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Evaluation of the Swedish national environmental monitoring of pesticides

Översyn av det svenska miljöövervakningsprogrammet för växtskyddsmedel i jordbruksmark

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SAMMENDRAG/SUMMARY:

Plantevernmidler er et viktig verktøy i dagens plantevernpraksis i jordbruket for å sikre gode avlinger. Miljørisikoen knyttet til det enkelte plantevernmiddel vurderes nøye før det godkjennes for bruk, men langvarig overvåking er nødvendig for å avdekke de faktiske miljøkonsentrasjoner og -effekter etter forskriftsmessig bruk av plantevernmidler.

Sveriges nasjonale miljøovervåkingsprogram for plantevernmidler startet i 2002. Hovedmålet med programmet er å følge langtidstrender i påvirkningen av jordbrukets plantevernmiddelbruk på kvaliteten av overflate- og grunnvann, samt å bestemme miljøkonsentrasjonene av plantevernmidler i sediment, luft og nedbør.

Formålet med denne evalueringen var å vurdere styrker og svakheter ved overvåkingsprogrammet, samt behov for endringer i den praktiske gjennomføringen, rapporteringsprosedyrer og målsetningen med programmet. Denne evalueringen vurderer også behovene hos de aktuelle sluttbrukergruppene for programmet som inkluderer svensk landbruks- og miljøforvaltning, rådgivningstjenesten i landbruket, bønder og bondeorganisasjoner mv.

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Preface

This report presents an evaluation of the Swedish national environmental monitoring of pesticides performed by the Norwegian Institute for Bioeconomy Research (NIBIO). The report has been commissioned and funded by the owner of the Swedish national environmental monitoring of pesticides, the Swedish Environmental Protection Agency (EPA).

The objective for this evaluation was to assess strengths and weaknesses of the monitoring program as well as required changes with regard to the implementation of the monitoring (i.e. choice of monitoring locaations, sampling strategy, pesticide coverage), the reporting procedures, and the current purpose and aim of the program. Further, the evaluation was to consider the demands of the relevant actor groups including the Swedish agriculture and environment administration, agricultural advisory/extension service, farmers and farmers associations a.o. Details are given in the signed contract for the evaluation (Appendix 1).

The evaluation include recommendations for changes in the monitoring program considering a 10% budget cut or increase.

This report represents NIBIO's scientific evaluation of the monitoring program based on both contracts and manuals for the program, reports and other dissemination from the program, inputs from and discussions with the reference group, the program manager SLU Department of aquatic sciences and assessment, and the program owner the Swedish EPA. Other relevant data/publications including scientific peer reviewed literature and grey literature (reports and websites) have also been consulted in the work.

The interaction between NIBIO and the actors within the monitoring program and the reference group for the program has been restricted to online-contact only due to the covid19 pandemic through 2020.

Ås, 29.01.21

Marianne Stenrød and Roger Holten

Content

1 Summary

Chemical pesticides are an important tool in pest management strategies used within conventional agriculture for maintaining yields of sufficient quality and quantity. The environmental risks from pesticide use must be thoroughly assessed before they can be approved and marketed, but long-term monitoring data are essential to reveal the actual environmental concentrations of pesticides resulting from approved pesticide use.

The Swedish national environmental monitoring program for pesticides started in 2002. The main objective of the program is to track long-term trends in agricultural influences on surface- and groundwater quality from pesticide application, with additional aims to determine the occurrence of pesticides in sediment, air, and precipitation.

The objective for this evaluation was to assess strengths and weaknesses of the monitoring program as well as required changes with regard to the implementation of the monitoring, the reporting procedures, and the current purpose and aim of the program. This evaluation also consider the demands of the relevant actor groups including the Swedish agriculture and environment administration, agricultural advisory/extension service, farmers and farmers associations a.o.

Monitoring locations

The representativeness of the chosen monitoring locations for current Swedish agriculture was assessed by comparing the dominating crops, soil types, and climate conditions for the monitoring sites of the pesticide monitoring and for the entire country.

The evaluation show that the existing monitoring locations does not sufficiently represent the major agricultural areas located on clayey soils in the central parts of Sweden. A model catchment for pesticide transport in Svealand should be included to represent these areas, specifically as clayey soils with a lot of macropores can increase the leakage of pesticides to the groundwater and increase the losses via surface if it is saturated (surface runoff) or drained (subsurface tile drainage).

Further, areas with vegetable production or greenhouse production are not included in the current monitoring program. There are challenges in these productions specifically due to intensive pesticide use (vegetable cropping) and water handling (greenhouses) and both productions may pose a very high risk for both groundwater and surface water contamination locally. However, it will be challenging to identify representative locations for a monitoring site for such productions, and the percentage area they represent is low.

Discussions with the reference group revealed a concern about the general representativeness of the monitoring program due to the restricted number of monitoring sites. It was suggested that the Swedish monitoring could be strengthened by more interaction and collaboration with the monitoring programs of the other Nordic countries. A Nordic collaboration might be especially favorable for Sweden considering the central location among the Nordic countries with some similarities in soils, climate and cropping practices with all the other countries.

Sampling strategy

The suitability of the implemented sampling strategy in capturing peak and base flow pesticide concentrations was assessed by taking into account the current sampling strategy for the different environmental compartments, the potential improvements currently being tested within the frame of the program, and (supporting) evidence from the scientific, peer-reviewed literature.

The main stream water sampling scheme include weekly time-integrated composite sampling in the streams at the outlet of the monitoring catchments, and biweekly/monthly grab samples of the monitored rivers, during the spraying season. This is supplemented by sampling during winter and sampling of runoff events in selected sites. A surface water sampling strategy should encompass both

long-term chronic exposure concentrations and short-term acute exposure concentrations to properly address the objectives of the monitoring program. This would require an implementation of a event-triggered flow-proportional sampling in all monitoring sites in addition to today's time-proportional composite sampling. Also, the objective to assess pesticide losses in stream water would require a year-round monitoring in the locations where winter crops are grown and there is a risk of pesticide transport during winter.

Groundwater sampling in the four main monitoring catchments is done from groundwater wells established in locations representing both inflow and outflow areas of groundwater to the sites. The groundwater sampling appear to be within current European recommendations, but an increase in the number of monitoring locations should be considered due to the needs of key stakeholders.

Sediment samples are included in the monitoring to account for the occurrence of less water soluble pesticides/pesticides that sorb to mineral and organic soil particles. The results from the current sediment sampling included in the program appears to be of little value due to the large uncertainty with regard to what the samples represent. A change in the sediment sampling protocol is planned for 2021, and this is anticipated to largely remedy the current lacks in the sampling protocol.

Considering all the possible changes/improvements of the sampling strategy for the program, any implemented changes must observe the need to maintain a consistent core dataset based on an unchanged sampling protocol troughout the monitoring period. This is necessary to ensure the availability of data for long-term trend analysis. However, the reference group ask for a more flexible approach outside this core sampling program e.g. by the development of shorter term plans to focus on specifc stakeholder needs.

Coverage of analytical methods

The coverage of analytical methods of the program was evaluated by taking into account the current use of pesticides and occurrence of persistent and toxic formerly used/legacy pesticides in the environment as well as the annual revision routines that are established.

The current coverage is deemed appropriate with regard to parent compounds, and the recently implemented procedures to improve the coverage for pesticide metabolites appear sound and transparent. It must be ensured that analytical or economic constraints does not reduce the rate of increase in coverage too much.

Reporting procedures

The suitability of current reporting procedures have been evaluated in relation to the stated objectives of the program, the published national environmental objectives and national action plan for sustainable use of pesticides, and expressed stakeholder needs/opinions.

The main result of the evaluation point toward moving today's annual reports to a web based format. This should be given a high priority due to the needs expressed by the reference group for more frequent data updates and more accessible formats than pdf reports. Further, a more flexible web based dissemination platform should be considered on a longer term, to make it easier for the a broad range of end-users to retrieve data for their specific needs and also to make the data more accessible for the general public.

Recommendations

The report conclude with a recommendation for prioritization of measures (existing activities and proposed changes/improvements) within the monitoring program when considering a 10% budget cut or increase.

2 Background and objective

Chemical pesticides are an important tool in pest management strategies used within conventional agriculture for maintaining yields of sufficient quality and quantity. The risks that pesticides will be leached from farmland to waters and have a harmful impact on non-target organisms must be thoroughly assessed before such plant protection products can be approved and marketed (e.g. Directive 2009/128/EC; Regulation (EC) No 1107/2009). However, reports indicate that residual amounts of these compounds and their metabolites are present in surface and groundwater and might exert non-target effects on aquatic organisms (e.g. Stone *et al.* 2014, Allinson *et al.* 2015, Stenrød 2015, Bradley *et al.* 2017, Szöcs *et al.* 2017, Boye *et al.* 2019). Climate, soil properties and management practices govern the development of weeds, fungal diseases and insect pests. In turn, these factors determine the need for and possible use and efficiency of pesticides, as well as the environmental fate of these chemicals. Hence, long-term monitoring data are essential to reveal the actual environmental concentrations of pesticides resulting from recommended pest management practices and use of these products.

The Swedish national environmental monitoring program for pesticides started in 2002. The main objective of the program is to track long-term trends in agricultural influences on surface- and groundwater quality from pesticide application, with additional aims to determine the occurrence of pesticides in sediment, air, and precipitation. The Swedish national environmental monitoring of pesticides are a part of the Swedish Environmental Protection Agency's national environmental monitoring program, and the Swedish Agricultural University (SLU), the department of aquatic sciences and assessment, is the long-term contractor performing this monitoring program. A detailed description of the strategy and design of the monitoring program and the data obtained, was recently published in the peer-reviewed Journal of Environmental Quality (Boye *et al.* 2019).

As part of the continuous development of this monitoring program, an external evaluation was commissioned by the Swedish EPA, with the aim to assess strengths, weaknesses and required changes with regard to the following aspects of the monitoring of surface water, groundwater and sediment:

- Representativeness of the chosen monitoring locations for current Swedish agriculture
- Suitability of the implemented sampling strategy in capturing peak and base flow pesticide concentrations (i.e. time- and flowproportional sampling, growing season and full year monitoring)
- Coverage of analytical methods in relation to current use of pesticides and occurrence of persistent and toxic formerly used/legacy pesticides in the environment
- Ability of current reporting procedures in answering the requirements of the Swedish agriculture and environment administration, agricultural advisory/extension service, farmers and farmers associations a.o.

When evaluating these topics we have also taken the stated objectives of monitoring program into consideration.

This report is to provide the necessary background material for the Swedish EPA to perform an adequate revision of the monitoring program. A description of the evaluation process, the data used, and the conclusions from the evaluation is presented. The report also include a recommendation for prioritization of measures when considering a 10% budget cut or increase.

3 Evaluation process

3.1.1 Data

3.1.1.1 Data associated with the monitoring program

The data used to assess the specific questions raised in the purpose/mandate for the evaluation included the following categories of publications associated with the monitoring program:

- Reports showing the format of the regular communication from the monitoring program, i.e.the annual report (Nanos & Kreuger 2015) and the long-term summary report with trend analyses (Lindström *et al.* 2015)
- Reports for specific screening studies (Boström *et al.* 2016, Lindström *et al.* 2016), to assess the suitability of the coverage of the annual program
- Contracts, manuals, reports and scientific publications showing the requirements, actual performance and the results from the program (Naturvårdsverket 2017 a & b (manuals), Naturvårdsverket 2018 a, b & c (contracts), Nanos & Kreuger 2015, Lindström *et al.* 2015, Boye *et al.* 2019)
- Manuals and reports describing the risk assessment procedure (e.g. KemI 2008 and 2020; Bundschuh *et al.* 2014, Lindström *et al.* 2015)
- Websites for dissemination of results from the program (i.e. Toxicity index for the risk assessment of monitoring results (Sveriges miljømål 2020), SLU Centre for pesticides in the environment (CKB) (slu.se/ckb), National environmental monitoring of pesticides (plant protection products) (https://www.slu.se/en/departments/aquatic-sciences-assessment/environment/pesticide_monitoring/), Pesticide data from the Swedish monitoring program (https://www.slu.se/en/departments/aquatic-sciences-assessment/environment/pesticide_monitoring/pesticide_data/), Data host agriculture, pesticides (http://jordbruksvatten.slu.se/pesticider_start.cfm)

In addition, all participants in the reference group for the program as well as the contracted party, SLU Department of aquatic sciences and assessment, was invited to provide inputs to the evaluation through an email questionnaire focused on the following:

- Do you identify elements (e.g. cultivation practice, crops, areas, nature types, water bodies) in current agricultural practice and pesticide use in Sweden that are not sufficiently covered/represented by the study areas included in the national pesticide monitoring program within agriculture?
- How do you assess the suitability of the current sampling strategy with weekly time-proportional composite samples through the growing seasons with regard to representing/capturing the actual problems with pesticide transport from soil to water? (e.g. risk of missing peak concentrations, frequency of sampling, sampling period, sampling method)
- Are there examples of frequently used pesticides that are not included in the monitoring? If so, are there specific reasons behind this?
- How do the current report procedures conform with the purpose of the program? Are there specific needs for other or altered reports to better accomplish this purpose? Please comment in relation to the use of the results (i) to comply with and improve current directives and environmental

objectives, (ii) as data input to the approval and re-approval process for plant protection products (PPPs), (iii) to communicate with the growers and other actors within the agricultural sector etc.

- Additional comments including suggestions for improvements, changes and new additions to the program.

Contributions were received from SLU, KemI and Länsstyrelsen. These contributions are incorporated in the text of this report and are identifed when used in the discussion of priorities for the future development of the program.

3.1.1.2 Data from other sources

Peer-review literature has been reviewed to assess the program in relation to state of the art for pesticide monitoring programs focused on representing the risk connected to exposure and toxicity of pesticides in surface water in agricultural areas. Literature obtained through ISI WEB of Knowledge using the following search phrases:

- Pesticide monitoring AND stream water AND sampling strategy OR sampling frequency
- Pesticide monitoring AND river AND sampling strategy OR sampling frequency

was (downloaded to an EndNote library,) reviewed, identifying 43 articles of relevance to assess the sampling strategy for the surface water monitoring included in the program. Only studies cited in the text are listed in the references with this report.

Further, a more restricted literature review using ISI WEB of Knowledge and Google Scholar was done to assess the suitability of the sediment and groundwater sampling strategy included in the program, as well as other aspects discussed in the evaluation.

Other relevant websites/data sources utilized include the National pesticide sales statistics (https://www.kemi.se/en/statistics/quantities-of-sold-pesticides).

3.1.2 Procedure and timeline

The following elements were included in the evaluation process, upon agreement between NIBIO and the Swedish EPA:

- Review of the mandate, technical description and selected (descriptive/background/baseline) reports for the program, including contact with SLU
- Review of relevant peer-reviewed publications
- Email survey to retrieve inputs from the reference group for the program and from SLU (Appendix 2)
- Evaluation of the program according to the focus areas depicted in the mandate/purpose for the evaluation
- Written consultation process to retrieve inputs to the draft report from the reference group and SLU, including meetings where NIBIO presents the draft report to the respective parties
- Presentation of revised report to the Swedish EPA for final inputs
- Final report submitted to the Swedish EPA and published as a NIBIO report.

4 Description and assessment of the program

4.1 Monitoring locations

The representativeness of the chosen monitoring locations for current Swedish agriculture was assessed by comparing the dominating crops, soil types, and climate conditions for the monitoring sites of the national environmental pesticide monitoring and for the entire country.

The national pesticide monitoring program focuses on the sampling of surface water, groundwater and sediments from four sites/model catchments in the most intensive agricultural regions of Skåne (M42), Halland (N34), Västergötland (O18), Östergötland (E21) in addition to two rivers (Skivarpsån and Vege å), all situated in the Southern part of Sweden (Figure 1).

In addition, sampling of rainwater and air are also being done at selected sites but these aspects are not discussed in this evaluation report. All County Administrative Boards in Sweden are also given the opportunity to fund additional sampling in their respective counties. This has resulted in additional sampling of surface water being conducted in the above mentioned and other regions of Sweden, but that is also outside the mandate and scope of this report.

Surface water and ground water from other sites are also sampled within the program area for nutrient monitoring but pesticides are not included in the analyses from all those sites.

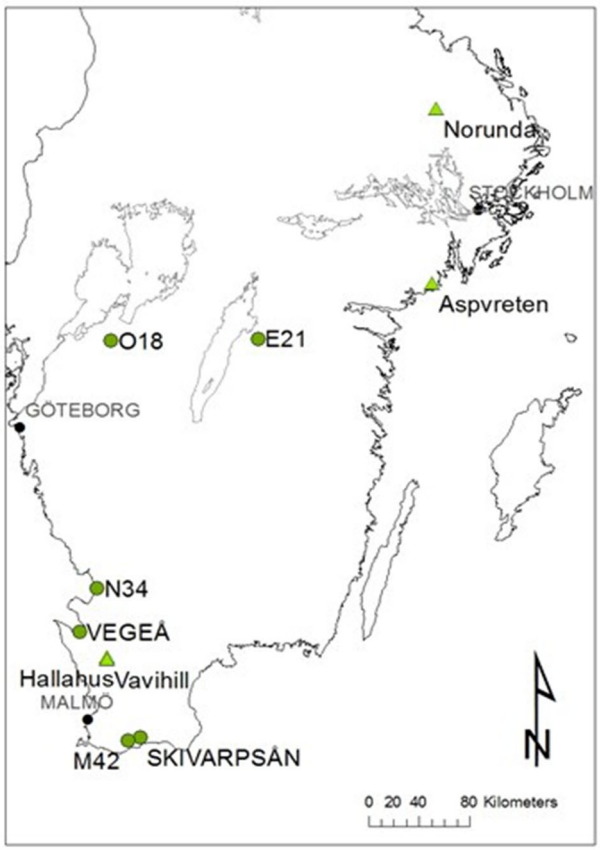

Figure 1: Map of national sampling areas for pesticides in groundwater, surface water and sediment in the Southern part of Sweden (O18, E21, N34, M42, Vege å, Skivarpsån). In addition, areas where rainwater and air are/have been sampled, are included (Norunda (from 2016), Aspvreten (until 2016), Hallahus, Vavihill) (Figure copied from Sveriges Lantbruksuniversitet (SLU) - Institutionen för Vatten och Miljö (2020).

The chosen catchments are model catchments for entire Sweden and have been assessed to be representative for the main agricultural regions in terms of soil types, agricultural practices and major crops grown even though only located within four counties (Skåne, Västergötland, Östergötaland, Halland) in the Southern part of Sweden (Götaland). The same catchments are also included in the environmental monitoring program for nutrient losses from agriculture (Boye *et al.* 2019).

