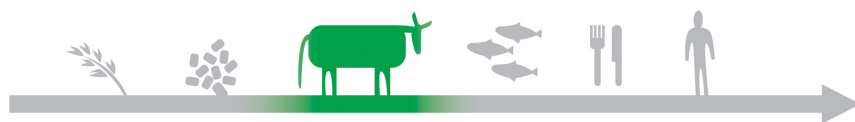


The surveillance programme for Chronic Wasting Disease (CWD) in free ranging and captive cervids in Norway 2018



Veterinærinstituttet
Norwegian Veterinary Institute



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Summary

In 2018, six wild reindeer (*Rangifer tarandus*) from the Nordfjella sub-population in South-Norway and one moose (*Alces alces*) from the Flesberg municipality tested positive for CWD. The culling process in Nordfjella was completed in spring 2018. A total of 33,658 samples of wild, semi-domesticated and captive cervids were analysed in 2018 (includes two reindeer from Svalbard). A scientific paper described the findings of CWD in Norwegian moose to be of a novel type [1]. In addition to cervids, also enrolled in Norwegian surveillance of animal TSE is wild musk ox (*Ovibos moschatus*). Twenty-two animals, all from the Dovrefjell Mountains, were tested and found negative for TSE.

Introduction

Chronic Wasting Disease (CWD) was for the first time in Europe detected in 2016, in Norway [2]. This was also the first detection of a natural CWD infection in reindeer (*Rangifer tarandus*) worldwide. CWD is a transmissible spongiform encephalopathy (TSE) or prion disease of cervids [3]. It is an invariably fatal neurodegenerative disease with no known treatment or methods of prophylaxis. Well-known in North America, CWD has since the 1960's gradually spread to an increasing number of states and provinces (May 2019: 26 states in USA and 3 provinces in Canada), both in captive and free-ranging cervids [4]. South Korea has also diagnosed the disease in elk (*Cervus elaphus nelsoni*) imported from Canada [5]. Since 2016, with disease emergence in Norway naturally susceptible species also include reindeer, and thus Norway have three affected species; reindeer, moose (*Alces alces*) and red deer (*Cervus elaphus*). Finland detected CWD in moose in February 2018, one old female close to the border of Russia [6].

Four cervid species are prevalent in natural free-ranging populations in Norway: moose, red deer, roe deer (*Capreolus capreolus*), and reindeer. Red deer predominate along the west coast, whereas moose and roe deer mainly inhabit other areas of the country [7]. The wild reindeer is found in fragmented sub-populations in the remote alpine regions of Southern Norway [8]. In addition, Norway has a population of semi-domesticated reindeer that live in a free-ranging condition, though herded. The majority of semi-domesticated reindeer are found in the northern part of Norway, particularly in the county of Finnmark.

The available official numbers of hunted cervids in 2018 were 30,636 moose, 43,777 red deer, 33,280 roe deer, and 4,156 free-ranging reindeer, respectively [9]. Additionally, the semi-domestic reindeer population counts about 250,000 animals [10]. There are approximately 120 deer farms in Norway; most of them keep red deer, but some farms have fallow deer (*Dama dama*) and occasionally both species.

Testing wild cervids for CWD was initiated in 2002 through the National Health Surveillance Program for Cervids and musk ox (*Ovibos moschatus*), operated by the Norwegian Veterinary Institute (NVI). A passive surveillance programme for CWD in Norwegian wild and captive cervids has been running from 2003. In addition, samples from slaughtered semi-domestic reindeer from several regions in the country have been tested. Norway performed a survey for CWD in 2006 and 2007 according to Commission decision 2007/182/EC, examining 700 red deer. Shown in Table 1 is the total number of cervids tested for CWD from 2002-2018.

Table 1. The number and species of cervids tested for chronic wasting disease (CWD) in Norway 2002-2018. Additional two wild reindeer from Svalbard in 2018 is not included in the table.

Year	Moose (<i>Alces alces</i>)	Red deer (<i>Cervus elaphus</i>)	Reindeer (<i>Rangifer tarandus</i>)		Roe deer (<i>Capreolus capreolus</i>)	Fallow deer (<i>Dama dama</i>)	Unknown Species	Total
			Semi-domestic	Wild				
2002-15	142	825	966	10	203	13	0	2,159
2016	4,403	2,597	1,738	842	484	0	88	10,152
2017	5,468	4,082	10,937	2,921	1,959	20	272	25,659
2018	6,705	8,428	12,046	3,650	2,124	48	655	33,656
Total	16,718	15,932	25,687	7,423	4,770	81	1,015	71,626

Aim

The aim of the programme is to detect the occurrence of CWD in the Norwegian cervid populations.

Materials and methods

The CWD program test wild cervids submitted for necropsy at the NVI. In addition, euthanized animals and fallen stock of captive deer and semi-domestic reindeer above 24 months and wild cervids above 12 months enrolls in the program. Additionally a large annual sampling effort in wild cervids harvested in regular hunting has been put in action since the disease discovery. This effort is a cooperation between the Norwegian Food Safety Authority, the Norwegian Environmental Agency, the Norwegian Institute for Nature Research (NINA) and NVI. Slaughtered semi-domesticated reindeer (aged above 12 months in southern Norway and above 24 months in northern Norway) were also included in the test program.

After the detection of CWD in 2016, it was decided by the Ministry of Agriculture and Food to cull the remaining population of wild reindeer not harvested in 2016 and 2017, in the management area Nordfjella zone 1 [11]. The culling operation was completed by April 2018. All 2424 animals from this zone were included in the CWD surveillance.

The routine diagnostics of CWD require brain tissue (*Medulla oblongata*). Due to early detection of prions in lymphatic tissue of reindeer in Norway, retropharyngeal lymph nodes were included (since 2016) in the analysis of all cervids where such tissues were available (for 2018: 79% of the samples tested).

