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The surveillance programme for Chronic Wasting Disease (CWD) in free-ranging and captive cervids in Norway 2025

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Content

Summary

A total of 11,612 samples of wild, semi-domesticated and captive Norwegian cervids were analysed in 2025. Of these, three moose (*Alces alces*) tested positive for CWD. All were old females culled in Folldal (20 years old), Tvedestrand (17 years old) and Selbu (16 years old) municipalities. The latter case was a traffic injury.

The cases detected showed disease characteristics previously described for the species in previous reports, i.e. PrP^{Sc} was only detected in brain tissue, and no prions were detected in lymphoid tissues with diagnostic tests (ELISA and western blot). In the Nordic countries, CWD has shown sporadic appearance in moose and red deer, whilst in reindeer the disease has been contagious and with lymphoid detections in routine diagnostics.

Introduction

Chronic Wasting Disease (CWD) was for the first time detected in Europe in 2016, in Norway [1]. This was also the first detection of a natural CWD infection in reindeer (*Rangifer tarandus*) worldwide. The index case in reindeer was in Nordfjella management area in Southern Norway. All subsequent positive reindeer until 2020 were found in this area (Figure 1). The Nordfjella sub-population was eradicated in 2018 [2]. In 2020, one reindeer CWD case was discovered at Hardangervidda, which is the neighboring area/population to Nordfjella. Another case in reindeer was detected at Hardangervidda in 2022.

CWD is a transmissible spongiform encephalopathy (TSE) or prion disease of cervids [3]. It is an invariably fatal neurodegenerative disease. Well-known in North America, CWD has since the 1960's gradually spread to an increasing number of states and provinces (July 2025: 36 states in USA and five provinces in Canada), both in captive and free-ranging cervids [4]. The republic of Korea has also diagnosed the disease after importation of infected elk (*Cervus elaphus nelsoni*) from Canada [5]. Following the emergence of CWD in Norway, reindeer were identified as a naturally susceptible species. Norway has by now three affected species; reindeer, moose (*Alces alces*) and red deer (*Cervus elaphus*).

CWD in the Nordic cervids has shown different epidemiological patterns according to species. In routine diagnostics (ELISA and western blot) reindeer have detectable prions both in brain and lymphoid tissues, whilst moose and red deer cases only in the brain. The tissue- and geographic distribution suggests a contagious character of the disease in reindeer. The disease in moose and red deer occurs sporadically, has only been found in older animals, and there is little evidence for contagiousness and horizontal spread between live animals. Since 2018, old female moose has also been diagnosed with sporadic CWD in Finland and Sweden [6,7].

Four cervid species are prevalent in natural free-ranging populations in Norway: moose, red deer, roe deer (*Capreolus capreolus*) and reindeer. Red deer predominates along the west coast, whereas moose and roe deer mainly inhabit other areas of the country. The wild reindeer is found in fragmented sub-populations in the remote alpine regions of Southern Norway [8]. The official numbers (February 2026) of hunted cervids were in the 2025 season: 25,951 moose, 49,449 red deer, 27,173 roe deer and 3,851 wild reindeer [9]

In addition, Norway has populations of semi-domesticated reindeer that live in a herded condition, though free ranging and migrating between summer- and winter-feeding areas. Most semi-domesticated reindeer are found in the Northern part of Norway as part of the Sami culture, particularly in the county Finnmark, and the total population counts about 250,000 animals [10]. There are approximately 100 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 muskox (*Ovibos moschatus*), operated by the Norwegian Veterinary Institute (NVI) on behalf of the

Norwegian Environmental Agency. From 2003, a passive surveillance programme for CWD has been in place in Norwegian wild and captive cervids. The programme is coordinated by NVI and financed by the Norwegian Food Safety Authority (NFSA). In addition, the programme includes testing samples from slaughtered semi-domesticated reindeer from several regions of the country. In 2006 and 2007 the European Commission (decision 2007/182/EC) initiated a survey for CWD where Norway took part, like the EU member-states, testing 700 cervids. A similar testing was performed in EU in the years 2018-2020 (reg. 2017/1972), covering six member states in addition to Norway. Shown in Table 1 is the total number of cervids tested for CWD in Norway from 2002-2025.

Since there is no separate program to report surveillance of TSE in Muskox, such testing is included in this publication. TSE has never been reported in the species.

Table 1. Number and species of cervids tested for CWD in Norway 2002-2025. Additional 61 wild reindeer from Svalbard, sampled from 2018 - 2022 and 2024, are not included in the table.

Year	Moose (*Alces alces*)	Red deer (*Cervus elaphus*)	Reindeer (*Rangifer tarandus*)		Roe deer (*Capreolus capreolus*)	Fallow deer (*Dama dama*)	Unknown Species	Total
			Semi-domesticated	Wild				
2002-15	142	825	966	10	203	13	0	2,159
2016	4,403	2,582	1,750	831	484	15	87	10,152
2017	5,468	4,083	10,942	2,920	1,955	20	271	25,659
2018	6,705	8,428	12,051	3,645	2,124	48	655	33,656
2019	5,936	5,758	12,949*	3,322	1,695	37	450	30,147
2020	6,200	4,274	6,517	3,208	1,832	92	405	22,528
2021	4,525	4,939	6,154	3,507	1,885	28	623	21,661
2022	3,151	2,641	6,658	3,079	1,817	17	221	17,584
2023	2,026	2,221	5,571	2,176	2,124	5	95	14,218
2024	1,727	1,917	3,502	2,003	1,702	27	54	10,932
2025	1,649	1,613	4,349	2,334	1,585	26	56	11,612
Total	**41,932**	**39,281**	**71,409**	**27,035**	**17,406**	**328**	**2,917**	**200,308**

Aim

The aim of the program is to document the occurrence of CWD in the Norwegian cervid populations.