Table 1: Use of pesticides on all arable crops 2016/17 in all counties of Sweden. Treated crop area, per cent, and active substance, kg/ha and tonnes. From Table 1.1a in Statistics Sweden (SCB) (2018).

Samtliga åkergrödor[2]	Antal företag[3]	Grödareal[4]	Behandlad areal		Aktiv substans			
		Hektar	%	mf[5]	kg/ha	rmf[6]	ton	rmf[6]
Län								
Stockholms	38	69 639	48	3,9	0,39	13,9	13,1	15,1
Uppsala	113	147 298	60	2,8	0,32	4,6	28,0	6,3
Södermanlands	67	113 847	59	2,4	0,34	10,9	22,9	12,3
Östergötlands	198	191 983	47	1,9	0,42	5,7	37,9	7,5
Jönköpings	40	84 388	16	2,1	0,40	17,5	5,5	21,6
Kronobergs	19	45 192	..	..	..	..	..	..
Kalmar	114	115 579	36	2,3	0,62	8,7	25,5	12,0
Gotlands	71	82 256	45	3,0	0,69	9,0	25,6	10,9
Blekinge	81	29 327	46	3,7	1,14	9,9	15,3	14,5
Skåne	718	426 066	69	1,3	1,36	1,9	400,4	2,8
Hallands	117	103 667	54	3,0	0,60	7,3	33,7	9,0
Västra Götalands	264	423 436	44	1,5	0,43	4,7	81,1	6,1
Värmlands	91	94 439	26	2,2	0,31	7,1	7,8	11,4
Örebro	104	93 265	60	2,3	0,47	5,4	26,2	6,6
Västmanlands	45	90 237	59	4,9	0,36	6,3	19,2	9,9
Dalarnas	77	54 415	28	2,8	0,39	7,5	6,0	12,5
Gävleborgs	60	62 221	16	2,5	0,26	10,9	2,6	17,3
Västernorrlands	5	43 605	..	..	..	..	..	..
Jämtlands	3	37 394	..	..	..	..	..	..
Västerbottens	20	58 885	13	3,7	0,20	35,0	1,5	32,3
Norrbottens	7	29 663	..	..	..	..	..	..
Produktionsområden								
Götalands södra slättbygder	486	314 597	80	1,2	1,24	2,1	310,3	2,6
Götalands mellanbygder	439	303 129	51	1,6	1,10	3,7	168,5	5,2
Götalands norra slättbygder	308	415 703	56	1,4	0,46	3,9	106,0	5,0
Svealands slättbygder	367	535 416	57	1,4	0,36	3,5	111,3	4,2
Götalands skogsbygder	314	429 632	21	1,2	0,42	6,5	38,2	8,6
Mell. Sveriges skogsbygder	239	164 785	27	1,4	0,33	5,2	14,6	7,5
Norrland	99	233 539	9	1,3	0,26	14,1	5,5	13,8
Storleksgrupper								
5,1-20,0 hektar	141	194 026	30	3,1	0,74	11,0	42,7	13,5
20,1-50,0 hektar	289	288 231	33	1,9	0,67	5,7	63,5	7,8
50,1-100,0 hektar	478	413 144	44	1,6	0,65	4,1	119,7	5,5
100,1-200,0 hektar	586	575 451	47	1,3	0,68	3,2	184,3	4,3
>200,0 hektar	752	913 041	54	1,1	0,69	2,7	338	3,5
Hela Riket[7]								
2017	2 252	2 396 801	46	0,5	0,69	1,6	754,3	1,9
2010	2 148	2 446 123	47	1,0	0,74	2,7	852,9	2,4
2006[8]	8 697	2 330 112	48	.	0,75	.	817,4	.
1998[8]	9 786	2 528 500	48	.	0,85	.	1 036,0	.

1) Ogräsmedel, svampmedel, insektsmedel, tillväxtreglerare och snigelmedel
2) Summa åkermark förutom träda, och ospecificerad åkermark enligt Jordbruksverkets slutliga arealstatistik JO 10 SM1703
3) Antal företag som ingår i beräkningarna
4) Arealerna baseras på uppgifter från Lantbruksregistret
5) mf = (absolut) medelfel i procentenheter
6) rmf = relativt medelfel i procent
7) Fram till och med 2006 ingick snigelmedel bland insektsmedlen. År 2010 var antalet observationer inte tillräckligt för redovisning av resultat
8) För 1998 och 2006 redovisades resultaten exklusive blastdödningsmedel och medel för tillväxtreglering. Mängd aktiv substans inklusive dessa medel uppgick för 1998 till 1 069 ton och för år 2006 till 837 ton aktiv substans

In total the four catchments represent an area of 1 14 5152 ha, which is about 48 % of the total agricultural area of Sweden (ca. 2 400 000 ha) (Table 1). In the catchments 85-92 % of the area is under farmland (Table 2, (Boye *et al.* 2019)).

As these catchments are rather small (8-16 km^2), two rivers, Skivarpsårn and Vege å, both in Skåne, have been included in the program representing medium sized catchments with areas of 102 and 488 km^2 respectively (Table 2, (Boye *et al.* 2019)).

The four counties in which the model catchments are located, are among the most intensely farmed counties in Sweden with agricultural areas between about 104 000 and 426 000 ha (Boye *et al.* 2019). Skåne alone stood for over 50 % of the total amount of pesticides applied in Sweden in 2016-2017 (Statistics Sweden (SCB), 2018). In Västergötland, Östergötland the amounts of pesticides used reached 11 and 5 % of the total amount respectively.

Other counties in Sweden also have large areas of agricultural land. Uppsala for example has ca. 147 000 ha of farmland, and has the same amount of pesticides used related to the total amount as Halland (4 %) in the South of Sweden. Uppsala is in the middle part of Sweden (Svealand), and it could be argued that a model catchment also should have been located in this county to cover the central parts of the country.

Runoff from greenhouses have been documented to be a challenge in certain areas both in Norway and Sweden (Roseth 2009, Kreuger *et al.* 2019). From this we suggest that including more frequent monitoring in these areas is considered if funding allows. This has also been stated by Jenny Kreuger at SLU in her respons to the evaluation group (J. Kreuger 2020, pers. comm.). Finding representative locations for a long term monitoring of this production may however be challenging.

Table 2: Catchment characteristics. From Boye *et al.*. (2019).

Catchment	Total area	Farmland	Mean temperature†	Mean precipitation†	Dominant soil type‡	Main crops
	km^2	%	°C	mm		
O18	7.66	92	7.2	628	Clay loam, silty clay loam	Cereals, oil seed
E21	16.32	89	7.2	567	Loam, clay loam	Cereals, oil seed, potato
N34	13.93	85	8.0	741	Sandy loam, loam	Cereals, forage, potato
M42	8.24	92	8.5	710	Sandy loam, loam	Cereals, sugar beet, oil seed
Skivarpsån	102.00	86	8.4	705		Cereals, forage, oil seed, sugar beet
Vegeå	488.00	66	8.7	700		Cereals, forage, oil seed, sugar beet

† Values represent averages for the period 2002–2016, using data from the closest operational weather station to each sampling location for each year (exact locations for nearest weather stations have varied over the period).

‡ Data from the Swedish Environmental Protection Agency arable land inventory (Eriksson et al., 2010), adapted to international particle-size standards according to Tranter et al. (2011) and Moeys (2014).

4.1.1 Soils

According to Tiberg *et al.* (1998) 30-40 % of agricultural soils in Sweden are characterized as clay soils (> 25 % clay) being glacial and postglacial clays and clay loam. The soils in the catchments O18 Västergötland and partly E21 Östergötland falls into this category (Table 2). Further, 15-20 % of the agricultural soils in Sweden are silt-dominated (< 25 % clay), i.e. silt loam or loam. The soils in the catchments N34 Halland and M42 Skåne falls partly into this category. Approximately 20-30 % of Swedish agricultural soils are defined as sand-dominated, i.e. sandy loam or loamy sand and soils in the catchments N34 and M42 also falls into this category. In total these soil types cover 65-90 % of Swedish agricultural land. Further, 5 % of the agricultural sols are organic soils and 10-20 % are clayey till or clay till (boulder clay) (Tiberg *et al.* 1998).

Plotting the soils of the 4 catchments together with 1930 characterized Swedish agricultural soils (Figure 2) indicates that they fall well within the bulk of the data although only one finer, more clayey soils (40-60 % clay) are represented even though as much as 10-20 % of Swedish agricultural soils are defined within that category (Tiberg *et al.* 1998).

The soil map of the Southern parts of Sweden, Götaland and major parts of Svealand, (Figure 3) shows that the soil types that dominate the agricultural areas in both regions, are of the same type and have the same origin but looking at this in more detail, and examining the soil texture of these regions, one can clearly see that there are differences worth taking into account, e.g. areas of very high clay content around the lakes Hjälmaren and Mälaren, areas of relative intensive agriculture (Figure 4).

Looking at more detailed soil texture data from agricultural soils in Svealand and Götaland (Table 3), median values of the different soil parameters show that the content of organic matter in the soils of the model catchment counties are within the range one would find in agricultural soils in this part of the country although agricultural soil in Svealand seems to contain less organic material than most soils in the bigger part of Götaland (Figure 5). The soil particle size fractions show that the clay contents in agricultural soils in parts of Svealand, e.g. in the county of Uppsala, is much higher (41 %) than the clay content of the soils in the model catchment counties (11-28 %).

Based on the available information, assessing the representativity of the soils in the four catchments is difficult., Overall the soils in the catchments seem to be representative for the larger part of Swedish agricultural soils, even though heavier clays found in the middle part of Sweden is less well represented. From this we advice including pesticides in the sample analysis from the catchments where nutrients already are being monitored in Svealand, i.e. in Uppsala (C6) and/or Västmanland (U8) (Linefur *et al.* 2020). Clayey soils with much macropores may enhance transport of pesticides downwards to groundwater and even enhance surface runoff if saturated or drained (Jarvis 2007, Ulén *et al.* 2013).

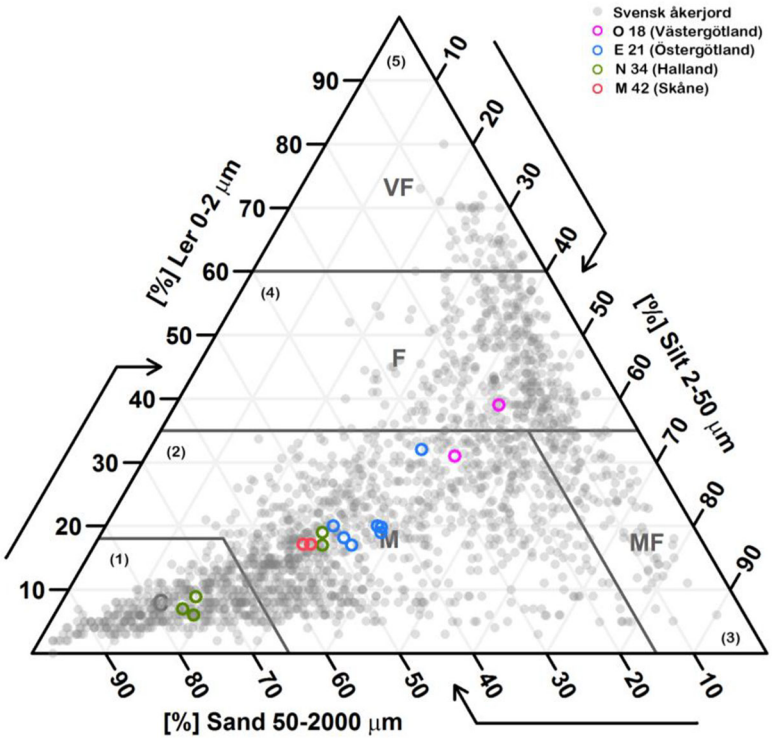

Figure 2: Texture triangle used to classify soils: coarse-grained (1: C), medium-grained (2: M), medium to fine-grained (3: MF), fine-grained (4: F), very fine-grained soils (5: VF). Coloured circles represent the most common soils (total ≥80%) in each type area: purple - Västergötland; blue - Östergötland; green - Halland; red - Skåne. Gray circles represent the texture in 1930 soil samples from the Swedish arable land inventory (Eriksson *et al.*., 2010), edited by Julien Moeys (Moeys and Shangguan, 2014). From Lindström *et al.*. (2015).

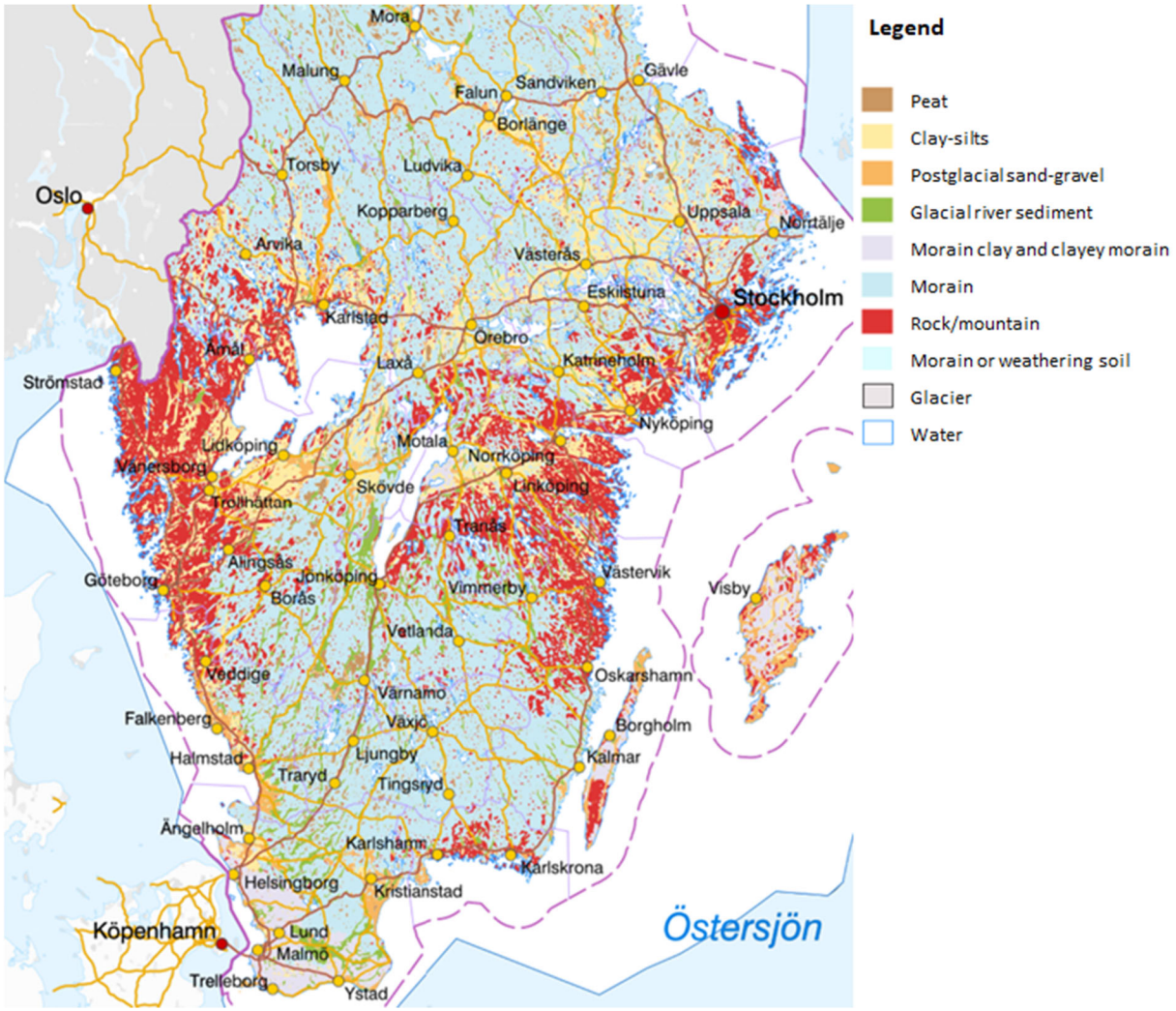

Figure 3: Soil map of the Southern part of Sweden. Source: Sveriges Geologiske Undersökning (SGU) (2020).

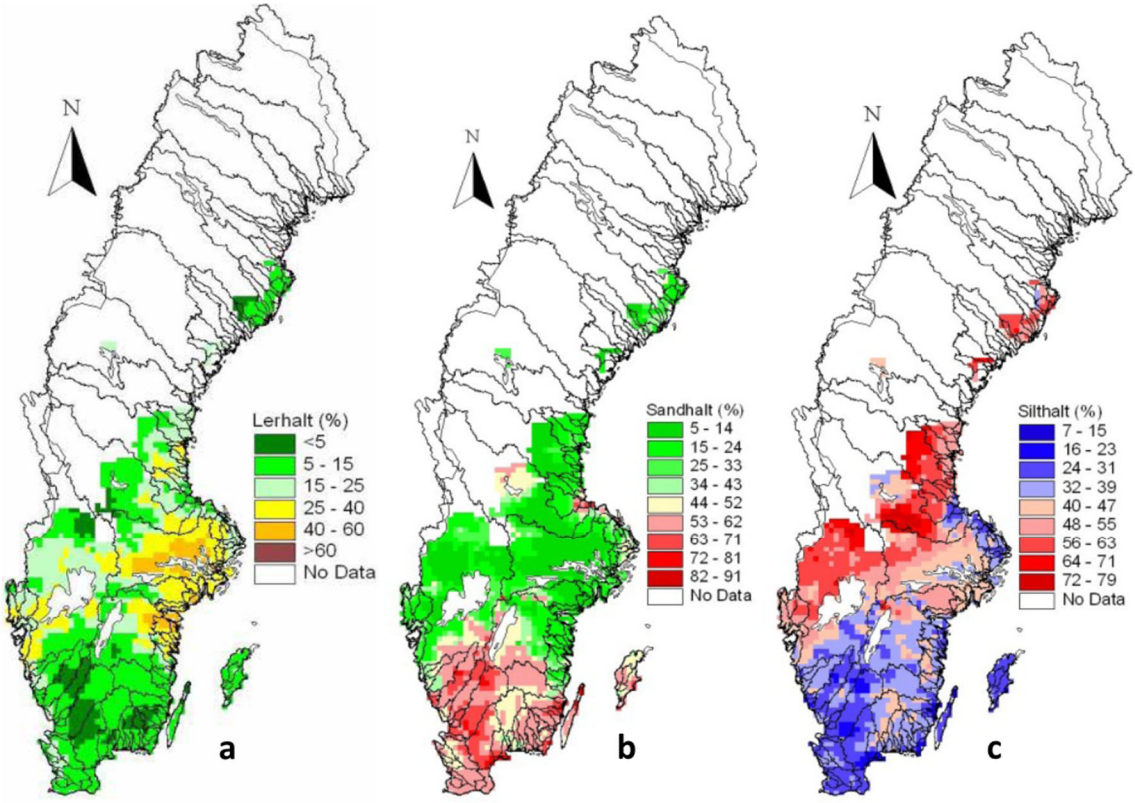

Figure 4: Distribution and content of clay, sand and silt in Swedish soils (Source: Olsson (2020)).

