No. 55

January, 1961

ONTARIO

FISH AND WILDLIFE MANAGEMENT REPORT

PROVINCE OF ONTARIO

DEPARTMENT OF LANDS AND FORESTS

Fish and Wildlife Branch

(These Reports are for Intra-Departmental Information
and Not for Publication)

Hon. J. W. Spooner
Minister

F. A. MacDougall
Deputy Minister

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TIME SCHEDULE

A chronological table of the places visited is given below.

June 18 - 24	Ocean crossing.
June 25 - 28	Vacation in Britain. Contacted head of British Forest Service re people to see.
June 29	Visit to Alice Holt Forest Research Station to find out about the work being done on grey squirrels.
June 30	Visit to Oxford to see Dr. Elton (absent) and Dr. Chitty.
July 1	Sightseeing in England.
July 2	Visit to Grange-over-Sands to find out about work of Nature Conservancy, accidently met Dr. Elton.
July 3 - 12	Sightseeing and travel to Edinburgh.
July 13	Visit to Nature Conservancy in Edinburgh to meet men working in Scotland and to find out something about their work.
July 14	Sightseeing.
July 15 - 16	Trip across Scotland to west coast and back to Inverness with Mr. P. Lowe who is working on red deer research and who pointed out deer range and discussed his work en route.
July 17	Visit to Remnant Caledonian Pine Forest at Aviemore.
July 18 - 30	Sightseeing.
July 31-Aug. 5	Travel to Stockholm.
Aug. 6	Stockholm to Gallivare, Lapland, Sweden.
Aug. 7	Waited in Gallivare to meet Mr. T. Ahti.
Aug. 8	Accompanied Ahti to Kuolpa Reindeer Research Station. Talk by Mr. Skuncke on condition of reindeer in Sweden and brief tour of station. Met Persson and Uggla who were to accompany us.
Aug. 9	Tour of Research Station.
Aug. 10	Travel by all five to Vittangi where a car was obtained.
Aug. 11	Travel north and west to Kilpisjarvi, Finland, with stops to discuss reindeer range en route.

Aug. 12	Travel to Lyngen Fiord, Norway, to see summer range of reindeer. Return to Kilpisjarvi.
Aug. 13	Return to Gallivare examining reindeer range en route.
Aug. 14	Travel to Muddus National Park to see moose range and discuss Dr. Uggla's theories on forest fires.
Aug. 15 - 16	Remained at Muddus.
Aug. 17	Travelled to Haparanda, on the Swedish-Finnish border.
Aug. 18	Travelled from Haparanda to Helsinki.
Aug. 19	Interviewed Mr. Matti Helminen of the Game Research Institute in Helsinki and left for Stockholm.
Aug. 20 - 21	In Stockholm contacted Wenmark and the men at Svenske Jakt regarding possibility of observing a moose hunt and learning something of wildlife management in Sweden.
Aug. 22 - 23	Weekend sightseeing.
Aug. 24 - 29	Travel to Oslo for interviews with Knut Rom of Norwegian Sportsmen's Society and Krafft, a biologist working with moose for a pulp and paper company.
Aug. 30	Returned to Stockholm where I met Mr. Hamilton and talked with Mr. Wallerstedt regarding Swedish hunting customs.
Sept. 1	Spent the day with Dr. Borg visiting a veterinary clinic.
Sept. 2	Drove to Ostermalma Wildlife School with Wallerstedt. Saw game-keepers educational program. Guest of Baron von Essen.
Sept. 3	Discussed school courses. Went to visit Mr. Ackerman, an outdoor writer and hunter. Returned to Stockholm.
Sept. 4 - 5	Stockholm to Enanger to visit game bird research station and Mr. Hoglund.
Sept. 6 - 9	Travelled to Solleftea for three days moose hunt on a pulp company limit.
Sept.10	Return to Stockholm where the men at Svenske Jakt were contacted regarding future plans.
Sept.11 - 12	Weekend sightseeing.
Sept.13 - 14	Travel to Munich.
Sept.15	Talk with Dr. Engelhardt and introduced to Chief Forester Gunder.

Sept.16	Arranging interpreter etc. for next three days.
Sept.17	Interviews in Gov't Office. Gunder offered to take me on two trips into the mountains to see wild boars, red deer, and chamois.
Sept.18 - 19	Trips into the Bavarian mountains.
Sept.20	Travel to Graz.
Sept.21	Talked with Dr. Ammon.
Sept.22	Travel to Vienna. Dr. Kolner not in.
Sept.23	Dr. Kolner still not in but planned to join him on Sept. 27.
Sept.24	Mountains - Austrian Alps - hoped to see chamois.
Sept.25 - 26	Weekend sightseeing, return to Vienna.
Sept.27	To Allentsteig. Day spent with Dr. Kolner learning of hunting methods.
Sept.28	Leave for Arnhem.
Sept.29-Oct.2	International biologists' conference at Arnhem..
Oct. 3 - 4	Weekend sightseeing. Return to Sweden.
Oct. 5	Return to Stockholm.
Oct. 6	Stockholm to Ostermalma.
Oct. 7	Observed Royal moose hunt in southern Sweden.
Oct. 8	Travel to Denmark.
Oct. 9	At Kalo Research Station, talked to Andersen about his deer work.
Oct. 10 - 11	Weekend sightseeing.
Oct. 12 - 13	Return to Edinburgh and Aberdeen.
Oct. 14	Talked with Dr. W. Edwards and Dr. Dunnet of Aberdeen University.
Oct. 15	Visit to Scottish farm.
Oct. 16 - 20	Returned to London and prepared to sail.
Oct. 21 - 29	Return ocean voyage.
Oct. 30	Return Toronto.

REPORT ON INVESTIGATION OF EUROPEAN WILDLIFE MANAGEMENT METHODS (SUMMER OF 1959)

by
H.G. Cumming

Abstract

A combination of vacation time and leave-of-absence was used for a trip to Britain, the Finnoscandian countries, Germany, Austria and Holland. The general attitudes of the various countries to wildlife and their management methods and hunting traditions were studied. The major species involved were reindeer, moose, red deer, roe deer, wild boars and chamois. Notes were also kept on fur-bearing animals, game birds, fisheries and forestry. Visits were made to a wildlife biologists' conference, two sportsmen's associations and a wildlife management school.

BACKGROUND OF TRIP

Like most Canadians I have always felt a strong curiosity about the Old World. I also had a professional interest in Europe where the high human population and intense utilization of the land presented a preview of possible future conditions in North America. Similarities between the flora and fauna of the two continents suggested that present European wildlife philosophies and management methods might become applicable in North America. For these reasons I requested a leave-of-absence to extend my trip from a vacation in Britian to a fact finding circuit about the northern European continent.

Very few arrangements were made before leaving Canada and only the most general timetable was established so that changes could be made en route to take advantage of any opportunities that might arise. My vacation period, accumulated for two years, I spent mainly in Britain where I was able to see and hear some things about British wildlife in addition to sightseeing. I then travelled to northern Sweden to study reindeer, returned to southern Finland, crossed over to Norway and returned once more to Sweden for a moose hunt. I turned south in Europe to Bavaria, in southern Germany, where I was able to see and study some of the continental animals and management methods. After a week in Austria, I returned to Holland where an international biological conference was in progress. I then returned once more to Sweden for a second moose hunt and, after a short visit to a research station in Denmark, turned homeward with only a short stop in Scotland.

WILDLIFE PHILOSOPHY AND LAWS

In order to understand sporting practices and wildlife management methods in Europe it is necessary first to understand the philosophies regarding wildlife and the laws arising from them. The present attitudes to wildlife in Europe arise from traditions dating far back into feudal times. Hunting was a royal sport and wildlife belonged to the kings and to the landed aristocracy. Any commoners caught poaching were severely punished. It was against these traditions that settlers in North America, for the most part drawn from the common people, reacted by declaring that wildlife was the property of all and that everyone had equal rights to hunt. Although the large estates of Europe are mostly a thing of the past, wildlife still belongs to the landowner. It comes to be regarded almost like domestic livestock. Hunting is an expensive privilege, not a right.

Britain:

In Britain all game belongs to the Crown. The Common Law has ruled that when it is killed, it becomes the property of the landowner upon whose estate it was killed. With nearly all land in Britain privately owned, game has become considered in almost the same way as if it belonged to the landowner. Since there is no open hunting there has never been any market hunting in the North American sense. Wild game can be sold or bought on the market the same as the sheep and cattle raised on the same land. Nor has there been any need of seasons. A gentleman's agreement among landowners decreed that one does not hunt deer at certain times of the year and it is not sporting to use unfair methods. The landowner would see to it that anyone hunting on his property by invitation obeyed these unwritten rules.

Since there were few actual game laws the only law enforcement necessary was with regard to trespass and theft. These laws were usually enforced by the game keeper or some other employee on the estate. Only in the last few years have any inroads been made in this traditional position.

Sweden:

Swedish traditions in everything from government to sports are much like those of Britain. In Sweden as in Britain all hunting was originally reserved for the King and nobility. Hunting rights are now vested in the landowner who may either make use of them himself or rent them to someone else. The legal position of wildlife was not too clear. Although one person definitely stated that the wildlife belonged to the landowner, the presence of countrywide licences and laws and the statements of other people lead me to believe that here as in England ownership is actually vested in the Crown. At any rate in practice wildlife is thought of as belonging to the landowner. When game is shot out of season it is not merely a matter of breaking hunting regulations. It is also considered as theft in that the landowner's property has been taken. Even on State land there is no open hunting. Only forest workers can hunt there. City dwellers can only hunt on lands where they have rented the hunting rights or where they have been invited to hunt by someone who owns or is renting hunting rights.

Reindeer in Sweden are considered to be domestic animals since none of the original wild ones remain. This means that no hunting or wildlife laws apply to reindeer. Practically all other animals that we would consider wild are there considered in the same way. There is a very close integration between wildlife and forestry. Moose browse is always referred to as moose damage. There is a continual effort to obtain a mutually beneficial balance between forestry products and wildlife.

Hunting licences are required in Sweden but they are actually licences to carry a gun rather than to hunt. No shot-gun or rifle can be bought without a licence. When the licence has been obtained hunting rights to some area still have to be found before it is actually permissible to hunt. Besides the original licence there is an extra sum charged for each moose killed. The main compulsion toward paying this extra fee seems to be a moral one.

Game laws are enforced by the local police officers. Penalties include payment for the game to the landowner or renter on whose land it was shot, a fine to the government, loss of gun and in some cases refusal of licence renewal which prevents the acquisition of a new gun. In other cases the offender might be put out of the national hunting society or in severe cases go to jail. There is nothing nominal about the enforcement by local police. Their activities in this regard seem quite similar to the enforcement activities of our conservation officers in Ontario.

Norway:

Norwegian game philosophies and laws seem to be very similar to those of Sweden. If anything, there is a little less tradition connected with the hunting in Norway. The landowner can set up the hunting on his land on any basis he wants to and charge any rent for which he can find a buyer. Enforcement in Norway is also by the local police but it was reported to be not as active as in Sweden. The Norwegians claimed that this was not much of a problem because the interest of the local citizens prevented any great amount of illegal shooting. Some large landowners and sportsmen's groups have their own enforcement officers. Game can be sold here as in other European countries. The wild reindeer are considered as game and suitable hunting laws apply.

Denmark:

In Denmark the philosophy of private ownership of wildlife was clarified for me by a story of red deer damaging sugar beets. If the red deer comes at night from a woodlot onto a neighbours field of beets the law forbids the landowner to shoot the deer at night. At the same time he cannot sue the other man for damages because as soon as the deer crosses on to his property it is considered to belong to him. This makes for serious problems where there are over-populations of deer. Hunting in Denmark is on the basis of hunting areas owned or rented, yet despite the very dense population of humans it was claimed that anyone who wants to hunt can do so. They also stated that despite long seasons and no bag limits there is no depletion of game. This is partly because their major big game species is the roe deer which is very difficult to

over-shoot and partly because of good management by the owners or renters of the hunting areas. As it does to most Europeans, the North American system of wide open hunting sounds fantastic to the Danes. They see it as a disorganized, uncontrollable, dangerous melee.

Germany:

The situation in Germany is somewhat different from any of the other European countries. During my talks with officials in Bavaria I discovered the only example on my entire trip of landowners not having the hunting rights on their own property. Since 1850, when the first hunting laws were passed and the first hunting areas set up, owners of property smaller than 81 hectares (200 acres) have not owned the hunting rights on their own land. They must combine their property with some adjacent land to make an area larger than 81 hectares as a hunting unit. Anyone with land over this size does have hunting rights which he can either use himself or rent to others. In Germany the renting of hunting rights is a profitable business.

Each hunter must have a licence for three years before he can rent a hunting area for himself. Until that time he can only hunt at the invitation of friends. In order to get a hunting licence an oral examination must be passed. Six examiners are selected by the government to ask questions on different phases of hunting. Since it is considered to be an honour to be chosen, the examiners are all voluntary. The head examiner is the President of the State Licencing Office. A prospective licencee is questioned by each examiner in turn on his own particular speciality. The applicant must have satisfactory knowledge about firearms, hunting, regulations and traditions and about the animals themselves in order to qualify.

In reply to my questions as to where this required information could be obtained, I was informed that one could go with a friend, read books, or go to one of the State courses for new hunters. It was considered best to do all three. At the State courses instruction is given regarding the written hunting laws of the State, the unwritten laws and knowledge about animals and hunting methods. Since the licence is issued to allow shooting of specified numbers of bucks, does and fawns accurate age and sex determination in the field is essential. The licence can be rescinded if the hunter shoots the wrong deer. For this reason field methods for age and sex determination such as size of antlers and body form, are taught as part of the course. The handling of firearms is also included and under this system only one or two accidents have occurred in Bavaria in the last several years.

I was interested in finding out what some of their hunting laws were. I discovered that jacklighting and night hunting in general were forbidden. No hunting was allowed from cars. No dogs or drives were allowed for the hunting of roe deer or red deer. Shot-guns except with slugs and .22 calibre rifles were disallowed. Snaring deer was also forbidden. On the positive side it was required that a metal tag be put on red deer, roe deer, chamois and wild boar before removing them from the forest. Another law required that any hunting area owner or renter must have a dog available to follow wounded red deer or

roe deer. The unwritten laws or traditions covered such things as not shooting at red deer over 200 metres (about 650 ft.) or rabbits at over 40 paces. The laws were surprisingly similar to ours but they went even further than ours in some respects.

Enforcement of the laws is by the gamekeepers, the German "Professional Hunters". These men are private employees and only have authority in their own hunting areas. In these areas, however, they have practically police powers being able to arrest poachers and take them to court. The gamekeepers are required to pass a State examination similar to that required for a hunting licence but much more difficult. Successful candidates are given a badge which is worn on their hunting cap. When cases come to trial, several courts, instead of levying regular fines, order the man to pay an equal amount to the very powerful and widespread wildlife protection organization. It is thus used for the benefit of wildlife.

Summary:

The general European concept of wildlife as private property has led to many differences in practice from North America. Most wildlife management is done on small areas by private individuals, either as a part of general forestry practice or for the express purpose of providing the owner or renter with more game. State employed biologists were quite rare in comparison with North America. The laws of hunting were much more general in some ways and yet more demanding in others. More emphasis was placed on traditions and the proper thing to do. The practical results of these attitudes will become more evident in the examination of particular situations.

WILDLIFE CONFERENCE AT ARNHEM, HOLLAND

An international wildlife biologists conference was held at Arnhem, Holland, from September 27th to October 3rd. Having been informed of the conference by Dr. de Vos of the Ontario Agricultural College, I planned my trip so that I could listen in on the meeting for a few days. I was rather surprised at the small size of the gathering since there were only fifty or sixty men present. Besides all the ordinary problems involved in holding such meetings they had the additional one of languages. The meeting finally settled into the practice of having all papers summarized in German and English by someone who knew both languages. Although the practice of wildlife management in Europe is more intensive and probably much more effective than in North America, their wildlife research work at present seems to be lagging somewhat behind that of Canada and the United States. There is too much of a tendency to rely on traditional management methods and neglect the development of new ones.

A good example of this slowness in taking over new ideas was displayed by the verbal battle in the Arnhem meeting over the causes of poor antlers in roe deer. Dr. Reick of Germany started it by saying in a paper that the traditional argument as to whether poor antlers were caused by hereditary or environmental conditions was now obsolete. He stated that selective hunting had been going on for many years throughout Europe and that antlers had only

decreased in quality as a result. It was his opinion that there was now no further doubt but that population levels and food conditions were the determining factor.

Many others were not so sure of this. Dr. Borg of Sweden wondered about the uses of antlers and mentioned a Norwegian paper which stated that antlers are a means of increasing the body surface for cooling during summer and are not of much use as weapons. This brought on further controversy concerning the value of antlers to the deer. Some of the suggestions were that antlers were accessories of no use, weapons for fighting in defence, and behaviour and sex linked characters. Dr. Rieck was asked if any research were being done on a relation between parasites and antlers in Germany. He answered in the affirmative and went on to declare that a negative correlation had been found. It was questioned whether present antlers were really any worse than those of some years ago and some men took each side.

Dr. de Vos then stated the North American tradition on this question and Dr. Whitehead of England agreed. He described the roe deer population introduced into Ireland from an area which grew very poor antlers. In the new range the same deer grew good antlers. He also cited a similar experience with red deer in New Zealand.

Perhaps North American biologists would do no better in a discussion of the value of antlers, but it seemed to me that a discussion of the causes of poor antlers would never even have arisen in a biologists' meeting in North America. There is now very little controversy among professional biologists on this point. It is generally accepted that soil and food conditions plus population size determine not only the development of good antlers but of good animals as well. These concepts were not nearly so well accepted in Europe.

Another interesting question that arose was the danger of using poisons of various kinds in agriculture and forestry. Examples of actual damage from poisoning were called for. In Sweden 5,000 to 50,000 herons were killed by chronic poisoning due to DDT and similar chemicals used for insects. About 3,000 black-headed gulls were killed by another chemical a few months previous. They were unable to find the source of the poison.

