range.

The species reaches its greatest display on rocky, eroded slopes with coarse, stony soil, being only scantily distributed on soils of finer composition, and lacking entirely on the heavy diluvial type. Over its entire range it is widely distributed on mountain slopes facing southward. The region of its optimum development lies between five hundred and one thousand meters, and above fifteen hundred meters only a few specimens are to be found (80:8). It does occur in Sonora, Mexico, at sea-level, but wherever found below two hundred meters in altitude rarely attains the size and strength necessary for forming branches.

In part of its distribution area in the United States sahuaro is associated with the related pitahaya or organ-pipe cactus (*Lemaireocereus Thurberi*), and in Sonora is found also with the garambullo (*Lophocereus Schottii*). Both of these companions are more slender and smaller. In central Sonora it grows with *Pachycereus Pringlei*, a plant of similar form but even larger size (80:7).

Papago Sahuaro, formerly one of the United States National Monuments, is named for this plant and occupies more than two thousand acres of desert land situated about nine

miles east of Phoenix, Arizona, where there is a splendid display of *Carnegiea gigantea* on the rocky hillsides. Incidentally, sahuaro is the state flower of Arizona (19:II, 165).

We are especially indebted to Shreve for detailed information regarding the biology of sahuaro. He (80:7) finds that the plant seldom attains a height greater than twelve meters, and that it reaches a maximum age of 150 to 175 years. Flower formation begins when the plant is three to four meters high and from fifty to seventy-five years of age. The flowers appear in May and become densely formed under the apical growing region on both the main stem and the branches. The fleshy fruits ripen five to six weeks later. It is common for the red-shafted flicker (*Colaptes cafer collaris*) to dig holes in the stem of this species for nests (48:213; 19:II, 166; 65:II, 221).

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Although sahuaro was not botanically described until 1848 (19:II, 164; 33:159), when Engelmann proposed for the plant seen along the Gila River the name *Cereus giganteus*, it was known to the early explorers and missionaries in the Southwest.

Until 1905, it was assumed that *Carnegiea gigantea* was not known to civilized man before 1848, when it was described in Emory's report (33:159). This was accepted by Sargent (76:V, 54) and remained unchallenged until June, 1905, when attention was called to the fact that the plant doubtless had been observed much earlier. MacDougal (58:129) mentioned the Coronado expedition but stated that the earliest printed record of sahuaro was that relating to the journey of Oñate in 1604. Castañeda (93:515), chronicler of the Coronado expedition of 1540-42, writing of the region of Petatlan in Mexico (along the present Rio Sinaloa), said "The nature of the country changes here very greatly, because from this point on there are no trees except the pine, nor are there any fruits except a few tunas, mesquites, and pitahayas." He was undoubtedly, in the light of our knowledge of the distribution of sahuaro, not referring to this plant. However, on the following page (93:516), writing

of the Indians of the valley of Suva in Mexico (somewhere in northern Sonora) he recorded: "They are great Sodomites. They drink wine made of the pitahaya, which is the fruit of a great thistle which opens like the pomegranate. The wine made them stupid." In the light of the distribution of pitahaya and sahuaro the plant to which Castañeda referred might have been either species, but from his description of it as "a great thistle" the author is inclined to think he had sahuaro in mind; Safford (75:557) is of the same opinion. Jaramillo (93:585), who accompanied the Coronado expedition, wrote of going from the present Arizpe, in Sonora, through deserted country to a river where some Indians presented his party with pitahayas (may have been either or both sahuaro and *Lemaireocereus Thurberi*), and stalks of roasted *magwey*.