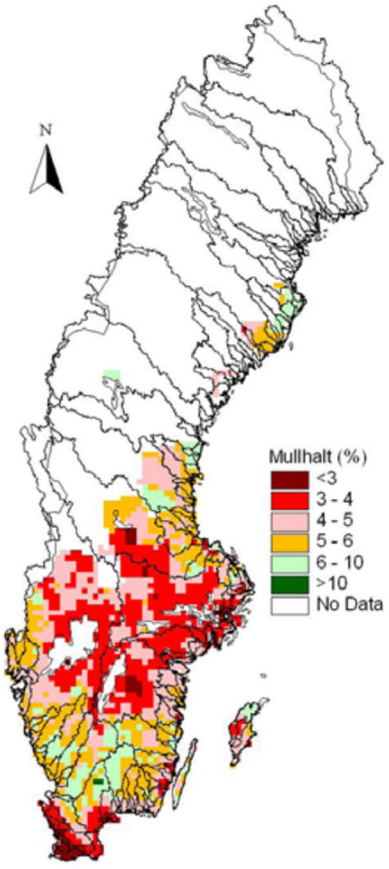

Figure 5: Distribution and content of organic matter in Swedish soils (Source: Olsson (2020)).

Table 3: Soil texture data from agricultural soils in counties in the southern and middle part of Sweden. Median values are presented for each parameter. The number of observations for the different parameters varied between 153 to 2486 in the different counties depending on the size of the county. Data retrieved from the Soil and Crop Inventory and National Soil Mapping database (Sveriges lantbruksuniversitet (SLU), 2020).

County	Organic mat. (%)	Clay, < 0.002 mm (%)	Sand, 2-0.06 mm (%)	Silt, 0.06-0.002 mm (%)
Blekinge	4,7	8	59	32
Dalarna	3,8	12	11	66
Gävleborg	5,2	19	19	58
Halland	5,5	11	61	28
Jönköping	5,3	7	58	34
Kalmar	4,9	9	57	32
Kronoberg	6,2	6	56	37
Skåne	3,4	13	56	30
Stockholm	3,6	33	25	39
Södermanland	3,7	37	13	46
Uppsala	4,1	41	13	42
Värmland	4,0	21	16	58
Västmanland	3,9	41	9	47
Västra Götaland	4,3	20	34	43
Örebro	4,1	25	18	48
Östergötland	3,6	28	29	35

4.1.2 Climate

All four model catchments are located in Götaland, in the Southern part of Sweden. The climate in this area is defined as warm temperate with relatively warm summers and mild winters. The mid- and northernmost part of the country, Svealand and Norrland, are defined as cold temperate, with shorter vegetation periods and longer winters (Stendahl 2020).

Looking more detailed at the 1961-1990 average annual temperatures and precipitation for the different counties (Table 4), one can see that the counties in Götaland which host the model catchments in the monitioring program, on average are both wetter and warmer than counties further north, e.g. Uppsala in Svealand.

Östergötland, Västergötland and Skåne has average annual temperatures of about 6-7 °C and precipitation of about 615-750 mm, while Uppsala have average annual temperatures of 5 °C and average annual percipation of 585 mm.

Figures 6 and 7 shows more detailed data for different areas of Sweden. It seems that most countes have become warmer and wetter in recent years, but the relative difference between the counties seems to be more or less the same (Table 4).

The fact that climate on average is somewhat dryer and colder in Svealand compared to Götaland and that big agricultural areas also are located in this climatic zone, further strengthen our previous advice based on the assessment of soil conditions, to include an additional monitoring site from this part of the country in the program. Slower degradation due to dryer and colder weather may result in a higher risk for runoff and or leaching.

Table 4: Summary of data from climate analysesfrom Swedish counties. Average annual temperature in °C and average annual precipitation in mm. In brackets, percentage change in average annual precipitation within the period relative to the period 1961-1990. From Persson (2015).

Län	Årsmedeltemperatur (°C)				Årsmedelnederbörd (mm) *(δ%)*			
	61-90	91-08	91-10	91-12	61-90	91-08	91-10	91-12
Norrbotten	-1.5	-0.5			661	729 *(10.3)*		
Västerbotten	0.3				740			
Västernorrland	1.9	2.9			659	716 *(8.6)*		
Jämtland	1.0			1.9	745			801 *(7.5)*
Gävleborg	3.4	4.4			677	698 *(3.1)*		
Dalarna	2.5			3.5	733			775 *(5.7)*
Värmland	4.4			5.3	764			822 *(7.6)*
Västmanland	5.3		6.2		650		683 *(5.1)*	
Uppsala	5.0		6.0		585		596 *(1.9)*	
Örebro	5.0				740			
Stockholm	5.8	6.9			612	628 *(2.6)*		
Södermanland	5.8				602			
Östergötland	6.0	6.9			615	623 *(1.3)*		
Västra Götaland	6.1	7.0			794	894 *(12.6)*		
Jönköping	5.6		6.4		741		821 *(10.8)*	
Kronoberg	6.1	7.0			753	835 *(10.9)*		
Skåne	7.2		8.0		747		805 *(7.8)*	
Blekinge	6.8		7.6		680		735 *(8.1)*	

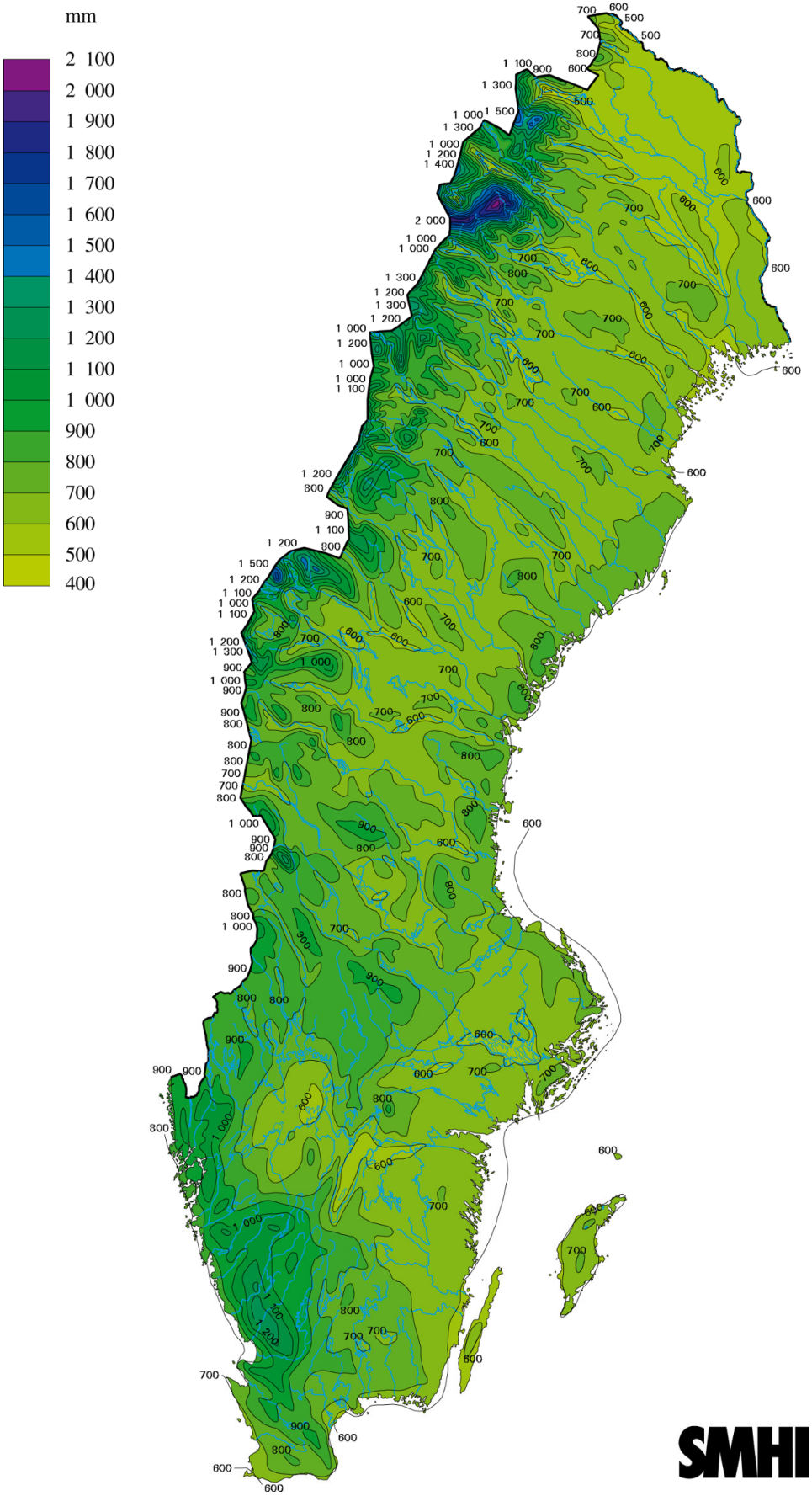

Figure 6: Map of measured average annual precipitation for the normal period 1961-1990 in Sweden (Swedish Meteorological and Hydrological Institute (SMHI), 2020).

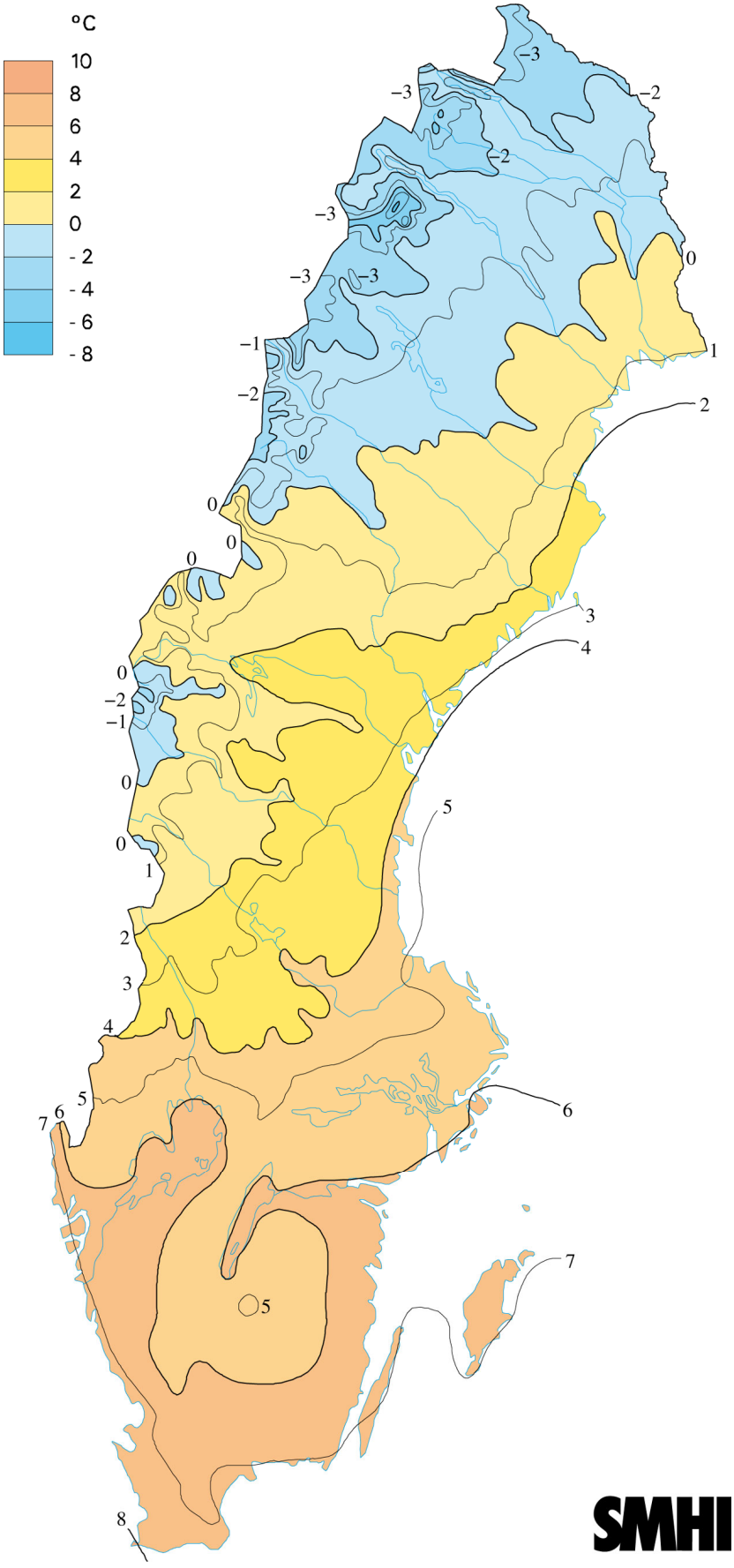

Figure 7: Map of measured average annual temperatures for the normal period 1961-1990 in Sweden (Swedish Meteorological and Hydrological Institute (SMHI), 2020)

4.1.3 Crops

Cereals is by far the greatest single crop in Sweden if grass is excluded (Olsson 2020). Comparing the distribution of crops in the model catchment counties with other counties in the central and southern parts of Sweden, the distribution seems to be fairly representative for this bigger area with 40-50 % of the area being cropped with cereals, 2.5-10 % oil seed crops and 30-50 % grass (Figure 8). Looking more detailed at the model catchment counties (Figure 9) this picture is confirmed but one can slo see that suger beats is a major crop in e.g. Skåne and that potatoes and peas also are relevant crops in some of the counties. Overall it seems that all the major crops of Sweden are well represented in the model catchments.

As stated in the last evaluation report of the monitoring program (Ludvigsen 2006) more frequently sprayed crops like vegetables and fruits are not very well represented in the monitoring program. Even though these are minor crops in Sweden with only about 0.4 % of the cropped area in the country (SCB Jordbruksstatistisk sammanställning 2019), they may represent areas of high risk for surface water contamination in the actual areas where they are grown. An example of this are findings from the Norwegian monitoring program, JOVA. The JOVA monitoring catchments dominated by potato, vegetable and berry crops (i.e. the monitoring sites Vas and Hei) exhibit a generally higher environmental risk as estimated from the pesticides detected throughout the >25 year monitoring period (e.g. Stenrød 2015, Bechmann *et al.* 2017), compared to the catchments dominated by cereal crops, grassland and pasture. This is especially evident in later years (Table 5) and can in part be explained by irrigation practices, i.e. frequent, as well as the dominating soil types, i.e. sandy soils prone to pesticide leaching to drains and subsequently surface water.

Intensive vegetable production may pose a high risk for local groundwater and surface water contamination. Based on this we advice that, given the appropriate funding was made available, including areas of intensive vegetable production in the monitoring program should be considered. Finding representative loactions might however be challenging.

Table 5: Overview over findings in the Norwegian surface water monitoring program in 2018 and 2019. Numbers in brackets are preliminary data from 2019 (Source: NIBIO 2020, unpublished).

Catchment	Catchment size, ha	Cropped area, %	Average annual rainfall, mm	Number of pesticide detections	Number of samples	Number of detected pesticides	Detections above the risk indicator (MF)
Vas	65	62	1230	47 (82)	12 (12)	19 (19)	1 (5)
Hei	170	62	829	67 (111)	8 (12)	19 (20)	7 (32)
Sku	449	61	785	20 (34)	10 (11)	10 (12)	2 (3)
Mør	680	65	665	11 (30)	7 (10)	7 (12)	0 (3)
Hot	1940	58	892	6 (*)	9	3	2
Tim	91	94	1189	8 (9)	10 (10)	3 (5)	0 (1)
SUM				159 (266)	56 (55)	35 (40)	12 (44)

* Not monitored anymore. A new monitoring site is being established in Trøndelag.

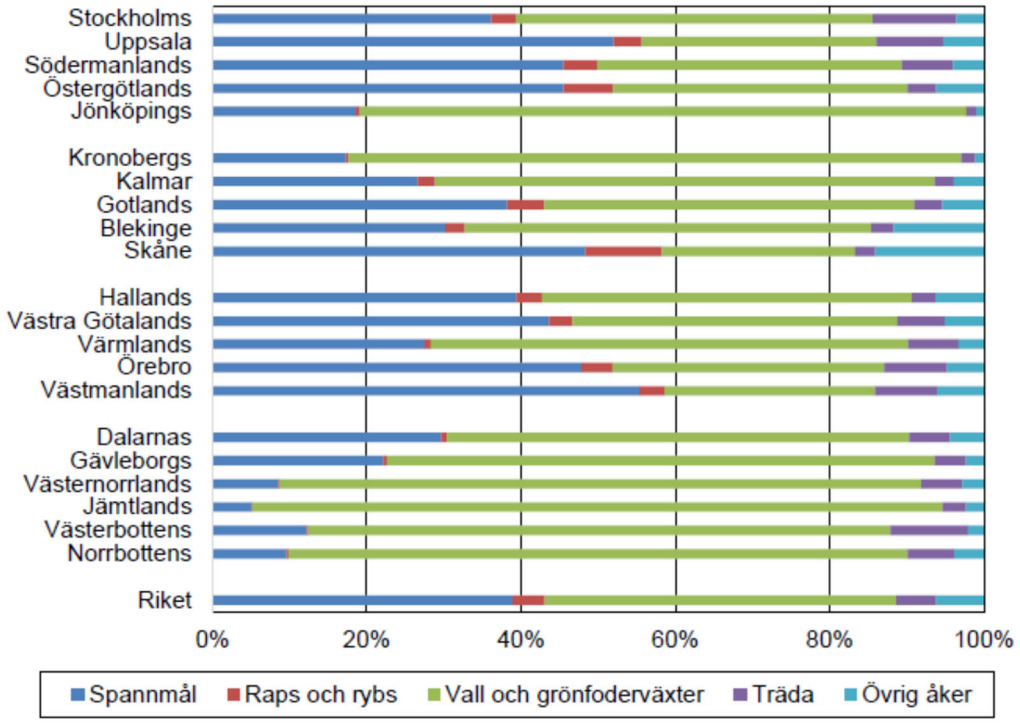

Figure 8: Distribution of crops in Swedish counties (Source: Olsson (2020)).

