Atmospheric deposition of heavy metals in Norway

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Title - Norwegian and English

Atmosfærisk nedfall av tungmetaller over Norge, Landsomfattende moseundersøkelse 2015
Atmospheric deposition of heavy metals in Norway, National moss survey 2015

Summary - sammendrag

På oppdrag fra Miljødirektoratet har NILU-Norsk institutt for luftforskning i samarbeid med Norges teknisk-naturvitenskapelige universitet (NTNU), samlet inn mose fra 230 lokaliteter og bestemt innholdet av 53 metaller i disse. Hensikten med undersøkelsen er å kartlegge atmosfærisk nedfall av tungmetaller i Norge. Sammenliknet med data fra 2005, observeres det en nedgang i deposisjon av vanadium og bly. For krom, nikkel, kobber, sink, arsen, kadmium og antimon, er det ikke observert nevneverdig endring i deposisjon fra 2005 til 2015.

Commissioned by the Norwegian Environment Agency, NILU – Norwegian Institute for Air Research in collaboration with Norwegian University of Science and Technology (NTNU), collected moss from 230 sites and determined the content of 53 metals in these. The purpose of the survey is to map atmospheric deposition of heavy metals in Norway. Compared with data from 2005, a decrease is observed in the deposition of vanadium and lead. For chromium, nickel, copper, zinc, arsenic, cadmium and antimony, there is no appreciable change in deposition from 2005 to 2015

4 emneord

Langtransportert luftforurensing, tungmetaller, mose, deposisjon

4 subject words

Long-range atmospheric transport, heavy metals, moss, deposition

Front page photo

Hilde Th. Uggerud

Content

1. Introduction

Long-range atmospheric transport contributes still significantly to deposition of heavy metals in Norway. The geographical distribution of heavy metal deposition has been mapped in 2015 by analysing samples of moss collected from 230 localities throughout the country. This report presents the results from the Norwegian survey in 2015 and a comparison with the results from earlier surveys back to 1977. The Norwegian moss survey is part of a European research programme called "International Cooperative Programme on Effects of Air Pollution on Natural Vegetation and Crops (ICP-Vegetation)", which includes a large part on Europe. The survey primarily applies to ten elements that are prioritized in the European programme: Vanadium, chromium, iron, nickel, copper, zinc, arsenic, cadmium, mercury and lead. In addition, content of 43 other elements in moss are reported. The discussion of the individual elements is primarily focused on what is related to air pollution. Nevertheless, possible natural sources of metal content in moss and how this might influence the data interpretation is also discussed.

1.1 Previous work

Mosses generally lack a root system and therefore absorb trace elements from the atmosphere, in dissolved as well as in particulate form. This was first utilized by Swedish scientists, who showed that contents of some heavy metals in moss samples in Sweden corresponded to known geographical distributions of these metals in atmospheric deposition (Rühling & Tyler, 1971; 1973). Following this work, moss sampling was introduced in heavy metal deposition surveys in Sweden (1975), in Norway (1977), for Scandinavia (1985) and for greater parts of Europe (1995, cfr. Rühling et al., 1996; Rühling and Steinnes, 1998). Starting in 2000 a moss survey on the European level is carried out every five years (Harmens et al., 2007; 2008; 2010).

In Norway, following the 1977 survey, subsequent moss surveys have been carried out in 1985, 1990, 1995, 2000, 2005, and 2010, covering around 500 sites. The results have been documented in national reports and in numerous international publications (Steinnes, 1980; Schaug et al., 1990; Steinnes et al., 1991; Berg et al., 1995; Steinnes et al., 2009). More over a linear relation between concentration in moss and wet deposition rate has been well established for several elements (Berg et al., 1995; Berg and Steinnes, 1997b).

On the other hand, some practical limitations of the technique have been revealed and reported in the literature (Steinnes, 1995). It appears that elements that are essential nutrients in plants or have a similar behaviour may move from the current annual growth segment of moss into next year´s segment. Among the elements of priority in the moss survey, this is particularly important for Zn, where it leads to natural "background" levels of around 30 ppm, and in the case of Cu a corresponding level of about 3 ppm (Berg & Steinnes, 1994). For the remaining elements of priority in this report, this effect seems to be negligible.

Another effect to be mentioned is the competition of cations from airborne marine aerosols (Na, Mg, etc.) for exchange sites on the moss surface (Steinnes, 1995). This disturbing factor is very evident for Mn, which appears to be strongly depleted in moss samples from coastal areas, but apparently not serious for any of the priority elements discussed in this report.

1.2 Moss survey

Based on the experience from previous moss surveys in Norway, it was decided to carry out another nationwide survey in 2015. As previous surveys had shown that large parts of the country are exposed to low levels of heavy metal deposition often showing small variations within a given geographical region, the Norwegian Environment Agency decided to reduce the number of sampling sites by 50%.

2. Experimental

2.1 Sampling and sample preparation

The protocol for sampling is described in the "Heavy metals, Nitrogen and POPs in European mosses: survey 2015, Monitoring manual (ICP-Vegetation, 2015)" and is followed by all the nations that report results from their national surveys to the European survey. A list of principles for sampling in different terrain is given, such as distance from trees to avoid influence from canopy drip and not to sample in slopes with running water. However, a certain degree of flexibility is built in to take into account that there is significant variation in climate, topography, season duration and land use across Europe. During the period 1.6 – 1.9 2015 samples of Hylocomium splendens were collected at 230 sites all over mainland Norway. The sampling sites were selected among the previous 460 sampling sites used in the 1995, 2000, 2005, and 2010 moss surveys, considering existing knowledge about differences in deposition levels and gradients. Sampling sites were located at least 300 m from main roads and densely populated areas, and at least 100 m from any local road, single house, or agricultural field. At each site 5-10 sub-samples of moss were taken within an area of ca. 50m X 50m and collected in a 2-litre paper bag. Disposable polyethylene gloves were employed during sampling as well as in further sample preparation. If possible, moss sampling under the crown projection of trees was avoided. Coordinates at each site were recorded by GPS. A map showing the 2015 sampling locations is presented in Fig. 1 a).

In the laboratory the samples were air-dried on bench at room temperature and further cleaned by hand. The part of the moss corresponding to the previous three years´growth was separated for analysis.

2.2 Analysis

Digestion of moss samples was performed with a microwave technique system (UltraCLAVE, Milestone, Italy). Dry moss (0.5-0.6 g) was accurately weighed and HNO_3 (5 ml, supra pure) was added. The samples were digested according to a 65 minutes long temperature programme, with stepwise heating to 250 °C and a holding time of 30 minutes at 250 °C.

After cooling, the digests were quantitatively transferred to polypropylene tubes and diluted to 50 ml with deionized water.

For determination of metals, aliquots of 1.0 ml and 0.1 ml, respectively, were diluted to 10 ml. Rhenium at 1 ng ml^{-1} was used as internal standard.
For determination of mercury, aliquots of 25 ml were diluted to 50 ml and added 5 ml BrCl for stabilisation.

A high resolution inductively coupled plasma mass spectrometer (ICP-HRMS), ELEMENT2 from Thermo Scientific, Bremen, was used for determination of metals. All calibration standards, blank samples and reference materials contained 1%(v/v) HNO3 (s.p) and 1 ng ml^{-1} rhenium as internal standard.

A cold-vapour atomic fluorescence spectrophotometer (CV-AFS), Tekran, Canada, was used for determination of mercury.

In this way satisfactory results were obtained for 53 elements, including the 10 elements of priority in the European moss survey organized by the UN ICP Vegetation (Harmens et al. 2007).

The moss reference samples M-2 and M-3 prepared and distributed by the Finnish Forest Research were used to assess the accuracy of the results. Moss material in sample M-2 is collected in the vicinity of a metal smelter, while the moss material in M-3 is sampled in a forest to represent background levels. Based on an international intercomparison of results (Steinnes et al., 1997) recommended values exist for all 10 elements of priority in the moss survey as well as many other elements. The values obtained for M-2 and M-3 in 2015 are generally in good agreement with corresponding reference values where available (Table A.1).

The statistical methods used is Mann-Kendall test (Gilbert, 1987) and Sen's method. The Mann-Kendall test is widely used to assess trends in datasets where variables are not normally distributed. The Sen's slope estimate is used to calculate the trend lines shown in figures 13-17. The Mann-Kendall test is used to indicate significance level of these trends. Software used for the calculations is MAKESENSE (Salmi et al., 2001).

3. Results

In addition to the ten elements of priority (V, Cr, Fe, Ni, Cu, Zn, As, Cd, Hg, Pb) results for additional 43 elements are reported (Table A.2). Not all of these elements occur in the moss only because of atmospheric deposition (Steinnes, 1995), but many of them may have the atmosphere as the primary source. In Table A.3 selected median values from the present survey are compared with corresponding values from the moss surveys in 2005, 1995, 1985, and 1977. Colour maps showing the geographical distributions of the ten priority elements in the different sampling years considered are presented in Figs. 2-12.

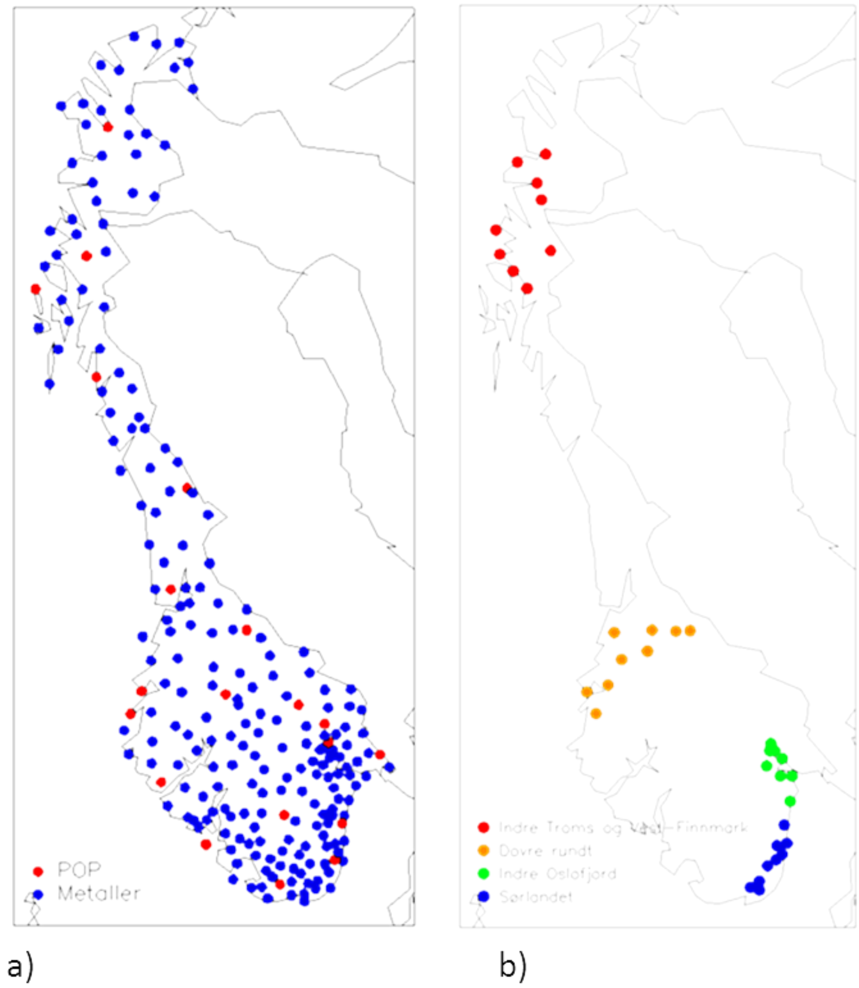


Figure 1 a) Site map b) Location of sampling sites selected for discussion of temporal trends in areas with respectively higher (Sørlandet/Indre Oslofjord) and lower (Dove rundt/Indre Tromsø Vest Finnmark) metal deposition than average

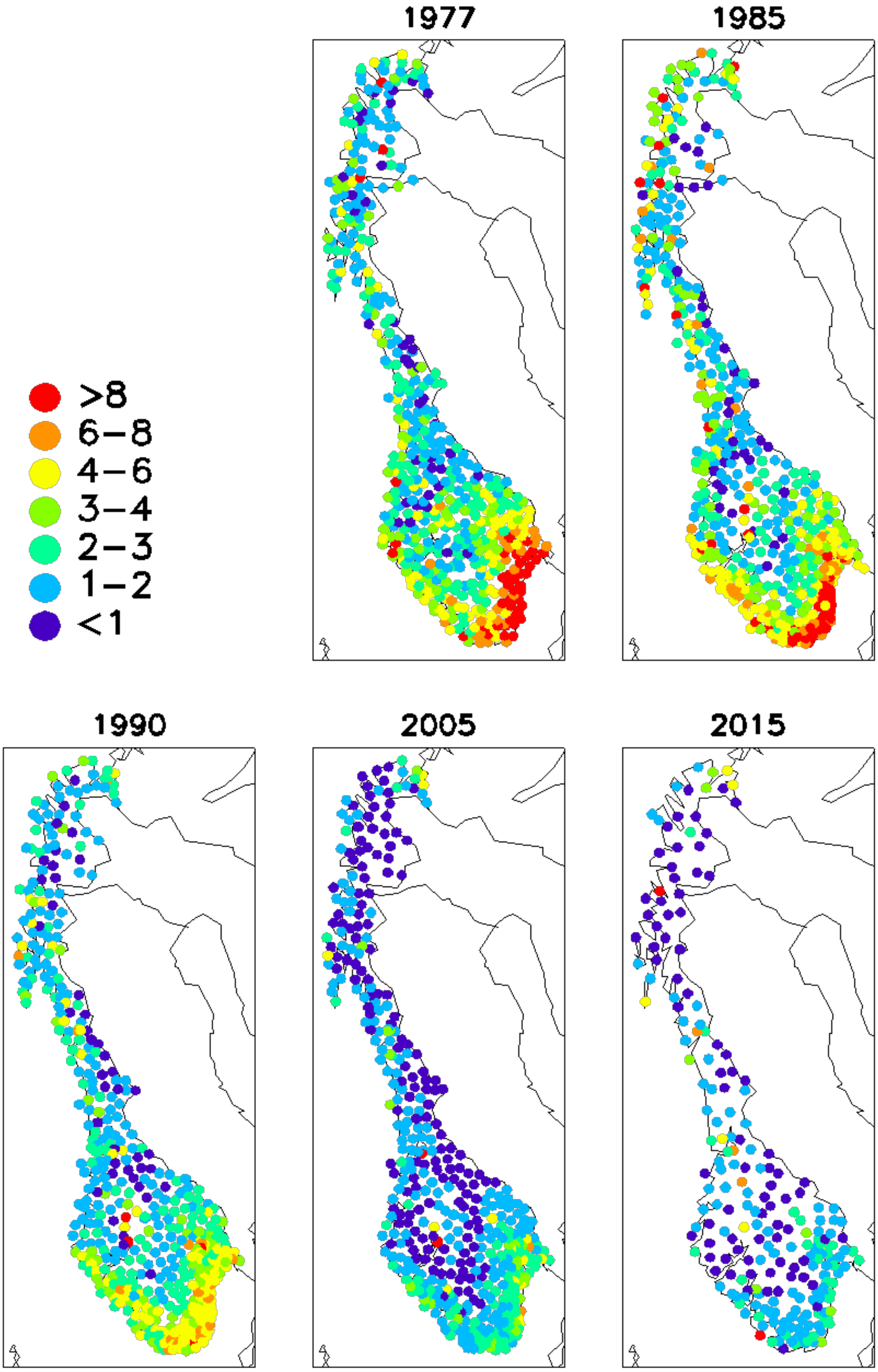


*Figure 2 Concentration of **vanadium** in moss in Norway (mg kg^{-1}) at five different years in the time period 1977 - 2015. The colour scheme applies to all maps.*

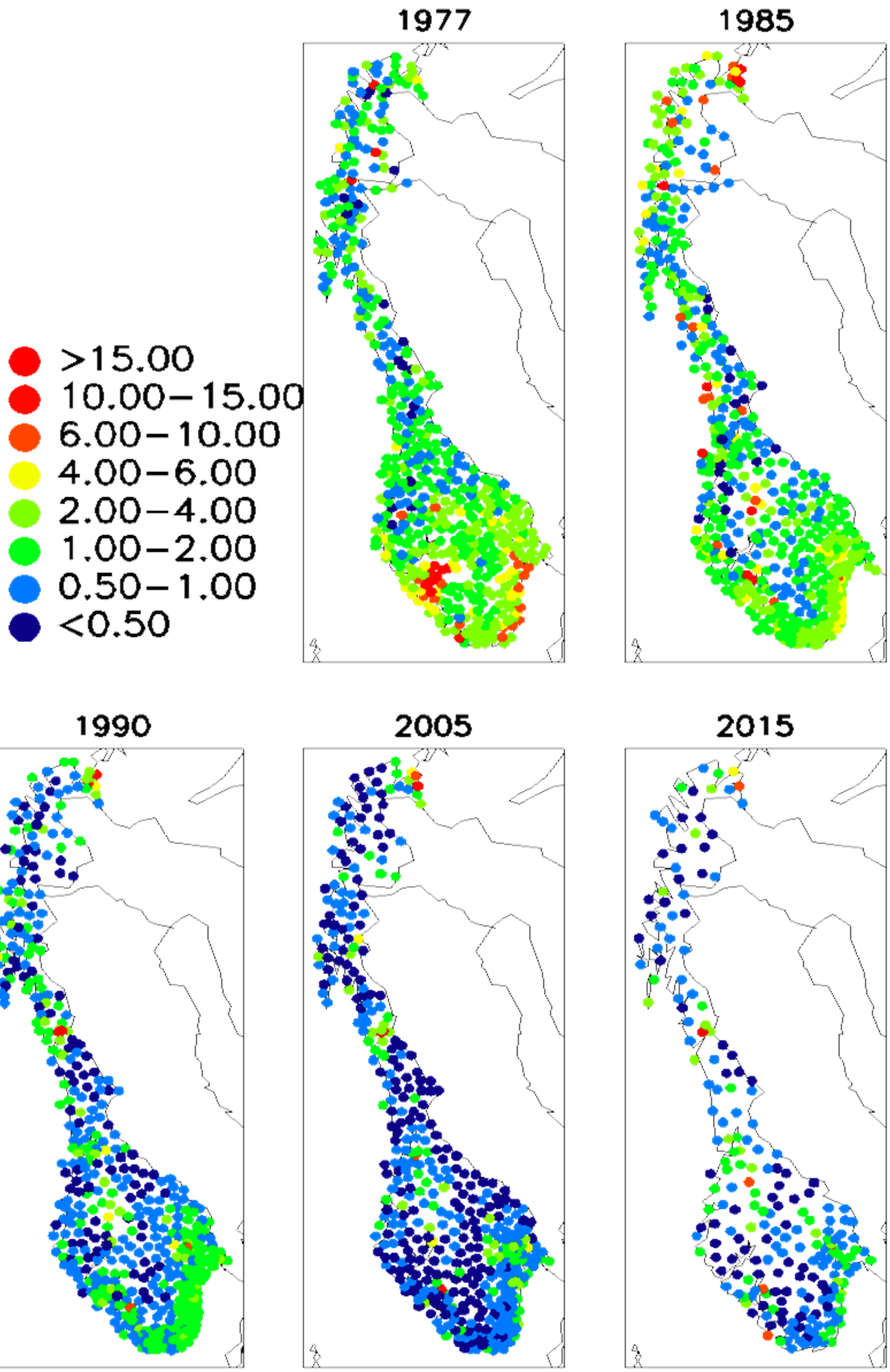


*Figure 3 Concentration of **chromium** in moss in Norway (mg kg^{-1}) at five different years in the time period 1977-2015. The colour scheme applies to all maps.*

