



Norsk institutt for luftforskning  
Norwegian Institute for Air Research

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# Ren luft for alle

ExtraStiftelsen project 2019/HE1-263918

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**NILU report 22/2020**



## Preface

This report presents the goals, methodology, results and conclusions from the “*Ren luft for alle*”-project carried out in 2019. The project was part of the Oslo European Green Capital, and was funded by ExtraStiftelsen (now: Stiftelsen Dam). *Ren luft for alle* was coordinated by NILU – Norwegian Institute for Air Research with Norwegian Asthma and Allergy Association (NAAF) as a partner. Oslo Municipality, and specially Oslo Kommune, Bymiljøetaten, Oslo Kommune, Utdanningsetaten, and the Oslo Green Capital delegation have supported the project in many ways from its start.

We would like to thank all the participant schools. Without their involvement this project could not have been realised: Asker International School, Bekkestua barneskole, Blakstad skole, Bygdøy skole, Drøbak skole, Døli skole, Fjellfoten skole, Fjellhamar skole, Grunnskolen Oslo Kristne Senter, Holumskogen skole, Kampen skole, Maura skole, Munkerud skole, Nesoddtangen skole, Nyskolen i Oslo, Rasta skole, Rosenholm skole, Rykkinn skole, Råholt skole, Solberg skole, Trasop skole, Tveita skole, Ullevål skole, Vinderen skole, Volla skole, Årnes skole, Åsgård skole and Vinderen skole. Special thanks to the 4<sup>th</sup> grade teachers and students from the above mentioned schools.

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## Summary

In 2019, in the framework of Oslo being European Green Capital, NILU – Norwegian Institute for Air Research invited students from elementary schools to measure air pollution in their neighbourhood, using simple and affordable measuring methods based on paper and Vaseline. The measuring campaign was conducted in the period between 15 March and 15 May. This is the high season for particulate pollution in Norwegian cities, due to dust resuspension. The school campaign has helped researchers to get data on particulate matter from many places where data was not available, and has increased awareness among the children about the sustainability challenges cities are facing.

A team of two NILU-researchers visited the students and introduced them to the topic of air pollution. The students prepared the measuring devices and selected the places where they wanted to monitor. After one week, they retrieved the devices and used a scale to compare the amount of dust fastened to the Vaseline. All of the data gathered by the students was uploaded by the teachers to a website (<https://luftaforalle.nilu.no/>), where a map showed all the results from the participating schools. More than 60 4<sup>th</sup> grade classes (with students of 8-9 years of age) joined the campaign and almost 300 measurements were collected.

During the campaign, NILU-scientists visited 10 schools (Volla, Munkerud, Tveita, Trasop, Holmlia, Døli, Ullevål, Råholt, Årvoll, Auli) in Oslo and Akershus and carried out the activity together with the teachers. We did a pre- and post- test evaluation with the children in the classes with a 10-question multiple choice test. The results show that using citizen science improved science instruction and helped to integrate knowledge by including student views and taking advantage of the diverse ideas the students generated. The citizen science approach employed in the schools combined the four key elements that promote knowledge integration: eliciting ideas, adding new ideas, distinguishing among ideas and reflecting and sorting out ideas.

Citizen science gives learners an insight into the ways that scientist generate solutions for societal problems. But more importantly, citizen science provides a way to differ from the classic view of the learner as an absorber of information, by considering the social context of instruction and making the topic personally relevant.

# Ren luft for alle

## ExtraStiftelsen project 2019/HE1-263918

### 1 Background of the project

Oslo was entitled the European Green Capital in 2019. During that year, a number of activities and events were arranged to engage the population in environmental issues. Research institutes, NGOs and industry were offered the opportunity to propose activities aimed at increasing participation and awareness of urban environmental challenges.

In that framework, NILU - Norwegian Institute for Air Research proposed to carry out the campaign "Ren luft for alle" (clean air for all) that was aimed at engaging school children in activities related to local air pollution. The purpose of the campaign was to bring together children, researchers, teachers and NGOs to work together to achieve cleaner air in our cities. Pupils at primary schools were able to carry out air quality measurements using simple and inexpensive measurement methods. In addition, children and adults worked together to find ways to raise people's awareness on air pollution, how air pollution affects our health, what individuals can do to reduce air pollution and how to protect themselves from it.

"Ren luft for alle" had a focus on public health. We strongly believe that it is essential to actively involve children in improving the air quality where they live, by making them "environmental ambassadors". The engagement process is very important as this is the first step towards increased awareness and changed behavior on the road to better (public) health.

**Why focusing on air pollution?** Air pollution affects our health throughout our lives - from the womb to the day we die. Air pollution can cause respiratory illnesses, cardiovascular disease and cancer, and especially aggravate the situation of those who are already ill. We also know that children are particularly vulnerable to environmental threats that can lead to chronic diseases, such as asthma. Since the 1970s, the number of children with asthma has quadrupled in Norway, and today more than 20% of school-aged children have been diagnosed with asthma. Recent research shows that air pollution also affects children's brains, especially traffic-related pollution is thought to have a negative impact on children's cognitive development.

The project "Ren luft for alle" has prepared educational material for pupils and teachers focusing on air quality and health. The goal was to increase the understanding of the topic and encourage positive action. In order to achieve our goal we have:

1. Prepared useful information for students and teachers.
2. Achieved learning goals through action-based learning (e.g., measurement campaign).
3. Raised awareness and influenced the local community through school and local activities aimed at contributing to a cleaner, safer and healthier local community.

NILU monitors air quality throughout Norway. The results show that several Norwegian cities, including Oslo, exceed the limit values set to protect human health (Figure 1). In order to comply with the limit values, both "top-down" and "bottom-up" approaches are required. Raising awareness, engaging users and thereby changing behaviors are ways to contribute to the "bottom up" approach. In a previous collaboration, NILU and NAAF (Norwegian Asthma and Allergy Association) implemented local initiatives to engage the population in mapping their local environment and raising awareness of the link between air pollution and health (EU project CITI-SENSE, <http://co.citi-sense.eu>). In "Ren luft for alle", NILU and NAAF, including the volunteers in the NAAF Region Oslo and Akershus, worked together to engage children in elementary school, their teachers and parents in measuring air quality.