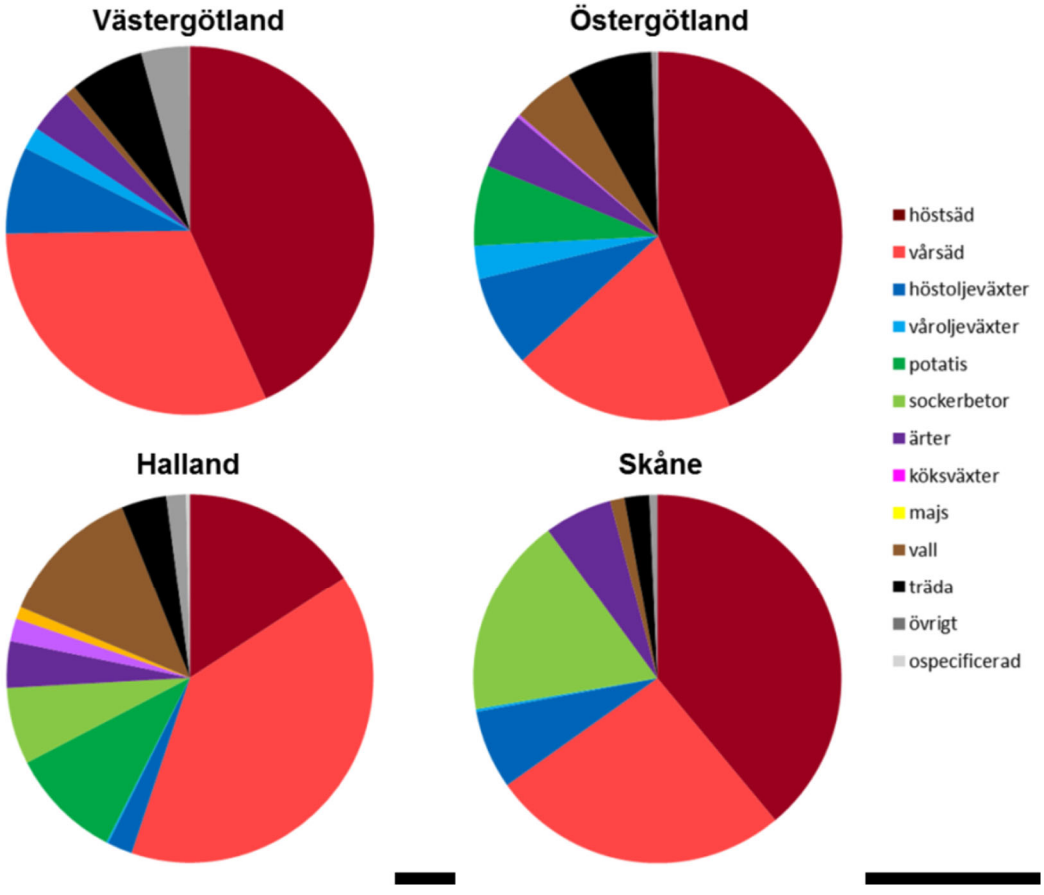

Figure 9: Distribution of crops in the Swedish counties of Västergötland, Östergötland, Halland and Skåne (Source: Boye *et al.*. (2013).

4.2 Sampling strategy

The suitability of the implemented sampling strategy in capturing peak and base flow pesticide concentrations was assessed by taking into account the current sampling strategy for the different environmental compartments, the potential improvements currently being tested within the frame of the program, and (supporting) evidence from the scientific/peer-reviewed literature.

The national environmental monitoring of pesticides include sampling of streams and rivers, groundwater, sediment, air and rainfall for analysis of pesticides. The assessment of the sampling strategy of the program included in this evaluation is restricted to the agricultural streams and rivers, groundwater and sediment as depicted in table 6 below.

Table 6: Monitoring sites and sample types included in the evaluation of sampling strategy for the national environmental monitoring of pesticides.

Site	Stream water composite sampling (weekly/ bi-weekly)	River sampling (monthly/ bi-weekly)	Sediment sampling (annually)	Groundwater sampling (quarterly)
O18 (Vestergötland)	X		X	X
E21 (Östergötland)	X		X	X
N34 (Halland)	X		X	X
M42 (Skåne)	X		X	X
Skivarpsån		X	X	
Vegeå		X	X	

As a specific quality assurance (QA) measure to prevent contamination of samples during sampling or transport, blank samples (not contaminated with pesticides) of surface and groundwater are sampled regularly from the different study areas and analysed. This is currently funded by SLU but we advice that this should be considered a part of the actual monitoring program.

4.2.1 Surface water sampling

The main stream water sampling scheme include weekly time-integrated composite sampling in the streams at the outlet of the monitoring catchments (O18, E21, N34, M42), and biweekly/monthly grab samples of the rivers, during the growing/spraying season April/May-October/November.

Bi-weekly time-proportional composite sampling during the winter and early spring period (December-April) (detailed description in Boye *et al.* 2019) has been performed for one season in all monitoring catchments but over a longer period only for the M42 catchment in Skåne. Later years the time-integrated sampling scheme has been complemented by flow proportional sampling during periods of increasing water flow (flow-triggered automated flow proportional grab sampling) in one of the monitoring catchments. The surface water sampling scheme for the different monitoring locations is outlined in table 7.

Table 7. Surface water sampling scheme for the monitoring locations of the national environmental monitoring of pesticides.

Site	Time-integrated sampling summer	Grab sampling summer	Time-integrated sampling winter	Flow-triggered/ -proportional grab sampling summer
O18* (Vestergötland)	X		2007/08 2019/20	
E21* (Östergötland)	X		2007/08 2019/20	
N34* (Halland)	X		2007/08 2010-p.t.	
M42* (Skåne)	X		2001/02 2007/08 2010-p.t.	(2006/07) 2009-p.t.
Skivarpsån**		X		
Vegeå**		X		

*Detailed data on agricultural practice/pesticide use, sediment sampling and groundwater sampling.
**Statistical data on agricultural practice/pesticide use, sediment sampling

There is a large amount of published research results on pesticide fate and transport in soil (e.g. Flury 1996, Jarvis 2007, Reichenberger *et al.* 2007, Brown & Beinum 2009, Tang *et al.* 2012, Holten *et al.* 2019) and there are complex interactions with climate, soil and cropping practices. The main transport of pesticides happens within weeks after pesticides spreading dominates the annual flux of pesticides (e.g. Flury 1996, Belles *et al.* 2019) and rainfall events with subsequent soil leaching and storm runoff are mainly controlling the transfer of pollutants from diffuse sources in catchments during floods (e.g. Rabiet *et al.* 2010, El Azzi 2016). However, there are differences in what are the main transport mechanisms for different (groups of) pesticides during runoff events (i.e. particle bound and/or dissolved) and how during what part of the runoff event the maximum concentrations can be measured in stream water (e.g. Petersen *et al.* 2012, Lefrancq *et al.* 2017, Topaz *et al.* 2018). There are also studies indicating that certain pesticides show a more constant background contamination pattern (e.g. Belles *et al.* 2019).

It is important to have more knowledge on the different transport mechanisms for pesticides to be able to appropropriately design the sampling strategy to be able to detect effects of cropping practices/ BMPs on catchment scale (O'Donnell 2012). Spycher *et al.* (2018) stated that '*the challenges reside in understanding the complexities of (1) the highly dynamic concentration profiles of (2) several hundred active substances with (3) differing seasonality',* and showed that risks from pesticides can be underestimated by more than a factor of 10 in vulnerable catchments and that an increased temporal resolution is essential to cover acute risks. Stehle *et al.* (2013) concludes that event-triggered sampling more successfully detects exposure incidences than sampling at regular intervals (i.e. grab sampling at 1, 3.5, 7, 14 and 30 day intervals). Sampling frequency greatly affect the ability to capture the actual occurrence of pesticides in stream water and Norman *et al.* (2020) show that nearly 2 and 3 times as many unique pesticides were detected in daily samples as compared to weekly composite and weekly discrete samples, respectively. Further, there were specific challenges in detecting insecticides in stream water, and these were frequently missed by weekly discrete and composite samples.

Further, there are lot of research assessing different integrative sampling techniques (e.g. Morrison *et al.* 2016, Zhang *et al.* 2016 and 2018, Criquet *et al.* 2017, Guibal *et al.* 2018, Castle *et al.* 2018, Hageman *et al.* 2019, Jonsson 2019). The applicability of passive sampling methods as part of the national pesticide monitoring has not been evaluated in this report.

The main sampling method of the program being composite sampling over a longer time periods, provide monitoring data capturing the majority of pesticides but rarely encompass the peak concentrations. However, current research results pin point the need for more detailed monitoring data during runoff/flood events to be able to assess the actual levels of short-term peak pesticide concentrations of the different groups of pesticides. Small streams are important refuges for biodiversity, and monitoring strategies that reflect peak concentrations are needed (Szöcs *et al.* 2017).

A method for increased sampling frequency during flood events is currently being tested in one of the catchments, and compared to the time-integrated weekly samples these flow-triggered and flow-proportional samples show higher detection frequency for the same sampling period (Nanos & Kreuger 2015). An evaluation by Bundschuh *et al.* (2014) show that this flow-triggered sampling, uncovered an up to 7-fold underestimation of the maximum concentration in terms of toxic units for daphnids and fish during run-off events when relying solely on the time-proportional composite sampling. Even though the resolution of this sampling and analysis is restricted, this is a concept to consider expanding further when economically feasible as the results will greatly improve the reliability of the measured environmental concentrations and their value for risk assessment. However, the employed sampling is done on rising water levels and not during the recession of the flood event, where less mobile pesticides might predominate due to hysteresis effects (Lefrancq *et al.* 2017).

We suggest that such sampling methods aimed at capturing peak concentrations should be considered for all the monitoring sites due to the large variability in runoff patterns potentially caused by differences in climate, soil and cropping practices.

Long term data series where the metodology is both sufficient and consistent is a prerequisite to determine long term trends in environmental pesticide exposure consentrations. The need for long-term monitoring is even stronger with the climate change and continuous changes in agricultural practices. This is an argument to not alter or reduce the sampling program drastically as this will greatly diminish the value and usability of the monitoring data. In our opinion, both a time-proportional composite sampling program and a flow-triggered sampling approach is necessary to fulfil the program objective of studying the levels of pesticides in surface water both with regard to long-term chronic exposure and short term acute exposure concentrations, as supported by Bundschuh *et al.* (2014).

Sampling throughout the year (i.e. including winter sampling) would be necessary to enable calculation of total losses from the monitoring catchments. However, this is only performed in 1-2 catchments. As mentioned, research results show that the main losses are during the growing season, shortly after spraying and particularly when spraying is followed by heavy rainfall and runoff. Climate change with potential for increased area with production of winter crops will result in increased use of pesticides during the fall and hence also increase the risk of pesticide loss during late fall and winter. Hence, we assess that the main monitoring program should be expanded to include sampling during the winter period in all catchments where there is a trend with increased area with winter crops, to better achieve the objective of assessing total loads of pesticides to the streams. This would also improve the use of the monitoring data to develop guidelines on how to minimize the pesticide transport from soil to water and enable development of best management practices.

Considering the use of the monitoring data in developing risk indicators for agricultural use of pesticides as part of the environmental objective 'Non-toxic environment', the necessity for an all-year sampling program must be assessed in relation to the period of biological activity and risk of effects on aquatic organisms. This aspect has not been further evaluated in this report.

4.2.2 Groundwater

Groundwater sampling in the four main monitoring catchments (O18, E21, N34, M42) is done from groundwater wells established in locations representing both inflow and outflow areas of groundwater to the sites. The established wells allow sampling from two depths at each location, the actual depths varying between the different monitoring sites (e.g. Lindström & Kreuger 2015). Overall the sampling represents shallow groundwater from 2-7 m depth.

Groundwater sampling is performed on four occasions through the year; February, April, August and November.

Considering a recently published evaluation of different exposure scenarios and study designs for groundwater monitoring (Gimsing *et al.* 2019), the Swedish national monitoring can be grouped within exposure assessment options 2 or 4;

> (2) Residue concentration in the upper portion of the groundwater from below treated fields but excluding groundwater shallower than 1 m below the ground surface (in field; edge of field)
>
> (4) Residue concentration in groundwater shallower than 10 m below ground surface but excluding groundwater shallower than 1 meter below surface (in field, edge of field, sub catchment)

For these scenarios an edge-of-field study design with a two-well setup in the inflow and outflow areas as for the Swedish monitoring, is deemed sufficient for catchments with a well characterized groundwater flow.

The published methodology for the program does not allow for a more in-depth evaluation of the suitability of the chosen locations and depths for the groundwater wells. Gimsing *et al.* (2019) recommend that the sampling interval should consider the expected temporal patterns and the concentration profiles in the saturated zone and the temporal aspects of the specific protection goal. From our assessment this mainly relate to the environmental quality objective Good-Quality Groundwater and the aim to ensure that '*the quality of groundwater is such that, with few exceptions, it is not limited in use for public or private supply of drinking water*'. Since the program reports indicate a low variability between years in the detections of pesticides in groundwater, the possibilities to reduce the amount of samples analysed pr year could be considered (e.g. reduce from 4 to 3 sampling times). However, weather conditions experienced in the current changing climate with erratic rainfall events, extreme dry and wet periods/conditions are likely to increase the occurrence of pesticides in groundwater at any time during the year. From this, we assess the current quarterly sampling frequency to be both within the recommendations for long-term groundwater monitoring and in line with the needs under more unstable/extreme weather conditions.

Discussions with the reference group of the monitoring program revealed that KemI, SGU and Länsstyrelsen consider the current monitoring as a minimum, and would suggest to increase the number of groundwater monitoring sites to improve the representativeness for a broader range of groundwater conditions/reservoirs.

4.2.3 Sediment

Sediment samples are included in the monitoring to account for the occurrence of less water soluble pesticides/pesticides that sorb to mineral and organic soil particles. The coverage of pesticides for the analysis of sediment deviates from the analysis of the surface and groundwater samples, with 108 substances being analysed for the former in 2017.

Sampling of sediments has been performed annually in the agricultural streams of the four monitoring catchments (O18, E21, N34, M42) and the two rivers (Vegeå and Skivarpsån) since 2003. The

sampling is done during a period of slow/low water flow in the fall (e.g. September) and in a part of the stream with slower flow that allows for sedimentation. The upper 0-2.5 cm of the sediment in the stream is sampled by use of a small metal shovel within a small area (<3 m^2) of the stream bank.

Sediment analysis is assumed to be an important supplement to water analysis, as it provides an estimate of the sediment bound (fraction of) pesticides and enables an assessment of toxicity/risk in this compartment. Sediment samples will potentially provide higher measured pesticide concentrations than water samples, although at an expected lower detection frequency (Schäfer *et al.* 2011), which is in line with the results from the monitoring program. It is however important that the sampling strategy is sufficient to provide a reliable estimate of the of pesticides in sediment. The sampling procedure in the national pesticide monitoring provides a sample that represent a small section (< 3 m^2) of the stream at one time-point during the year, and would hence provide low reproducibility between years due to variability in exact sampling location, weather conditions, spraying and pesticide transport conditions. While the sediments sampled are thought to be representative of the sedimentation during the sampling year, it will in reality be greatly affected by the stream flow during the spraying season and the risk of river bank erosion in the individual stream. This will hamper the interpretation of the results in relation to evaluating impact of cropping practices, soil and climate conditions in the catchment, as is shown in the reports from the program stating that there are now significant time trends of or trends that can be explained by spraying practices in the results for sediment analyses (Lindström *et al.* 2015).

From this large uncertainty in the current estimates of pesticides in sediment we advice that this sampling procedure is further assessed and alternative solutions are sought. SLU is currently testing an alternative sediment sampling technique where a contraption submerged in the stream enables sampling of particles sedimenting from the stream water during the entire spraying season. The technical description of this procedure (Jonsson 2019, internal procedure SLU) indicate that the implementation of this method will greatly improve the representativeness of the sediment samples from the monitored streams. Sampling at several locations in the stream will further improve the representativeness of sediment sampling in the program.

Depending on the use of the results by stakeholders and the environmental objective for which these results are aimed, we suggest that also alternative measurements/methods could be considered. Such measures could include biological samples (e.g. sediment dwelling organisms) or sediment sampling in the recipient water body. Possible alternative methods has not been evaluated in this report. Biological sampling (macroinvertebrates and diatome) is already part of other linked studies performed at SLU.

4.2.4 (Sampling for) improved toxicity assessment

Currently the measured concentrations are assessed in relation to established environmental objectives and guideline values (known toxicity data from lab scale studies), while no on-site assessments of potential effects are included. As suggested above, biological samples could be a potentially important complement to the current water and sediment sampling program. Other options could include studies of other organisms, or toxicity testing of collected water samples.

We advise that this question is addressed in combination with a review of the sediment sampling procedures, but a thorough assessment of possible methods to implement has not been done in this evaluation.

4.3 Coverage of analytical methods

The coverage of analytical methods of the program was evaluated by taking into account the current use of pesticides and occurrence of persistent and toxic formerly used/legacy pesticides in the environment as well as the annual revision routines that are established.

Moschet *et al.* (2014) and Spycher *et al.* (2018) illustrate the importance of a sufficient coverage of the analytical methods used in environmental monitoring of pesticides through the impact on the resulting risk assessment. Further, Barceló (2007) discuss this in the context of effect-directed analyses of toxicants and monitoring in European river basins.

The chemical analysis of pesticides in surface and groundwater, sediment, precipitation and air sampled within several separate national monitoring programs, are all performed by the organic risk pollutants laboratory (OMK) at SLU; accredited (SS-EN ISO/ENC 17025:2018) for fresh water and drinking water analysis of pesticides and organic pollutants (Swedac, 2018). Regular attendance in international proficiency tests showing good results assure the quality of the analyses at the laboratory.

To ensure efficient sample handling in the laboratory, the same coverage and analytical methods is used for all water samples. This means that certain banned substances relevant for precipitation samples due to transboundary atmospheric pollution/transport are also included when analysing surface and groundwater samples, although the former is formally part of a separate monitoring program.

4.3.1 Inclusion of parent compounds

The coverage of the analytical methods used in the national pesticide monitoring program included 148 different substances in 2018 (J. Kreuger 2020, pers. comm.).

The coverage is currently revised annually as part of the meetings in the reference group for the program. An index is calculated for all the PPPs approved for use in Swedish agriculture based on the following criteria:

- Used amount (kg) within the study areas
- Sprayed area (ha) within the study areas
- Sorption to soil (K_{foc})
- Degradation rate in soil (DT50)
- Prioriy substance according to the Water framework directive (WFD) (including both the priority substances and the watch list)
- Toxicity to aquatic organisms (e.g. Swedish Riktvärde)

Each criteria is rated between 1 to 10, with high values denoting undesirable properties and a high priority for inclusion in the monitoring.