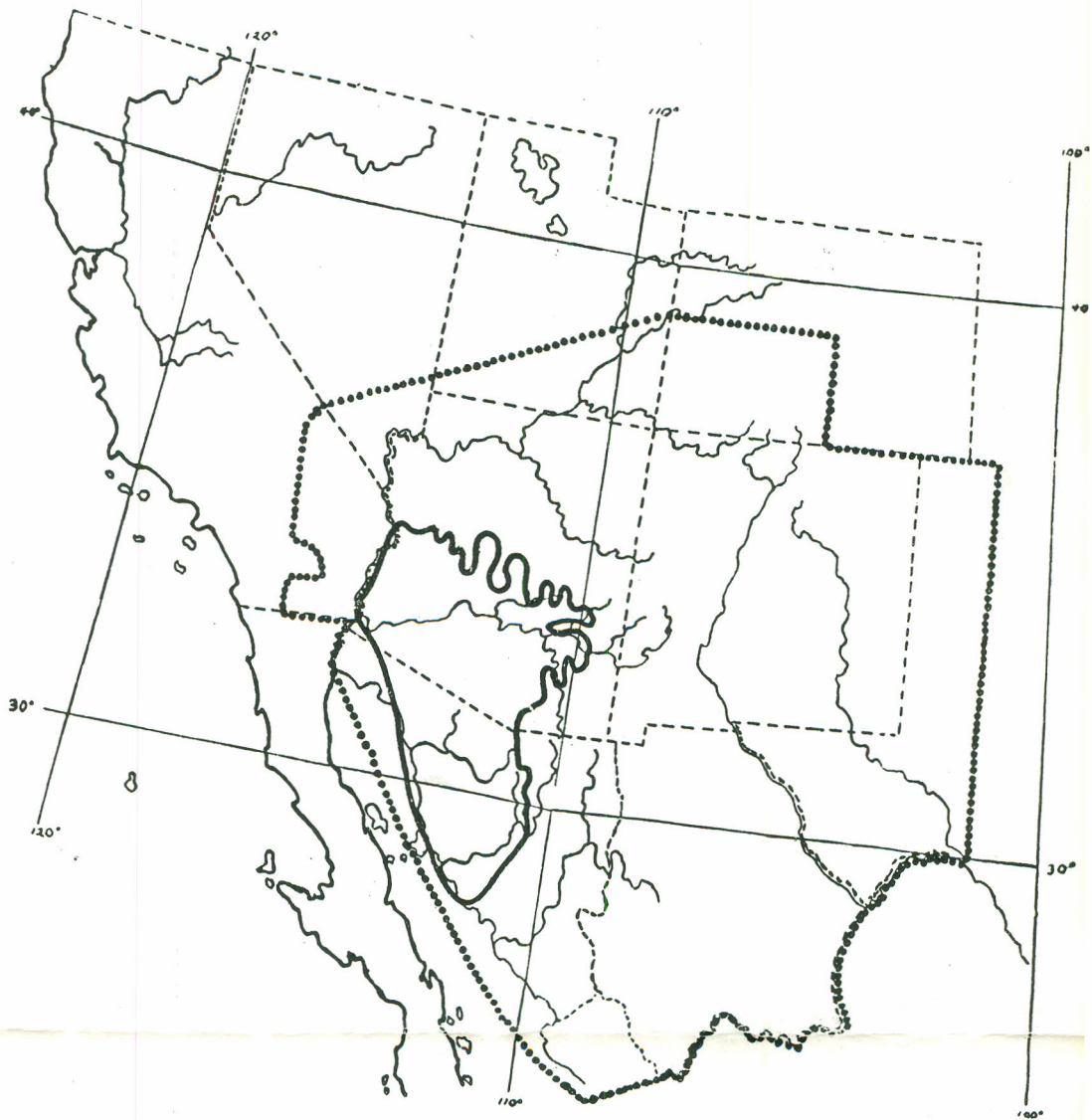
The next reference to any of these giant cacti is undoubtedly that relating to the journey of Oñate (4:155), conqueror and governor of New Mexico, who, while on an exploratory journey westward from his headquarters on the Rio Grande in 1604, at length came to a small stream, named San Andrés, where the "tierra caliente began to produce the pitahaya" and by going down it (the present Bill Williams Fork) (25:II, 477) found the large stream which they sought—the present Colorado River. As pointed out by MacDougal (58:129) no other large arborescent cactus which might be confused with sahuaro is to be found in this region. Benavides (8:36) wrote, in 1630, of New Mexico abundantly yielding a number of specific crops among which was the pitahaya. The limits of Benavides' conception of New Mexico were, of course, more extensive than the present state boundaries, and his boundaries preclude the possibility of the pitahaya being anything but *Carnegiea gigantea*.