In England DNOC was rated the biggest killer among the weed control chemicals. It was stated that organo-phosphorus sometimes caused large scale local deaths but its effects varied with the weather. Aldrins have killed pigeons and game birds and sodium arsenite used for potato bugs is also dangerous. DDT has been known to kill 20 partridges in one instance. It was the general opinion of the meeting that the widespread use of these poisons was an undesirable thing and efforts should be made to have their application controlled.

The meeting would have been more use to me if I had been able to attend it near the first of my trip. As it was, I was only able to visit one research station as a result of contacts made at the conference. However, the opportunity to meet and talk with so many European biologists and to hear a discussion of their problems made the little extra effort required to take in the meeting well worthwhile.

EUROPEAN SPORTSMEN'S ASSOCIATIONS

Sweden:

The most unusual sportsmens organization was the Swedish National Hunting Society (to give it an English name). It is a combination Sportsman's Association and government department. It was first begun as a sportsmen's organization in 1830. In 1938 it received the first payment of a government subsidy. This was not in the form of a gift, but rather it was a nationalization. The society is now authorized and controlled by the government as a working body to carry out wildlife management in Sweden. At the same time, it maintains its membership of sportsmen throughout the country as well as a separate group of associate members who are landowners. It was certainly a most unusual combination of government and sportsmen.

The executive of the organization is headed by the Chairman appointed for a two year period from among the ordinary members of the party in power in the Swedish Parliament. Under him are six Directors selected from the Hunters Congress in Stockholm and chosen so that two represent the north of Sweden, two come from the middle country and two from the south. There is an executive staff with stenographers and assistants who are civil servants and who have an office in Stockholm. There are no field biologists but there are eighteen consultants in districts throughout Sweden. These are mostly graduates of the wildlife school and act in an advisory capacity to the local organizations.

The sportsmen's side of the organization is made up of 65,000 - 70,000 active members and 110,000 associate members. The active members are hunters who pay 10 Kronor ($2.00) a year membership to join one of the 25 county organizations. They automatically become members of the national organization and half of the fee is sent on to that body. The associate members are mostly landowners who are given a free membership. They are encouraged to work with the local sportsmen toward improving conditions for wildlife. A monthly paper called "Svensk Jakt" is published by the organization along with occasional scientific publications.

The funds provided for the organization by the government are obtained from the sale of the 10 Kronor hunting licences which allow the carrying of a gun. Of the 250,000 licences sold each year, about 2,000,000 Kronor (equivalent to about $600,000 in buying power) goes to the National Hunting Society. Each year's activities are financed by the money collected the previous year. An annual budget must be presented to the government outlining proposed projects and expenditures for the coming year. The government thus has final control of the organization's finances.

The organization of associate members seems to be an attempt to improve relations with landowners and at the same time encourage wildlife management. A law has been enacted setting forth the method by which these landowners may band together into management units. When a group of landowners wish to organize, they inform the county level of the sportsmans organization and their group is registered for a period of five or ten years. At the end of that time the small organization must be reviewed by the county group, to determine if they are functioning well before their registration can

be renewed. These farmers' organizations may get grants from the county sportsmen's organization for depredations on livestock or for wildlife improvements such as plantings for cover. Usually when such a farmers' organization exists, the whole area containing their combined holdings is leased for hunting as one unit. Individual owners then share the proceeds on a proportional basis. This seemed to me to be an excellent way of encouraging wildlife on private lands.

Norway:

The most active private sportsmen's organization with which I was in contact was in Norway. It is an organization of associated clubs with a total membership of 28,000. The executive is made up of four secretaries, one of whom travels around to member clubs, one looks after publications, one concentrates on dogs and one is general secretary assisted by three stenographers. In their Oslo office I talked to Mr. Knut Rom their general secretary. There are several sources of income for the club. Among them is an 8 Norwegian Kroner ($1.15) fee forwarded for each member by the local clubs, a 5 Norwegian Kroner (.75¢) fishing licence in the management area surrounding Stockholm, and an annual grant of about 30,000 Kroner ($4,300) from the government. The annual budget for the club funds is around 250,000 Norwegian Kroner ($35,700). Of this amount about 80,000 Norwegian Kroner ($11,400) is spent for fisheries work alone. This includes running their own hatchery, doing lake surveys, restocking and many other kinds of management projects. In the wildlife field they maintain a running battle with government biologists over the wild reindeer herd of Norway and they presented me with some convincing arguments on their side. They are also interested in all other forms of hunting including the willow grouse, ptarmigan and moose.

Bavaria:

Before the last war there was a law to the effect that all hunters in Bavaria must belong to the sportsmen's organization. A hunter could be ejected from the sportsmen's organization for breaking the unwritten laws of hunting. This would mean that he would not be able to renew his hunting licence. In this way it was possible to keep a very tight rein on hunters. Since the war this law has been rescinded. Of the 30,000 hunters now in Bavaria about 22,000 belong to the hunter organization. Many hunters feel that the present situation leads to a breakdown of many of the traditional hunting courtesies. Despite some agitation from hunters to get the law re-enacted, the State authorities hesitate because they consider it an undemocratic practice.

A second organization, the National Protection Organization in Bavaria seemed to be of a slightly different nature. Dr. Eng hardt, who is very prominent in the organization, told me that it was established for the protection and conservation of wildlife. He cited as an example of their work, a 10 year battle that has been waged between wildlife and timber interests over deer damage to forests. He said that their organization had taken an active part on the side of the wildlife and that he was happy to be able to say that an amicable agreement had now been reached. Levels of deer populations are reduced through hunting to the point that damage to the forests is not

extensive. The membership of the organization is about 60,000 and membership fees are 2 Marks per year (.50¢). They have no full time employees but rely on volunteers.

OSTERMALMA WILDLIFE SCHOOL, SWEDEN

The Swedish National Hunting Society supports a wildlife management school at Ostermalma about 30 miles from Stockholm. With Mr. Wallerstedt of the Hunting Society I spent a lovely September afternoon driving through the southern Swedish countryside to the school. It was harvest time and the golden fields showed up plainly the scattered patches of green forests in woodlots and around the rocky outcroppings in the fields. The school is held in what was formerly a large country estate. The woodlot surrounding it is a State forest and the principal of the school is also the forester in charge of the State forest. There is a small lake in front of the main buildings and streams and ponds here and there through the area. The large white buildings of unusual architecture were set in these beautiful surroundings.

Inside the main building there was a pleasant "old world" atmosphere. On the ground floor there were living quarters for the school principal Baron von Essen and his wife and family. On the second floor were rooms for guests, a small classroom and two offices. The classroom was hung with tapestries from Turkey imported by the original owner. In the halls trophies from moose, roe deer and sitka deer adorned the walls. We were made most welcome here and after being shown our room we were taken out for a tour of the surrounding area before dark.

After walking through an orchard where a roe deer fawn could be seen grazing under the apple trees we came to the pheasant raising pens. The old fashioned way of raising pheasants with hens is taught for use on small areas and the more modern method with electrically heated brooding pens for use on larger estates. We passed by duck ponds with artificial nesting sites and went on to visit a flock of tame geese. Later we drove through the towering forests to where a small trout pond and stream were maintained. Although we were unable to see any moose I was fortunate in hearing my first roe deer barking on a mist covered meadow. A food plant nursery was maintained from which I listed the following species:

Plants for Wildlife

Name	Use
Rosa canina	Food and shelter
Rosa rugosa regeliana	Food and shelter
Sorbus ancuparia	Food
Crataegus monogyna	Food and shelter
Caragona arborescens (Siberian pea)	Food and shelter
Picea abies	Shelter
Prunus avium	Food
Slonbuska	Food and shelter

Upon returning to the main buildings we passed a large dog kennel. Labrador retrievers and the Swedish moose dogs were among several varieties represented. In answer to my questions, it was explained that not only were the students taught game management, but the organization of hunting and the conducting of hunting parties thus they would need to know how to handle dogs and guns. Practical field training is given in various methods of hunting.

The following day I learned some more about the school. It was begun in 1947. The buildings and grounds are State property rented by the National Hunting Society. The school receives from the government about 133,740 Swedish Kronor ($26,750)per year. Most of this is obtained from the 10 Kronor licence fund, but about 20,000 Kronor ($4,000) comes from the National Hunting Society's separate income. About 43,740 Kronor ($8,750) of this amount is used as wages for the permanent employees. These include the head of the school, Baron von Essen, an assistant principal who is also an administrator, a practical teacher, a gardener and a housekeeper. Another 7,000 Kronor ($1,400) is set aside for special lecturers and the remainder is spent on maintenance and general operations.

The school is run from February 1st to December 1st for one complete course. There is no tuition fee, but 150 Kronor ($30.00) board and 75 Kronor ($15.00) for books and ammunition is charged each month. Only 12 students are accepted at one time. Entrance requirements include employment for at least six months on a big estate or forest company working with game management. Most students have over a year of practical experience before entering. Several foreign students take the course from time to time, most of them coming from Norway and Denmark. I was informed that they had tried a three months special course for employees of the National Hunting Society and that this programme would probably be continued at intervals.

In order to determine toward what ends the school was directed I enquired about the destination of the students after graduating. They informed me that in the eight years the school had been operating 169 Swedish students have applied, of whom 87 have been accepted and 84 completed the course. Of this number, 32% have gone with the National Hunting Society, 25% with forest companies, 18% with private estates, 8% have started into game-keeping as a private business and 17% are now working at other lines. It appears that the purpose of the school is to turn out wildlife workers with sound practical and technical knowledge but not on a university level.

In reply to my questions about courses I was supplied with the curriculum, the major points of which were translated for me on the spot. The subjects studied are as follows: Gamekeeping, breeding, releasing game, reducing predators, hunting, knowledge about game, dog training and keeping, weapon handling and game shooting, laws and the hunting society, fish and fisheries, forest management, gardening and map reading.

After considering the school as a whole, I came to the conclusion that it was somewhere between the level of the Forest Ranger School and the wildlife course at the Ontario Agricultural College, with more detailed practical instruction than either. I received there one of the warmest welcomes of any place on my trip and their friendliness and willingness to go out of their way to be helpful was greatly appreciated.

REINDEER IN FINNOSCANDIA

Arrangements in Sweden:

The only definite arrangements that I had made before leaving Canada were with Mr. Ted Ahti of Finland whom I had met in northern Ontario the previous year. Mr. Ahti had written that he was to meet Mr. Folke Skuncke and some other Scandinavians interested in reindeer range analysis for a trip to northern Sweden, Finland and Norway studying various range conditions. Upon being assured of my interest he made arrangements for me to join the field party.

I met Mr. Ahti in Gallivare, Lapland, Sweden, on August 8th, 1959. We left almost at once for a Swedish reindeer research station called Kuolpa which was situated about 15 miles south of Gallivare and could only be reached by taking a train to Harrtrask and walking for about two miles through the woods. Since the research station consisted of only three small buildings, it reminded me somewhat of the early research station in Algonquin Park. The three buildings were a cook-house and residence for the cook, a bunk-house, and a building to do paper work and some laboratory work. The staff of the research station was as follows: Mr. Folke Skuncke who was in charge, a veterinarian who spent about half his time at the station, two to four Lapp herders, and a Lapp woman as cook.

The two other Swedish members of our party besides Mr. Skuncke had already arrived at the station. Dr. Evald Uggla might be described as a research forester. He did his Ph.D. work on forest fires and still lectures at the Forest High School (similar to our Faculty of Forestry) at the University of Uppsala. Sven Persson was a student at Uppsala who was working on lichens during the summer. Dr. Uggla came on the trip to increase his knowledge of caribou; Mr. Persson came to improve his knowledge of lichens; and Mr. Ahti came to improve his understanding of Mr. Skuncke's range analysis methods.

Reindeer and Lapps:

Soon after our arrival at the station we assembled in the laboratory for a talk by Mr. Skuncke on the background information essential to an understanding of the reindeer in Sweden. A most amazing fact, learned later in Stockholm, was the total population of reindeer in Sweden, estimated at 275,000 animals. This is almost three times the estimated number of moose. These are all domesticated animals, the last wild ones having disappeared about 1900. The reindeer belong to about 3,000 Lapp herders out of a total population of 10,000 Lapps in Sweden and 33,000 Lapps in the world. Only Lapps are allowed to own reindeer in Sweden, but this is not so in Norway or Finland, where anyone can keep them. When the word Lapland is applied to Sweden, it refers to the north-west province of the country sometimes called Landskap. Lapland, Norrbotten and Vasterbotten are divided into Lappmarks which are something like our Forest Districts running north-west to south-east with the rivers. The Lappmarks are divided into siidas which are somewhat like long narrow registered traplines. Each family of Lapps is supposed to keep their reindeer within their own sitor except on the eastern side of Sweden where the

boundaries become rather vague. There are 34 mountain siidas and 16 forest siidas. They are patterned on the traditional migration routes of the reindeer. The Lapps keep the herd together but they let the reindeer take the lead in finding food. These divisions of northern Sweden may be found on a map in Mr. Skuncke's latest book (Skuncke, 1958).

There are two kinds of reindeer, mountain reindeer and forest reindeer. The mountain reindeer migrate to the western mountains in the spring for summer pasture and return to the eastern grazing lands along the Gulf of Bothnia in autumn. The forest riendeer are much more sedentary spending nearly all their lives in the forests. The forest reindeer bulls weigh from 150 to 200 kilogrammes (330-440 lbs.). During the rut an animal of this size may lose from 10 to 20 kilogrammes (22-44 lbs.). The mountain reindeer are somewhat smaller, weighing from 100 to 150 kilogrammes (220-330 lbs.) before the rut. These are believed to be live weights but it is not certain.

Farming in Sweden goes as far north as about Karesuando or Mauna along the Torne River from the Gulf of Bothnia. The western side of the country is more or less unsuitable for agriculture. Farther south on the eastern side of Sweden in Vasterbotten large scale farming is practiced and here conflict cometimes arises between reindeer herders and the farmers. By law the farmers are responsible for repairing their own fences but the reindeer owners must pay for any damage done. Since it is winter time when they are in that part of the country not a great deal of damage is done to crops.

Some Lapps come from Norway into Sweden and vice versa but there is no interchange between Finland and Sweden. There are international agreements between Norway and Sweden allowing certain numbers of reindeer to be pastured for the summer in Norway by Swedish Lapps and again specified numbers to be wintered in Sweden by the Norwegian herders. This works quite well but there are always some complaints on either side over grazing more than the specified number.

Kuolpa Research Station:

The first buildings for the research station were begun in September of 1954. The first reindeer were obtained in the Spring of 1955. They were driven up from Rodingstrask far to the south near Boden because there exists there a comparatively homogeneous herd of forest reindeer. A wire fence has been built around an area of 1,250 hectares (about 3,000 acres) or 4.7 square miles. Since the snow in that area gets to be about four feet deep a fence two metres high was required. In Sweden the cost of fencing was about 5.5 Swedish Kronor per metre or perhaps .30¢ per ft. They consider a net type fence with 20 centimetre squares to be about the best.

In April in deep snow the herd was driven through a gap in the wire fence which was then closed up. There were 53 adult animals at this time. Mr. Skuncke considered that this was about a minimum number for such an operation. He said that the largerthe numbers were the easier the herd was to handle.

Inside the fence they built corrals in five different places before they managed to get the reindeer into them. At first they had mountain Lapps who were used to herding the mountain reindeer with dogs by whooping and driving them. The forest reindeer were so wild that they could not be handled. Later they got Lapps who lived in the forest. They used no dogs, spoke quietly and moved slowly at all times. Only three men were used. Not only were they able to get the reindeer into the corral but they had them tamed within three months. The reindeer can now be caught by hand.

Insect pests were used to help in taming the reindeer. The corral which we visited was built near a small stream in a swamp but on a hummock so that the ground within the corral was well drained except for the stream running through one corner and springy with deep turf. An open faced shed was built on the high ground and a smoke fire of wet turf on logs was built in front of it. The reindeer driven into this corral would find relief from the insects in the smoke and in the shed. In this way they were soon brought under control and tamed. Now it is difficult to keep them out of the corral. A few wild reindeer, not from the original herd, were in the corral trying to escape the mosquitoes while we were there.

From the original herd of 53 adult animals 18 young were born in the first year, 1955. There were 26 or 27 young born the second year in 1956, 39 in 1957, 28 in 1958 and 35 in 1959. They lose about two or three animals each year through disease and some have escaped over the outside fence. The present number of animals is 140.

The working corral stood about 200 yds. through the woods from the buildings. It was about 100 ft. square and at the time of our first approach contained about 40 reindeer. We were cautioned to be very quiet and make no sudden movement as we entered the corral. While we watched, the Lapps began catching some of the reindeer for Mr. Skuncke to measure with calipers and tape. Most of the animals were caught by one hind leg and then guided from before and behind to the proper place. A few had to be chased and lassoed with a rope. After being measured the reindeer were taken to a spring scale hung in the shed. A sling was put under them and they were weighed alive. After we had watched and photographed the measuring and weighing of about half-a-dozen reindeer, we returned to the buildings for an explanation of the work that was being done. Although the corral was quite unimpressive I found that the purpose it served was of much greater value than the rather simple arrangements indicated.

The research being carried on at Kuolpa may be divided into four sections, two under the direction of Mr. Skuncke and two under the direction of the veterinarian. Projects were as follows:

1. A study of the summer food habits within the enclosure. Much of the material on reindeer summer range analysis in Mr. Skuncke's new book (Skuncke 1958) was gathered within the enclosure of the research station. On an afternoon field trip we examined some of the large marshes on the area. The lowland sites seemed almost identical with many found in northern Ontario except that Norway spruce replaced white spruce on the uplands and Scotch pine replaced black spruce in the wetter marsh edges. Our party dug several places

in the marsh examining the various food plants present. We also looked at some Salix species, and other shrubby growth eaten as summer food. The study of food habits was extremely easy because the animals were so tame. They were wandering all around the buildings grazing on various kinds of grasses and could even be seen from the windows. Since they live in almost a natural state it was merely a matter of several years observation to determine food habits.