Of the 50 substances with the highest sum index in 2018, only three (chlormequat chloride, diquat, desmedipham) were not included in the monitoring program (J. Kreuger 2020, pers. comm.).

The rational for not including these substances rely on the following:

- Not possible to include in established multi-methods for gas- and liquid-chromatography → single residue methods required that will increase the cost substantially
- Diquat and desmedifam no longer approved for use as of 2020
- Chlormequat chloride of low toxicity to aquatic organisms (Dutch Riktvärde 240 µg/L)

Based on the reports of pesticide use in the study areas, substances not included in the analyses constituted <9% of the total amount of sprayed pesticides in 2018 (of which chlormequat chloride constituted about 50%). The corresponding value based on the pesticide sales statistics in 2018 was 6%.

We assess that this procedure is transparent and ensures the relevant input from key stakeholders, and the annual assessment consider both amounts used and potential toxicity to aquatic organisms. The above analysis of the resulting coverage of the monitoring, based on data provided by SLU, show that all relevant pesticides are included in the program as far as technical and economic constraints allow.

4.3.2 Inclusion of metabolites

In 2018 15 metabolites were included among the 148 substances covered by the chemical analysis within the program. There is an expressed need for the post-authorization monitoring point of view (KemI) to (progressively) expand the coverage to include major metabolites of the approved pesticides. From this, while also regarding the economic constraints of the program, an ongoing discussion between KemI and SLU has recently resulted in the agreement that the following stepwise procedure should be employed to ensure the inclusion of the relevant metabolites in the coverage of the monitoring of pesticides in ground- and surface water within the national program.

- Identify relevant metabolites from:
    1) Discussions of active ingredients within SCoPAFF (Standing Committee on Plants, Animals, Food and Feed, section pesticides-legislation (European Commission)), including pesticides not approved for use in Sweden (responsible: KemI)
    2) Approval process for PPPs in Sweden, that also include exposure assessment for Swedish conditions (responsible: KemI)
- Assess identified metabolites with regard to:
    1) Risk of leaching to groundwater (responsible: KemI)
    2) Toxicological relevance (according to data from the EFSA conclusion for the individual active ingredient) (responsible: KemI)
    3) Potential challenges and relevance to include in existing analytical methods (multi methods vs single residue methods; use within the study areas; use of screening method as an initial step to assess relevance) (responsible: SLU)

In this procedure relevance based on existing data is a prerequisite for inclusion, and lack of data alone should not be considered sufficient grounds.

The work is preferably to be done through a continuous routine rather than in larger bulks, thus requiring a routine where KemI assess new substances and inform SLU about potential candidates throughout the year.

The major challenge is that only a few pesticide metabolites are included in the current monitoring, while there is increasing awareness and knowledge of the importance of including major and highly toxic metabolites in such monitoring programs (e.g. Reemtsma *et al.* 2013). We consider that the recently implemented routine is sound and sufficiently aimed at improving this aspect for the national environmental pesticide monitoring. The effects of this new routine will be noticeable from 2021 and it must be ensured that technical/analytical or economic constraints does not reduce the rate of increase in coverage too much.

4.3.3 Removal of legacy pesticides

In addition to the coverage of the pesticide monitoring being assessed at regular intervals to ensure the inclusion of newly approved substances, there are also routines for the removal of no longer approved substances that are not relevant for further long-term monitoring. The latter involves SLU identifying the substances that have not been detected in any of the monitored sample matrices (surface and groundwater, sediment, precipitation and air) during the last 5 years of monitoring, to discuss their

possible exclusion with the Swedish EPA. An exclusion would only be warranted when the substance in question is not a priority substance according to the WFD (2013/39/EU) or the Swedish Agency for Marine and Water Management. Published research results support the continued/long-term inclusion of legacy pesticides in monitoring programs due to their occurrence and toxicity (e.g. McKnight *et al.* 2015), but we are of the opinion that the current procedure implemented in the national pesticide monitoring is sufficiently well-founded and consistent.

4.4 Reporting

The suitability of current reporting procedures have been evaluated in relation to the stated objectives of the program, the published national environmental objectives and national action plan for sustainable use of pesticides, and expressed stakeholder needs/opinions.

4.4.1 Current reporting routines

The national monitoring program for pesticides generates a lot of data and analysis from many environmental compartments (surface water, groundwater, sediments, air and rain). Data on agricultural practices, e.g. crops and pesticide application data, are also included. All these data, as well as data from additional single projects are processed and presented in annual written reports made available to the public. In addition to the annual updates from the main monitoring program, e.g. Nanos and Kreuger (2019), more long-term trends also are being analysed and reported (Lindström *et al.* 2015). Smaller projects, e.g. screening projects, are also reported consecutively (e.g. Boström *et al.* 2020, Jonsson *et al.* 2019, Lindström *et al.*. 2017) but these assessments are not funded within the main monitoring program. Data and analysis from the monitoring program and related projects are also published in international peer reviewed journals (Boye *et al.* 2019, Sandin *et al.* 2018, Steffens *et al.* 2015). These more comprehensive analysis of monitoring data and in-depth investigations in the monitoring sites are part of the work area of SLU CKB.

According to the agreements between SLU and the Swedish EPA on the different monitoring projects, the maximum sum that can be allocated to the annual reporting is between 30 and 40 % of the total budgets. In reality about 4 % of the total budget of the monitoring program is used for communicating and reporting and approximately 50 000 SEK for the reporting alone (J. Kreuger 2020, pers. comm.).

SLU comments that the reporting of the monitoring program is very time consuming and the resources allocated to reporting has not been assessed to be adequate. How to do the reporting in a more time efficient way have therefore been discussed with the program's reference group. Since the results from the monitoring program may be used by a wide variety of end users, one of the conclusions from these discussions were that it is difficult to find new reporting formats that satisfies all end user's needs and wishes.

KemI are of the opinion that all figures and tables presented from the monitoring program are important and valuable, but that the figures that compare the findings of the program with threshold values are especially important/critical. The annual reports from the monitoring program are often published with a 2-year delay, and the reference group express a need for the data to be made available earlier, e.g via a web based solution. We assess that with a web-based report solution where the results from the monitoring are published as soon as they are ready, the annual written reporting would not be necessary. More detailed written reports every 3rd or 4th year on long term trends etc would then perhaps be sufficient. KemI suggest more focused thematic reports with in-depth analyses including trend analyses, instead of the current reports that present an overview of 'all' results. Proposals for thematic reports can be separate trend reports for surface water (corresponding to Lindström *et al.*. (2015)), sediment sampling and groundwater sampling. KemI also expressed a need for simple statistical analysis of the monitoring data, but this has so far not been prioritized within the current budgets.

4.4.2 Accessibility of data

How the monitoring results is disseminated through different channels is illustrated in Table 8. Based on this overview we consider that the reporting of results from the monitoring program answers to most of the objectives set for the program, at least when supplemental reports from e.g. SLU-CKB are included.

Table 8: The main objectives of the monitoring program and where these objectives are being addressed or showcased in written disseminations.

Objective	Dissemination channels				
	Annual reports	Summary reports	Other CKB reports	Peer reviewed articles	Online/ Web-based[1]
Study levels of pesticides in surface water and shallow groundwater, and follow long-term changes.	X	X	X	X	X
Obtain evidence to assess how the quality of water is affected by various cultivation and mitigation measures.		x[3]	X	X	
Assess the determination of pesticides in the sediment.	X	X			
Calculate the size of mass transport, as well as its percentage of total pesticide use in the area.	x[2]				
Provide basis for the authorities' actions and recommendations, with the purpose of reducing transport of pesticides to the aquatic environment.	X	X	X		X
Provide a basis for validation of regional calculation models.			X		

[1] Data made electronically available.[2] Only possible in the Halland and Skåne catchments. [3] Only very briefly discussed

All written reports are made available electronically from the SLU-CKB website (https://www.slu.se/centrumbildningar-och-projekt/SLU-Centrum-for-kemiska-bekampningsmedel-i-miljon/publikationer/rapporter-fran-ckb/) and all measurement data from the monitoring program are made available from the website of the data host (Datavärden; http://jordbruksvatten.slu.se/). This web page allows the end-user to choose to display data from either single sites, single substances or single years in excel sheets. In addition to the measured environmental pesticide concentration, these excel sheets also contain information on e.g. the monitoring sites, and methods for sampling and pesticide analysis.

As mentioned above, the reference group of the monitoring program has discussed new reporting formats and several suggestions have been made. It was stated that getting an overview of all the available data is currently difficult and that work needs to be done on making these data more easily available both with regard to finding the required data and also on how to interpret them. One suggestion was to post more general information about the monitoring program on the website and then link a number of figures (and possibly tables) and other details to this text, e.g. details on sampling frequency and the methods of analyses. Figures and tables could then be easily updated as soon as the results of that particular part of the monitoring program was ready (without elaborate text describing the new results). We assess that this is a suitable procedure to make the monitoring results publicly available more quickly. According to SLU a change like this would require extra resources, but a one-time sum would probably be sufficient.

4.4.3 Possibilities to relate to national environmental objectives and other stakeholder needs

The results from the monitoring program may be used by many different end users, as outlined above. Finding reporting formats that satisfy all parties may not be possible within the current budgets. The data can e.g. form a basis for advising and training farmers. Having results from different agricultural areas makes it easier for farmers to relate to the presented results.

Trend analyses and environmental objectives

The reporting from the main monitoring program is mainly focusing on describing water quality status and relating the findings to concentration target values/threshold values in surface water (Riktvärde) and groundwater (Nanos and Kreuger 2017, Lindström *et al.* 2015). The trend analyses included in the reports from the program focus on measured concentrations of the individual substances in relation to the current environmental objective (Riktvärde) for the substance. Further, trends are assessed for the different monitoring sites looking at a Pesticide Toxicity Index (PTI) where the ratio of the measured concentration (MEC) to Riktvärde is summed for those substances and samples where this ratio is above 1 (i.e. summing the occasions where the MEC is above Riktvärde and hence indicating a risk to aquatic organisms) (Lindström *et al.* 2015).

Based on the increasing amount of research results indicating the risk of low-dose effects of pesticides (e.g. Schäfer *et al.* 2012, Liess *et al.* 2013, Peters *et al.* 2013, Liess *et al.* 2019) we advice that it should be considered whether the summary reports should use a PTI including all measured pesticides. This version of the PTI is used in the annual reports, and might provide a more relevant estimate of the potential environmental risk. There is a large variability of pesticide effects in the environment, both regarding toxicity of single substances and differences in cumulative toxicity from pesticide mixtures to different organisms/groups of organisms. It should be considered to include more elaborate methods to assess for these differences (e.g. Backhaus & Faust 2012, Neale *et al.* 2015, Shao *et al.* 2019), depending on the use of the results by stakeholders and in relation to governmental environmental goals and objectives. The current evaluation based on Riktvärde and the PTI index is a conservative, worst case approach based on data from single-substance toxicity tests. We recognize that a more elaborate/sophisticated approach would be too time consuming to perform on an annual basis, but that it could be considered for trend analysis in summary reports. However, the reference group consider the current risk assessment procedure in the program to be sufficient for the current Swedish environmental objectives and guideline values.

The monitoring include detailed data on cropping- and spraying practices that may provide important new knowledge on governing factors and processes in the catchments when coupled to the analysis results of pesticides in stream water, groundwater and sediment. The current reports from the monitoring include some information on the amount of pesticides used in the different catchments and the crops grown, but there is very little information given on e.g. the effect of different tilling practices and on mitigation measures commonly used in the catchments. Climatic factors and soils are discussed to a certain degree. Connecting the measured pesticide concentrations to at least a minimum of information on tilling practices and mitigation measures can be valuable information, both for farmers, the agricultural advisory services and the authorities. Long term data series are necessary to be able to draw firm conclusions on the effects of implemented measures in a catchment, due to the complex interactions between climate, cropping practice, distance between sprayed field and water body, slope, soil properties etc. and the large variability in these factors. We suggest that these possibilities could be further explored considering that the data sets currently include close to 20 years of monitoring. The necessity of such efforts within the monitoring program must be considered in relation to already existing reports and analysis provided by other Swedish institutes or authorities (e.g. Statistics Sweden, Swedish Agriculture Agency).

Data from the monitoring program has also been used by authorities in various contexts, e.g. when measured data from the monitoring was compared to Predicted Environmental Concentrations (PECs) and Predicted No Effect Concentrations (PNECs) calculated by the European Food Safety Authority (EFSA). This then formed the basis for suggesting a new method for calculating PEC values for pesticides in surface water (Berggren *et al.* 2018, Boström *et al.* 2019).

Another important area where the results from the monitoring program are used is the annual update of the indicator (PTI) to follow up the Government's work with the environmental goal of a non-toxic environment (http://www.sverigesmiljomal.se/miljomalen/giftfri-miljo/vaxtskyddsmedel-i-ytvatten/). Work connected to the monitoring program has also been used in the development of water quality standards (WQS) for surface water and the mentioned indicator used to assess the water quality and environmental exposure (Asp and Kreuger 2004, Asp *et al.* 2004).

Considering the environmental quality goal 'A non-toxic environment', KemI suggest that one should consider reporting how pesticide levels in raw water for drinking water relate to the Government's goals set in the Swedish action plan (NAP) for sustainable use of plant protection products (N2019/01607/SMF). This requires an assessment of the representativeness of the monitoring sites for drinking water reservoirs. The overall goal of the NAP is a gradual reduction in the levels of pesticides in surface water and groundwater until levels are close to zero. This is in line with the Swedish Parliament's environmental quality target; a "Non-toxic environment". In the case of raw water for drinking water, this target has been specified to be <0.025 µg/l. The sampling points in agricultural land (both groundwater and surface water) within the monitoring program do, according to KemI, not normally include raw water for drinking water. For surface water these sources should be larger lakes, while for groundwater it can be larger aquifers but also individual wells. When the monitoring sites affect such drinking water sources it may be relevant to consider the goal in the action plan, while for the registration process of pesticides KemI may only consider the 0.1 µg/L limit for drinking water.

Model validation

Data from the monitoring program has been used to validate regional pesticide models, e.g. MACRO-SE, both with regard to input data on pesticide applications to make more realistic scenarios (Steffens 2015, Boström *et al.* 2015) but also with regard to comparing model output with measurements done within the monitoring program (G. Boström 2020, pers. comm).

Research

Although outside the direct mandate and budgets of the montoring program, data and knowledge from the monitoring program are quite often used as a basis for other research, reports and publications, e.g. reports focusing on the effects and risks to aquatic and terrestric animals (Jonsson and Kreuger 2018, Goedkoop and Kahlert 2015, Goedkoop and Kahlert 2018, Rundlöf *et al.* 2012). The contribution of single crops to the contamination of surface waters have also been reported (Boye *et al.* 2013) in addition to assessments of possible mitigation measures although focusing on vegetated buffer zones (Boye *et al.* 2012).

The work carried out within the monitoring program has also been used in several contexts in research. An example is a PhD project where the significance of different soil types for losses of pesticides to the watercourses in the catchment in Östergötland was studied (Sandin *et al.* 2018).

4.5 Current budgets and estimated costs of proposed measures

4.5.1 Current budgets

The main monitoring program is funded by the Swedish EPA through the main program area "Miljögifter terrestrisk" and action area "Pesticider". The funding was 2.86 mill. SEK pr year for 2018

and 2019, and 2.92 mill. SEK for 2020. According to the project agreement for 2016-2017 (J. Kreuger 2020, pers. comm.) these funds are further allocated to different areas within the program with approximately 60 % to chemical analyses, 19 % to project leading, 11 % to sampling and data collection, 6 % to data processing and 4 % to communication and reporting.

Two additional projects related to the main monitoring program have also received independent funding from the Swedish EPA the last 2-4 years.

1) A project on sampling during winter in area N34 (Halland area) received funding through program area "Jordbruksmark" and action area "Utredningsoppdrag". This project was granted 110.000 SEK in 2017, 175.000 in 2018, 65.000 in 2019 and 183.000 for 2020-2021.

2) A project on flow proportional sampling vs time integrated sampling of pesticides received funding through the program area "Miljögifter terrestrisk" and action area "Pesticider". The funding was 335.000 SEK pr year for 2018 and 2019 and 345.000 SEK for 2020.

4.5.2 Proposed measures

Table 9 summarize and exemplify costs for the possible measures to improve the monitoring program that have been discussed and proposed in section 4.1-4.4.

Table 9. Proposed measures to improve the monitoring program discussed in chapter 4, with estimated implementation costs. The measures are listed in the order they are mentioned in the text above.

Possible changes	Remark	Annual costs pr site, in kSEK
Monitoring location with clay soil (e.g. Uppsala; C6)	Uppsala C6 is a monitoring catchment for nutrients. Could be included in monitoring also for pesticides, with sampling of stream water, groundwater and sediment during the growing season.	600** (+ 150 startup-cost for water sampling)
Screening greenhouse production	Screening survey in selected locations. Should be organized as separate project(s) outside of the monitoring program	2300****
Winter sampling	Should be implemented in all sites due to climate change with increased winter cropping, mild winters and rainfall/runoff events throughout the year. (Assuming M42 and N34 can be included based on current funding.)	183*
Event triggered flow-proportional sampling	Should be implemented in all sites to be able to assess the short term acute concentrations (24 samples).	345*
Improved groundwater well network	Need for more locations and more wells pr location to adequately assess the risks from pesticide use under climate change to groundwater quality…	120*** (+ sampling cost and possible start costs)
Revised sediment sampling	Should be replaced by other sediment sampling regime. New methodology currently being developed and tested by SLU should be assessed for suitability.	Within current budget for sediment sampling
Blank samples for QA	Discuss whether this should be part of the main program	92 (total cost for all sites)
Web based dissemination of current reports	Move reports from current report format to a more flexible reporting format via slu.se/ckb	100 (one-time cost to transfer current reports)
Extended web based dissemination	Establish an end-user focused solution with more flexible and updated/real-time results dissemination.	One time cost. No estimate made.

*Based on cost for N34 or M42 in 2020/21. **Estimate based on total cost for the main monitoring program 2020 (not incl. sampling during winter or flow events). ***Estimate based on data in Linefur & Kyllmar 2017. ****Cost estimate based on contract for screening survey of 9 locations during 2017-2018.

5 Overall evaluation and recommendations

5.1 Monitoring locations

We suggest that the monitoring program should include a model catchment for pesticide transport in Svealand to represent the central part of the country. The reasons for this include that a) Svealand have large areas of agricultural land with extensive use of pesticides, b) heavy clay soils are widespread in this part of Sweden while these soils are less well represented in the other monitoring catchments, and c) the climate is on average somewhat dryer and colder in Svealand compared to Götaland where the other monitoring catchments are located. Clayey soils with a lot of macropores can increase the leakage of pesticides to the groundwater and increase the losses via surface if it is saturated (surface runoff) or drained (subsurface tile drainage).