Padre Kino, who explored southern Arizona and northern Sonora as far west as the Colorado River, came to the Papago Indians in 1687. In letters to the Father Visitor Oracio Polise in 1698 he wrote (5:73n; 11:I, 187) of the Papagos of Sonora giving him foods among which were "plentiful pitajayas." Again, in 1700, he wrote of setting

out for San Luys Bertrando de Bacapa, a Papago village in northern Sonora, and that on the way, as well as at San Luys Bertrando, the Indians gave them many "viands and many very good *pitajayas* which on this coast (Gulf of California) are abundant, and last until December" (11:I, 256) (these pitahayas might have been either or both *C. gigantea* and *Lemaireocereus Thurberi*). He also recorded that the cowboys neglected their cattle in order to eat pitahayas (*C. gigantea*) at San Xavier (11:I, 291) near present day Tucson, Arizona. In this same connection Velarde (94:128), writing of Pimería Alta in 1716, observed that wild fruits were very few, only those of the tree cactus (undoubtedly *C. gigantea*), tunas, wild nuts, and acorns being available.

Sahuaro fruit was referred to in the "Documentos para la Historia de Mexico" (32:3rd ser. IV, 522) as occurring in Pimería Alta and described as little different from pitahaya fruit. Anza (12:1, 78-9), on his expedition through Papago land in 1774, traversed areas grown with sahuaro, pitahaya, etc., where the Papago at certain seasons lived on these as well as other desert fruits supplemented by small game. Diaz (12:II, 260-61), in the same year, in his diary of a journey made with Father Garcés and Anza in order to open a road from Sonora to northern California by way of the Gila and Colorado rivers, referred to the Papago as wandering almost continually in several types of country in search of wild animals and plants, among which were sahuaro and pitahaya fruit. Similarly Font (12:IV, 505-06), accompanying Anza on the latter's expedition to Monterey by way of the Colorado River in 1775-76, referred in his diary to having seen sahuaro near the ruined mission of Marcelo de Sonóytac which was located between Arroyo del Carrizal and Sonóita in southwestern Arizona.

Pfefferkorn (67:I, 139), writing in 1794 of the use of sahuaro by the Indians of Sonora, compared the fruit with that of pitahaya and observed that although it was inferior to the latter in quality, a syrup was prepared from the fruit which excelled that of pitahaya.



Map showing the distribution of *Carnegiea gigantea*, as well as the limits of the American Southwest. Adapted from the map in "*Carnegiea gigantea* Britton & Rose" by Forrest Shreve, *Die Pflanzenareale* 3 (1): 7-8, 1931. By permission of author, editor, and publisher. Limits of the Southwest, as interpreted by the authors, shown by the heavy dotted line.

Pattie (90:104), an Indian trader and trapper, who spent the period from 1824-29 in the interior part of the continent, and during which time he passed several times up and down the Gila River, described a plant which was unquestionably sahuaro. However, Hardy (42:212), who passed through the southern portion of the region occupied by sahuaro and visited Sonora in 1825-28, wrote that "Our route lay over a plain, upon which immense quantities of petahaya were growing"; also of a stick which was used for "detaching the fruit from the top of the petahaya, a plant of the cylindrical cactus species, growing from eight to twenty feet in height." Although it may well be that Hardy was describing sahuaro one cannot be certain that such was the case.

