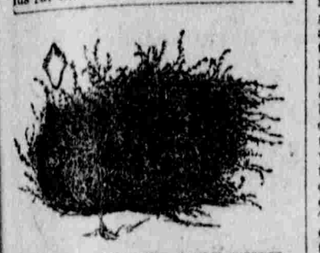
WHY THE DESERTS ARE NOT FERTILE

Presence of Alkali and Lack of Nitrogen Are the Causes.

SALT BUSHES REMOVE ALKALI,

While Legumes and Rotation of Crops Restore Nitrogen to the Barren Soils.

What causes the deserts? Lack of moisture, or lack of soil, or lack of drainage, are the general causes of infertility. The question raised in the nature-study classes at the university was, quite naturally, How may be the desert places be redeemed? What can be done for soil that refuses to yield even after water has been found for it? That is one of the problems which our western science and civilization has yet to solve. The principal contributions thus far have been (a) the recorded experience of practical farmers in reporting the success or failure of experiments they have undertaken; (b) the investigations of the department of agriculture at Washington; (c) the work on Utah soils by the experiment station at Logan, and of the stations in certain other states.



THE AUSTRALIAN SALT BUSH.

The Best of the Alkali-Consuming Plants Recommended for Planting On Desert Soils.

In general, the conclusions of Mr. Kennedy of the government service, in his bulletin "Saltbushes," which will be sent free to anyone applying for it, are of the utmost value and suggestiveness.

SALTBUSHES AS FODDERS.

Three kinds of salts combine to render the waste lands alkaline and arid: common salt, Glauber's salt, and sal soda, or black alkali; the last named being the most injurious to vegetation. Over most of the extensive areas of the west in which the land is so alkaline that none of the cereals, grasses, or clovers will grow, the saltbushes will thrive well, extracting the alkali and producing excellent forage. The Australian saltbushes are the best for this purpose. They will produce from 15 to 20 tons of green, or three to five tons of dry forage per acre. Many of these grow well on non-alkali lands. The seed for trials will be furnished free by the government. On alkali lands the seed should be sown in spring or summer and pressed into the soil; on other lands, the seed may be lightly covered. The saltbushes withstand severe drouth, and in a few years relieve the soil of its alkali. Black alkali soils may be reclaimed by being treated with gypsum. The saltbushes compare favorably with other fodders as to their flesh forming properties, ranking with oat hay as to digestibility, and being freely eaten by horses, cattle, hogs, sheep, goats, and chickens. But cattle are likely at first to eat too much of this forage when green. The Australian, the gray, the slender, the roundleaf and the bladder species from Australia, and the shad scale, Nuttalls, the spiny, the scrub, the Utah, the tumbling, and Nelson's of the American kinds, are supposed to be the best for planting.

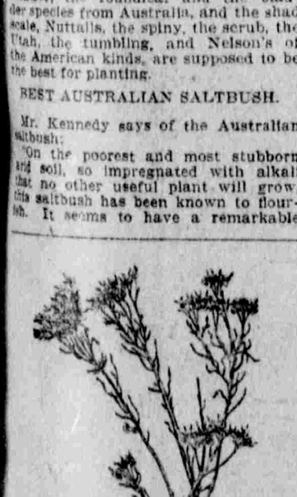
THE TORCH WEED.

Compare With the Desert Astragulus As to the Meager Foliage Characteristic of Desert Plants. Drawn From Nature by Preparatory Student.

BEST AUSTRALIAN SALTBUSH.