Discussions with the reference group for the monitoring program support the suggestion that an additional monitoring site on more clayey soil, e.g the established C6 in Uppsala, would be a good addition to the program. There is already established monitoring for nutrient leaching in the C6 site, and the costs included would be connected to the annual interviewing of farmers for pesticide use, the annual cost for sampling and pesticide analysis, and a one-time cost for installing a stream water sampler.

Vegetable production and greenhouse production are not included in the current monitoring program. However, there are challenges in these productions maybe specifically due to intensive pesticide use (vegetable cropping) and water handling (greenhouses) and both productions may pose a very high risk for both groundwater and surface water contamination locally. Due to the low percentage area of vegetable production in Sweden, establishing a monitoring site for this production is of low priority from the pesticide authorities (KemI). Representativeness will also be an issue when locating a monitoring site for greenhouse production, and we consider that screening surveys like the one performed in 2017/2018 (Kreuger *et al.* 2019) would be a more appropriate approach. The importance of more knowledge of the challenges in greenhouse production was pointed out by KemI and the farmers union (LRF) in the evaluation process, but this should possibly be handled outside the main monitoring program.

In general, the reference group discussions revealed a concern about the general representativeness of the monitoring program due to the restricted number of monitoring sites. It was suggested that the Swedish monitoring could be strengthened by more interaction and collaboration with the monitoring programs of the other Nordic countries, ex. with joint projects on specific challenges as well as lab-intercalibration projects. A Nordic collaboration might be especially favorable for Sweden considering the central location among the Nordic countries with some similarities in soils, climate and cropping practices with all the other countries. At present, KemI use data from the Danish PLAP project in their risk assessment, as Denmark is representative of southern Sweden.

5.2 Sampling strategy

A surface water sampling strategy should encompass both long-term chronic exposure concentrations and short-term acute exposure concentrations to properly address the objectives of the monitoring program. This would require an implementation of a flow-triggered flow-proportional sampling in all monitoring sites in addition to today's time-proportional composite sampling. Further, the objective to assess pesticide losses in stream water would require a year-round monitoring in the locations where winter crops are grown and there is a risk of pesticide transport during winter. The needs expressed by the reference group suggest that a year round monitoring with winter sampling in all sites should be of high priority.

The groundwater sampling appear to be within current European recommendations, but an increase in the number of monitoring locations should be considered due to the needs of key stakeholders (e.g. KemI, SGU).

The results from the current sediment sampling included in the program appears to be of little value. A change in the sediment sampling protocol is planned for 2021, and this is anticipated to largely remedy the current lacks in the sampling protocol. However, a more comprehensive sediment sampling scheme and/or alternative sampling options (e.g. biological samples) could be considered.

Any changes in the sampling program must consider the need to maintain a consistent core dataset based on an unchanged sampling protocol troughout the monitoring period. This to ensure the availability of data for long-term trend analysis. However, the reference group (e.g. Swedish Agriculture Agency) voice that the program could preferably be more flexible outside this core sampling program by the development of shorter term (e.g. 5-year) plans to focus on specifc substances, sampling metods etc. in order to better and more rapidly respond to stakeholder needs like data needs for indicators developed in the Swedish decision making system.

5.3 Coverage of analytical methods

We regard the current coverage to be appropriate for parent compounds, and the recently implemented procedures to improve the coverage for pesticide metabolites appear sound and transparent. However, it must be ensured that technical/analytical or economic constraints does not reduce the rate of increase in coverage too much.

5.4 Reporting

Reporting of the monitoring program is regarded very time consuming and the resources currently allocated to reporting (4% of total budget) is not assessed to be adequate. Discussions on how to do the reporting in a more time efficient way and how to make the data available earlier conclude that a web-based solution would be preferable. Moving today's annual reports to a web based format, should be given a high priority due to the needs expressed by the reference group for more frequent data updates and more accessible formats than pdf report. SLU informed about current discussions and plans for a web-based version of the content of the traditional reports from 2021. More detailed written reports every 3rd or 4th year on long term trends would then perhaps be sufficient together with reports on more specific topics being published when relevant.

We suggest that a more flexible web based dissemination platform is considered on a longer term, to make it easier for the key stakeholders/end-users to retrieve data for their specific needs and also to make the data more accessible for the general public. There is ongoing work to expand the services included in the data host (Datavärden) at SLU, a service for accessing raw data from a range of monitoring programs. This service is independent of the changes discussed in this evaluation.

With regard to the written reports, connecting findings to more information on tilling practices and mitigation measures can be valuable information, both for farmers, the agricultural advisory services as well as the authorities. The necessity of such efforts within the monitoring program must be considered in relation to already existing reports and analysis provided by other Swedish institutes or authorities (e.g. Statistics Sweden, Swedish Agriculture Agency). Developing special reports based on the monitoring program is one of the focus areas of SLU-CKB. It could be considered whether the reference group of the monitoring program should discuss and provide inputs about needs for such special reports/data analyses on a regular basis.

Possibilities to improve the current method for risk assessment of the pesticide concentrations could be explored, but considering the current environmental objectives and guideline values, the existing risk assessment procedure in the program is sufficient.

5.5 Priorities in case of budget changes

Based on the desirable changes for the monitoring program discussed in this report, we have included a prioiritization of changes under different economic constraints below.

5.5.1 Proposed changes in case of budget increase

Table 10 include the prioritized measures to improve the current monitoring program.

Table 10. Prioritization of suggested measures to improve the monitoring program.

Budget frame	Activity	Cost estimate (kSEK)	Remark	Priority
Within a 10% increase				
	Web based dissemination of current reports	100 kSEK	One-time cost. Special project that could preferable be funded outside the main monitoring program.	1
	Expansion of winter sampling of stream water	183 kSEK	Cost pr site pr year	2
	Expansion of event-triggered flow proportional sampling of stream water	345 kSEK	Cost pr site pr year	3
	Blank QA samples included in the main program	92 kSEK	Total annual cost	4
Within a 15-20% increase				
	Establish monitoring in a site with clayey soil in Svealand (C6).	600 kSEK	Annual cost pr site. Will also involve start-up cost of 150 kSEK.	1
	Increased number of groundwater monitoring sites	120 kSEK	Annual pesticide analysis cost pr site. There will also be annual sampling cost and start-up cost, and possibly also cost to include pesticide use information.	6

As noted in table 10, we suggest that the transfer of the current annual reports to a web base dissemination format should have a high priority. This work does however mainly include a one-time cost and should be organized as a short-term project funded outside of the main monitoring program.

In addition to the measures listed in table 10, the evaluation provided input from the reference group on a few more comprehensive tasks that should be considered as valuable additions to the monitoring program in a longer term. Firstly, there should be a more thorough discussion about the needs and possibilities to establish an extended web based dissemination platform for the program. No cost estimate for such a project has been made during the evaluation, and this should preferably be organized as a short-term project funded outside of the main monitoring program. However, an end-user focused web-based solution with more flexible and updated/real-time results dissemination will be a necessary update of the program in the longer term. Further, the need for more information about the risks from greenhouse production should be sought by making plans for (re-occuring) screening survey(s). The contract for a screening survey performed in 9 greenhouse locations during 2017-2018 indicate a cost of approximately 2300 kSEK for such a survey, and such a large project should preferably be organized as a project funded outside of the main monitoring program.

The prioritization of the suggested changes above (table 10) is proposed by the evaluators at NIBIO after discussions with the reference group for the program. There are however differing opinions

among the stakeholders in this regard. These possible improvements of the program should be further discussed by the funder, the Swedish EPA, and the reference group members

5.5.2 Proposed changes in case of budget cuts

In a situation with a 10% budget cut any changes in the program ust ensure that a core dataset is maintained so that the necessary data to analyse long term trends is not affected. A suggestion based on the results of the current evalution is shown below (Table 11).

Table 11. Priorities of existing activities in case of a 10% budget cut

Activity	Annual budget* (kSEK)	Remark	Priority
Current main program	2737	Including: management, pesticide analysis, sampling/data collection (time-composite water sampling, groundwater sampling, sediment sampling), data processing, reporting. Excl. winter sampling (see below)	1
Winter sampling	366	Including both sites currently funded under the main program and a separate contract, respectively.	1
Event triggered flow proportional sampling	345	Including the one site currently included that is funded by a separate contract	2
Current total	3448		
Revised total (-10%)	3103	When including current main program and winter sampling in two locations.	

*Budget sums collected from the main program and the current additional contracts.

This cut in the program will hamper the interpretation of the data with respect to acute toxicity in surface water, but will keep the elements needed for the long term trend analysis and a minimum amount of monitoring data for transport of pesticides in autumn sprayed areas and to assess changes in risks due to climate change.

If subject to a budget cut, it should also be considered to develop shorter term (e.g. 5-year) plans to try to incorporate additional components (e.g. specific sampling methods, data analysis a.o.) to a reduced long-term core program. This will allow some flexibility to address specific topics.

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Appendices

1. Contract (Avtal Nr 220-19-001)
2. E-mail survey for reference group
3. Responses to e-mail survey (not included in open report)
4. Minutes from discussion meeting with the reference group (not included in open report)

Appendix 1

NATUR VÅRDS VERKET

SWEDISH ENVIRONMENTAL PROTECTION AGENCY

AVTAL

Datum 2019-10-21

Nr 220-19-001

Utförare:
Norsk institutt for bioekonomi (NIBIO)
Att: Marianne Stenrod
Postboks 115
1431 Ås
NORGE

Intern information för Naturvårdsverket:

Ärendenr	NV-04817-19
Upph.nr./ramavtal	NV-04817-19
Konto	5781
Org.enhet/K-ställe	3501
Projekt	L284
Finansiär	2013
Motpart	-

Naturvårdsverket och utföraren träffar härmed följande avtal:

Anslag 1:2 Miljöövervakning m m.

Programområde
Miljögifter terrester

Delprogram
Pesticider

Ersättning (exklusive mervärdesskatt)
250 000 NOK bå 2019 (UPPDRAG)
150 000 NOK bå 2020 (UPPDRAG)

Undersökning/-ar/uppdrag
Översyn av delprogrammet Pesticider (växtskyddsmedel)

Period
2019-09-25--2020-12-31

Preliminär verksamhetsberättelse lämnas senast

Avtalet omfattar följande handlingar:
Denna huvudsida
Bilaga 1: Specifikation
Bilaga 2: NV:s allmänna villkor för uppdrag

Årlig verksamhetsberättelse lämnas senast

Övrig redovisning
Se bilaga 1

Projektledare
Marianne Stenrod

Förekommer det i ovan uppräknade handlingar mot varandra stridande uppgifter eller föreskrifter, gäller de sinsemellan i ovan angiven ordning om omständigheterna uppenbarligen inte föranleder annat.

Kvalitetsansvarig
Marianne Stenrod

Pg/Bg/B-kto/Org.nr
-

Betalningsrutiner
Se Övriga upplysningar nedan.

Övriga upplysningar
2019 års beviljade medel utbetalas mot faktura så snart undertecknat avtal inkommit till Naturvårdsverket. Faktura måste vara NV tillhanda absolut senast 2019-12-28.
2020 års beviljade medel utbetalas mot faktura efter att uppdraget slutredovisats och godkänts.
Faktura måste vara Naturvårdsverket tillhanda absolut senast 2020-12-27.

Ansvarig handläggare vid NV: Anna Hellström

För Naturvårdsverket 2019-11-11

Helena Lööström-Urban, enhetschef

För Utföraren 20

Firmatecknare, Institutions- eller Verkschef

Projektledaren 20

Marianne Stenrod

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DETTA AVTAL HAR UPPRÄTTATS I TVÅ LIKALYDANDE EXEMPLAR, VARAV PARTERNA TAGIT VAR SITT.

Naturvårdsverkets org.nr: 202100-1975

Specifikation till avtal nr 220-19-001, ärendenr NV-04817-19

Allmänna uppgifter

Programområde/Miljömål	Miljögifter Terrester
Delprogram/Delområde	Pesticider
Undersökningar/Uppdrag	Översyn av delprogrammet Pesticider (växtskyddsmedel)
Undersökningstyper	---
Utförare (inkl. adress)	Norsk institutt for bioøkonomi (NIBIO) Postboks 115 1431 Ås, Norge
Projektledare	Marianne Stenrød Tel: +47-48297607 E-post: marianne.stenrod@nibio.no
Programkoordinator	---
Projektmedarbetare	Marianne Stenrød (PhD, Forsker/Avdelingsleder) Roger Holten (PhD, Forsker)
Kvalitetsansvarig hos utföraren	Arne Hermansen (Divisjonsdirektør, NIBIO Bioteknologi og plantehelse)
Ansvarig handläggare vid Naturvårdsverket	Anna Hellström Tel: 010-6981139 E-post: anna.hellstrom@naturvardsverket.se
Period	2019-09-25—2020-12-31
Rapporteringsdatum	2020-11-30
Ersättning	250 000 norska kronor bå 2019 (uppdrag) 150 000 norska kronor bå 2020 (uppdrag)

Syfte

Att ta fram ett underlag för revision av det nationella miljöövervakningsprogrammet för växtskyddsmedel i jordbruksmarksområden. Underlaget ska belysa styrkor, svagheter och behov av förändringar i programmet samt ger förslag på prioriteringar vid en eventuell neddragning, alternativt utökning, av medel.

Bakgrund

Fram till 2001 bedrevs övervakning av växtskyddsmedel i ytvatten i SLUs regi i ett av typområdena (Vemmenhög, Skåne). Grunden till nuvarande nationella övervakningsprogram lades sedan genom en utvärdering av dåvarande program för övervakning av växtnäringsläckage i typområden i jordbruksmark år 2000 och mätningar av växtskyddsmedel i sediment och vatten från bäckar i jordbruksområden år 2001. I en arbetsgrupp bestående av Naturvårdsverket, Kemikalieinspektionen, Jordbruksverket och SLU bestämdes sedan var och hur miljöövervakning skulle bedrivas framöver.

Undersökningar av växtskyddsmedel ingår sedan 2002 i programområde Jordbruksmark i den nationella miljöövervakningen. Övervakningen genomförs av Sveriges lantbruksuniversitet (SLU) på uppdrag av Naturvårdsverket. I undersökningarna ingår insamling av ytvattenprover, grundvattenprover och sediment för analys av växtskyddsmedel från fyra avrinningsområden, s.k. typområden, som ligger i jordbruksbygder i länen Västergötland, Östergötland, Halland och Skåne, samt från två åar i Skåne, Skivarpsån och Vege å. Övervakningen sker i de områden med högst andel jordbruksmark i de aktuella länen och i den mest jordbruksintensiva delen av Sverige.

Inom övervakningen av växtskyddsmedel undersöks fyndfrekvens, halter och trender hos växtskyddsmedelsrester i avrinnande ytvatten, i grundvatten samt i sediment. Information om användningen av växtskyddsmedel samlas årligen in från lantbrukarna i områdena. På lång sikt vill man kunna relatera eventuella förändringar i förekomst av växtskyddsmedel till genomförda åtgärder.

Som ett led i det kontinuerliga förbättringsarbetet av Naturvårdsverkets nationella miljöövervakningsprogram genomförs regelbundet revisioner av de olika programområdena och delprogrammen. Syftet med denna överenskommelse är att göra en översyn av hur det nationella övervakningsprogrammet för växtskyddsmedel fungerar och har fungerat sedan den senaste revisionen 2006-2007. Målet med uppdraget är att kunna ge uppdragsgivaren och utföraren ett underlag för att om möjligt förbättra innehåll och genomförande av programmet i framtiden.

Institutionen för vatten och miljö på Sveriges Lantbruksuniversitet är utförare av övervakningen. Det finns även en referensgrupp knuten till miljöövervakningsprogrammet med deltagare från berörda myndigheter och branschorganisationer.

Det nationella Miljöövervakningsprogrammet för pesticider i jordbruksmark består av följande delar:

- Fyra avrinningsområden (typområden) med mätning av ytvatten och grundvatten.:
  Skåne (M 42)
  Halland (N 34)
  Östergötland (E 21)
  Västergötland (O 18)

- Mätning i ytvatten i två åar i Skåne, Skivarpsån och Vegeån.

- Årlig provtagning av sediment från åar och Intensivtypområden.

Inom programmet görs även en årlig inventering av odlingsåtgärder, inklusive användningen av växtskyddsmedel (i samarbete med växtnäringsövervakningen)

Inom miljöövervakningsområdet för Luft mäts bekämpningsmedel i luft och nederbörd men den övervakningen omfattas inte av denna översyn.

Omfattning och genomförande

Målet med uppdraget är att ge uppdragsgivaren och utföraren ett underlag för att om möjligt förbättra innehåll och genomförande av programmet i framtiden.

Översynen ska även ge förslag på prioriteringar vid en eventuell neddragning av medel med 10 % och ge förslag till eventuella behov av utökning om en möjlighet till ökade medel finns.

I översynen ska programmets olika syften, så som underlag till direktiv, miljömålsuppföljning, processen för godkännande av växtskyddsmedelsprodukter och återkoppling till jordbruksnäringen beaktas.

Uppdraget ska omfatta översyn av:

valet av övervakningsområden för miljöövervakningen,

provtagningsstrategi så som frekvens, tekniker mm vilket även omfattar:

- Utvärdering av den flödesproportionella provtagningen som skett i Skåneområdet sedan 2006 som ger underlag till beslut om den ska införlivas i huvudkontraktet
- Utvärdering av vinterprovtagningen i Halland som ger underlag till beslut om den ska införlivas i huvudkontraktet

valet ämnen som övervakas,

rapporteringen av resultatet från miljöövervakningen

- Vilket innebär att svara på om det behövs det några förbättringar av eller kompletteringar till nuvarande rapportering av resultatet från miljöövervakningen.

I uppdraget ingår att ha kontakt med utföraren (se kontaktuppgifter nedan).

Deltagarna i den referensgrupp som är knuten till miljöövervakningsprogrammet för växtskyddsmedel i jordbruksmark ska ges möjlighet att ge synpunkter på programmet.

Referensgruppen består (förutom Naturvårdsverket och utföraren (SLU)) av representanter från berörda myndigheter och branschorganisationer:

Kemikalieinspektionen (KemI)
Sveriges geologiska undersökningar (SGU)
Havs- och vattenmyndigheten (HaV)
Länsstyrelsen
Lantmännens riksförbund (LRF)
Svenskt växtskydd

Aktuella underlagsrapporter är:

En årsrapport som ger en bild av omfattningen och innehåller provtagning analys och utvärdering

Resultat från miljöövervakningen av bekämpningsmedel (växtskyddsmedel) Årssammanställning 2014. Nanos T., Kreuger J. SLU, Vatten och miljö, Rapport 2015:19.

