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SILVER FOX FARMING.

BY

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF BIOLOGICAL SURVEY,
Washington, D. C., May 28, 1908.

SIR: I have the honor to transmit herewith a report on the rearing of silver foxes. As civilization encroaches on the breeding grounds of wild animals the supply of fur steadily diminishes and the price correspondingly advances. If furs as articles of use and adornment are not soon to disappear from general use, methods must be devised for raising fur-bearing animals in confinement. This subject is now being investigated by the Biological Survey. The present bulletin furnishes information as to the possibilities of the propagation of silver, or silver-black, foxes and the best methods of conducting the business. The silver-black fox is one of the highest priced of fur bearers, and hence offers a tempting field for experiment. The business of raising this animal is believed to promise fair if not large returns for skill, experience, and the investment of moderate capital.

I recommend that this report be published in the Farmers' Bulletin series.

Respectfully,

C. HART MERRIAM,
Chief, Biological Survey.

Hon. JAMES WILSON,
Secretary of Agriculture.

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SILVER FOX FARMING.

INTRODUCTION.

Of all the products derived from wild animals, furs are the most useful and valuable. Indispensable to primitive man, they are scarcely less important to the most civilized, for in warmth, beauty, and durability no manufactured fabrics excel them. But expanding civilization is steadily diminishing the supply of furs, both by increasing the demand and by encroaching upon the territory in which they are produced. Many furs, like ivory, whalebone, and other natural commodities, already are so scarce that the demand for them is met largely by the substitution of inferior products. Activity in the pursuit of fur-bearing animals and development of system in handling and marketing the furs have reached a degree scarcely to be surpassed. Therefore the growing and world-wide demand for furs of high quality can be met only by increasing the number of the animals producing them. This at once suggests that fur bearers may be propagated in confinement, and that by this means an important industry may be developed. The idea is not new, for the domestication of fur-bearing animals has been the subject of considerable thought and experiment in the past. Most of the early enterprises were devoted to the smaller and less valuable animals, as skunks and minks, and seldom advanced beyond theoretical or experimental stages; but results of considerable importance have been obtained recently with the blue fox in Alaska and with the silver fox in eastern North America.

The Biological Survey as yet has not investigated the Alaska blue fox industry, but a study of silver fox raising has been made, in the course of which a number of persons engaged in the business were visited and their methods examined.^a From this study it appears that although many experiments have failed, a few have succeeded to an extent indicating important possibilities for the future. It may be stated, however, that success is not due to following any set of rules, since much depends upon the personal fitness of the one conducting the undertaking. It is to be remembered also that as a busi-

^a At the request of many of them the names of these fox breeders are withheld, but thanks are due to all of them for the facilities and information which they courteously furnished.

ness fox raising is still in the experimental stage, and that even the most successful breeders are subject to a percentage of failure.

THE SILVER FOX.

The name "silver fox," as commonly used by furriers, includes the dark phases of the ordinary red fox, variously called silver, silver-gray, silver-black, or black. The animal is the common fox (*Vulpes fulvus*) of northern North America, the crafty Reynard of the books, closely allied to the European fox. It should not be confused with the gray fox, or tree fox, of the southern part of the United States, a very different animal, the fur of which has comparatively little value. Naturalists distinguish several species and subspecies, the characters of which are not important in the present connection. The color of the red fox of the northeastern States and of its allies of the colder parts of North America varies from red to black, and these extremes, with the gradations between them, form four more or less distinct phases, respectively known as red, cross (or patch), silver, and black. In the red phase the animal is entirely rich fulvous, except restricted black markings on the feet and ears, a white area at the end of the tail, and certain white-tipped hairs on the back and rump. From this phase to the next the black increases in extent until, in the typical cross fox, the black predominates on the feet, legs, and underparts, while fulvous overlaying black covers most of the head, shoulders, and back. A gradual increase of the black and elimination of the fulvous or its replacement by white brings us to the next phase, the silver (or silver-gray), in which no fulvous appears, the entire pelage being dark at the base and heavily or lightly overlain with grayish white. Silver foxes vary from those in which the color is entirely grizzled to those in which it is entirely black, except a few white-tipped hairs on the back and rump. Finally, in the black phase, the white is absent from all parts except the tip of the tail, which is white in all phases. The red phase is much more abundant than the others, but the three interbreed freely, and wherever one occurs occasional examples of the others also may be expected. In general the cross fox is fairly common, the silver-gray is comparatively scarce, and the pure black is excessively rare. The prices usually paid for skins of the different phases vary according to the relative scarcity of the animals. Thus red fox skins command only a moderate price, cross foxes are somewhat higher, silver foxes are several times higher, and pure black skins are exceedingly valuable, being higher priced than any other fur except sea otter.^a

^aThe following prices are quoted on fox skins (northeastern) in the Fur Trade Review for January, 1908: Red fox, \$1.50 to \$3.50; cross fox, \$4 to \$8; silver fox, \$50 to \$250. These prices are low, and indicate only the relative values of the three color phases. Much higher prices are frequently paid for skins of extra quality, especially for high grade silver fox skins.