Materials and methods

The CWD surveillance program includes testing of slaughtered semi-domesticated reindeer (above 12 months in Southern Norway and above 24 months in Northern Norway). Slaughtered farmed deer (above 24 months). In addition, euthanized animals and fallen stock of captive deer and semi-domesticated reindeer (above 24 months) are also included. Wild cervids (above 12 months), or any animal showing clinical signs, as well as wild cervids submitted for necropsy at the NVI. In addition, since the discovery of CWD in 2016, extensive testing of hunted

cervids has been implemented. The program is owned and financed by the NFSA, run by the NVI and the sample collection is a cooperation between the NFSA, the Norwegian Agriculture Agency, the Norwegian Environmental Agency, the Norwegian Institute for Nature Research (NINA), and NVI. Apart from cervids, available wild muskoxen found dead/or killed are also enrolled in the Norwegian surveillance of animal TSE. These animals live in the Dovre Mountains, as the only free-ranging muskox population in Norway.

The routine diagnostics of CWD require testing of brain tissue (*Medulla oblongata*) as a minimum. Due to early detection of prions in lymphoid tissue of reindeer in Norway, the retropharyngeal lymph nodes have, since 2016, been included in the testing of all cervid species and muskoxen when available.

A rapid test (IDEXX HerdChek BSE-Scrapie AG Test, IDEXX Laboratories, Westbrook, USA) is used to screen samples from pooled brain and lymph nodes for detection of PrP^{Sc}.

Initially, positive ELISA results are retested in brain and lymph node separately, before confirmatory western blot (TeSeE® WESTERN BLOT, Bio-Rad, Marnes-la-Coquette, France), according to the manufacturer's instructions. All the samples are analysed at NVI, being the national reference laboratory for animal TSEs and a WOAH (founded OIE) reference laboratory for CWD.

PRNP variation

PRNP is the gene encoding the cellular prion protein (PrP^{c}). Variation within this gene is associated with CWD susceptibility and development [11,12]. In Norwegian cervids *PRNP* variation differs between species, reindeer being most polymorphic, followed by red deer, moose and roe deer respectively, with the latter being monomorphic [13]. All animals detected positive for CWD in the current surveillance program have been sequenced and *PRNP* variation has been recorded (Table 2). The PRNP allele nomenclature/genotype presented in this report follows Güere et al. [12] [13].

Table 2. PRNP genotype variation in Norwegian cervids diagnosed with CWD. Genotype nomenclature follows Güere et al. [12,13].

Genotype		**Reindeer**					**Moose**		**Red deer**
		A/A	A/B	A/C	A/D	B/C			
Year	**Variation at codon**	wild type* / wild type	wild type / [S225Y]	wild type / (83-91del)	wild type / [N176D]	[S225Y] / (83-91del)	wild type / wild type	[K109Q] / [K109Q]	[Q226E] / [Q226E]
2016		2		2			2		
2017		5	3			1	1		1
2018		3	1	2				1	
2019							1	1	
2020					1		1		
2021							2		1
2022		1					1	1	1
2023							1		
2024							2		
2025							3		
Total		**11**	**4**	**4**	**1**	**1**	**14**	**3**	**3**

* Wild type, sequence in accordance with Rangifer tarandus granti prion protein (Prnp) gene, GenBank accession number DQ154293.1. The wild type *PRNP* sequence is the same for reindeer, moose and red deer.

Results

In total, samples from 11,612 individual cervids were analysed in 2025 (Table 1), of which three wild moose tested positive for PrP^{Sc}. These animals shared characteristics previously described for Nordic moose [14,15], with diagnostically detectable prions only in the brain tissue.

Semi-domesticated reindeer accounted for 4 349 samples, corresponding to about 37% of the total of analysed cervids. Moose samples counted 1,649 and red deer 1,613, being the two larger subgroups beside slaughtered semi-domesticated reindeer. The number of tested roe deer, fallow deer and wild reindeer, was 1,585, 26 and 2,334, respectively. In addition, there were 56 animals, whose species were not registered, and 5 muskoxen that were tested and found to be negative.

A total of 71% of the animals were tested by analysing both lymphoid tissue and brain tissue. From the remaining animals, respectively for 28% and 0.4% only the brain or lymphoid tissue was available for testing. Table 3 and Figures 2-8 give the numbers, species and geographical distribution of cervids tested for CWD in 2025.

Table 3. Number of cervids tested in the Norwegian surveillance programme for CWD 2025, by species and reason for submission. Additional 5 muskoxen are not included in the table.

Species	Wild			Captive and semi-domesticated			Total
	Hunted	Diseased, injured or traffic killed	Unknown	Slaughtered	Diseased, injured or traffic killed	Unknown	
Moose	836	529	282	0	2	0	1,649
Red deer	969	241	272	128	2	1	1,613
Reindeer	2,034	43	257	4,260	53	36	6,683
Roe deer	37	1,383	165	0	0	0	1,585
Fallow deer	0	0	0	24	0	2	26
Unknown	3	2	51	0	0	0	56
Total	**3,879**	**2,198**	**1,027**	**4,412**	**57**	**39**	**11,612**

