

HOMER L. SHANTZ, 1876 TO 1958: A BOTANIST IN AFRICA AND THE AMERICAS

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Introduction

Homer LeRoy Shantz was an American pioneer of environmental mapping studies. He mapped vegetation, soils and available moisture, and studied the effects of erosion, salinity and alkalinity of soils and environmental damage through time. The maps he created of the African continent were used by the Commission to Negotiate Peace to establish new political and economic boundaries after the First World War. He was President of the University of Arizona from 1924 to 1936 where he continued mapping studies of the Southwest and Central and South America. The U.S. Forest Service employed him to map the forest reserves of the western United States as a management tool. Shantz' work is important to the history of science as one of the founders of ecological biogeography and studying landscape change over time. His approach is used throughout the world by national and international agencies when evaluating land, economic and social problems.

Biography

Homer Shantz was born in Michigan in 1876. He was educated at Colorado College and received a doctorate at the University of Nebraska in 1905 where he first began environmental surveys from the Botany Department. He was employed in the Botany Department of the University of Illinois. From 1927 to 1935 he was a member of the Carnegie Institute of Washington, Ecological Research section. A Western Union telegram dated July 8, 1927 shows he accepted a salary of \$12.00 per month and a house.¹

Dr. Homer Shantz was employed by the USDA, Bureau of Plant Industry, Land Classification Board during the first decades of the 1900's to map the soils and vegetation of the United States. His task was to create the vegetation and soils maps of the United States and, in particular, the western states. By touring Ford car, foot, horse or train, he made his way spending months in the field, making notes on vegetation, soils, environmental degradation, the people and the small primitive western settlements.

He was asked to perform a similar task in Africa. He was a member of the Commission to Negotiate Peace after World War One. Employed by the Office of Foreign Seed and Plant Introductions, Department of Agriculture, he began a survey of Africa in 1919-1920 and returned in 1924 to conduct a Plant Exploration tour of Africa. He made three expeditionary trips to Africa, mapping

the vegetation and soils from Cape Town, South Africa, to Cairo in 1919-1920, 1924, and 1956-1957.² Part of the purpose of his explorations was to discover plants, especially food grains, medicinal crops and trees that might be suitable for introduction to the United States. He created a large collection of sorghum gathered from throughout Africa, in addition to collections of medicinal plants and information on valuable fruit and shade trees.

The results were included in the reports and maps of the General Records of the American Commission to Negotiate Peace, 1918-1931, national archives held in various locations; and, in his book "The Vegetation and Soils of Africa", published in 1923.^{3,4} In addition, the University of Arizona Special Collections Library holds originals of many of his maps and notes.

In 1924 Homer Shantz was selected as President of the University of Arizona in Tucson, Arizona. He held that post until 1936. During this time he and his students continued mapping the vegetation of the United States and South America, collecting herbarium and live specimens. Some of these are still to be seen in the grounds of the University of Arizona. In 2002 it was officially dedicated and accepted as a member of the American Association of Botanical Gardens and Arboreta, as the oldest botanical garden in Arizona.

After his involvement in the settlement of the First World War land distributions in Africa, Shantz returned to the Department of Agriculture, where he was Chief of Wildlife Management Division, U.S. Forest Service. He continued his work in vegetation and soils mapping of the western United States until his death in 1958 during a vegetation-mapping trip to South Dakota.

Western Travels -- Homer L. Shantz in the Western States, Oregon, Nevada, Utah, Arizona, New Mexico and Texas

Homer Shantz began mapping parts of the western United States in the late 1800's as a graduate student at Colorado College and in the first decade of the twentieth century while on the faculty of the Botany Department of the University of Nebraska. Later, employed by the Department of Agriculture, Land Classification Board, he mapped the western states. He spent months in the field, often traveling alone, or with a team of researchers, by Model T, train or horse where there were no roads. Ranchers and farmers gave him shelter and what information they had on the land before lending him a horse to continue his mapping. Shantz photographed vegetation landscapes, plant close-ups and also dusty collections of hand hewn cabins that later became towns, and the inhabitants of those settlements.