Since the animals are essentially alike in habits and in all respects except color, it is evident that silver foxes can be bred as easily as red ones and at a much greater profit, provided they breed true to color. Therefore, although some attention has been given to raising red and cross foxes, efforts to breed the more valuable silvers have been more persistent.

HISTORY OF SILVER FOX BREEDING.

Foxes, especially red foxes, have been kept alive in zoological collections and by private individuals since early historic times. Owing to the value of its fur, however, the silver fox seldom has been confined longer than necessary for it to attain marketable condition. The persons most likely to obtain the live animals have been farmers and woodsmen, to whom immediate returns were of such importance that few cared to risk experimentation for the sake of future profits. Only in recent years and in most cases only after experience with the less valuable red foxes have serious attempts been made to raise silver foxes. Of some twenty parties known to have engaged in breeding them, one began fifteen years ago and another eight years ago, while all the others undertook the business within the last five years. Those who have persevered in spite of early failures have in the end attained considerable success. Some have become discouraged and have discontinued after a few years, while others are now just beginning and their experience is too slight to be of much value in determining the practicability of the business. Most of them are men of small means living in sparsely settled regions. Their original stock has been obtained chiefly by taking the young from the dens of wild foxes. In some cases small stock companies have been formed and considerable sums of money invested in land, equipment, and breeding stock. For reasons explained later (p. 18), most of these companies have failed.

Thus far, the breeding of silver foxes has been carried on chiefly in the State of Maine and in the Canadian Maritime Provinces—New Brunswick, Nova Scotia, and Prince Edward Island. It has been undertaken to some extent also in Michigan, Alaska, Labrador, and Newfoundland.

AREA SUITED FOR FOX FARMING.

The natural habitat of red, cross, and silver foxes includes the greater part of northern North America, from the central United States northward to and including the border of the treeless tundra. The red phase inhabits nearly all this region, but the silver phase, although known from most parts of it, is very irregularly distributed. In general it is much more common in northern localities than in southern, but many parts of the north where red foxes are abundant produce silvers only rarely. From the reports of wholesale fur

buyers, it is learned that many silver fox skins of high quality are secured from Newfoundland and from the Height of Land, between Quebec and the peninsula of Labrador. Considerable numbers come also from Alaska and the Canadian Northwest.

It is, of course, well known that pelts of all fur-bearing animals are more valuable when produced in northern localities. Furriers learn from experience that certain localities are not too far south to produce valuable furs, but the conclusions they are able to form are only of very general application. The ordinary individual, however, is seldom able to profit by the experience of furriers and, especially if he chances to live in a region from which fur-bearing animals have been extirpated, he is unable to judge whether or not his own locality is

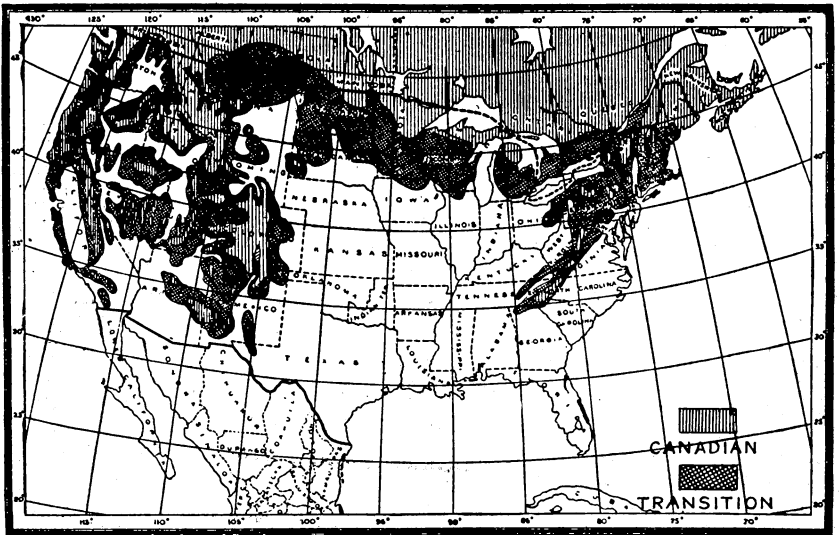


FIG. 1.—Map of life zones in which fox farming is feasible in the United States, showing the Canadian zone where conditions are excellent, and the Transition zone, in parts of which conditions are favorable.

favorably situated for producing foxes with valuable pelts. Fortunately, a reliable guide to all such matters is furnished by the maps of the life zones of the United States. These zones are transcontinental belts, throughout which the animal and plant life are relatively uniform in character. To determine the areas suitable for fox farming, therefore, it is necessary only to learn which zones include localities where foxes are known to produce superior fur. The records of the Biological Survey show that such localities occur only north of the southern boundary of the Canadian zone. This boundary, as shown on accompanying map (fig. 1), crosses the States of Maine, New Hampshire, Vermont, Michigan, Wisconsin, Minnesota, and North

Dakota, and extends southward along the mountains in New York, Pennsylvania, West Virginia, and in all the States of the Rocky Mountain region and westward. South of this line, in the transition zone, foxes having a fair quality of fur may be raised, but the best are obtained only in the Canadian and more northern zones.

