Scientists Study the Plant Life In Desert

Carnegie Laboratory Established in Midst o fthe Arid Lands of the Southwesished in Midst of the Arid in Botanical Research.

A SHORT distance from Tucson, Ariz., in the midst of a desert growth of cactus and other harsh and forbidding plants peculiar to the southwest, is the Carnegie Desert Laboratory, an institution that will amply repay a visit on the part of the scientifically-inclined tourist, says the Philadelphia Record.

The desert laboratory is part of the great Carnegie Institution, which is accomplishing so much for science in various fields of research. It was established in 1903 for the purpose of studying plant life of the desert, and the results are certain to be of great benefit to humanity. "Dry farmers," are demonstrating that the unwatered plains region of the Rockies is capable of producing crops, whereas 20 years ago that portion of the country was regarded as a desert. If drouth-resisting plants can be developed, further increasing the productivity of lands that are now barren or sparsely productive, the food problem of the world will be advanced materially toward solution.

Frederick V. Coville, botanist of the department of agriculture, at whose suggestion the Carnegie Desert Laboratory was founded, with Dr. D. T. MacDougal, made probably the first investigation of the desert popularly known as Death Valley. Several years before the founding of the desert laboratory he penetrated Death Valley.

Many Discoveries.

Many interesting and valuable discoveries were made during this investigation. In fact, Dr. Coville's trip practically laid the foundation of the desert laboratory, as it was demonstrated that the subject of plant life in the desert demanded patient investigation. Dr. MacDougal made a series of experiments at Turkey Tanks, on the western edge of the malpais, or lava desert, near the Little Colorado river, east of Flagstaff, Ariz., in 1898. Later, when these two botanists made the tour that resulted in the establishment of the desert laboratory at Tucson, they journeyed to the desert regions of western Texas, New Mexico, Arizona and California, and spent some time investigating the sand dunes of Chihuahua, in northern Mexico, on the old trail followed by the traders from Santa Fe. The outcome of this trip was the establishment of the laboratory at Tucson.

The Carnegie Desert Laboratory is in an ideal place for carrying out botanical investigations in the desert—a field that has been almost entirely neglected, owing to the difficulties and hardships that have beset expeditions. The laboratory is located immediately west of Tucson. The citizens of that ancient and most interesting city aided materially in establishing the laboratory, giving title to the 860 acres on which the laboratory is located and aiding materially in other ways.

In Typical Desert Country.

The land in which the laboratory is located is typical of the desert country of Arizona. It is incapable of being irrigated, which is an important point, inasmuch as irrigation ditches in the vicinity might render experiments valueless, owing to dampness caused by seepage. Tumamroc Hill rises to a height of 860 feet over the lower mesas in the immediate vicinity of the laboratory, giving a wide altitudinous diversity, which is most essential, as the growth of desert plants is found to vary greatly in accordance with altitude.

The laboratory itself is of unique construction. It is completely equipped with all scientific botanical instruments and meteorogical instruments. A feature is a temperature chamber, dug in the exact center under the building. This chamber is six by six feet, with an air space of brick all about it, and with an entranec so constructed that one can enter the chamber without creating any disturbing air currents. The top of the chamber is insulsted and exact records of the temperature can be secured.

Wide Field.

The work of investigation is not confined to the vicinity of Tucson, but is being carried on in all parts of the southwest. Expeditions are being constantly sent out, and visiting scientists join many of these excursions. All classes and conditions of desert plants are being grouped and studied. One of the most interesting and vital experiments is the study of water-storing plants. It has been known for years that certain plants have great capacities for storing moisture, this reserve being drawn upon to sustain the plant in time of long-continued drouth. In Mexico the "barrel cactus" contains so much water that the natives frequently cut the top from the plant and refresh themselves from the water found in the interior of the great plant. Some of these water-storing plants were collected and stored at the Carnegie Desert Laboratory at the outset of the work there, and with a view to ascertaining how long the plant growths would flourish without additional moisture. The plants for seven years have put forth shoots and leaves at the beginning of each rainy season, drawing on their stores of water and apparently showing no signs of dissolution.

Investigated Salton Basin.

The experts from the Carnegie Desert Laboratory made a thorough investigation of the great Salton basin before the overflow which completely inundated that country a few years ago. Since the repair of the leak that sent the flood waters of the Colorado river into the Salton basin, a process of evaporation has been going on, and it is estimated that in a few years the basin will be arid once more. This affords the botanical experts a rare chance to study the changes wrought in the desert growth of the basin, as compared with the results secured before the great influx of moisture took place.

In the Colorado desert the Carnegie experts have been enabled to carry out some interesting and valuable observations concerning alkali resistant plants. At Salton, which lies on the edge of the salt flat, near several alkaline springs, plants are growing from soil that is heavily encrusted with salt and alkali.