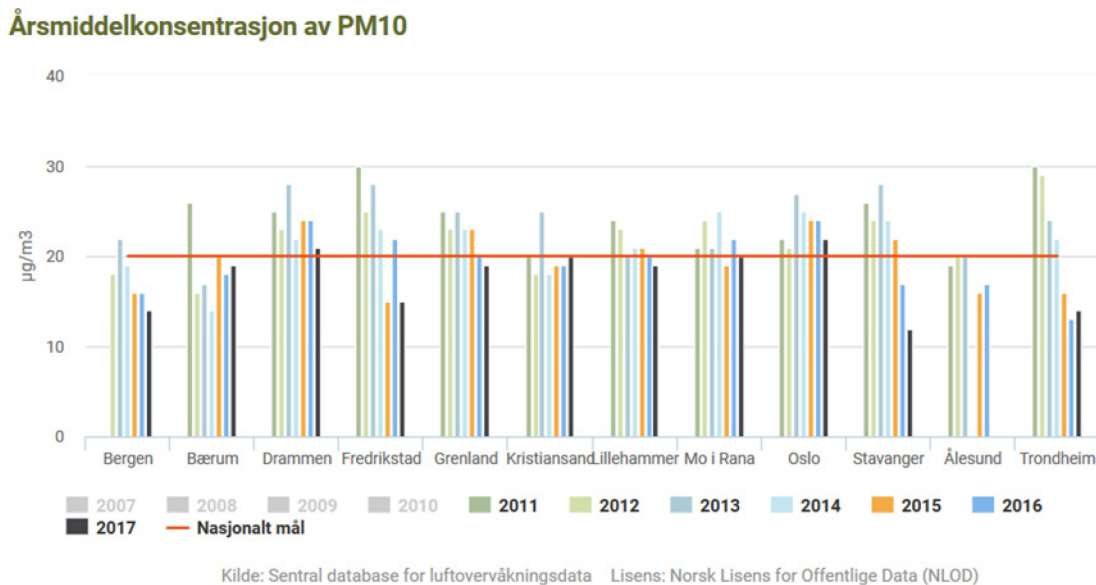


Figure 1. Air quality levels ( $PM_{10}$  yearly average for 2011-2017) in Norwegian cities. Source: Miljostatus.no

"Ren luft for alle" was part of the official program during the Oslo Green Capital 2019 activities, and the funding from ExtraStiftelsen was employed to cover the costs associated with the preparation and implementation of the campaign. This included the design of learning material, establishing dialogue and collaboration with the schools on the measurement campaign and presenting the project results in an international conference and at the Environmental Festival (Miljøfestivalen #mittgrønneoslo) in Oslo.

## 2 Objectives and target group

The aim of the "Ren luft for alle"-project was to disseminate knowledge about air pollution to both students and teachers and to engage them in the work to improve the air quality where they live. To achieve this goal, we:

1. Created an action-based teaching toolbox, as well as instruction manuals for creating and using simple measuring instruments to monitor air quality and to visualize the results.
2. Implemented a joint measurement campaign using simple measurement technology in spring 2019.
3. Established collaboration with schools in Oslo and Akershus and gave them the opportunity to present the results of their measurement campaign to a larger audience during the Urban Future Global Conference in Oslo and at an environmental festival organized by the Oslo municipality as part of Oslo Green Capital activities.

### 2.1 Target group

The target group were students and teachers in primary and secondary schools. In the 2019 campaign we focused on 4<sup>th</sup> grade students in the schools in Oslo and Akershus. The material is freely available through an online platform (<https://luftaforalle.nilu.no/>) and other schools as well as interested people in all age groups could use it.

The educational toolbox was developed together with a masters student in digital education from the University of Oslo, and was reviewed by teachers and 4<sup>th</sup> grade students. In collaboration with the Education Agency (Utdanningsetaten i Oslo, UDE) we ensured that the toolbox was in line with the learning objectives in the school's curricula. The Environment Agency (Bymiljøetaten i Oslo) reviewed also the material and their help was crucial to reach the schools in Oslo and Akershus.

### 3 Project implementation

Implementing “Ren luft for alle” required considerable work for both planning and executing the school campaign and the festival. From the beginning of the project, we established contact with the Oslo Green Capital committee to coordinate our initiative with their plans. In this context, we had a meeting with the Education Agency and the Environmental Agency in Oslo to market our initiative and to make use of their communication channels.

After contacting the schools, we carried out the following activities from January 2019:

1. In collaboration with a masters student in Digital Learning at the University of Oslo, we developed information material for children aimed at helping them to understand the connection between air pollution and health, how we measure air pollution, how we can reduce our exposure and what we can do to improve air quality. The material was prepared in a way to help children to design their own scientific study with their own air quality measurements. All material was freely available on the project website (<https://luftaforalle.nilu.no/>).
2. NILU coordinated a measurement campaign in which 4<sup>th</sup> grade classes from schools in Oslo and Akershus were invited to build their own sensors of cardboard and petroleum jelly (Figure 2). The sensors were then deployed outside the school building for one week to collect dust. After the collection phase, the students could infer the level of air pollution by comparing their sensor to a calibrated scale developed by scientists at NILU (Figure 3). Using a simple web solution, the teachers (or the students) were then able to upload their measurement data on a map.
3. Together with the children we created a unique common air quality map. The data from all participating schools was displayed on the air quality map through the website provided by NILU (<https://luftaforalle.nilu.no/>). Through the website, the students had access to the common map where they could see the data reported by themselves and also by the other schools participating in the campaign.
4. The campaign was carried out between March and April, when particle pollution is often high due to the resuspension of road dust. NILU collected all the data generated by the schools. The results are stored in a database at NILU and can be visualized through the main project website.
5. The master student and one scientist from NILU visited several schools and conducted the following activities in one or several classes of each school: school lesson about air quality and preparation and deployment of the sensors together with the children. We also visited one school as observers during the day the students collected the sensor and analysed the results. This enabled us to evaluate the material, the satisfaction of the children and to get feedback from the teacher.
6. The master student also prepared pre- and post- tests to evaluate whether the campaign had contributed to increased knowledge and awareness about air pollution among the children who participated. For this reason, questionnaires with identical questions have been handed out to the children to be completed before and after the campaign. The evaluation of the results has to be handled with care as we had no control case.



7. The first measurement results, including the common air quality map, were presented at the Urban Future Global conference (22-24 May 2019 in Oslo) by three students from Årvoll skole and Tveita skole.
8. NILU also participated in the Environmental festival organized by the Environment Agency in Oslo as part of the European Green Capital activities. During the festival the results of the campaign were displayed, and we had educational activities to increase awareness about air pollution. We invited all participating children to draw their view on air quality and their visions for Oslo. We collected more than 100 drawings which are now currently stored at NILU. We would like to make them available through the main website.