CHARACTER OF LOCATION AND SPACE REQUIRED.

Having decided upon the latitude and climate best for fox raising, it is important next to consider the character of the exact location to be selected. It is possible to closely approximate the conditions under which wild foxes live, but this is by no means essential; indeed, whether it is desirable even is somewhat doubtful. If the inclosures are too large, particularly if they afford a variety of conditions, the foxes may remain so wild as to be unmanageable. On the other hand, if the enterprise is conducted in limited quarters in a city, or

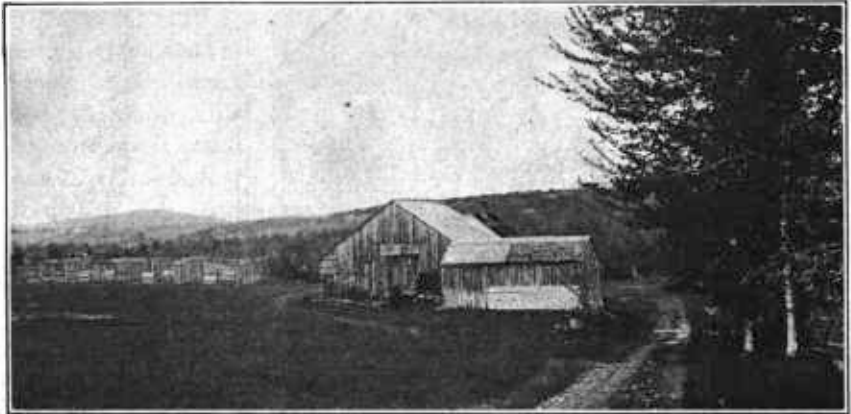


FIG. 2.—Fox yards on open ground near a farmhouse.

even in a small village, where the foxes are often disturbed by visitors, they become restless and suspicious and do not breed well. The best conditions, therefore, are neither exactly natural nor yet too artificial. Foxes require very little space and thrive in inclosures not more than 40 feet square. These may be but a few rods from a farmhouse (fig. 2), or, if visitors are excluded, in a quiet place on the outskirts of a village. A total space of 5 acres is ample for extensive operations, and it is not likely that more than 2 acres will be needed for any except a large and long-established business. A half acre will accommodate about 6 pairs of foxes, which is quite as many as a beginner should attempt to handle. The selection of ground may depend upon circumstances, but effort should be made to include a few trees or small shrubs. These afford shade and a feeling of seclusion and security to the animals. Perfectly open ground has

been used with fair success, and in other cases yards have been situated in thick woods (fig. 3). Neither extreme is to be desired, but many trees are better than none at all. For the sake of cleanliness, sandy soil should be selected wherever possible.

The fox farm of exaggerated newspaper account usually is represented as occupying a lonely island or a vast inclosure of wild land, and too often beginners are led to believe that such places are essential. This is not the case, for, although an ordinary back yard is not quite sufficient, but little more is required. Islands have some advantages and apparently are suited to the requirements of blue foxes in Alaska; but silver foxes need close personal attention, which

can better be given in restricted inclosures.



FIG. 3.—Fox yards in thick woods.

INCLOSURES AND EQUIPMENT.

Inclosures for foxes are made with some of the many varieties of woven-wire fencing. No. 16 galvanized wire is strong enough, but not so durable as No. 14. The mesh should be not greater than 2-inch, for young foxes are able to wriggle through an opening 3 inches

square. The fencing should be about 10 feet high and sunk into the ground 2 feet, while at the top 2 feet should be allowed for an inward overhang to prevent the animals from climbing out. The sunken part may be turned in 1 foot or more, and flat stones may be laid at the edge to prevent escape by digging. Experience shows that this precaution is rather more than is necessary, for since the foxes try to escape by digging only at the edge of the wire, sufficient security is obtained by merely sinking the wire directly into the ground. The use of stones, however, is usually but little additional expense. The way they are laid is well shown in figure 4. The overhanging horizontal wire is easily adjusted along the top of the fence by means

of cross pieces on the posts. This is essential, for foxes are good climbers, and in winter snow often greatly reduces the distance to the top of the fence. The arrangement of subdivisions will necessarily depend somewhat upon circumstances, but the general plan should in most cases conform to that shown in the accompanying diagram (fig. 5). Here a wide outer court is provided, separating the smaller inclosures in which the foxes are actually kept from the unfenced area possibly open to the public. The court shown in the diagram is only 40 feet wide, but it might well be much wider, since its object is not so much to give additional security as to prevent curious visitors or stray domestic animals from annoying the foxes. As the foxes may be annoyed merely by seeing persons or animals at a distance, it is best to have a wide outer court, containing, if possible, bushes and trees. This outer court may be kept locked and the inner inclosures visited only by regular keepers, to whom the foxes are accustomed. If the locality be sufficiently quiet the outer court may be narrow or, in some cases no doubt it may safely be omitted, but the importance of preventing annoyance of the animals can scarcely be overestimated. Often the inclosures may be situated within a fenced pasture. Other means for obtaining seclusion also may be employed, as the training of hedges or the building of solid board fences about 6 feet high immediately outside the wire fences.