When I asked about winter food I was informed that the fenced area is not sufficient to support that size of herd throughout the winter. We were shown feeding troughs used to supplement their winter diet. Mr. Skuncke stated that the diet recommended by Prof. Haflond of Veterinary High School in Stockholm was as follows: 1 kilogramme of dried sugar-beet per deer per day (refuse from the factories, free of molasses which gives the reindeer indigestion) plus salt and a meal made from the waterplants Fucus and Laminaria. They were also fed herring meal and fish meal in small quantities. Even this artificial feeding is not sufficient to keep the herd throughout the winter and the Lapp herders are forced to take them from the enclosure and handle them in the normal way for all reindeer herds, that is, by simply keeping them together and restricting their wanderings.

2. Measurements of the animals to determine growth rate and to establish whether the mountain and forest reindeer are different sub-species. The two groups of reindeer look different and behave differently. The mountain reindeer have short triangular faces whereas the forest reindeer have long rectangular faces. As mentioned before the forest reindeer are much more nervous and must be handled differently. They are also larger in weight. Body measurements were being carried out at Kuolpa to determine if the two groups were different subspecies. The information thus gathered was filed on cards.

3. Parasites. Although black flies, mosquitoes, warble flies and bot flies all attack the reindeer it is the latter two that are studied at Kuolpa. The veterinarian who works at Kuolpa part-time and at Stockholm part-time on reindeer diseases is in charge of this work. They have tried some insect sprays for control purposes but have not as yet found anything that is satisfactory.

4. Castration. Lapps castrate their reindeer for the same reasons that farmers castrate domestic cattle:

(a) It increases the growth of the animals.
(b) It eliminates excess males from the population.
(c) It reduces the weight lost during rutting season.
(d) It makes the reindeer easier to handle.

Very often the herd leader is an old steer and it is usually steers that the Lapps break to harness. The work at Kuolpa according to the veterinarian whom I met later in Stockholm is to determine what age is best for castrating and to compare results of the Lapp hand method of castrating with that using Australian sheep castrating tools. Mr. Skuncke said that it appeared that the best time to do the castrating was under one year of age so that the mother could still be determined and the best calves retained for breeding. There are several bad effects from total castration. It is more

painful to the animal and it causes deformation of the antlers. With the Lapp method very regular antlers are obtained. The veterinarian is working on a mechanical method which will be similar in effect to the Lapp method.

Altogether, I was most impressed by the efficiency with which information was being obtained for a very small outlay of capital. By keeping the establishment small and supplying the two scientists in charge with plenty of field assistance a great deal of useful information is being obtained on the very modest research station.

Field trip through northern Sweden, Finland and Norway:

After returning to Gallivare by train we took a bus to Vittangi where we spent the night. From there we went on in a car rented from the local government agency, accompanied by Mr. Uno Lindstedt who was a forester and supervisor of the Lapps in the farthest north Lappmark of Sweden.

Our first stop was at an old kiln where tar was extracted from pine logs. We were shown a pile of chips which were forty years old and showed no rot whatsoever. I was unable to determine whether they did not rot because of the tar in them or the dry weather. We stopped several times to examine winter range locations for reindeer, the last stop being beside the farthest north pine stand in Sweden. I was surprised at the heavy lichen grazing that they considered to be quite normal and not at all over-grazed.

Driving on we crossed a river into Finland and stopped to examine a swamp where perma-frost had built up large mounds in the muskeg. Single reindeer were seen occasionally by the road. We stopped to talk with some Lapps in a roadside encampment. They seemed remarkably like our Indians in habits although there was little similarity in looks. They ranged from blond to black in hair colour. There were little or no mongoloid features. They all dressed in their native costumes with many bright red articles of clothing. Like our Indians they live in tepees with a fire in the middle and beds around it. The smoke escapes through the usual hole at the top. There are moccasins and knives and wooden cups for sale at the roadside stands. Even the dogs look much like our huskies.

We stopped at Kilpisjarvii about 10 p.m. well before sundown. The next morning we drove on and soon left the low rolling country interspersed with swamps which was Finland for the mountains of the Norwegian coastline. Even here, far beyond the arctic circle, timbering was in progress on the mountain sides. We came down to the sea at Lyngen Fjord and followed the road around a bay and out a long peninsula, Here in the mountains we came to a small Lapp encampment with several wooden houses and tents. Since they belonged to Mr. Lindstedt's area in winter, we stopped for a few hours to talk with them. Leaving the car at a place called Svensby we walked upward to a peculiar open park-like stand of twisted birches about 30 ft. high. Underfoot it was so wet we had to take off our shoes and stockings despite the fact that it was on about a 45° angle. After examining the grasses under these trees it was decided that they were not of the right type for good summer range.

When we passed through the tree belt we came out on to a less inclined grassy plain which was just as wet. Beyond in the distance stood the grey snow capped mountains. All the mountains we had seen to this point were well treed to a certain height, then covered with lesser vegetation up nearly to the snowline. These mountains, however, were only bare grey rock. I was told that the reindeer would be high up in the mountains even going on to the snowy areas of the glacier caps in the daytime to keep cool. Although the reindeer grazed along all the other mountain sides in their journey, this was the ultimate summer range. After looking the place over as much as possible without going into the mountains, we returned to the car and drove back to Kilpisjarvii for the night.

The following day we drove back into Sweden to examine the wintering range of the same herd which we had been following into the mountains. We also looked over several places where aerial spraying had been used to kill deciduous trees and discussed the possible effects on wildlife.

During the trip we had several discussions concerning reindeer in general and the Niels Blink herd which we were following in particular. We were told that it took one week to move the reindeer from their winter range in Sweden to a summer range in Norway, but that it took eight weeks to bring them back. The total distance was 350 to 400 kilometres (217-240 miles). The herd is made up of a little over 2,000 animals, possibly 2,300. They considered this to be a smaller herd than usual for a Lapp to own. They said that he started twelve years ago with about 200 animals. They also indicated that it was possible to change the habits of reindeer. It took one man three years to change his animals from the habit of migrating to the mountains to that of staying in the forest range all year round.

In answer to my question they told me something of the economics of reindeer herding. Reindeer regularly have one young per year, the increase being about 25% of the herd. About half of the yearling females can bear calves and almost all of the two year olds do so. They continue to have calves up to nine or ten years old and occasionally to sixteen years. With 10% males and 90% females they can get 45% of the cows to have calves. In the wild about 15% of the cows have calves. The increase of the winter adult population of a domestic herd is 40%. The best proportion for a tame herd is about 20% bulls and 80% cows. This is to provide a safety margin over the 10% that would be sufficient and also to include some young animals for the future. The animals which are not kept as breeders are castrated for work or butchered. In order to have 50 males five or six years of age it is necessary to have 100 at three or four years. In wild herds the sex ratio is normally 50-50. Mr. Skuncke felt that wild herds should have at least 30% bulls. Butchering is carried out in the fall from October through November and December.

Snow depth has a considerable effect on reindeer. One metre of snow produces difficult conditions for mountain reindeer. Forest reindeer will not even dig through that much.

Reindeer Parasites and Diseases:

While in Stockholm I enquired of the veterinarian associated with the Research Station about diseases of reindeer in Sweden. He stated that of the four major insect pests, mosquitoes, black flies, bot flies and warble flies, only the last two do very much damage to the animals. Reindeer are very much afraid of bot flies and warble flies and will not eat when they are in the neighbourhood. It is estimated that between one and two million Swedish Kronor ($200,000 - $400,000) a year were lost due to these two insects slowing growth and destroying hides. He added that about 90% of the hides of Swedish reindeer were damaged by warble fly larvae. The warble flies attack the animals from the middle of June to the middle of September. They are specific for the reindeer, the warble flies on cattle being a different species.

A disease which has been affecting reindeer periodically for a long time broke out again this summer. Caused by Pasteurella multocida it begins in calves but also spreads to adults. The lesions described to me were septicemia and bronchio pneumonia in subacute cases. The organizm can be isolated from the liver or spleen. In 1912 to 1913 the same disease was present in southern Lapland. At the time 1500 reindeer were lost the first year and 1600 the second year. This summer 200 or 300 were lost in the north of Jamtland. There was also a disease in Jamtland in the early thirties that was not diagnosed and may have been the same thing. It is a summer disease only and they suspect that it is transmitted by mice. It is also found in cattle, hares, etc., as hemorrhagic septicemia, but it has not been found in moose.

Another reindeer disease that they have had in the past is foot rot, caused by Spherophorus necrophorus more commonly called Actinomyces necrophorus in North America. It is spread by walking on ground infected by diseased animals and is eliminated by thinning out the herd and placing corrals on high places. They have also infected reindeer experimentally with foot and mouth disease. It is present in Russian reindeer now but it has not been found in Sweden.

Reindeer in Norway and Finland:

I was unable to discover the total number of reindeer in Norway, However, it is estimated that there are 30,000 wild reindeer alone, all situated south of Trondheim. There are three large areas and some smaller ones where reindeer can be hunted, nearly all on crown land. In the area where the wild and tame reindeer meet, the wild ones are spreading north and breaking up some of the southernmost tame herds.

An area just south of Trondheim is causing considerable controversy between sportsmen and government biologists. The sportsmen's association estimates that in the Trondheim band 10,000 reindeer are now present. Government officials on the other hand place the figure at 6,000 to 7,000. The sportsmen's association claims that the winter range is already pressed and cites as evidence the fact that tame reindeer calves weigh 18 to 20 kilogrammes (40-44 lbs.) on the 1st September while wild calves weigh only seven to

ten kilogrammes (15-22 lbs.). The sportsmen believe that the lower weight of the wild calves is due to a shortage of food on the overcrowded range.

Since the government biologists feel that the reindeer numbers are low they restrict hunting methods. Only 1,000 animals are allowed to be shot each year. Since the sportsmen's association considers that the reproduction of the herd is 25%, they feel that this number should be increased. The reindeer are stalked by one or two men on foot. They are only allowed to have one shot in their guns, the guns being locked by the police. They must have a minimum area of 1,000 decares (250 acres) per reindeer shot. The sportsmen feel that all these restrictions are not only unnecessary but harmful to the herd. Thus we have an argument between sportsmen and government officials that is almost exactly the reverse of the most frequent arguments on this continent.

In Finland the position of reindeer is more like that in Sweden. They are not considered to be game animals although there may be a few wild ones along the eastern boundary of Finland where they have immigrated from Russia.

MOOSE IN FINNOSCANDIA

General Biology

Description:

Since all moose belong to one holarctic species, that is a species which is circumpolar in distribution there is every reason to believe that the Swedish "elg" would be quite similar to Ontario moose. This deduction was soon borne out by my observations. While driving along a bush road with Dr. Hoglund near Boda on the evening of September 5th I was fortunate in seeing what appeared to be a yearling cow run off the road into the woods. It was dark brown in colour and it impressed me mainly as being smaller in size and possibly with shorter legs than the Ontario moose. This impression was strengthened by a cow and calf which were seen while hunting near Sollcftea on September 7th and by several moose seen after they were shot by other hunters.

In order to confirm my impressions, I made inquiries about the weights of Swedish moose. Unfortunately the information I obtained is of less value than it might have been due to my neglect to establish what kind of weights were being quoted. I believe that in most cases the hog dressed weight, that is the whole animal without entrails was the one used. Mr. Wallerstedt of the Swedish Hunting Society informed me that one of the biggest bulls known weighed 470 kilogrammes (1,036 lbs.). Another was reported as weighing 550 kilogrammes (1,212 lbs.) but this one was not confirmed. An average bull would weigh about 300-310 kilogrammes (about 660-680 lbs.). By comparison the largest moose weighed by Peterson (1955) on St. Ignace Island, Ontario, was 1,177 lbs. Although this is very little different from the Swedish maximum weight it would appear that our average weight is higher than that in Sweden running around 800 or 900 lbs.

Mr. Ackerman gave me some additional information on Swedish moose weights. He stated that out of 250 moose shot last year (1958) in southern Sweden the largest weighed 236 kilogrammes (520 lbs.). However, he claimed that this animal would only be three years old and that 10 years ago the best moose were around 300 kilogrammes (660 lbs.). It may be that Swedish moose are not really as much smaller than Ontario moose as is sometimes thought, the differences being made up largely in the young age of the moose in Sweden and possibly in shorter legs.

In Norway Mr. Knut Rom informed me that a calf would weigh about 50-60 lbs. at hunting season in early September. Mr. Arne Krafft stated that on the pulp company land where he works a short distance north of Oslo the average dressed weight last year was about 200 kilogrammes (about 440 lbs.) for bulls and 170 kilogrammes (375 lbs.) for cows. The biggest bull shot in this area, over which he has authority to weigh all moose, was 310 kilogrammes (683 lbs.). Thus Norwegian moose seem to be much the same size as Swedish moose.

Another difference between Scandinavian moose and moose from Ontario was in their antlers. The largest trophy antlers that I saw in Sweden although very regular and pleasing to look at impressed me as being about the size of those of a four year old bull in Ontario. The young age of the moose probably has something to do with the general small size of antlers in the south of Sweden but it would hardly prevent occasional large ones in the north.

Mr. Ackerman commented that moose antlers in southern Sweden were normally not larger than the horns of the barn-yard cow due to the average low age of the animals. This was considered to be a serious problem in southern Sweden and there was much discussion about methods of allowing some bulls to reach a mature age. A set of antlers that I saw in Oslo were larger than any seen in Sweden but still only reached what would be considered an above average size in Ontario.

Another problem much discussed in Sweden was the shape of the antlers. Especially where heavy hunting presuure was continual, there seemed to be an increasing proportion of the herd with the so-called "tine" antlers and these were considered to be of inferior quality for trophies to the palmate antlers. There was much talk of trying to encourage hunter selection to reduce them. The increasing number of tine antlers was believed to be due to the hunter preference for palmate type antlers over long periods of time. It was also suggested that the tine type weremore successful in fights. Although there is little evidence of tined antlers even existing in Ontario at the present time it is quite possible that hunting over prolonged periods might bring about an increase in this less desirable form. However, there would have to be a great increase of hunting pressure before it would have any considerable influence on the herd.

Habits:

There seem to be some differences in habits between Swedish moose and moose in Ontario. From what I could understand moose in Sweden do not depend on water plants for summer food supplies. Although Skuncke states that

moose are generally associated with damp ground they do not seem to be nearly as aquatic in habits as our moose in Ontario. This may be only a reflection of the smaller amount of water available in Sweden, but I was given to understand that they did not make much use of the lakes that were present.

Another difference in habits between Swedish moose and moose in Ontario is that the former seem to come into the open much more frequently in order to graze on farmers grain crops. This is a very serious problem in Sweden and would indicate a grazing habit that is not found in Ontario. It was mainly oats that were affected. Apparently there had been sufficient agitation by farmers to bring about the payment of damages out of funds collected from the sale of hunting licences. It was not possible to collect for forest damage, only for damage to farmers crops.

A third habit that seemed to be different from Ontario moose had to do with mating. The Swedish hunters were most interested and surprised to hear of the Canadian method of hunting moose by calling them with the birch-bark horn. Upon further enquiries about Swedish moose I was informed that they were very seldom heard to call in autumn. Several hunters had never heard them at all and others had heard them occasionally but said they made very little noise. This might be a reaction to the intensive hunting in Sweden but at any rate it seemed quite different from the case in Ontario.

Habitat:

Considerable speculation has arisen in Ontario regarding moose habitat in Sweden as this could be a reason for their high numbers. In the north of Sweden much of the country is wooded and conditions for moose seem quite similar to those in Ontario. There were possibly more scattered farms than in northern Ontario and more human activity in the form of towns and roads. The major difference however, was in the species of trees. The Scotch pine in Sweden seems to take the place of both jackpine and black spruce in Ontario. The only other major conifer in Sweden is the Norway spruce. The Scotch pine could be seen not only on sandy uplands but also in the swamps. This seemed to me to be a major difference from the standpoint of moose because of their great preference for Scotch pine. It was as if black spruce had suddenly become the favourite food of moose in northern Ontario. The Scotch pine was a very widely distributed tree species and at the same time a major moose food. The nearly unproductive black spruce swamps in Ontario are thus replaced in Sweden by areas with favourable food plants.

In southern Sweden an ideal interspersion between fields and forests resulted from the farming methods. There are many rocky outcrops in southern Sweden so that the farm fields are mostly irregular in shape. There are small stands of woods here and there around the outcroppings with the fields curving in and out around them. The result is a very great distribution of forest edge. This undoubtedly adds to their problem of moose eating oats because of the close proximity of forest and field but it also means that moose are living in a habitat in which food supplies and shelter are almost ideally intermixed. Very heavy hunting of moose occurs in parts of southern Sweden which seemed very similar to southern Ontario in forest type. Some of the

northern conifers are replaced by hardwoods such as oaks and beeches and the climate seemed not unlike that of southern Ontario. They have about 800 millimetres of precipitation a year of which much is snow which melts quickly in winter time. It was my opinion that this interspersion in the south coupled with the prevalence of pines in the north was the major reason for the high production of moose in Sweden.

Food Habits:

Except for the reduced aquatic vegetation in the diet and the addition of grazing in the fields, the food habits of moose in Sweden seemed quite similar to those in Ontario. Scotch pine seemed to be the major food species followed by aspen and birch. Other hardwood species although of lesser importance made up a significant percentage of the food eaten. Moose browsing, or as they call it "moose damage", in Sweden looked very similar to what I had been used to seeing throughout northern Ontario.

In Norway Mr. Arne Krafft has been doing some work on determining food habits. He has been following fresh moose tracks in the winter on skiis and counting the twigs browsed. So far he has only counted numbers of twigs but he is planning to measure the diameter of the part that is left and compare it with similar twigs which he will weigh to determine the weight of browse eaten by the moose. He hopes to get both the species eaten and the amounts eaten. Mr. Kraft stated that in the jackpine forest type moose eat pine, juniper, some birch and mountain ash. In the spruce forest type they eat birch, willow, mountain ash, alder and some pine and juniper. When I mentioned that birch was a major food in Ontario he stated that the moose there prefer willow and mountain ash to birch in the spruce forest and Juniper communis in the pine forest. He thus confirmed my opinion that food habits of Swedish moose were similar to those of moose in Ontario.