Emory (33:72, 75, 79), leading the advance guard of the "Army of the West" from Fort Leavenworth to San Diego during the Mexican War, saw, along the Gila River in 1846, this plant, then botanically undescribed, and wrote of it bearing "a saccharine fruit much prized by the Indians and Mexicans" (33:72). Bartlett (7:II, 188-193, 209, 248, 272, 290, 296) encountered it a few years later at a number of points along the Gila River in Arizona, and described the plant, flowers and fruit as he also did on the way from Santa Cruz, Sonora, to Magdalena (7:I, 416). In this same connection, Sitgreaves (83:20) saw this species along the Colorado River below the Gila in 1853, while Bigelow (69:IV, 13), botanist of the United States Government Expedition which explored a route near the thirty-fifth parallel for a railroad from the Mississippi River to the Pacific Ocean, writing of the desert flora, noted the occurrence of sahuaro. It was also observed by Whipple and Ives (69:III, 101) of the same expedition, and by Möllhausen (65:218-21), who also found this same plant along the Bill Williams Fork in Arizona. The international boundary commission, working between 1891 and 1896 on the boundary between the United States and Mexico, also observed sahuaro at a number of places (70:20, 22, 23, 24). Bandelier (6) referred several times to the common occurrence of sahuaro in southern Ari-

zona and northern Mexico and recorded (6:484) that in the valley of the Sonora River the sahuaro was supplanted by the Piahaya.

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From aboriginal times to the present day, the Papago of southern Arizona and northern Sonora more extensively utilized sahuaro fruit than did any other people. The Papago country is part of the Sonoran Desert region, and broad alluvium-floored valleys bordered by relatively small steep-sided mountains are characteristic of the region (20:1). Springs which furnished a permanent water supply were to be found only in these hills and, therefore, to get even drinking water these people had to lead a migratory life. Their winter camp was known as the Well while the summer camp was called the Fields. These Indians returned from the Well in late June or early July to pick the ripe sahuaro fruit which they carried to their summer villages for their great yearly ceremony. This was held just before the rainy season and at this time the fruit was fermented and drunk, accompanied by dancing, singing, and oratory (21:4-5, 9). Although the Papago year contained numerous ceremonies, the most important was, and is, this great drinking ceremony which brought the rain and initiated the Papago calendar year (21:4-5, 9, 20). There is little doubt that sahuaro fruit has often served as a life-saver in ancient times when other sources of food failed by reason of extended drought periods. Thackery and Leding (89:407) observed a good crop of the fruit in southern Arizona after an unusually dry three-year period. The Papago depended upon this fruit to a much greater extent than did any other people of the Southwest, and some six hundred families gathered about 600,000 pounds each year (89:410; 50:23).

Cactus camp, established to gather the fruit, was an occasion of jollity. It meant almost the first fresh food of the year, the first taste of anything sweet and, principally, the preparation for the great drinking ceremony. The fruit, which grew at the top of the plant, was hooked down with a pole, as much as twenty-five feet long, made of two ribs

Thurberi, and was gathered in large quantities by the inhabitants.

The stems of the plant were often crushed and thrown into running streams to stupefy fish (87:904; 19:II, 117; 31:177-78). The wood was also used for fuel (31:392).