NILU aims to repeat the initiative in the years ahead, therefore all the material will remain available at the project website (<https://luftaforalle.nilu.no/>). We have also established contact with Miljølære.no (<https://www.miljolare.no/>), a repository for activities that can be carried out by schools in their nearby environment. Miljølære.no has been developed and is maintained by Skolelaboratoriet i realfag at the University of Bergen. They are now willing to make "Ren luft for alle" an activity on their website and through this will reach out to all the schools subscribed to the portal. It is also possible that the campaign can be part of the Forskningskampanjen, initiated by Norges Forskningsrådet (NFR).


*(Teip her)*


## Luftmåler

Satt ut: \_\_ / \_\_ / \_\_

Tatt inn: \_\_ / \_\_ / \_\_

Sted: \_\_\_\_\_



**Skoleprosjekt -  
vennligst ikke rør!**

*(Teip her)*

Figure 2 Example of the sensor using paper and petroleum jelly used in the schools (luftmåler).

## Støvskala

Sammenlign luftmåleren med støvskalaen og velg smilefjeset som passer til:



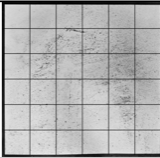

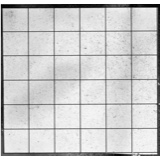

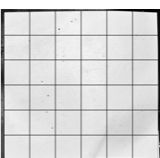



Bilde	Beskrivelse	Prikker pr cm <sup>2</sup>	Luftforurensningsnivå	Smilefjes
	Papiret har mange svarte og grå prikker. Store deler av papiret har blitt grått.	> 50	Veldig høyt	
	Papiret har ganske mange svarte og grå prikker. Det er noen felter på papiret som har blitt grå.	26 - 50	Høyt	
	Papiret har svarte og grå prikker over hele flaten, men det er ikke noen felt som er farget helt grå.	11 - 25	Noe	
	Papiret har bare noen få svarte og grå prikker, og det er ikke noen felt som er farget helt grå.	< 11	Lite	

Figure 3. Calibrated scale developed by NILU to compare with the results from the sensors (luftmålere) and estimate the air pollution levels.

## 4 Results

### 4.1 Action-based teaching toolbox

One of the goals of the project was to design an action-based teaching toolbox, as well as instruction manuals for creating and using simple measuring instruments to monitor air quality and to visualize the results. At the beginning of the project and after a meeting with Oslo Kommune UDE, we decided to focus on 4<sup>th</sup> grade students. However, all materials developed by the project could easily be used by teachers from other grades, by parents at home or by any other interested citizens. The materials were uploaded to the project website and made freely available for everyone. The teaching toolbox was created in collaboration with a master student in digital learning, and contained the following materials:

1. Guidance material:
  - a. Tutorial with a detailed description of the methodology for the classroom activity. It was designed to be used by teachers.
2. Activity material:
  - a. Template to create the sensor (luftmåler)
  - b. Dust scale to interpret the results from the sensor and obtain the air pollution level

- c. “My experiment” template to document the experiment and follow the steps in designing a scientific experiment.
3. Background information:
    - a. For teachers: information about air pollution (sources, types of pollutants, levels in Norway, etc.)
    - b. For 4<sup>th</sup> grade students: information about air pollution adapted to the level of 4<sup>th</sup> grade students.
    - c. For 5<sup>th</sup> and 6<sup>th</sup> grade students: information about air pollution with more advanced information, adapted for older children.
  4. Learning objectives:
    - a. Competence goals: relevant competence goals of the activity in relation with the curricula for 4<sup>th</sup> grade.

All the materials are still available through the project website. Figure 4 displays the action-based teaching toolbox as it was used in Trasop skole, Oslo. During day 1, the teacher (in this case also assisted by NILU scientists) gave a lecture on air pollution, the students read the background information and asked questions. Afterwards, they created their own experiment by help of the “My experiment” template, formulated their hypothesis, described the methodology and selected the place they wanted to conduct the measurement/hang up the sensor. After they completed the template, the students built the sensor (luftmåler) using paper and Vaseline, and went outside the school building with the teacher to hang it on nearby fences, light poles, trees, etc . They worked in groups of 2-4 students. One week later, they collected the sensors and compared the amount of spots on the Vaseline with the dust scale to obtain the air pollution level. They wrote down the conclusions of their experiment and the teacher uploaded the measurement data to the project portal on the “Ren luft for alle” web pages.



The teacher introduces the project and the topic of air quality.



The students design their own hypothesis and research questions, describe the methodology and build the sensor to conduct the experiment.



With the help of their teacher, they deploy the sensor in the location they selected during the design of their experiment.



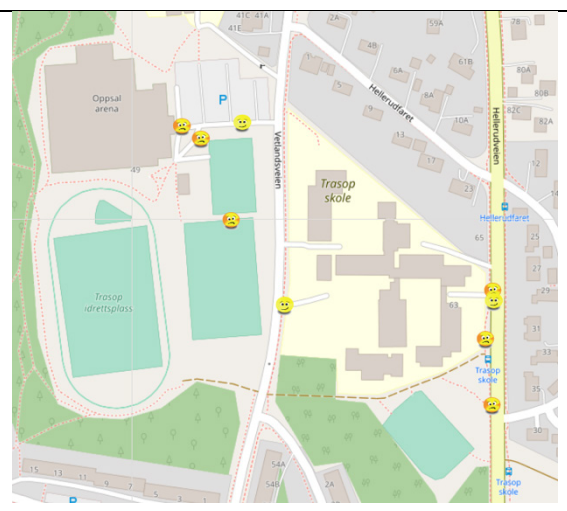
	<p>After 1 week, they can collect the sensor. They take it carefully back to the class, making sure it does not get exposed to more dust from their clothes, backpack, etc.</p>
	<p>The children analyse the data, counting the dust points and comparing the results against the dust meter, to reveal the pollution level.</p>
	<p>The teacher uploads all the results from the class to the map on <a href="https://luftaforalle.nilu.no">https://luftaforalle.nilu.no</a>.</p>

Figure 4. Pictures from the hands-on-work with the teaching toolbox at Trasop skole.

The activity material and background information have also been promoted at the European Clean Air Day (ECAD, <https://cleanaireday.eu/>) as one of the suggested activities. As part of the ECAD day, the material created in “Ren luft for alle” was presented at the stand “Sniffing Odours” in the Museum für Naturkunde in Berlin (Figure 5) and used by schools in Portugal (Figure 6) and Netherlands.