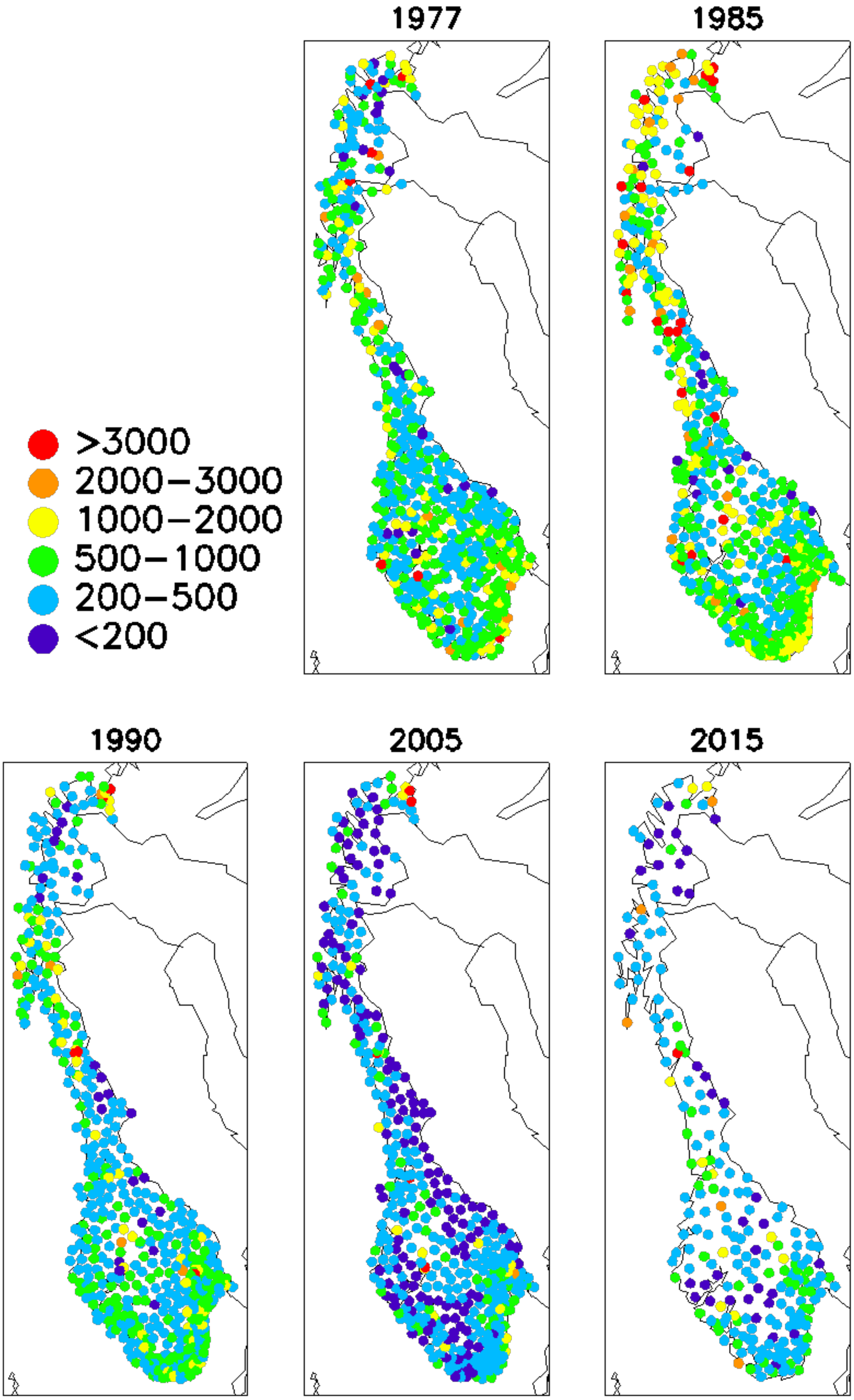


*Figure 4 Concentration of **iron** in moss in Norway (mg kg^{-1}) at five different years in the time period 1977-2015. The colour scheme applies to all maps.*

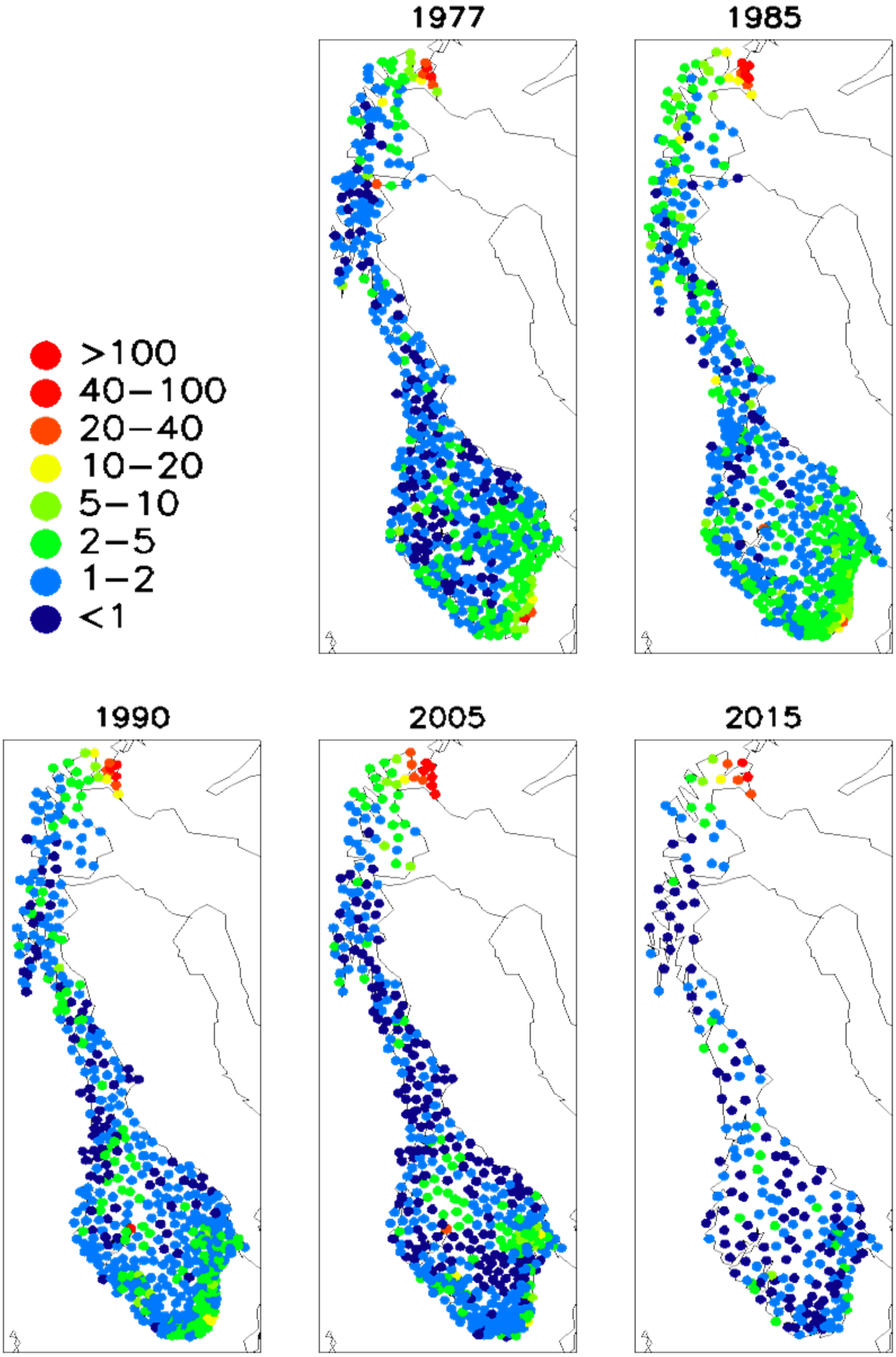


*Figure 5 Concentration of **nickel** in moss in Norway (mg kg^{-1}) at five different years in the time period 1977-2015. The colour scheme applies to all maps.*

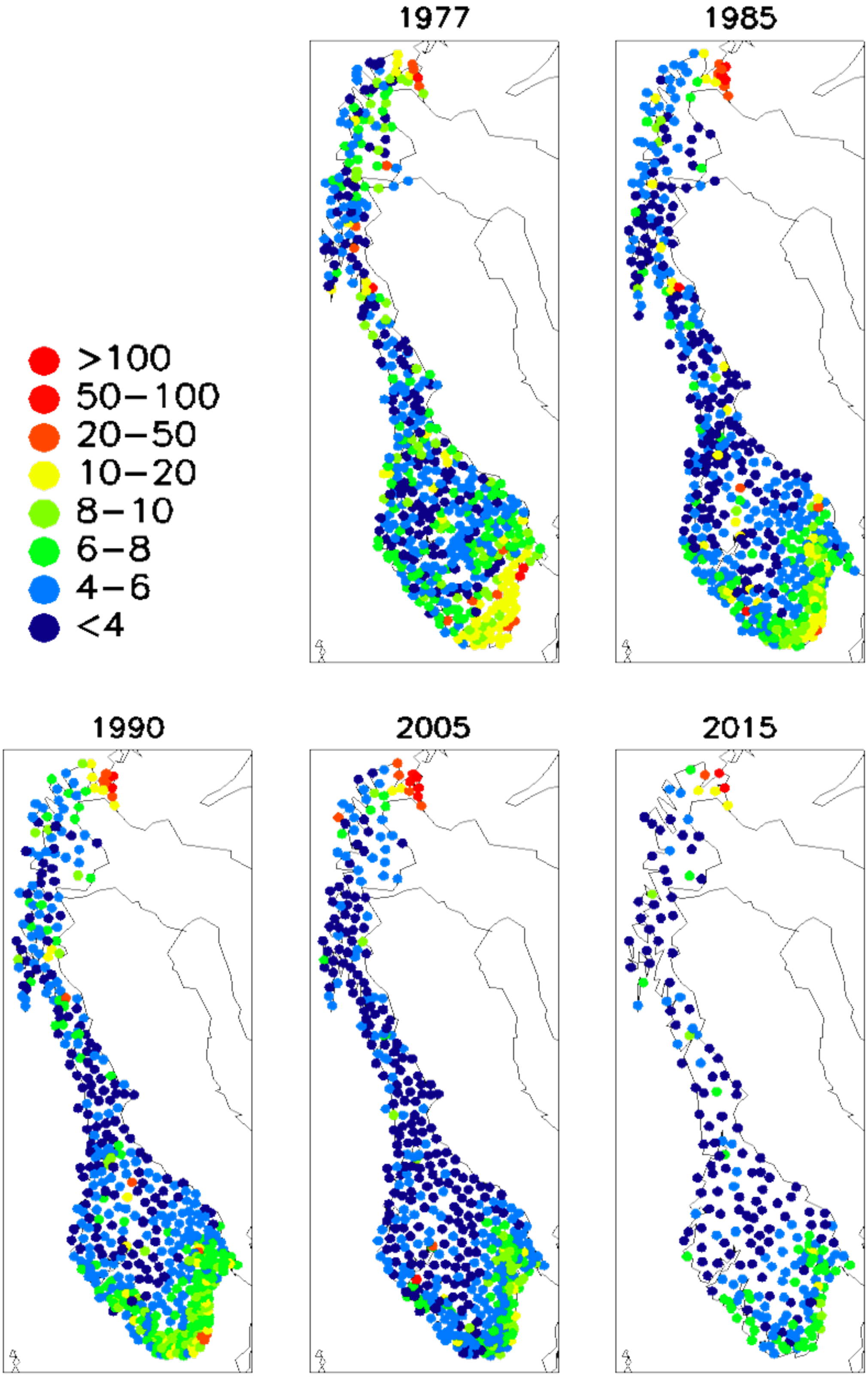


*Figure 6 Concentration of **copper** in moss in Norway (mg kg^{-1}) at five different years in the time period 1977-2015. The colour scheme applies to all maps.*

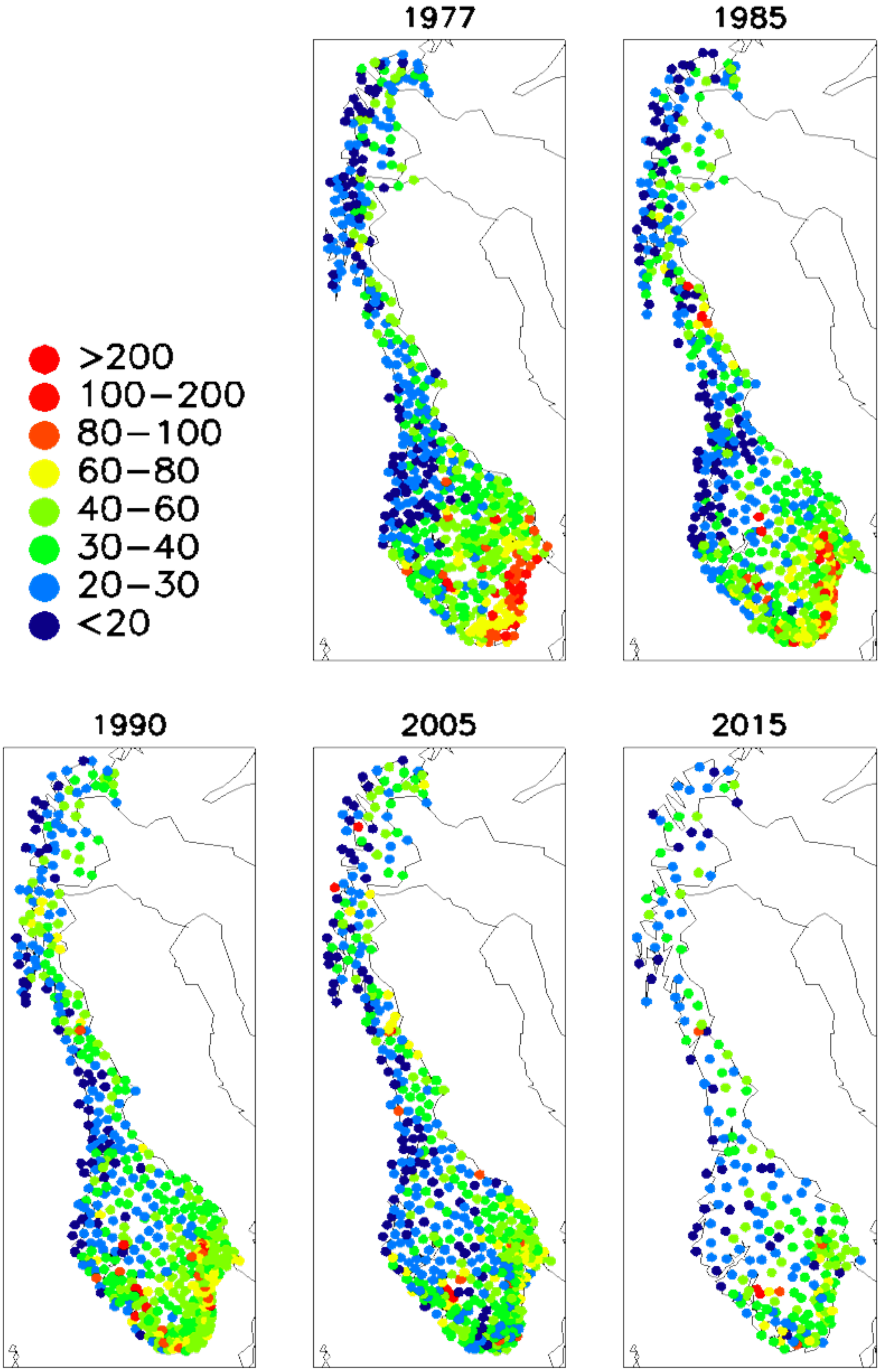


*Figure 7 Concentration of **zinc** in moss in Norway (mg kg^{-1}) at five different years in the time period 1977-2015. The colour scheme applies to all maps.*