A rapid test (TeSeE[®] SAP ELISA from Bio-Rad) was used to screen samples from pooled brain and lymph nodes for detection of PrP^{CWD}. All the samples were analysed at NVI, being the national reference laboratory for animal TSEs and an OIE reference laboratory for CWD.

Initially positive ELISA results were retested in brain and lymph node separately, before confirmation by the TeSeE[®] Western-blot from Bio-Rad, according to the manufacturer's instructions.

Results

In total, samples from 33,658 individual cervids were analysed in 2018, of which seven tested positive for CWD: one wild moose and six wild reindeer, respectively. With 12,046 animals, slaughtered semi-domesticated reindeer made up about 36% of the total. Moose samples counted 6,705 and red deer 8,428, being the two larger subgroups beside slaughtered reindeer. The number of tested wild reindeer and roe deer was 3,650 and 2,124, respectively. In addition to cervids, also enrolled in Norwegian surveillance of animal TSE is wild musk ox. Twenty-two animals, all from the Dovrefjell Mountains, were tested and found negative for TSE.

There were six wild reindeer positive for CWD. All originated from Nordfjella zone 1, as the index case of 2016 and all other CWD positive reindeer. The diagnostic findings do not differentiate cases of reindeer from what reported for cervids from the North American continent. The one old female moose found CWD positive in 2018 had similar diagnostic features as the three previous (2016-2017) detected moose, showing atypical characteristics [1]. The animal was detected in the municipality of Flesberg, Buskerud County.

Given in Table 2 and Figures 2-9 are the numbers, species and geographical distribution of cervids analysed for CWD in 2018.

Table 2. The number of cervids tested in the Norwegian surveillance programme for chronic wasting disease (CWD) 2018, distributed on species and reason for submission. Additional two wild reindeer from Svalbard in 2018 is not included in the table.

Species	Wild			Captive and semi-domesticated			Total
	Hunted	Diseased, injured or traffic killed	Un-known	Slaughtered	Diseased, injured or traffic killed	Un-known	
Moose	5,651	1,050	3	0	1	0	6,705
Red deer	6,949	836	0	614	27	2	8,428
Reindeer	3,486	137	27	11,799	239	8	15,696
Roe deer	215	1,411	498	0	0	0	2,124
Fallow deer	4	0	1	39	3	1	48
Unknown	95	39	512	9	0	0	655
Total	16,400	3,473	1,041	12,461	270	11	33,656

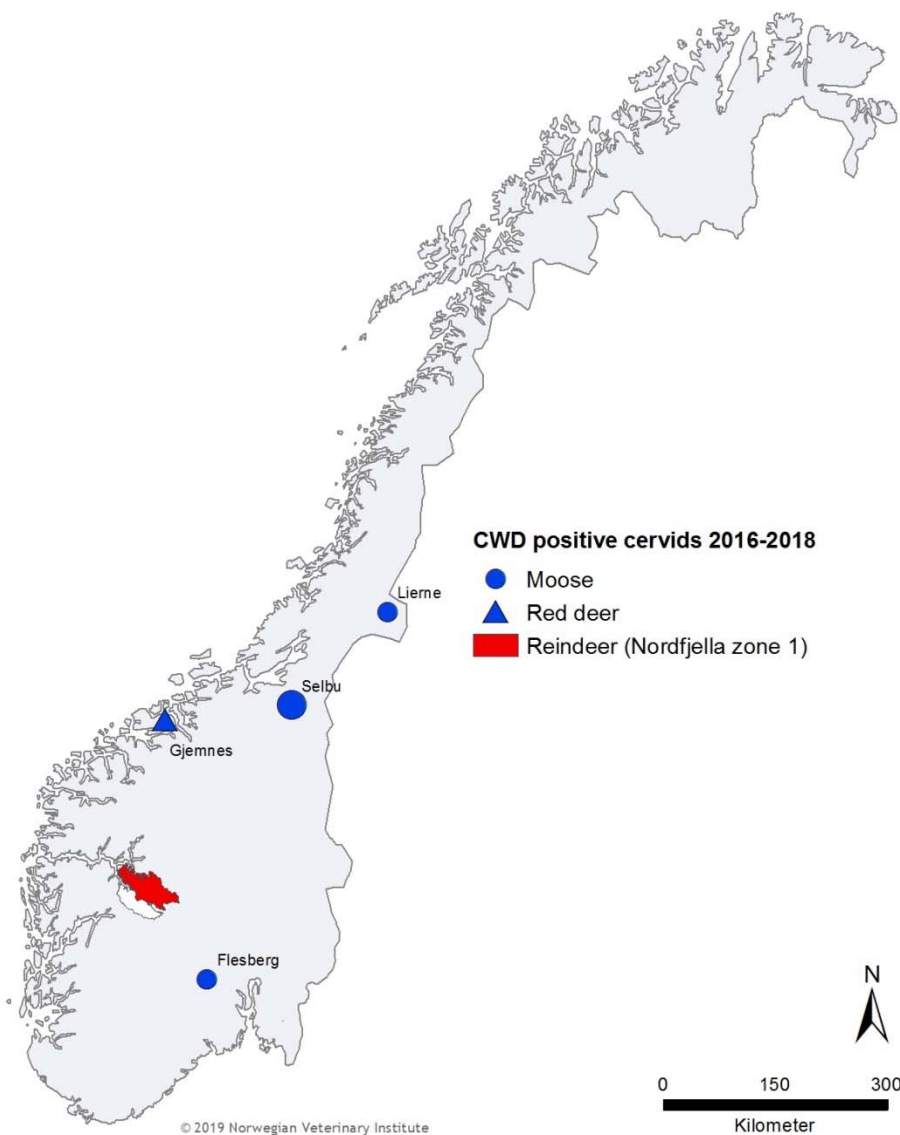


Figure 1. Geographical location of Nordfjella zone 1 (red) and zone 2 (white), and the municipalities in which the CWD positive cervids have been detected through the Norwegian surveillance programme for chronic wasting disease (CWD).