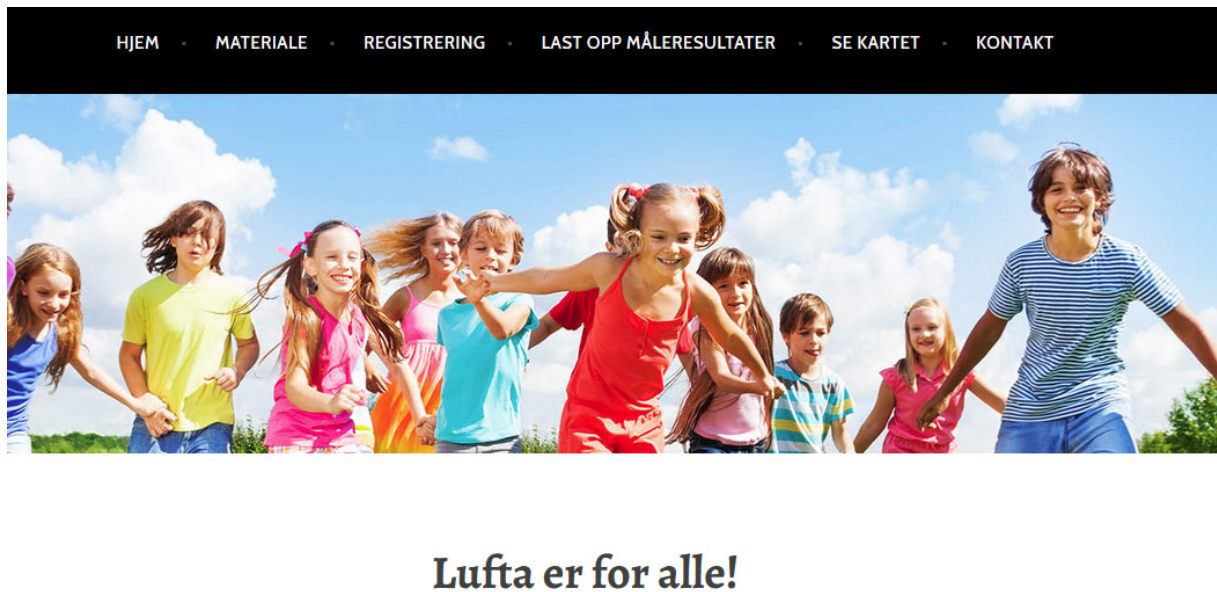


Figure 5. Stand in the Museum für Naturkunde in Berlin displaying the action-based teaching toolbox created in “Ren luft for alle”. (Photo: Simone Ruefenacht).



Figure 6. Air meter sensor used in schools in Portugal. The material was translated to Portuguese language (Photo: Marta Camera Oliveira).

In the framework of the project we also created a dedicated website where the schools could find the material mentioned above, and also as part of the action-base toolkit, a portal to upload the results (Figure 8 and Figure 8).



NILU – Norsk institutt for luftforskning ønsker med dette å invitere elever på 4. trinn i

Figure 7. Screenshot of the “Ren luft for alle” website (<https://luftaforalle.nilu.no>).

The part of the portal dedicated to upload the results from the campaign had a registration area, where the schools were asked to provide a name for their class and the name of the school. This was used to keep a track of how many schools registered, and also if some of the schools that registered did not upload any results. We did not store any private information regarding the students or the teachers. All results could also be found at the project website on a map (Figure 9). The map had also a search function, making it possible to select between period of time, school and level of pollution.

Figure 8. Screenshot from the “Ren luft for alle” website showing the interface where to input the results.

## 4.2 Joint measurement campaign

During January 2019, we prepared a list of the primary schools in Oslo and Akershus, and sent an email to their directors presenting the campaign and inviting the schools to participate. For that purpose we prepared a 2 page leaflet (in Norwegian) explaining the purpose of the campaign and the tools we have created for the schools to actively participate in measuring air pollution. At the beginning of February 2019, we sent out the invitation (see Appendix A).

The “Ren luft for alle” campaign took place between March and May 2019. We selected this period, as it is during the spring time that particulate matter levels are higher due to road dust resuspension. Thus, we expected that during spring we will be able to measure higher concentrations than during other times of the year. However, the material and website was open and schools could submit their results also after May 2019. A total of 60 classes from 30 schools in Oslo and Akershus joined the “Ren luft for alle” campaign. During this time, we collected around 300 markers (Figure 9). It should also be mentioned that schools that were not directly contacted (i.e. schools outside Oslo and Akershus) also joined the campaign, and we also had some markers from organizations and private individuals (Figure 10).

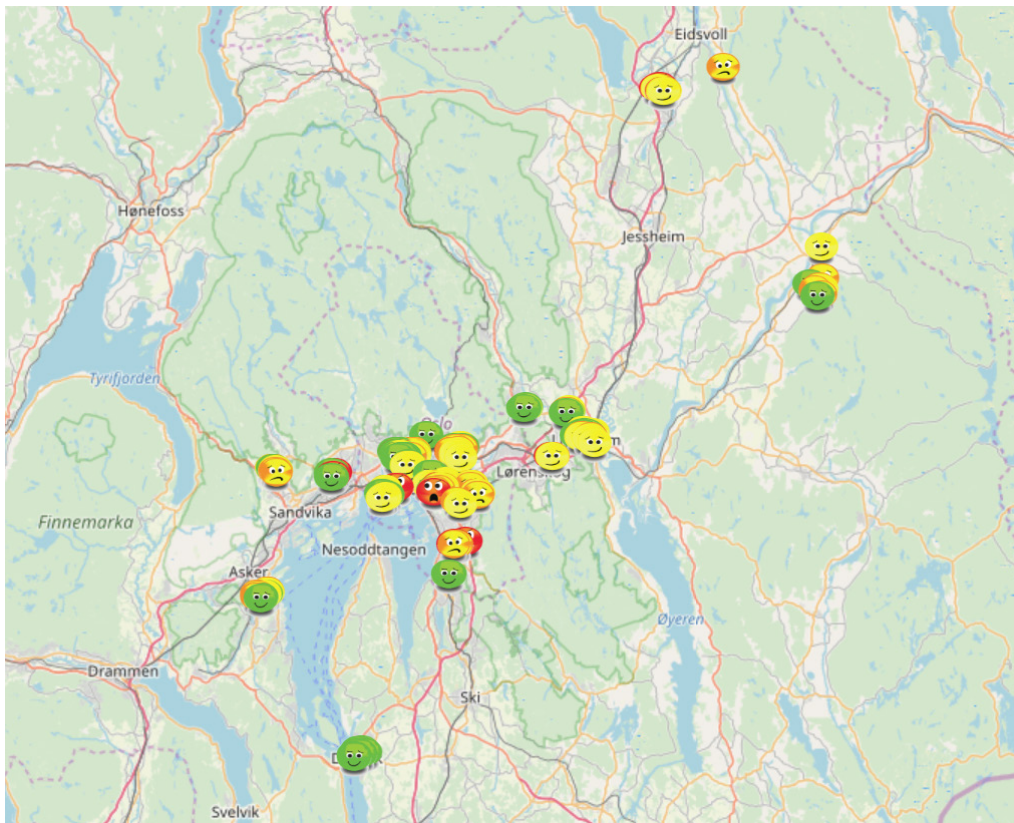
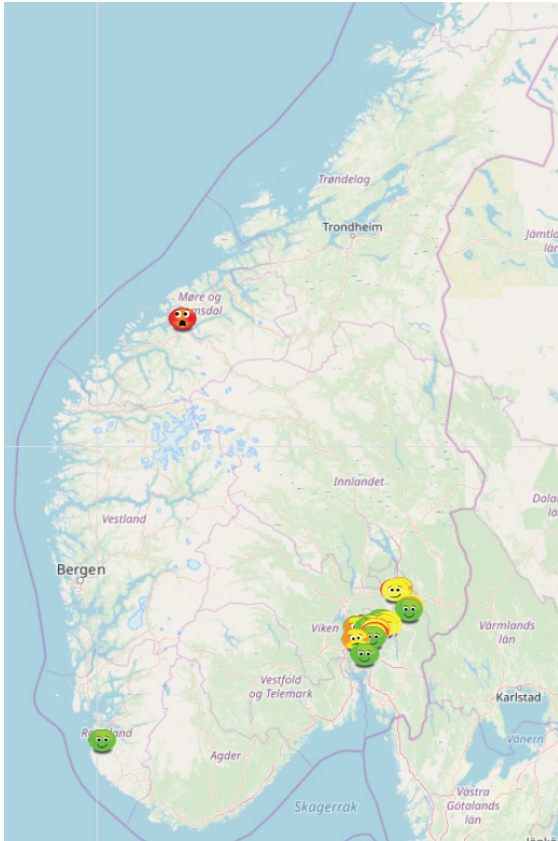