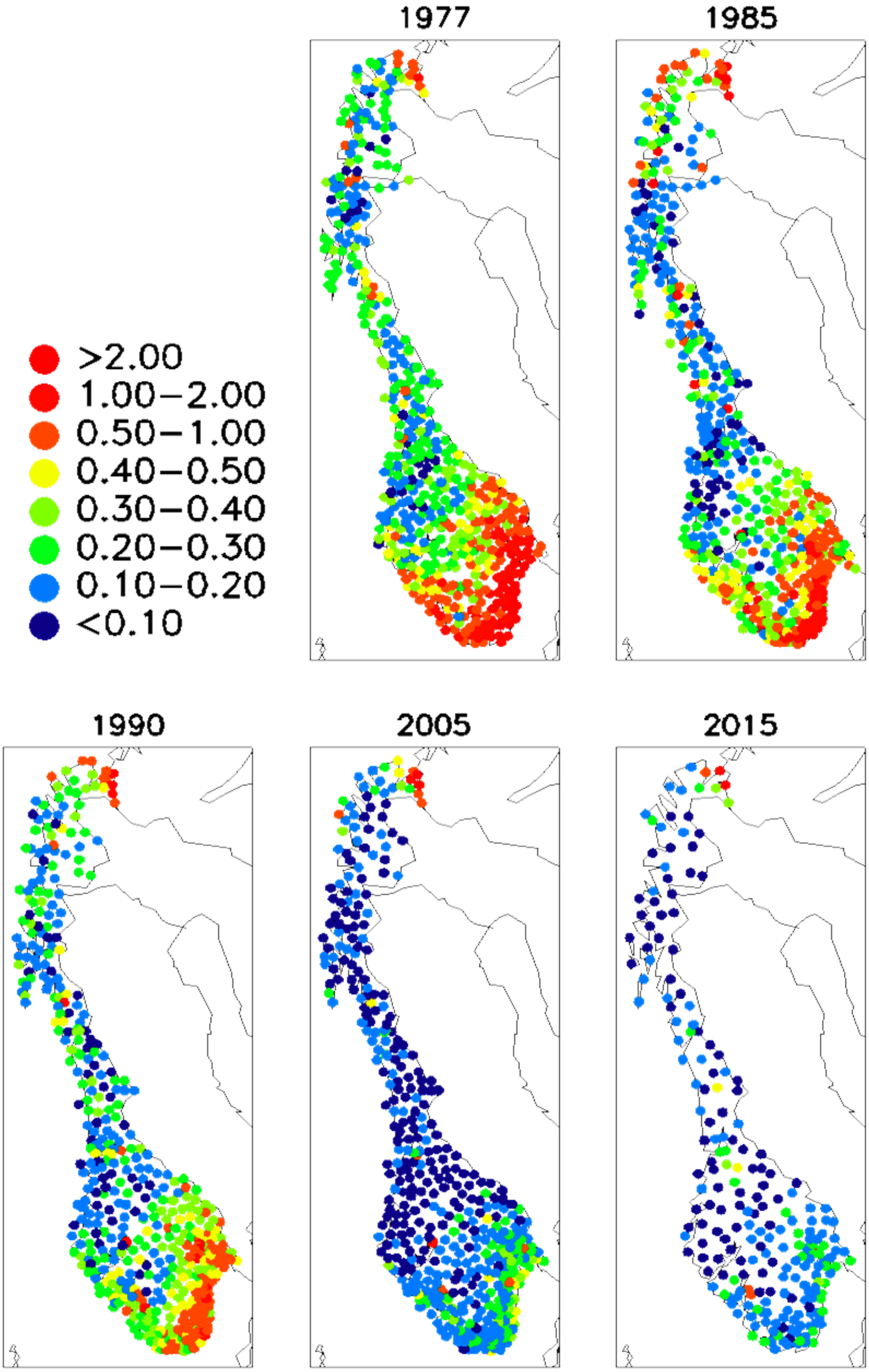


*Figure 8 Concentration of **arsenic** in moss in Norway (mg kg^{-1}) at five different years in the time period 1977-2015. The colour scheme applies to all maps.*

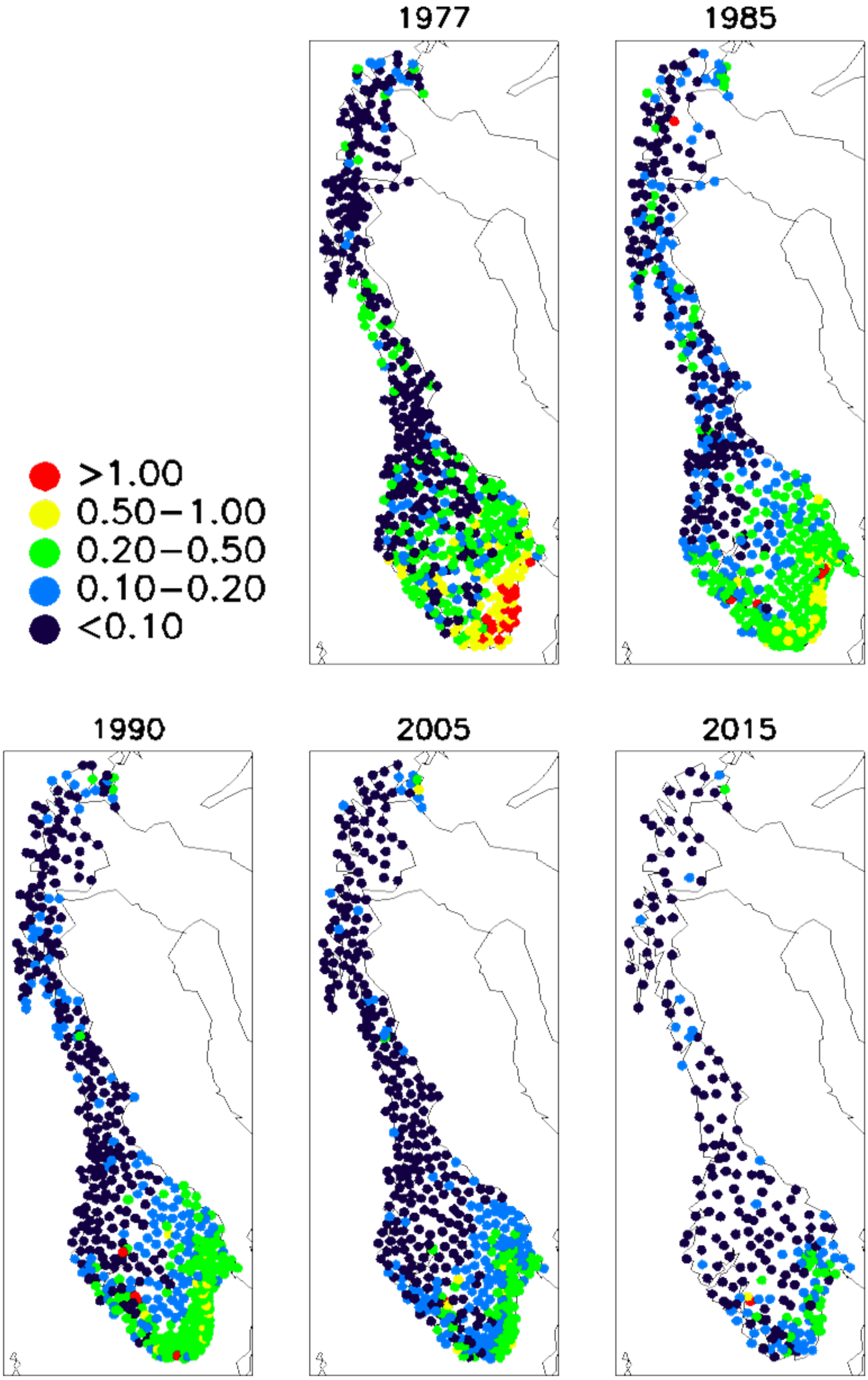


*Figure 9 Concentration of **cadmium** in moss in Norway (mg kg^{-1}) at five different years in the time period 1977-2015. The colour scheme applies to all maps.*

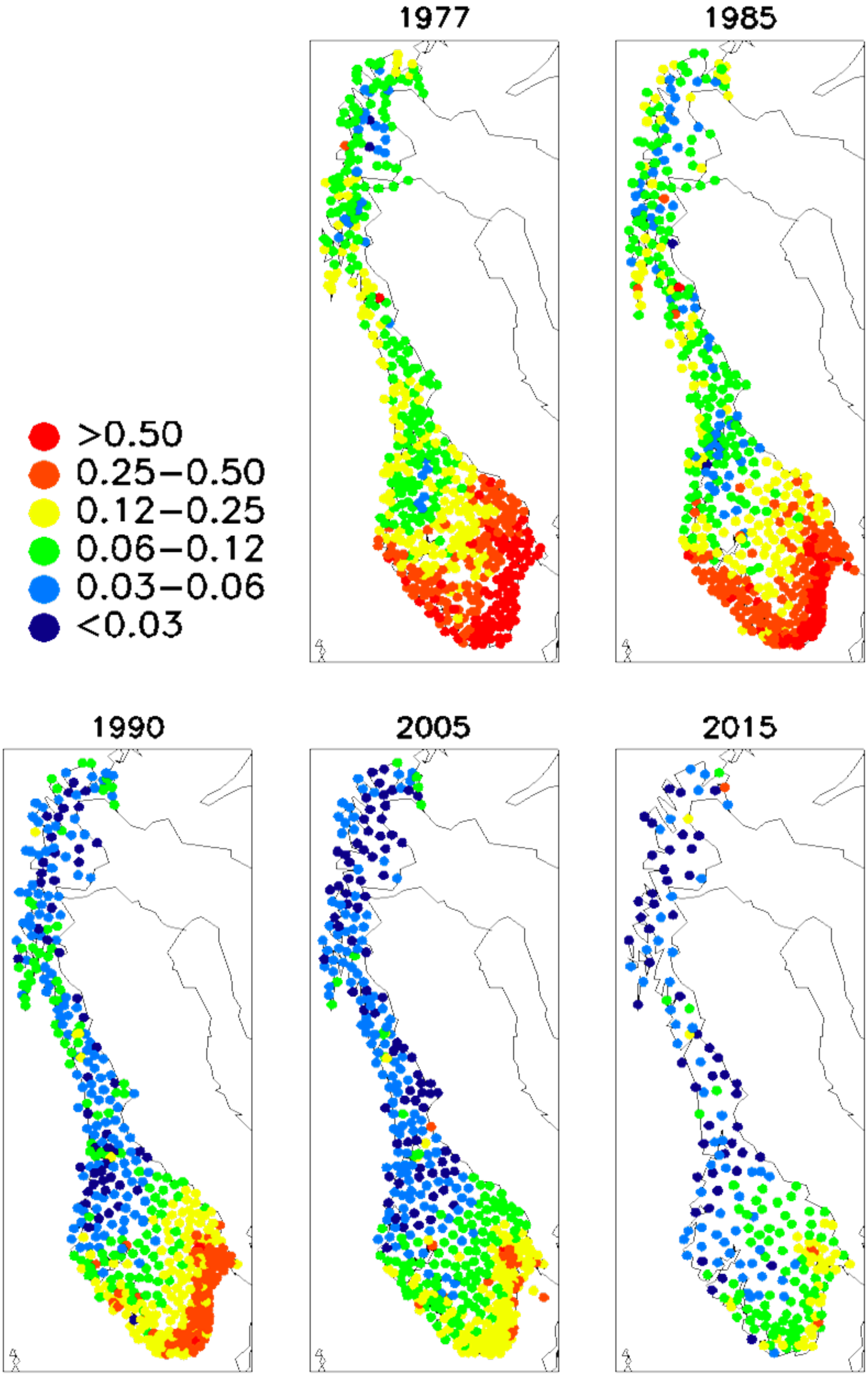


Figure 10 Concentration of ***antimony*** *in moss in Norway (mg kg^{-1}) at five different years in the time period 1977-2015. The colour scheme applies to all maps.*

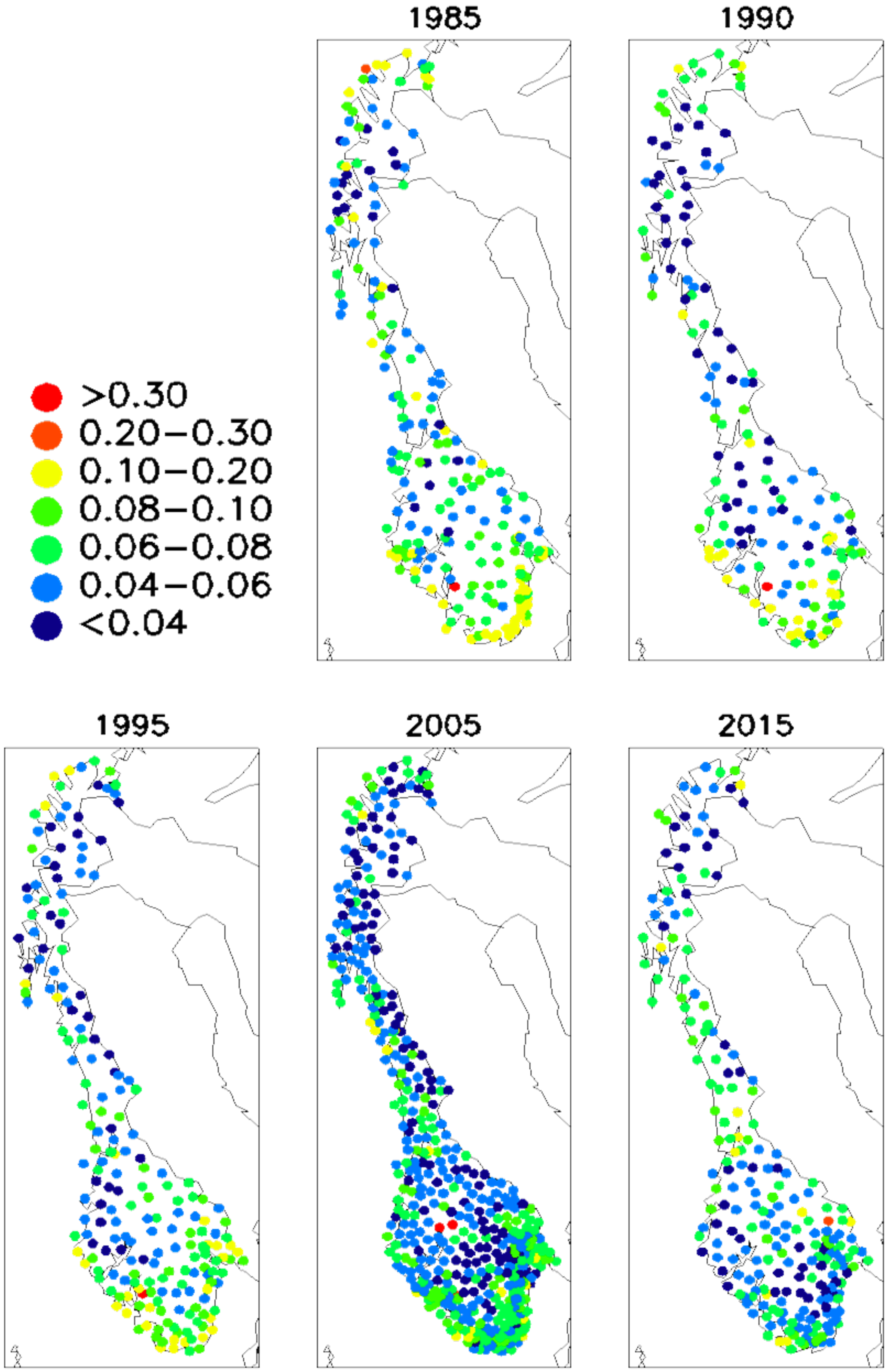


*Figure 11 Concentration of **mercury** in moss in Norway (mg kg^{-1}) at five different years in the time period 1977-2015. The colour scheme applies to all maps.*

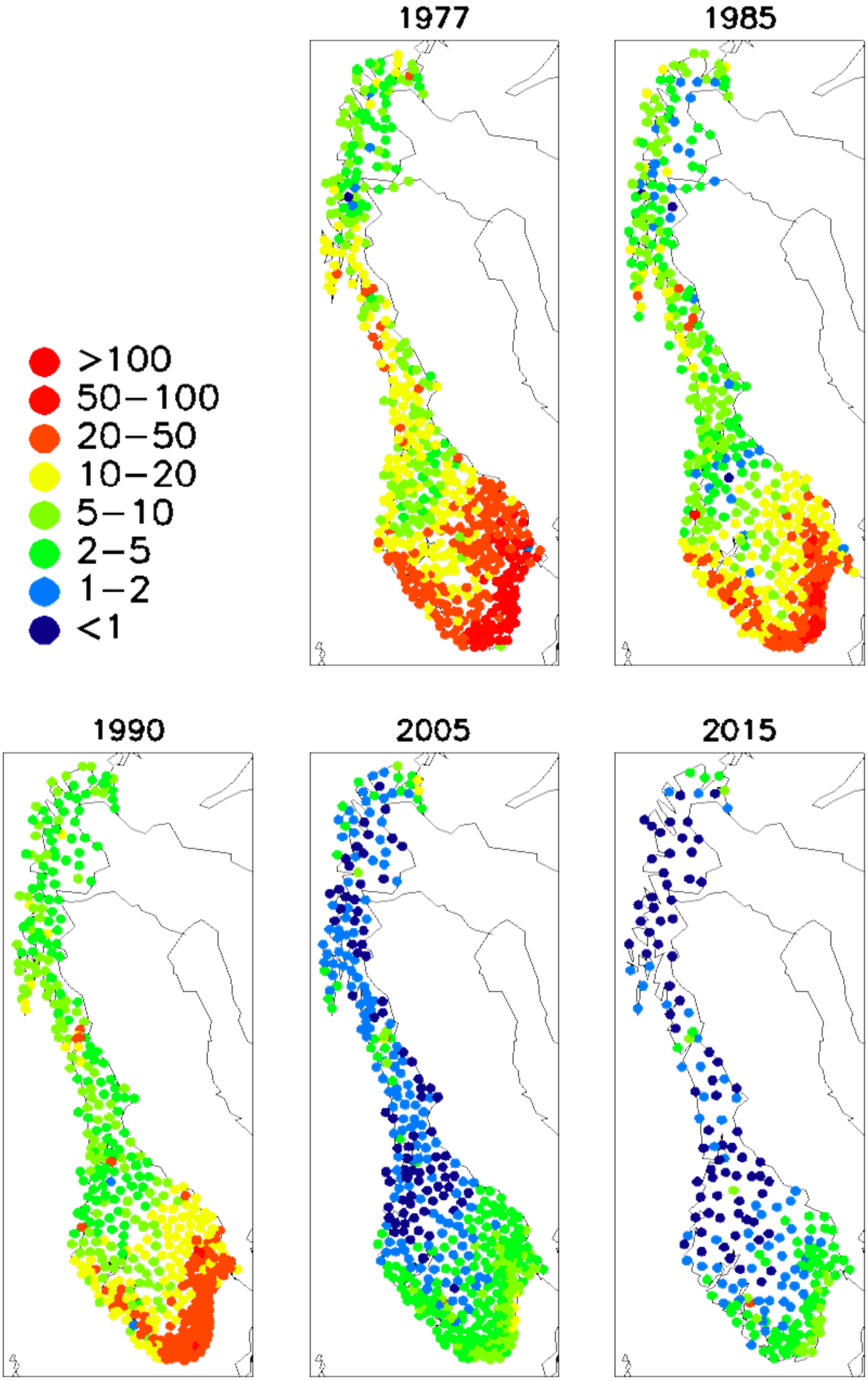


Figure 12 Concentration on ***lead*** *in moss in Norway (mg kg*$^{-1}$*) at five different years in the time period 1977-2015. The colour scheme applies to all maps.*

Moss data from more than 40 years of moss surveys reveal four regions that stands out compared to the rest of the country. From the maps it appears that several elements show the highest relative levels in two specific areas at all times, one in the far south where the contribution from long-range atmospheric transport is higher than elsewhere in Norway, and another around the inner part of the Oslo fjord where the population density in Norway is highest. Ten sampling sites in each of these areas sampled in every moss survey since 1977 were selected for a closer study of temporal trends in atmospheric deposition. These sites are marked on the map in Fig. 1 b) and their coordinates are listed in Table A.4. Blue Colour: Sørlandet. Green Colour: Oslofjord area. Contrary there are two areas where the influence of air pollution appears to be particularly low at all monitoring times: Dovre region in mid Norway and Indre Troms/Vest-Finnmark in the north. Mean values of the priority elements in the four selected areas at different times are shown in table A.5. Time trends for some elements are shown in Fig. 13-17.