Moose Hunting

History of Hunting in Sweden:

As in Britain hunting in the middle ages was reserved for royalty in Sweden. Commoners who owned taxable land were given the right to hunt on their own property by Gustav III in 1789. This ordinance was not ratified until 1808 at which time the whole population took up moose hunting until moose were faced with extinction a few decades later. A ten year closed season allowed some recovery but in 1836 hunting again endangered the moose. The Swedish Sportsmen's Association which was formed in 1830 began a continuous campaign for shorter seasons. In 1890 a law was passed forbidding the shooting of calves and this was made countrywide in 1912. The season was eventually reduced to its present six days. By the 1920's the moose population was again steadily building up. No one has been able to explain the continued increase which is very similar to the one we have seen in Ontario. The increasing moose herds have done more and more damage to farmers crops and forest regeneration until special seasons have had to be declared to reduce the numbers in trouble areas. They now have combined the open season over the entire country with special seasons in some places.

The general season is only a few days long and varies with the locality. In Angermanland Province which is about halfway up the eastern side of Sweden the season is four days long. Straight west from there is Jamtland it is seven days long, while farther north it is only two days. In this season everyone who has hunting rights and a licence can go and shoot as many moose as he is able. No calves are allowed to be shot during the general season except in Jamptland.

The special season again varies with the locality. It is a split season with a total length of twenty days in Angermanland Province, about ten days are allowed in September and another ten days in October with the mating season between the two hunting seasons. In this special season an established number of adults and calves may be shot on each area where the season applies. The number is obtained by taking 30% of the estimated population on the area. In some parts of southern Sweden there is a thirty-day special season and some pulp companies where damage is particularly severe have the right to shoot moose all winter. This right is not very enthusiastically exercised, however, because the Swedes prefer to hunt moose for sport in the regular seasons.

In Norway the season this year is from September 27th to October 10th which includes the rutting season. I received the impression that this was fairly standard over southern Norway, but it may vary with the locality.

Licencing and Enforcement:

Everyone hunting moose in Sweden must buy a 10 Kronor ($2.00) licence. About 250,000 of these licences are purchased each year, usually from the local post offices. Since the licences also cover other kinds of hunting the Swedes estimate that about 200,000 of them are actually used for moose hunting. An additional 50 Kronor ($10.00) fee must be paid for each moose shot. The licence is actually a licence to carry a gun. It does not entitle the holder to hunt unless he either owns, rents or is invited to a hunting area. Enforcement of the laws is by regular police assigned to this special duty.

In Norway similar regulations are in force. To shoot a moose the following licences are required: 10 Kroner licence ($1.25) to the Government which is handed back to the municipality. A 10 Kroner licence to carry a gun and a 30 Kroner ($4.25) fee for each moose shot. Enforcement in Norway is by county police. I was informed that it was not a very active enforcement but that there was not much illegal hunting due to the great interest taken by the local sportsmens clubs and local people in general.

Hunting reas

There is no such thing as an "open" moose hunting area in Sweden. Even State land is closed to everyone except the forest workers who are allowed to hunt on it. This is partly because State areas are not very extensive. Wildlife belongs to the landowner. If anyone shoots a moose on someone elses property it is just as much a theft as if it were a domestic cow. The landowner has the right to hunt himself, invite in friends, rent his land to other hunters or join with other farmers in making a larger hunting

area. There is no trespass law in the forest. He cannot stop people entering his forest unless they are hunting. He can stop them from entering his fields. Pulp companies can close their roads on timber holdings but they cannot prevent entry on foot.

For a private individual to hunt, he must own some land, rent a hunting area from a landowner, or be invited by a landowner or renter to hunt. He would usually find out about places being for rent by advertisements in local papers. He then goes to the landowner and makes an offer. If it is satisfactory he gets the hunting rights for that area and can invite as many friends as he wants to join him in the hunt, as long as they are all properly licenced. Over most of Sweden it seems that nearly every man has a brother, uncle or a friend who owns or rents a hunting area.

In Norway also it is necessary to rent a hunting area. Prices range up to 1,000 to 2,000 Kroners ($140-$280). The areas are rented by means of closed bids and may vary from 500 acres to 4,000 acres in size.

Moose Management

Moose damage:

As mentioned previously farmers could collect compensation for moose damage to their fields. This did not mean that there was no problem in the forest. Moose damage in Swedish forests seemed to be much more severe than in Ontario for several reasons: A major commercial species, Scotch pine, was also a preferred food of moose. Moose populations were higher and forest management is much more intensive. In some areas that I was shown where foresters were trying for regeneration of Scotch pine, moose browsing seemed to have seriously affected about half of the regeneration. Many of the trees eaten were on plantations or on areas where some silvicultural practice was being followed to promote regeneration and where thinnings and prunings were planned for the future. This meant that any single tree eaten was a much greater loss of investment than under the extensive forestry practices in most of Ontario. As a result moose damage to forests and possible methods of alleviating it provide widespread topics of conversation in both Sweden and Norway.

Control or remedy was attempted by means of the various special seasons in the worst troubled areas and by allowing the farmers or woods companies affected to shoot moose throughout much of the year. These practices seemed to be fairly satisfactory. Some forest companies attempted to offset the damage by moose with the revenue obtained by renting their lands for hunting. It seemed that the majority just wrote it off as loss and tried to keep the moose population within reasonable bounds.

Census and allowable kill:

In Sweden each of the small organizations of farmers must report the number of moose on their area during the winter. Owners of private property and pulp company officials also have to report to the county organization of the National Hunting Society. This estimate is obtained by counting tracks in

the snow. The counting is carried out by local farmers, foresters and other people thoroughly familiar with their own areas. Each man gives an estimate of the number of moose on 1,000 to 5,000 hectares (about 4-20 square miles). If the figures presented seem reasonable to the county organization a special season can be declared and the allowable kill calculated as 30% of the population estimate.

In Norway a local committee of five men is elected, three by the county council, one by the forest owners and one by the farm owners. These committees decide on the numbers of moose, the damage to the forest and the necessity of winter feeding. They also determine the numbers of moose to be shot and the number of acres per moose that will be allowed. This last item refers to a system whereby the country is divided into areas on each of which one moose can be shot. These areas can sometimes be combined for hunting purposes, but never more than six together. The owners within any one area may either shoot the moose on it or rent out the area to someone else. Returns are divided among the farmers according to the size of their farms. The size of the area on which one moose may be shot depends on the kind of country. In poor moose range they are larger than in good moose range. They may vary from 500 acres to 4,000 acres. Mr. Knut Rom thought that the Government was inclined to divide the county into equal units to avoid quarrelling but he felt that the proportional division was better and that the Government was coming to hold the same opinion.

The method of counting by the use of tracks in Norway was somewhat more formally organized than in Sweden. It was called circular counting. Mr. Rom stated that in a locality where old hunters had estimated 35 to 50 moose 122 were counted by this method. The counts are made during March and April. Each forest district is divided into counting compartments. Each person is given one compartment to count although if the area is a large one more than one man may be used. The size of the compartment varies with the density of moose in the area. The men doing the counting have been living in the same place for many years and are familiar with both the country and the moose. They may be loggers, foremen of forest companies, farmers or woodworkers. The area is first circled and all tracks noted. It is then criss-crossed and the tracks and moose on it recorded. Time of observation, sex and age of any moose seen are taken for later comparison with neighbouring compartments. Finally the area is circled once more and any new tracks crossing the ski trail are noted. The forester who has charge of the forest management on the area is then responsible for combining the various counts. Mr. Kraft stated that this method was first used in 1945 and that they have done it each winter for the past three years. He said that the counts were consistent and increasing. He believed that this method gives them a very accurate estimate of the numbers of moose on the area.

Population and Production Figures:

The country of Sweden and the Province of Ontario are roughly comparable with regard to flora, fauna, and climate. It would seem worthwhile, therefore, to compare the moose production figures for the two countries. According to a 1958 world atlas, the area of Sweden is 173,194 square miles while that of Ontario is 363,282 square miles. The human population of Sweden

in 1958 was about seven million while that of Ontario was about five million. The estimates of total numbers of moose were about 90,000 for Sweden and about 125,000 for Ontario. This is at a rate of one moose per 1.9 square miles for Sweden and one moose per 2.4 square miles for Ontario. Although these figures indicate that the production per unit area is lower in Ontario, they are not really comparable since unknown proportions of farm land, muskeg, etc. are involved.

In view of the above figures, the numbers of hunters in the two countries are quite surprising. In 1958, there were 200,000 moose hunters in Sweden, while the number of hunters for the same year on Ontario was only 26,295. In Sweden, these hunters shot 30,400 moose, while in Ontario they shot only 7,386 moose. This means that the percentage hunter success for Sweden was 15.2 as compared with 28.1 for Ontario. The lower hunter success figure for Sweden is probably a normal result of the larger number of hunters. Success always goes down as the number of hunters increases. The astonishing fact is that with only about half the land area and with a little larger human population, the Swedes are shooting nearly five times as many moose as we are in Ontario.

The highest density of moose known to exist in Ontario is 2.8 moose per square mile on a 25 square mile plot surveyed from the air. This was a most unusual incidence of winter moose concentration and a more normal figure might be one moose per 2 - 3 square miles. In order to get a better idea of the production per unit effort in Sweden than the total figures could give, I enquired of several men how many moose were produced on the areas with which they were familiar.

In the north of Sweden in Angermanland Province, Mr. Hamilton gave me some population figures for a pulp and paper company limits. The estimated population at present was six moose per 1,000 hectares (1.5 moose per square mile). The company officials would like to reduce this population to about two moose per 1,000 hectares (1 moose per 2 square miles) to minimize the damage they do toforest reproduction. It would appear that Swedish moose densities of this sort would not be extraordinary in Ontario, but the average density would probably be higher.

In southern Sweden, Mr. Ackerman gave me some figures on moose kills. He stated that in 1957 on 200,000 hectares (about 770 square miles) 600 moose were shot (one moose per 1.3 square miles). He considered this to be over 30% of the herd and was not surprised when the harvest in 1958 dropped to 500 moose (one moose per 1.5 square miles). On his own hunting area of 400,000 hectares (15.4 square miles) Mr. Ackerman has a quota of seven adults and three calves in the thirty-day special season. This is at a rate of one moose per 1.5 square miles. These production figures seem considerably higher than in Ontario.

Mr. Ackerman was among those who estimated the total moose population for Sweden at 90,000. This figure, I believe, was obtained on the logic that a third of the moose were shot. Since this was known to be 30,400, the total population must be about three times that much. It was argued by several people that the Swedish population figures must be accurate since the quotas

set from them led to a proper harvest. It is quite possible, however, for two wrongs to make a right. It could easily be that the total population was higher than they thought and the percentage shot lower. This would let results come out correctly without having the proper figure for the total number of moose. This would account for the fact that although the harvest figures for some areas are so high the population estimates are not so much higher than in Ontario.

In Norway on 9,000 shooting units allowing one moose per unit 6,600 moose were shot for the last two years or 73.3% of the allowable harvest. The pulp company for which Mr. Krafft works has holdings totalling about 400 square kilometres or about 150 square miles. About 100 hunters took 55 moose off this area in 1958 for a success of about 55%. This is at a rate of one moose per 2.7 square miles. They had permission to take 63 moose off the same area so the actual take was 87.3% of the allowable take. This would have been at the rate of one moose per 2.4 square miles. The pre-hunting population was calculated as seven to eight moose per ten square kilometres (1.8 moose per square mile to 2.1 moose per square mile). It appears from this that the total population would be about 300 moose and, therefore, the proper percentage to be shot was considered as about 20%. In one area south of Hurdal Lake 40 moose were counted on 20 square kilometres last April, (5.1 moose per square mile on a 7.7 square mile area). The count of moose this past winter was five to six moose per ten square kilometres (1.3 moose per square mile to 1.6 moose per square mile) over the whole of the company limit. This would be considered a very high moose population in Ontario. Mr. Kraft rates his area as below average moose habitat for Norway.

In Finland the total moose population was estimated at about 25,000 to 30,000 moose. Of this number about 5,000 moose are shot each year. The moose density is highest along the south-west coast of Finland adjoining Sweden. These population figures are based on estimates of increase, decrease or average numbers submitted by sportsmen and forest rangers from around the country.

Additional Facts About Special Areas

Southern Sweden

Mr. Ackerman who lives perhaps 50 miles west of Stockholm is an author, outdoor writer and world wide hunter. As such he was very much interested in moose and their management in Sweden and was able to provide me with some additional facts and opinions about the part of Sweden he knew best. When I enquired about his personal hunting areas and methods, he stated that with his favourite dog he has shot 76 moose in the past five years. He indicated the value of moose hunting dogs by mentioning that he had turned down 10,000 Kroners ($2,000) for his favourite hunting dog which is featured in the pictures of the book which he helped to edit (Malm, Ackerman and Andreae, 1959). He claimed that he usually shoots about 25 moose each year in various hunting areas.

When asked about population figures, Mr. Ackerman estimated that 1,000 hectares of woodland would produce about four moose (one moose per square mile). He went on to state that he thought the small remnant red deer herd in southern Sweden should be encouraged, the reason being that, besides the fact that the red deer causes less damage to the forest than the moose, twenty red deer could be produced per 1,000 hectares (5.2 deer per square mile). From these figures he concluded that red deer could produce more kilos of meat per hectare than moose and with no damage to the forest other than to the bark of young spruce.

When questioned about his opinion of the present moose season in Sweden, Mr. Ackerman stated that he considered the over-all kill of moose in Sweden to be about right. There were some sections, however, where hunting was becoming too heavy. In particular he mentioned the area previously discussed where over 30% of the herd was shot. He also stated that although the over-all kill was about right, in many places too many of the older animals were being eliminated. Not only did this mean very poor antlers but also a possibility of declining herd vigor. Since few moose in the southern provinces live over three years of age and, having in mind that both bulls and cows first breed in their second year, that is at $1\frac{1}{2}$ years old, it seemed logical to conclude that such very young animals would not be as aggressive as larger bulls. The result over many years could be detrimental. Mr. Ackerman's solution was to extend the special type of season. If this were done the shooting of calves could be specified in order to adjust the age distribution of the kill and to allow more animals to reach an older age.

In comparing the moose hunting production figures for Sweden with those which I supplied for Ontario Mr. Ackerman expressed the opinion that the great network of roads and the widespread human population in Sweden were major reasons for the higher annual kill there. His many comments on problems concerning all wild game showed a wide knowledge and appreciation of production figures and management problems as well as hunting and hunting methods. My short talk with him was a most enjoyable and profitable one.

Hurdal, Norway:

Mr. Arne Krafft had the most unusual position of any man I met. He was wildlife biologist for a pulp and paper company. This company, the Eidsvold Vaerk, holds about 400 square kilometres (154 square miles) of forest land. This they rent out to hunters on the theory that moose should be a part of the crop along with the trees. They have, therefore, set up hunting on a business basis and hired Mr. Krafft to manage it.

The forested districts each have a forest manager who is a graduate of a forestry school. The forest managers appoint a "hunting witness" from among their employees for each hunting party. He is paid by the hunters in money or meat along with his regular salary. His job is to see that hunting laws are obeyed and to control or carry out himself the weighing of all the moose shot.

The price charged to hunters last year was 600 Norwegian Kroner (about $85.) for a bull or 400 Norwegian Kroner (about $57.) for a cow, $1\frac{1}{2}$ years or older. Calves are protected by law. When I expressed my curiosity as to the reason for the differential in price Mr. Krafft replied that it was due to the fact that the meat is sold by the hunters. Hence the bulls produce more meat and they are the most sought after. The price of meat last year was 5 Norwegian Kroner per kilogramme dressed weight (about .32¢ per lb.).

Since there is no prescribed way in which a landowner must conduct the hunting on his land, Mr. Krafft has suggested some changes in the method of charging for use in the 1959 hunt. Hunters will be charged the sale price of the meat calculated at the rate of 5 Kroner per kilogramme less 100 Kroner for each bull and 200 Kroner for each cow. The main purpose of this change is to correct the sex balance of the herd which has been thrown off by years of preferential hunting for bulls. The new method will mean that the hunter receives 100 Kroner for each bull that is shot and 200 Kroner for each cow. The rest of the money from the sale of the animals goes to the company. Mr. Krafft thinks that the hunters will like this arrangement. The huntsman will know exactly how much his hunt will cost since the sale of the meat will exactly balance the cost charged by the company except for the 100 or 200 Kroner which are paid to him to help offset the cost of the hunt. At the same time the company will stand to profit since it will be getting an average of 1,000 Kroner instead of 600 for a bull and 850 Kroner instead of 400 for a cow. Mr. Krafft commented that it would move hunting from the realm of the money making venture back to that of an outdoor sport. It seems to be a most radical and profitable idea for all concerned.

Solleftea, North-east Sweden:

Mr. Henning Hamilton a forester with the Graningeverken A.B. Pulp & Paper Company described to me a more common attitude on the part of the Pulp & Paper Company toward moose hunting. On the 200,000 hectares (about 770 square miles) of woodland which they own they do not rent any land to hunters. It is kept almost exclusively for their own employees. There is one exception in that about 2% of the hunters are outside men who have been sold licences of 10 Kronor for a hunting area of about 200 hectares or 50 Kronor for 2,000 hectares of land. Even in this case the hunters often hunt with company employees so it is more of a licence than a land grant. The company makes no effort to make money on the moose hunt but it does collect one hind quarter from each moose killed which is given away for goodwill. The company is quite happy to have the hunters remove the moose and thus reduce moose damage. To Mr. Hamilton the hunting problems are only a small sideline to his general work which is in the field of silviculture and reforestation. However, the interest in moose hunting runs very high among company employees and considerable organization is required to ensure an orderly and successful hunt.

Description of Moose Hunting in Sweden

Although many small variations in hunting methods may be found in different parts of Sweden there are two main divisions into which all Swedish moose hunting methods may be grouped. In the north dogs are used by the

hunters while in the south dogs are used only for trailing wounded animals while the hunt is conducted by a drive method. When dogs are used they may be either on the leash or free. Fortunately I was able to observe both of the major types of moose hunting being carried on.