Mr. Kennedy says of the Australian saltbush:

"On the poorest and most stubborn arid soil, so impregnated with alkali that no other useful plant will grow, this saltbush has been known to flourish. It seems to have a remarkable number of virtues, including great frost resistance, palatability, heavy yield, sandbinding qualities, and the habit of spreading freely. Sheep are especially fond of this saltbush and hogs eat it freely. A mixture of three parts of this forage with one part of common hay is readily eaten by horses and cattle. It is probable that about 20 tons of green feed or five tons of cured forage could be produced from one acre. The introduction of this plant to owners of waste alkali lands has certainly been a great achievement. As it has almost the same nutritive ratio as alfalfa, it would seem that it must have nearly as high a feeding value. Von Mueller states that, in his opinion, many of the valuable qualities of the Australian woods are due to the abundance of this and other saltbushes in the regions in which the sheep are grazed. Owing to its thin, flexible stems it can be handled like alfalfa, while most of the other saltbushes are only fit for browsing. Of all the different species in cultivation in this country this Australian saltbush seems to be the most promising, both because of its hardness and the bulk of tender fodder produced."



THE RABBIT BRUSH.

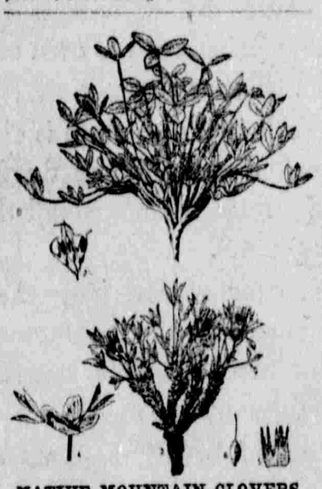
Compare With the Desert Astragulus And Torchweed. Drawn From Nature by a Student.

NATURE OF UTAH SOILS.

The first settlers found the soils of Utah of extraordinary fertility as soon as water was applied in irrigation. But many of the soils are no longer so, and yield only fair and diminishing returns. Many of the bottom lands, too, have become alkaline, and have had to be abandoned. The irrigation of the higher lands has washed the alkali upon them. The virgin soils of Utah originally formed from the decay and erosion of the mountain rocks, were rich in all minerals necessary to growth, but lacked one essential element—nitrogen, the most important of plant foods. Nitrogen was not entirely lacking, however, for within the great basin especially the land was well supplied with plants of the legume or pea family, which have the power of taking nitrogen from the air by indirect means and storing it in the soil.

BACTERIA SUPPLY NITROGEN.

These plants supply nitrogen by means of colonies of bacteria, which grow upon their roots. These bacteria are of two groups. The first, called the nitrifying bacteria, form soluble nitrates, or plant food, from the ammonia compounds in manure or green crops plowed under; and this kind of bacteria is found in all soils. The second, called the tubercle forming bacteria, are those that aid peas, clovers, vetches, etc., to secure nitrogen from the air. This they do by forming in colonies that cause tubercles to grow on the roots of the leguminous plants. These bacteria are cultivated in some of the experiment stations, and the cultures are sold to farmers for the purpose of inoculating the soil with them.



NATIVE MOUNTAIN CLOVERS.

Leguminous Plants That Supply the Soil With Nitrogen. 1. Trifolium Gymnocarpum. 2. T. Andinum

and especially soil intended for the growth of alfalfa.

SOIL INOCCULATION.

"Soil inoculation" is the process of adding to it those bacteria that produce nodules on the roots of the leguminous plants. There are two methods of soil inoculation: (1) by taking soil from a field known to produce nodules on the particular plant desired, and applying this soil to the land that is to be inoculated; (2) by inoculating the seed before planting with the desired germ culture, which may be purchased from some of the stations. A bulletin on soils, from the Agricultural college of Utah (Dr. Widtsoe) gives the following comprehensive summary.

LEGUMES AS FERTILIZERS.