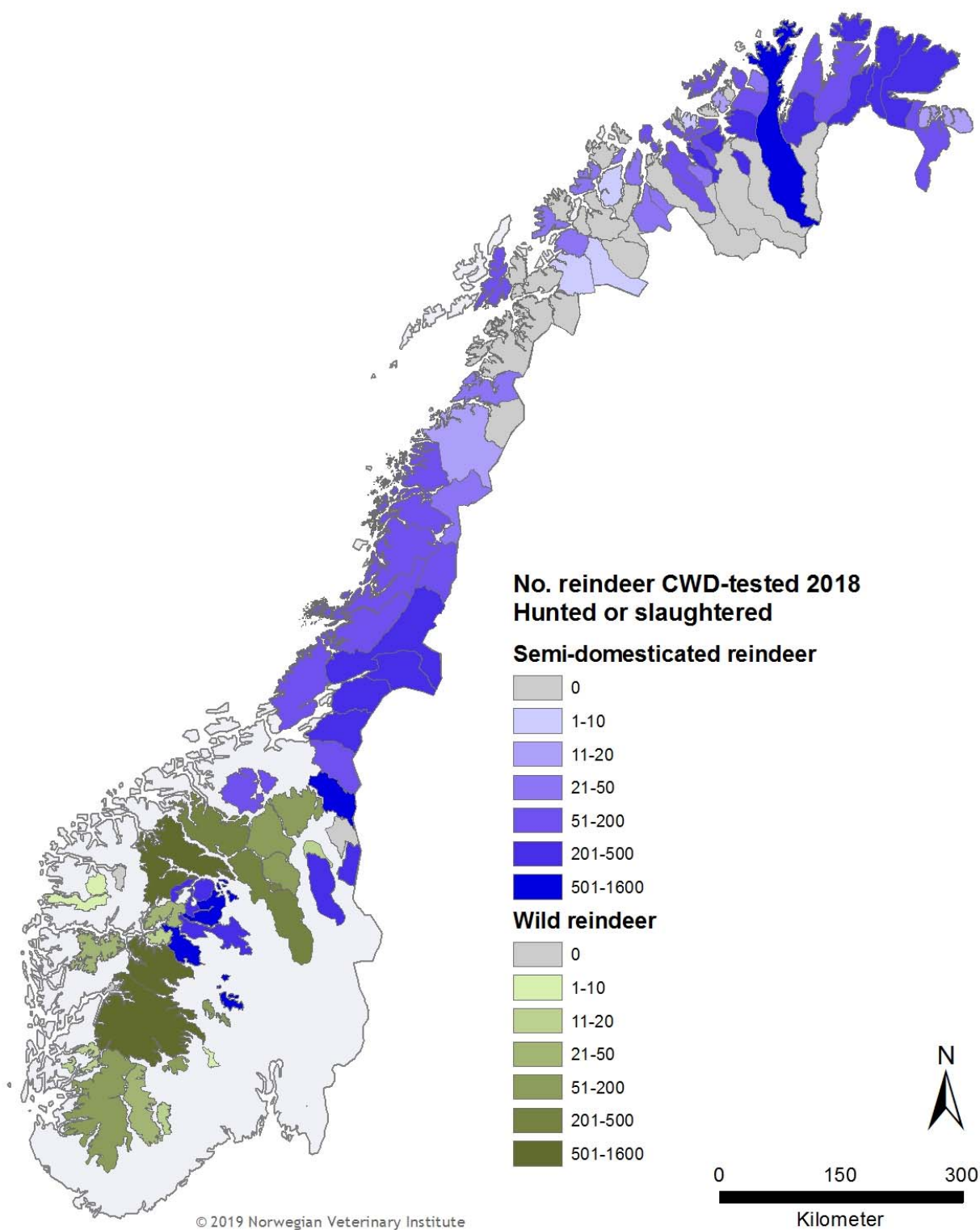


Figure 2. The number and geographical distribution of hunted free-ranging (green) and slaughtered semi-domestic (blue) reindeer (*Rangifer tarandus*) tested in the Norwegian surveillance programme for chronic wasting disease (CWD) in 2018.