One trip he took, in the fall of 1916, provides a typical example of his travels. On this trip he traveled through Oregon down through Nevada and across to California and Utah before going southeast through Arizona. He took a constant

photographic record of his travels. Camera supplies consisted of one Century Grand Senior 4 X 5, Goerz Dagor lens 6.8, one wide angle lens, one Goertz telephoto lens, ray filters, one Goerz Kodak 3 ¼ X 4 ¼ with 4.8 color lens, 150 3 ¼ X 4 ¼ film packs, 350 4 X 5 film packs. The earliest pictures in the Shantz collection are 4 X 5 glass negatives and positives.

The number of Land Classification mapping team members varied each trip, from large crews of fourteen to just himself. He was accompanied on this trip by Dr Piemeisel and they started out traveling by Model T Ford.

Brookings Bend and Burns and Pershings are just roadhouses and water stations set in a vast prairie landscape. Denio, Oregon, on the Nevada Oregon line, was a collection of schoolhouse, store, hotel and saloons (on the Nevada side). He wrote of Crane, Oregon,

"[Crane] was a handful of wooden structures set in a clean dust patch fully 8 to 10 inches deep. Through this roads were plowed in all directions by autos and wagons. All the buildings are only temporary and inadequate. Lodging houses and restaurants are only temporary and of the most miserable type." ⁵

They traveled through Oregon past Silver Lake to Summer Lake and here,

"The sage is pure on the ridges, yellow pine on the hills at the right at 38 miles. At 41 miles a peculiar white rock weathered like bad lands at the top of the ridge at the right. ... It is called Potash Lake." Page 317.

Then through a great valley with Paisley at the bottom of the lake. Page 318
[Photo]

Lake View, Goose Lake, Lake City, turning off the main road to drive the 14 miles to New Pine Creek on the Oregon Nevada border.

"Here we are on the state line. Many Indians passed along the road. The only white man in town that I saw was Piemeisel." Page 329.

[Photo]

[These photos] "show the type of conveyance used by the Indians who are now returning to their reservation after having been attending an Indian fair in Surprise Valley." Page 330, 331.

At this point they moved west going through eastern California before turning back into Nevada. They went through Riedervale NV, 49 Valley and 49 Station both of which were saloons. Page 340.

On the Burns Winnemucca road Shantz comments, "At 24 miles Forest Service has an establishment. At this point there is a great quantity of obsidian, the soil being covered with great quantities of this black glass." Page 331.

Opal mine region 25 miles from Denio the stones are "unusually brilliant but are soft and chip badly on drying, deep fire color and also black opals and opalized twigs in the clay bad lands". Page 347, 348

They arrived at Denio, Oregon September 19, 1916, on the Oregon/Nevada line with a schoolhouse, store, hotel and the Nevada side has saloons. Page 350, 351

From Denio, as there was no road, Shantz and Piemiesel were "transported from Denio to Winnemucca a distance of 110 miles by Mr. F.A. Robinson." Page 357,

From Winnemucca they caught a train. They turned back south again going through Iron Point, Battle Mountain to Austin on September 22, 1916, then through Bailey, Waters, Ravenwood and Vaughn.

There are two photos of the town of Austin and a great photo of Piemeisel riding on top of the train. Page 365, 367, 370.

[Photos]

Then to Waters and Elko on September 24, 1916. Page 372 and Page 375
[Photo].

Ely, Cobre and Currie and Goshute and then to "Cherry Creek which is a degenerate gold camp." Page 379.

There is a large 2 storey red brick school house here. Page 382, 383

[Photo].

On this section of the journey they moved from Wells NV, to Low, Utah and Salt Lake City, Utah.

"We left Salt Lake City at 11:40 pm en route to Mina, NV. The Southern Pacific train did not leave Ogden until after 2 o'clock the following afternoon and as a consequence we were obliged to leave the train at Elko about 9 pm since it was impossible to make connection at Hazen the next day, September 28th. The vegetation north and east of Elko is almost entirely sage. We left Elko at about 2 pm arriving at Hazen, NV at 11, and proceeded from there to Mina where we arrived at about 6 am September 29th". (1916) Page 398.