"Among the many plants that covered the Utah valleys, during the many centuries that came and departed before the first settlers arrived, were many species of the family leguminosæ, which has the power of enriching the soil with nitrogen. From all this it is not surprising to find liberal supplies of nitrogen and of humus in many of the soils of Utah. The dry, rather hot climate, tended naturally to reduce the organic matter not humified. Beyond the Great Basin, and on its rim, the amounts of nitrogen and humus are not so large; for here the climate was drier and vegetation did not flourish. All plants which belong to the leguminosæ, or which carry their seeds in pods, have the power of taking nitrogen from the air by indirect means. They can do this through the action of minute plants, micro-organisms, that settle and grow upon the roots of podbearing plants, and which have the power of taking free nitrogen from the air and changing it into a form fit for the use of plants. If a root of clover, or pea or lucern, etc., be taken from the soil and examined, numerous small swellings, and spherical bodies will be seen upon it and suspended from it by threads. These swellings or tubercles are the homes of the nitrogen gatherers and indicate a healthy state of the plant. As far as known today, only the leguminous plants will support these minute organisms upon their roots. A leguminous crop grown upon a piece of land will enrich it very much, even if the crop be taken away, for the roots will remain and they will be heavily charged with nitrogen, which will be of value to the crop of the next season. If a crop of clover, for instance, be plowed under, the results will be more favorable, for then all the nitrogen in the leaves and the stalks can be utilized by the succeeding crops."

WHY DO SOILS WEAR OUT?

The soils of Utah, especially within the basin, are rich in all plant foods. Why do they wear out? or better, why do the yields diminish after some years of cultivation? The virgin soils were rich in plant food that was in a very soluble condition, and which would be used by the plants first of all. As successive crops were raised upon the land, this easily available food became exhausted and the plants were compelled to fall back upon the more insoluble portion of their food supply. With the passage of the seasons, the plant food that remained would be in a more insoluble condition; and, consequently, the plants would feed with increasing difficulty. This led to a decrease of the yields of crops on the lands, for a crop is, roughly, directly dependent upon the amount of easily available plant food present.

ROTATION OF CROPS.

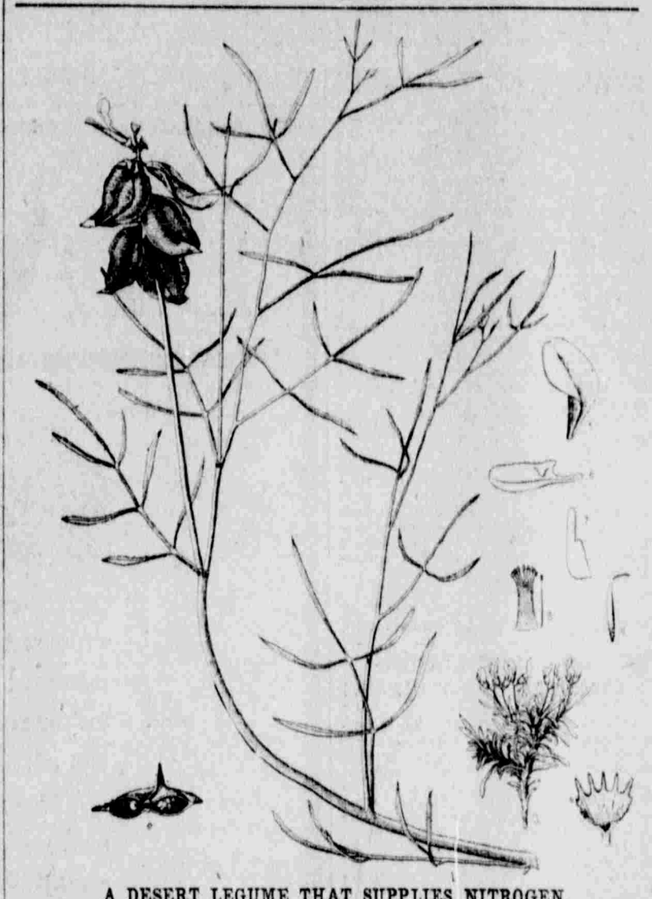
To grow the same crop upon a field year after year is the very worst way of treating the soil. Every plant has its own peculiar habit of life. It feeds more heavily upon one substance than upon another; it attacks the soil particles in its own characteristic manner; its peculiar root system will use only a certain portion of the soil, and only to a certain depth; in short, it will exhaust the land, making it weak and worn in one way, leaving it fertile in all other ways. When, now, weeds settle upon the lands, those having habits different from the crop grown, will find a rich soil for their growth and will flourish, always with great detriment to the crop desired by the husbandman, and often with its total destruction. The first consideration, therefore, in a system of rotation of crops, is to exhaust the soil as uniformly as possible. This may be done by following, for instance, a shallow rooted with a deep rooted crop, in order to exhaust the upper and lower layers alike.