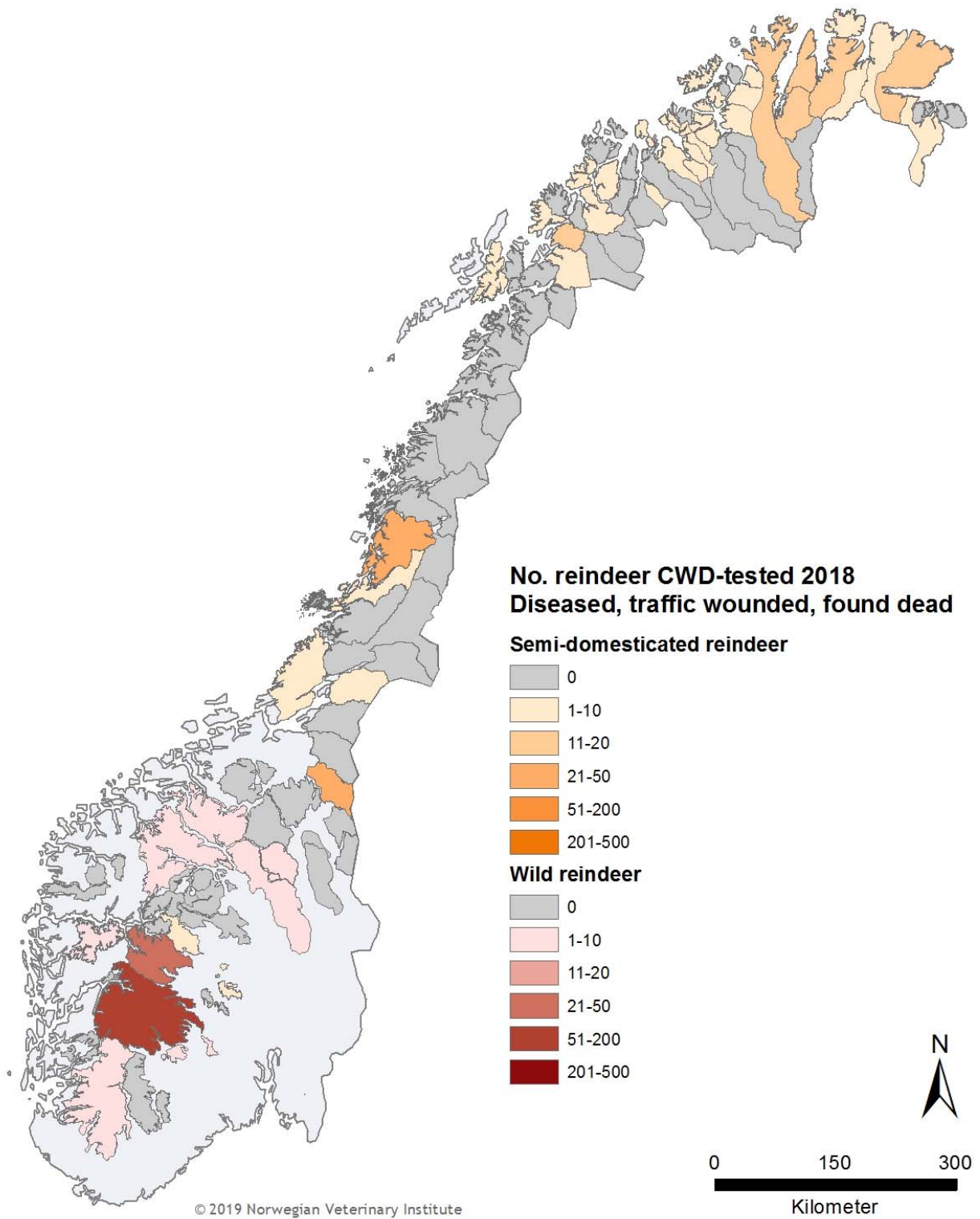


Figure 3. The number and geographical distribution of reindeer (*Rangifer tarandus*), both free-ranging and semi-domestic, found diseased and euthanised, traffic wounded or dead and tested in the Norwegian surveillance programme for chronic wasting disease (CWD) in 2018.

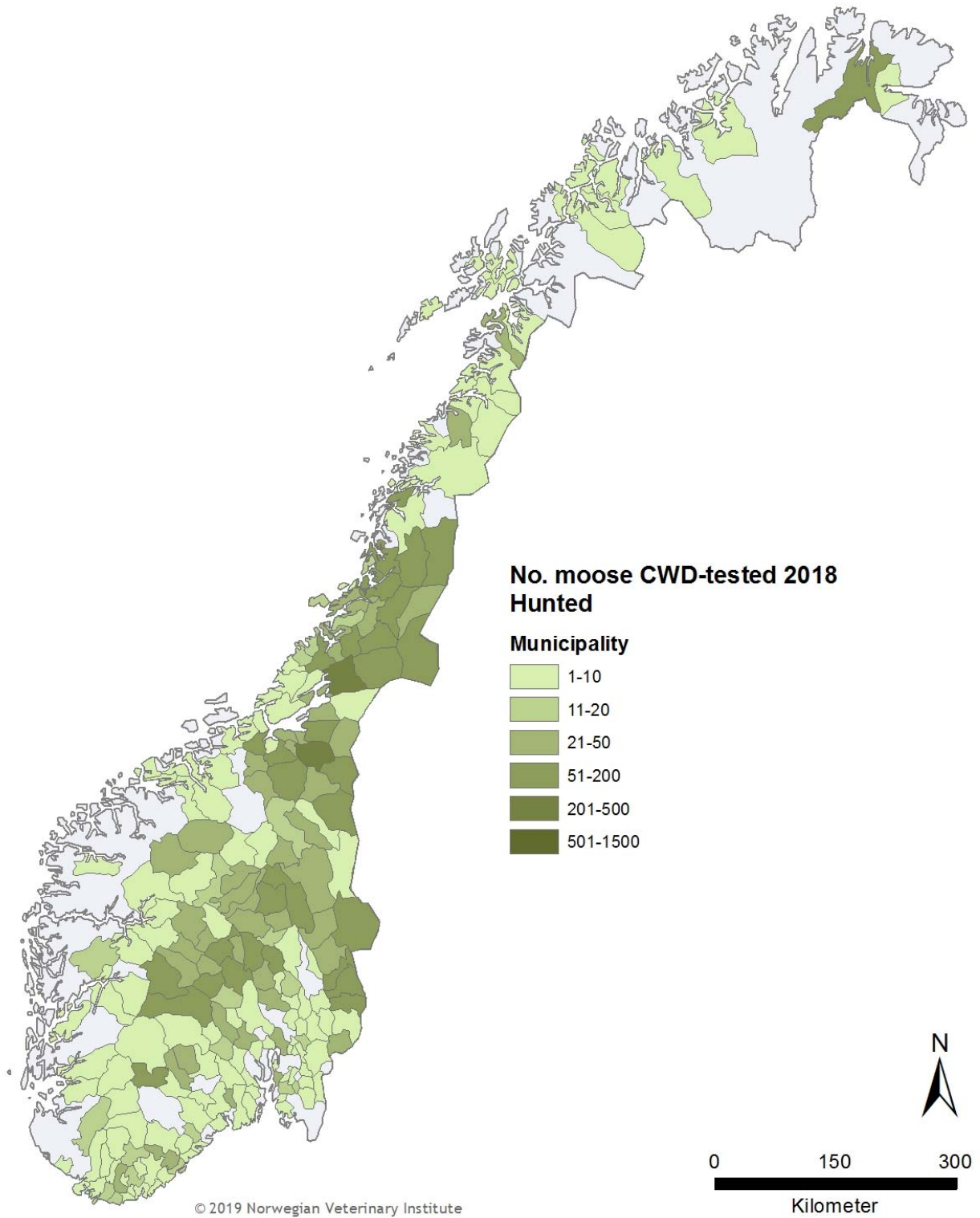


Figure 4. The number and geographical distribution of hunted free-ranging moose (*Alces alces*) tested in the Norwegian surveillance programme for chronic wasting disease (CWD) in 2018.