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A few smaller species of the old *Cereus* alliance were utilized as food in the Southwest but constituted only minor sources of supply. Among these is *Machaerocereus eruca* (T. Brandeg.) Britt. & Rose, the fruit of which resembles that of *M. gummosus* but even more acid in flavor and therefore not so highly esteemed. So far as known, it extends from San Gregorio, Baja California, to below Santa Margarita Island along the coast in sandy areas (18:21). It occurs sparingly on the sandy and silty Magdalena Plains, but is not abundant enough to be of much importance from the standpoint of food-supply. Also the slightly acid, red, globular, spineless fruit of *Myrtillocactus cochal* (Orcutt) Britt. & Rose, found in Baja California, as far north as the vicinity of San Vicente, and called *cochal* by the Indians, was eaten. The fruit is still greatly prized, and it is said that the flesh of the small (two to three cm. in diameter) fruit, which tastes like that of a strawberry, remains cool even on hot days. The natives prefer to pick it early in the morning, however. The stems were used for fuel (87:911; 19:II, 178). Shreve (82:263) found this desert species ranging on the peninsula north to the central part of the transition between desert and chaparral and extending north of Ensenada in close proximity to the ocean. Another plant utilized to some extent was *Wilcoxia striata* (T. S. Brandeg.) Britt. & Rose, found in Baja California and Sonora, where it was known to the Indians as *pitahayita*, *sacamatraca*, and *jarra-matraca*. The insipid fruit was little used but the vine-like plant was valued medicinally. A cloth saturated with juice of the crushed roots was applied to the chest to relieve inflammation of the lungs (87:903; 18:19). In this same connection a night-blooming *Cereus*, *reina de noche* or *huevo de venado* (*Peniocereus Greggii* [Engelm.] Britt. & Rose),

was sometimes utilized (45:158; 75:553; 31:220). This plant, which reaches a height of one and one-half meters, is never very common and is distributed in western Texas, southern New Mexico, and Arizona to Sonora, Chihuahua, and Zacatecas (19:II, 112-13). Hrdlička, in 1908, recorded that the San Carlos Apache, of Arizona, ate the fruit as well as the flowers (51:257), and Castetter and Underhill (21:16) observed that the shoots were, to some extent, eaten as greens by the Papago, who also chewed the large root for thirst, or sometimes baked the root whole in ashes, then peeled and ate it (21:18). These Indians mixed the ground pod with deer grease to make a salve for sores (21:65). Lumholtz (56:I, 4-5) found the natives of northern Sonora using the very large fleshy root of this plant as soap.

BIBLIOGRAPHY

1. ALEGRE, F. J.
1841-42. Historia de la Compañía de Jesus en Nueva-España. 3 v., Mexico.
2. BAEGERT, J.
1864-65. An account of the aboriginal inhabitants of the Californian peninsula. Trans. and arr. by Chas. Rau. Smithson. Inst. Rpt. for 1863, pp. 352-69; also for 1864, pp. 378-99.
3. BANCROFT, H. H.
1883. The Native Races. v. 1. Wild Tribes. San Francisco.
4. 1889. History of Arizona and New Mexico. San Francisco.
5. BANDELIER, A. F.
1890. Final report of investigations among the Indians of the southwestern United States, pt. I. Papers of Archaeol. Inst. of Amer. Amer. Ser., no. III. Cambridge.
6. 1892. Final report of investigations among the Indians of southwestern United States, pt. II. Papers of Archaeol. Inst. of Amer. Amer. Ser., no. IV. Cambridge.
7. BARTLETT, J. R.
1854. Personal narrative of explorations and incidents in Texas, New Mexico, California, Sonora and Chihuahua, etc. 2 v., London.
8. BENAVIDES, A.
1916. The Memorial of Fray Alonso Benavides. Madrid, 1630. Reprinted, Chicago.
9. BENNETT, W. C., and R. M. ZINGG.
1935. The Tarahumara. Chicago.