HOW TO ADD NITROGEN.

The element nitrogen, which is contained by soils in smaller quantity than any other constituent, is used by plants in greater quantities than any other plant food taken from the soil, with the exception of water; consequently, the supply, even in fertile soils, is likely to be soon exhausted. Inside of the Great Basin, many soils have already become deficient in this element, and a few never did contain enough of it. Outside of the Basin, and on its rim, many virgin soils can not produce one good crop, though watered abundantly, because of the lack of this element; and, often, ignorance of the principles of agriculture has left otherwise fertile lands unused for many years, while lands poorer in most ways, but containing more nitrogen, have been cultivated.

To replace the nitrogen taken away by crops, or to increase the amount already present, a leguminous or podbearing crop should be made a part of every rotation. The crops that may be used are many: Peas, beans, the clovers, including lucern, vetches, etc.

As an example of a simple, four-year rotation, we may take the famous Norfolk system: 1st, wheat; 2nd, clover or some other leguminous plant; 3rd, barley; 4th, turnips, or some other hoed crop. The very successful rotation of New York state is as follows: 1st, barley or wheat; 2nd, clover or some other leguminous crop; 3rd, corn, potatoes or roots; 4th, oats.



A DESERT LEGUME THAT SUPPLIES NITROGEN.

1. Astragulus Simplicifolius. Notice the Spare Foliage of the Desert Species. 2. A Smaller Astragulus.

THE SPIDER AND HIS WEB.

He is Not an Insect for the Reason that He Has Too Many Legs.

SPIDERS form good objects for a rainy-day study, and two hours in a neglected garret, watching these clever little beings, will often arouse such interest that we shall be glad to devote many days of sunshine to observing those species which hunt and build, and live in the open fields. There is no insect in the world with more than six legs, and as a spider has eight he is therefore thrown out of the company of butterflies, beetles and wasps, and finds himself in a strange assemblage. Even to his nearest relatives he bears little resemblance, for when we realize that scorpions and horseshoe crabs must call him cousin, we perceive that his is indeed an aberrant bough on the tree of creation.

Nature has provided spiders with an organ filled always with liquid, which, on being exposed to the air, hardens and can be drawn out into the slender threads which we know as cobweb. The silkworm encases its body with a mile or more of gleaming silk, but there its usefulness is ended as far as the silkworm is concerned. But spiders have found a hundred uses for their cordage, some of which are startlingly similar to human inventions.

A list of all the uses of cobwebs would take much space, but of these the most familiar is the snare set for unwary flies—the wonderfully ingenious webs which sparkle with dew among the grasses or stretch from bush to bush. The framework is of webbing, and upon this is woven the sticky spiral which is so elastic, so ethereal; and yet strong enough to entangle a good-sized insect. How knowing seems the little worker, as the web and his den of concealment being completed, he spins a strong cable from the center of the web to the entrance of his watch-tower. Then, when a trembling of his aerial spans warns him of a capture, how eagerly he seizes his master cable and jerks away on it, thus vibrating the whole structure and making more certain the confusion of his victim.

Those spiders which leap upon their prey, instead of setting snares for it, have still a use for their threads of life, throwing out a cable as they leap, to break their fall if they miss their foothold. What a strange use of the cobweb is that of the little flying spiders! Up they run to the top of a post, elevate their abdomens, and run out several threads, which lengthen and lengthen until the breeze catches them, and away goes the wingless aeronaut for yards or for miles, as fortune may dictate! We wonder if he can cut loose or pull in his balloon cables at will.