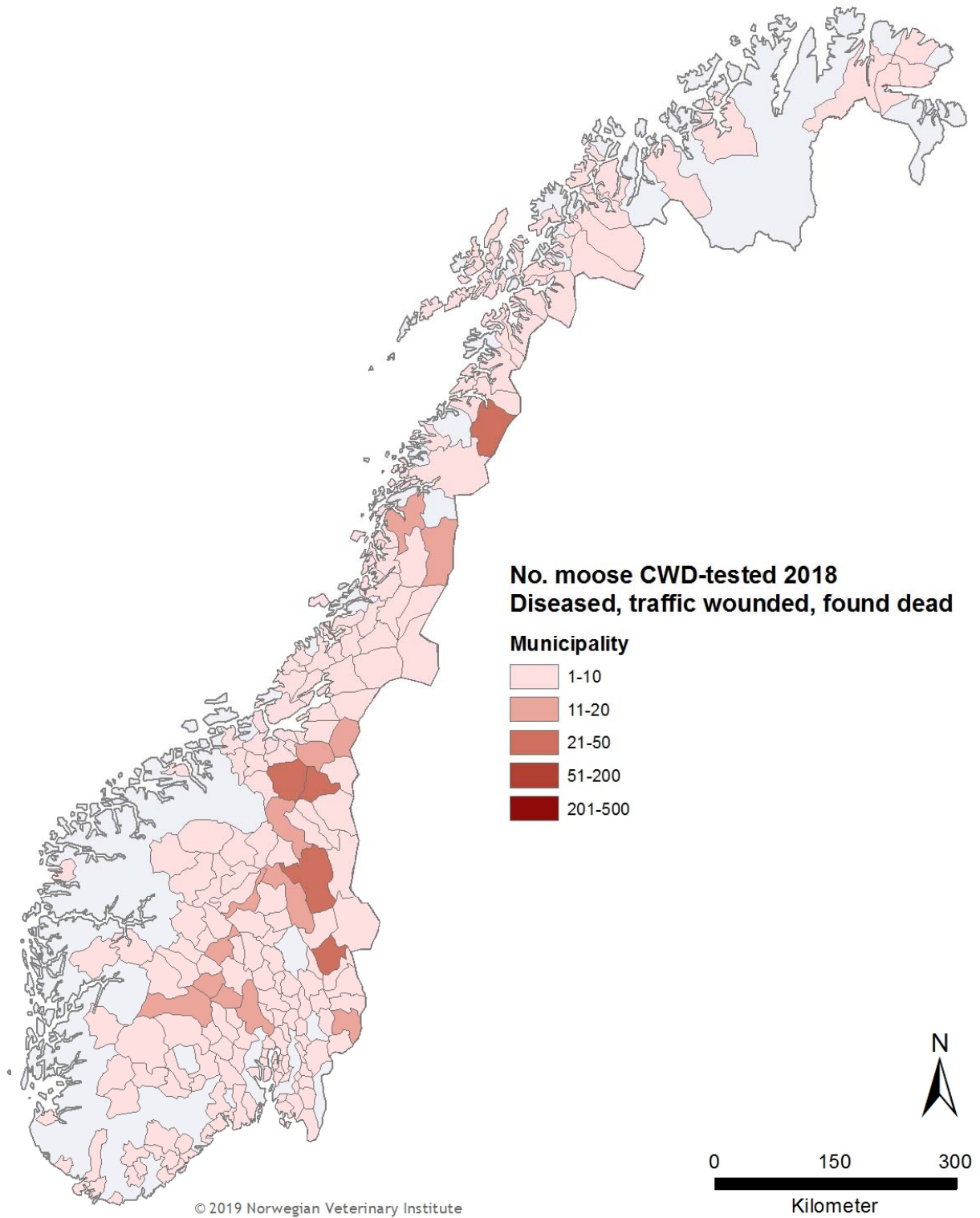


Figure 5. The number and geographical distribution of free-ranging moose (*Alces alces*) found diseased and euthanised, traffic wounded or dead and tested in the Norwegian surveillance programme for chronic wasting disease (CWD) in 2018.