10. BIEBER, R. P.
1925. The Southwestern trails to California in 1849. *Miss. Valley Hist. Rev.* 12:344-75.
11. BOLTON, H. E.
1919. Kino's historical memoir of Pimería Alta. 2 v., Cleveland.
12. 1930. Anza's California expeditions. 5 v., Berkeley.
13. BOURKE, J. G.
1891. On the border with Crook. New York.
14. 1895. The folk-foods of the Rio Grande Valley and of northern Mexico. *Jour. Amer. Folk-Lore* 8:41-71.
15. BRAND, D. D.
1936. Notes to accompany a vegetation map of northwest Mexico. *Univ. New Mex. Bull., Biol. Ser.* 4 (4): 3-27.
16. BRANDEGEE, T. S.
1890 a. A cardon forest. *Zoe* 1:26.
17. 1890 b. Notes concerning the collection of plants made by Xantus at Cape San Lucas and vicinity. *Zoe* 1:269-72.
18. 1891. Cactaceae of the Cape region of Baja California. *Zoe* 2:18-22.
19. BRITTON, N. L. and J. N. ROSE.
1919-23. The Cactaceae. Carnegie Inst. Washington Pub. 248. 4 v.
20. BRYAN, K.
1925. The Papago country, Arizona. U. S. Geol. Surv. Water-Supply Paper 499.
21. CASTETTER, E. F. and R. M. UNDERHILL.
1935. Ethnobiological studies in the American Southwest. II. The Ethnobiology of the Papago Indians. *Univ. New Mex. Bull., Biol. Ser.* 4 (3): 3-84.
22. CASTETTER, E. F. and M. E. OPLER.
1936. Ethnobiological studies in the American Southwest. III. The Ethnobiology of the Chiricahua and Mesquero Apache. A. The use of plants for foods, beverages, and narcotics. *Univ. New Mex. Bull., Biol. Ser.* 4 (5): 3-63.
23. CLAVIGERO, E. X.
1780. Storia antica del Messico cavata da' migliori storici spagnuoli, e da' manoscritti, e dalle pitture antiche dell' Indiani:—4 v., Cesena.
24. 1852. Historia de la Antigua ó Baja California. Obra posthuma—traducida del Italiano por Nicolas Garcia de San Vicente. Mexico. Original ed. pub. in Italian, Venice, 1789.
25. COUES, E.
1900. On the trail of a Spanish pioneer. The diary and itinerary of Francisco Garcés in his travels through Sonora, Arizona, and California 1775-1776. 2 v., New York.
26. COVILLE, F. V.
1904. Desert plants as a source of drinking water. *Smithson. Inst. Rpt. for 1903*, pp. 499-505.
27. CREMONY, J. C.
1868. Life among the Apaches. San Francisco.

28. CURTIS, E. S.
1907-30. The North American Indian. 20 v., Cambridge.
29. DAVIS, E. H.
1920. The Papago ceremony of Vikiita. *Mus. Amer. Indian, Indian Notes and Monographs* 3 (4): 157-77.
30. DENSMORE, F.
1929. Papago Music. *Bur. Amer. Ethnol. Bull.* 90.
31. DIGUET, L.
1928. Les Cactacées utiles du Mexique. *Archives D'Histoire Naturelle*. v. 4, Paris.
32. DOCUMENTOS PARA LA HISTORIA DE MEJICO.
1853-57. 20 v. in 4 ser. Ser. 3 is in 4 parts referred to as volumes. Mexico.
33. EMORY, W. H.
1848. Notes of a military reconnoissance, from Fort Leavenworth in Missouri, to San Diego, etc. 30th Congress, 1st session.
34. 1857-59. Report on the United States and Mexican boundary survey. 34th Congress, 1st session. 2 v.
35. FORDE, C. D.
1931. Ethnography of the Yuma Indians. *Univ. Cal. Pubs. in Amer. Arch. and Ethnol.* 28:83-278.
36. GIFFORD, E. W.
1932. The southeastern Yavapai. *Univ. Cal. Pubs. in Amer. Archaeol. and Ethnol.* 29:176-251.
37. 1936. The Northeastern and Western Yavapai. *Univ. Cal. Pubs. in Amer. Archaeol. and Ethnol.* 34:247-354.
38. GODDARD, P. E.
1920. San Carlos Apache myths and tales. *Amer. Mus. Nat. Hist. Anth. Papers* 24:7-85.
39. GOLDMAN, E. A.
1916. Plant records of an expedition to Lower California. *U. S. Nat. Herb. Contr.* 16:309-71.
40. GOODWIN, G.
1935. The social divisions and economic life of the Western Apache. *Amer. Anthropol.* 37:55-64.
41. GROSSMAN, F. E.
1873. The Pima Indians of Arizona. *Smithson. Inst. Rpt. for 1871*, pp. 407-19.
42. HARDY, R. W. H.
1829. Travels in the interior of Mexico. London.
43. HAVARD, V.
1895. Food plants of the North American Indians. *Torr. Bot. Club Bull.* 22:98-123.
44. 1896. Drink plants of the North American Indians. *Torr. Bot. Club Bull.* 23:33-46.
45. HEDRICK, U. P. ed.
1919. Sturtevant's notes on edible plants. New York State Dept. of Agric. Rpt. 27, v. 2, pt. II, Albany.
46. HEMSLEY, W. B.
1879-88. Biologia Centrali-Americana—or contributions to our knowledge of the flora and fauna of Mexico and Central America. Botany, v. 1-5. Ed. by F. D. Godman and Osbert Salvin. London.