FIG. 4.—Corner of fox yard showing stones to prevent escape by digging.

The inner inclosures are of two kinds, most of them small and designed for single animals or pairs, but one or more are somewhat larger and intended to accommodate a number of foxes at one time. Every compartment should be provided with doors so arranged that animals may be transferred readily. The beginner with only one pair of foxes may start with two of the small compartments and gradually add others as needed, meanwhile keeping in mind some general plan insuring a systematic and convenient whole. The small compart-

ments should be at least 30 feet square. Those shown in the diagram are 30 by 40 feet and the larger runs 75 by 40 feet. Passageways giving free access to all the compartments should be 4 to 6 feet wide.

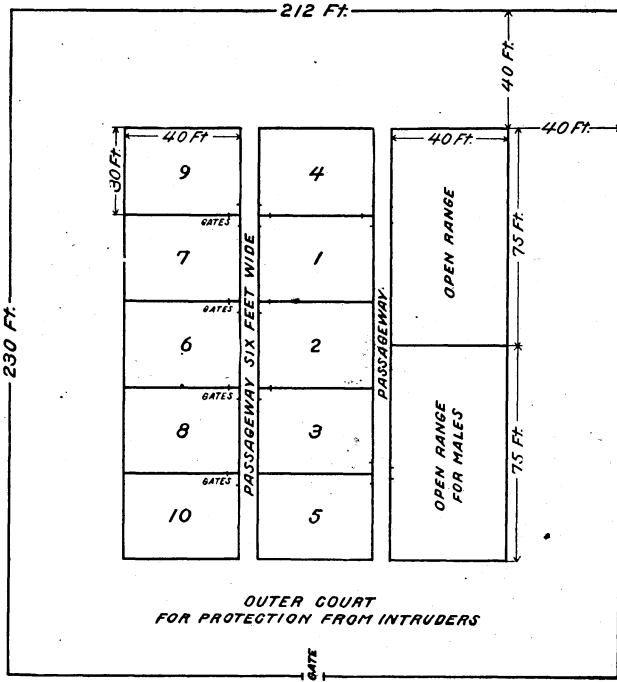


FIG. 5.—Plan for arrangement of fox yards.

Each compartment should contain a small house or shelter box, for, although the foxes often dig natural dens in the ground, they usually accustom themselves readily to artificial shelters. A common form of these is much like a dog kennel and about the same size (see fig. 8). They are ordinarily made 4 or 5 feet square and 2 or 3 feet high, with an

entrance about 6 inches square. A small, hinged trapdoor 8 inches square, giving the keeper access to the inside, may be provided on the back of the house, but this is seldom needed, and its absence removes the temptation to disturb a parent fox at a critical time. Several other forms also are used, especially some contrived with reference to the exclusion of light. These may be made

of boxes or barrels to which are attached closed passages about 2 feet long, with a single or a double elbow at the end (see figs. 6 and 7). These furnish retreats more nearly like a natural fox

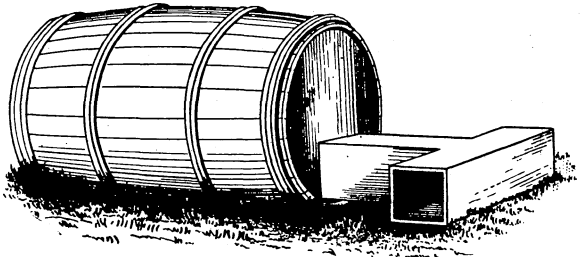


FIG. 6.—Barrel shelter for female and young.

den than the kennels, but it is doubtful if they are superior. No nesting material is needed inside the boxes, as the old foxes either do without or provide themselves from refuse in their inclosure.

FOOD.

Wild foxes eat a great variety of food, including mice, rabbits, birds, and insects, such as grasshoppers, crickets, and beetles. At certain seasons large quantities of berries are eaten. Meat, therefore, is only part of their natural diet. Many fox breeders, failing to recognize this fact, have fed meat largely or exclusively. Although this is not always followed by bad results, it is much better to supply the foxes with a mixed diet, including, besides meat, such food as bread, milk, table scraps, or manufactured dog biscuits, all of which are relished. Indeed, foxes, like dogs, are almost omnivorous, and there is less danger in any particular kind of food than in too large quantities at irregular intervals. Overfeeding is a very common

trouble and produces fat, sluggish animals that do not breed well. The normal weight of a healthy fox is from 6 to 9 pounds; so animals weighing more than 10 pounds are too fat. When excessively fat they may weigh

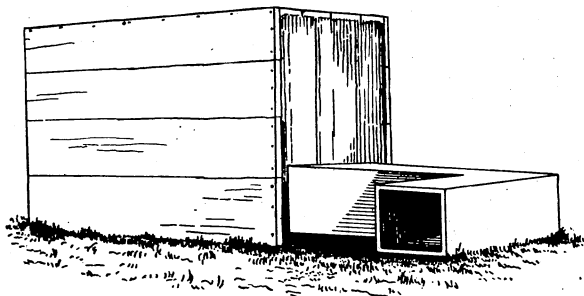


FIG. 7.—Box shelter for female and young.

as much as 16 pounds. Overfat animals are sometimes produced by keeping a number in one inclosure, making it possible for the boldest or tamest to get more than his share of food.