Figure 9. Map showing the 300 markers collected during the “Ren luft for alle” campaign in Oslo and Akershus.





*Figure 10. Map showing the collected markers in the targeted area of Oslo and Akershus, and contributions from other areas in Norway.*

As mentioned before, the monitoring method employed in “Ren luft for alle” was selected as one of the monitoring methods for the European Clean Air Day (<http://cleanairday.eu>), organized by the European Citizen Science Association (ECSA) working group on Air Quality and celebrated on 20 June 2019. NILU translated the materials into English, and then other volunteers from the ECSA organization translated them to other languages. Per today, some of the materials and the website are available in the following languages: Norwegian, English, Danish, Dutch, German and Hungarian. The “Ren luft for alle” method will also be employed in the European Clean Air Day 2021, to be celebrated in October. Figure 11 shows the markers collected outside Norway during 2019.

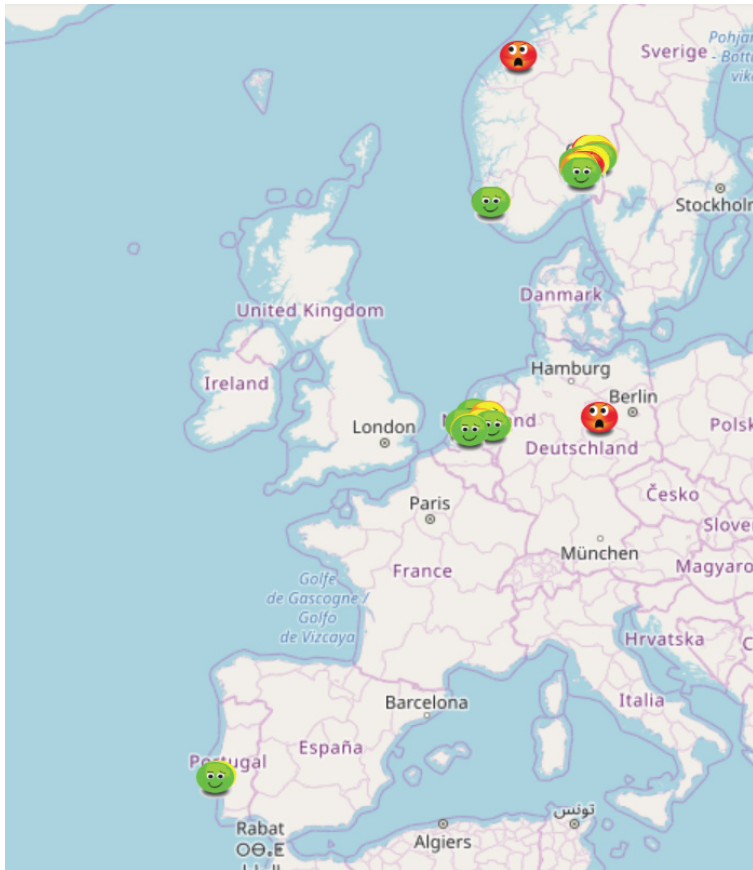


Figure 11. Markers collected in Norway and Europe during 2019.

### 4.3 Dissemination and communication of the results

The “Ren luft for alle” project was disseminated to different target audiences through different channels. Our target audiences were:

1. Schools, children and parents in Oslo and Akershus
2. Administrations: Oslo municipality, Oslo Green Capital Committee
3. Research institutes and organizations interested in Citizen Science

We used different channels to communicate with the different target groups. During the whole duration of the project we had email exchange and face-to-face meetings with Oslo municipality, specifically with BYM and UDE. The schools were contacted at the beginning of the project through email, and we kept email contact during the project with all the participating schools. We also disseminated the project using social media (e.g. events on Facebook, Figure 12) and on different forums like the Bedre byluft forum where Norwegian municipalities meet to discuss about air quality challenges in Norway and the Bymiljøkonferansen that took place in June 2019 in Oslo. The results were (and still are) presented in scientific conferences (e.g. Barcelona Citizen Science Biennale 2019, ECSITE 2019, ECSA 2020 conference) and we are currently writing a scientific paper to be published in a peer reviewed journal.



Figure 12. Event created on Facebook to join the campaign “Lufta er for alle”, as part of the project “Ren luft for alle”.

The first communication event was the kick-off of the campaign on 15 March 2019 at Årvoll skole, Oslo. The kick-off was opened by Research Director Britt Ann Kåstad Høiskar from NILU and Raymond Johansen, the governing mayor of Oslo (Figure 13). During the kick-off the 4<sup>th</sup> grades students had the opportunity to ask questions about the campaign and build their own air quality sensor with paper and petroleum jelly. The kick-off was covered by media (national tv and regional press) and social media (Facebook and twitter).

During 2019, the “Ren luft for alle” project participated in two events in the framework of Oslo being European Green Capital: Urban Future Global Conference (March 2019) and Oslo Environmental Festival (June 2019).

