



After-LIFE Conservation Plan  
LIFE09 NAT/SE/ 000344 MIRDINEC

## Management of the invasive Raccoon Dog (*Nyctereutes procyonoides*) in the north-European countries (MIRDINEC)



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### Background

The raccoon dog (*Nyctereutes procyonoides*) was introduced to the European parts of former Soviet Union during the years 1929-1955 to enhance the number of fur game in the area. Since then the raccoon dog has spread like a wildfire over large parts of Europe, threatening European biodiversity, animal and human health and economy. Before our project started the raccoon dog was common in large parts of central Europe. It had invaded Finland early in its expansion process and could be found over the whole country, although only common and reproducing in the south and mid parts of the country. A few individuals had been found in Southern Denmark. The first known reproduction of raccoon dog in Sweden was found on the Island of Haparanda-Sandskär close to the Finnish border in northern Sweden in 2006. Haparanda-Sandskär is a national park and a Natura 2000 area and a very important Island for ground nesting sea birds. The raccoon dogs were culled and shortly after this the work to find funding for a raccoon dog project started. In 2008 the first national funding was approved for a project aiming to improve our knowledge about the biology and behavior of the raccoon dog in its expansion zone, and based on this knowledge to suggest tools to manage the invasive alien species. The first study was followed by other national research and management projects where the tools were tested with promising results. We however soon realized that Sweden alone would not be able to stop the raccoon dog from establishing. Some raccoon dogs moved up to 400 km in a few months. For a highly mobile species such as the raccoon dog it is absolutely necessary with a transnational project, where neighboring countries in which the species already exists fulfill the ratified conventions from the Rio- and Bern conventions and tries to stop the invasive species from spreading to other countries. We applied for, and were approved, this LIFE+ project where we have shared our knowledge and tools with Finland and Denmark and where they have tried to stop further spread of the raccoon dog to Sweden and Norway. In Finland a lot of knowledge and experience about raccoon dog management already existed after many years of raccoon dog research and hunting, for example regarding trapping and hunting with dogs, which were also incorporated in the application. In Denmark the raccoon dog was only present on Jylland (the mainland bordering to Germany), and they also, besides from helping Sweden and Norway, wanted to stop it from spreading further to the rest of their country (the Islands Fyn and Sjælland).





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During the LIFE+ project we have implemented the following management and monitoring actions;

**Management**

- Early warning systems consisting of game cameras directed toward scent lures at possible immigration routes
- Transmitter (GPS/GSM) tagged animals that lead us to new individuals (Judas animals)
- Sterilization of released transmitter animals so they will not be able to reproduce if we were to lose them through transmitter failure
- Hunting with dogs and traps, both for culling and tagging
- Citizen science systems in Sweden and Denmark
- Dissemination of results and education of hunters, ornithologists and the public leading to higher awareness of IAS among the public in general and higher quality tips about raccoon dog occurrences coming in to the project through the citizen science system in particular
- International conference to disseminate our results and methods to other managers and scientists outside the Nordic countries
- We have also created and implemented a very well-functioning cooperative transnational management framework

**Monitoring**

- Larger camera based monitoring systems at the main immigration routes of the raccoon dog in all countries allowing us to follow the development of the populations
- Combining the camera monitoring systems with marked transmitter animals allow us to calculate population estimates (mark-recapture techniques)
- A population model allow us to model the effect of our actions and future development of the population
- A database where all management data are gathered

**Outcome of the actions**

Our management actions have been very successful, we have;

- Demonstrated a successful international management organization and cooperation to manage a highly mobile invasive alien species.
- Slowed down the dispersal of raccoon dogs from Finland to Sweden and Norway and started reducing the population where it already exists in those countries.
- Slowed down a further dispersal in Denmark and prevented a fast population increase.
- Demonstrated that our innovative methods for culling and management of the raccoon dog also work on other species, several raccoons (*Procyon lotor*) have been culled within the project in Denmark and Sweden.
- Involved the local hunters in the management.
- Informed and educated stakeholders and the public to increase the awareness of IAS and improve incoming reports to our citizen science systems.
- Disseminated our actions to managers and scientists in other countries at our international conference.