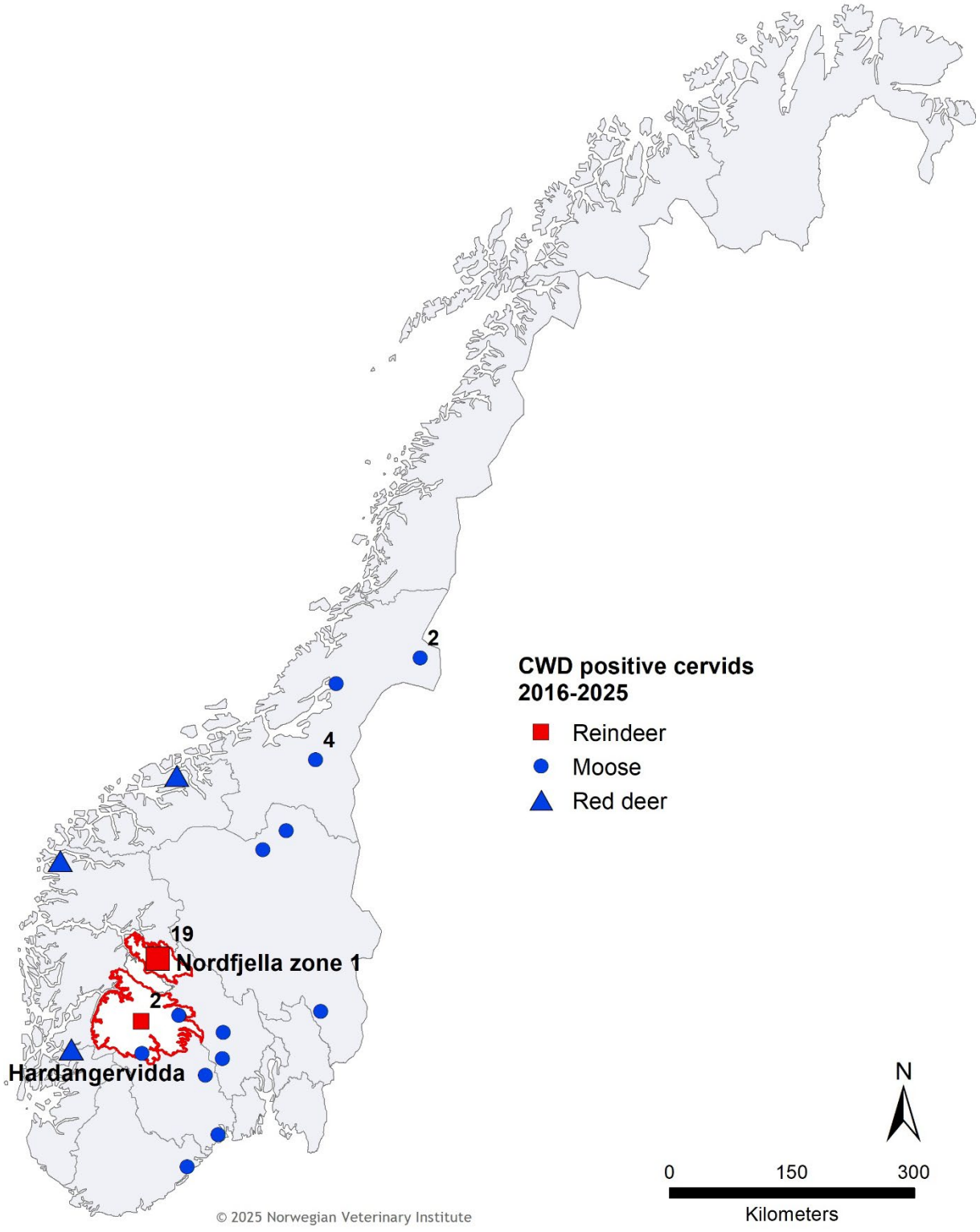

Figure 1. Geographical location of Nordfjella and Hardangervidda (encircled in red), and municipalities where CWD positive cervids have been detected through the Norwegian surveillance programme for CWD. For locations with more than one case, the number of animals is indicated.