The Urban Future Global Conference is Europe’s largest event for sustainable cities. The event was held in Oslo, the European Green Capital 2019 on 22 - 24 May 2019. The Urban Future Global Conference is the world’s largest meeting dedicated to city changers – decision makers who actively, passionately and effectively make cities more sustainable. During the conference, the project was presented by three 4<sup>th</sup> grade students, a representative from Oslo municipality BYM, Susanne Lützenkirchen, and the project leader, Nuria Castell. The children took the major role during the presentation of the project (Figure 14).



Figure 13. Picture from the kick-off of “Ren luft for alle”. During the event, the students at Årvoll skole had the opportunity to ask questions to the Governing Mayor of Oslo. Picture: Christine F. Solbakken



Figure 14. Presentation of the project “Ren luft for alle” at the Urban Future Global Conference in May 2019 in Oslo. Picture: Christine F. Solbakken

The Oslo Environmental Festival (Miljøfestivalen #mittgrønneoslo) was arranged by Oslo municipality. Different institutions and organizations working with the topic of environment could participate with a stand. The festival was held in Sofienberg park and NILU and NAAF Oslo and Akershus presented the results from “Ren luft for alle” and invited children to join us in three different activities: (1) a quiz to smell three different types of pollution and guess the sources; (2) look at pollution components under the microscope and (3) draw/describe how we can make air quality better (Figure 15). During the festival, we collected more than 100 drawings, and plenty of ideas for a better and cleaner city (Figure 16). All the drawings were collected by NILU and were showed to representatives from Oslo Municipality BYM during a meeting.

	<p>(1) a quiz to smell three different types of pollution and guess the sources</p>
	<p>(2) look at pollution under the microscope</p>

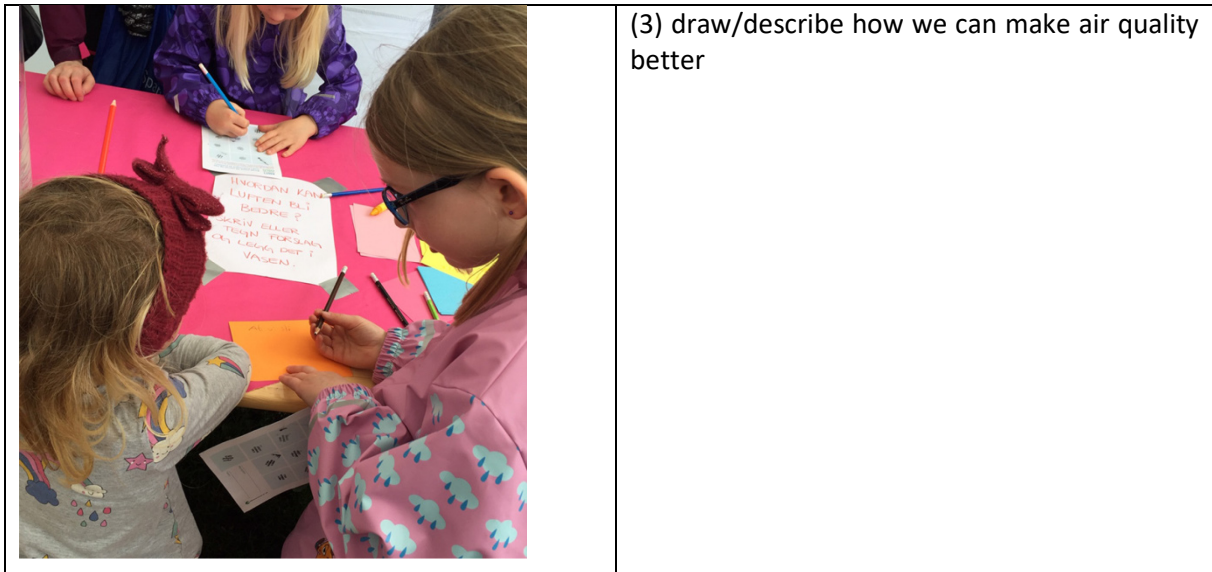


Figure 15. Activities promoted by the “Ren luft for alle” NILU-NAAF team during the Miljøfestival in Oslo. Pictures: Nuria Castell

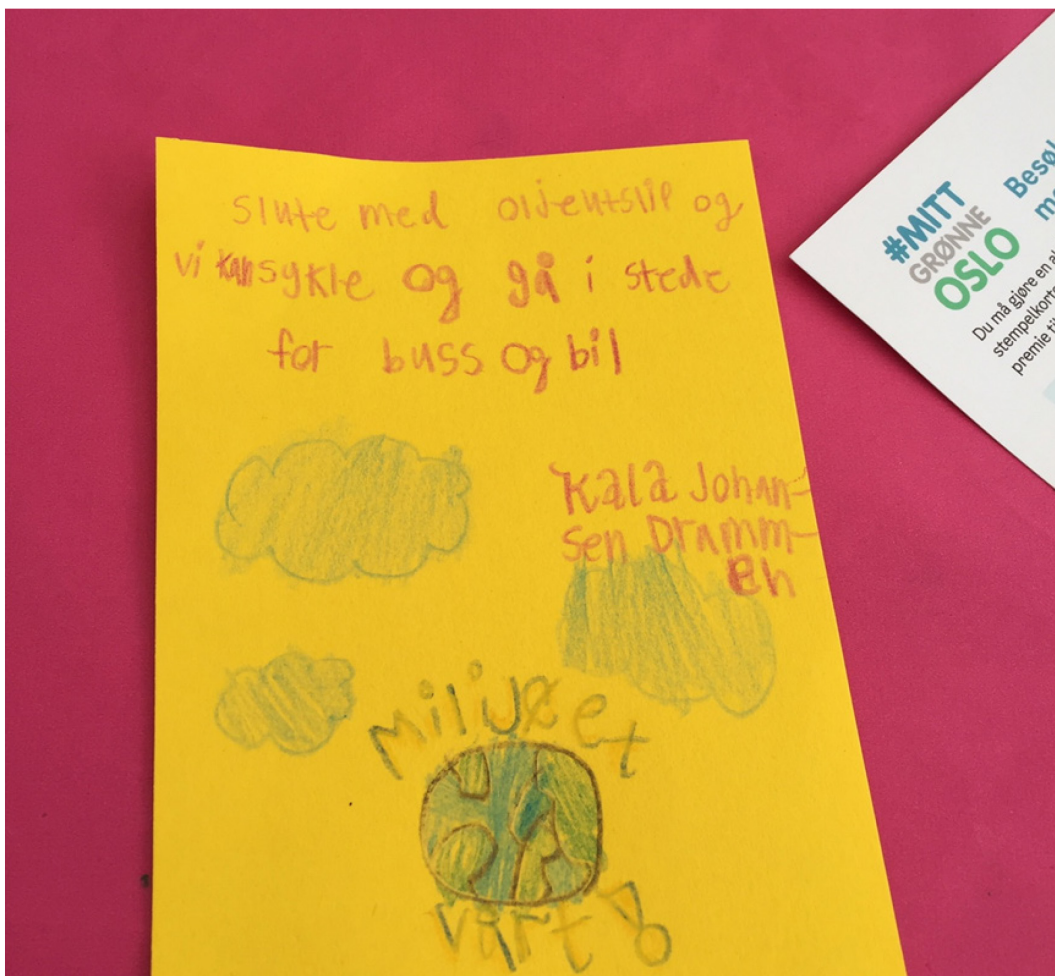


Figure 16. Example of one of the drawings made by children participating in the “Ren luft for alle” activities at the Miljøfestival 2019. Pictures: Nuria Castell