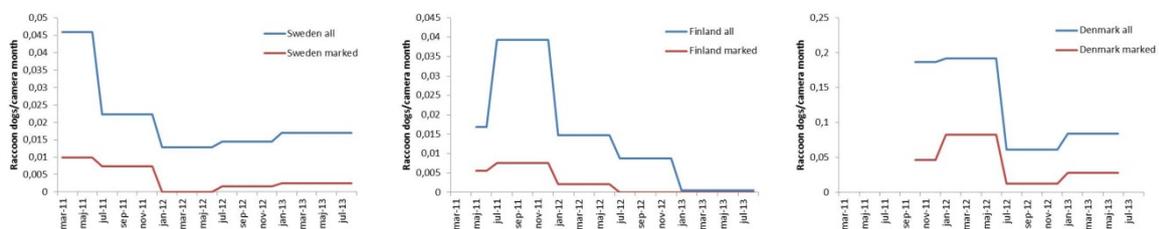


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### How is the outlook for the raccoon dog in the project area?

#### Population development

During the project we have culled, or captured and sterilized, over 1400 raccoon dogs. We have been monitoring the raccoon dog population during the project by systematic stationary setups of game cameras baited with scent lures. The index (catch per unit effort-CPUE) will tell if the catch changes with time in the same area and with the same standardized sampling intensity. The populations are according to our population indexes decreasing in Sweden, northern Finland and Denmark (figure 1).



**Figure 1.** Population development in the Swedish, Finnish and Danish monitoring areas during the project. The change in population is shown as an index (number of raccoon dogs captured on picture per camera month over time). The indices cannot be used to compare density between countries.



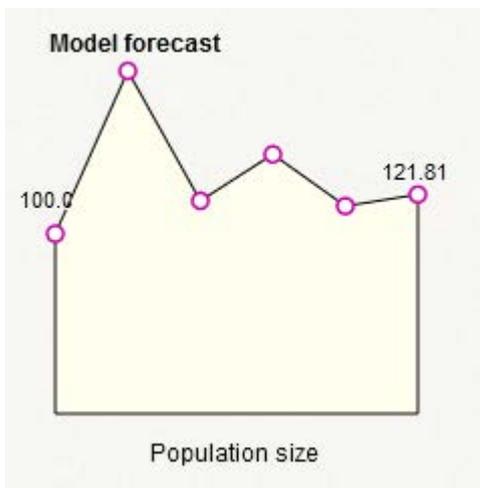


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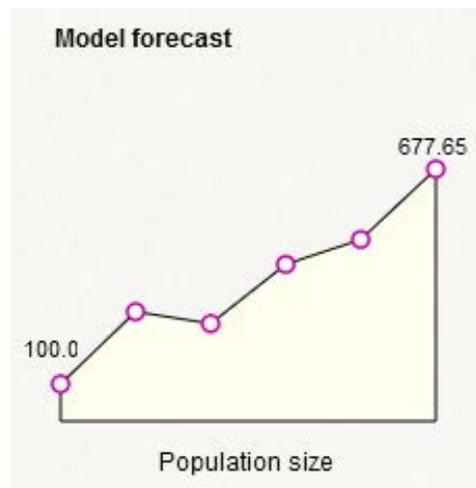
Population model

We have constructed an individual based population model for the raccoon dog. The model has been demonstrated in Sweden where we have sufficient knowledge of the population dynamics of the population to use it properly. A capture-recapture estimate (based on the camera systems and the proportion of marked animals in the pictures) in Sweden gave an approximate number of 100-150 raccoon dogs in winter population in Sweden during the project. A population estimate of a rare and elusive species like the raccoon dog in its expansion range is very difficult to perform with any certainty. The limited data makes the estimates to fluctuate randomly, especially at very low population densities. The population density is therefore not a suitable way to monitor the development of the population; if reasonably stable it will however tell something about what size the population has on average during our project time. To say something about the population trend, the more stable CPUE index above is therefore better.