It is always to be remembered that foxes in confinement require as much care as other animals. But it is a strange fact that the experienced stock raiser, who knows full well what disastrous results follow when his horses or cattle get free access to the grain bin, will unhesitatingly throw a whole carcass to his foxes and let them gorge. Since this does not kill them at once, or make them visibly sick, and since they are supposed to feed in this way in the wild state, he sees nothing wrong in it, especially as it saves the trouble of daily attendance. If for no other reason, a regular daily ration is preferable to irregular feeding because it necessitates a more constant and intimate relation between the keeper and his charge. It is a good plan, however, to give them bones with little meat on them now and then, upon which they may gnaw indefinitely. Occasionally they may be

regaled with tidbits consisting of small wild mammals, as rabbits, woodchucks, rats, mice, and other animals likely to be captured about the farm. Fresh drinking water, of course, should be supplied regularly. * If a spring or other natural water supply can be included within the yards much labor is saved.

A fair daily allowance for each fox is one-fourth of a pound of meat and a small handful of miscellaneous scraps. One of the most successful breeders feeds a quarter of a pound of meat and a quart of skim milk daily. Another varies the meat diet with a sort of hoecake made of corn meal and sour milk. The meat used is beef or mutton in the form of butcher's scraps, unsalable parts, and the like, or, most commonly, horse meat procured especially for the purpose. Horse meat is very satisfactory food for foxes and especially commends itself on account of its cheapness. In all rural districts it is a very simple matter to procure a worn-out but perfectly healthy horse, and after slaughtering it to keep the carcass on ice, furnishing a supply of meat for months. When located on the seacoast near fishing settlements fox raisers supply fish, lobsters, and other sea foods to their foxes at little or no cost and find them satisfactory. The expense of feeding is thus comparatively small. According to an estimate of one of the most experienced fox breeders, who fed butcher's meat and skim milk, the cost of feeding one fox, when everything is purchased, is 1 cent per day. In actual practice, however, the cost in his case was much less, since he was able to utilize the scraps from his own table and to obtain much other material from his neighbors.

BREEDING.

Foxes breed only once a year, and the mating or rutting season includes the months of February and March. The period of gestation is about fifty-one days. Therefore the young are born in April and May. The number of young in a litter varies from two to eight, the average number born to adult parents being five. In the wild state foxes are monogamous. The male has only one consort, at least only one in a season, and while the young are being reared he dutifully forages for them. In confinement, however, one male sometimes has been mated successfully with two or even three females. In certain cases this may be desirable, and at an advanced stage of the business may offer no difficulties, but at first it is advisable to handle the animals in pairs. It is possible, also, as proved in a number of instances, to allow male and female to remain together throughout the year without bad results, but it is much better to keep them separate, except during the mating season. They may be paired in December or January and separated in March or April. The females should be kept in the small inclosures continuously and the young removed when weaned. The males, if regularly fed, are not quarrelsome, except in the rutting season, and there-

fore during the greater part of the year may be allowed to run together in the larger inclosures. The separation of the sexes is not, as many suppose, to prevent the male from viciously killing the young; for, unless suffering from hunger, he usually is a model parent, and has even been known to climb a high fence in the effort to carry food to his offspring. But the presence of the male often results in injury to the female during pregnancy, resulting in abortion; or it excites her unduly after the young are born, leading to rougher treatment than they are able to stand.

When born the young are small and weak, but if all is well they grow rapidly, and when about six weeks old begin to come out to play and to lap a little milk or to take an occasional bit of solid food. If allowed to do so, they will continue to nurse for nearly six months. They breed the first season, when a little less than a year old, but usually produce only two or three young.

Foxes in confinement, as in their natural state, show considerable individuality. Some are much better breeders than others; some can never be induced even to mate, and others mate but do not produce young. Their wild nature dominates most of their actions, and it is rare that one becomes really tame. They are constantly in a state of fear, and it is only by the greatest care that confidential relations can be established between them and their keepers. This fear is probably the chief cause of the failure to breed regularly. It may cause the female to refuse the attentions of the male, or having received them, she may prove infertile, or she may become excited so as to injure herself and give birth prematurely. But worst of all, even after producing a litter of healthy young, she may be so solicitous for their safety that in her effort to get them out of imaginary harm's way she maltreats or kills them. Often when her young are just born or only a few days old she will carry them about the inclosure all day, apparently seeking a place to hide them. Perhaps she digs a den in the ground and removes the young one by one from the warm box to the cold ground. Thus they may be moved successively to a number of freshly dug dens and to and from these and the box until the little things are so mauled and exposed that they die.

Keeping the foxes in a secluded place free from visitors is not sufficient alone to overcome these difficulties. Although strangers should be kept away, a regular attendant should visit the animals daily and use every effort to gain their confidence. This is not easy, and a great deal depends upon the personality of the man in charge. One not thoroughly interested or not naturally fond of animals, and therefore slow to understand their ways, is not likely to succeed. Careful observation and a faculty of intuition enables a good keeper to anticipate the moods of the animals and to interpret their actions

at critical times so as to act quickly and without violence. He knows just when the foxes are getting too much food, just when the sexes should be brought together or separated, when the female becomes pregnant, when the young should be born, when they need special attention, and when they may safely be left to the exclusive care of the mother. He is not overinquisitive as to the number of young that are born, and seldom needs to disturb the anxious parent, relying on her actions to show whether or not the little ones are thriving.