Concentration of the ten priority elements in moss from each sampling location is given in Table A.6, which also includes the coordinates of the sampling sites.

4. Discussion

Temporal trends for mean concentrations of priority elements in selected areas are shown in figures 13-17.

4.1 General trends

Concentrations of elements in moss do not depend only on atmospheric deposition of pollutants from local and more distant sources (Steinnes, 1995). The following natural sources may also contribute to the observed results:

- Natural cyclic processes, in particular long-range atmospheric transport of substances from the marine environment.
- Root uptake in higher plants and transfer to the moss e.g. through leaching of elements from living or dead plant material.
- Mineral particles released to the air e.g. from wind erosion of local soil.
- Uptake from the ground in periods where the ground is covered with water.

Some elements are essential to the moss plant, e.g. Zn. Essential elements or other elements with similar chemical behaviour may be transferred from one annual growth segment to the next, and thus contribute to a natural background level of the element in the moss.

All this means that there will always be a certain background level of all naturally occurring elements in moss samples. This level may vary among sampling sites depending on the above processes. In spite of this it is normally quite simple to identify the additional contributions from air pollution. Experience from previous surveys employing multivariate statistics on the moss data (e.g. Schaug et al., 1990; Berg et al., 1995a) identifies relatively higher levels of metals such as V, Zn, As, Cd, Sb, and Pb in areas subject to long-range atmospheric transport of Pollutants from other parts of Europe (cfr. Figs. 2, 7, 8, 9, 10, 12). Mo, Ag, Tl, and Bi also belong to this group of elements. The content of Hg in moss is most probably related to air pollution (Steinnes et al., 2003), but in this case the deposition is more evenly distributed geographically, indicating a substantial contribution from Hg^0, which is evenly distributed in air over the Northern Hemisphere. The geographical distribution of elements such as Cr, Ni, Cu, and to a lesser extent V, Fe, Co, Zn, As, Cd, and Hg are to some extent influenced by deposition from industrial point sources (Steinnes et al, 2011).

For many elements, geographical distributions with no connection to air pollution are observed. Distributions of Mg and Sr show geographical patterns indicating marine aerosols as an important source. Supply to the moss via direct uptake from the soil solution or via uptake in higher plants and subsequent transfer to the moss appears to be dominating for Mn and probably important also for Mg, Ca, Zn, Rb, and Cs. It also appears to play a role for Cu and possibly for Cd. Contribution from wind erosion of natural mineral material (agricultural fields, gravel roads, etc.), is assumed to be a generally dominant source for Li, Al, Ga, Y, lanthanides, Th, and U, and outside influence areas for local pollution sources also for V, Cr, Fe, and Co (Berg et al., 1995a). This factor is probably also important for elements not already mentioned, such as Be, Ti, Zr, Nb, Hf, Ta, and W.

Notably, the levels in moss of some elements assumed to be of local geogenic origin (e.g. Al) have also declined regularly over the period since the first moss survey in Norway, whereas the elements assumed to be supplied to the moss mainly via higher plants (Mg, Ca, Mn, Rb) have not shown a similar decline in the moss samples. This may indicate that the first mentioned group is also supplied from sources not related to local geochemistry, e.g. long-range transport of fly ash particles from coal combustion. This assumption was supported by an investigation of moss samples collected respectively in 1977 and 2005 at the same sites in south Norway using electron microscopy combined with x-ray microanalysis (Weinbruch et al., 2010), where spheric microparticles were observed. These particles most probably originating from high-temperature processes such as coal combustion were much less abundant in the 2005 moss samples.

4.2 Discussion of elements clearly related to air pollution

In the following is a more specific discussion of elements in moss either dominated by long-range transport or known to be released in significant amounts from domestic sources of air pollution. A more detailed discussion of metal pollution from Norwegian industries is available elsewhere (Steinnes et al., 2011).

4.2.1 Vanadium (V)

Deposition of V from long-range transport has decreased to about 20% of the 1977 value in Sørlandet, and Oslofjord area. The 2015 levels are about 70% of corresponding values in 2005.

4.2.2 Chromium (Cr)

Deposition of Cr from long-range transport has decreased to about 20% of the 1977 value in Sørlandet and 35 % in Oslofjord area. 2015 levels are similar to those in 2005.

4.2.3 Nickel (Ni)
Deposition of Ni in Sørlandet decreased by a factor of 5 from 1977 to 2005, presumably because of reduced emissions from a nickel smelter in Kristiansand. For comparison the Ni level in Oslofjord area was stable during the period, at about 30% of the 1977 level in Sørlandet. No appreciable change was observed from 2005 to 2015, and presently the highest level is observed in the Oslofjord area.

4.2.4 Copper (Cu)
Copper is an essential element in moss, and a baseline level of about 3 ppm must be subtracted from the observed values before evaluating the contribution from atmospheric deposition (Berg & Steinnes, 1994). The excess Cu level has stayed constant over time in the Oslofjord area. In Sørlandet Cu deposition decreased by 50% until 2005 to reach a similar level as in the Oslofjord area.

4.2.5 Zinc (Zn)
The current level of 20-30 ppm Zn in the low deposition area may reflect a baseline value (Berg & Steinnes, 1994) because Zn is an essential element in moss. Considering the excess Zn amount the 2005 values have decreased to about 50% of the 1977 level and stayed constant from 2005 to 2015, indicating that there is still atmospheric deposition of Zn from transboundary transport.

4.2.6 Arsenic (As)
Deposition in Sørlandet, mainly from long-range transport, decreased by almost a factor of 10 from 1977 to 2005, and is currently at the 2005 level. In Oslofjord area the 1977 As level was about half of the value in Sørlandet, but in 2005 same level was observed in the two areas. No appreciable change was observed from 2005 to 2015.

4.2.7 Cadmium (Cd)
The present Cd level in Sørlandet is about 20% of the 1977 value, but still 5 times higher than in the low-deposition areas. In Oslofjord area the current level is similar to the Sørlandet value, and about 50% of the 1977 level. No appreciable changes in Cd levels were observed during the period 2005-2015.

4.2.8 Antimony (Sb)
The contribution from long-range transport has decreased appreciably all over the country. In Sørlandet the 2005 value was about 15% of the 1977 level. In the Oslofjord area the 2005 level was slightly higher than in Sørlandet, and about 40% of the corresponding 1977 value. The 2015 values were similar to those from 2005. At present the main source of Sb in air is presumably automobile traffic (brake linings) – in Norway and elsewhere.

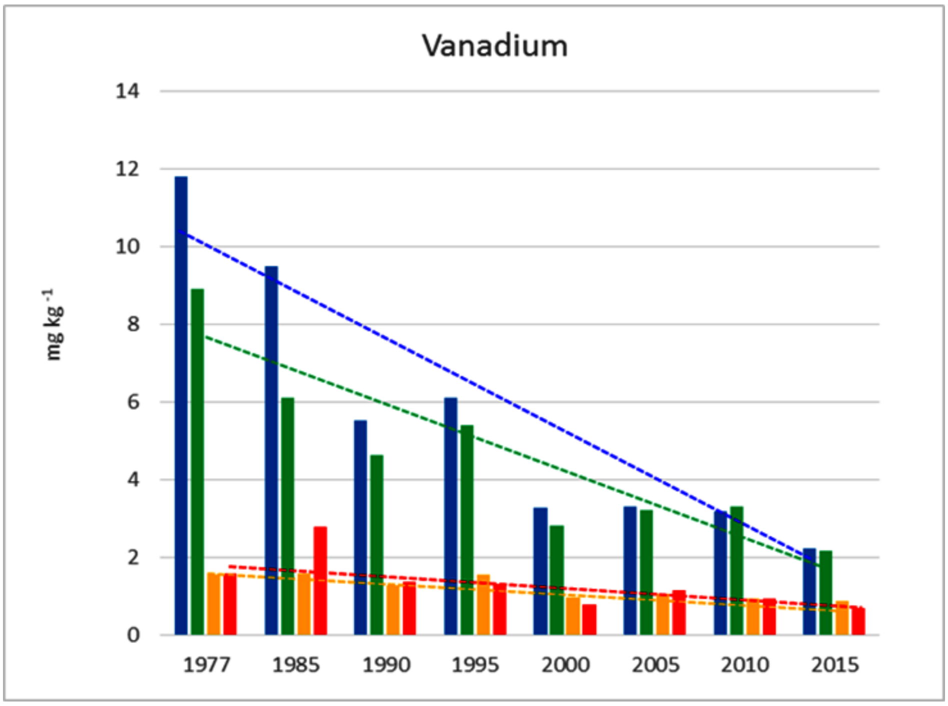
4.2.9 Mercury (Hg)
Levels of Hg in moss show little variation with time as well as geographically. This confirms experience from previous moss surveys in Norway. The main reason for this even distribution may be that the main source is deposition of Hg^0 from the hemispheric pool, (Steinnes et al., 2003), where the residence time of Hg is around one year.

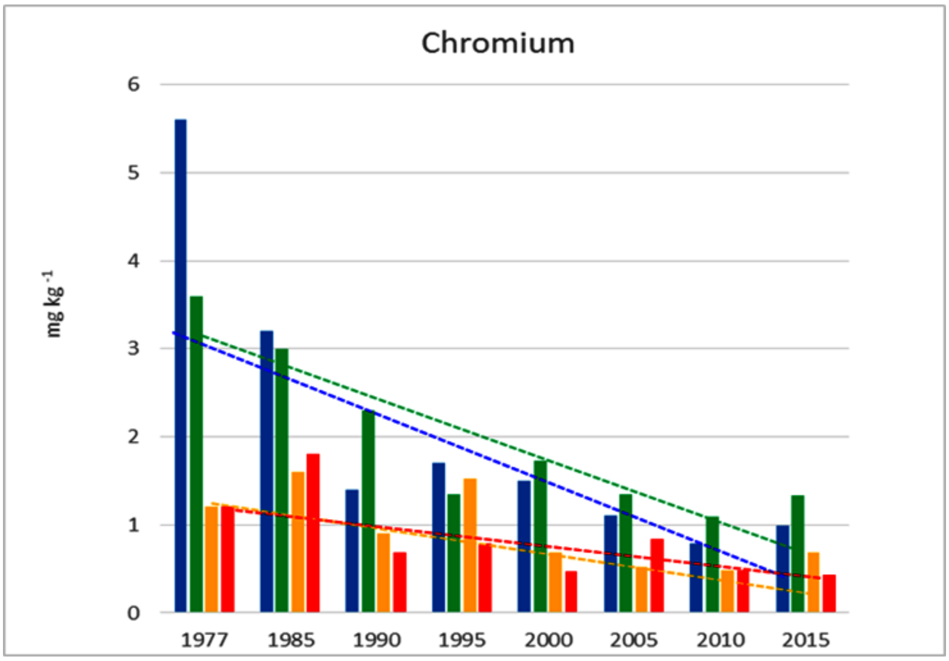
4.2.10 Lead (Pb)
There has been a substantial decrease of Pb deposition all over Norway since 1977, mainly because of the international and domestic facing out of leaded gasoline. The 2005 levels in moss was about 5% of the 1977 level in Sørlandet, 10% in Oslofjord area, and 10-15% in the background areas. Further decline is observed from 2005 to 2015. The Mann-Kendall test

indicates that level of significance for the declining trends is high (0.001) for all four regions. In fig 17 Sen's slope estimates are calculated from 1990 when lead no longer was added to petrol in Norway and Western Europe.
By using regression equations (Berg and Steinnes, 1997), moss concentrations are converted to deposition rates. Through the national survey on Long Range transported air pollution-atmospheric supply, metals in precipitation are measured at 5 different locations in mainland Norway. The observatory at Birkenes is a representative measurement site for Sørlandet. Average deposition rates for lead from year 2012-2014 at Birkenes correlates well with average lead concentration in moss obtained from Sørlandet in 2015. High correlation between lead concentration in moss and deposition rates is also evident for Indre Oslofjord and Hurdal, even though Hurdal is not a particularly representative measurement site for the region Indre Oslofjord.

4.2.11 Other elements

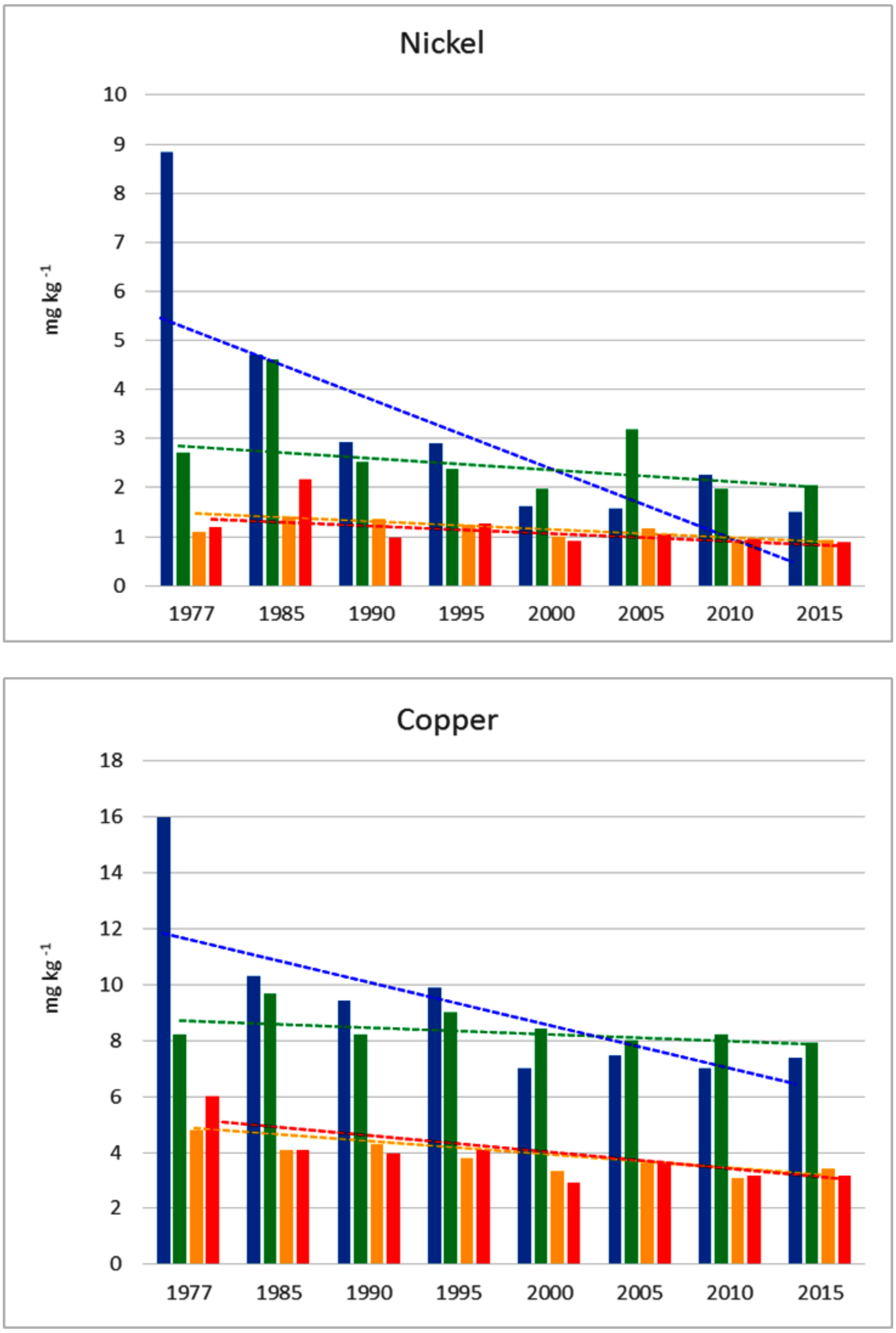
Among the additional elements determined in 2015 are Ag, Tl, and Bi associated with long-range atmospheric transport and partly to releases from local sources, but the levels are generally low. The remaining elements reported are present in the moss samples mainly because of natural processes, cfr. discussion in 4.1.





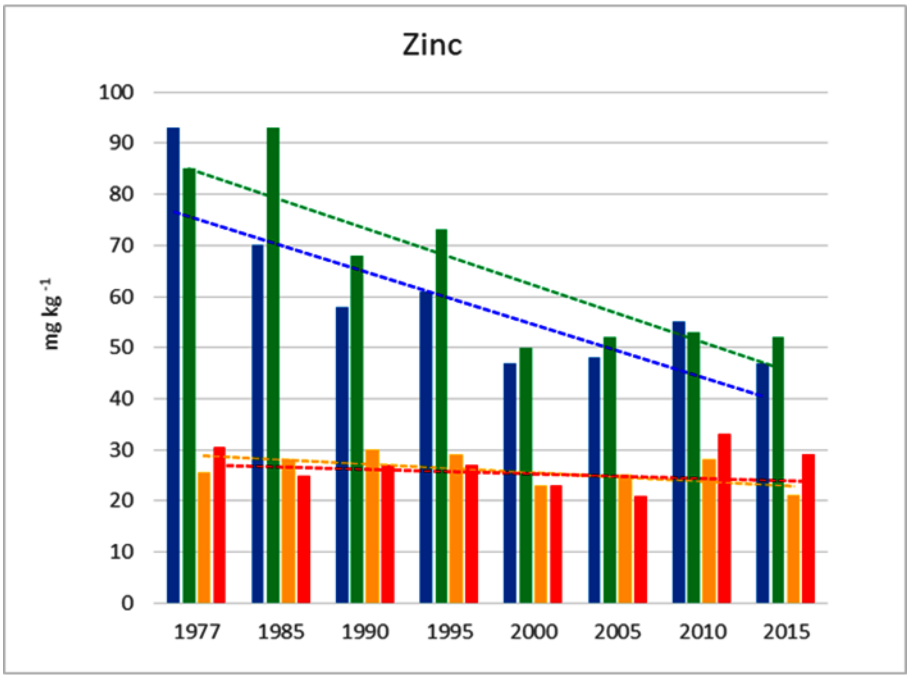
Level of significance	V	Cr
Sørlandet	0.01	0.01
Indre Oslofjord	0.05	0.01
Dovre rundt	0.05	0.1
Indre Troms/vest-Finnmark	0.01	0.1

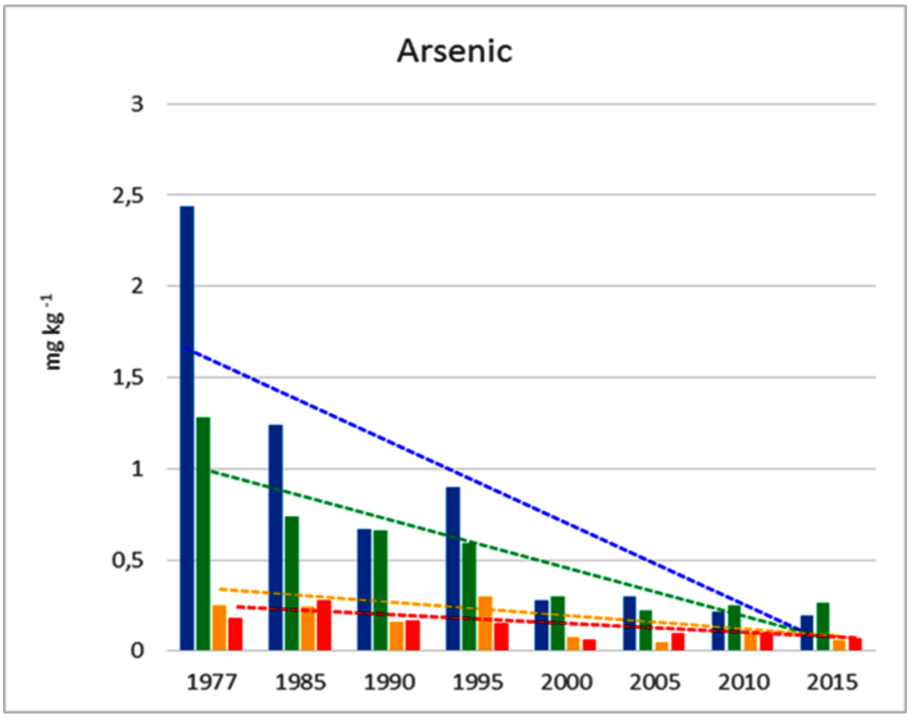
Figure 13 Mean values for vanadium and chromium in moss from selected regions, given for moss survey from 1977-2015. Trend lines and level of significance are included.