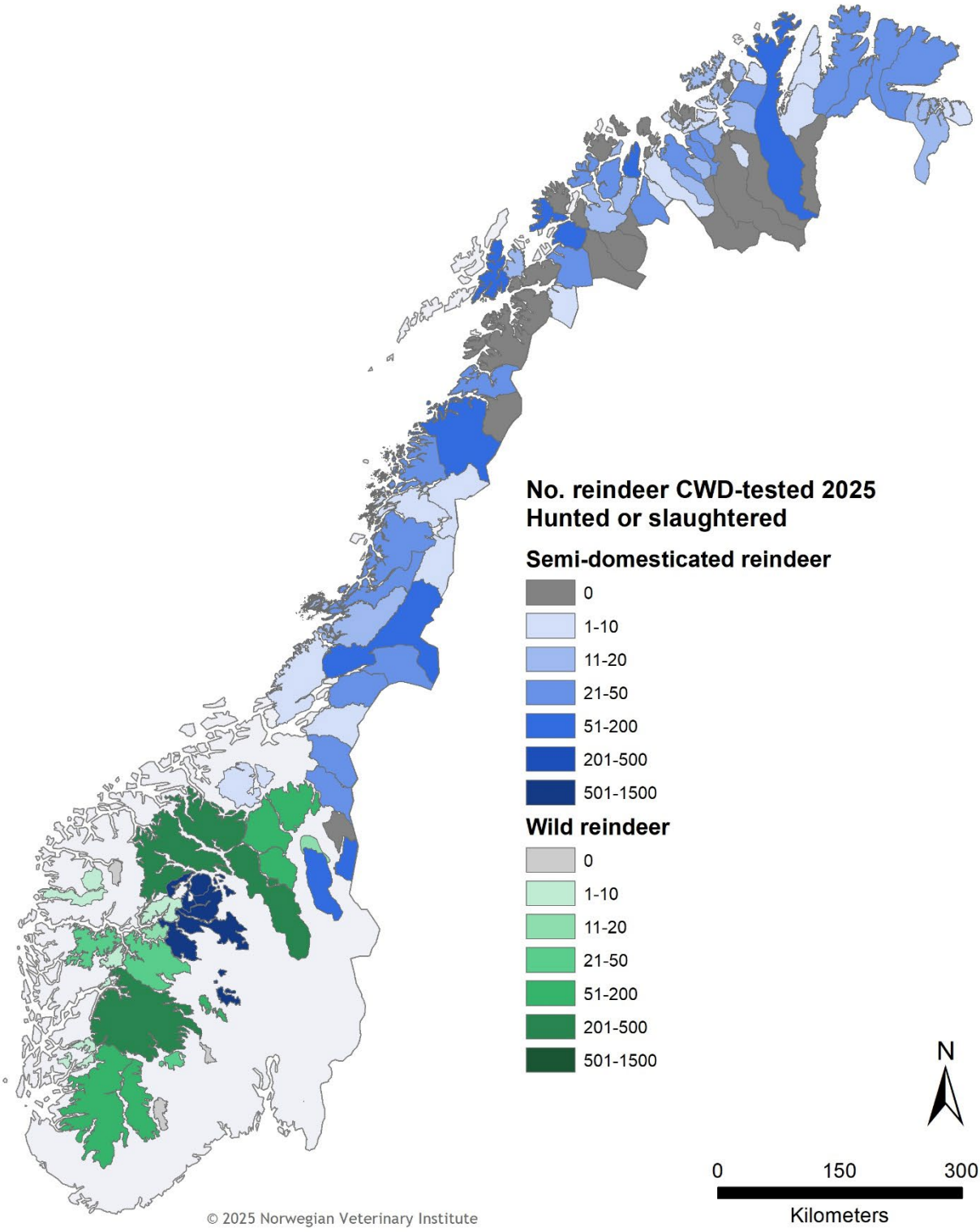

Figure 2. Number and geographical distribution of hunted free-ranging (green) and slaughtered semi-domesticated (blue) reindeer (Rangifer tarandus) tested in Norway in 2025.

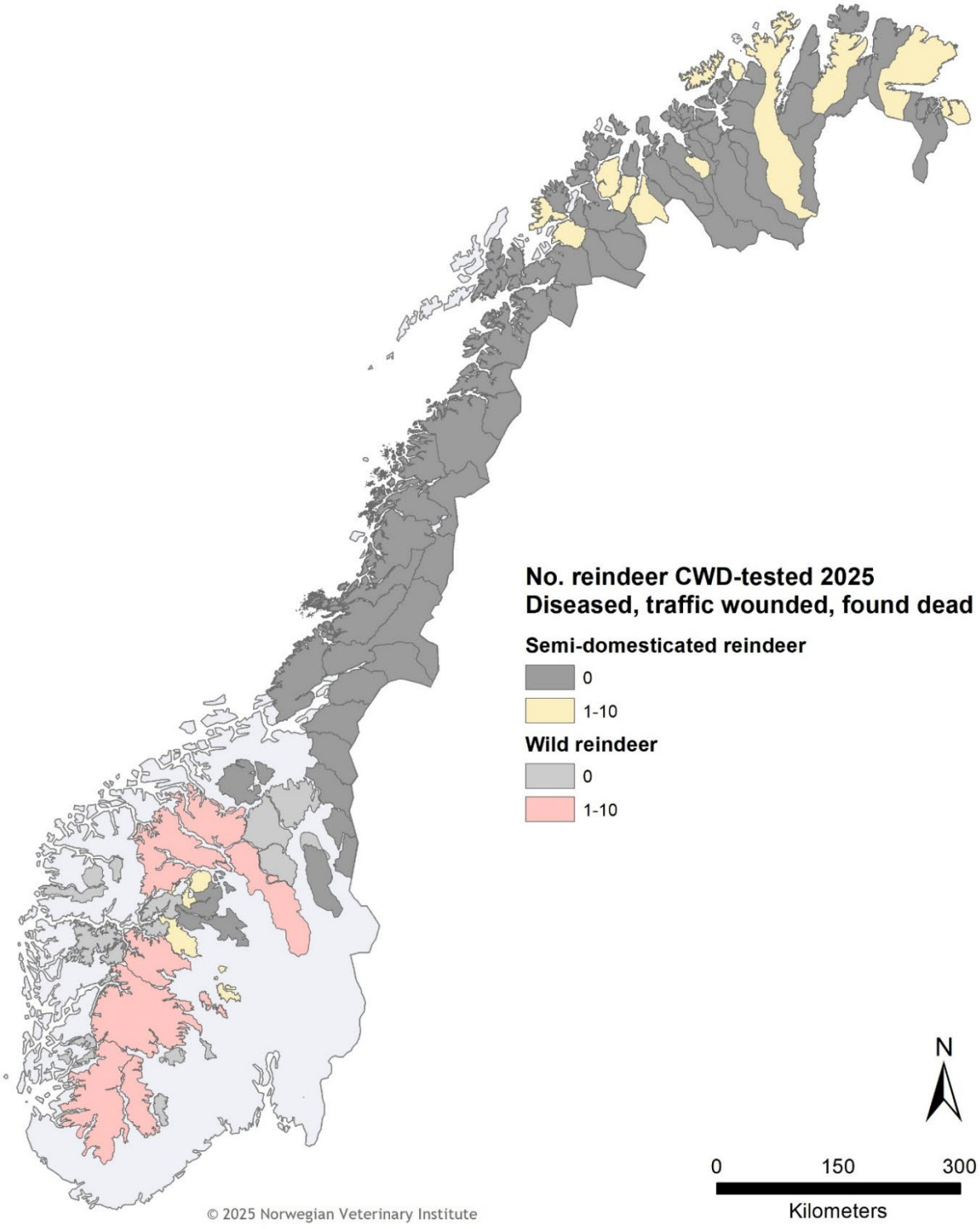

Figure 3. Number and geographical distribution of reindeer (Rangifer tarandus), both free-ranging and semi-domesticated, found diseased and euthanised, traffic-injured or found dead and tested for CWD in Norway in 2025.