The palm groves of the Colorado desert, near Indio, offer a special field of investigation. The parched slopes of the foothills of the San Bernardino mountains seem incapable of supporting any life, but within the mouths of some of the canyons occur groves of a native palm. Thousand Palm Canyon, near the desert settlement of Indio, affords an astounding example of desert growth. In this canyon are many palms, which, at full maturity, are 50 feet high and have trunks two feet in diameter. Most of the old trunks are apparently blackened by fire. The dead leaves of the younger trees are folded downward, and sometimes form a cylindrical mass eight feet in diameter. As the trees grow taller these dead leaves fall to the ground, leaving a naked trunk, with a collar of green leaves at the top. These trees grow in clay, encrusted with alkali.

Changes in Plants.

To determine the changes wrought by different altitudinous and climatic conditions, various species of desert plants have been transferred from one part of the country to another, and the changes are being recorded with scrupulous care. Small plantations have been established in different spots, to observe minor details of meteorology, etc. One of these plantations is at Cinchona, Jamaica. American watercress, growing near Lake Champlain in three feet of water, has been transferred to the desert plantations at Jamaica. Sweeping changes are being wrought in the plant, owing to the transfer, all of which changes are being minutely recorded for the benefit of science.

Some important studies in transportation, to determine the water relations of the desert region, are being made; also experiments to determine the relations of desert plants to light and humidity. Delicate recording apparatuses have been established at different points to note the differences between the temperatures of the soil and of the air. At the laboratory there is an automatic rain meter, the weight of the water doing its own recording.

Desert Disappears.

Exploration and utilization of desert areas have led to the abandonment of the term desert to all the regions in the west once known as the "Great American Desert," except those about the lower Colorado river and near Great Salt lake. In fact, humanity has been encroaching more and more on the unwatered portions of the west, and it is predicted that in time even the total deserts will sustain a population, like the desert of Sahara, which is populated by over 2,000,000 people.

The work of the Carnegie Desert Laboratory will increase in importance as the tide of civilization approaches closer and closer to the frowning desert areas. Settlers will know absolutely what plant life will thrive under desert conditions. The work of Luther Burbank in developing an edible spineless cactus shows what can be accomplished in literally drawing the fangs of the desert and converting a useless plant growth into something that will sustain life.

Utilizing Desert Plants.

The Papago Indians have found means of utilizing many of the desert plants of the southwest for sustenance. In fact, these indians are desert folk par excellence. They know how to take every advantage of chance water holes, and their villages and farms are in the direct line of traveling thunderstorms, showing that meteorology must have been studied from surrounding peaks. They raised crops of beans by irrigation when the first Spaniards entered the country where Tucson now stands—and, in fact, were the first scientific investigators to take up the work that is now being carried on so elaborately by the white man.

Systems Of Farm Management

By H. H. Schutz, Asst. Prof. of Agronomy, New Mexico A. & M. College

W. J. Spillman, of the bureau of plant industry, gives the factors that determine the systems of farming: Condition of climate, proximity to market, character of farm labor, sociologic conditions, and soil.

The last of these factors in its relation to productiveness is taken as the basis of the classification, in which the types of farm management are divided into: (1) livestock farming; (2) grain and hay farming; and (3) non-humus farming.

In the first of these the crop raised and bought is fed upon the farm and the manure is added to the soil, while little or no other fertilizer is used. General livestock, dairy, and special livestock farming are recognized as subtypes, with market gardening, where city manure is used, considered a type intermediate between livestock and grain and hay farming. This latter depends upon roots, stubble, and catch crops for its humus and nitrogen, and upon commercial fertilizers for the mineral elements. Its ultimate value is not yet fully understood.

Non-Humus Farming.

The third, or nonhumus system of farming, makes no provision for the maintenance of the humus supply, and finally results in wornout or abandoned farms.

The second type is extensively used on the irrigated lands of the west where alfalfa and the salts and silt of the water keep up the fetrility. The third type, as well as the first, prevails in all parts of the country, especially in those where one crop has been found extraordinarily profitable.

An interesting fact brought out is that the amount of fertilizer used in a state or county is inversely proportional to the amount of livestock raised.

Diversity in Farming.

To show the diversity allowed on farms that do not sell anything that will rob them of fertility, Mr. Spillman studied in detail a general livestock farm having beef raising as its specialty; a strictly dairy farm; and one engaged in feeding western range lambs and a flock of pure bred sheep.

The farm of E. E. Chester, of Champaign county, Illinois, was studied as an example of the first type. Horses, cattle and hogs are raised or bought for feeding purposes, and are fed from pastures of blue grass, timothy and clover, on corn, wheat and oats. An elastic rotation is practiced that varies with conditions of soil, seeding and needs of stock.