A most fascinating tale would unfold could we discover all the uses of cobweb when the spiders themselves are through with it. Certain it is that our ruby-throated hummingbird robs many webs to fasten together the plant down and lichens which compose her dainty nest.

Search the pond and you will find another member of the spider family swimming about at ease beneath the surface, thoroughly aquatic in his habits, but breathing a bubble of air which he carries about with him. When his supply is low, he swims to a submarine castle of silk, so airtight that he can keep it filled with a large bubble of air, upon which he draws from time to time.

And so we might go on enumerating almost endless uses for the web, which is nature's gift to these little waifs, who, ages ago, left the sea and have won a place for themselves in the sunshine among the butterflies and flowers.—New York Evening Post.

A MONSTER CRACK IN THE EARTH.

THE second largest crack in the earth in the United States has been discovered in a remote part of the Terlingua quicksilver district, ninety miles south of Marathon, Tex., according to Dr. William B. Phillips, formerly director of the state mineral survey, who is now operating mines in that section.

Dr. Phillips says this crack is 11 miles long and no less than 700 feet wide at any point. It is 1,800 feet deep. The walls are almost perpendicular.

The country where it is located has an altitude of about 3,000 feet. Careful exploration of this remarkable crack has not yet been made. It is believed that search may reveal rich mineris, particularly quicksilver.

The crack is far from any human habitation, with the exception of the shack of an old Mexican, who lives in its gloomy bottom. He was found by a party of hunters, but fled at their approach and reached the bottom of the crack by means of a rude rope ladder, which he had made from the fiber of the cactus plant.

The hunters followed him down the ladder and cornered him in his house. The old man could not be induced to talk much. Only a glimmer of the sun could be seen from the bottom of the pit and the Americans did not tarry long. They noticed that a stream of pure water bubbled up near the Mexican's shack, and that he seemed well provided with vegetables and other edibles. Goats grazed upon the grass and shrubbery which covered the floor of the cavern, and chickens were gathered around the home of the hermit. The old Mexican said he came there years before from Mexico. How long ago he could not remember. He lived there because he wanted to be alone. He had visited Boquillas, a town about 30 miles distant, a few times.

The discovery of this freak of nature recalls the fact that Big Bend county was until a few years ago the rendezvous of desperate outlaws, Mexicans and Americans. Many futile pursuits after these murderers and thieves were made by United States and Texas officers of the law.

The discovery of this crack may explain how these criminals evaded capture so easily. It is believed that they made the cavern their rendezvous.

The Taylor gang of train robbers, who held up a Southern Pacific train near Valentine years ago, was reported to have obtained $60,000. It is said that all of the members of the gang were afterward captured or killed, but none of the money was recovered.

UGLIEST FISH IN THE WORLD.

The repulsive object shown in the cut is the head of what is known as the oarfish and is found in the waters off the coast of New Zealand.

VERY LIKE AN ELEPHANT.

One of the most wonderful vegetable freaks of the season is shown in the accompanying cut. It is a daffodil bulb

raised by an amateur florist and is as perfect a figure of an elephant as if it were carved with that intent.

Artificial Ice Making.

Few American trades have grown as rapidly in recent years as artificial ice making. The conditions of ice supply and the number of factories requiring ice in enormous quantities seem to promise a further extension of the business. It is limited to no particular state, but has been most generally and most largely developed in the south.

In 1870 there were four artificial ice-making plants in the United States. In 1880 there were 35. In 1890 there were 200. In 1900 there were 806. There are now considerably more than 1,000.

The capital invested in them is more than $15,000,000, and the amount of ice they turn out in a year is in excess of 5,000,000 tons, of which 1,500,000 tons is manufactured in the southern states.

The original artificial ice plant established in the United States was in New Orleans in 1866, and the intention of its projectors was declared to be to supply artificial ice in the territory south of the ice line, which is south of the North Atlantic, New England, middle and Northwestern States. By degrees ice plants have been established in the territory supplied with natural ice, breweries, hotels, restaurants, packing-houses and hospitals having refrigerating plants.—New York Sun.