After Elko, Hazen and Mina, NV, there was Sodaville, Lone Pine, CA, Rhodes, Tonopah Junction, NV.

“Shows pure sage with Juniper in the background at Mount Montgomery Station. At this point a small band of Paiutes got off the train for the purpose of picking pinon nuts. ...we pass down into the valley west of Mt Montgomery.” Page 406.

Then he mentions, they travel to Benton, Hamil and Chalfort, Laws, Zurich, Kearsarge, Owenyo, Lone Pine—that he called “a very old and primitive city”, and on to Los Angeles, Palm Springs, and then by train through Maricopa, AZ, and on to El Paso and San Antonio and to Carthage...

"We proceeded on through San Antonio to a small clay mining camp called Carthage where we spent a miserable night on the floor of a boarding house. It rained all night."⁶

He wrote about, and photographed the American Indian people. He photographed his way through Arizona, and New Mexico, and on to Texas. He travelled through Isleta photographing the adobe houses and the Spanish church.

First World War and the American Commission to Negotiate Peace

President Woodrow Wilson led the Commission and selected Secretary of State Robert Lansing, diplomat Henry White, Presidential Adviser Edward M. House and General Tasker H. Bliss to serve as his fellow Commissioners Plenipotentiary. The Commissioners were supported by a large administrative and advisory staff.

The Africa Division, lead by Prof. George Louis Beer, Director. Africa Division was assigned to study colonial problems and make recommendations concerning proposed African mandates. This division gathered information on population density, ethnographic and religious distributions, climate, natural resources and areas suitable for white colonization and placement of a projected Cape to Cairo railway route.⁷

In 1918, Homer Shantz was selected to join the team of technical advisors in the Africa Division. He was to survey of natural plant resources and crop potential of Africa and produce a vegetation map of Africa. This information would be used for the redistribution of African lands from German and Belgian to American and English control.

Homer was also to document information on vegetation, soils, current land use, population locations and displacement due to war, disease and forced

relocations. In addition, he was to find out about the political sympathies of colonial governments and their leaders, and the feasibility of the proposed Cape to Cairo railway linking the tip of Africa to the Mediterranean.

Travels in Africa

Shantz's first trip to Africa took one year, 1919 to 1920. It began in the St Vincent Islands, where he stayed on Santo Antao Island, taking photographs of the Mattiato Ranch, markets and the people. His ship then sailed to Cape Town where he zigzagged his way up through South Africa, from Hout Bay to Port Elizabeth, and then through many small towns to Johannesburg. From here he traveled to Tanganyika, through the Congo, through the Sudan and Ethiopia, and along the Nile to Cairo.

Homer L. Shantz traveled the first part of the trip through Africa with Harry E. Raven, of the Smithsonian Museum, who was collecting animals for that Institution. Raven was his sole companion on their visit to the Kafui River in Northern Rhodesia; however, from there Shantz traveled north to Cairo by himself.

Along the way he visited all the points of interest, museums and Herbaria including the 'Alphen Farm' owned by Henry Cloete, a 200 year old estate and house; the Tokai forest station growing trees from all over the world, and the Groot Constantia government wine farm, built in 1685. Shantz made several trips to the Kirstenbosch National Botanical Gardens on the east face of Table Mountain where he photographed the grounds extensively and made collections that were sent to the United States in 1919, some of which are in the permanent collection of the Smithsonian Herbarium.⁸ Shantz spent some time with Dr. Rudolph Marloth one of the leading botanists of Southern Africa and an analytical chemist, who studied the relationship between the flora, the soil and climate. These interests coincided with Shantz' interest in soil chemistry and fertility. He also met with F. W. Fitzsimmons, Director of the Museum that also had a live venomous snake garden.