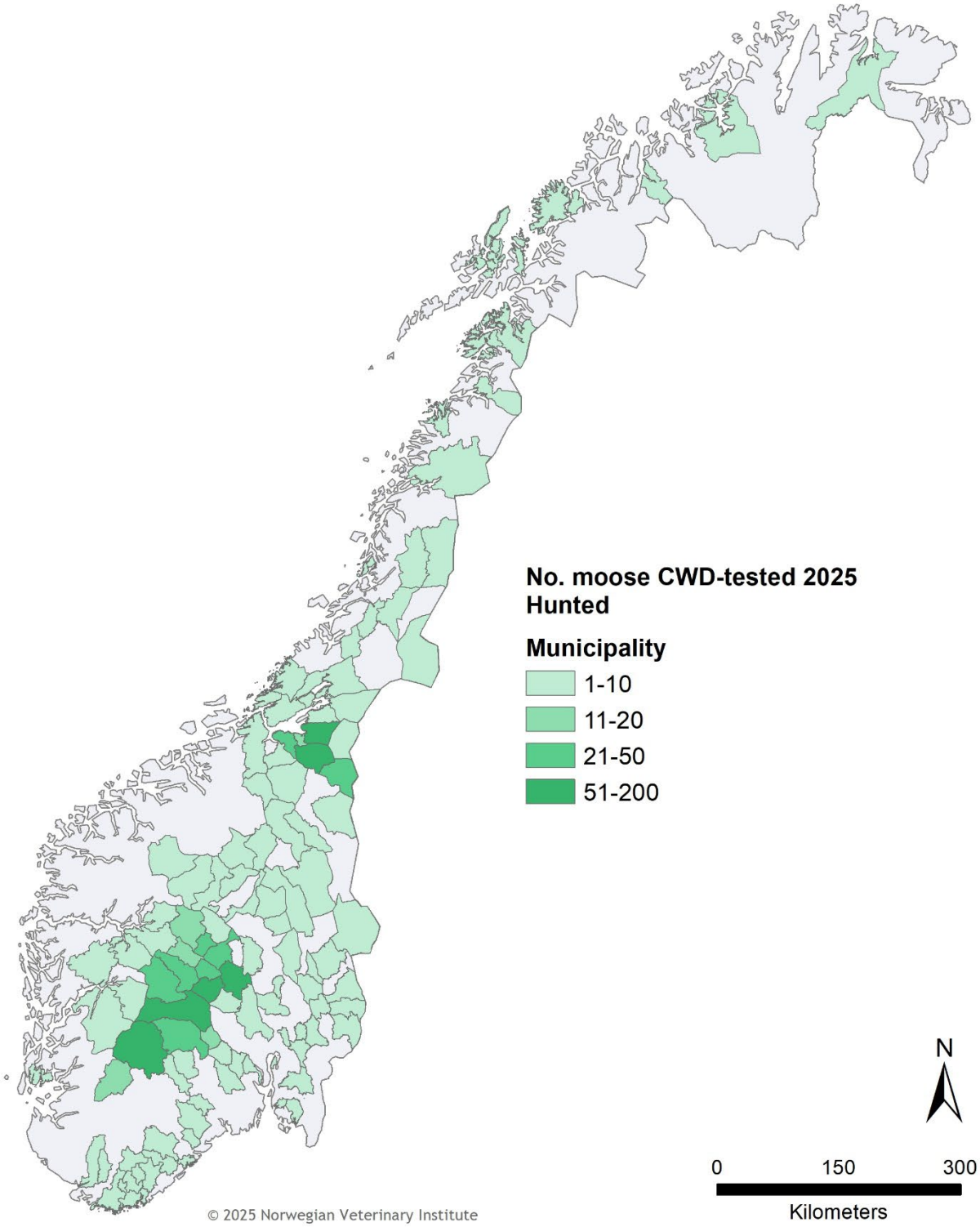

Figure 4. Number and geographical distribution of hunted free-ranging moose (Alces alces) tested for CWD in Norway in 2025.