GENERAL HABITS OF FOXES IN CONFINEMENT.

Aside from the matter of propagation, the mere keeping of foxes in confinement has proved simple. It is true that they do not become very tame, or only in exceptional cases. Even the offspring of several

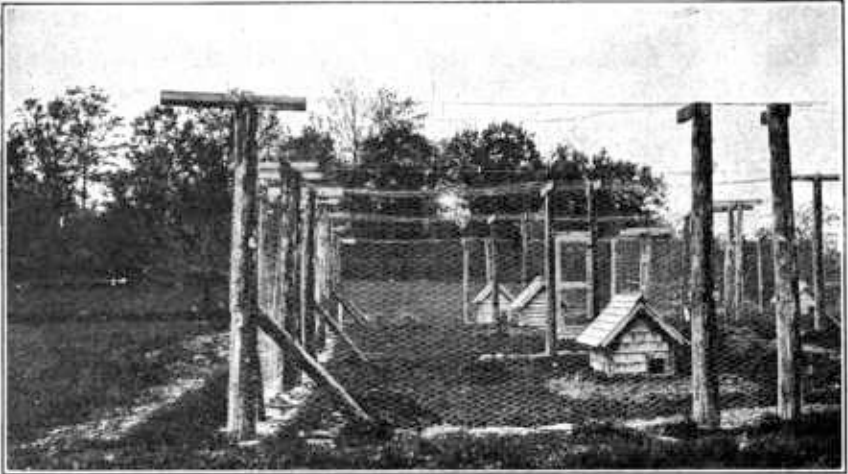


FIG. 8.—Yards of a successful Maine fox farm.

generations of foxes reared in captivity remain wild and, except when young, evince more or less distrust of human beings. Still, life in the wire inclosures does not seem unpleasant to them. When thinking themselves unobserved they play together or lie contentedly stretched at length in the sun. Cold weather has no terrors for them and snow is a delight. At times of alternate freezing and thawing it is dangerous to allow them to lie down on snow, as they may thus seriously injure their coats. They rarely make determined efforts to escape from the inclosures, except during the first few days of captivity. Then they dig for perhaps a foot at the extreme edge of the inclosure where the wire enters the ground. If the wire does not enter the ground, but is merely turned in at the bottom for some 2 feet, they dig only in the angle, and obviously can not accomplish much, as they must work by thrusting their paws through the mesh

of the wire. If stones are placed along the edge of the wire, they make no effort to dig at all, as tunneling under seems never to occur to them. So far as known none have escaped by digging, but a few have managed to climb out. The overhanging wire at the top effectually prevents this at most times, but an unusually heavy drift of snow in winter sometimes enables them to reach an elevation from which they can leap to the top and scramble out. In several cases, however, they have returned to the inclosures and climbed back or have been caught in traps set for them nearby. When at large, foxes do not often climb trees, but in confinement they do so readily and voluntarily, often lying curled up in the thick branches of a spruce or fir for hours.

Although in general of suspicious nature and inclined to be unfriendly to man, foxes in confinement usually maintain good relations among themselves. If well fed, they seldom fight, or if they do it is without fatalities. In a few cases two or more have turned upon a fellow captive and killed or badly crippled it, but usually this has been due to underfeeding or to improper handling during the rutting season. Except when young, they snap and bite at their keeper if he attempts to handle them; so they are separated or transferred by driving them from one inclosure to another through gates arranged for this purpose. When this is not feasible, they may be driven into boxes and so moved. They stand shipment well and may be boxed and sent on a journey of several days by rail with perfect safety. Foxes have been shipped even so far as from Alaska to Maine, but unless specially cared for in transit they do not often survive such a long journey.

DISEASE.

So far as known, fatal disease has been so rare as to be negligible in any general consideration of fox raising. Here and there an animal has died of some unknown internal complaint, but no particular disease has manifested itself. Nothing in the nature of an epidemic has thus far appeared, and even minor diseases have been exceedingly few. Improper feeding causes temporary bowel troubles and a few foxes are reported to have died from a "dizziness in the head," supposed to have been caused by eating too much meat. Fleas occasionally have proved troublesome and may even cause the death of young animals. No doubt foxes may contract mange and other diseases to which dogs are subject, but if kept in cleanly quarters and fed properly they are reasonably safe.

CAUSES OF FAILURE.

The principal cause of failure in attempts to breed foxes appears to have been lack of close personal attention. This is required even

with animals which have long been thoroughly domesticated, as horses, dogs, cattle, and poultry. How much more then is it necessary in the case of an animal suddenly transferred from the wild state to restricted quarters and unnatural conditions. The business of fox raising is new, and he who would succeed must give it careful thought, studying the moods of the animals and preparing himself

to intelligently meet emergencies as they arise. A resourceful, persevering man with a natural fondness for animals can assuredly succeed, where one not so qualified would assuredly fail.