47. HERNANDI, F.
1790. *Historia plantarum novae Hispaniae*. 3 v., Matriti.
48. HORNADAY, W. T.
1921. *Campfires on desert and lava*. Ed. 2, New York.
49. HRDLICKA, A.
1904. Notes on the Indians of Sonora, Mexico. *Amer. Anthrop.* 6:51-89.
50. 1906. Notes on the Pima of Arizona. *Amer. Anthrop.* 8:39-46.
51. 1908. Physiological and medical observations among the Indians of southwestern United States and northern Mexico. *Bur. Amer. Ethnol. Bull.* 34:1-460.
52. HUMBOLDT, F. H. A. von
1811. *Political essay on the kingdom of New Spain*. 2 v. Trans. by John Black. New York.
53. KISSELL, M. L.
1916. Basketry of the Papago and Pima. *Amer. Mus. Nat. Hist. Anthropol. Papers* 17:115-264.
54. KROEBER, A. L.
1931. *The Seri*. Southwest Museum Papers 6.
55. 1935. *Walapai Ethnography*. *Amer. Anth. Assoc. Mem.* 42:7-293.
56. LUMHOLTZ, C.
1902. *Unknown Mexico*. 2 v., New York.
57. 1912. *New trails in Mexico*. New York.
58. MacDOUGAL, D. T.
1905. The suwarro, or tree cactus. *N. Y. Bot. Gard. Jour.* 6:129-33.
59. 1908. Botanical features of North American Deserts. *Carnegie Inst. Washington Pub.* 99.
60. MASON, J. A.
1920. The Papago harvest festival. *Amer. Anthrop.* 22:13-25.
61. MASON, O. T.
1904. *Aboriginal American Basketry*. U. S. Nat. Mus. Rpt. for 1902, pp. 171-548.
62. McGEE, J. W.
1898. The Seri Indians. *Bur. Amer. Ethnol. Rpt.* 17, pt. 1, pp. 1-344.
63. MEARNS, E. A.
1907. *Mammals of the Mexican boundary of the United States*. U. S. Nat. Mus. Bull. 56 (1):1-501.
64. MEIGS, P.
1935. *The Dominican Mission Frontier of Lower California*. Univ. Cal. Pubs. in Geog. 7:1-232.
65. MOLLHAUSEN, B.
1858. *Diary of a journey from the Mississippi to the coasts of the Pacific with a United States Government Expedition*. Trans. by Mrs. Percy Sinnett. 2 v., London.
66. PALMER, E.
1870. *Food products of the North American Indians*. U. S. Commissioner of Agr. Rpt. pp. 404-28.