By using 100 individuals as initial population size (i.e. approximately the size of the adult population in Sweden during the project) and the parameter estimates estimated from the project data in Sweden our population model suggest that the population will be kept at a constant size during the first five years after applying our management actions and thereafter it will start decreasing (figure 2a and 3a). So far this prediction seems close to the real outcome according to our results. However, if no effort had been done to limit the population there would have been well over 650 individuals after five years according to the model (figure 2b).



**Figure 2a.** Population development during five years including our efforts in culling and sterilisation.

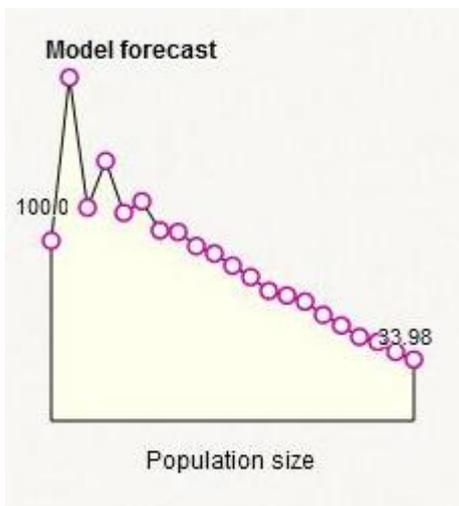


**Figure 2b.** Population development during five years without our efforts in culling and sterilisation.

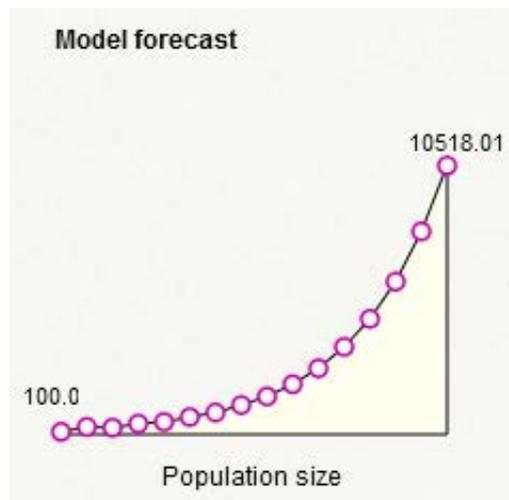


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Continuing the management with the same intensity, given that the input data reflects the reality reasonably well, would mean that the population start decreasing after about five years, and within 10-20 years only a few raccoon dogs remain (figure 3a). On the contrary, stopping the management would mean that we would have at least 2500 raccoon dogs in Sweden in ten years' time and over 10 000 in 15 years' time, i.e. the population would increase exponential as it has done in Finland and other countries invaded by the raccoon dog (figure 3b). In Finland they shot 800 raccoon dogs in 1980, when the hunting statistics started. In year 2000 they shot 85 000 individuals and in year 2011 they shot close to 180 000 raccoon dogs.