His major contact in intelligence gathering was Philip Jacobus Pretorius (1877-1945) a big game hunter and the scout for the South African Army employed by General Jan C. Smuts to locate the German troops and askaris of General von Lettow-Vorbeck in German East Africa, or Tanganyika, now called Tanzania. The Germans controlled Tanganyika, the Belgian Congo to the north, and German South-West Africa to the west. The South Africans and British controlled Northern and Southern Rhodesia and British Central Africa, Nyasaland, and south to the Transvaal the Orange Free State and the Cape Colony. Pretorius wrote about his life and wartime experiences in his autobiography.⁹

The fighting by colonial powers in Africa began years before the formal declaration of war in Europe. Belgium, Germany, England and France jockeyed for position controlling territory, natural resources and African labor. Central and southern Africa was the site of large-scale armed conflicts between forces sympathetic to Germany or British and South Africans.¹⁰ Immediately following the Boer War, the British and South Africans formed alliances to curb the encroachments of Germany into territories held by them. This led to large battles in central Africa, even before the outbreak of WWI. Deneys Reitz' book *Afrikander*, details the life of one young man who fought the British in the Boer War.¹¹ No sooner had this conflict ceased, than he joined in a strange alliance with the British against the Germans and Belgians who began to assert their influence southward. Both sides used large numbers of conscripted Africans, 'askaris' who were armed and mobilized, either willingly or forceably, to fight for almost no pay, often hundreds of miles from home. In addition, many thousands of Indians were also conscripted, neither group were professional soldiers, they were mercenaries hired for a pittance, little more than food, clothing and bullets.

These tribesmen died by the tens of thousands of disease, smallpox, malaria, yellow fever, influenza, dysentery and starvation, in conflicts that were never accurately documented (Hodges 1987).¹² Whole regions of the continent were either under- or over-populated, due to the forced movement of people. This, in turn, meant that agriculture suffered either from neglect or over farming, resulting in continued patterns of malnutrition and hunger and disease at high levels (Page 1987).¹³

P.J. Pretorius had traveled throughout southern Africa from the Cape Colony to King Khama's country, southern and northern Rhodesia and as far north as Uganda and Kenya. His knowledge of the tribes, the bush and transportation was invaluable in locating and destroying the German troop bases and supplies. He persuaded the Wachaka, living on the slopes of Mt Kilimanjaro to cease fighting the South African Army. In the Lindi district, the tribes had been forced to grow food for the German troops. Pretorius enlisted and armed 2,000 of them and they overthrew the German forces in that district.¹⁴

Admiral King-Hall of the British Royal Navy recruited Pretorius to locate the 'Königsberg'. This German warship had been patrolling the east coast of Africa sinking British merchant vessels and transports. On August 6 the 'Königsberg' captured the 'City of Winchester' removed the coal and supplies and scuttled the British merchant ship. The 'Königsberg' then took refuge in the Rufiji river delta. On 19 September 1914 the 'Königsberg' fired on the cruiser HMS Pegasus which caught fire and sank. The 'Königsberg' then ran for cover in the Rufiji River steaming fifteen miles upstream. The British Navy and the South African Army did not know where it was hiding only that it was in the river delta systems of the east coast of Africa. Pretorius and his ten scouts, recruited from the German camps, located the ship upstream for the shallow water gunboat HMS Severn.

After almost a year of evasion, on July 11 1915 HMS Severn was able to travel upstream close enough to shell and sink the German cruiser.

After this episode P.J. Pretorius was asked to hunt rogue Cape elephants in the Addo bush. Homer Shantz visited Major Pretorius and his wife here and lived in their bush camp. Major Pretorius later sent Homer Shantz a signed copy of his book *Jungle man; the Autobiography of Major P.J. Pretorius*, and the personal and camp photographs that Shantz took while he and Raven were visiting are glued to the title page.¹⁵ There is a detailed description in Shantz' notes of elephant hunts that took place while they were in camp, and the adoption of several baby elephants and efforts made to keep them alive. These materials are now in the Special Collections Library at the University of Arizona.

In 1919 Shantz visited the Bantu compound of de Beers Company's diamond mine at Du Toit's Pan and this visit provided many documentary photographs of the living conditions at that time for the diamond mine workers. He also photographed white mine workers sorting diamonds in a wooden shack, and their children waiting to go to school. There are photographs of the trading store, and the blue field mining techniques employed to mine surface fields.