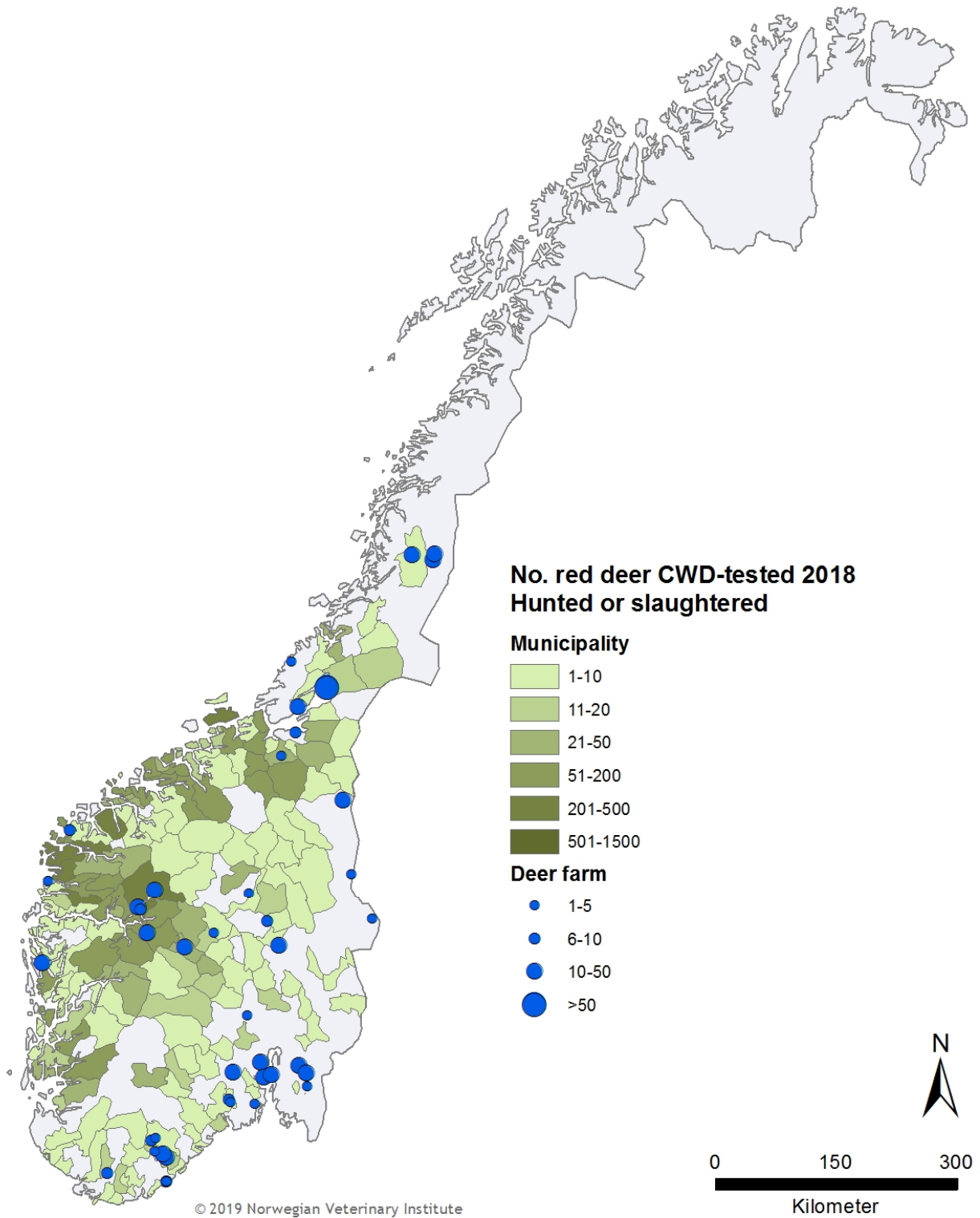


Figure 6. The number and geographical distribution of hunted free-ranging (green) and slaughtered captive (blue dots) red deer (*Cervus elaphus*) tested in the Norwegian surveillance programme for chronic wasting disease (CWD) in 2018.