Many men otherwise well qualified do not succeed on



FIG. 9.—Fox yards on open ground.

account of the half-hearted way in which they undertake the business. They do not consider it of prime importance, but make it only an adjunct to other work. Hoping that it may bring them a little supplementary income, they trust it to proceed automatically, meanwhile devoting their best thought and energy to something else. Practically the only conspicuous successes in fox raising have been attained by men who have given it their best efforts.

Companies formed for the sole purpose of raising foxes, however, have uniformly failed. This has been due largely to the great difficulty of securing a hired keeper having the necessary personal interest. Scarcely less disastrous

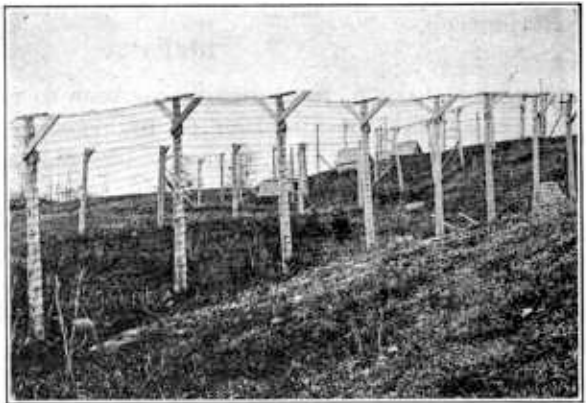


FIG. 10.—Fox yards showing detail of outer fence.

has been the advocacy of different methods of management by different stockholders, each insisting that his theoretical way is the only proper one. Many attempts to raise foxes have been of such short duration that their failure can scarcely be taken into account in considering the practicability of the business. Such fail-

ures might have been turned into success by persistence; in fact, no fox breeder has succeeded from the start. It is interesting to note also that some men, while able to handle foxes well, do not develop the business properly because they are not sufficiently venture-some. Having raised a litter of excellent foxes, the enterprising beginner looks to the future and selects the best of them to add to his breeding stock. Some, however, can not withstand an offer of a few hundred dollars for a good pelt when they think of the casualties that may befall the animal bearing it, and so when the next season comes around their breeding stock is neither larger nor better than before. Among other causes which deter timid owners from retaining many valuable foxes are the possibilities of theft and the serious harm which may be inflicted by malicious trespassers. At present it is not easy to establish ownership of an escaped fox in a country inhabited by wild foxes. It is therefore possible for persons so inclined to contrive the escape of valuable animals, and when they are free to kill them and market their skins.

In the actual handling of foxes all minor difficulties may be easily surmounted by practical men. Failure usually consists only in details relating directly to the breeding; that is, the foxes will not mate, they are infertile, or they fail to rear their young. Experienced breeders attribute these difficulties to two principal causes: (1) Overfeeding, causing the animals to become so fat that they do not breed, and (2) lack of seclusion and quiet, causing excitability and apprehensive nervousness. These matters have already been discussed.

BREEDING FOR IMPROVED STOCK.

Hope for increased profits in fox raising lies almost entirely in improving the stock by selective breeding. The darker the animal the more valuable its pelt. Hence the object of every breeder should be to produce pure black foxes, or as nearly pure black as possible. To do this he must retain his darkest and most valuable animals for breeding, selling only the poorer ones. The temptation to sell animals of high value is often very great, but in the long run such animals are likely to be more profitable if kept for breeding. The possibilities of modification and improvement by selection are fully as great with wild animals as with domestic, and already have been demonstrated in the case of foxes. Some of the highest priced fox skins ever put on the market have been from animals reared in confinement and improved by selective breeding.

Since the silver fox is only a color phase of the red fox, its progeny might be expected often to revert to the red color. As a matter of fact, however, silver foxes bred in confinement have almost invariably produced only silver offspring. Moreover, it is believed that in silver foxes of known red ancestry any tendency to red off-

spring may be "bred out" in a few generations.^a Evidence on this important point is scanty, but the experience of one breeder may be cited. Beginning with a red female and a silver male, five pups were raised, two red, two cross, and one silver. The silver produced from this mating was then bred to an unrelated silver, the result being two cross and one silver. The silver thus produced was then bred for two seasons and gave birth to seven young, all of which were silvers.

Breeding for disposition is perhaps fully as important as breeding for color. So far this has not been attempted to any extent, but evidently it may be of great importance in overcoming some of the principal difficulties now encountered. By selecting those animals which show the least aversion to man, due regard being paid to other qualities, as prolificness, a strain may be obtained which will breed with the certainty of our domestic animals. This in time should produce a thoroughly domesticated race of foxes, a result of inestimable value, amply justifying the utmost efforts. Although it may not be fully accomplished by those who begin it, every breeder should keep its importance in mind, for every slight improvement will be to his advantage, and in the end the unqualified success of the business will be assured.