About 200 acres, or more than one-third of the arable land is in pasture; blue grass in the permanent, and in the temporary pasture timothy and clover sod is used the third, fourth, and sometimes the fifth years. Corn is the principal cultivated crop, usually 140 acres, part being planted where corn had stood the year before, the remainder on clover or timothy and clover sod. The same land is used two or three years for corn; each fall about 20 acres are put into wheat, and in the spring about 25 acres into oats with clover. Pure clover remains down two years, mixed with timothy four or five years.

The Cattle Side Line.

Cattle, of which there were seldom less than 100 or more sold for breeding purposes, and steers are bought and fattened for market. Mr. Chester has gradually changed his herd to registered stock and now a calf at weaning time is valued at $100. He buys steers weighing between 500 and 800 lbs., feeds them economically on pasture, corn stalks, clover hay and silage, and when they have reached the 1000 lb. mark they are given 40 pounds ensilage, a peck of corn, and all the clover hay they care for. During March and April on this feed their increase averages three pounds a day; then at the end of April and until June they are put on blue grass with a peck of corn per day. The period of fattening varies between 100 and 120 days.

About 100 hogs are kept and grain fed except when following cattle on feed. They are sold at 200 pounds. When the spring yield is old enough the sows and pigs are put in the pasture after the cattle.

Sells Horses.

Twice as many horses as are necessary for the work are kept, the object being to make enough profit on those sold to pay for the sustenance of those needed. To prepare them for market they are given sufficient quantities of clover hay and as much corn and oats as they will eat. In substituting green corn for dry, one dry ear daily is replaced by a green one. He thinks that farmers should raise only draft horses.

In Allan county, Indiana, is located the dairy farm of T. E. Ellison, which was studied by Mr. Spillman in this investigation. No regular rotation is practiced; all the crops are fed and more feed bought as required. An area of 105 acres is devoted to blue grass pasture and the manure is spread as it is produced. It is virtually a dairy farm with 100 registered and grade Jersey cows and 75 young animals, no breeding stock being sold. The heifer calves are fed skim milk, clover hay and blue grass pasture. Six brood sows raising two litters each enable him to market about 100 hogs annually, they being sold at about 225 lbs. The pigs get buttermilk, rape and corn; sows with litters, all the rape they will eat, some grass and buttermilk. An acre of rape planted in April gives two crops a year, and is cut and fed twice daily. Thirteen work horses are also kept.

Corn Principal Crop.

Corn is the principal crop, about 170 acres being devoted to it. Grown four or five years in succession it is manured as needed, and yields frequently as much as 100 bushels per acre, though the average is 60 bushels. Forty to 50 acres furnish the corn for a 650 ton silo, the remainder of the corn being shocked and husked, the stover shredded, which latter, according to Mr. Ellison, greatly adds to the profit of the farm.

Each of the 20 acres so planted produces three to four tons of oats which is cut for hay; clover is sown with it on land previously occupied by corn. A like tract is used for growing clover. The first year it is made into hay, the second it is plowed up for corn.

He has found alfalfa equal to bran in feeding value. It was sown with oats, using 20 pounds alfalfa per bushel of oats, and yielded over four tons in three cuttings.

With the aid of his dairy business in a city near by where he sells butter, ice cream and pasteurized cream and milk, he clears over $8000 annually.

J. E. Wing's farm of Champaign county, Ohio, is noted for its sheep and crops of alfalfa. He cuts three crops per year from his 100 aacres of alfalfa; grows no wheat and has found the following a good rotation: Alfalfa, four years; corn, one year; beardless barley, one year. The barley is removed in time to let the alfalfa get a good start the first season.

His labor bill on 260 acres he farmed is $1500, and $2500 represents his net profit.

Alfalfa is used for hay and pasture, and to avoid danger from bloating cattle and sheep pastured on it, he sows brome grass with it, dividing the pasture into four lots, and feeding it when mature. He finds it more profitable to raise alfalfa and buy what corn he lacks, the latter being used for feeding western lambs. The corn is replanted with pumpkin for use in feeding breeding ewes in winter. His experiments lead him to believe that alfalfa and brome grass will sustain six times the stock that blue grass can carry. Twelve acres of alfalfa, brome grass and blue grass in 1902 carried 20 steers and 140 sheep from May 1 to June 15.

From 700 to 1000 western lambs are fed yearly, besides caring for about 75 registered Dorsets. Feeding the lambs four months adds 50 to 100 percent to their weight, this being accomplished by feeding two pounds alfalfa and about 2½ bushels of corn per 100 head.

Manure is applied to the corn in winter and spring, and what remains furnishes a top dressing for the meadows and pastures.