**Figure 3a.** Population development during 20 years including our efforts in culling and sterilisation.



**Figure 3b.** Population development during 15 years without our efforts in culling and sterilisation.

### After LIFE conservation

The LIFE+ MIRDINEC project have had an after LIFE meeting to discuss the future raccoon dog management in our countries. The economic questions are discussed below. The project leaders from the partnership countries can see no reason to do any major changes. The project partners would like that the successful transnational management and positive collaboration we have had in the LIFE MIRDINEC project will continue after the end of the project, using the same framework as during the project and with Sweden as coordinating partner. Our cooperative transnational management has been very successful. Each country is now self-standing, but in close cooperation with the other countries. The project will continue with transnational project meetings to update each other, and share progresses made with new or improved tools through national research efforts to become as efficient as possible within the whole management area. We will gather our management data in a common database. We aim to put together a common annual report at the end of each year which will be put on the LIFE+ MIRDINEC home page ([www.mardhund.se](http://www.mardhund.se)). The positive collaboration also constitutes a foundation for future transnational work with invasive alien predators, such as the raccoon and the American mink (*Neovison vison*). Norway was as a non-EU country not allowed to participate in the LIFE project. They were however a financier and part of our LIFE+ project steering group. Norway is now a full partner of the transnational management cooperation.



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The management will if future long time funding is secured continue according to respective national management plan produced during the LIFE project. There are a lot of common parts. Voluntary hunters are one of those. Local hunters are very important in all countries and have contributed largely to the success of the project. Thousands of educated hunters being out in nature are a very efficient tool to reach success in a culling project like this. It is however important to remember that there is also necessary with a professional core in the project. It is easy to find and kill animals when they are common, but at very low densities such as in our case, there is also a need for professional managers that have access to efficient tools that are not accessible or legal for hunters, and that will respond to observations during all times of the year around the clock. All countries will continue using most of the tools developed and demonstrated during the LIFE project, i.e. monitoring with game cameras, culling and capturing with traps and dogs, Judas animals to find new animals, citizen science system in Sweden and Denmark and continue using the common database. All countries will however move towards more strict management projects. There will be no excessive data gathering for scientific purposes other than limited projects to improve the management further and then usually in cooperation with research projects. During the last six months of the LIFE project we invested in some new equipment such as MMS cameras, transmitters and trap alarms within the frame of the LIFE budget to replace worn out project gear. Special consideration was then also taken regarding the after-LIFE management. This new generation management gear will, apart from replacing the old gear, lower the costs for the after-LIFE management since the new technique reduces the man hours in the field. There is no need to check traps every day with the new trap alarms and MMS cameras and the new generation satellite transmitters will enhance the connection to the animals and minimize the need for manual triangulation.

Some of the general changes that will be done incorporate a more cost efficient use of transmitter animals (less positions per day but keeping the same efficiency as found by research connected to the LIFE project together with technical development of the transmitters), moving over to MMS cameras in the camera systems to become more efficient regarding early warning/fast response (as an effect of technical development during the project), rearranging the EWS systems to become more cost efficient (covering larger areas with the same amount of cameras without losing information as found by research connected to the LIFE project). In Denmark the number of stationary cameras will be fewer but concentrated in those areas where they have been most informative.

More specifically the following actions will be implemented in each country by the given organization from the end of the LIFE project;

### ***Sweden***

- Management (culling and capturing with traps and dogs, Judas animals to find new animals, citizen science system, registration in database) – Swedish Association for Hunting and Wildlife Management
- Continued co-operative management and information activities with volunteer hunters – Swedish Association for Hunting and Wildlife Management
- Information about IAS and dissemination/education of project results – Swedish Association for Hunting and Wildlife Management/ Swedish University of Agricultural Sciences
- Monitoring of the population and the effects of our actions (EWS system), applied research to constantly improve tools – Swedish University of Agricultural Sciences
- Monitoring of diseases – National Veterinary Institute
- Legal permissions – Swedish Environmental Protection Agency and/or respective County Administrative Board



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### ***Denmark***

- Management (culling and capturing with traps and dogs, Judas animals to find new animals, citizen science system, registration in database) – Danish Nature Agency
- Continued co-operative management and information activities with volunteer hunters within the framework of the Danish Hunters Association – Danish Nature Agency
- Information about IAS and dissemination of project results – Danish Nature Agency
- Legal permissions – Danish Nature Agency
- Monitoring of diseases – DTU Veterinary, National Veterinary Institute