Level of significance	Ni	Cu
Sørlandet	0.01	0.05
Indre Oslofjord	> 0.1	> 0.1
Dovre rundt	0.1	0.05
Indre Troms/vest-Finnmark	0.1	0.05

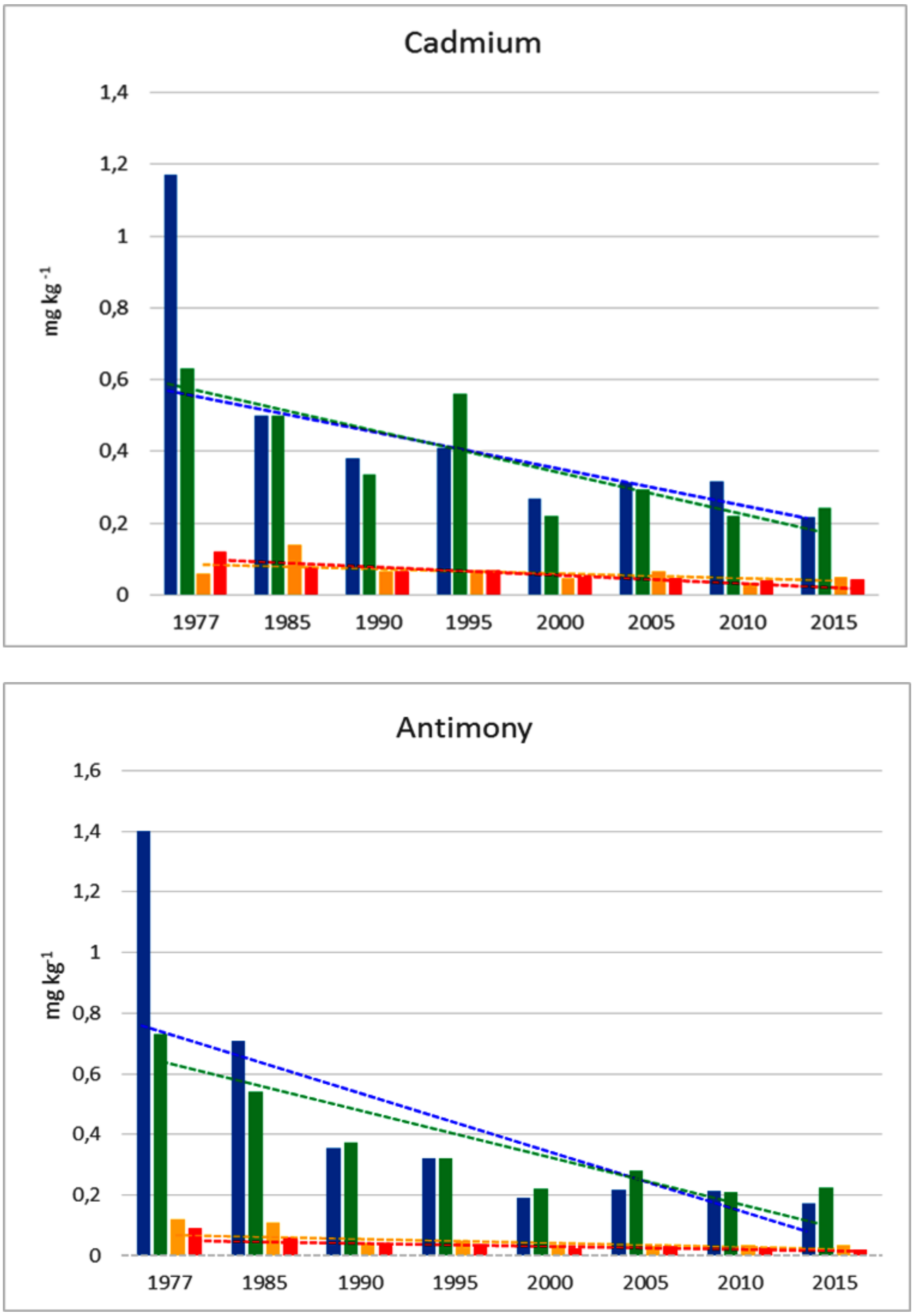
Figure 14 Mean values for nickel and copper in moss from selected regions, given for moss surveys from 1977-2015. Trend lines and level of significance are included.





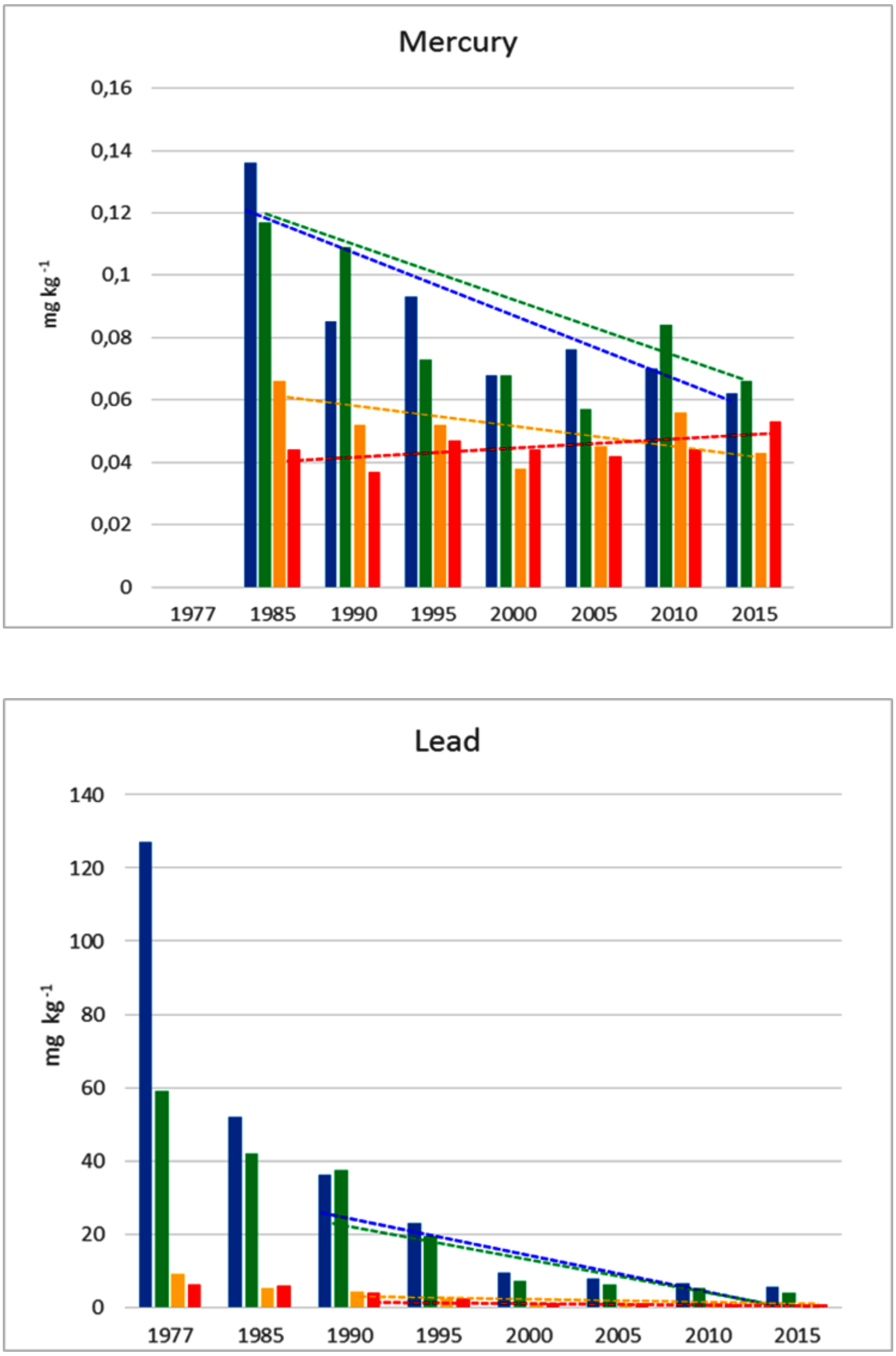
Level of significance	Zn	As
Sørlandet	0.05	0.01
Indre Oslofjord	> 0.1	0.01
Dovre rundt	> 0.1	0.05
Indre Troms/vest-Finnmark	> 0.1	0.1

Figure 15 Mean values for zinc and arsenic in moss from selected regions, given for moss surveys from 1977-2015. Trend lines and level and significance are included.



Level of significance	Cd	Sb
Sørlandet	0.05	0.01
Indre Oslofjord	0.1	0.01
Dovre rundt	> 0.1	0.1
Indre Troms/vest-Finnmark	0.01	0.01

Figure 16 Mean values for cadmium and antimony in moss from selected regions, given for moss surveys from 1977-2015. Trend lines and level of significance are included.



Level of significance	Hg	Pb-1990
Sørlandet	0.05	0.01
Indre Oslofjord	0.1	0.01
Dovre rundt	> 0.1	0.01
Indre Troms/vest-Finnmark	> 0.1	0.01

Figure 17 Mean values for mercury and lead in moss from selected regions, given for moss surveys from 1977-2015. Trend lines and level of significance are included.

4.3 Temporal trends in selected areas

4.3.1 Backgroud areas

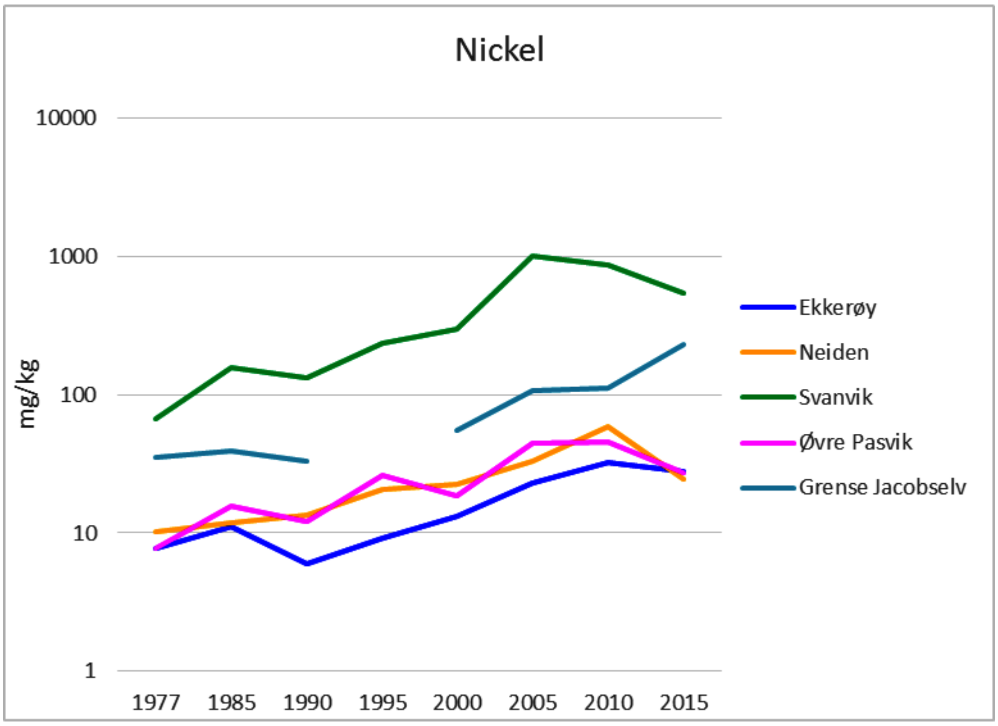
From the results shown it is clear that the air pollution of most elements discussed above has been substantially reduced over the last 40 years also in areas initially regarded as "clean" with respect to atmospheric deposition of metals.

4.3.2 Southernmost Norway vs. Oslofjord region

For most of the elements discussed in 4.2 the highest deposition levels over time are evident in Sørlandet and Oslofjord areas. During the 1970s and 1980s most metal levels were substantially higher in Sørlandet. However, the decline of several metals (e.g. Cr, Ni, Cu, As, Sb) has generally been greater in Sørlandet than in Oslofjord area. Two possible reasons for this may be suggested. Possibly Oslofjord area receives a proportionally higher part of transboundary pollution from countries in eastern Europe than what is the case in Sørlandet. This assumption is supported by a previous study showing that the ratio between stable lead isotopes ($^{206}Pb/^{207}Pb$) in the south-east of Norway differs from the value generally observed in the country and is more similar to the ratio found in Eastern Europe/Russia (Steinnes et al, 2004). The same is the case for the region far north-east in Norway. These findings indicate an East Europe/Russia origin of lead deposited in regions south-east and far north-east in Norway. It may also be that the fast urbanization of the Oslofjord area may have contributed to less emission reduction of some elements. This issue should be further considered.

4.3.3 Border areas to Russia

Ever since the start of the moss surveys in Norway substantial deposition of metals from two copper-nickel smelters in Russia were recorded in eastern Finnmark near the Russian border. Concentrations of Cu and Ni in moss at the most affected sites as a function of time are shown in Fig. 18. As evident from the figure the deposition appeared to increase substantially until 2005 and then a slight decrease appeared in the following surveys. The influence from these smelters on Norwegian territory is limited to the nearest 200 km from the smelters.



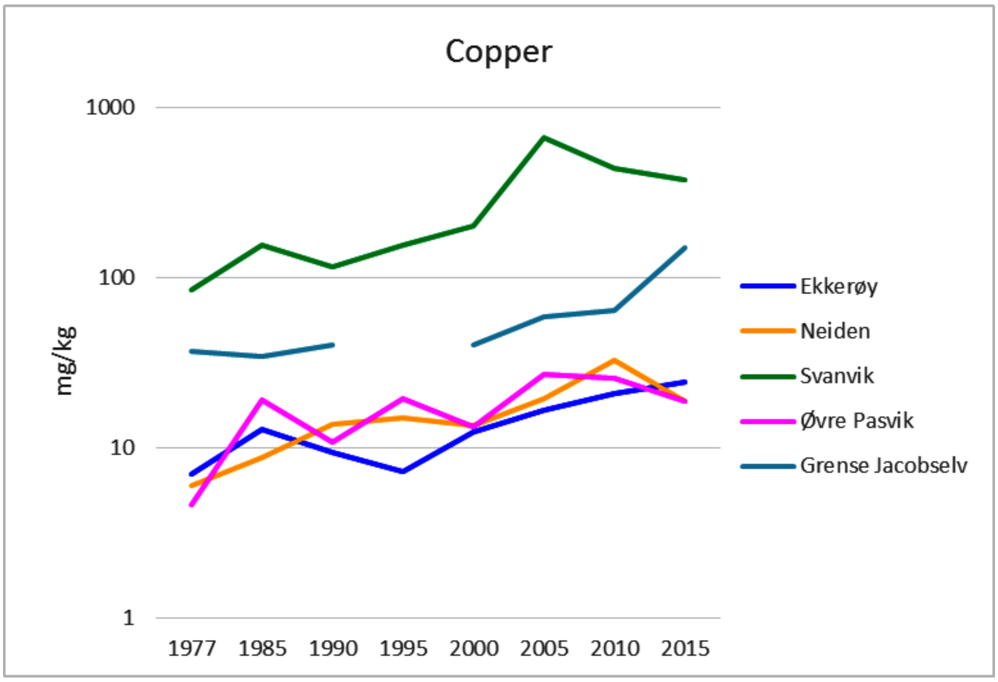


Figure 18 Concentration of copper and nickel in moss at selected sites in Eastern Finnmark as a function of time.

4.4 Influence from domestic industries

Still some influence of domestic industries can be seen in some samples from the 2015 national moss survey, such as Cr at Mo i Rana, and Zn at Odda. A specific moss survey around Norwegian industries was carried out simultaneous with the present national survey, and the results are presented and discussed in a separate report.

5. Conclusion

In 2015, the number of sampling sites were reduced by 50%. Even so, there is good agreement between this years dataset and previous datasets, indicating that the selected sampling points are those which provide the essential information.
Comparison of average value of the priority elements from four selected regions show that deposition in the region Indre Oslofjord is on the same level as in the most deprived region Sørlandet. Overall, there has been small changes in deposition level in Norway in the time period 2005 to 2015.

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Annex results of moss survey 2015

Table A.1 Results from analysis of reference moss M-2 and M-3 obtained by NILU in 2015 are given in column 2 and 4. The recommended values for M-2 and M-3 based an international intercomparison (Steinnes et al., 1997) are given in column 3 and 5. Reference values with less statistical quality than recommended values are indicative and marked yellow. Recommended values listed are based on results from ICP-MS. Where ICP-MS results are missing, recommended values from other techniques are listed.