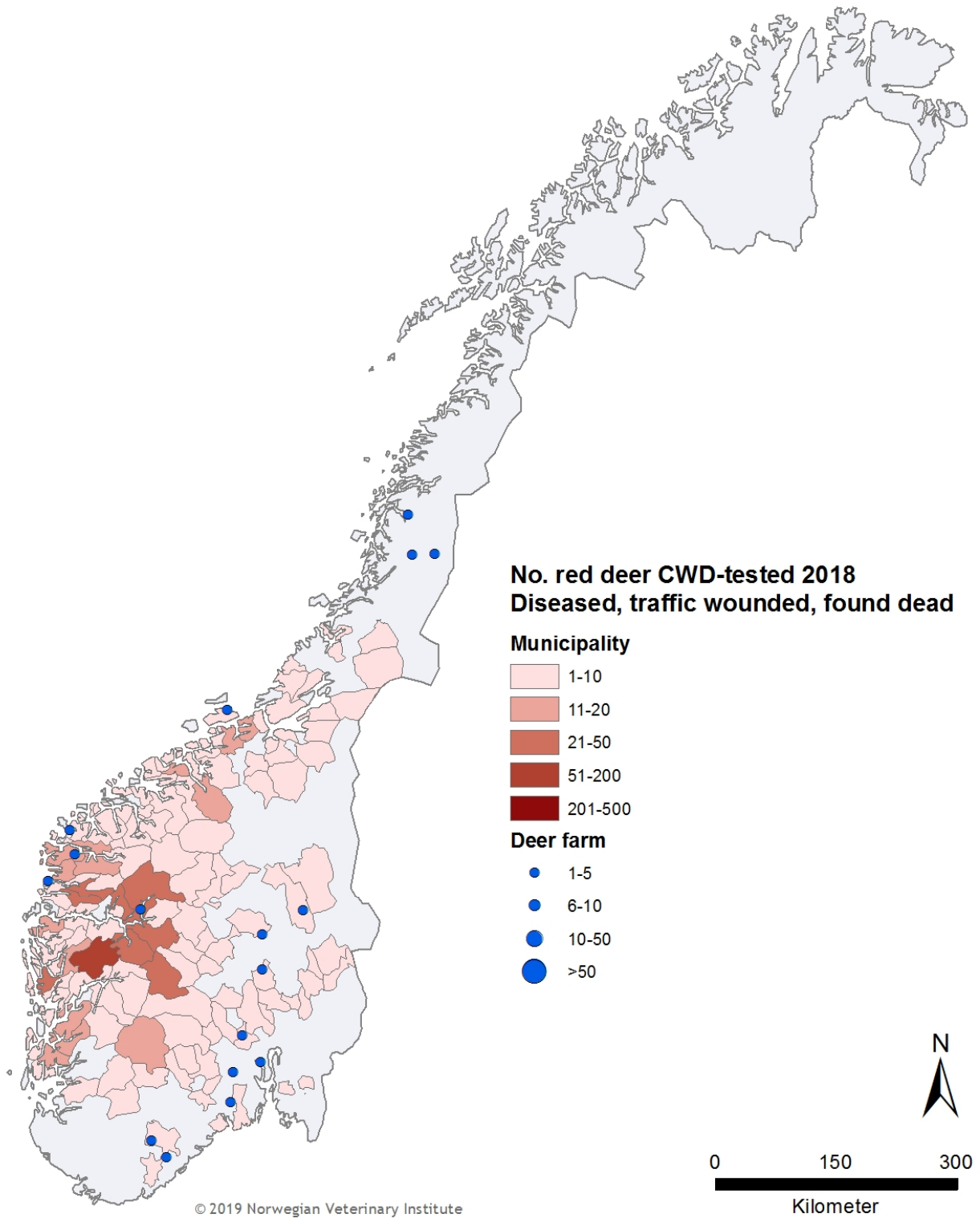


Figure 7. The number and geographical distribution of free-ranging (red) and captive (blue dots) red deer (*Cervus elaphus*) found diseased and euthanised, traffic wounded or dead and tested in the Norwegian surveillance programme for chronic wasting disease (CWD) in 2018.

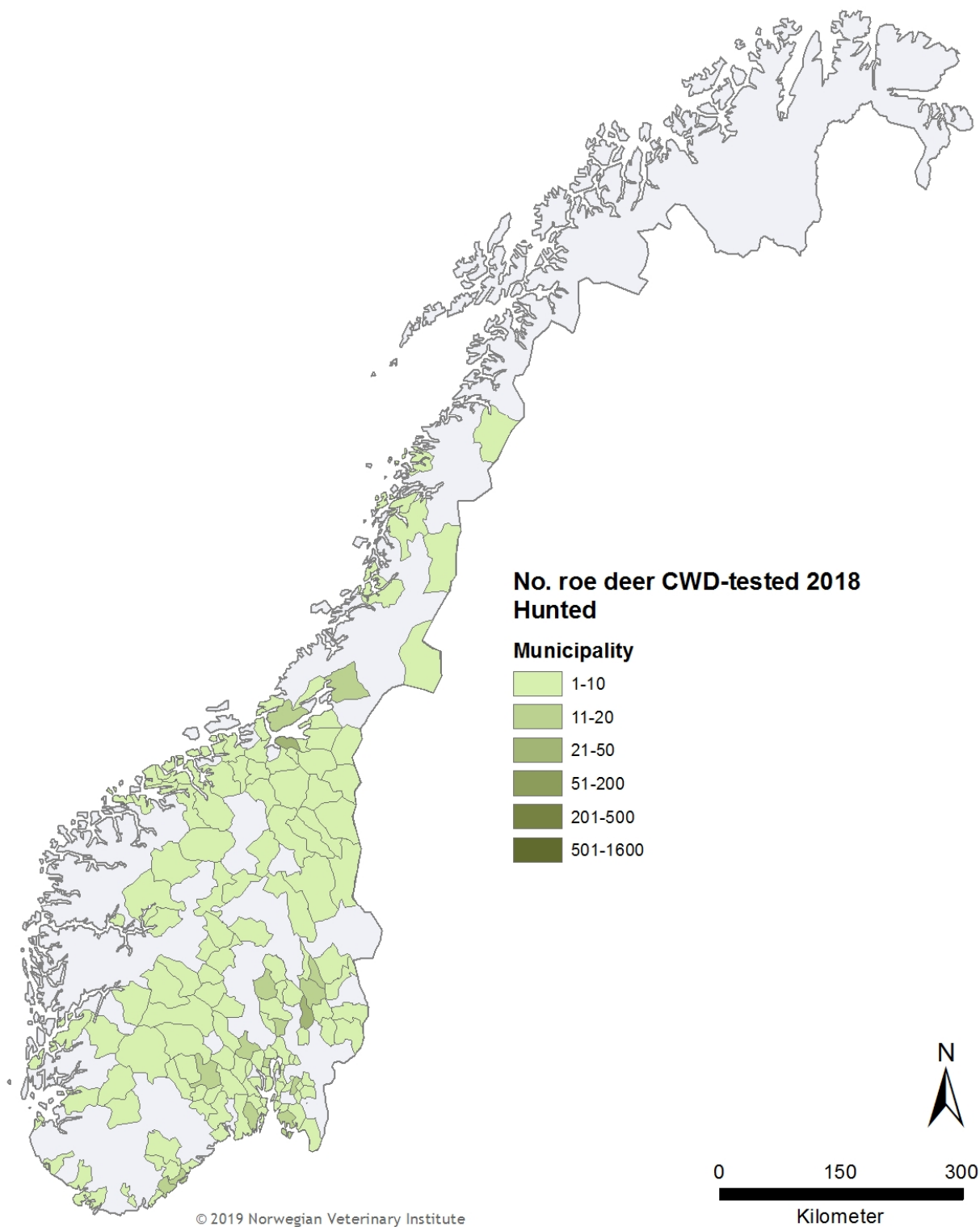


Figure 8. The number and geographical distribution of hunted free-ranging roe deer (*Capreolus capreolus*) tested in the Norwegian surveillance programme for chronic wasting disease (CWD) in 2018.