Moving north, Shantz evaluated the landscape and interviewed various experts including Dr Lorenz the Borneo explorer, who became the Consul-General for Holland at Cape Town, South Africa. The topics included the damage caused by the intense fighting in Africa, the botany of the region particularly food, useful and medicinal plants, and the activities by Germany and their sympathizers.

Along the way he made a large herbarium collection of 284 sorghum species as he noted that this was a primary African grain crop. This was in addition to the sorghum species he collected in the U.S.

Contributions to Science – Ecological Mapping for Political and Social Needs

Early vegetation maps of the late 1800's lead to Shantz' vegetation maps of the early 1900's through the 1940's that combined soils, climate and an international system of vegetation classification. His maps were used to determine land use for economic and political purposes. His maps were a great advance on the science of mapping vegetation and climate.

In the sixteenth century maps showed forests where hunting and timber sources were located, water sources for milling and transportation, and mining sources. Military and political necessity lead to these developments. Vegetation maps of the United States in the late 1800's and first two decades of the nineteenth century, lead by Clements, still used vague botanical terminology.

Schimper in 1898 presented a new vegetation map of the world, the first to show ecological formations such as 'tropical rainforests', 'thornforests and scrub'. These regional vegetation zones were then linked with climate zones. Climate is the external factor most closely associated with vegetation. Vegetation, in turn, affects soils development, and both are affected by land forms. Towards this new global view, Koppen (1918) published a world map with new climatic classifications closely linked to vegetation regions.¹⁶

Homer Shantz' mapping of the western United States and Africa was part of this new direction in mapping research. He linked geographical formations such as rivers, mountains and plains to plant communities, locating places and administrative districts. The landmark vegetation map by Shantz and Lon was published in 1923 but completed in 1913.¹⁷ For more than a generation this map remained the only significant vegetation map of the United States.¹⁸ The Shantz and Marbut map, '*The Vegetation and Soils of Africa*' was the landmark map for that continent.¹⁹ These map vegetation regions such as prairie, tall grass-low tree savanna and thorn forest, the soils and the climate.

Shantz' emphasis on scientific measurements, botanical species, chemical soil studies, moisture levels in the air and soil, was not popular, but it was more useful. The titles of some of his mapping works indicate the trend, The "Relative Water Requirement of Plants" and "The Wilting Coefficient for Different Plants, and its indirect Determination", and the "Atlas of American Agriculture" that includes sections on Land Relief; Climate; Temperature, Sunshine and Wind; Frost and Growing Season; Precipitation and Humidity; and, Soils of the United States, as part of the physical basis of agriculture. These principles of ecological biogeography have become integral to mapping.²⁰

Swiss botanist Agustin P. de Candolle in 1820 defined two directions for biogeographical investigation: ecological biogeography and historical biogeography. Shantz' work as one of the founders of biogeography demonstrates ecological and historical biogeographical focus.²¹ In his lifetime, students of Professor Shantz used his maps to return to study the environmental changes that took place in parts of the western United States, on National Forest reserves, and in Kenya.²² It will be possible to use his photographs, many of them panoramas consisting of two, three or four photographs, to return precisely to the same spot and study changes not only in human occupation, but in natural vegetation and climate long-term changes, hundreds of years into the future. Major shifts in climate and vegetation of are growing concern: Shantz' photographic record gives us the tools to measure these changes with precision.

Shantz, and his interest in soil degradation make his photographs invaluable for return photography studies of vegetation and landscape change through time. This technique has been successfully employed, using his photographs in such works as *Photographic Documentation: Vegetation Changes in Northern Great Plains*; and *The Changing Mile: an Ecological Study of Vegetation Change with*

Time in the Lower Mile of an Arid and Semi-arid Region; Ecology of Sonoran Desert Plants and Plant Communities.^{23, 24}

Homer L. Shantz's particular interests were environmental degradation brought about by inappropriate farming, grazing and orchard practices. He documents this carefully in both his notes and his photography choices. The increase in erosion, the patterns of erosion caused by run-off and slope angle, the increase of alkaline conditions leading to poor or no growth of vegetation; these topics had his full attention in field studies.