	Reference Moss M-2		Reference Moss M-3	
Element	***NILU (mg kg^{-1})***	***M2 Recommended values (mg kg^{-1})***	***NILU (mg kg^{-1})***	***M3 Recommended values (mg kg^{-1})***
Be	0.012± 0.003	0.143 ± 0.012	0.009 ± 0.002	0.015 + 0.003
B	19.0 ± 2.0	16.1	11.7 ± 1.5	9.9
Na	227 ± 11	160 ± 15	145 ± 4	133 + 12
Mg	830 ± 70	775	800 ± 45	726
Al	310	190	250	180
S	1000 ± 40	963 + 93	890 ± 70	830 ± 74
K	7510 ± 400	6980 ± 350	4885 ± 340	4100
Ca	2290 ± 140	1920	2340 ± 130	1880
Sc	0.06 ± 0.01	0.067 ± 0.029	0.40 ± 0.01	0.060 ± 0.013
V	1.60 ± 0.10	1.42	1.35 ± 0.06	1.18
Cr	1.14 ± 0.07	0.99	0.65 ± 0.10	0.61
Mn	353 ± 17	357	515 ± 22	551
Fe	289 ± 13	273	164 ± 4	131
Co	1.10 ± 0.08	0.98	0.117 ± 0.004	0.116
Ni	17 ± 1	16.3	1.1 ± 0.1	0.96
Cu	68 ± 4	69.1	3.5 ± 0.2	3.78
Zn	32 ± 1	36	22 ± 1	24.9
Ga	0.11 ± 0.01	0.113 ± 0.020	0.09 ± 0.01	0.084 ± 0.018
Ge	0.017 ± 0.004	0.023	0.011 ± 0.003	
As	0.94 ± 0.06	0.97	0.111 ± 0.004	0.104
Se	0.27 ± 0.06	0.33	0.99 ± 0.04	0.107
Rb	46 ± 4	39.8	22 ± 1	19.8
Sr	5.6 ± 0.4	5.26	5.0 ± 0.3	4.68
Y	0.100 ± 0.005	0.099 ± 0.014	0.073 ± 0.005	0.067 ± 0.013
Ag	0.13 ± 0.01	0.13 + 0.014	0.036 ± 0.005	0.027 ± 0.004
Cd	0.445 ± 0.020	0.445	0.107 ± 0.005	0.106
Sb	0.17 ± 0.01	0.212	0.038 ± 0.002	0.052
Cs	0.48 ± 0.03	0.53	0.18 ± 0.01	0.185
Ba	20.0 ± 1.2	17.2	14.7 ± 0.7	13.2
La	0.19 ± 0.03	0.189	0.13 ± 0.02	0.131

	Reference Moss M-2		Reference Moss M-3	
Element	***NILU (mg kg^{-1})***	***M2 Recommended values (mg kg^{-1})***	***NILU (mg kg^{-1})***	***M3 Recommended values (mg kg^{-1})***
Ce	0.35 ± 0.05	0.35 ± 0.03	0.27±0.04	0.25 ± 0 .03
Sm	0.024 ± 0.005	0.031	0.010 ± 0.003	0.02
Hg	0.058 ± 0.005	0.059	0.040 ± 0.002	0.036
Tl	0.045 ± 0.002	0.048 ± 0.004	0.051 ± 0.003	0.053 ± 0.002
Pb	7.2 ± 0,3	6.62	3.7 ± 0.2	3.43
Th	0.06 ± 0.01	0.042	0.04 ± 0.01	0.027
U	0.025 ± 0.003	0.021 ± 0.005	0.016 ± 0.002	0.0128 ± 0.0013

Table A. 2 Arithmetic mean, median, minimum and maximum values of 51 elements in 229 moss samples collected in 2015 (mg kg^{-1}).

Element	Mean	Median	Minimum	Maximum
Li	0.20	0.16	0.04	2.02
Be	0.02	0.02	0.002	0.300
B	3.0	2.5	< 0.2	20
Na	240	210	60	800
Mg	1380	1350	470	3280
Al	570	460	100	3050
S	850	820	470	1860
K	3640	3560	1770	6400
Ca	3250	3030	1820	7230
Sc	0.1	0.09	0.02	1.4
Ti	34	24	6	152
V	1.6	1.2	0.3	14
Cr	1.1	0.7	0.2	17
Mn	450	400	40	1660
Fe	490	310	78	8125
Co	0.5	0.2	0.06	23
Ni	5.1	1.1	0.4	550
Cu	7.2	4.2	1.8	370
Zn	36	31	8	409
Ga	0.16	0.13	0.03	0.88
As	0.17	0.13	0.04	4.72
Se	0.3	0.3	0.009	2
Rb	13.7	12.4	1.4	81
Sr	116	13.6	3.8	60
Y	0.26	0.18	0.02	1.55
Nb	0.10	0.07	0.01	1.4
Rh	0.003	0.003	< 0.001	0.027
Ag	0.03	0.02	0.007	0.40
Cd	0.12	0.08	0.02	1.33

Element	Mean	Median	Minimum	Maximum
Sb	0.08	0.07	0.007	0.38
Te	0.02	0.01	< 0.007	0.31
Cs	0.22	0.16	0.02	1.63
Ba	30	25	5.3	130
La	0.48	0.32	0.07	3.5
Ce	0.93	0.61	0.10	4.78
Pr	0.09	0.06	< 0.001	0.55
Nd	0.37	0.23	0.01	2.24
Sm	0.07	0.05	0.004	0.38
Eu	0.05	0.04	0.01	0.19
Gd	0.09	0.06	0.004	0.62
Tb	0.02	0.01	< 0.001	0.09
Dy	0.05	0.03	< 0.001	0.26
Ho	0.008	0.006	< 0.001	0.05
Er	0.04	0.03	0.002	0.22
Tm	0.004	0.003	< 0.001	0.016
Yb	0.004	0.003	< 0.001	0.016
Lu	0.02	0.02	< 0.001	0.16
Ir	0.008	0.006	0.002	0.08
Pt	0.02	0.01	0.005	0.09
Hg	0.08	0.05	0.005	0.53
Tl	2.2	1.6	0.28	22
Pb	0.06	0.05	0.001	0.4
Bi	0.1	0.08	< 0.001	0.5
Th	0.04	0.03	0.007	1.5
U	0.008	0.006	0.002	0.08

Table A. 3 Median values (mg kg-1) for elements from the Norwegian moss surveys in the period 1977-2015.

Median values
Period 1977-2015

Element	2015	2010	2005	2000	1995	1990	1985	1977
Li	0.16	0.12	0.098	0.10	0.18	0.22		
Be	0.02	0.008	0.02	0.008	0.02	< 0.02		
B	2.5	3.3						
Na	208	123						
Mg	1350	1340	1390	1540	1400	1200		
Al	461	280	260	350	290	430	800	760
S	820	815						
K	3560	3870						
Ca	3030	2790	2740	3120	3200	2800		
Sc	0.09		0.06					
Ti	24	25	27	31	43			
V	1.20	1.40	1.40	1.35	2.3	2.4	3.1	2.5
Cr	0.66	0.59	0.58	0.69	1.0	0.90	1.6	1.7
Mn	400	290	320	330	250	300		250
Fe	310	280	270	360	470	470	660	540
Co	0.20	0.22	0.19	0.17	0.24	0.25	0.32	0.22
Ni	1.10	1.2	1.2	1.1	1.6	1.6	2.0	1.6
Cu	4.2	4.0	4.4	4.2	5.2	5.2	4.9	5.7
Zn	31	31	31	32	38	36	35	33
Ga	0.13	0.10	0.09	0.11		0.20		
As	0.13	0.13	0.12	0.14	0.21	0.27	0.38	0.32
Rb	12	13	11	9.9	11	10		9.5
Sr	13	15	13	11.5	13	13		
Y	0.18	0.17	0.14	0.15	0.23	0.22		
Nb	0.07	0.11	0.05	0.04	0.08			
Mo	______	0.19	0.18	0.11	0.16	0.15		0.1
Ag	0.02	0.02	0.02	0.02	0.03			0.07
Cd	0.08	0.08	0.09	0.09	0.13	0.13	0.17	0.2
Sb	0.07	0.06	0.07	0.06	0.09	0.09	0.16	0.17
Te	0.01	< 0.001						
Cs	0.16	0.15	0.14	0.13	0.18	0.18		0.12
Ba	25	25	22	19.2	24	24		
La	0.32	0.33	0.26	0.28	0.41	0.44		0.46

Ce	0.61	0.59	0.48	0.54	0.81			
Pr	0.06	0.06	0.05	0.06	0.10			
Nd	0.23	0.23	0.20	0.22	0.38			
Sm	0.05	0.04	0.04	0.04	0.07			0.07
Eu	0.04	0.04	0.02	0.01	0.02			
Gd	0.060	0.05	0.04	0.04	0.07			
Tb	0.01	0.007	0.005	0.005	0.01			
Dy	0.03	0.03	0.03	0.03	0.05			
Ho	0.006	0.004	0.004	0.005	0.010			
Er	0.03	0.02	0.02	0.02	0.03			
Yb	0.02	0.01	0.01	0.01	0.02			
Lu	0.003		0.001					
Ir	0.006							
Pt	0.010		0.001					
Hg	0.06	0.06	0.06	0.05	0.07	0.06		
Tl	0.05	0.04	0.04	0.03	0.06	0.08		
Pb	1.6	1.5	2.2	2.7	5.8	9.3	11	15
Bi	0.05	0.03	0.01	0.01	0.02	0.03		
Th	0.08	0.10	0.05	0.05		0.08		0.08
U	0.03	0.02	0.02	0.02	0.04	0.04		

Table A. 4 Coordinated for the sites included in the four selected areas.

Selected regions Coordinates					
Sørlandet			**Dovre rundt**		
Site name	N.latitude	E.longitude	Site name	N.latitude	E.longitude
Lillesand	58.15.437	08.24.107	Sømådal	62.06.052	11.38.614
Birkeland	58.21.918	08.14.709	Narbuvoll	62.21.949	11.28.847
Skiftenes	58.24.038	08.30.681	Dalsbygda	62.30.855	11.01.787
Iveland	58.23.969	07.55.389	Velledalen	62.19.563	06.45.612
Froland	58.33.929	08.35.096	Isfjorden	62.33.850	07.50.718
Tromøy	58.29.194	08.52.380	Molde	62.43.910	07.00.899
Risør	58.45.316	09.12.714	Kårvatn	62.46.964	08.49.847
Lyngdal	58.09.813	07.11.973	Oppdal	62.36.210	09.44.136
Konsmo	58.16.402	07.23.208	Budal	62.44.558	10.27.360
Hidreskog	58.17.527	07.02.049	Søvassli	63.13.496	09.18.963
Lillesand	58.15.437	08.24.107	Sømådal	62.06.052	11.38.614
Indre Oslofjord			**Indre Troms / Vest-Finnmark**		
Site name	N.latitude	E.longitude	Site name	N.latitude	E.longitude
Hvaler	59.06.0	10.53.878	Andenes	69.17.330	16.02.333
Drøbak	59.38.7	10.40.344	Gratangen	68.40.105	17.31.018
Nesodden	59.48.130	10.40.331	Dividalen	68.46.996	19.42.469
Høvik	59.53.350	10.33.448	Salangen	69.03.721	17.44.526
Kjelsås	59.58.051	10.45.723	Gibostad	69.26.526	17.58.660
Konnerud	59.43.621	10.04.684	Bilto	69.28.626	21.29.107
Hvittingfoss	59.30.782	09.53.727	Kvaløya	69.46.091	18.50.024
Brunlanes	59.04	09.55	Kvænangsbotn	69.43.635	22.04.507
Slagen	58.18.572	10.30.973	Øksfjord	70.13.657	22.22.803
Botne	59.26.978	10.13.082	Stilla	69.53.865	23.34.077

Table A. 5 Mean values (mg kg^{-1}) for vanadium, chromium, copper, zinc, arsenic, cadmium, antimony, mercury, and lead from selected areas in the period 1977-2015.

Element	***Year***	***Sørlandet***	***Indre Oslofjord***	***Dovre Rundt***	***Indre Troms/vest-Finnmark***
V	1977	11.8 ± 4.1	8.9 ± 3.3	1.6 ± 0.7	1.6 ± 0.4
	1985	9.5 ± 3.2	6.1 ± 1.8	1.6 ± 0.7	2.8 ± 1.7
	1990	5.5 ± 1.4	4.6 ± 1.2	1.3 ± 0.4	1.4 ± 0.7
	1995	6.1 ± 1.3	5.4 ± 1.3	1.57 ± 0.73	1.32 ± 0.53
	2000	3.3 ± 1.3	2.80 ± 0.95	0.99 ± 0.43	0.79 ± 0.46
	2005	3.3 ± 1.4	3.2 ± 1.3	1.1 ± 0.2	1.2 ± 0.5
	2010	3.2 ± 1.4	3.3 ± 1.4	0.95 ± 0.53	0.95 ± 0.40
	2015	2.2 ± 0.6	2.2 ± 0.3	0.9 ± 0.2	0.3 ± 0.2
Cr	1977	5.6 ± 1.9	3.6 ± 1.7	1.2 ± 0.5	1.2 ± 0.5
	1985	3.2 ± 0.9	3.0 ± 0.8	1.6 ± 0.8	1.8 + 1.2
	1990	1.4 ± 0.4	2.3 ± 1.8	0,9 ± 0,6	0.7 ± 0,2
	1995	1.7 ± 0.4	1.3 ± 0.5	1.5 ± 0.8	0.8 ± 0.3
	2000	1.2 + 0.8	1.7 ± 1.5	0.7 ± 0.3	0.5 ± 0.2
	2005	1.1 ± 0.6	1.3 ± 1.0	0.5 ± 0.2	0.8 ± 0.4
	2010	0.8 ± 0.3	1.1 ± 0.5	0.5 + 0.3	0.5 ± 0.2
	2015	1.0 ± 0.3	1.3 ± 0.4	0.7 ± 0.3	0.4 ± 0.2
Ni	1977	8.8 ± 4.9	2.7 ± 1.0	1.1 ± 0.4	1.2 ± 0.5
	1985	4.7 ± 1.1	4.6 ± 2.3	1.4 ± 0.6	2.2 ± 1.1
	1990	2.9 ± 1.3	2.5 ± 1.3	1.3 ± 0.6	0.99 ± 0.26
	1995	2.9 ± 0.7	2.4 ± 0.7	1.2 ± 0.4	1.3 ± 0.4
	2000	1.6 ± 0.5	1.97 ± 1.03	1.0 ± 0.6	0.9 ± 0.3
	2005	1.6 ± 0.4	3.2 ± 2.0	1.2 ± 0.7	1.1 ± 0.2
	2010	2.3 ± 1.3	1.97 ± 1.00	0.89 ± 0.45	0.95 ± 0.24
	2015	1.5 ± 0.5	2.0 ± 1.4	0.93 ± 0.23	0.88 ± 0.12
Cu	1977	16 ± 3.2	8.2 ± 3.8	4.8 ± 1.3	6.0 ± 1.9
	1985	10.3 ± 3.7	9.7 ± 3.4	4.1 ± 1.2	4.1 ± 1.1
	1990	9.4 ± 2.4	8.2 ± 2.4	4.29 ± 0.76	3.9 ± 0.6
	1995	9.9 ± 1.9	9.0 ± 2.5	3.8 ± 0.5	4.1 ± 0.9
	2000	7.0 ± 1.3	8.4 ± 2.9	3.33 ± 0.65	2.93 ± 0.31
	2005	7.5 ± 1.7	8.0 + 2.7	3.6 + 0.8	3.7 ± 0.8
	2010	7.0 ± 2.5	8. 2 ± 3.9	3.07 ± 0.98	3.16 ± 0.72
	2015	7.4 ± 0.7	7.9 ± 2.7	3.4 ±1.2	3.2 ± 0.6
Zn	1977	93 ± 21	85 ± 48	25.4 ± 3.6	30.5 ± 17.5
	1985	70 ± 19	93 ± 41	28 ± 11	25 ± 18

	1990	61 ± 19	73 ± 30	29 ± 12	27 ± 11
	1995	61 ± 19	73 ± 30	29 ± 12	27 ± 11
	2000	47 ± 22	50 ± 16	23 ± 8	23 ± 7
	2005	48 ± 17	52 ± 23	25 ± 9	21 ± 7
	2010	55 ± 15	53 ± 14	28 ± 11	33 ± 19
	2015	47.2 ± 0.26	51.8 ± 15.9	20.6 ± 4.6	29.1 ± 5.5
As	1977	2.44 ± 0.86	1.28 ± 0.33	0.25 ± 0.11	0.18 ± 0.07
	1985	1.24 ± 0.44	0.74 ± 0.29	0.24 ± 0.10	0.28 ± 0.18
	1990	0.67 ± 0.21	0.66 ± 0.35	0.16 ± 0.04	0.17 ± 0.07
	1995	0.90 ± 0.26	0.59 ± 0.11	0.3 ± 0.2	< 0.15
	2000	0.28 ± 0.08	0.30 ± 0.12	0.07 ± 0.02	0.06 ± 0.03
	2005	0.3 ± 0.1	0.22 ± 0.07	0.05 ± 0.02	0.095 ± 0.03
	2010	0.22 ± 0.06	0.25 ± 0.07	0.10 ± 0.03	0.10 ± 0.02
	2015	0.20 ± 0.02	0.26 ± 0.10	0.06 ± 0.02	0.07 ± 0.03
Cd	1977	1.17 ± 0.15	0.63 ± 0.28	0.06 ± 0.04	0.12 ± 0.08
	1985	0.50 + 0.17	0.50 +0.17	0.14 + 0.09	0.08 + 0.04
	1990	0.38 ± 0.15	0.33 ± 0.13	0.07 ± 0.02	0.07 ± 0.04
	1995	0.41 ± 0.12	0.56 ± 0.26	0.07 ± 0.03	0.07 ± 0.03
	2000	0.27 ± 0.13	0.22 ± 0.10	0.05 ± 0.02	0.05 ± 0.03
	2005	0.31 ± 0.08	0.3 ± 0.1	0.07 ± 0.03	0.05 ± 0.02
	2010	0.32 ± 0.1	0.22 ± 0.05	0.04 ± 0.01	0.04 ± 0.02
	2015	0.22 ± 0.04	0.24 ± 0.07	0.05 ± 0.02	0.04 ± 0.02
Sb	1977	1.40 ± 0.34	0.73 ± 0.26	0.12 ± 0.03	0.09 ± 0.02
	1985	0.71 ± 0.18	0.54 ± 0.16	0.11 ± 0.03	0.06 ± 0.01
	1990	0.36 ± 0.10	0.37 ± 0.13	0.04 ± 0.02	0.04 ± 0.01
	1995	0.32 ± 0.07	0.32 ± 0.11	0.05 ± 0.02	0.04 ± 0.02
	2000	0.19 ± 0.05	0.22 ± 0.10	0.03 ± 0.01	0.02 ± 0.01
	2005	0.22 ± 0.04	0.28 ± 0.16	0.032 ± 0.007	0.031 ± 0.010
	2010	0.22 ± 0.06	0.21 ± 0.12	0.035 ± 0.011	0.028 ± 0.011
	2015	0.17 ± 0.05	0.22 ± 0.09	0.04 ± 0.02	0.018 ± 0.007
Hg	1977	No data	No data	No data	No data
	1985	0.14 ± 0.04	0.12 ± 0.05	0.07 ± 0.02	0.04 ± 0.01
	1990	0.09 ± 0.03 *	0.11 ± 0.04 *	0.05 ± 0.03 *	0.04 ± 0.02 *
	1995	0.09 ± 0.02 *	0.07 ± 0.01 *	0.6 ± 0.2 *	0.05 ± 0.02 *
	2000	0.07 ± 0.02	0.07 ± 0.02	0.04 ± 0.01	0.04 ± 0.03
	2005	0.08 ± 0.02	0.06 ± 0.02	0.05 ± 0.01	0.04 ± 0.01
	2010	0.07 + 0.02	0.08 + 0.04	0.06 + 0.01	0.04 + 0.01
	2015	0.06 ± 0.02	0.07 ± 0.01	0.04 ± 0.02	0.05 ± 0.02

Pb	1977	127 ± 30	59 ± 20	8.9 ± 4.1	6.3 ± 3.0
	1985	52 ± 16	40 ± 14	5.3 ± 3.5	5.7 ± 3.2
	1990	36 ± 9	38 ± 21	4 ± 2	4 ± 2
	1995	23 ± 5	19 ± 5	2.4 ± 0.7	2.1 ± 1.0
	2000	9.5 ± 3.6	7.1 ±1.3	1.1 ± 0.3	1.11 ± 0.4
	2005	7.8 ± 2.9	6.3 ± 2.1	0.9 ± 0.2	1.0 ± 0.3
	2010	6.4 ± 2.9	5.1 ± 1.0	0.82 ± 0.38	0.71 ± 0.19
	2015	5.6 ± 1.0	3.9 ± 1.1	0.56 ± 0.06	0.53 ± 0.09

*Few samples from each region. Listed values are average of 2-5 samples.