Northern Hunting With Dogs:

The Swedish National Hunting Society arranged for me to go with Mr. Henning Hamilton to observe the hunt on the property of the Graningeverken A.B. Pulp & Paper Company. Both the open season and the special season were begun in this area on Monday September 7th. The open season continued until Thursday September 10th while the special season ran until Saturday September 19th, followed by an additional season from October 7th to 17th. Seven men took part in the hunt besides myself. They were a chief ranger, a woodlands manager, another company employee of unknown rank, a farmer who kept the dogs, two army officers who were invited as friends and Mr. Hamilton. Although the area to be hunted was only about 8,000 hectares in size (about 31 square miles) the hunters complained that they did not have enough men to properly conduct the hunt. They said that the previous year they had had 15 men in the party and that the smaller number of hunters would allow moose to slip through the line.

Moose hunting in northern Sweden begins amid a spirit of festivity. For about two weeks before the hunt many of the men were talking about plans and looking forward to their annual vacation. I was informed several times that it was "like Christmas" to them. It was one of the big celebrations of the year.

Despite the partying however, our party was up at 4 a.m. on the opening day. Although we only took time for a hurried cup of coffee and some hard bread before hurrying to the hunt we could hear other hunters already on adjoining hunting areas when we drove to our own. A map was produced and several minutes were taken up with discussing strategy. Finally we entered the cars and drove down some small company haul roads. At intervals the man directing the hunt would indicate where a hunter was to get off and we would drive on. The hunters were placed so that they were just out of sight of each other along the road. Usually a corner or a hill separated them. By the time all had been situated the dog handler was already on his way to the other side of the area to be hunted with his dog.

During the first drive I took my place as a hunter. About half-an-hour after starting I had the good fortune to see a cow and a calf cross the road. However, I was unable to get a shot away and the next man in line had the misfortune to have his gun jam.

After the first couple of drives we stopped for coffee and again at noon we gathered by a small fire. The first dog was so tired from running by this time that it lay flat on its side at every opportunity. During lunch two policemen drove up and stopped for coffee. They were dressed in peak caps and blue overalls. After discussing the hunt generally and joining us in coffee they asked the hunters for their licences. These were readily produced and with farewell waves they continued on their way. If the uniforms and language had been different the whole episode could have taken place in Ontario.

After lunch I joined Mr. Hamilton with a fresh dog to see how the other end of the hunt was conducted. The Swedish "Elghund" or "moose dog" looks quite like the North American husky but is a fully recognized and registered breed. There are several different kinds of dogs such as the grey dog and the Jamt dog (from Jamtland) and the smaller Lapp dog one of which we were using. The dogs are usually grey or black in colour with erect ears and tail curled over the back. The head looks a little like that of a German Shepherd but with a shorter nose. The dogs seem mild in disposition and very keen on the hunt. The many moose dogs which I saw while in Sweden were all either tied or on leash except when in the actual business of hunting or released for a short frolic.

Upon entering the woods from a road the dog was released from the leash to range at will. It started down what seemed to be an old trail but soon turned off. I found that the dog handler merely walked forward slowly while the dog ranged back and forth in front of him much in the manner of a bird dog. Although the hunters were posted around the area to get any moose that were flushed out this was not the primary purpose of the hunters. The ultimate in Swedish moose hunting is when the dog catches the moose. If the moose is a cow or a young animal it usually just runs out to the waiting hunters but if it is a mature bull it will often turn and try to attack the dog. The dog then circles it barking furiously and keeping just out of reach while the following hunter runs forward at top speed towards the noise. Usually the moose is too engrossed in trying to kill the dog to hear the approach of the hunter and thus becomes an easy prey. For a Swedish moose hunter all other methods of hunting moose are but poor substitutes for this one, the true sport. Unfortunately I was not able to see this drama first hand. Through a freak of chance all the moose shot by our party were cows and calves. Thus there was no opportunity for the dog to do its work.

The hunt was much the same each day with only a change to new sections of the hunting area. The last day provided variation in that we had to travel by boat. The weather was cold in the mornings, warming later in the day, much like a mid-October day in Ontario. Leaves were still very much on the trees and the weather was for the most part sunny. The moose each day were hung in a barn and rough dressed. They were later taken into town and turned over to a butcher. A horse from the nearby farm was used to drag the moose from the woods in most cases, but the last day of the hunt they had to be cut into quarters and carried out by the men. Even in Sweden moose hunting can be hard work. As I remember it, the total success for our party was as follows - 1st day a cow and calf and a second calf in the evening, 2nd day a single cow, 3rd day a yearling cow and two adult cows. Total count seven moose for seven men. This would not be the total harvest for this area as the later special season would see more hunting.

Southern Sweden:

I was most fortunate in that the National Hunting Society was able to arrange for me to observe the Royal moose hunt in southern Sweden. Although the present King does not hunt himself, the Royal Hunting Society composed of the most important men in the country carries on the hunt on the royal grounds.

Since the hunt was located quite near the gamekeepers school at Ostermalma I was instructed to contact the director of the school, Baron von Essen, and accompany him and his students to the hunt.

The hunt began at about 7 a.m. with the gathering and mutual greetings of the hunters. There were two main groups involved. The drivers were mainly students from the school but included some local help. These numbered about 30. The shooters were the members of the Royal Society also numbering about 30. A detailed map provided a schedule for the day's drives. Since the first one was to be at about 8 a.m. the shooters were soon located in their line at previously built blinds which consisted of small piles of brush just big enough to hold one or two shooters. Sharp at the appointed time the hunting horn of the drivers sounded to inform all that they were on their way.

As the drive progressed hunters were kept informed of the position of the drivers by blasts on the horn. A series of parallel lines on the map with times marked beside them allowed everyone to check as to whether the drivers were still on time. As they approached the line of waiting hunters activity there increased. A hare dashed from the woods toward us and then returned the way it came. To our left we saw Baron von Essen shoot a roe deer. To our right we heard someone shooting at a moose. Some capercaillie and black game flew overhead. Finally the horn sounded quite near and a few minutes later we were able to hear a continual ticking sound. A man came through the woods unhurriedly hitting two sticks together. Soon the whole line of drivers could be seen and the shooters began to emerge.

After a brief conversation and examination of one of the downed moose the cars were brought up by the chauffeurs and the party was moved to the next area. There was little spare time as the drives were scheduled close together. Again we all took our positions in the blinds and again the horn sounded for the beginning of another hunt.

At noon a table was set up and wrapped lunches were provided. As we ate and talked of the hunt a truck came by with about four dressed moose from the morning's hunt on their way to the freezer. Later in the afternoon I also saw the horse that was employed to pull the moose from the woods. The country where the hunting took place was southern mixed-wood type with hardwoods and conifers in about equal proportions. Most of the blinds were set up along the outside of small dirt roads. In each blind small finger signs pointed to the blinds on either side so that the shooter would know where not to shoot. I was unfortunate in not seeing any live moose for many were shot during the day. As they were immediately picked up and taken away, I could not find out what the total count was. This is undoubtedly an excellent way to get a good harvest of moose and is well adapted for the men involved, many of whom were elderly and would not have been able to undertake the discomfort of the more rugged form of hunting. Despite its obvious efficiency, however, several of the younger men informed me that it was not their idea of how moose should be hunted. Hunting with a dog still reigned supreme.

RED DEER IN EUROPE

European red deer are larger than North American white-tailed deer but considerably smaller than their nearest North American relatives the elk or wapiti. There is variation in the size of red deer in different parts of Europe. The smallest animals are in Scotland, while the largest are in central Europe around southern Germany, Austria, Yugoslavia and Hungary. The most important countries in my study of red deer were Scotland and Bavaria, Germany.

Scotland:

Very little is known about red deer in Scotland considering their long proximity to outstanding scientists. Despite the fact that the British have done such excellent work on population studies, none of these methods has been applied to red deer populations. Two sources of information on red deer are available. One is the very thorough practical knowledge possessed by the gamekeepers and stalkers of Scotland. The other is the work done by Dr. Frazer Darling. Dr. Darling estimated the numbers of deer in Scotland before the war at a quarter-of-a-million animals. In 1949 he estimated that there were still half that number remaining. The magnitude of the problem of overstocking can be seen from Dr. Darling's estimate that the proper number of deer for optimum condition is 100,000. How many deer there are now is anybodys guess. At a time when the problem of red deer in Scotland is coming very much to the fore, they find themselves with little knowledge from which to work.

There are two bright spots in the Scottish deer picture. One is the work of the Nature Conservancy and the other is the new law just now going into effect. In the Nature Conservancy the man at present working on red deer is Mr. P. Lowe. His main project is on the Isle of Rum off the west coast of Scotland. The limited area and absence of any trees on the island have allowed them to make a complete count of the numbers of deer. They know the herd so well that many of the deer are named and their feeding areas well known. A tagging programme for fawns captured at a young age helps in getting to know the individual animals. They have been forced by political considerations to reduce the deer herd rather than allowing it to build up to a peak as they had intended. They are trying census techniques on the known numbers of deer in the hope of finding a method that will be applicable to the rest of Scotland. They are also working on an aging technique based on measurements on the length of tooth row, diapasm, and total length of jaw. We were able to see a few deer at a great distance in the high mountains of the western highlands but because of the season of year and the shortage of time we were not able to see any close at hand.

The new law appears to be based to a large extent on recommendations by Dr. Darling in his paper to the United Nations Scientific Conference on conservation in 1949. Prior to World War II hunting in Scotland was regulated by a gentleman's agreement concerning the time and methods of hunting. Most hunting was on private estates where the landlord would countenance no foolishness and where gamekeepers kept poaching to a low level. After World War II with fewer men able to afford gamekeepers and with an increased popularity for hunting in meat-starved Britain the situation got out of hand. Large private hunting lodges were turned into hotels and run by people who knew little of

deer and cared little for hunting traditions. Anyone who paid would be accepted. At the same time the improved roads, increased motor travel, and high meat prices lead to organized commercial poaching on a large scale. With no laws regulating the seasons or night shooting, the reduced number of gamekeepers had great difficulty handling the situation.

The new laws were hailed by everyone I met as a real improvement. There are three major provisions to this legislation which has been passed but has not yet come into force. It sets up American style hunting seasons, prohibits shooting at night, and gives the Nature Conservancy the right to remove deer that are damaging crops. It was backed by landlords who were having difficulty controlling poaching, people interested in the humane aspect of hunting because of the wounding and escaping of night shot animals, and the Nature Conservancy people who wanted a lever to use on landlords that refused to do anything about reducing the herds on their property. The new laws are looked upon with great hope as establishing the basis for sound management of the Scottish red deer.

Bavaria:

Germany is one of the most densely populated countries in the world. From a population of 76 people per square kilometre in 1900 the population has increased to 130 per square kilometre today as compared to 17 per square kilometre in the United States. Despite the problems in maintaining wildlife populations created by such a dense human population there are estimated to be 30,500 red deer in Bavaria alone. Most of these live in the southern part of Bavaria next to the Austrian border in the high mountains. The number of red deer is regulated by law. Any deer over the prescribed number must be shot. In the south, where the country is mountainous and agriculture less important 3.5 red deer per 100 hectares (about 9.1 deer per square mile) is the maximum number allowed so that forest regeneration will not be damaged. A lesser number is established for the rest of Bavaria because of the damage to crops and intensive forestry. Red deer were said to be spreading into new areas due to the regulation limiting shooting which was passed in 1933. The number of red deer permitted to be shot is based on how much damage they do to field and forest. The exact animals to be shot are prescribed and the hunter can lose his licence for shooting the wrong one.

The licence in Bavaria costs 50 Marks ($12.00) plus an additional 15 to 16 Marks ($4.00) for insurance. The insurance protects him to the extent of 30,000 Marks ($7,500) for damage to objects and 100,000 Marks $25,000) for damage to people. However, I was assured that there were seldom any accidents because of the way their hunting is organized.

In order to hunt a man must rent a hunting area or be invited by a friend who owns or rents one. The cost of renting an area for hunting red deer was quoted as 12 to 14 Marks per hectare (about $1.00 to $1.25 per acre). Since the minimum size of hunting area allowed is 81 hectares the minimum annual rent for a huntingground is 972 Marks ($243.). Furthermore, it is required by law that the area be rented for at least a 12 year period for red deer. On State land most hunting is done by State employees but a few animals (360 this year) are sold to be shot by outside hunters at 150 to 200 Marks

($40.00 to $50.00) per animal. The size of the areas rented on State land for hunting red deer run from 1500 hectares (5.8 square miles) in the mountain regions, and from 750 hectares (3 square miles) and up in the lowlands. For hunting on one of these areas the hunter must pay about 20,000 Marks ($5,000) per year to the Government. He must also pay nearly an equal amount for feed, gamekeepers wages, dogs, houses and entertainment. Despite these extremely high prices there are many men in Germany today who can afford to rent hunting areas. They are even paying higher prices for hunting in neighbouring countries.

Red deer are required by law to be fed in winter. The situation in the Bavarian mountains seemed quite similar to that described for wapiti in western North America. The deer go into the mountains in the summertime but their traditional wintering grounds in the lower valleys have now been usurped by humans. Hence in order to maintain any populations they must be fed in winter. I visited one feeding station consisting of a field two or three acres in size with food troughs and a barn to hold the feed. It was stated that open water must be near each feeding station or the deer would die of thirst. A mountain stream flowed by the open rear gate of the field I was in. The deer would come down from the mountains at dusk to feed and move a short distance to cover during the day. The food used is a silage of green grass salted and pressed much like sauerkraut. This is fed with hay, acorns and malt from the breweries. About 3 or 4 lbs. of the silage and hay is fed each day along with a little acorn or malt and oats. They also feed sunflower seeds, beets and soya bean meal, but although these are very good they are too expensive. The estimated cost of feeding red deer was 20 pfennigs per animal. Since 100 and 120 red deer were fed at the station I visited this would mean about 20 Marks ($5.00) per day for the station.

In talking about the problems of red deer management some additional facts about the deer were recorded. Maximum age of red deer was given as about 20 years, with maximum antler development at 14 years. An aging method using dentition much as we do in Ontario is in use in Bavaria with the following age groups being designated. ½, 1½, 2, 2½, 3, 4-5, 5-6, 6-7, 7-8, 8-10, 10-12 and 12-14 years. The reproduction rate was quoted as 80 calves per 100 cows.

Austria:

I was unable to see any red deer in Austria but Dr. Ammon of Graz described to me the rather elaborate winter feeding method which was in use there. On the theory that too easy access to food was not good for the deer they considered that 14 hours out of 24 should be spent obtaining food. In order to bring this about the food was placed in caches that were hardpacked so that they were hard to pull apart. Between the caches were placed small haystacks and salt licks with the idea that the deer would move from one to the other. I was told that only two deer per 100 hectares were allowed on an area because a nursing deer requires 200 grammes of albumen per day for milk production and 150 grammes for itself. If populations are any more dense than this the proper food is not available.

Preparation of the caches is by teams of four men, one mowing, one transporting and two tramping. The food is usually put up in late May and June. Plastic bags containing five cubic metres are used to pack the food. One of these is enough to feed ten animals for about 1½ months. When properly prepared, a job which takes about eight hours, they will not spoil for two years. In filling the plastic bags, layers of freshly cut grass are alternated with layers of leaves and twigs from both deciduous and evergreen trees. Only the new growth chopped into 10 centimetre lengths is used. Layers of molasses and sugar are spread between the layers of greens and some turnips are mixed in to provide enough water content. This is packed into the plastic bags by tramping and sometimes by running over with a tractor. After being left to heat for three days a hole is dug and a layer of building paper placed on it. The bag of prepared food is then set in the hole and about 40 centimetres of earth is heaped over it. It is left in this condition until needed in the wintertime. Along with the cached food some hay is fed but it too is mixed with alternate layers of leaves. Dr. Ammon stated that deer fed in this way have shown excellent antler development.

The hunting of red deer in the mountains of Austria is by a drive method when females are to be shot to reduce the herd. Otherwise when stags are being hunted the method used is stalking with a guide or still hunting from one of their tower blinds. The stags are sometimes called to the towers with the use of cow horns.

Denmark:

Only about 3,000 red deer live in Denmark because of the damage they cause to crops and forests. Of these about 600 are shot each year. The hunting season is from September 1st to March 1st for stags and from October 1st to March 1st for cows and calves. All hunting is on rented or private land.

Despite the small numbers present some excellent work has been done on the testing of traditional counting methods for red deer in Denmark. In some sand dune plantations the total estimated number of deer was 150. When they wanted to reduce the herd Mr. Andersen with whom I talked persuaded them to shoot 140 plus 40 outside the actual area. Next year 140 plus 30 were shot, and this was continued for four years. On the basis of the succeeding years' kill figures they calculated that the original population must have been about 350 deer. This experiment supplemented their work on roe deer which is reported in the section on that animal.

Other Countries:

In Sweden only about 150 red deer are left. Efforts are being made to increase this herd as they are different from either the deer in Scotland or Germany. They are intermediate in size with a slightly varied conformation of the antlers.

In Norway about 1500 stags are shot each year along the west coast north of Trondheim. They provide very fine shooting but there is little interest shown by hunters. Perhaps because the stalking is so difficult.

In Holland due to the high human population there is very little room for red deer. The deer they have are nearly entirely confined to hunting preserves. Red deer from other countries have been imported in an effort to improve the antler quality in these preserves but with no success. It is now pretty well accepted that soil is the determining factor. It does not provide the essentials for good antler growth.

ROE DEER IN EUROPE

Roe deer are much smaller than the North American white-tailed deer and therefore are very much smaller than the European red deer. They seemed about the size of a medium breed of dog except for the longer legs. They are much more common and are much greater in numbers than the red deer because they require less shelter, less living area, and less food. They can survive in much more highly cultivated country and cause less damage to crops or forests.

Bavaria:

The Bavarian officials estimated that there were 593,500 roe deer in Bavaria. They are very intensely managed. In deciding how many deer may be shot on a hunting unit, the area is determined and the size of unsuitable land within the hunting unit is subtracted. This gives the total usable area which is then divided into percent forests and meadows, since more meadows mean more food, yet some forests are required for shelter. The animals are counted in the spring before the young are born, then again after the young come and finally in the late summer. The hunt is arranged from this last figure so that they will again be reduced to the number allowed by law. A balanced sex ratio of 50-50 is preferred and 100 fawns per 100 females is expected.