#### 4.4 Evaluation of the campaign

At the end of the activities, we interviewed two teachers from Råholt skole and Årvoll skole. The teachers commented that they found the activity exiting and some of the students even started thinking about a scientific career as a possibility. Some students wanted also to conduct the activity at home and hang the sensors outside their homes, showing that the activity was of great interest, and not just a “school task”. Regarding the level of difficulty of the teaching material, they commented that for some students some words were a bit difficult, but that this was used as an opportunity for students to help each other by explaining the difficult words to those that did not know them. However, there were many new concepts, and it is necessary to have more repetitions so that the concepts are clearer for the students. Both teachers agreed that in general the instruction material was not difficult, and the students could follow the instructions, including the comparison of their air sensors (luftmåler) with the calibrated scale (stovskala) to obtain the air pollution level. One of the interviewed teachers also commented that when the children wrote down their conclusions, the students initiated a debate (without the teachers asking) and talked about air pollution for more than 1 hour.

Another comment from the teachers was about the inclusivity of the activity. Those children that are not so interested in science enjoyed to go outside and climb to deploy the sensors during, and they had a greater interest in the results. The activities created a feeling of ownership. The teachers also commented that the visit from a scientist helped to boost the engagement of the students.

Besides the interview with the teachers, we conducted a pre- and post- test with the children by means of a questionnaire. The conclusions we can extract from these tests are limited as we did not have any control group. Also, we did not have an individual pre- and post- test, but we collected all the test in each class. In some cases, the number of pre- and post- test for a particular class do not match, as the number of attendees to the class may vary (e.g. sickness). The pre- and post- test were only conducted in the classes that NILU visited. During our visit, we observed big differences in the classes (e.g. concentration, reading level, involvement), this was also displayed in the results from the questionnaires. In total, from the 12 classes that conducted both, the pre- and post- test, we collected 245 pre-tests and 238 post-tests. Seven classes filled in only the pre-test (124 tests), but did not return the post-tests. When analysing the results from the classes that filled in both, the pre- and the post-tests we can see that there is a 10% increase in the number of correct answers. We can also observe a reduction in the misconceptions, for instance, before performing the activities, 46% of the students thought that particulate matter is bigger than the diameter of a human hair, while after the activities, this wrong answer is only given by 22% of the students. Similarly, most of the students (60%), thought air quality was not a problem in Norway before starting the activities, while after the activities, only 32% of the students replied that air quality was not a problem in Norway. We can also see a decrease of 10% in the number of wrong answers to the question of what we can do to improve air quality.

#### 4.5 The project in the future

After the positive experiences of the 2019 campaign, we aim to continue supporting the campaign in the following years. On our website, we are inviting all schools in Norway to join us in a campaign in 2020. We have also established contact with channels that schools use as a repository for their activities, as for instance Miljolare.no. We have received the positive feedback that they will display the “Ren luft for alle” activities and materials on their web pages and thus we can reach schools all over the country. Additionally, Oslo municipality has also made the materials available through the web pages KlimaSkolen (Figure 17).

The screenshot shows the KlimaSkolen website interface. At the top left is the KlimaSkolen logo. To its right are navigation links: '→ Til klimaoslo.no', 'Hjem', and 'Om oss'. Below the navigation is a search bar with the text '← TILBAKE TIL SØK'. The main heading is 'Lufta er for alle' in large, bold, black font, with 'NORSK INSTITUTT FOR LUFTFORSKNING' in smaller blue text below it. To the right of the heading is an illustration of two stylized figures carrying a large green pencil. Below the heading is a red button with white text: 'GÅ TIL UNDERVISNINGSPLEGG'. The main content area is titled 'AVSLUTTET PROSJEKT. FREMDELES AKTUELT' in bold black font. Below this is a paragraph of text: 'Prosjektet er hovedsakelig for elever på 4.trinn, men kan lett tilpasses elever opp til 6.trinn. Norsk institutt for luftforskning (NUPI) har utviklet en fagtekst om svevestøv tilpasset begge aldersgrupper. Prosjektet ble gjennomført i 2019. Materialet ligger fremdeles tilgjengelig for en lokal gjennomføring.' Below the text is the section 'GJENNOMFØRING' in bold black font, followed by a paragraph: 'Elevene plasserer egenkonstruerte luftmålere i nærmiljøet og leser av resultatene etter en uke. Resultatene benyttes i etterarbeid i'. To the right of the main text are three sections: 'TRINN' with two yellow buttons 'Trinn 3-4' and 'Trinn 5-7'; 'FAG' with one yellow button 'Naturfag'; and 'VARIGHET' with one yellow button '2-4 timer'. At the bottom right is the section 'RESSURSTYPER' with one yellow button 'Prosjekt'.

Figure 17. The project documentation is accessible from other platforms used by Norwegian schools.

## 5 Conclusion

The project engaged 4<sup>th</sup>-grade students from 60 classes in monitoring air pollution. Interviewed teachers talked very positive about the project, and how it allowed all students in the class to be involved in creating their own scientific experiment. The pre- and post- tests have shown that overall the project has contributed to increasing the knowledge about air pollution among the participating students.

We believe that children play an important role in addressing the urban challenges to ensure a sustainable future. The project's ambition is that the teaching material and tools that were developed can be part of the curriculum and be used as activities in the school even after the project ends. In order to do that, we will continue establishing alliances with other institutes and organizations, and maintain the project website.