### ***Finland***

- Management (culling and capturing with traps and dogs, Judas animals to find new animals) – Finnish Wildlife Agency
- Continued co-operative management and information activities with volunteer hunters – Finnish Wildlife Agency
- Information about IAS and dissemination of project results – Finnish Wildlife Agency
- Efforts to renew the current legal context of the raccoon dog and its status as an invasive species, in alignment with the Finnish management plan of the raccoon dog, produced during the LIFE project. – Finnish Wildlife Agency
- Monitoring of diseases – EVIRA
- Legal permissions – Finnish Wildlife Agency

### ***Norway***

- Management (culling and capturing with traps and dogs, Judas animals to find new animals, registration in database) – Norwegian Environment Agency/Norwegian Nature Inspectorate
- Information about IAS and dissemination of project results – Norwegian Environment Agency
- Support to neighboring countries – Norwegian Environment Agency

## **SWOT analysis**

The project feels confident that it is possible to stop the raccoon dog from establishing in Sweden, Norway and remaining parts of Denmark, given that we can continue our work with the same intensity until we have control of the population. Optimally we want to reach a situation where we have almost only sterilized transmitter animals in the population that will find new individuals dispersing in to the immigration zones. Some things cannot be controlled though. Below we have summarized the most important positive and negative issues for a successful future management of the raccoon dog in the Nordic countries in a SWOT analysis.

### **Strengths**

- International cooperation to fight IAS established during the project
- Successful methods and tools developed during the project
- Successful dissemination of the project have involved the public citizens
- Positive cooperation with local hunters established during the project
- Good connections and positive relationship with applied research established during the project



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### Weaknesses

- Local opposition of the project and thefts of equipment despite successful information activities and local involvement in general

### Opportunities

- New EU legislation on invasive alien species can strengthen the work with invasive species
- A recently signed state secretary intent between the Swedish, Norwegian and Finnish ministries of environment regarding the raccoon dog
- Massive amounts of data produced in the project may encourage research within the area even further

### Threats

- Prohibition of efficient traps and tools also for management purposes. It is crucial to be as efficient and fast as possible when managing invasive species.
- Climate change may alter the intensity of the raccoon dog invasion to a point where we cannot hold it back any more. If the climate gets increasingly warmer at a fast rate, suitable areas will increase and so will reproduction, survival and the dispersal frequency of the raccoon dog, especially in the northern areas of Norway, Sweden and Finland (in Denmark the climate is mild and suitable for raccoon dog).
- External opposition against the project may grow to a point where the raccoon dog get informal local protection in some areas. Despite massive information campaigns some individuals will never accept killing of animals even though IAS may threaten long term biodiversity.
- National laws not adapted to the threat of IAS may stop or slow down parts of the management.
- Shortage of necessary funding

### **Future funding**

The most acute threat is the future long term funding of the project continuation in all countries. If Finland and/or Denmark were to cancel their current management it would be very difficult to keep Sweden and Norway free of raccoon dogs in the longer perspective.

To become effective it is important with long term funding connected to management projects. We have been working on the future funding for many years and are now hopefully close to a long term funding solution in the Nordic countries.

It has, on Swedish initiative, been written and signed a state secretary intent between the Swedish, and Norwegian ministries of environment and the Finnish ministry of agriculture and forestry, stating that the countries want to develop their cooperation to stop the raccoon dog from spreading between countries. They argue that it is a common and prioritized question to take action to prevent raccoon dog establishment and to stop its dispersal within and between countries. They further argue that it is a common prioritized question to secure funding to be able to take those actions. This intent has just been signed and no decisions regarding the funding have yet been taken in the time of writing. There is also currently a lot of political attention on the raccoon dog in the Swedish parliament and the Nordic council (the official inter-parliament body in the Nordic countries).



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However, even though promising, the LIFE MIRDINEC project can give no guaranties that we will have a long term funding solution or when such a solution will be realized at the time of writing.