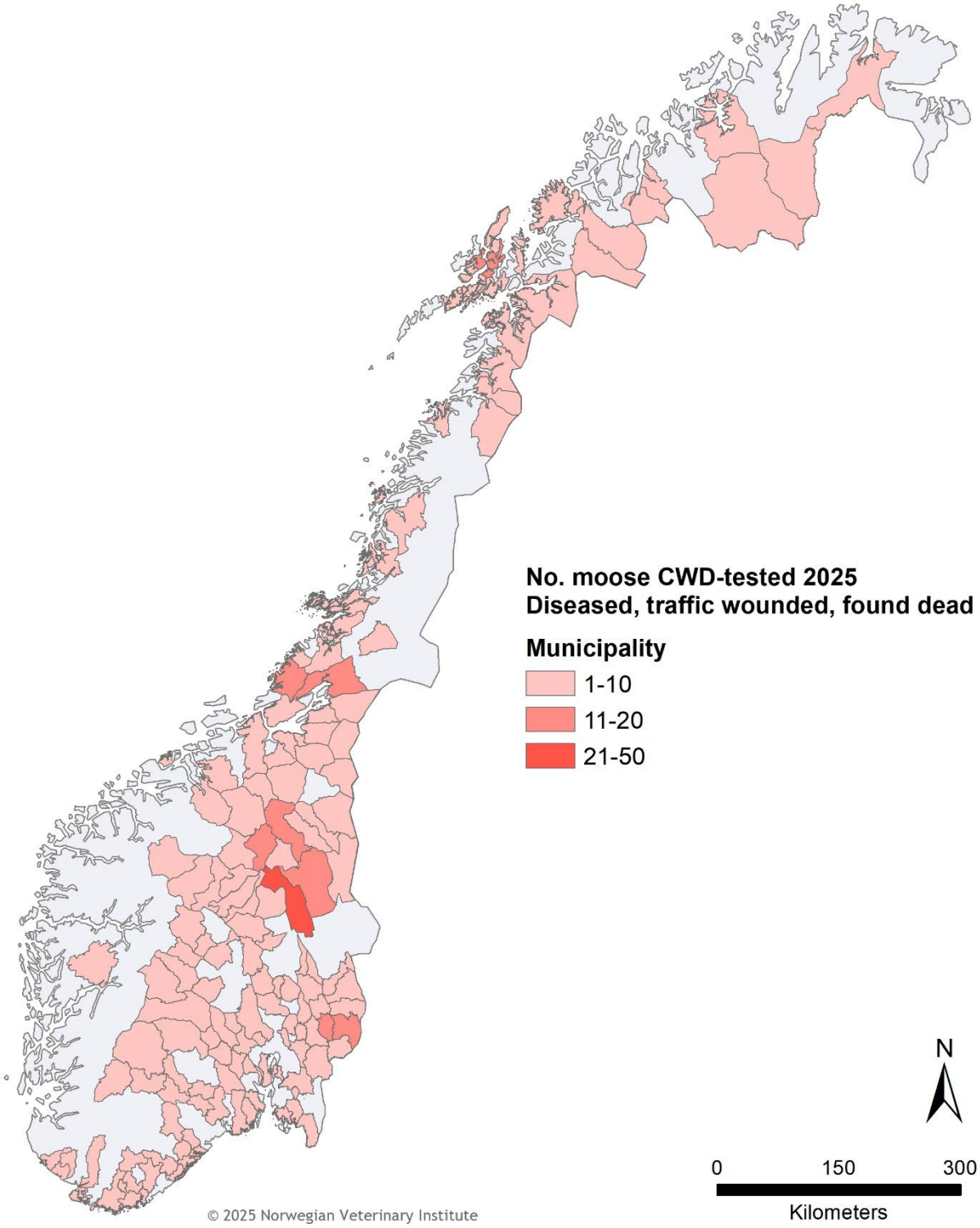

Figure 5. Number and geographical distribution of free-ranging moose (Alces alces) found diseased and euthanised, traffic wounded or dead and tested for CWD in Norway in 2025.

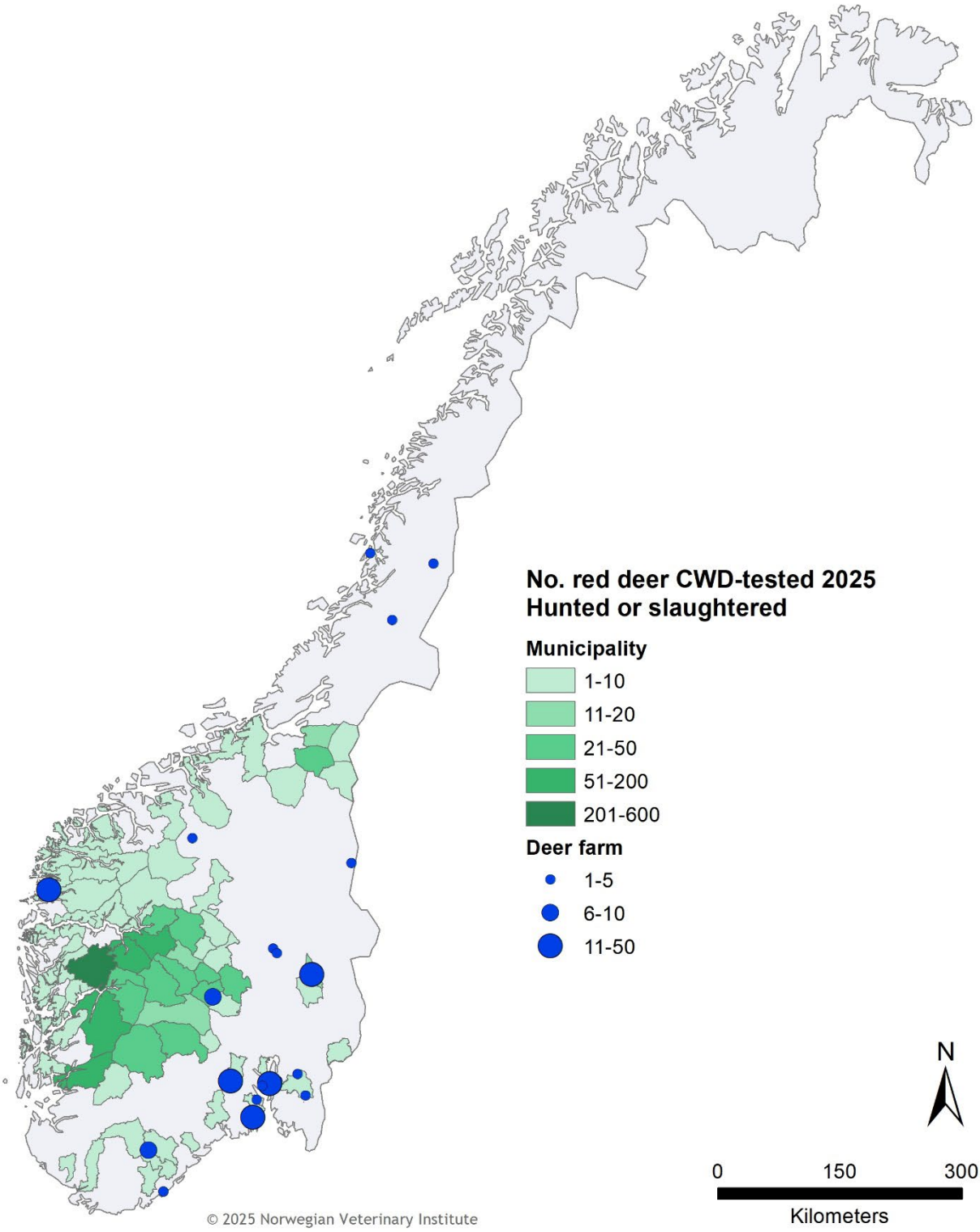

Figure 6. Number and geographical distribution of hunted free-ranging (green) and slaughtered captive (blue dots) red deer (Cervus elaphus) tested for CWD in Norway in 2025.