Table A. 6 Coordinates and results for each sampling site.

Results Moss survey 2015													
Site name	N. Latitude	E. Longitude	V mg kg^{-1}	Cr mg kg^{-1}	Fe mg kg^{-1}	Ni mg kg^{-1}	Cu mg kg^{-1}	Zn mg kg^{-1}	As mg kg^{-1}	Cd mg kg^{-1}	Sb mg kg^{-1}	Hg mg kg^{-1}	Pb mg kg^{-1}
Kornsjø	58.56.980	11.38.872	2.0	1.2	432	1.3	6.1	28	0.23	0.15	0.18	0.076	3.4
Aremark	59.13.723	11.43.247	2.6	0.75	661	1.0	4.2	45	0.13	0.16	0.11	0.041	2.2
Rømskog	59.40.141	11.49.012	1.0	0.57	185	0.90	3.4	38	0.12	0.19	0.09	0.056	2.1
Hvaler	59.06.060	10.53.787	1.6	0.98	338	0.99	7.5	46	0.21	0.27	0.22	0.088	3.7
Tune	59.22.392	11.00.613	1.8	1.1	372	1.4	5.7	56	0.19	0.30	0.17	0.061	3.5
Jeløy	59.27.295	10.39.172	1.9	1.4	423	1.6	7.7	36	0.17	0.17	0.19	0.046	3.1
Degernes	59.24.656	11.28.031	1.8	1.0	405	0.98	5.7	47	0.18	0.13	0.14	0.061	3.1
Drøbak	59.38.784	10.40.225	2.3	1.3	527	1.3	5.6	53	0.23	0.14	0.23	0.048	2.9
Enebakk	59.43.914	11.08.664	2.2	0.99	753	1.2	6.3	49	0.21	0.17	0.17	0.066	3.2
Nesodden	59.50.031	10.40.333	2.2	1.4	590	1.4	9.5	40	0.22	0.15	0.28	0.069	2.9
Høvik	59.53.377	10.33.237	5.6	6.7	1710	4.9	18.4	58	0.52	0.20	0.33	0.060	4.5
Sollihøgda	59.57.822	10.21.560	1.3	0.87	304	0.81	5.5	40	0.13	0.34	0.14	0.040	2.0
Bogstad	59.59.175	10.37.755	1.3	0.83	319	1.4	6.8	51	0.13	0.19	0.13	0.037	3.0
Kjelsås	59.57.998	10.45.389	2.6	2.1	758	4.2	15	88	0.26	0.39	0.38	0.092	4.9
Hakadal	60.06.309	10.50.426	2.1	1.1	704	1.2	6.9	60	0.18	0.13	0.18	0.082	3.0
Asak	59.58.621	11.06.657	1.0	0.70	270	0.86	4.2	31	0.15	0.10	0.21	0.045	4.4
Aurskog	59.58.693	11.29.910	1.3	0.75	313	1.0	3.9	47	0.16	0.14	0.10	0.056	1.9
Nordmoen	60.15.087	11.06.870	1.2	0.85	311	1.0	6.0	18	0.19	0.07	0.11	0.046	1.9

Site name	N. Latitude	E. Longitude	V mg kg^{-1}	Cr mg kg^{-1}	Fe mg kg^{-1}	Ni mg kg^{-1}	Cu mg kg^{-1}	Zn mg kg^{-1}	As mg kg^{-1}	Cd mg kg^{-1}	Sb mg kg^{-1}	Hg mg kg^{-1}	Pb mg kg^{-1}
Magnor	60.00.009	12.22.058	1.6	0.95	405	0.90	5.3	35	0.15	0.08	0.14	0.101	2.5
Kongsvinger	60.10.123	12.08.776	1.2	0.81	280	1.1	3.5	39	0.15	0.09	0.13	0.074	2.3
Nord-Odal	60.24.969	11.34.174	1.4	0.99	403	0.84	4.0	31	0.10	0.09	0.12	0.266	2.3
Røgden	60.23.379	12.33.328	1.1	0.70	259	1.5	4.0	53	0.14	0.12	0.11	0.065	2.3
Våler	60.41.674	11.59.053	1.1	0.59	271	1.1	3.1	26	0.16	0.07	0.10	0.061	2.3
Kise	60.47.169	10.47.216	2.1	1.7	661	3.2	4.9	30	0.18	0.09	0.11	0.078	1.9
Mesnali	61.03.642	10.49.889	2.3	1.3	1015	1.1	3.3	34	0.21	0.07	0.10	0.110	2.2
Trysil	61.25.266	12.22.928	1.0	0.39	339	0.44	3.8	23	0.10	0.05	0.07	0.064	1.1
N. Osen	61.19.294	11.47.923	0.73	0.43	289	0.55	3.2	21	0.12	0.05	0.07	0.060	1.0
Stai	61.27.981	10.59.972	0.65	0.40	189	0.67	3.6	28	0.09	0.09	0.12	0.050	1.3
Atnasjøen	61.53.283	10.10.150	0.57	0.38	162	0.99	3.2	43	0.08	0.12	0.07	0.085	1.1
Jutulhogget	61.59.908	10.53.296	0.66	0.46	210	0.78	2.3	26	0.09	0.06	0.07	0.066	1.0
Sømådal	62.06.057	11.38.606	0.52	0.32	185	0.50	2.0	23	0.05	0.04	0.06	0.044	0.6
Narbuvoll	62.21.942	11.28.853	0.77	0.48	262	0.77	1.8	17	0.04	0.04	0.05	0.034	0.6
Dalsbygda	62.31.552	11.04.765	1.0	0.83	326	0.71	2.8	20	0.10	0.03	0.05	0.044	0.5
Brandbu	60.25.972	10.34.505	3.6	2.1	1358	1.7	5.3	47	0.22	0.10	0.18	0.046	2.2
Sanderstølen	60.52.261	09.13.207	0.90	0.59	266	1.7	2.9	20	0.12	0.06	0.08	0.052	1.0
Dokka	60.49.969	09.57.792	0.88	0.51	224	0.83	4.1	32	0.15	0.10	0.10	0.061	1.8
Synnfjell	61.06.677	09.41.605	0.51	0.30	135	0.88	3.2	41	0.09	0.09	0.07	0.051	1.0
Ø.Slidre	61.09.575	09.03.220	1.1	0.62	360	0.92	2.8	31	0.17	0.04	0.06	0.047	0.9
Vang i V.	61.09.626	08.25.211	0.92	0.45	261	2.4	3.4	26	0.15	0.07	0.11	0.086	1.3
Ringebu	61.36.920	10.04.212	0.70	0.45	211	0.74	2.7	31	0.09	0.07	0.07	0.052	1.0

Site name	N. Latitude	E. Longitude	V mg kg^{-1}	Cr mg kg^{-1}	Fe mg kg^{-1}	Ni mg kg^{-1}	Cu mg kg^{-1}	Zn mg kg^{-1}	As mg kg^{-1}	Cd mg kg^{-1}	Sb mg kg^{-1}	Hg mg kg^{-1}	Pb mg kg^{-1}
Skåbu	61.36.723	09.27.125	0.68	0.51	200	1.3	3.0	23	0.09	0.07	0.06	0.050	0.5
Gjendesheim	61.29.030	08.50.068	1.2	0.66	280	1.4	3.2	20	0.13	0.07	0.08	0.049	1.3
Leirdalen	61.39.595	08.10.882	4.8	2.4	1167	1.4	4.3	47	0.09	0.05	0.05	0.073	0.6
Heidal	61.46.802	09.14.666	1.6	1.1	488	1.2	3.6	25	0.11	0.05	0.08	0.066	0.8
Dombås	62.02.464	09.07.475	1.1	1.3	347	1.4	3.1	20	0.07	0.03	0.08	0.059	0.7
Bjorli	62.16.920	08.08.061	0.60	0.46	210	0.55	3.1	17	0.04	0.02	0.05	0.046	0.3
Røyken	59.44.896	10.27.005	1.9	1.2	463	1.4	7.6	56	0.29	0.36	0.20	0.052	3.6
Konnerud	59.43.602	10.07.032	2.3	1.4	593	1.3	7.3	37	0.33	0.27	0.23	0.050	5.8
Hvittingfoss	59.43.602	10.07.032	2.1	0.98	642	2.0	6.9	66	0.18	0.30	0.14	0.065	3.8
Kongsberg	59.40.911	09.40.987	1.3	0.58	361	0.72	3.8	18	0.10	0.06	0.07	0.039	1.6
Åmot i M.	59.55.035	09.55.132	1.6	0.81	553	1.1	5.1	34	0.23	0.11	0.12	0.066	2.2
Flesberg	59.56.611	09.30.207	0.85	0.50	239	0.74	4.7	29	0.12	0.08	0.05	0.048	1.4
Hønefoss	60.11.525	10.11.589	2.0	1.4	638	1.9	7.1	35	0.22	0.10	0.13	0.068	2.2
Flå	60.25.944	09.27.224	1.5	0.93	530	1.1	4.2	34	0.15	0.12	0.11	0.039	1.6
Vasstulen	60.19.881	08.29.329	0.49	0.28	137	0.65	4.4	59	0.08	0.07	0.02	0.049	0.8
Ål	60.37.208	08.32.561	1.2	0.80	495	0.99	4.5	29	0.11	0.08	0.10	0.093	2.2
Strandevatn	60.43.605	07.44.601	1.8	0.78	552	1.3	3.7	24	0.19	0.07	0.06	0.075	1.5
Hemsedal	60.51.390	08.33.181	1.2	0.65	347	1.1	3.9	18	0.09	0.07	0.08	0.042	2.1
Tjøme	59.05.411	10.25.646	1.1	0.66	314	0.70	5.0	19	0.13	0.05	0.05	0.040	5.2
Brunlanes	58.59.857	09.53.344	2.4	1.5	889	1.1	6.3	34	0.30	0.05	0.08	0.069	4.9

Site name	N. Latitude	E. Longitude	V mg kg^{-1}	Cr mg kg^{-1}	Fe mg kg^{-1}	Ni mg kg^{-1}	Cu mg kg^{-1}	Zn mg kg^{-1}	As mg kg^{-1}	Cd mg kg^{-1}	Sb mg kg^{-1}	Hg mg kg^{-1}	Pb mg kg^{-1}
Steinsholt	59.18.090	09.49.493	1.2	0.58	216	1.1	5.1	38	0.15	0.11	0.11	0.060	3.1
Slagen	59.18.475	10.30.965	2.2	1.3	535	2.0	6.2	48	0.21	0.26	0.18	0.059	5.3
Botne	59.26.353	10.13.845	1.9	0.97	550	1.4	7.6	50	0.16	0.25	0.13	0.064	4.2
Levang	58.50.298	09.26.110	2.2	2.0	551	1.9	7.0	44	0.20	0.26	0.12	0.057	4.4
Eidanger	59.07.145	09.41.780	2.4	2.4	834	2.1	13	60	0.33	0.29	0.25	0.029	5.9
Neslandsvatn	58.58.173	09.10.841	1.7	0.81	377	1.3	6.0	35	0.19	0.18	0.12	0.024	4.6
Rørholt	59.04.339	09.21.234	1.2	0.58	233	0.87	5.8	41	0.14	0.18	0.10	0.054	3.6
Treungen	59.00.409	08.32.978	1.1	0.55	301	0.80	4.4	45	0.12	0.14	0.10	0.045	2.1
Drangedal	59.05.965	08.58.246	1.1	0.47	205	1.4	6.0	70	0.15	0.27	0.08	0.027	3.3
Flåbygd	59.18.667	09.01.654	0.90	0.47	252	0.76	4.2	25	0.14	0.12	0.09	0.026	2.0
Veum	59.16.938	08.04.501	1.1	0.50	284	0.80	3.8	31	0.09	0.08	0.06	0.039	1.4
Åmot	59.30.109	07.58.105	1.5	0.66	472	1.5	5.1	35	0.11	0.08	0.04	0.040	1.9
Sauland	59.37.027	08.55.230	0.86	0.47	240	1.4	6.5	33	0.13	0.08	0.10	0.068	1.6
Rjukan	59.51.074	08.26.290	0.66	0.43	178	1.0	4.1	24	0.13	0.04	0.05	0.028	1.1
Vågslid	59.46.518	07.25.405	0.61	0.33	184	0.87	3.6	83	0.07	0.12	0.12	0.030	1.0
Tinn	59.58.301	08.52.478	0.69	0.45	181	1.3	4.1	26	0.14	0.06	0.08	0.032	1.5
Lillesand	58.15.417	08.24.267	2.9	1.1	637	2.4	8.5	40	0.18	0.21	0.11	0.067	5.8
Birkeland	58.23.218	08.14.956	2.0	0.72	316	1.3	7.0	46	0.18	0.20	0.22	0.060	7.0
Skiftenes	58.23.678	08.31.408	2.2	0.86	321	1.2	7.2	35	0.19	0.25	0.26	0.048	7.1
Iveland	58.24.05	07.54.475	1.9	0.95	500	1.1	6.2	36	0.17	0.19	0.14	0.044	3.5

Site name	N. Latitude	E. Longitude	V mg kg^{-1}	Cr mg kg^{-1}	Fe mg kg^{-1}	Ni mg kg^{-1}	Cu mg kg^{-1}	Zn mg kg^{-1}	As mg kg^{-1}	Cd mg kg^{-1}	Sb mg kg^{-1}	Hg mg kg^{-1}	Pb mg kg^{-1}
Mykland	58.38.365	08.19.949	2.2	0.89	456	1.3	5.9	61	0.15	0.17	0.10	0.044	2.6
Froland	58.33.928	08.35.117	1.7	0.75	251	1.0	6.8	44	0.18	0.27	0.16	0.044	5.2
Tromøy	58.29.214	08.52.349	3.7	1.6	941	2.6	9.1	65	0.23	0.28	0.09	0.059	5.6
Risør	08.45.518	09.12.554	2.1	1.0	339	1.3	8.0	37	0.21	0.23	0.20	0.062	5.7
Åmli	58.48.203	08.30.417	1.0	0.41	197	0.77	4.1	30	0.10	0.23	0.10	0.036	2.2
Bygland	58.50.246	07.48.450	1.0	0.39	200	0.82	3.9	33	0.12	0.23	0.09	0.038	2.3
Solhomfjell	58.55.713	08.52.297	1.3	0.50	265	0.90	3.7	29	0.14	0.08	0.12	0.059	2.4
Hylestad	59.06.494	07.30.895	0.72	0.36	215	0.62	4.3	31	0.08	0.08	0.12	0.052	1.1
Lista	58.07.641	06.38.682	1.1	0.51	193	0.84	5.0	40	0.15	0.21	0.07	0.041	2.9
Mandal	58.01.552	07.31.124	3.0	1.8	913	1.8	6.4	23	0.23	0.14	0.14	0.047	5.8
Vennesla	58.15.176	07.51.213	1.7	1.7	302	1.9	6.9	40	0.21	0.19	0.15	0.048	6.5
Kvinesdal	58.15.792	06.52.856	1.1	0.55	218	0.77	5.1	39	0.14	0.09	0.10	0.045	2.5
Lyngdal	58.09.829	07.11.784	1.7	0.75	292	1.2	6.5	42	0.20	0.19	0.18	0.051	5.8
Konsmo	58.16.840	07.22.704	2.3	1.2	789	1.4	7.1	57	0.18	0.17	0.21	0.092	5.5
Hidreskog	58.17.610	07.02.023	2.2	0.99	458	1.4	7.3	70	0.24	0.16	0.17	0.089	5.1
Sporkland	58.30.773	06.44.475	1.0	0.36	176	0.72	3.7	39	0.10	0.09	0.07	0.049	2.4
Eiken	58.30.676	07.09.693	1.1	0.55	327	0.65	4.2	28	0.14	0.12	0.09	0.063	2.1
Åseral	58.34.786	07.32.767	1.7	0.64	426	1.1	6.0	36	0.17	0.11	0.11	0.080	3.1
Knaben	58.40.293	07.02.714	1.3	0.55	314	0.75	5.4	58	0.14	0.38	0.07	0.059	2.7
Åkenes	58.48.640	07.27.979	1.1	0.60	240	0.72	7.4	39	0.17	0.16	0.07	0.050	2.3