Using his African photographs, there have been studies of vegetation change through the decades, such as *Kenya's Changing Landscape*.²⁵ Homer Shantz wrote a lot about "black alkali", he frequently notes the "appearance of salts of black alkali", or the increase in salinity in soils through leaching of organics, with the end result that the soils are black and cannot grow any vegetation at all. In 1913 in the Escalante Valley, California, he performed a series of experiments testing a series of small bores at 1, 2 and 3 feet noting soil type, total solids present and water content measured through electrical resistance in Ohms. For example, in one location he notes at 1 ft he measured 970 Ohms at 93.5 degrees Fahrenheit ambient temperature. This type of study of moisture retention is a part of today's approach to vegetation and forestry studies.

Shantz was one of the first to systematically study the effects of water, rainfall and irrigation, drip and flood irrigation, on the build-up of salts in the thin, desert soils of the western United States. He made several tours through the orchard regions of California and Oregon, studying the soils in orange, lemon, cherry, apple, and plum orchards. He also studied moisture and soils in grape growing regions.

The fact that Homer Shantz has taken comprehensive sets of photographs of large tracts of western arid, and semi-arid lands *before* substantial changes occurred through grazing, ploughing or irrigation, has made it possible for later generations of vegetation and soils scientists to continue the study of change through time and management. It will be possible to use his photographs, many of them panoramas consisting of two, three or four photographs, to return precisely to the same spot and study changes not only in human occupation, but in natural vegetation long-term changes. Today's concern with global warming can benefit from this photographic record.²⁶

He made studies of the forest regions of Oregon and Washington state yellow pine, bull pine and douglas fir forests. He notes soil types and growth, with enough photographic evidence to provide for studies in forestry change since 1916, and 1911 in some cases. Shantz' notes give us personal comments, decisions and anecdotes for all his travels. At a distance of fifty to ninety years they cannot but help to provide a historical perspective on the creation of scientific thought. Shantz gives a comprehensive comment for the basis upon

which he decides the distinction between prairie grasslands and short grass lands. "These great formations run into each other imperceptibly and the distinction between them will be for some time a matter of personal judgment. Even if an arbitrary division is made on percentage of surface covered or dominance of one type or another, still the establishment of an arbitrary standard will be more or less a matter of personal judgment. At present I feel inclined to map the grass area of the Washington-Oregon region as prairie, and the grass area of New Mexico, Arizona and Utah as short grass."²⁷ He traveled to Ontario in 1916, to the U.S.S.R. in 1930 and Germany in 1934. He took part in the International Phytogeographic Expedition to Switzerland in 1923.

The political needs of the First World War lead to the development of vegetation mapping as a political tool. Hiring Dr Shantz and over one hundred academics for the American Commission to Negotiate Peace was the first time academics were organized into government departments and employed specifically to gather information for political purposes.

Collections

The Smithsonian National Herbarium houses the Shantz Collection in their Historical Collections, 791 'original' specimens from the U.S. and 809 African 'original' specimens including food and medicinal plants, with an extensive Grain sorghum collection and a Grass sorghum collection. The term 'original' means that it is the first of that species in the collection, not a duplicate holding. These may be found at: <http://persoon.si.edu/botany/collectJ>. Enter 'Shantz' to access his collection.²⁸

The grounds of the University of Arizona were planted extensively by Homer Shantz and his students who collected botanical specimens and brought them back and planted them in the grounds. In 2002 the University of Arizona grounds were included in the National Historical Register as a Historical Botanical Garden.²⁹

The reports and maps of the General Records of the American Commission to Negotiate Peace, 1918-1931, that include Shantz' maps and notes, are archived on microfilm in the National Archives and Records Administration, located in various locations; and in his book "The Vegetation and Soils of Africa". In addition, the University of Arizona Special Collections Library holds originals of many of his maps.³⁰

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