Rapporter från två screeningsstudier som omfattar fler åar och representerar en större del av jordbruksmarken i Sverige:

Nationell screening av bekämpningsmedel i åar i jordbruksområden 2016. Uppföljning av 2015 års undersökning. Lindström, B., Boström, G., Gönczi, M., Kreuger, J. 2017. Sveriges lantbruksuniversitet, Institutionen för vatten och miljö, Rapport 2017:5

Nationell screening av bekämpningsmedel i yt- och grundvatten 2015. Boström, G., Lindström, B., Gönczi, M. och Kreuger, J. CKB rapport 2016:1. Sveriges lantbruksuniversitet 2016.

En långtidsöversikt, 2002-2012 och en fördjupad beskrivning av övervakningsområdena:

Resultat från miljöövervakningen av bekämpningsmedel (växtskyddsmedel). Långtidsöversikt och trender 2002-2012 för ytvatten och sediment. Lindström, B., Larsson, M., Boye, K., Gönczi, M. och Kreuger, J. Sveriges lantbruksuniversitet, Institutionen för vatten och miljö, Rapport 2015:5. 2015.

Kontaktpersoner

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Redovisning av uppdraget

Rapportutkast och eventuell muntlig presentation senast 31 oktober 2020.

Uppdraget ska slutredovisas i en rapport senast 30 november 2020.

NATURVÅRDSVERKETS ALLMÄNNA VILLKOR VID UPPDRAG (NVAV 19.1)

Dessa allmänna villkor är främst avsedda att användas för konsulttjänster men kan även användas, där så bedöms vara lämpligt, i andra sammanhang då uppdrag utförs åt Naturvårdsverket.

1. Uppdragets genomförande

1.1 Leverantören ska utföra uppdraget på sätt som anges i dessa allmänna villkor, såvida inget annat avtalats, samt enligt övriga avtalshandlingar.

Leverantören och de tjänster som utförs ska uppfylla de i upphandlingsdokumenten ställda ska-kraven och de enligt anbudet uppfyllda bör-kraven.

Uppdraget ska genomföras fackmässigt och med omsorg. Vid dess utförande ska användas erforderligt antal personer med för uppgiften/varje ingående deluppgift adekvat utbildning, kompetens och erfarenhet.

1.2 Leverantören anser att uppdraget är tillräckligt beskrivet och är införstådd med vad som krävs för att utföra detta.

1.3 Leverantören får under uppdragstiden inte åta sig andra uppdrag som kommer att få till följd att denne kan komma att företräda intressen som gör honom/henne olämplig att handha det aktuella uppdraget. Naturvårdsverket ska omedelbart informeras om det under uppdraget uppkommer en sådan situation, eller risk för att den kan uppkomma. Leverantören får inte i samband med detta uppdrag motta ersättning inom uppdraget i någon form från annan än Naturvårdsverket.

1.4 Parterna ska hålla varandra underrättade om förhållanden som kan antas ha betydelse för uppdraget. Leverantören ska utan dröjsmål anmäla till Naturvårdsverket behov av arbete som inte ingår i uppdraget. Underrättelse med anledning av försening regleras i punkt 3.2. Leverantören ska, om Naturvårdsverket så begär, avrapportera enligt verkets anvisningar.

1.5 Relevanta miljöaspekter ska beaktas vid utförande av varje uppdrag. Minimal miljöbelastning och maximalt miljövänlig profil ska alltid eftersträvas. Miljömärkt papper ska väljas och rapporter m.m. tryckas dubbelsidigt. Eventuella resor ska belasta miljön så lite som möjligt och genomföras på ett för verket kostnads- och tidseffektivt sätt. Tåg och lokal kollektivtrafik bör i detta syfte användas så långt möjligt. Leverantören ska innan kontakt tas med Naturvårdsverket för överenskommelse om en resa, noga överväga om den går att ersätta med distansöverbryggande teknik. Sådan teknik ska då i stället användas, om det inte är olämpligt i aktuell situation.

1.6 Leverantören ska säkerställa kontinuiteten i arbetet vid erhållna uppdrag och ta tillvara rationaliseringsmöjligheter som kan sänka kostnaderna för Naturvårdsverket.

1.7 Naturvårdsverkets internt styrande dokument och övriga dokument ska tillämpas om detta särskilt överenskoms inom ramen för detta avtal. Leverantören har då fått del av dokumenten i fråga. Detsamma gäller för eventuella andra verktyg och stöd som Naturvårdsverket använder i sin verksamhet.

1.8 Om så särskilt överenskommits ska Naturvårdsverket lämna leverantören tillgång till de lokaler, den information och det underlag som behövs för uppdragets genomförande och i övrigt utföra överenskomna åtgärder.

1.9. Vardera parten ska för sin del utse högst två kontaktpersoner, vars namn ska anges i avtalet. Dessa ska företräda sin part i löpande frågor kopplade till uppdraget. Kontaktpersonerna är inte med stöd av detta avtal behöriga att besluta i frågor om ändringar och tillägg till avtalet enligt punkt 16. Byte av kontaktperson ska snarast meddelas motparten skriftligen.

2. Leverantör - underleverantör

2.1 Leverantören har rätt att byta ut i avtalet namngiven person som ska arbeta med uppdraget efter skriftligt medgivande från Naturvårdsverket. En förutsättning för byte är att ny person har motsvarande kompetens inom aktuellt område som den utbytte och att utförandet av uppdraget inte blir lidande av bytet.

2.2 Leverantören har rätt att anlita underleverantör för genomförande av uppdraget eller viss del därav efter skriftligt medgivande från Naturvårdsverket. Därvid gäller i övrigt vad som sägs i punkt 2.1 ovan samt 2.5 nedan.

2.3 Leverantören är skyldig att utan oskäligt dröjsmål byta ut i uppdraget erbjuden person eller anlitad underleverantör om Naturvårdsverket begär det och har sakligt skäl för sin begäran. Sådant skäl kan vara att dessa enligt Naturvårdsverkets bedömning saknar erforderlig kompetens, samarbetssvårigheter förekommer eller uppdraget inte utförs på det sätt som regleras i uppdragsbeskrivning, tidsplan eller avtalet i övrigt.

2.4 Leverantören svarar för kostnader och tidsåtgång vid byte av utförare och vid anlitande av underleverantör och för att dessa ska sätta sig in i uppdraget. Dessa åtgärder utgör inte heller grund för förändring av avtalade villkor.

2.5 Leverantören ansvarar för underleverantörers uppdrag som för eget uppdrag. Leverantören svarar också för att villkoren i detta avtal och andra villkor för uppdraget gäller även mot av leverantören anlitad underleverantör och av andra utförare vid byte.

3. Tider - försening

3.1 Uppdraget ska vara slutfört senast avtalad leveransdag/tidpunkt för slutredovisning. Leverantören ska följa upprättad tidsplan.

Uppdraget är slutfört när det slutredovisats i avtalat skick vid avtalad tidpunkt för leverans/slutredovisning och godkänts av Naturvårdsverket.

3.2 Om part befarar att försening kommer att inträffa eller att ändringar inom tidsplanen kommer att ske, ska parten genast underrätta motparten om detta skriftligen samt ange anledningen till förseningen eller ändringen. Vid försening från leverantörens sida ska denne samtidigt ange när och hur arbetet åter beräknas följa tidsplanen eller, om sådan saknas, när leverans kan ske. Vid försening förorsakad av Naturvårdsverket ska verket ange om behov finns av att ändra tidsplanen.

Är försening, som inte förorsakats av Naturvårdsverket, längre än en vecka, ska leverantören dessutom, skriftligen meddela Naturvårdsverket hur och när arbetet åter beräknas följa tidsplanen. Sådan underrättelse ska lämnas två gånger i veckan med två mellanliggande vardagar till dess tidsplanen åter följs, om inte Naturvårdsverket skriftligen medgivit avsteg från detta. Sådant medgivande får ändras av Naturvårdsverket. Ersättning utgår inte för leverantörens extraarbete i detta avseende.

3.3 Endast part som lämnat underrättelse enligt punkt 3.2 får åberopa det förhållande som föranlett förseningen, om inte motparten insett eller bort inse detta och att det inverkar på tidsplanen. Underlåter leverantören att lämna sådan underrättelse utan uppskov, har Naturvårdsverket rätt till ersättning för den skada som kunde ha undvikits om underrättelsen lämnats i tid.

3.4 Leverantören har rätt till erforderlig tidsförlängning om han/hon hindras att fullgöra uppdraget på grund av förhållande som beror på Naturvårdsverket. Är så fallet ska detta förhållande särskilt anges i tidsförlängningsdokumentet, annars anses det bristande fullgörandet vara orsakat av leverantören. Tidsförlängning ska göras genom skriftlig ändring av avtalet enligt punkt 17 för att gälla.

Om Naturvårdsverket begär att tidsplanen ska ändras har leverantören rätt till skälig ersättning med styrkt belopp om denne åsamkats merkostnad. Detta gäller dock inte om begäran beror på av leverantören orsakad försening.

3.5 Om förseningen beror på leverantören eller något förhållande på leverantörens sida har Naturvårdsverket rätt till vite, oavsett om skada skett eller inte. Detta gäller även om tidsplanen har reviderats på grund av sådan försening som nämns i första meningen. Tidsberäkningen ska

då utgå från den ursprungliga tidsplanen. Rätten till vite gäller vid överskridande av bestämd tid för genomförande av del av uppdraget om detta särskilt avtalats. Vite ska erläggas med 1 procent av avtalat fast arvode för varje påbörjad sjudagarsperiod (kalenderdagar) som förseningen varar, om inte annat särskilt avtalats. Vid uppdrag som utförs enligt löpande räkning eller löpande räkning med takpris beräknas vitet på motsvarande sätt på det totala fakturerade beloppet. Vite ska dock erläggas med högst 15 procent av ovan nämnda belopp, d.v.s. fast arvode respektive fakturerat belopp. Beloppen räknas exklusive mervärdesskatt.

Naturvårdsverket har rätt att avräkna upplupet vite från leverantörens ersättning. Leverantören ska efter skriftlig begäran från Naturvårdsverket räkna av vitesbeloppet före fakturering. Sådan avräkning ska framgå av fakturan. Har avräkning inte gjorts i fakturan är leverantören skyldig att efter anmodan från Naturvårdsverket skicka kreditfaktura på vitesbeloppet innan betalning sker.

Vite utesluter inte Naturvårdsverkets rätt till prisavdrag enligt punkt 9.2 eller skadestånd enligt punkt 9.3, men ska avräknas från sådant.

3.6 Naturvårdsverkets rätt till vite är förverkad om anspråk på ersättning inte framförts senast tre månader efter det uppdraget slutförts eller annars upphört. Detta gäller dock inte vite enligt separat anti-diskrimineringsreglering, för det fall att parterna ingått sådan.

4. Ersättning

4.1 Ersättning för uppdraget ska utgå som fast pris, löpande räkning eller löpande räkning med takpris. Parterna har i detta avtal angivit vilken ersättningsform som gäller. Ersättningen är angiven exklusive mervärdesskatt. Leverantören svarar för personalskatter, arbetsgivaravgifter, semesterersättning och dylikt.

4.2. Utförs uppdraget enligt löpande räkning utgår arvode för redovisad tidsåtgång för uppdragets utförande.

Vid löpande räkning med takpris får leverantören inte debitera arvode utöver angivet takpris.

4.3 Med fast pris avses det arvode som ska erläggas för uppdragets utförande, oavsett leverantörens tidsåtgång.

4.4 Utförs uppdraget mot löpande räkning med takpris eller fast pris gäller följande. Om Naturvårdsverket begär begränsning eller på annat sätt ändring av uppdraget, och leverantören då kan påvisa att detta innebär kostnadsökning för honom/henne, ska överenskommas om nytt takpris respektive fast pris om leverantören så begär. Överenskommelsen ska ske enligt punkt 16. Detsamma gäller merarbete som Naturvårdsverket har orsakat genom fel eller försummelse eller om leverantören identifierar behov av arbete som inte ingår i uppdraget.

Leverantören ska vid dessa fall ta initiativ till förhandling genom skriftligt meddelande till verket innan debiterbart arbete utförs. Saknas överenskommelse enligt första stycket har leverantören inte rätt till ytterligare ersättning eller ändra överenskomna villkor.

4.5 Vid fast pris ersätts inte särskilt för utlägg och övriga kostnader. Vid övriga ersättningsformer ersätts utlägg endast om avtalad och verifierad kostnad är nödvändig för genomförande av uppdraget och Naturvårdsverket har godkänt utlägget.

Ersättning för övertid, jour och beredskap samt för arbete under obekväm arbetstid utgår endast om parterna särskilt kommit överens om detta i avtalet.

4.6 Vid uppdrag mot löpande räkning har leverantören rätt till ersättning enligt Skatteverkets meddelande om traktamenten och andra kostnadsersättningar vid resa som i förväg skriftligen överenskommits med Naturvårdsverket och för verifierade resekostnader.

4.7 Utöver vad som angivits ovan föreligger ingen ersättningsskyldighet för Naturvårdsverket.

5. Fakturering och betalning

5.1 Ersättning ska faktureras och utbetalas sedan uppdraget slutförts och arbetsresultatet överlämnats och godkänts av Naturvårdsverket. Vid uppdrag som i tid beräknas överstiga tre månader kan särskilt överenskommas i avtalet om dellikvid. Dellikvid får utbetalas högst en gång varje månad för utfört och redovisat arbete samt med verifierade kostnader och utlägg, vilka godkänts av Naturvårdsverket.

5.2 Betalning sker endast mot faktura. Av fakturan ska det tydligt framgå vad fakturan gäller med specificering av vilken tjänst/produkt som har levererats, pris per enhet och totalt antal enheter, fakturabelopp, fakturerad moms samt vilken tidsperiod fakturan avser. Varje faktura ska ha ett unikt löpnummer och innehålla uppgift om leverantörens bankgiro-/postgirokonto, F-skattsedel och organisationsnummer. Det ska även framgå om fakturan avser slutlikvid.

Fakturan ska märkas med kontaktpersonens namn, avtalets ärendenummer och kostnadsställenummer (fyra siffror som börjar med "3"). Vid felaktiga eller ofullständigt ifyllda fakturor har Naturvårdsverket rätt att begära kreditfaktura samt att leverantören skickar ny faktura med korrekt och fullständig information.

Naturvårdsverket har rätt att genom erforderlig kontroll förvissa sig om att prestationer som anges i fakturan motsvaras av utfört arbete.

Vid konsultfakturor ska bilaga bifogas med redovisade tider för uppdragets utförande, art och omfattningen av det arbete som utförts under den tidsperiod som fakturan avser, upparbetade kostnader under perioden samt annan ersättning som skriftligen överenskommits. Har uppdraget utförts enligt löpande räkning eller löpande räkning med takpris, ska dessutom anges antalet arbetstimmar per dag och timersättning för var och en av de personer som arbetar med uppdraget.

Fakturor ska skickas elektroniskt och i formatet PEPPOL BIS Billing 3.0 som följer den europeiska fakturastandarden EN 16931. Om leverantören inte har möjlighet att skicka fakturor i detta format finns en kostnadsfri leverantörsportal som leverantören efter överenskommelse med Naturvårdsverket kan använda. Naturvårdsverket har även möjlighet att ta emot elektroniska fakturor i vissa andra format, såsom SFTI Svefaktura 1.0, vilket kan överenskommas särskilt.

5.3 Leverantören ska, efter det att uppdraget slutförts, översända slutfaktura till Naturvårdsverket med samtliga återstående fordringar avseende uppdraget. Verkets betalning av en sådan slutfaktura medför att leverantören förlorar rätt till ytterligare ersättning för sitt utförande av den slutfakturerade tjänsten.

Samtidigt ska det under den ifrågavarande tiden framtagna och dokumenterade arbetsmaterialet, som inte överlämnats fortlöpande, överlämnas till Naturvårdsverket.

5.4 Betalning sker 30 dagar efter mottagande av godkänd faktura. Betalning innebär inte att arbetet har godkänts.

5.5 Leverantören har rätt att erhålla dröjsmålsränta enligt lag om Naturvårdsverket inte betalar i rätt tid. Sådan ränta regleras på anmodan av leverantören.

5.6 Leverantören och dennes anställda arbetar på uppdrag av Naturvårdsverket och avtalet innebär inte att ett anställningsförhållande uppstår mellan leverantörens anställda och Naturvårdsverket. Leverantören svarar därför för skatter, sociala avgifter och övriga kostnader förenade med erbjudna personers anställning. Skulle Naturvårdsverket enligt lag vara skyldig att erlägga skatter och/eller sociala avgifter på ersättning som ska betalas till leverantören, ska leverantören ersätta verket för sådana avgifter. Om möjligt ska detta ske genom avräkning från ersättningen till leverantören. Denna bestämmelse gäller även efter avtalstidens utgång.

5.7 Villkor som anges i faktura men som inte omfattas av detta avtal är inte bindande för Naturvårdsverket. Faktureringsavgifter och andra liknande avgifter som inte regleras i avtalet ska därför inte betalas.

5.8 Har leverantören anlitat underleverantör, får denne inte skicka fakturor direkt till Naturvårdsverket.

6. Rätten till resultatet

6.1 Naturvårdsverket får, om inte annat överenskoms i detta avtal, en full och oinskränkt äganderätt samt upphovsrätt och övriga immateriella rättigheter till resultatet av uppdraget. Med resultatet avses i detta avtal allt arbete och allt material, inklusive dokumentation, som leverantören inom ramen för avtalet tar fram

särskilt för Naturvårdsverket. Överlåtelsen av rättigheterna innefattar en rätt för Naturvårdsverket att ändra och modifiera i resultatet samt att överlåta rättigheter till resultatet vidare. Leverantören har inte utan verkets skriftliga medgivande rätt att utnyttja resultatet i sin fortsatta verksamhet. Leverantören ska gentemot anlitad underleverantör göra förbehåll för dessa Naturvårdsverkets rättigheter till resultatet.

6.2 Leverantören får inte publicera eller på annat sätt nyttja utredningsmaterial eller arbetsresultat som tillhör Naturvårdsverket utan verkets skriftliga medgivande. Allt sådant material ska överlämnas till verket när det inte längre behövs eller senast vid uppdragets slut. Avbryts uppdraget i förtid gäller vad som nämns i punkt 12.4 beträffande överlämnande och nyttjande av resultatet.