## **Appendix A**

### **Invitation for primary schools to participate in the “Ren luft for alle” campaign**



## Bli med på målekampanjen «Lufta er for alle»




### Invitasjon til skoleprosjekt i Oslo og omegn

Prosjektperiode: 15. mars-15. mai 2019



Oslo har blitt utnevnt til Europas Miljøhovedstad i 2019. I den anledning inviterer NILU - Norsk institutt for luftforskning til målekampanjen «Lufta er for alle», der barneskoleelever kan delta i aktiviteter knyttet til lokal luftforurensning. Formålet med kampanjen er å få barn, forskere, lærere og frivillige organisasjoner med på å jobbe sammen for å oppnå renere luft i byene våre.

Vi ønsker med dette å invitere barneskoleelever i Oslo og omegn med på å gjennomføre luftkvalitetsmålinger ved bruk av enkle og rimelige målemetoder. Disse målingene kan inngå i naturfagundervisningen, og bidra til at barna lærer mer om luftforurensning.

Underveis vil de få kunnskap om hvordan luftforurensning påvirker helsen vår, hvordan de kan beskytte seg mot skadelig luftforurensning, og om hva de kan gjøre for å bidra til å redusere mengden forurensning i lufta.

«Lufta er for alle» involverer barn aktivt i å forbedre luftkvaliteten der de bor, ved å gjøre dem til «junior-miljøforskere».

*“God luftkvalitet er viktig for alle, og særlig for barn. De må lære om lufta, hvordan den måles og hva som påvirker den. Slik kan de engasjere seg for et bedre miljø der de bor.”*



**Lan Marie Nguyen Berg,**  
miljøbyråd i Oslo

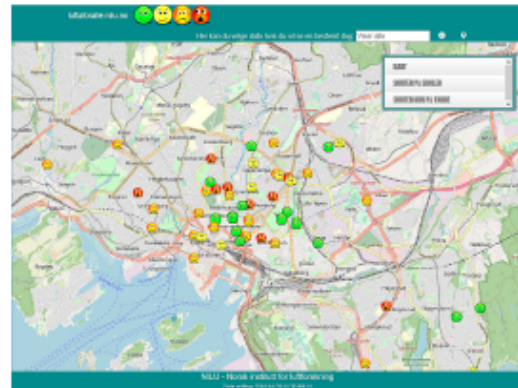
### Hvorfor inviterer NILU elever til å delta i et skoleprosjekt om luftforurensning?

Det er godt kjent at luftforurensning kan gi oss luftveislidelser, hjerte- og karsykdommer og kreft, og er du allerede syk kan luftforurensning bidra til å forverre tilstanden din. Barn er særlig følsomme for helseeffekter av luftforurensning, de kan for eksempel utvikle astma<sup>1</sup>. Siden 1970-tallet har antallet barn med astma blitt firedoblet i Norge, og per i dag har mer enn 20% av barn i skolealder fått astma-diagnose<sup>2</sup>. Nyere forskning viser at luftforurensning også påvirker barnas hjerner, og særlig trafikkrelatert forurensning antas å ha negativ innvirkning på barns kognitive utvikling<sup>3</sup>.

#### Mål for prosjektet

Målet for prosjektet er i tråd med kompetansemål i naturfag for 4. årstrinn - Forskerspiren, der eleven skal kunne

- bruke naturfaglige begreper til å beskrive og presentere egne observasjoner, foreslå og samtale om mulige forklaringer på det man har observert
- bruke måleinstrumenter, systematisere data, vurdere om resultatene er rimelige, og presentere dem med eller uten digitale hjelpemidler
- skrive rapporter og beskrivelser, revidere innhold etter tilbakemelding, vurdere innholdet i andres tekster og lage enkle digitale sammensatte tekster
- innhente og bearbeide informasjon om naturfaglige tema fra ulike kilder og oppgi kildene<sup>4</sup>



uke. Deretter skal de vurdere resultatet, og rapportere inn sine data på nettsiden.

#### Gjennomføring

Kampanjeforberedelsene tar ikke mye tid, og lar seg enkelt inkludere i undervisningen. NILU har utviklet informasjonsmateriale som kan brukes til å forklare elevene sammenhengen mellom luftforurensning og helse, hvordan vi måler luftforurensning og hvordan vi kan beskytte oss for den. Materialet ligger åpent tilgjengelig på nettsiden <https://luftaforalle.nilu.no/>.

På denne måten er elevene med på å lage et unikt felles luftkvalitetskart, som det på bildet over. Kartet skal vise data fra alle de deltakende skolene, og jo flere som er med, jo mer verdifullt blir kartet. Kampanjen skal gjennomføres i løpet av mars/april, når partikkelforurensningen ofte er høy som følge av oppvirvling av veistøv<sup>5</sup>.

I første del av målekampanjen skal elevene lage enkle sensorer av papp og vaselin. Sensorene skal de sette ut i sitt nærmiljø, og hente inn igjen etter én

Resultatene, inklusive det samskapte luftkvalitetskartet, skal presenteres både på [Urban Future-konferansen](#) i mai og på en planlagt [miljøfestival](#) i juni.

<sup>1</sup> <http://www.who.int/ceh/publications/don-t-pollute-my-future/en/>

<sup>2</sup> <https://www.lhl.no/lhl-astma-og-allergi/stovsamlere/fakta/>

<sup>3</sup> <https://www.medicaldaily.com/air-pollution-slows-cognitive-development-children-due-brain-inflammation-324136>

<sup>4</sup> <https://www.udir.no/k106/NAT1-03/Hele/Kompetansemal/kompetansemal-etter-4.-arstrinn>

<sup>5</sup> Når snø og is forsvinner fra veier og grøftekanter om våren blir veistøv som er samlet opp i og rundt veibanene gjennom vinteren sluppet løs og kan virvles opp i luften.

**«Lufta er for alle» har blitt godkjent som en av de offisielle aktivitetene under Miljøhovedstadsåret i 2019. Målekampanjen er et samarbeidsprosjekt mellom NILU og Norges Astma- og Allergiforbund (NAAF) samt NAAF Region Oslo og Akershus. «Lufta er for alle» samarbeider også med Oslo kommune Bymiljøetaten, Utdanningsetaten og Klimaløftet i Osloskolen.**

**Vil din klasse delta i kampanjen? Bli med her: <https://luftaforalle.nilu.no/>**

**For nærmere informasjon, ta kontakt med Sonja Grossberndt ([sg@nilu.no](mailto:sg@nilu.no)) eller Nürta Castell ([ncb@nilu.no](mailto:ncb@nilu.no))**



## **NILU – Norwegian Institute for Air Research**

NILU – Norwegian Institute for Air Research is an independent, nonprofit institution established in 1969. Through its research NILU increases the understanding of climate change, of the composition of the atmosphere, of air quality and of hazardous substances. Based on its research, NILU markets integrated services and products within analyzing, monitoring and consulting. NILU is concerned with increasing public awareness about climate change and environmental pollution.

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