The price for a hunting area for roe deer is much less than that for red deer and the area need only be rented for nine years instead of twelve. At about four to six Marks per hectare a minimum area of 81 hectares would cost 324 Marks ($81.00) per year. This would allow hunting for roe deer, pheasants,and other small game. Usually at least 250 hectares (about 600 acres) are rented. The average size would probably be about 1,000 hectares (about 2,500 acres). An average roe deer hunting area near a town would probably cost 3,000 to 4,000 Markes (about $1,000.) each year. Before the war farmers used to shoot roe deer because of the damage to crops but now hunting rights are worth more than the damage they cause. The number shot is again based on the damage as is the case for red deer. Apparently the same 50 Mark ($12.00) licence is required as for red deer and the number of bucks, does and fawns to be shot is again specified. The roe deer season is from June 1st for males and from September for females and young. No dogs or drives are allowed in the hunting. Winter feeding of roe deer is not nearly as prevalent as is red deer feeding. The only comment that I heard about it was to the effect that if they were fed only clover they became ill and died.

Denmark:

About 25,000 roe deer are shot each year in Denmark. The rent for hunting areas is about 5 to 10 Kroner per hectare (about 30 to 60 cents per acre), or double that on the best areas. In a park near Copenhagen they had heavy winter losses of roe deer until they began to crop them more heavily. They now shoot about 700 out of a fall population of 2,000 thus leaving about 700 mature females in the herd. A live roe deer is worth 200 to 300 Danish Kroner (about $30.00 to $45.00). These deer are usually used for stocking in other places. A dead roe deer would be valued at 50 to 70 Kroner (about $8.00 to $14.00). Because of the differential in price some estates actually raise roe deer to sell alive. The meat is worth about 3 to 3.5 Kroner per kilogramme dressed weight (about .25¢ per lb.). The hunting season is from May 15th to July 15th for roe bucks and from October 1st to December 31st for any roe deer.

The only real research on field techniques in the North American tradition was found in the Danish work on roe and red deer. Some of the results of their work have been published in papers by Dr. Johs. Andersen of Kalo Research Station. The work was begun when this research station was set up on an old hunting estate. An effort was made to remove all deer from the two small isolated wood lots on the area preparatory to the introduction of better stock. They made an estimate of the number of deer in the woodlots using the accepted European method of repeated observations, such as, counting the deer as they come from the wood to feed in the early morning. Ten men were assigned the task of shooting all the deer. It took three months of hunting three or four days a week with the use of dogs to kill them all. After the first day the deer would not come out for the dogs but ran in circles inside the woods. Among the many conclusions from this work was the fact that 75% of the animals must be shot to give a true picture of the sex ratio of roe deer because of the tendency for bucks to come out of the woods first. Even more surprising was the number of deer killed . Nearly three times the original estimate of the deer population in the woodlots was finally harvested.

In a subsequent experiment, the number of roe deer in a 500 hectare (1,250 acres) enclosure was estimated at 125 deer. A total of 165 were actually shot. In this area which was severely overbrowsed the mean weight of deer was 2 kilogrammes (about 4½ lbs.) lower than at the Kalo Research Station and the production of fawns was only 0.9 fawns per female in the fenced area as compared with 1.3 fawns per female at Kalo.

The serious questions which this work raised concerning the accuracy of the older counting methods led to the development of a new method for estimating roe deer numbers at Kalo. Deer were trapped in a long narrow pen of wire with a trap door at one end to which a long rope was attached. The door was left open at all times except for being tripped from a distance by the men checking the trap. When the deer were caught, the men would immediately rush into the pen and, crowding the deer to the other end. catch them before they could start racing against the wire. The jaws of the captures animals were examined for ages. Leather collars with three coloured plastic plates on each side plus a number plate were then fastened on the deer along with ear tags for positive identification of individuals. The young deer were marked with a special colour combination for that year while older deer were marked with a standard colour.

After about 70 to 80% of the deer in the woods were marked in this way, stalkers were sent out in the spring, usually immediately after the completion of tagging, to record numbers of deer seen. Using a telescope the colours of marked deer would be recorded along with the sex. Any uncertain observations were omitted. The ratio of marked to unmarked animals then provided a kind of Lincoln index and the numbers of different year classes seen provided an estimate of mortality rates. Although this method is not yet thoroughly tested it is hoped that it will give very good results. The only serious source of error seems to be the tendency of young animals to be caught more easily than adults. They do not believe, however, that any difficulties with the new method will lead to errors of the kind revealed in the old one. Pre-baiting for the traps begins right after Christmas and trapping continues from January 1st until the snow goes or until the end of February when the growth of new antlers interferes.

Other Countries:

In Austria the common hunting method for roe deer is a drive in which men close in from four sides through the woods. The hunters are allowed to shoot before them only to a certain point in the drive after which they can only shoot the deer after they have gone through the drive line.

In Sweden there are estimated to be 150,000 roe deer. In 1957 it was estimated that 20,000 to 30,000 roe deer starved during a severe winter. Despite this loss the hunt the following autumn produced about the same number of deer as in previous years, that is about 35,000 to 40,000. In Jamtland Province they estimate the weight of roe deer at 40 kilogrammes (about 90 lbs.) and more. About 1,000 deer are shot there each year out of a population of 3,000 to 4,000. In middle Sweden 25 kilogrammes (about 55 lbs.) is the weight of a very good buck. An any deer season is in force except in certain counties where a special season is declared allowing hunting in September and December. The roe deer population is considered to be still on the increase.

In Norway the population of the roe deer is estimated at 75,000 to 150,000 deer, yet in 1956 only 1,500 were shot. The law does not permit roe deer to be hunted with dogs but it does permit hunting hares with dogs. The sportsmen feel that it is partly for this reason that roe deer are considered a pest which disturbs the hare shooting. The Sportsmen's Society is trying to get the Government to allow hunting of roe deer with dogs. The Norwegians mentioned that the roe deer are seriously affected by snow in Norway as well as in Sweden. They include foxes among the predators on this small deer.

WILD BOARS IN BAVARIA

I was not able to learn very much about wild boars in Europe. In Bavaria they do so much damage that they are not fed any more. Indeed they are supposed to be shot on sight, but many hunters like them and do not shoot. Right after the war when the Germans were forbidden to have guns the wild boars increased greatly and did a great deal of damage. They are now pretty well under control again with very few being found outside the enclosures. In larger parks they are kept for the sake of tradition. I was able to see

some in Forstenreid Park on the outskirts of Munich. They were lured out by a few pails of garbage much as we show off bears at garbage dumps. There was a high wire enclosure around the area and a giant live trap to catch any that escaped. Here the damage done by the wild pigs was tolerated even though torn up roots and holes dug under the plantation trees were very much in evidence.

In Austria due to a misunderstanding I missed a chance of seeing a wild boar hunt at Allensteig near Vienna. The hunt was by some Government officials and was carried out on an army training ground which was also used as a hunting preserve. The director of the hunt described it to me as a drive made up of 20 men and four or five dogs, usually dachshunds or fox hounds with about 20 shooters waiting on the other side. The shooters would be lined up along two dirt roads that met at a corner. The drivers would then form a semicircle driving into the angle. The shooters were only allowed to shoot the hogs after they crossed the road. It was forbidden to shoot towards the drivers. Only wild boars and foxes would be shot on such a drive.

CHAMOIS IN THE ALPS

One of the animals of the mountainous regions of Europe is the chamois. Looking somewhat like our mountain goats, it has rather short curved black horns. It is brownish in colour with black and white markings on the face. It does not breed until five years old and then only has one young per year. Herds may reach a size of 40 to 50 animals. Adult bucks stay with the herd only in winter. Cows withdraw from the herd at the time of calving. The hunters have to be very careful of their shooting plans because of the low reproductive rate.

The method used for hunting chamois was described to me in Austria. Shooters are set up at several mountain passes so that they block off a circular mountain valley. The chamois are then driven down into the valley and are shot at each pass through which they try to escape. The alternative to this sort of hunting method is stalking, whereby one or two men attempt to approach the chamois on foot. This is very difficult because of the animals' behaviour pattern of watching the lower ground from great heights in the mountains.

Disease Problems:

The greatest problem in chamois management at the present time is a variety of mange caused by the mite, Sarcoptes scabiei var. rupicaprae. Although this disease has been present for many years it was intensified after the war by the double process of herds increasing due to restrictions on the use of guns for hunting and reduction of the range through expanding human populations. The more crowded the range became the greater the problem. Some mountains have already had all chamois destroyed by the disease.

The female of the parasite lays 30 to 50 eggs. In two to four days they hatch into six legged larvae. After another two to four days they develop into eight legged nymphs. In another three days they have become adults and after three more days they are ready to begin laying eggs themselves. The total

life cycle takes only 10 to 15 days. Assuming a 50 to 50 sex ratio one female can have half a million young in 2½ months. For this reason the disease spreads very rapidly. A similar parasite *Sarcoptes scabici* var. *caprae* infects goats. Although the two mites look identical, it is believed that they cannot infect other hosts. The exact difference is questionable but it has been suggested that they might be different sub-species.

The mites are very small. They can live 12 to 14 days separate from the host in winter but only six days in summer due to the more rapid metabolic rates in warm weather. Although they may be passed on by infected ground, it is usually by direct contact between animals. Since this includes dead animals, all hides must be burned when efforts are made to control the disease. The meat is thought to be harmless to foxes. The effect on the chamois is the production of great unsightly lesions around all the body openings. Very often the animal becomes blind and cannot eat. I was shown coloured slides of chamois in various stages of affliction. There seemed to be a steady increase in the incidence of hard crusted scabs as the disease progressed.

Control methods to date have consisted mainly of shooting diseased animals. Since all hides have to be burned this is a difficult procedure. Yet, in some places they have reduced herds by four, five or six chamois per 100 hectares. They have also tried to reduce the number of tourists, who add to the problem by chasing the chamois off their feeding places in their efforts to see the animals or to go mountain climbing. An unusual method of control was begun a few years ago in Bavaria, based on the idea that by reducing internal parasites they would allow the animals to build up their strength until they could throw off the external parasites. In the first test of this theory blocks with minerals, iron, copper, manganese, phenothiasm (to destroy internal parasites) arsenic, spices to attract the animals, copper sulphate, and 50% sodium chloride were put out on a special study area. In the first year 20 infected animals were shot. In the second year three were shot and in the third year none were shot. This demonstration so impressed the Bavarian Government that the workers were given enough money to begin a special research programme in an effort to obtain more conclusive results.

About two years ago a fence was built on one of the mountains as the beginning of a research station. They had trouble with snow the first winter but by putting two poles together and leaving the fence loose between them they managed to beat this problem. Because of the extreme inaccessibility of the area a United States Army helicopter was employed to bring in the metal fence posts. The fenced area was divided into two parts and captured animals were placed on each. It was hoped that by artificially infecting one group of animals they would be able to determine if the parasites could spread without direct contact between hosts. Of the animals already infected two are being fed ordinary salt as a control. On them the disease is developing normally. Another one is being fed the special salt and results so far look promising. They hope to continue this experiment until it is conclusive. In the meantime they are learning something of the food habits of chamois. They planted plants in the enclosures and counted them so that preferences could be determined. They found that the animals eat herbs, grass, browse and lichen. This project was one of the best designed and carried out research programmes that I saw on the continent. If it proves to be successful it would appear to be a milestone in the handling of wildlife diseases.

Use of Capture Gun in Research:

In the course of visits to the enclosure in the mountains mention was made of a capture gun being used to obtain animals for the enclosure. Further enquiries revealed that it was the same gun that we have been using in Ontario. When I enquired about its effectiveness I was surprised to find that they considered it good. Further questioning revealed that they had modified it considerably for improved performance. At a demonstration three darts were put within a foot of each other from about 150ft. Probably 30ft. would be a maximum range for this kind of accuracy with our gun. The changes which they made were as follows:

1. The gun was converted to a single shot weapon. They argued that if the first shot missed there would be no time for a second one anyway.
2. A pressure gauge was attached to the front end of the air chamber so that a compressed air tank could be attached.
3. The pressure regulator was changed inside the gun and a new indicator reading in metres was added.
4. A sighting telescope was added.
5. A projected addition was the mounting of a range finder for increased accuracy.

In use, a charge of 60 atmospheres compressed air is loaded in the gun using the pressure gauge to determine the amount. The pressure regulator is then set at the correct distance adjusting the pressure as follows:

For 60 metres - 26 atmospheres pressure.

For 50 metres - 20 atmospheres pressure.

For 30 metres - 12 atmospheres pressure.

For 20 metres - 8 atmospheres pressure.

This was set for the double purpose of maintaining a constant trajectory for more accurate shooting and of preventing the dart from hitting too hard at close distances. This kind of pressure arrangement was particularly desirable in Bavaria because of the fact that they were working in the mountains where pressure might vary two or three atmospheres from the time they loaded the gun until they got up to the chamois.

With these changes in the gun they soon found they were able to hit the animals. However, they were still not knocking them out. When experiments with the captive animals showed that the drug was working all right, they decided to do some experiments with the darts. Since the darts were empty after shooting they knew that the fluid was being ejected. In order to test them further they put up a paper target and spread papers on the ground along the path of flight to the target. They then loaded several darts with ink and shot them at the target. They found that very little ink was ever deposited on the target but it could be found all along the path of flight. Obviously the fluid was being lost before the dart hit the animal. The reason for this was that

the rubber stopper in the dart was removed by inertia when the dart was fired. The little loss of fluid on short flights did not make any difference but when they increased the range of the gun the problem suddenly became serious. They met it by changing the dart:

1. The rubber stopper was turned around and by means of a small piece of plastic was fitted into the tail section of the dart. This simple change meant that it would come out on impact rather than when fired.
2. The needle was shortened.
3. The barb was changed to a small pair of backward pointing notches for summer use or four notches for winter use due to the thicker hair of the chamois in winter.
4. The tail of the dart was clipped shorter to reduce air resistance.

Since they have made these changes they have not lost an animal. They had captured 15 or 16 chamois in the previous three months and had used the gun on goats and red deer with equally good results. They are now negotiating with the American company to sell them patent rights for the improved guns and darts.

The drug used on the chamois was nicotine salicylate. They reported no trouble with it and no antedote was used. When the animals died from other causes it was examined histologically in a laboratory. It showed no damage from the nicotine despite the fact that it had been one of several animals that had been knocked out three times. They find the drug takes four to five minutes to act during which time the animal may travel 600 metres. In order to recover them dogs are used to trail them until they go down. The animal usually stays unconscious about 30 to 45 minutes and is still dizzy for an hour afterwards. If a longer period of time is required for handling the animal, an anesthetic of a different kind is administrated. The darts are only boiled after use and no effort is made to keep them asceptic because they must go through the thick mat of hair. After the hunters come up to the chamois they disinfect the wound with foctun on the outside but do not feel that antibiotics are needed. Tranquilizers are used when transporting the animal (ethylmethylbutyl barbituricum). The only trouble they have encountered is that the animal will die of loss of blood if it happens to be hit in an important vein. The dose of nicotine salicylate used is 60 kilogrammes per square centimetre body surface which works out to about 9 ml. per kilogramme for chamois and 15 ml. per kilogramme for red deer.

FUR-BEARING ANIMALS

Grey Squirrels in England:

The North American grey squirrel, *Seiurus carolinesis leucotis*, the subspecies found in eastern Ontario, was introduced into England about the beginning of the present century. In England, as in North America, they nested in the trunks of large trees and in leafy nests built low in the branches of

trees. Raising two litters per year, they spread rapidly, but soon were found to be injurious to forestry interests. Since they are of little harm to trees in North America I was interested in seeing what kind of damage they did in England. I found that they eat the bark from the base of the trunks of trees and to a lesser extent from the branches. They usually attack deciduous trees but will also damage pines and first. The smooth skinned species such as the Acers, beeches, hornbeams and birches are particularly susceptible. Even if the squirrels do not kill the trees, the quality of the wood is much reduced by deformation of the trunk. The squirrels also attack seed beds in nurseries and cones in seed orchards. The damage is sufficiently serious to warrant a research project at the Alice Holt Forest Research Station in southern England.

Movement Studies:

The first stage of the study was begun about five years ago as an effort to learn something of the movements of the squirrels. A programme of trapping, tagging and releasing squirrels was begun on a 17 acre plot. This was soon found to be too small and a two mile radius was added to the original area. Nearly 100 animals have been marked in this project. Some of them have been re-trapped about one mile away after only four days. One was caught about 100 times in three or four years. The objectives of this early phase of the programme were to determine the best times for trapping in order to control the animals; to find out the area that must be trapped to protect a specific place; to establish size of territories and home range; and to find the relationship between population sizes and surrounding crop production.

Aging Criteria:

The second phase of the study was initiated in the hope of finding an aging technique that would work on live animals. The method used thus far is based on staining the dentine by painting silver nitrate on the teeth. Drawings are then made of each tooth using an epidiascope or a camera lucida. The dentine parts of the drawing are filled in with ink and photographed on 35 mm. film. Standard negatives have been prepared by photographing bits of black paper cut from a sheet of known area and scattered on a white sheet of paper. The tooth photograph is compared with the standard photographs by means of a light sensitive cell and galvanometer. The total area of dentine is used to determine the age of the squirrel.

Population Estimation:

Many methods of counting the squirrels have been attempted. Nest counts, counts of squirrels over specified times and area, and Lincoln indices have been the major ones. The Lincoln index using live traps and tagging was the only method which showed promise. The abundance of squirrels is suggested by the fact that 76 animals were trapped on 16 acres for an average 4.5 squirrels per acre. They believed that they had trapped all the squirrels in this particular woodlot and that it was an unusually high population.
Mr. Courtier, one of the research workers, recounted having shot 18 squirrels in two hours by just walking through a woodlot.

Control:

Four methods of control have been attempted:

1. Bounty. A total of £32,000 (nearly $90,000) was spent in one year on squirrel tails, bountied at 2s.0d. a tail, with no noticeable effect on the squirrel population. The total squirrels killed and reported in this programme, most of them being bountied, were as follows:

1951	160,483
1952	168,038
1953	262,589
1954	406,903
1955	235,350
1956	172,310
Total	1,405,673

Various bounties were paid on 968,279 of these squirrels totalling £63,029 (about $176,000). Since no reduction was effected the bounty payments were stopped.