Site name	N. Latitude	E. Longitude	V mg kg^{-1}	Cr mg kg^{-1}	Fe mg kg^{-1}	Ni mg kg^{-1}	Cu mg kg^{-1}	Zn mg kg^{-1}	As mg kg^{-1}	Cd mg kg^{-1}	Sb mg kg^{-1}	Hg mg kg^{-1}	Pb mg kg^{-1}
Skredå	58.50.568	06.46.098	1.2	0.42	226	0.82	3.8	29	0.10	0.09	0.07	0.046	2.1
Håhelleren	59.01.873	07.08.098	1.5	0.45	367	0.91	4.5	30	0.10	0.11	0.07	0.055	1.9
Mydland	58.24.813	06.25.362	2.2	0.83	558	1.9	7.1	97	0.14	0.44	0.09	0.090	4.5
Ogna	58.31.815	05.48.187	0.9	0.51	221	1.1	4.7	32	0.12	0.08	0.05	0.065	2.1
Lund	58.32.267	06.22.702	1.4	0.77	294	0.89	6.4	23	0.16	0.11	0.13	0.074	3.3
Ålgård	58.45.269	05.51.890	1.2	0.55	330	0.64	5.1	69	0.16	0.16	0.09	0.107	2.9
Byrkjedal	58.46.681	06.19.883	2.4	0.96	524	1.9	6.0	19	0.20	0.10	0.14	0.091	4.5
Sola	58.51.220	05.34.665	2.1	1.1	561	0.93	5.3	30	0.21	0.09	0.15	0.139	3.2
Forsand	58.55.652	06.16.801	1.2	0.52	223	1.0	4.3	71	0.16	0.08	0.08	0.064	2.1
Lyse	59.02.697	06.38.927	1.9	0.65	434	1.5	6.0	24	0.14	0.09	0.07	0.075	3.0
Skudesnes	59.10.518	05.16.271	12	6.5	2912	3.1	6.7	32	0.21	0.13	0.02	0.069	1.7
Laugaland	59.14.119	06.16.038	1.2	0.45	246	0.62	3.0	27	0.11	0.11	0.09	0.048	1.9
Nedstrand	59.20.239	05.41.549	1.0	0.44	247	1.1	6.4	73	0.14	0.15	0.08	0.060	3.8
Blåsjø	59.24.758	06.36.191	1.3	0.40	254	0.92	5.1	35	0.13	0.06	0.08	0.053	2.1
Suldal	59.29.305	06.26.500	1.1	0.46	273	0.82	4.9	26	0.10	0.09	0.09	0.061	1.8
Saudasjøen	59.38.145	06.17.887	1.6	1.3	491	1.2	6.0	35	0.24	0.29	0.11	0.070	6.4
Roaldkvam	59.39.194	06.53.517	1.2	0.40	276	1.1	4.4	40	0.10	0.08	0.08	0.056	1.6
Ølen	59.35.526	05.48.702	2.1	0.94	621	1.7	7.2	33	0.18	0.06	0.11	0.071	2.8
Fitjar	59.52.803	05.20.660	1.1	0.42	204	0.70	6.0	25	0.18	0.12	0.11	0.055	2.1
I. Matre	59.52.259	06.02.016	1.3	0.43	249	0.75	4.0	32	0.11	0.12	0.11	0.060	4.5

Site name	N. Latitude	E. Longitude	V mg kg-1	Cr mg kg-1	Fe mg kg-1	Ni mg kg-1	Cu mg kg-1	Zn mg kg-1	As mg kg-1	Cd mg kg-1	Sb mg kg-1	Hg mg kg-1	Pb mg kg-1
Odda	60.03.360	06.32.078	1.7	1.02	514	0.66	6.8	409	0.55	1.33	0.05	0.115	22
Valldalseter	59.57.120	06.58.086	0.90	0.45	251	1.5	4.3	74	0.09	0.13	0.05	0.033	1.1
Måge	60.12.332	06.33.552	3.1	6.5	1308	9.3	6.9	187	0.70	0.58	0.04	0.066	7.0
Tørvikbygd	60.18.153	06.10.415	1.0	0.82	267	1.3	5.6	46	0.12	0.13	0.07	0.047	1.7
Holdhus	60.13.946	05.50.478	1.4	0.56	295	0.92	5.3	49	0.12	0.08	0.11	0.075	4.3
Os	60.10.950	05.24.250	3.0	3.8	924	2.3	6.7	36	0.19	0.16	0.15	0.056	2.9
Espeland	60.22.114	05.29.582	1.9	1.1	801	2.1	7.1	29	0.14	0.06	0.13	0.050	2.0
Ulvik	60.35.479	06.51.512	0.68	0.33	166	0.62	4.3	28	0.10	0.08	0.04	0.048	1.5
Bulken	60.37.727	06.15.661	2.8	1.4	1045	1.5	5.0	46	0.21	0.05	0.07	0.058	1.7
Åsane	60.29.591	05.23.264	1.3	0.80	499	1.4	6.5	30	0.22	0.09	0.10	0.067	1.7
Modalen	60.54.911	05.58.025	0.56	0.26	131	0.74	4.8	20	0.06	0.04	0.03	0.043	1.2
Sløvåg	60.50.780	05.06.269	1.7	0.50	584	0.78	2.4	18	0.11	0.06	0.03	0.031	2.8
Aurland	60.54.508	07.13.012	0.82	0.33	257	0.68	2.6	21	0.07	0.04	0.03	0.048	0.64
Hovlandsdal	61.14.918	05.24.578	1.0	0.29	170	0.58	2.8	14	0.09	0.06	0.07	0.040	2.4
Hafslo	61.18.609	07.07.876	0.50	0.26	153	0.53	2.4	22	0.06	0.07	0.04	0.041	0.87
Viksdalen	61.19.575	06.16.011	0.62	0.24	179	0.49	3.7	22	0.07	0.06	0.03	0.057	1.3
Eikefjord	61.37.009	05.37.609	0.61	0.22	108	0.46	3.3	23	0.07	0.10	0.03	0.041	1.1
Jostedal	61.37.829	07.15.710	0.65	0.35	202	0.95	4.0	48	0.07	0.06	0.04	0.040	0.81
Vågsøy	61.59.101	05.07.299	2.2	1.43	625	1.8	6.3	9	0.07	0.04	0.04	0.039	1.5
Eid	61.55.155	06.05.670	0.76	0.42	229	0.49	3.4	25	0.07	0.08	0.04	0.048	0.83

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Oppstryn	61.54.818	07.10.523	1.8	0.95	637	2.0	4.4	14	0.07	0.04	0.05	0.039	1.0
Kvalsvik	62.21.890	05.32.356	0.95	0.59	217	0.99	3.1	8	0.17	0.04	0.04	0.065	0.93
Velledalen	62.19.553	06.45.607	0.73	0.34	205	0.54	3.5	23	0.08	0.04	0.04	0.040	0.68
Valderøy/ Godøy	62.28.565	06.00.947	1.1	0.49	217	0.71	3.4	10	0.09	0.06	0.03	0.047	1.1
Isfjorden	62.35.128	07.47.893	1.1	0.57	249	0.76	4.0	21	0.04	0.04	0.01	0.026	0.57
Molde	62.43.391	07.00.972	1.2	1.1	274	1.1	4.5	13	0.05	0.07	0.02	0.087	0.56
Kårvatn	62.46.991	08.49.881	1.0	0.65	262	0.57	2.8	21	0.07	0.05	0.01	0.049	0.56
Kvisvik	63.03.008	08.01.411	1.7	1.2	444	1.4	3.6	23	0.12	0.06	0.05	0.087	0.71
Kongsvoll	62.16.798	09.36.167	1.4	1.6	448	1.7	3.5	41	0.09	0.05	0.04	0.048	0.67
Oppdal	62.35.770	09.46.172	7.3	8.3	2107	4.3	5.8	22	0.21	0.04	0.08	0.043	5.2
Budal	62.49.333	10.27.148	1.0	2.6	314	2.0	4.8	30	0.42	0.06	0.01	0.021	0.50
Vauldalen	62.38.585	12.01.126	0.9	0.57	266	1.2	3.4	41	0.09	0.10	0.03	0.057	0.76
Hølonda	63.05.104	10.05.117	1.9	1.2	533	1.6	3.7	28	0.34	0.06	0.04	0.058	0.60
Tydal	63.04.206	11.26.001	1.1	0.78	308	0.86	3.3	45	0.08	0.06	0.01	0.050	0.74
Søvassli	63.13.517	09.18.625	1.3	1.1	357	1.0	3.4	16	0.06	0.05	0.01	0.039	0.62
Snillfjord	63.24.971	09.31.486	1.8	1.1	630	1.1	3.4	23	0.08	0.09	0.06	0.070	0.72
Malvik	63.22.698	10.36.347	6.1	2.7	1390	1.5	6.1	33	0.23	0.04	0.02	0.069	1.8
Trolla	63.26.972	10.17.756	2.2	1.5	541	1.7	3.9	32	0.20	0.05	0.05	0.116	0.82
Forsnes	63.25.233	08.25.233	1.0	0.45	203	0.58	3.4	14	0.09	0.04	0.02	0.060	0.84
Åfjord	63.58.169	10.01.872	2.1	0.94	721	1.1	3.6	19	0.09	0.10	0.03	0.097	0.71

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Flora	63.27.124	11.20.873	0.8	0.56	216	2.9	4.1	24	0.09	0.04	0.02	0.093	0.75
Åsen	63.41.008	11.02.098	1.9	1.2	500	1.0	4.1	34	0.11	0.03	0.03	0.107	0.69
Sandvika	63.39.324	12.14.999	1.1	0.74	301	1.1	3.4	29	0.13	0.05	0.02	0.070	0.82
Verrabotn	63.48.104	10.35.694	5.6	2.2	1754	1.4	3.2	21	0.17	0.04	0.04	0.073	1.2
Hammer	64.10.157	12.02.260	1.2	0.63	299	0.71	3.7	33	0.09	0.04	0.05	0.114	1.2
Namdalseid	64.13.521	11.01.329	1.5	0.87	472	0.73	3.2	27	0.10	0.04	0.02	0.080	0.88
Aglen	64.37.939	11.04.025	1.8	1.0	628	0.94	3.7	26	0.12	0.07	0.11	0.081	1.2
Udland	64.17.517	13.38.145	1.5	0.88	474	1.1	3.3	36	0.05	0.07	0.02	0.091	1.0
Muru	64.28.397	14.05.335	0.42	0.31	122	0.77	2.8	49	0.04	0.07	0.01	0.043	0.48
Joma	64.53.304	13.55.656	0.73	0.46	188	1.3	2.8	27	0.11	0.09	0.02	0.039	1.0
Trones	64.44.576	12.51.069	1.0	1.7	282	1.2	6.5	50	0.45	0.08	0.06	0.061	0.97
Foldereid	64.57.589	12.12.278	2.0	0.73	696	0.86	3.1	15	0.09	0.07	0.04	0.064	1.3
Smalåsen	65.05.841	13.20.125	0.75	0.43	206	0.66	3.5	38	0.07	0.08	0.02	0.039	0.87
Vennesund	65.12.975	12.02.089	1.0	0.60	282	0.86	3.1	22	0.10	0.07	0.03	0.062	0.83
Harvasstua	65.19.740	14.24.712	0.3	0.24	82	0.94	3.0	43	0.06	0.08	0.01	0.041	0.53
Krutå	65.41.121	14.28.745	0.3	0.27	78	1.4	2.4	35	0.06	0.08	0.01	0.032	0.52
Grane	65.35.237	13.24.521	1.2	0.84	433	4.3	4.1	25	0.12	0.08	0.04	0.076	1.3
Alstahaug	65.56.825	12.29.276	3.6	2.4	1560	2.4	3.5	20	0.14	0.11	0.01	0.078	1.1
Vassvatnet	66.23.784	13.10.418	1.6	0.98	430	1.1	4.5	36	0.18	0.10	0.04	0.090	2.9
Umbukta	66.10.876	14.33.078	2.4	2.1	791	1.7	4.6	19	0.06	0.07	0.03	0.050	1.1

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Koksverket	66.19.536	14.10.112	7.0	17	8125	3.9	8.2	86	0.28	0.17	0.14	0.073	5.6
Eiterå	66.23.733	14.39.427	1.3	2.5	743	1.4	4.5	57	0.12	0.11	0.05	0.077	2.6
Glomfjord	66.47.587	14.00.368	1.5	0.77	391	0.80	3.0	24	0.12	0.12	0.04	0.065	0.84
Junkerdal	66.48.790	15.25.404	1.8	1.1	650	1.1	3.4	33	0.16	0.06	0.07	0.086	1.2
Børvasstind	67.09.972	14.26.152	0.90	0.49	283	0.58	3.0	27	0.09	0.08	0.04	0.066	0.87
Øvrevatn	67.13.100	15.35.491	0.93	0.56	272	1.5	5.2	33	0.09	0.13	0.01	0.044	0.98
Festvåg	67.24.687	14.44.201	1.5	0.89	473	1.1	4.2	28	0.15	0.08	0.06	0.082	1.7
Mørsvikbotn	67.41.505	15.50.980	0.89	0.62	333	0.70	3.4	22	0.10	0.09	0.04	0.075	0.90
Skjomen	68.09.771	17.33.961	0.82	0.54	353	0.88	3.8	35	0.09	0.06	0.06	0.066	0.73
Kanstadbotn	68.27.516	15.52.334	1.0	0.40	251	0.69	2.8	18	0.12	0.08	0.03	0.042	1.4
Svolvær	68.14.024	14.30.470	1.7	1.0	494	1.0	7.3	18	0.16	0.06	0.05	0.076	1.8
Moskenes	67.54.799	13.04.275	5.6	2.4	2146	1.5	4.9	21	0.17	0.07	0.02	0.074	1.6
Bø	68.46.359	14.40.368	1.1	0.63	286	1.1	3.1	12	0.10	0.05	0.03	0.062	1.1
Andenes	69.17.341	16.02.583	0.71	0.36	210	0.66	3.1	25	0.06	0.07	0.01	0.079	0.54
Gratangen	68.40.201	17.30.894	0.86	0.53	302	0.88	2.0	31	0.05	0.03	0.04	0.081	0.53
Harstad	68.44.604	16.25.352	0.85	0.53	306	0.94	3.0	28	0.07	0.07	0.04	0.106	0.78
Dividalen	68.47.032	19.42.325	0.58	0.28	212	0.85	3.0	23	0.04	0.03	0.02	0.079	0.40
Salangen	69.03.721	17.44.526	0.87	0.54	223	0.73	3.1	28	0.05	0.05	0.02	0.027	0.51
Øverbygd	69.00.640	18.59.016	0.85	0.50	290	0.82	3.6	28	0.08	0.04	0.04	0.050	0.67
Galgojavre	69.07.479	20.44.842	0.93	0.59	277	0.95	3.0	43	0.07	0.03	0.04	0.036	0.59

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Gibostad	69.26.522	17.58.512	0.73	0.45	189	0.82	3.3	40	0.06	0.10	0.01	0.043	0.54
Laksvatn	69.23.441	19.25.807	0.75	0.44	202	0.58	2.8	29	0.08	0.05	0.02	0.051	0.51
Bilto	69.28.675	21.29.106	0.67	0.39	200	0.98	2.9	25	0.08	0.03	0.02	0.062	0.53
Kvaløya	69.46.527	18.49.308	0.85	0.47	214	0.96	3.2	33	0.07	0.07	0.02	0.049	0.64
Storsteinnes	69.35.710	19.59.080	14	3.9	2672	3.2	8.7	37	0.15	0.05	0.02	0.070	0.62
Kvænangsbotn	69.43.334	22.04.024	1.0	0.76	284	1.1	3.3	23	0.14	0.03	0.02	0.040	0.49
Øksfjord	70.13.665	22.22.643	0.51	0.28	144	0.86	3.4	33	0.06	0.09	0.01	0.033	0.69
Stilla	69.53.859	23.34.062	0.41	0.26	113	0.93	4.3	19	0.08	0.03	0.01	0.035	0.40
Skaidi	70.26.177	24.30.282	0.70	0.55	187	1.2	3.7	30	0.11	0.04	0.03	0.032	0.49
Havøysund	70.59.528	24.38.678	1.1	0.51	247	1.2	2.9	16	0.14	0.05	0.02	0.088	0.73
Slåtten	70.44.007	24.32.364	1.4	0.72	368	1.9	3.2	25	0.20	0.04	0.02	0.096	0.91
Lakselv	69.49.662	25.09.911	2.5	3.1	704	2.8	3.4	19	0.11	0.03	0.03	0.045	0.60
Karasjok	69.25.756	25.47.029	0.46	0.50	119	1.5	3.0	18	0.07	0.03	0.01	0.027	0.28
Jergul	69.24.228	24.38.978	0.35	0.24	80	1.6	3.2	27	0.07	0.03	0.01	0.038	0.41
Kautokeino	69.03.139	22.52.745	0.73	0.49	199	1.9	6.7	42	0.09	0.10	0.02	0.076	0.90
Aiddejavvre	68.44.005	23.13.474	0.65	0.50	185	1.8	3.3	22	0.06	0.04	0.04	0.035	0.63
Lævajokk	69.55.931	26.27.021	0.50	0.25	94	3.0	4.7	43	0.09	0.08	0.20	0.042	0.55
Børselv	70.21.389	25.39.720	0.44	0.26	99	2.1	3.7	32	0.07	0.04	0.05	0.040	0.67
Hopseidet	70.47.950	27.43.069	1.7	1.0	446	2.6	4.1	21	0.16	0.05	0.03	0.052	1.1
Vestertana	70.28.396	27.56.975	0.62	0.30	129	5.0	4.9	28	0.16	0.06	0.02	0.054	0.89

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Syltefjord	70.32.042	29.59.145	1.3	0.57	310	6.5	6.9	21	0.19	0.04	0.03	0.053	2.2
Ekkerøy	70.06.603	30.11.039	3.8	1.9	1259	28	24	20	0.54	0.10	0.04	0.061	2.3
Grasbakken	70.04.087	28.50.515	3.1	3.0	920	13	11	23	0.28	0.07	0.05	0.046	1.3
Neiden	69.38.775	29.28.009	0.79	0.66	245	25	19	37	0.33	0.09	0.02	0.030	0.81
Svanvik	69.27.212	30.03.294	5.9	7.6	2885	547	374	55	4.7	0.42	0.29	0.118	6.7
Ø. Pasvik	69.09.467	28.58.812	0.83	0.59	174	27	19	14	0.39	0.07	0.05	0.037	1.2
Gr. Jakobselv	69.46.269	30.50.424	4.8	5.2	1711	229	149	20	1.9	0.15	0.09	0.089	3.4
Rauhelleren	60.17.300	07.43.113	0.50	0.19	188	0.82	3	57	0.06	0.37	0.04	0.039	0.95

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The Norwegian Environment Agency is working for a clean and diverse environment. Our primary tasks are to reduce greenhouse gas emissions, manage Norwegian nature, and prevent pollution.

We are a government agency under the Ministry of Climate and Environment and have 700 employees at our two offices in Trondheim and Oslo and at the Norwegian Nature Inspectorate's more than sixty local offices.

We implement and give advice on the development of climate and environmental policy. We are professionally independent. This means that we act independently in the individual cases that we decide and when we communicate knowledge and information or give advice.

Our principal functions include collating and communicating environmental information, exercising regulatory authority, supervising and guiding regional and local government level, giving professional and technical advice, and participating in international environmental activities.