6.3 Leverantören garanterar att hela eller del av resultatet, varken genom innehav, nyttjande, vidareupplåtelse eller överlåtelse, gör intrång i tredje mans immateriella rättighet. Leverantören ska vara behjälplig för det fall att krav riktas eller talan förs mot Naturvårdsverket om intrång på grund av användningen, genom att bl.a. tillhandahålla det underlag och annan information som verket har behov av. Leverantören ska ersätta Naturvårdsverket för de ersättningar (inklusive rättegångskostnader) och skadestånd som verket genom förlikning eller dom kan bli skyldig att utge. Leverantören ska därutöver ersätta Naturvårdsverket för verkets egna kostnader inklusive kostnader för ombudsarvode som uppkommit till följd av tvist med tredje man. Dessa bestämmelser gäller även efter avtalstidens utgång.

6.4 Digitalt producerat material som ingår i uppdraget ska i sin slutliga utformning kopieras till av Naturvårdsverket önskat elektroniskt medium och äganderätten till kopian övergå till Naturvårdsverket.

6.5 Naturvårdsverkets rättigheter enligt punkt 6 gentemot underleverantör regleras i punkt 2.5.

7. Tillstånd

7.1 Leverantören svarar för att erforderliga tillstånd, samtycken (t.ex. för behandling av personuppgifter), dispenser och dylikt som behövs för uppdragets genomförande har inhämtats, såvida inte annat avtalats.

7.2 Leverantören har inte rätt att använda Naturvårdsverkets namn, logotyp eller dylikt i reklam- eller marknadsföringssammanhang utan att ha inhämtat skriftligt medgivande från verket.

7.3 För data som ingår i geodatasamverkan ska Naturvårdsverkets egen licens användas i uppdraget. En särskild förbindelse mellan Naturvårdsverket och leverantören ska genom Naturvårdsverkets försorg upprättas före uppdragets påbörjande på blankett som tillhandahålls av Naturvårdsverket.

8. Statistik

Leverantören ska, under förutsättning av att det regleras i detta avtal, lämna statistik till Naturvårdsverket med uppgifter avseende under perioden fakturerade tjänster.

9. Ansvar för försening, fel eller brist

9.1 Om leverantören brister i att utföra uppdraget eller tillhandahåller ett resultat som innehåller fel eller brist i förhållande till avtalad specifikation är leverantören skyldig att, efter reklamation från Naturvårdsverket, utan oskäligt uppehåll/dröjsmål vidta rättelse. Naturvårdsverket har rätt att bestämma sådan tid för rättelse. Rättelse ska ske genom att leverantören fullgör uppdraget eller korrigerar felet eller bristen. Sådant arbete ingår i avtalad ersättning.
Har rättelse av fel eller brist inte vidtagits enligt första stycket har Naturvårdsverket rätt att själv eller genom uppdrag åt annan avhjälpa felet eller bristen på leverantörens bekostnad.

9.2 Vidtar inte leverantören rättelse enligt punkt 9.1 har Naturvårdsverket rätt till nedsättning av den avtalade ersättningen (prisavdrag) med ett belopp som skäligen kan anses motsvara felet eller bristen.

9.3 Härutöver har Naturvårdsverket rätt till skadestånd inom ramen för avtalad ansvarsbegränsning enligt andra stycket i denna punkt. Nedsättning av ersättningen som har utgått på grund av fel eller brist enligt punkt 9.2 ska avräknas från sådant skadestånd.

Naturvårdsverket har rätt att avräkna nedsättning av ersättning enligt punkt 9.2 och skadestånd från leverantörens ersättning. Därvid gäller det som sägs om avräkning av vite i punkt 3.5 andra stycket. Leverantören ansvarar för skada som denne vållat Naturvårdsverket eller tredje man mot vilken verket svarar om skadan orsakats av fel eller försummelse. Skadeståndet är, vid varje skadetillfälle, begränsat till det högsta av i) fem (5) prisbasbelopp enligt socialförsäkringsbalken (2010:110) eller ii) summan av det totala ordervärdet för avtalade beställningar. Dessa begränsningar gäller inte om uppsåt eller grov vårdslöshet föreligger. Med prisbasbelopp enligt denna punkt avses prisbasbeloppet vid tiden för skadans upptäckt. Begränsningen i denna punkt omfattar inte prisavdrag, ränta och vite och heller inte om skadeståndsansvaret avser intrång i annans rätt enligt 6.3 ovan.

9.4 Naturvårdsverkets rätt till vite vid försening regleras i punkt 3.5 och rätt till uppsägning i punkt 12.3.

9.5 Leverantörens ansvar gäller för fel eller brist som Naturvårdsverket anmäler inom tre månader efter det att verket har uppmärksammat felet eller bristen, dock senast ett år efter effektiv leveransdag/ tidpunkt för slutredovisning.

9.6 Naturvårdsverkets godkännande av leverantörens förslag, åtgärder eller handlingar befriar inte leverantören från ansvar för sådana fel och brister som uppenbart inte kunnat upptäckas av verket.

10. Försäkring

Leverantören ska under uppdragstiden på egen bekostnad hålla ansvarsförsäkring med ett försäkringsbelopp som motsvarar avtalat skadeståndsansvar enligt punkt 9.3 andra stycket. På begäran av Naturvårdsverket ska leverantören överlämna kopia av gällande försäkringsbrev.

11. Force majeure

Om part förhindras att fullgöra detta avtal av omständighet utanför sin kontroll som parten inte skäligen kunde förväntas ha räknat med vid avtalets träffande och vars följder parten inte heller skäligen kunde ha undvikit eller övervunnit eller av att partens underleverantör förhindrats fullgöra sin leverans på grund av omständigheter som här angetts, ska detta utgöra befrielsegrund som medför framflyttning av tidpunkt för prestation och befrielse från vite och andra påföljder. Detta äger tillämpning oavsett om orsaken till förseningen inträffar före eller efter avtalad leveransdag.

För att part ska ha rätt att göra gällande i första stycket nämnd befrielsegrund ska part omedelbart, då denne får kännedom om sådan omständighet som kan utgöra befrielsegrund, skriftligen underrätta motparten om detta.

Om avtalets fullgörande förhindras för längre tid än tre månader på grund av i första stycket angiven omständighet har part rätt att skriftligen säga upp avtalet. Leverantören ska då ersättas för utfört arbete och styrkta upparbetade kostnader. Leverantören ska innan betalning sker redovisa och överlämna resultatet av utfört arbete.

12. Förtidigt upphörande av avtalet

12.1 Leverantören har rätt att säga upp avtalet med omedelbar verkan om Naturvårdsverket väsentligt brutit mot avtalet. Leverantören har då rätt till ersättning för utfört arbete och av Naturvårdsverket godkänd avvecklingskostnad.

12.2 Naturvårdsverket har rätt att avbeställa sådana delar av uppdraget som inte har genomförts. Besked om detta ska lämnas skriftligen i så god tid att leverantören orsakas minsta möjliga kostnader. Ersättning ska då betalas för utfört och av Naturvårdsverket godkänt arbete enligt avtalet samt för skälig, nödvändig, styrkt och av verket godkänd avvecklingskostnad. Leverantören ska omedelbart vidta åtgärder för att avveckla uppdraget till minsta möjliga kostnad.

12.3 Naturvårdsverket har rätt att helt eller delvis säga upp avtalet med omedelbar verkan och få ersättning för skada om leverantören

- väsentligt brutit mot avtalet eller i väsentlig mån misskött uppdraget
- i icke oväsentligt hänseende brutit mot avtalet och inte vidtagit rättelse inom två veckor efter skriftlig uppmaning från Naturvårdsverket, om inte annat överenskommits i avtalet,
- inte efter två påminnelser från Naturvårdsverket, under två kalenderveckor, fullgjort sin meddelandeskyldighet vid försening enligt punkt 3.2 andra stycket,
- är försenad med slut- eller delleverans av uppdraget, eller på goda grunder antas komma att bli försenad, och är förseningen väsentlig

med hänsyn till den skada som orsakas Naturvårdsverket,
- försatts i konkurs, inleder ackord, inställt sina betalningar, blir föremål för företagsrekonstruktion, trätt i likvidation eller annars kan antas vara på obestånd,
- dömts för brott mot miljölagstiftningen enligt lagakraftvunnen dom, eller
- inte fullgör sina åligganden avseende skatter, sociala avgifter och övriga betalningsåligganden.

Leverantören har rätt till den ersättning som svarar mot vad utfört arbete är värt för Naturvårdsverket.

12.4 Uppsägning ska ske skriftligen och åberopad grund anges. Utfört arbete ska omedelbart efter besked om uppsägning redovisas för och överlämnas till Naturvårdsverket. Dessa åtgärder från leverantörens sida är en förutsättning för att ersättning därefter kan erhållas. Vid förskottsbetalning är leverantören skyldig att snarast återbetala den del av ersättningen som leverantören enligt punkterna 12.1 – 12.3 inte har rätt till samt eventuell avräkning enligt punkterna 3.5 andra stycket, 5.6, 9.2 och 9.3 Efter överlämnandet övergår rättigheterna till resultatet av uppdraget till Naturvårdsverket på samma sätt som om uppdraget fullföljts.

12.5 Naturvårdsverket har rätt att med omedelbar verkan helt eller delvis saga upp avtalet om domstol eller myndighet har fattat beslut som innebär att avtalet anses ogiltigt eller på annat sätt förhindrar Naturvårdsverket att göra inköp från eller använda avtalet. Om avtalet upphör att gälla enligt denna punkt ska inget ansvar kunna göras gällande mot Naturvårdsverket på grund av sådan uppsägning.

13. Ändrade ägarförhållanden

Väsentliga förändringar avseende ägarförhållandena hos leverantören ska utan dröjsmål skriftligen anmälas till Naturvårdsverket. På begäran ska Naturvårdsverket erhålla ytterligare information om de nya ägarförhållandena och den nya ägarens möjligheter att uppfylla avtalet. Naturvårdsverket har rätt att säga upp avtalet med omedelbar verkan om det finns skälig anledning att bedöma att den nya ägaren inte kan uppfylla avtalet. Uppsägning ska ske skriftligen inom 30 dagar efter det att Naturvårdsverket fått vetskap om de ändrade ägarförhållandena.

14. Sekretess

Sekretessbelagd uppgift får inte röjas eller utnyttjas av leverantören. Denne är i förekommande fall skyldig att informera sig om innebörden av offentlighets- och sekretesslagens (2009:400) bestämmelser om handlingars sekretess och om tystnadsplikt. Leverantören ska informera i uppdraget erbjuden person och anlitad underleverantör om gällande sekretess och tystnadsplikt. Efter begäran från Naturvårdsverket ska leverantören avkräva dessa en särskild sekretessförbindelse, som tillhandahålls av verket, innan arbetet påbörjas. Denna försäkran ska översändas i original till Naturvårdsverket. Leverantören ska införa motsvarande bestämmelse angående sekretess för underleverantör. Sekretessen gäller även när avtalet i övrigt upphört att gälla.

15. Behandling av personuppgifter

15.1 Naturvårdsverket är personuppgiftsansvarig för den behandling av personuppgifter som myndigheten bestämmer ändamålen och medlen för. Leverantören, som behandlar personuppgifter för Naturvårdsverkets räkning, är personuppgiftsbiträde. Behandling av personuppgifter ska ske i överensstämmelse med samtliga tillämpliga författningar. Ett personuppgiftsbiträdesavtal kan komma att tecknas mellan parterna.

15.2 Personuppgiftsbiträdet ska bl.a. vidta lämpliga tekniska och organisatoriska åtgärder för att skydda personuppgifterna i enlighet med skriftliga instruktioner från Naturvårdsverket och gällande författningar.

16. Ändringar m.m.

Ändringar i och tillägg till detta avtal ska för att vara gällande göras i form av skriftliga tillägg, som ska vara undertecknade av behöriga företrädare för parterna. Detta gäller inte vid byte av i avtalet namngiven person enligt punkt 2.1.

17. Skriftlig form

När det i punkterna 2.1, 2.2, 3.2, 3.5 andra stycket, punkterna 4.4 andra stycket och 4.6 krävs skriftlig form för vissa åtgärder får detta ske via e-postmeddelande. För övriga punkter i avtalet där skriftlighet krävs för viss åtgärd, ska denna i stället fullgöras i pappersform och dokumentet översändas via postbefordran, bud eller liknande.

18. Överlåtelse av avtalet

Avtalet får inte överlåtas utan den andra partens skriftliga godkännande.

19. Tvist

Tvister angående tolkning eller tillämpning av detta avtal samt övriga avtalshandlingar och därmed sammanhängande rättsförhållanden ska avgöras av svensk allmän domstol i Stockholm.

Rättigheter och skyldigheter enligt detta avtal bestäms av svensk rätt med undantag av dess lagvalsregler.

Appendix 2

Fra:	Marianne Stenrød
Til:	"jenny.kreuger@slu.se"; Agneta.Sundgren@lrf.se; anders.normann@svensktvaxtskydd.se; lena.maxe@sgu.se; Emilie.Vejlens@lansstyrelsen.se; Milena.Ivansson@kemi.se; Charlott.Gissen@jordbruksverket.se
Kopi:	Roger Holten; Anna.Hellstrom@Naturvardsverket.se
Emne:	ang. evaluering av det nasjonale miljøovervåkingsprogrammet for pesticider i jordbruksområder i Sverige
Dato:	tirsdag 25. februar 2020 15:41:00

Norsk institutt for bioøkonomi, NIBIO, skal i 2020 på oppdrag fra Naturvårdsvärket gjennomføre en evaluering av det nasjonale miljøovervåkingsprogrammet for pesticider i jordbruksområder (*Översyn av delprogrammet Pesticider (växtskyddsmedel)*), som omfatter de fire typområdene M42, N34, E21 og 18, og elvene Skivarpsån og Vegeån.

Evalueringen skal gi oppdragsgiver og utførende institutt (SLU) et grunnlag for om mulig å forbedre innhold og gjennomføring av programmet i framtiden, og oppdraget omfatter en vurdering av følgende elementer:

- Valg av overvåkingsområder for miljøovervåkingen
- Prøvetakingsstrategi inkl. frekvens, teknikk/metodikk mm, herunder vurdering av:
  - volumproporsjonal (flödesproportionell) prøvetaking i Skåne i perioden fra 2006, som kan danne grunnlag for å vurdere inkludering i det faste programmet
  - vinterprøvetaking i Halland, som kan danne grunnlag for å vurdere inkludering i det faste programmet
- Valg av pesticider som overvåkes
- Rapportering av resultater fra miljøovervåkingen, inkl. behov for å forbedre eller komplettere dagens rapporteringsrutiner

Evalueringen skal også omfatte forslag til prioriterte endringer som følge av en 10% økning eller reduksjon i budsjettrammene for programmet.

I arbeidet skal vi ta hensyn til bruksområdene for programmets resultater, inkl. bruk som underlag til direktiv, miljømålsoppfølging, prosess for godkjenning av handelspreparater (växtskyddsmedels-produkter), og interaksjoner med jordbruksnæringen.

En god prosess forutsetter god kommunikasjon med dere som referansegruppe og utfører for programmet, og **vi håper dere nå i starten av arbeidet kan gi oss innspill på hva dere tenker er spesielt viktig ift. de elementene/spørsmålene som inngår i evalueringen.**

Formuler gjerne dine innspill som svar på spørsmålene under, men vi tar gjerne også imot andre typer innspill.

1. Er det elementer (f.eks. dyrkingspraksis, kulturer, områder, naturtyper, vannforekomster e.l.) ved dagens praksis i svensk jordbruk og pesticidbruk du mener ikke omfattes/representeres godt nok av typområdene i den nasjonale pesticidovervåkingen? Grunngi gjerne potensielle forbedringspunkter/endringsbehov.

2. Hvordan vurderer du at dagens prøvetakingsstrategi med tidsproporsjonale blandprøver gjennom vekstsesongen klarer å representere problemomfanget med tap av pesticider fra jord til vann? (eks. Fanger man toppene? Burde det vært hyppigere prøvetaking? osv.)

Kommenter gjerne hvilke eventuelle forbedringer du ser kan komme av prøvetaking hele året (også vinter) og/eller annen prøvetakingsmetodikk (eks. volumproporsjonale prøver)

3. Er det mye brukte pesticider som pr i dag ikke er inkludert i overvåkingen? Er det evt spesielle grunner for at disse ikke er inkludert?
   Kommenter gjerne ift bruksstatistikk/omfang og godkjenninger.

4. Hvordan dekker dagens rapporteringsprosedyrer overvåkingens mandat/formål (syfte)? Ser du noen behov for annen/endret rapportering for å (bedre) oppfylle overvåkingens formål? Kommenter/eksemplifiser gjerne i forhold til bruk av resultatene i utvikling/oppfølging av direktiv, oppfølging av miljømål, datagrunnlag til godkjenningsprosessen, kobling/formidling til jordbruksnæringen/dyrkerne mm.

5. Har du noen (andre) forbedrings-/endringsforslag til dagens overvåking, inkludert forslag til nye tiltak (åtgärder)?

Vi håper du har mulighet til å sende oss dine innspill innen 20. mars.

Vi vil ta kontakt med utfører, SLU, gjennom prosessen for å avklare ulike spørsmål som dukker opp underveis i arbeidet, og både referansegruppen og utfører vil få tilsendt et utkast til rapport medio september 2020 med ca. 2 uker høringsfrist. Vi tar også sikte på å invitere dere til et møte mot slutten av september så vi kan diskutere rapportutkastet og deres innspill. Vi kommer tilbake med mer informasjon om dette senere.

Vi ser fram til et godt samarbeid med dere gjennom evalueringen!

Mvh
Marianne Stenrød og Roger Holten

Vennlig hilsen/Best regards
Marianne Stenrød
Forskningssjef/Head of department (PhD)

Bioteknologi og Plantehelse, Avd. Pesticider og naturstoffkjemi
Biotechnology and Plant Health, Dept. Pesticides and natural products chemistry

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NIBIO
NORWEGIAN INSTITUTE OF
BIOECONOMY RESEARCH

NIBIO - Norwegian Institute of Bioeconomy Research was established July 1 2015 as a merger between the Norwegian Institute for Agricultural and Environmental Research, the Norwegian Agricultural Economics Research Institute and Norwegian Forest and Landscape Institute.

The basis of bioeconomics is the utilisation and management of fresh photosynthesis, rather than a fossile economy based on preserved photosynthesis (oil). NIBIO is to become the leading national centre for development of knowledge in bioeconomics. The goal of the Institute is to contribute to food security, sustainable resource management, innovation and value creation through research and knowledge production within food, forestry and other biobased industries. The Institute will deliver research, managerial support and knowledge for use in national preparedness, as well as for businesses and the society at large.
NIBIO is owned by the Ministry of Agriculture and Food as an administrative agency with special authorization and its own board. The main office is located at Ås. The Institute has several regional divisions and a branch office in Oslo.

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