2. Free shot-gun cartridges stamped "squirrel cartridge" were issued to recognized squirrel clubs at the rate of two cartridges per squirrel tail turned in.

3. Long poles were used to poke squirrels out of the nests while shooters made a circle around the tree and shot any squirrel that came out. This was found to be the most effective method.

4. Trapping with live traps (spring traps are outlawed in England) were used quite extensively and were considered to be second best in effectiveness. Two kinds of traps were used. A multi-catch trap that would catch up to four squirrels at one time was considered inferior to a single catch trap. The latter was an ordinary box trap. It was found to be lighter, cheaper and more efficient. In one instance a total of 500 squirrels was caught in three weeks trapping on about 300 acres.

Marten in Scotland:

Dr. Jim Lockie of the Edinburgh Nature Conservancy was working on martens, weasels and stoats in a woodlot about three miles long by one-half mile in width. Due to the fact that haul roads are much used by marten for travelling because of the extreme thickness of the surrounding heather, scats are easily collected along the roads at all seasons. They are also collected from latrines, thought by Dr. Lockie to be associated with nests, on boulder piles in March and April. The scats are cleaned in a seine then separated in water by eye into the various components. The results are expressed as percent of dry weight. This is a compromise because of Dr. Lockie's dissatisfaction with the use of percent occurrence and, on the other hand, the extreme amount of time consumed in identifying all individual pieces.

From his work so far Dr. Lockie has found that the diet of marten is made up of the following foods in order of importance.

1. Microtus agrestis. The meadow vole.
2. Small birds.
3. Hares and rabbits.
4. Carrion including dead deer in winter.
5. Lepidoptera lavae and pupae.
6. Wasps nests and beetles.
7. Spawning trout that were scooped from the water in a manner similar to that used by bears.
8. Rowan and Vaccinium berries.

Of the three most important mice Microtus, Epidemus and Clethrionomys, only about five to eight percent of the population of wild communities is accounted for by Microtus. The preference shown by marten for this vole is indicated by the fact that in the analysis of marten stomachs, it makes up about 80% of the mice eaten. Clethrionomys is the next most important food with Epidemus last.

Finnish Fur-Bearers:

Red Squirrels:

The native red squirrels of Finland are dependent on seed production of spruce and to a lesser extent pine for enough food to sustain high populations. A hunting season is only declared on the years when good seed production leads to high numbers of squirrels. In a good year about 2,000,000 skins will be taken and sold as fur. At the Game Research Institute at Helsinki this relationship between the population level and food production has been investigated along with some work on the moulting of squirrels.

Muskrats:

Muskrats imported from North America are now nearly everywhere in Finland. An average of about 200,000 are trapped each spring, the highest so far having been 600,000. Muskrats are not liked by anglers because they are believed to destroy nearly all the vegetation in the lakes but they are otherwise well appreciated as valuable fur-bearers. Shooting muskrats is not allowed, a fact which some believe may lead to over-population and trouble in maintaining sufficient winter food.

Beaver:

They now have some European and some Canadian beaver in Finland. The first trapping and shooting season was in the autumn of 1958 when they harvested 100 beaver. Beaver are also increasing slightly in northern Sweden.

Mink:

One fur-bearer which is not appreciated in the Scandinavian countries is mink. No species of mink is native to Finnoscandia. The present population has built up from mink that were released from fur farms during the war. There

is much concern throughout both Finland and Sweden about the possible damage mink may do to waterfowl and upland game bird populations through the destruction of eggs and young. Although a few men were inclined to doubt whether the damage was really very great the majority of those I talked to were convinced that the mink was a serious menace.

Bears:

The European bear, Ursus arctius, also occurs in Finland. Mr. Helminen told me that the skull of a bear which weighed 300 kilogrammes (about 660 lbs.) had been collected.

Hares in Denmark:

The hunting of hares is an important sport in Denmark, the season being from October 1st to January 1st. In an average year in the north east part of Zealand the production will run about three hares shot per 100 hectares (about 82 acres per hare). In the best areas of Denmark the production will run at about 40 hares per 100 hectares (about one hare for every six acres). They estimate that about 400,000 hares are shot each year in Denmark.

Because of this interest research has been carried out on hare population estimations on the same basis as the work done on deer. On a 200 acre island used as a research area hares are tagged and the ears tattooed. They are able to catch 60% of the hares in each trapping so that by the time four or five trappings have been carried out all the hares are marked. They are trapped by means of a Lechleitner trap described in the Journal of Wildlife Management 22(4):371, 1958. After the marking, about 50 people (30 children from school and 20 adults) are used to drive the island and send the hares into a strung out fish net. Men waiting just in front of the net jump up and scare them after they pass, then grab them before they can become disentangled from the net. About one drive per week is held during the September peak population and again during March to show winter loss. There is very little loss in summer. The drive is organized much as a pignic would be with food for all and payment of 20 Kroner (about $3.75) to each adult.

On another island hunters thought that they had about 400 hares. In the drive before the hunt about 100 hares were marked. In the first hunt 200 hares were killed of which 20 were the marked ones. Using the Lincoln index this suggested a population of about 1,000 hares. Later, the research workers convinced the hunters that they could hold another shoot during which they shot 400 hares. Of these 39 were marked, again [illegible] estimate 1,000 hares.

On still another island rented by hunters 15 hares were introduced in 1946. In 1948 - 200 were shot, in 1949 - 700 and in 1959 they expected to shoot about 1,000.

Dr. Andersen and his co-workers think that hunting has very little to do with the size of hare populations. On another island there are usually 100 hares in the fall and 40 or 50 in the spring despite shooting. An exception was this year in which there were 200 hares because of an exceptionally dry year which allowed a greater survival of young than usual. A living hare will sell for 55 Kroner (about $8.25) and a dead one will sell for about 10 Kroner ($1.50).

Disease in Hares:

A few years ago hunters in Denmark thought that they should get new blood into the local hare populations. Accordingly, they imported some hares from Germany. The hares in Germany had been imported from Hungary where a disease called Brucellosis is common. Now that it is too late, a law has been passed against such imports into Denmark. The disease has already arrived.

The organism involved is Brucella suis. Although it does no serious damage to hare populations, it also infects pigs. It is believed that the pigs get it by eating hares which have died of the disease. Once the boars are infected they infect all sows in the herd with resulting high numbers of abortions and losses of young pigs. Some large farms have had to kill off all pigs on the estate. Here is yet another example of the danger of moving wildlife from their original habitat, even when the new location is already populated by the same species.

UPLAND GAME BIRDS AND WATERFOWL

Birds in Sweden:

There is very much hand raising of birds in Sweden. The instructors at the Ostermalma Wildlife School informed me that pheasants were extensively raised in southern and middle Sweden on big estates. This was because the owners of the estates wanted higher levels of game birds than the land could produce naturally. The pheasants would be released at eight or nine weeks of age and shot in November. Duck ponds were also a very common sight. Nearly every research station or any establishment having anything to do with wildlife had a part of the grounds made into duck ponds. Ducks were encouraged to nest by building many kinds of artificial nesting sites and placing them around the edges of the ponds. Presumably this is due to the great shortage of nesting areas in the Scandinavian countries. Coupled with extensive shooting in other countries, there being no international treaty, these nesting shortages have brought about greatly reduced waterfowl populations in the last few years.

At the wildlife school birds were raised for demonstration purposes. About 650 young pheasants were raised under domestic hens and allowed to run free outdoors while the hens remained in small slatted houses. This was to demonstrate the old method of pheasant raising which is still the best one for raising small numbers of young pheasants. About another 1500 pheasants were raised using various incubators and electric brooders. Any surplus eggs are sold to nearby private operators, about 4,000 in the Spring of 1959. Although the average number of eggs per bird is from 50 to 60 they had one Korean pheasant hen which laid 95 eggs this year. A few Hungarian partridge are also raised at the station (about 150 in 1959). They are all raised under domestic hens in order to obtain a better success rate since the eggs cost 4 Kroner (.80¢) a piece. They expect up to 77 eggs from a partridge hen.

In the duck ponds around the station about four or five common species of ducks were breeding in a great variety of manufactured nesting sites. They also had a tame flock of grey geese along with some Canada geese and a few other European species of geese.

Swedish Research Station:

Some of the most interesting work being done on upland game birds and waterfowl was at the Swedish research station at Enanger by Dr. Hoglund. Here, as at the reindeer research station, a single scientist was in charge of a small station with several technicians to aid him. The staff at Enanger consists of Dr. Hoglund, a bird keeper, and a clerk to look after correspondence and reports of marked birds. The establishment consists of two houses used as residences, laboratory and office, an enclosed duck pond and some wire pens.

Capercaillie, black game, and ptarmigan are the most important upland game birds in Sweden. All grouse hunting was forbidden from 1952 to 1954 but since that time there have been seasons on all three of the major species. Hunting of hazel grouse is still not allowed. Around Enanger, the season for capercaillie and black game only lasts from September 1st to 8th (including thetime of my visit). Because they collect birds for research purposes all year around, the men at the research station seldom do any hunting during the open season. The season varies in other parts of Sweden. It is for the whole month of October in some parts of the north.

The estimated kill for 1954-55 in Norrbotten and Vasterbotten provinces was as follows: capercaillie 18,000, black game 22,000, and ptarmigan 84,000. Capercaillie and black game seemed to be quite common through central and southern Sweden as I was able to see many during the time of my visit. The ptarmigan are confined mostly to the mountains along the Norwegian border.

In order to carry out their studies at Enanger Dr. Hoglund and his men had first to learn how to raise capercaillies. In the presently used method, eggs are taken from wild nests and carried in special transport cases containing sponge rubber bottoms with depressions for the eggs and four "hand-warmers" mounted above a piece of metal foil in the lid. After collection the eggs are incubated in an English made Corfew incubator at about 103 deg. F. for 26 days. Black game require only 24 or 25 days to hatch, hazel grouse 24 days and willow ptarmigan 21 days. The chicks are placed in small brooders with the heat lamp in one upper corner so that a temperature gradient of 30 to 40 deg. C. is established in the cage. At about one or two weeks of age, when suitable weather conditions prevail the chicks are put outside for an hour at a time, gradually lengthening the period until at about three weeks of age they are left out around the clock.

The birds are fed pheasant food, yolk of hens eggs boiled for two minutes, flowers, blueberries, spinach, salad, pulp from pressed apples and slices of fresh apple. It is believed that the greater the variety of food which can be fed the better. In summer they are fed all kinds of green foods and oats. During the winter eight months, capercaillie eat pine needles, black grouse eat birch buds and hazel grouse eat Alnus buds and catkins. In southern Sweden capercaillie also eat acorns in the fall and Vaccinium in the winter. In Germany and Russia they eat Fagus silvatica.

Many observations and experiments have been carried out on these species of birds at Enanger. Dr. Hoglund has found that capercaillie do not lay eggs until two years of age. Only about 30% lay eggs the first year. All other grouse are fertile the first year. In a study of the relation between capercaillie and blackcock he has been measuring the shape of eggs, length and width of bill, feet, tarsus, middle toe and head. He is weighing males to discover loss of weight at displaying time. He is studying the moult and the egg laying and mating behaviour of the birds. He has been experimenting with hybridization between the two and has already found that the eggs of the hybrids are smaller than those of either parent.

An important part of the work at Enanger is the study of body temperature and resistance to cold in young birds. A special cage is built with thermostatic control and chicks and ducklings are placed in it. At a specified temperature, for example 14 deg. C., they are left for a previously determined time, possibly 20 minutes. The rectal temperature is taken before and after the exposure to find what decrease has occurred. It has been found that capercaillie chicks get rigid from the cold when the body temperature starts to fall. They are unable to feed and must return to the hen for warmth. The chicks can stand a lower temperature if dry than if they are wet. This means that a combination of cold and wet weather for three to five days when the chicks are newly born is fatal to nearly all of the hatch because they cannot travel about to feed. The critical period is over in 18 days for capercaillie chicks as the first moult has come on about that time. It has been found that ducklings are quite different being much more resistant to cold than the chicks. These findings on captive birds they are now attempting to confirm on wild birds.

The major project with waterfowl is a food habit study. Although there is a hunting season for mallards from August 1st to November 15th in that area, waterfowl shooting is not extensively carried on. Due to the present shortage of waterfowl it is not even possible to do research on wild birds. In the food habits study young ducks are raised at Enanger and released in special small lakes. They are then collected at intervals through the year for crop examination.

About 8,000 birds are marked and released each year at the Enanger research station. Capercaillie have been returned from up to 30 kilometres (19 miles) from the release point. However, the average distance travelled by males in that part of Sweden is usually two or three kilometres (about one mile and a half to two miles). Hens move somewhat farther distances. The tags used on chicks and ducklings are wing tags because it is difficult to band very young birds. The wing bands can be used when the bird is less than a day old. They are put through the petagium or fleshy leading edge of the wing and hang beneath the wing. Over 50,000 of these tags have been used since 1945 and they now have recoveries of birds eleven years old. Hunter returns of older birds show equal numbers of wing-tagged and leg-banded birds. On this evidence they are convinced that the tags do not tear out and are of much value for tagging young birds.

Many other projects are being studied at the research station on a less intensive basis. The nesting habits of wild grouse are being investigated by means of electrical contacts placed under wild nests. The food habits of various birds and animals such as goshawks, minks, martens and foxes are being investigated. Likewise the stomachs and crops of all species of grouse analyzed. Altogether it was apparent that a good deal of excellent work was being accomplished at this station. My visit to Enanger provided me with my best look at European grouse and the work being done on them.

Birds in Other Countries:

In Finland Mr. Matti Helminen of the Game Research Institute in Helsinki told me something of his work on upland game birds. He collects wings and tails of capercaillie and black game from hunters in much the same manner as we do for ruffed grouse. He is also working on the parasites of these birds and on their sub-speciation.

In Norway I was informed that Dr. Hagen of the Game Research Institute near Oslo worked on upland game birds. Unfortunately time did not permit a visit to this establishment. Since about 75% of Norway is mountainous country ptarmigan is their most important game species.

In Britain although I was able to see red grouse in the field time did not permit an investigation of the grouse work being done by Drs. Watson and Jenkins whom I met and talked to briefly in Arnheim, Holland. I had not heard of them on my first visit to Britain.

FISHERIES IN SCANDINAVIA

Norway:

The Norwegian Sportsmen's Club controls and manages the fishing in the management unit comprising all lakes in the immediate vicinity of Oslo. Anyone who wishes to fish in these waters can buy a licence from the club for 5 Norwegian Kroner (about .70¢). No Government licence is required. The sale of these licences along with an additional 3,000 to 5,000 Norwegian Kroner (about $430 to $710) Government subsidy provides the club with a total fisheries budget of about 80,000 Norwegian Kroner (about $11,400). With this money they manage fisheries in the waters of the management unit and operate a fish hatchery near Oslo.

Much of the work is on a voluntary basis. The only permanent employee in the fisheries work is the man who runs the hatchery. Eighty-five groups of men totalling 450 individuals put in, on the average, 40-45,000 hours work each year voluntarily. A schedule is drawn up for the year as follows: Spring - coarse fish control work. Summer - scale collections, stomach collections and water pH measurements for Government biologists, improvement works of various kinds such as digging out spawning beds and removing brush. Autumn - fish stocking. Winter - lake measuring for survey purposes.

Mr. Knut Rom in conducting me around the hatchery told me something of its operation. They hatch about 200,000 brown trout each year. On the average about 160,000 of these are ready for stocking in September. About 30% of the stocked fish are recovered at around 14 to 16 inches in length. There is a size limit of 25 centimetres (about 10 inches) on the trout. An estimated 35-42,000 fish are caught by rod from the shores of the lakes and streams around Oslo each year. The food used in the hatchery is largely beef liver. About 1500 kilogrammes (about 3,300 lbs.) of liver per year is used in the production of the 160,000 trout. Three types of tanks were in use. The standard long trout rearing troughs, large cement tanks set into the ground in which the water could be raised or lowered by the shifting of a chain holding a moveable pipe, and a new type of square tank made out of fibre-glass. Water passes through the tanks at the rate of about 50 litres per minute (about 12 gallons per minute) for each tank thus totalling 2,500 litres per minute (625 gallons per minute) altogether. Although the hatchery was rather small compared to some of our larger ones it was a large scale and efficiently run operation for a sportsmen's club to undertake.

<u>Sweden</u>:

There is no actual course in fisheries at the University of Uppsala but there are two professors of limnology and one of ichthyology. In the Swedish Government there is no Department of Fisheries as there is in Norway, but there is a Fisheries Board in the Department of Agriculture. The Board is divided into two sections. One deals solely with pollution, the other one is sub-divided into three bureaus, one dealing with fresh water fisheries, one with marine fisheries and one with general administration. This section also runs the two laboratories for fresh water and marine research. There are local fisheries organizations in Sweden, three to the north of Stockholm, four to the south of Stockholm and a marine organization for either coast. Besides these organizations there is a fisheries assistant attached to 23 of the 24 provinces in the provincial administration who co-operates closely with the local organizations.

Near Stockholm I visited the Institute of Fresh Water Research at Drottingholm, Sweden. Dr. Lindstrom showed me the work in progress and explained Swedish fishing laws and customs. Besides straight fisheries research the people in the laboratory at Drottingholm give advice on damage estimates and claims at power dam sites. Much of the research work concerns growth of fish including back calculating growth from scale samples. They are also trying to do some work on population estimates but have as yet done nothing on physiology. They are studying spawning behaviour of five or six species be means of motion picture films. Dr. Nillson is working on stomach analysis and competition between species. There is also some work being done on the systematics of whitefish, the biology of young whitefish and the relation of young whitefish to plankton. Dr. Runnstrom is working on the biology of the char. Reports of the Insitute of Freshwater Research can be found in the Fish and Wildlife Library at Maple.

Other Countries:

In Britain I was able to learn very little about fisheries other than the system of renting out streams. The streams were divided into sections and the charge for fishing rights for any one section was determined by its productivity. Thus a section with very little chance of catching fish would have a low rental whereas a stretch of stream producing good numbers of fish would have a very high rental. Since it is not illegal to sell fish in Britain part of the cost of renting the section of stream can be recovered by selling the fish which are caught in it. To some extent this adjusts the difference between the high cost and low cost sections. In Germany also fishing rights are rented out. On State land where the fishing rights are rented to private sportsmen the sportsmen are required to look after fish stocking and any other management work that may be undertaken.