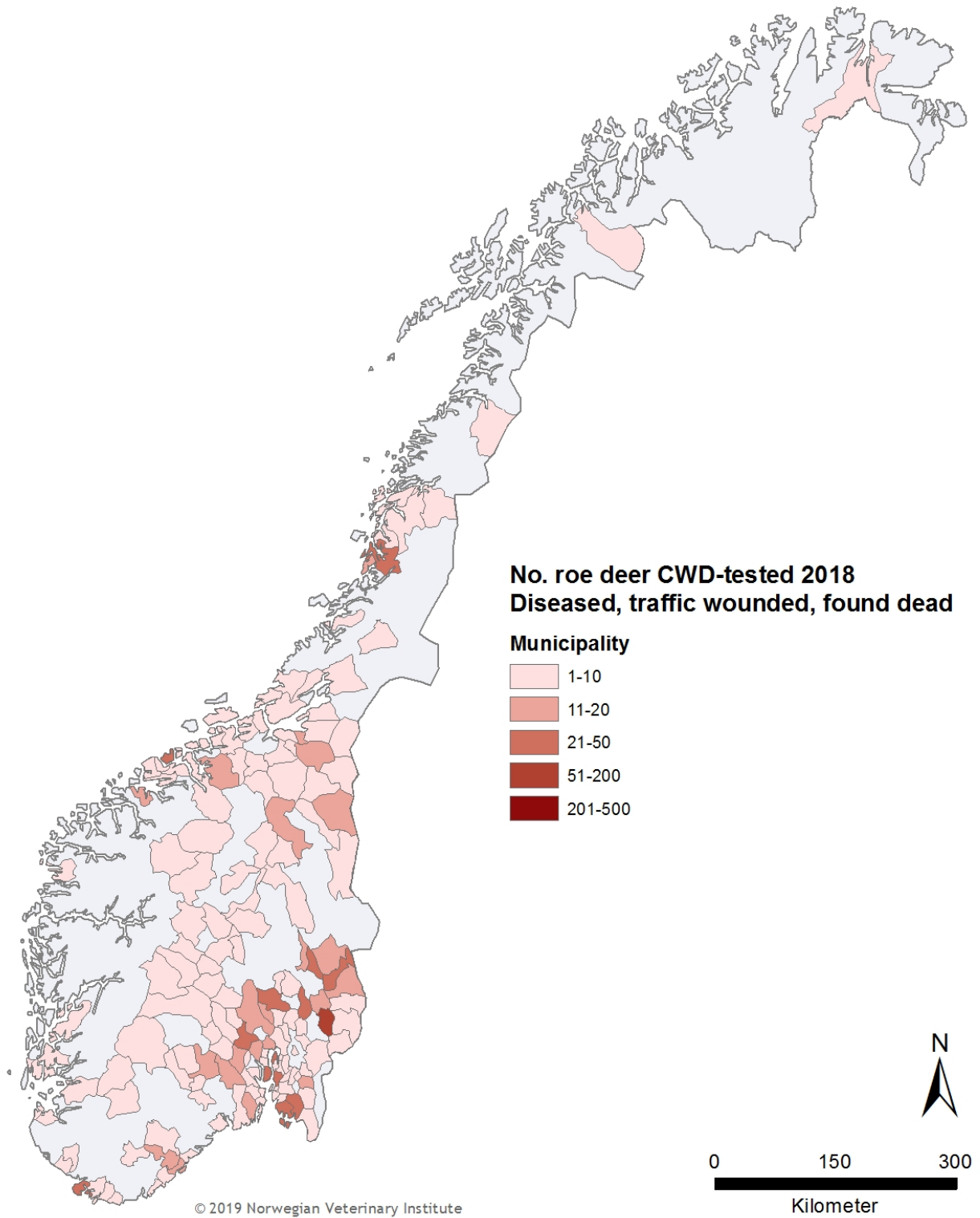


Figure 9. The number and geographical distribution of free-ranging roe deer (*Capreolus capreolus*) found diseased and euthanised, traffic wounded or dead and tested in the Norwegian surveillance programme for chronic wasting disease (CWD) in 2018.

Discussion

In 2016, CWD was for the first time detected in Europe, in five free-ranging cervids in Norway. The last three years of testing, about 75,000 animals, have so far revealed differences in strain characteristics in Norwegian cervid populations. The reindeer cases were indistinguishable from cases of CWD from North America, whereas the positive European moose and red deer have shown atypical characteristics. The affected reindeer subpopulation of Nordfjella zone 1 was culled in 2018 and measures are taken to avoid potential spread of infection from environmental contamination in this area.

Detection in moose and a red deer, with assumptions of little or no possibility of horizontal spread between live animals, do not elicit similar management measures as in case of reindeer. Still there is need of surveillance in all susceptible species as the level of assurance of infection-freedom is low for most cervid populations. Thus, the surveillance program continues in 2019, aiming both at detection of possible new cases of atypical CWD and documentation of freedom from classical CWD in other areas apart from Nordfjella.

Historically the number of cervids tested in Norway is low. 2159 animals in the period 2002-2015, of which only ten were wild reindeer. Low numbers is also the case for EU-member states and increased testing was initiated after the Norwegian detection, for those states with populations of moose and/or reindeer [12, 13]. Because of this limited testing, inference about historical CWD prevalence in Norway or Europe is difficult. In Sweden, results from the increased EU surveillance detected two old moose in the spring of 2019 [14].

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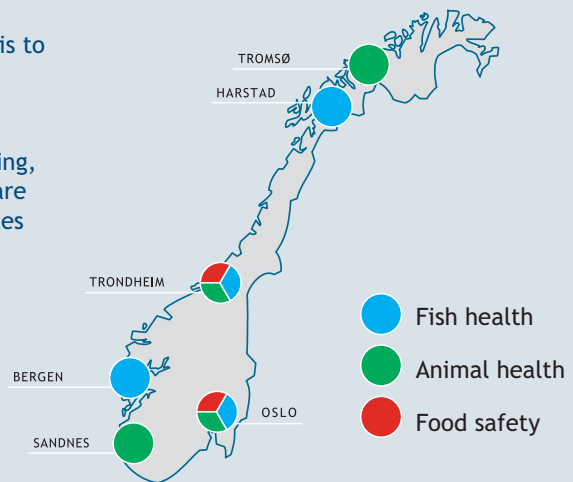
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