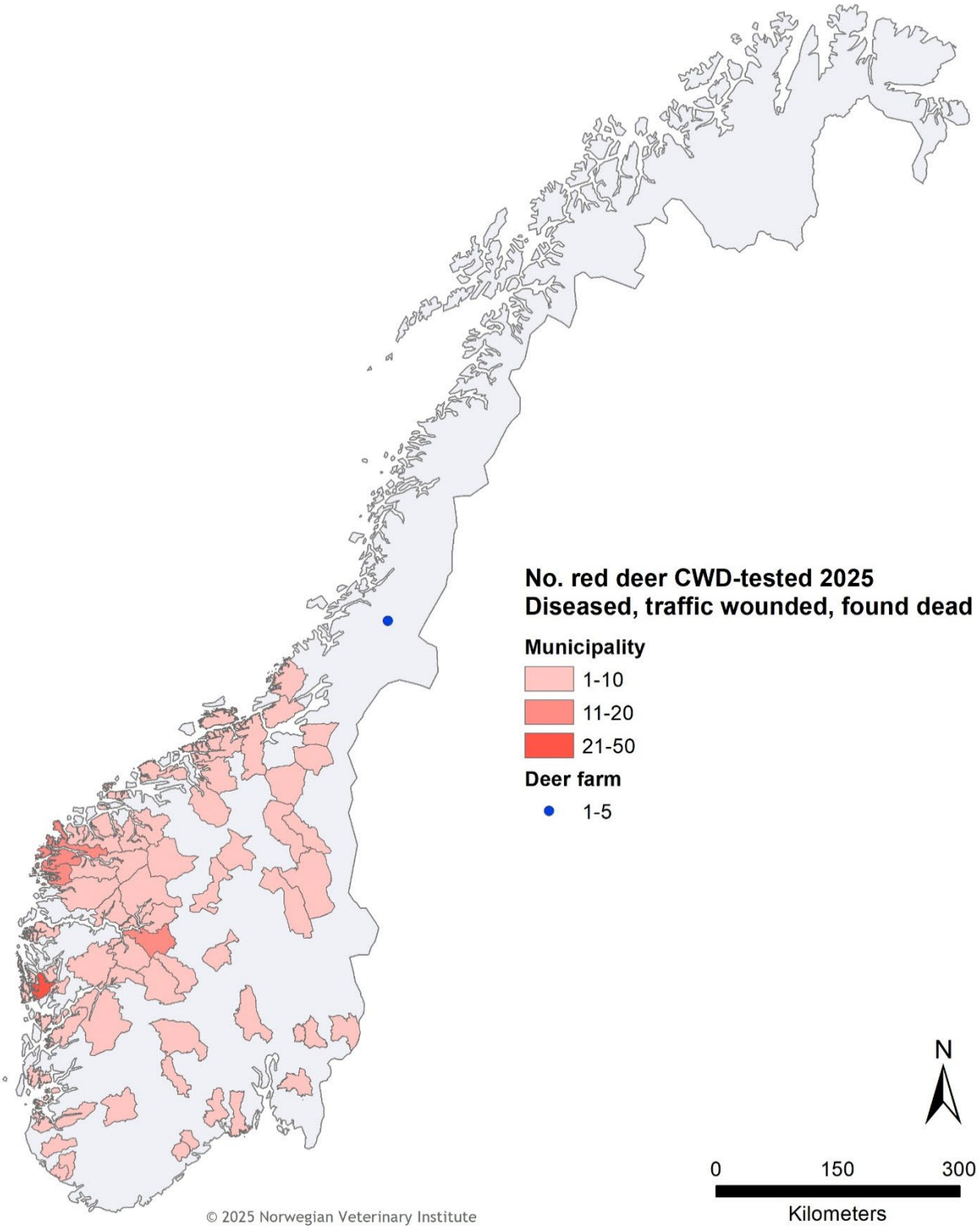

Figure 7. Number and geographical distribution of free-ranging (red) and captive (blue dots) red deer (*Cervus elaphus*) found diseased and euthanised, traffic wounded or dead and tested for CWD in Norway in 2025.