FORESTRY IN EUROPE

British Forestry:

Forestry in Britain at the present time consists mainly of reforestation work and plantation management. Hundreds of years of use and mis-use of the forests followed by the demands of two world wars have left Britain woefully short of productive forests. In both Wales and Scotland the British Forestry Commission is undertaking extensive conifer plantings to remedy this situation. To a person from eastern Canada where trees are everywhere abundant the complete absence of trees on the hills of Wales and on the highlands of Scotland is little short of astonishing. Although vast areas of these so-called wastelands are used for sheep grazing, the Forestry Commission has found that many sections would be of more value in trees. Large scale planting projects have been undertaken to bring these lands into productive forests.

Although there is no doubt that reforestation brings industry to the highlands and reclaims much land to a more useful form of vegetation, there are some unfavourable features to the planting programme. The trees were planted in large rectangular blocks that contrasted jarringly with the scenery composed of rolling heather covered hills. It was most surprising to hear residents condemn trees as a detriment to the scenery rather than acclaimed them as a welcome addition.

A second questionable aspect of the programme in the practice of planting large blocks of conifers. Ecologists know this produces an unnatural state which can be very dangerous. Undoubtedly economic considerations have entered into their present planting policies but it is unfortunate that less emphasis could not be placed on present economics and more thought given to long term benefits.

A third problem involved in the planting programme is the effect on deer. The men in the Nature Conservancy showed particular concern in this regard. In order to protect the young forests it has been necessary to erect high fences around them to keep out the deer. Not only do the fences establish

temporary barriers to deer movements but the forests themselves will reduce forage land available to deer and establish permanent barriers because of the barren interiors of the solid conifer stands. Already deer are being forced into new migration routes which are bringing about more damage to farm crops. It is doubtful whether the ecological consequences of these mass planting programmes are being fully considered by the Commission planners.

The condition of English forests presented a pessimistic preview of the possible future look of our own forests. At the Merlewood Research Station at Grange-over-Sands in England I had the good fortune of accompanying Dr. Charles Elton of Oxford and Dr. Elliott of the Merlewood Station to a wood in which they told me they were attempting to regenerate a natural woodlot. This seemed to be a contradiction of terms until they reminded me that all forests in England contain a large percentage of non-native species and have long been grown under the influence of human disturbing factors. This particular woodlot was set aside to be opened up by selective cutting and elimination of all foreign species so that natural regeneration would occur. It was hoped that in 100 years time this treatment would produce a natural native forest. In the meantime the woodlot will be used as a study area in which as rich a native flora as possible has been established. Here was a case in which it was too late to preserve a sample of typical forest. The sample had to be produced the hard way.

Sweden:

The forests of Sweden are very nearly analogous to those of Ontario. In the south, hardwood forests including such species as the oaks and beech are very common. Although there are some spruce and Scotch pine forests in the south, they become more plentiful and the tolerant hardwoods less frequent farther north. Also replacing the tolerant hardwoods are the European aspen and birch. Thus it is that moving north through Sweden one sees very similar forest changes to those seen when moving north through Ontario.

Despite superficial resemblances, however, there are some differences. The species are not quite analogous. Scotch pine for example can be found in high sandy sites similar to those occupied by our jackpine and also in the swamps in situations comparable with those of our black spruce. The soils of northern Sweden are not high in calcium content as in parts of northern Ontario but they are very low in nitrogen content. Time after time on our trip through northern Sweden it was pointed out that if the forest were cut the deciding factor in its regeneration would be the presence or absence of sufficient nitrogen in the soil. Very little regeneration would take place under standing trees because of the depletion of nitrogen by the root system of the trees. This fact had to be taken into consideration in planning silvicultural treatments.

Hormone Sprays:

Several advanced forestry practices are in use in Sweden. One of these examined by our group was the use of hormone sprays both from the ground and from the air to eliminate deciduous reproduction in favour of the preferred

evergreen reproduction. One of the places where we stopped had been cut three times: once a very long time ago, a second time in the 1940's and a third time in the 1950's. The general opinion of those present was that the spraying on this site would likely be successful. It appeared that the young evergreen reproduction would be forthcoming and that the lichens, which had to be considered as an important winter food for the reindeer herds of the area, would probably not be affected. A second place which we examined was sprayed by hand about five years previously. The larger trees which had been girdled before spraying showed no new shoots but smaller trees, mostly birch, which had been sprayed on the leaves only, now showed some recovery.

Although local results looked good, there were some reservations among the Swedish scientists about the advisability of such widespread use of an unknown technique. In 1958, 30,000 hectares (about 115 square miles) were sprayed and in the present summer of 1959, 40,000 (about 155 square miles) were being sprayed. It was pointed out that this was being done with little of no scientific knowledge about the effects of the spraying on such complicated ecological problems as soil microorganisms. Although the technique appeared to be getting results, without more research work its widespread use was dangerous.

Controlled Burning:

A second advanced technique being used in Swedish forestry was the much talked about controlled burning. In Muddus National Park Dr. Uggla showed us the area on which he had been studying the effects of controlled burning on the forests. Muddus National Park is not designed primarily for tourists but rather for research work. No hunting, fishing or flower picking is allowed. About 22% of the park area is northern bog type the rest being the central Swedish upland type. All forms of native Swedish wildlife are present including bears, reindeer, moose, foxes, capercaillie and eagles. When a power development project threatened to submerge large areas of the park a five man team was appointed to study various aspects of the flora and fauna that would be destroyed. In the parts of this area which we examined there had been a very hard fire in 1933 and young Scotch pine resulting from it were everywhere in evidence.

Dr. Uggla's problem was to study the regeneration after controlled burning, particularly with regard to the birches, Betula varicosa and Betula pubescens. He found that here in the north of Sweden, Rubus species obtain their greatest abundance four or five years after a fire. Almost immediately following, at five to six years, is found the greatest abundance of Culminaria. The rate of regeneration of trees after the fire is affected by their natural ability to spread. Birches as a rule of thumb, are considered to be able to spread their seeds two to three times as far as the height of the tree, while pines can only spread seeds a distance equal to the height of the tree. Birch seed years are also more frequent than pine seed years which only occur every tenth year. It is only once in 100 years that all factors are favourable for pine regeneration. In most years there is some adverse factor to hold them back.

In an effort to find out what happened in the midst of a forest fire, Dr. Uggla developed special instruments with which he was able to take temperatures while the fire was in progress. He found that temperatures up to

1,150 degs. C. could be measured and that the soil was completely sterilized on the surface by the fire. Yet despite this heat he found that the trees were not killed by the heat alone. In some cases trees not subjected to the heat were killed in exactly the same manner as those that were. He has not yet determined what is the killing factor but expects that it may be the smoke. He found that the soil cooled so quickly after the fire had passed that a person could walk through an area which had been burned in his bare feet five minutes after the fire went by. Dr. Uggla has now finished studying the plants and the effects of temperature and is proceeding to the study of the chemical results of controlled burning.

When asked about the extent of controlled burning in Sweden Dr. Uggla related the fire history of the forest. He stated that there were three stages. The first stage might be termed natural fires due to lightning and accidental human agencies. Due to modern fire suppression methods these fires are not as frequent as they used to be, nor are they so big. The second stage came with the burning of forests for the purpose of clearing by forest dwelling people. In the past in both Sweden and Finland the Finlanders would burn over an area and use it for about three years before going on to a new place. This stage seemed to be roughly equivalent to the burning done by Indians on the North American continent. The third stage is purposeful burning which has been common in Sweden since 1930. From that date to the present, over a ten year period, about 1,500 hectares (5.8 square miles) would be burned by accidental fires, while over 50,000 hectares (195 square miles) would be burned by controlled methods. Dr. Uggla estimated that about ten years would be gained in the reforestation cycle by burning. The tendency in recent years has been to reduce the size of the areas burned from 100 to 50 or even as low as 10 hectares (247 acres, to 124 acres to 25 acres). The burning is carried out only under ideal conditions. At least five inches of organic matter must be present and the moisture content should be about 60%. Burning can be very destructive where the soil is thin over the substrate. Controlled fires are directed downhill and against the wind in order that they may be controlled and not allowed to develop into crown fires.

Pulp and Paper Companies

In the course of studying moose management in the Scandinavian countries two pulp and paper companies were visited, one in Sweden and one in Norway. The company in Sweden was the Graningeverken A.B. I conferred with Mr. Henning Hamilton who worked at silviculture and reforestation besides managing the hunting on company land. The company owns outright about 200,000 hectares (one-half million acres) of woodlands. Most of these holdings were bought from small farmers and are, therefore, scattered over very much country. This is the case with many pulp and paper companies in northern Sweden. They are now in the process of trying to consolidate their holdings by buying and exchanging land. The Graningeverken Company is not a diverse corporation, as our companies commonly are, but is owned by one family. They have three mills for pulp and paper production and one saw mill along with several electric power developments. One hundred-and-fifty million Kronor (about thirty million dollars) are invested in one power station alone. The company is divided into several divisions; one for each mill, a woodlands division, a selling division and an electric power division. In the woodlands division the chief forester

has under him in staff position, men to look after roads, laws, holding formalities, forest conservation (Mr. Hamilton's position), scaling and transportation. In an executive position he has nine foresters who direct all operations in their own districts, the districts being about 20,000 hectares (about 77 square miles) in size. Each of these district foresters has with him from one to four rangers.

About 90% of the forest reproduction on company lands is natural and about 10% planted. Mr. Hamilton commented that their company depended more on natural reproduction than most companies did. For pine reproduction the seed tree method was most commonly used but for spruce reproduction small clear cuts were made in order to get seeding from the sides. It was felt that the seed tree method was not good for spruce because of the danger of blow down. Most of the clear cut areas were 10 to 20 hectares (25 to 50 acres) in size. Any cutting units under one to five hectares (2.5 to 12.5 acres) were discouraged on the grounds that they were uneconomical. In the case of pine reproduction, larger areas could be cut because of the use of the seed tree method. In many places pine and spruce were intermixed so that a combination of methods was in use. About one third of the wood used by their mills came from their own forests. The remainder was bought from local farmers.

Norway:

In Norway I discussed the operations of the Eidsvold Vaerk Pulp and Paper Company of Hurdal, Norway, with Mr. Arne Krafft. This company has holdings totalling about 400 square kilometres (155 square miles). About 20 to 30% of their production is in timber with the rest in pulp except for a little fuel wood. The annual production is about 100,000 cubic metres (3,534 cu.ft.) of wood. About 95% of their production is spruce and the rest is pine and hardwood. This is in approximately the same ratio as the forest composition of the area. Pine reproduction is almost entirely by the seed tree method while the spruce reproduction is about half by means of clear cutting and planting, and half by means of clear cutting with natural reproduction.

Under the company's chief forester are ten district forest managers each over a forest division. As in the Swedish company the chief forester co-ordinates the work of the ten forest managers who are graduates of forestry schools. The forest manager has the say in cutting practices, planting, hiring of men and practically all operations in his own area. Most of the men used are local farmers but the company also has staff houses for permanent employees. This company has decided to put moose hunting on a business basis and has hired a biologist to look after the moose management and hunting organization. Moose are considered as a crop of the land to be utilized as efficiently as the trees.

Germany:

Forstenreid Park:

On the outskirts of Munich lies Forstenreid Park, some 4,000 hectares (15.5 square miles) of combined forest plantation and wildlife hunting reserve. It is administered by a chief forester assisted by an office staff of three, plus three foresters and two gamekeepers. About 17,000 cubic metres of wood

are sold each year from this area, at the rate of about four cubic metres per hectare (about 57 cu. ft. per acre). Harvesting is planned in ten year periods and planting is planned 100 years ahead. About 30% of the reproduction is natural and about 70% artificial. A small tree nursery was maintained within the park to provide trees for transplanting. It was estimated that one hectare of artificial planting costs 1500 Marks ($150. per acre). The soils of this area are an alluvial sediment from the glaciated Alps. I was told that reforestation in the mountains presents many problems. Some old trees must always be left to protect the young ones from frost. They are 550 metres (about 1800 ft.) above sea level.

Silvicultural Theories:

In the Park I had my first close look at German forestry. Everywhere throughout Germany and Austria the traditional forests of single species evergreen composition are evident. The long straight rows of trees with all ground vegetation shaded out looked to me like oversized rows of corn. To my surprise, comments about the spruce and pine plantations brought the reply that this kind of forest was now outdated. I had been under the impression that the revolution in German forestry was mainly in theory but it is apparently a fact that is common knowledge. Upon hearing of my interest in the new forest practices, the Park Forester conducted us to another part of the park where a young forest of mixed pines, fir trees and beech was in evidence. I was told that on all modern German forestry plantations this type of planting was being carried out. Different species might be used in suitable places but always it must be a mixture. They went on to explain that attacks of insect pests and deterioration of the soil over hundreds of years in the solid evergreen stands had lead to the abandonment of the old method. Although they did not look as impressively neat and clean as the old forests, from an ecological standpoint the new forests looked much more balanced. There was no doubt that they would be better for wildlife. It was very gratifying to see that the new concepts had such widespread acceptance.

Logging by Cable in the Alps:

High in the Bavarian Alps north of the Austrian frontier I came across an unusual form of logging. After many attempts to log the forests in the high mountains by different methods, they finally succeeded with the use of a cable carrier which runs without support for 2,000 metres (about 2,200 yds.) from the mountain top down to the nearest road below. About 40 cubic metres of logs per day are brought down this cable in loads of two or three logs at a time. They estimate 1½ cubic metres per load, 500 cubic metres being brought down in 325 loads. Using this method, they cut about 8,000 cubic metres of wood per year off 10,800 hectares (about 42 square miles) of forested mountains in Fall County. The cost was estimated at five to six Marks per cubic metre (about 3¢ or 4¢ per cu. ft.) plus an extra 40,000 Marks ($10,000) for installation of machinery. Since the highest mountain in Fall County is 2,105 metres (6,900ft.) and the slopes are extremely precipitous, this was indeed a remarkable accomplishment.

Austria:

During the short time that I was in Austria, I only managed to find out a few things about Austrian forestry. I was most surprised to find that about 75% of Austria is forest land. Many Canadians think of Europe as treeless farmland spotted with cities and overrun with people. These figures from Austria show that such ideas are far from the truth. I was interest in learning that Populus canadensis was imported into Austria some years ago. With it had come a leaf-eating beetle whose larvae live in the bark of the tree. A destructive butterfly was also included with the trees. These now have to be fought. The Austrians are importing the fungus that grows in the trachea of the insects which has been used for their control in North America. This is just one more example of the dangers of importing exotic species.

CONCLUSIONS

1. European wildlife philosophies and laws provide less freedom for the individual hunter to hunt where he chooses, but more organization of hunting and protection of the rights of landowners.
2. Most wildlife management is done privately. There are very few government biologists.
3. At the wildlife conference in Arnhem, it appeared that although the traditional wildlife management methods of central Europe work well, they are so entrenched that little progress is being made in developing new ones.
4. European sportsmen's associations take a more active part in game management work than they do in North America. As a result many are subsidized by the Government.
5. The wildlife school at Ostermalma put more emphases on hunting techniques than is usually seen in North American wildlife schools.
6. The management of reindeer in Finnoscandia is largely a problem of range management not unlike that with cattle in western North America.
7. Moose hunting in Sweden is a very popular sport. Moose are much more heavily cropped than in Ontario due to more accessibility. Moose production is heavier due to excellent interspersion of farms, pulp companies, etc. and the fact that a favourite food, Scotch pine, is also a widely distributed forest tree.
8. Judging from the Swedish moose conditions, numbers of moose and numbers of moose hunters will probably increase in Ontario. Moose hunting may well become as important as deer hunting in southern Ontario.
9. Moose present a problem to forest management in Sweden because of the damage they do to Scotch pine reproduction. An effort is made to keep moose numbers low enough so that damage is not excessive.
10. The red deer of Scotland are greatly overpopulated. In Europe the red deer population is controlled to prevent damage to forest reproduction. A most artificial situation exists in the way the deer are dependent on winter feeding. This has been brought on by encroachment of humans on former wintering lands.

11. Requirements for obtaining hunting licences are very exacting in Germany. Perhaps we could adopt one of their ideas by adding some question on knowledge of game to our hunter safety course.

12. Roe deer in Europe are small enough to exist in quite highly populated areas. They are probably the most important big game animals in Europe. Their management is highly detailed and complex. Each farm is considered as a unit and managed as such.

13. The only research on big game populations equivalent to work done in North America was the work on red deer and roe deer at the Danish research station at Kalo.

14. Wild boars are maintained only in parks and hunting preserves because of the damage they do to farm lands.

15. The research work on chamois diseases in the Bavarian Alps was the most impressive seen in central Europe. A most unusual approach to controlling wildlife diseases was their attempt to improve the general condition of the animals by reduction of numbers and distribution of medicated salt block to eliminate intestinal parasites.

16. Fur-bearers seemed more important in Finland than any other country. The mink is regarded as a menace in the Scandinavian countries.

17. The Swedish research stations on upland game birds and on reindeer showed the excellent results possible by supplying research scientists with sufficient sub-technical assistance. This was possible with a very small outlay of money in buildings and equipment.

18. Only a little fisheries work was seen. It appeared not unlike work being done in North America.

19. In Britain the planting of solid conifer stands is now in progress, but in Germany this practice has been superceded by the new silvicultural ideas calling for mixed conifer and deciduous stands. In Sweden forest practices are very intensive. The use of hormone sprays and controlled burning is widespread.

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REFERENCES

Malm, Anders-Erik, Jan Akerman and Daniel Andreae.
1959. Algjagarens bok. Natur och Kultur Stockholm, Sweden. pp.1-470.

Peterson, Randolph L.
1955. North American Moose. University of Toronto Press. pp.1-280.

Skuncke, Folke.
1958. Renboten och deras gradering. Almgvist and Wiksells Boktrycheri AB, Uppsala, Sweden. pp.1-204.