Some have thought to obtain a more prolific and more tractable animal by crossing foxes with suitable breeds of domestic dogs, but their experiments have failed. Although foxes are classified in the dog family they are placed in a separate genus (*Vulpes*) differing from that (*Canis*) which includes the wolves, jackals, and other canines, from some of which domestic dogs undoubtedly were derived. The period of gestation in the dog, as well known, is about sixty-three days, whereas in the fox it is about fifty-one. Therefore, though perhaps not impossible, the successful crossing of dogs and foxes is scarcely to be expected.

Slight improvement of individual male animals not intended for breeding may be obtained by castration. This has been tried with red foxes and found to produce an animal of somewhat increased size, yielding a correspondingly more valuable pelt.

PREPARATION OF SKINS.

The preparation of skins requires some care, but no special implements or preservatives. The opening and only cut is made with a sharp-pointed knife, beginning on the bottom of one hind foot and extending up the hind side of the leg to the vent and thence down the other leg to the foot. The entire body is removed through this

^a Doubtless in conformity with Mendelian principles, but no careful experiments as yet have been conducted.

opening, using the knife to separate the skin when necessary, and proceeding down over the head to the lips, where the final cuts are made. Thus the skin is turned completely inside out. The tail bone must be carefully withdrawn, preferably by the use as a vise of two firmly held sticks (or a split stick), through which the bone is passed. To facilitate this it may sometimes be necessary to slit the tail on the underside. The skin is then carefully fleshed—that is, all the fat and bits of flesh adhering to it are removed. To dry the skin it is slightly stretched on a long, narrow, somewhat tapering board with a blunt, rounded end. After slipping over the board (hair side in) it should be hung in a cool, dry place and allowed to dry gradually. Ordinarily no preservative is necessary, and the drying should not be hastened by exposure to the sun or artificial heat.

PROFITS.

The expense of raising foxes is comparatively small. After building yards and securing stock, running expenses are slight. Without making extensive estimates of the profits of a well established fox farm, it may be said simply that every silver fox raised is likely to yield a pelt having a market value of over \$100. Even pale skins bring this figure, and darker ones much more. Pure black skins command almost fabulous prices, ranging from \$500 to \$2,000. It is therefore evident that a moderate income may be derived by raising comparatively few foxes. In the present stage of the business the sale of foxes for breeding stock is very profitable, as the live animals in good condition often bring fully twice as much as their cured skins. In fact, good, live silver foxes seldom can be obtained for less than \$500 per pair, and much higher prices have been paid.

The high prices paid for silver fox skins undoubtedly are due, at least in part, to the rarity of the animals, and the extensive production of such skins would necessarily tend to a reduction in price. Increasing population and wealth, however, insure a large future demand for fine furs, and no great decrease in prices is likely to occur until production reaches large proportions. Prominent wholesale dealers are of the opinion that if the production of silver foxes were doubled and redoubled within a few years prices would not thereby be affected materially.

The greater part of the world's fur is sold annually in London at two auction sales. In 1905, as reported in the *Fur Trade Review*, the total number of silver fox skins offered at the two sales was 1,097. This includes all grades from very pale skins to pure black. No classification is made other than by values, but it is probable that not over 100 of these skins were pure black. In 1906 the total number was 1,934 skins, or nearly double that of 1905, yet the average price

is reported 10 per cent higher. The total for the spring sale of 1907 is 1,909 skins, and according to reports prices were again 10 per cent higher than the previous year. One report contains the following statement: "The fashion for this article continues, and the fine dark skins are specially in demand. Prices, however, on the whole, average about the same as last year. * * * the highest priced skin realized £440" (\$2,140). Furriers also state that changing fashion is not likely to alter prices, for the market is world-wide, and a diminished demand in one or more countries is invariably offset by an increase elsewhere. At present the higher-priced silver fox skins are sold mostly to France and Russia, but the demand in the United States is increasing.

SUMMARY.

From the foregoing it is evident that silver foxes can be and in fact are being propagated in confinement. Like most new enterprises, fox raising is a business regarding which opinions vary. The favorable facts are that silver foxes are easily and securely kept in simple wire inclosures; that suitable food for them is cheap and easily obtainable; that they are not subject to serious diseases, and that their disposition and the quality of their fur can be improved by selective breeding. Opposed to these are the unfavorable facts that they are by nature suspicious, nervous, and not inclined to repose confidence in man; and that, largely for these reasons, they do not breed regularly and successfully, except when cared for by experienced persons more or less gifted in handling them.

The number of persons now engaged in the business is relatively small, and the work is still experimental, yet many of the initial difficulties already have been overcome. Numerous minor failures seem explainable in large measure, and are offset by several conspicuous successes. It is therefore probable that under proper management fox raising will be developed into a profitable industry, and it is perhaps not too much to expect that a domestic breed of foxes will be produced. Only time can show how far such expectations will be realized, but present indications must be regarded as very encouraging.

FARMERS' BULLETINS.

The following is a list, by number, of the Farmers' Bulletins available for distribution. The bulletins entitled "Experiment Station Work" give in brief the results of experiments performed by the State experiment stations. Titles of other bulletins are self-explanatory. Bulletins in this list will be sent free to any address in the United States on application to a Senator, Representative, or Delegate in Congress, or to the Secretary of Agriculture, Washington, D. C. Numbers omitted have been discontinued, being superseded by later bulletins.

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