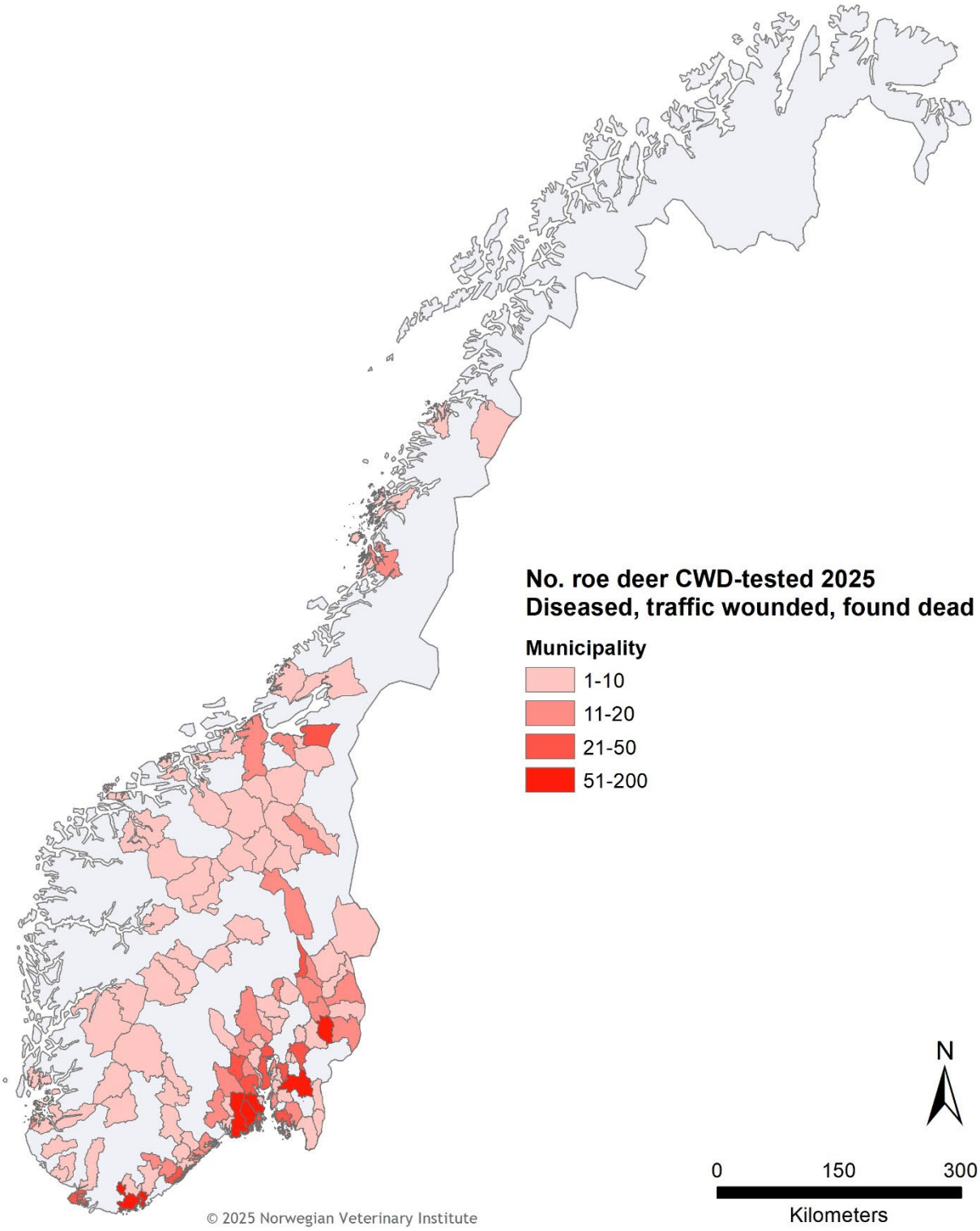

Figure 8. Number and geographical distribution of free-ranging roe deer (Capreolus capreolus) found diseased and euthanised, traffic wounded or dead and tested for CWD in Norway in 2025.

Discussion

In 2016, CWD was for the first time detected in Europe, in six free-ranging cervids in Norway. In total, the CWD testing revealed 21 reindeer, 17 moose, and three red deer with the disease in the period 2016-2025. The first 19 reindeer cases were detected within the outbreak zone 1 of Nordfjella wild reindeer management area. The affected population was culled in 2018. Two additional cases have been diagnosed in reindeer hunted at Hardangervidda in September 2020 and September 2022. This last discovery of CWD in a second reindeer area challenges the prospect of eradicating the contagious disease in the reindeer populations.

While the eradication of the Nordfjella sub-population was aimed to eliminate the local outbreak, subsequent findings have highlighted new epidemiological challenges. Hardangervidda holds the largest sub-population of wild reindeer in Europe. Compared with Nordfjella, the area is far less suitable for containment of the disease. Nevertheless, so far, no additional reindeer cases have been detected outside Nordfjella and Hardangervidda despite the testing of more than 98,000 reindeer. In the absence of additional detected cases, probabilistic modelling has therefore been applied to assess the likelihood of disease freedom across different areas. This indicates a limited infection in this species. Nevertheless, the probability of freedom as estimated using scenario tree modelling varies a lot between different wild reindeer management areas or semi-domesticated reindeer districts depending on population size and number of tested animals per area or district. From the extended surveillance of cervids, there is a confidence that CWD is not present at high prevalence (5%) in cervids in Norway [16]. For a lower prevalence (below 1%), there is less confidence. Only a few wild reindeer management areas have obtained a 95% probability of freedom for a design prevalence of 0.5% [17]. The Norwegian Veterinary Institute provide central management authorities with modelling of freedom probability in areas within restriction zones of CWD. Under the modelling assumptions of a design prevalence of 4 (i.e. that the probability of absence of CWD is calculated as the probability of finding at least one CWD-infected animal if there are 4 CWD-infected animals in the population), Hardangervidda and Nordfjella management areas have obtained 41 % and 99 % respectively, post hunting season in 2025. The reindeer district of Filefjell, with around 3000 semi-domesticated reindeer during the winter (post slaughter) and sharing (a fenced) border at summer pasture to the Nordfjella area, has obtained a high probability of freedom for a design prevalence less than 0.5 % [18]. Analysis of surveillance data from Norwegian and Swedish semi-domesticated reindeer districts used a scenario tree model, and at the national level the mean probability of disease freedom was 87.0 % in Norway by 2021 [19].

Beyond prevalence estimates, insight into disease characteristics across species is further informed by prion strain characterisation. Further research studies have shown that the strain found in reindeer is different from those of the two other cervid species. The reindeer cases were indistinguishable, in results of diagnostic test methods, from cases of CWD from North America. The positive European moose and red deer have shown characteristics of sporadic distribution [6,7,14], with no detectable prions in the lymphoid tissues using diagnostic tests, in contrast with the reindeer and cervids from North America. Although routine diagnostics primarily define these species differences, complementary research methods (PMCA) showed low detectable levels of PrP^{Sc} also in peripheral tissues [20] from moose and red deer. Inoculation studies in rodents demonstrated multiple strains among the Norwegian cases, across three species, all different from North American cases. Nevertheless, the reindeer strain has many similarities with strains isolated from cases from North America [21,22] and is expected to harbor similar epidemiological properties.

The positive CWD animals other than reindeer are 17 cases in approximately 42,000 tested moose and three cases in more than 39,000 tested red deer, indicating low levels of horizontal spreading, if any, between live animals in these species [6]. The area with the index case in moose has been subject to continuous testing within the surveillance program to reveal any possible accumulation of infection, finding no such indication. TSE in domestic animals, with Nor98 / atypical scrapie in sheep and atypical BSE in cattle, have prion strains showing similar sporadic nature. Nor98 / atypical scrapie and atypical BSE have a prevalence of about eight per 10,000 found dead (fallen stock) adult sheep and about two per 1,000,000 tested cattle, respectively. The number of tested cervids in Norway is not sufficient to estimate prevalence accurately. Consequently, a complete understanding of CWD epidemiology remains limited. For other European countries there is even much more uncertainty as the surveillance levels are still modest [7]. Taken together, the surveillance results and supporting research continue to indicate distinct epidemiological patterns of CWD among Norwegian cervid species, while underlining the need for sustained and targeted monitoring.

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