The current economic situation in each country is the following (2013-11-21);

**Sweden:** The Swedish EPA has funded the overlap between the end of the LIFE+ MIRDINEC project 2013-08-31 to the end of the year, 2013-12-31. The Swedish EPA has also approved funding until at least the end of 2014.

**Denmark:** The Danish Nature Agency has approved funding at least until the end of 2015, where after the project and the management plan will be evaluated before possible continuation.

**Finland:** No funding has been approved after the end of the LIFE+ project and no decisions has been made for the future funding. There is however active discussions ongoing about how to solve the future funding. At the moment, from the end of the LIFE+ project at the end of August 2013 until the end of December 2013, Norway has together with Sweden funded all of the Finnish management. The Finnish Wildlife Agency has announced that they are willing to continue coordinating the Finnish work and the actions that has been implemented within the LIFE+ MIRDINEC project, provided that the long term funding is solved.

The problem in Finland today is that the management responsibility of the raccoon dog is unclear. Since the raccoon dog according to the hunting law is a game species it shall be managed by the ministry of agriculture and forestry. They have however announced that the problem with the raccoon dog is not a hunting problem, but that the threat the raccoon dog poses on the biological diversity is a serious environmental problem, and being so also the ministry of environment should take responsibility in the question. In the national strategy of invasive alien species this shared responsibility regarding the raccoon dog has also been stated, a major problem however being that it is not enforced by law, thereby risking that no ministry is prioritizing the question.

Hopefully the newly signed state secretary intent and the working group connected to it will put focus on solving the issue about how the funding for the raccoon dog management shall be divided between the ministries in Finland. Given a positive economic solution, the Finnish Wildlife Agency is prepared to accept a commission to continue coordinating the work with trying to stop further spread of the invasive alien raccoon dog to neighboring Nordic countries initiated in the LIFE+ MIRDINEC project. The Finnish Wildlife Agency is however not prepared to finance the work only through money coming from hunters fees since the problem is not caused by hunters, but an environmental problem for the whole community.

**Norway:** Norway does not have a stationary population of raccoon dog but still have funding dedicated to take care of dispersing animals. Norway has all along the project been funding smaller projects in the neighboring countries that can help keep Norway free from the raccoon dog. Norway is at the time of writing funding a large part of the Finnish management at the border towards northern Sweden since Finland could not cover the funding needs themselves. Norway is positive to continue funding parts of management or research in the other countries also in the future, but only as long as those countries contribute a major part of the funding.



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**Project details**

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Management of the invasive Raccoon Dog (*Nyctereutes procyonoides*) in the north-European countries (MIRDINEC)

**Duration of the Project:**

01-09-2010 – 31-08-2013

**Total budget of the project:**

€ 5 318 278

Of which € 2 659 139 is provided by the European Commission LIFE+ fund

Of which the major part € 2 659 139 is provided by the European Commission LIFE+ fund and € 2 331 000 by the Swedish Environmental Protection Agency. The rest is provided by the beneficiaries and external financiers.

**Coordinating Beneficiary:**

Swedish Association for Hunting and Wildlife Management

**Associated Beneficiaries:**

Swedish University of Agricultural Sciences (SLU)

Swedish Environmental Protection Agency

Finnish Wildlife Agency

Danish Nature Agency

**External cooperation:**

National Veterinary Institute (Sweden)

Swedish Institute for Communicable Disease Control (Sweden)

Norwegian Environment Agency (former Directorate for Nature Management) (Norway)

County Administrative Boards of Västerbotten, Norrbotten and Skåne (Sweden)

Danish Hunters Association (Denmark)

Federation of Associations for Hunting and Conservation of the EU (FACE, Belgium).

**Co-financiers other than beneficiaries:**

LIFE+

Norwegian Environment Agency (former Directorate for Nature Management) (Norway)

**Photos:**

LIFE09 NAT/SE/ 000344 (MIRDINEC) project