67. PFEFFERKORN, IGNAZ.
1794-95. *Beschreibung der Landschaft Sonora*. 3 b., Köln.
68. REAGAN, A. B.
1929. *Plants used by the White Mountain Apache Indians of Arizona*. *Wisconsin Archaeologist* 8:143-61.
69. REPORTS OF EXPLORATIONS AND SURVEYS
1855-60. to ascertain the most practicable and economical route for a railroad from the Mississippi River to the Pacific Ocean. Made under the direction of the Secretary of War in 1853-6. 33rd Congress, 2nd session, 12 v.
70. REPORT OF THE BOUNDARY COMMISSION
1898. upon the survey and re-marking of the boundary between the United States and Mexico west of the Rio Grande, 1891 to 1896. 55th Congress, 2nd session. Senate Doc. v. 23.
71. ROSE, J. N.
1892. List of plants collected by Dr. Edward Palmer in 1890 on Carmen Island. U. S. Nat. Herb. Contr. 1:129-34.
72. 1899. Notes on useful plants of Mexico. U. S. Nat. Herb. Contr. 5:209-59.
73. RUDO ENSAYO (Anonymous).
1863. *San Augustin de la Florida, 1863*. Ed. by Buckingham Smith. Also trans. into English by E. Guiteras in *Records of the American Catholic Historical Society of Phila.* 1894. v. 5, no. 2. The ostensible date of the original essay was 1763.
74. RUSSELL, F.
1908. The Pima Indians. *Bur. Amer. Ethnol. Rpt.* 26 for 1904-05, pp. 3-390.
75. SAFFORD, W. E.
1909. Cactaceae of northeastern and central Mexico, together with a synopsis of the principal Mexican Genera. *Smithson. Inst. Rpt.* for 1908, pp. 525-63.
76. SARGENT, C. S.
1893. *Silva of North America*. 142. New York.
77. SAUER, C. and P. MEIGS.
1927. *Lower California Studies. I. Site and culture at San Fernando de Velicatá*. Univ. Cal. Pubs. in Geog. 2:271-302.
78. SAUNDERS, C. F.
1934. *Useful wild plants of the United States and Canada*. Ed. 3, New York.
79. SHREVE, F.
1924. Across the Sonoran Desert. *Torr. Bot. Club Bull.* 51:283-93.
80. 1931. *Carnegiea gigantea* Britton and Rose. *Die Pflanzenareale* 3 (1):7-8.
81. 1936 a. Plant life of the Sonoran Desert. *Scien. Monthly* 42:195-213.
82. 1936 b. The transition from desert to chaparral in Baja California. *Madroño* 3:257-64.

- X 83. SITGREAVES, L.
1853. Report of an expedition down the Zuni and Colorado Rivers. 32nd Congress, 2nd Session.
- X 84. SPALDING, V. M.
1909. Distribution and movements of desert plants. Carnegie Inst. Washington Pub. 113.
- X 85. SPIER, L.
1933. Yuman tribes of the Gila River. Chicago.
86. 1936. Cultural relations of the Gila River and lower Colorado tribes. Yale Univ. Pubs. in Anthropol., no. 3.
- X 87. STANDLEY, P. C.
1920-26. Trees and shrubs of Mexico. U. S. Nat. Herb. Contr. 23, pt. 1-5.
- X 88. STRONG, W. D.
1927. An analysis of Southwestern society. Amer. Anth. 29:1-61.
- X 89. THACKERY, F.A. and A. R. LEDING.
1929. The giant cactus of Arizona. Jour. Hered. 20:401-14.
- X 90. THWAITES, R. G.
1905. The personal narrative of James O. Pattie, 1824-1830. Early Western Travels 1748-1846. 18:20-364. Cleveland. Original ed. Cincinnati, 1831.
- X 91. VENEGAS, M.
1766-67. Histoire naturelle et civile de la Californie, etc. Trans. from the English ed. of 1759. 3 v., Paris.
- No 92. WILBUR, M. E.
1931. The Indian uprising in Lower California, 1734-37, as described by Father Sigismundo Taraval. Los Angeles.
- X 93. WINSHIP, G. P.
1896. The Coronado expedition. Bur. Amer. Ethnol. Rpt. 14, pt. 1, pp. 329-637.
- X 94. WYLLYS, R. K.
1931. Padre Luis Velarde's relación of Pimería Alta, 1716. New Mex. Hist. Rev. 6:111-57.