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Urban air quality citizen science

Phase 2: Suggested programme of research projects

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1 Introduction

1.1 This report

This report contains a short description of the elements of a suggested programme of projects for citizen science in the area of urban air quality. The programme has been put together by the authors of the report based on a review of current work in this area and discussions with the study Advisory Group in August 2013 (for membership see Appendix 1).

An overview of the programme is given below, followed by short 2-page summaries of each project. These projects are proposed for a future programme of citizen science urban air quality.

We also present in this report a brief description of two small methodological pilot studies. These pilot studies are not intended to cover the full range of the proposed projects, but to test some aspects of the proposed methodology. The findings of the pilot studies will be reported separately.

1.2 The programme of projects

The overarching programme of work for this project is focused on two main areas – transport and schools. These areas are not exhaustive, other areas have also been identified which could be taken forward through a similar programme.

Within the areas of schools and transport, five specific projects have been identified.

Schools:

- Schools near busy roads
- Cars idling outside schools

Transport:

- Pollution 'hotspots'
- Transport corridors
- Parks and greenspaces

Details of each of these projects are given in Chapter 2 of this report.

1.3 General principles for citizen science projects

There are a number of issues to be considered before taking on a citizen science project from identifying the question to be answered, through identifying funding and resources, design of the study and data collection and interpretation to the reporting of the results. These issues are addressed in detail in the Guide to Citizen Science produced by the UK Environmental Observation Framework and in the recently published guide "Choosing and using citizen science: a guide to when and how to use citizen science to monitor biodiversity and the environment"; both reports are available at:

http://www.ceh.ac.uk/products/publications/understanding-citizen-science.html

It is particularly important in citizen science projects to consider any ethical issues which may arise in the work. It is important to bear in mind the health and safety of the participants and to give training, advice or guidance where necessary.

Some citizen science projects will include the involvement of vulnerable groups of people, for example those which involve work with schools (and school children) or with adults with mental health problems. Investigators in such studies should consider whether ethical approval is required from a recognised ethics committee before such work commences. This would include an assessment of issues such as:

- What measures have been taken to ensure participation is voluntary and that participants know they can withdraw at any time?
- Will this information be available in both verbal and written form?
- What is being done to ensure participants do not become distressed by the findings particularly if they believe their own health has been affected by air pollution?
- What support will be provided to participants during the study?

1.4 Potential funding sources

Funding for citizen science projects can be gained from a variety of potential funding sources.

For larger studies, potential funding sources include:

The EC Horizon 2020 framework programme

http://ec.europa.eu/programmes/horizon2020/

Horizon 2020 is a recently launched European Commission funded programme. It will be issuing a number of calls for proposals with nearly €80 billion funding available over 7 years (2014 to 2020). It funds a wide range of research of which the most relevant is 'Science with and for Society' which it reports will aim "to build capacities and develop innovative ways of connecting science to society. It will make science more attractive (notably to young people), increase society's appetite for innovation, and open up further research and innovation activities. It allows all societal actors (researchers, citizens, policy makers, business, third sector organisations etc.) to work together during the whole research and innovation process in order to better align both the process and its outcomes with the values, needs and expectations of European society".

UK Government departments and research councils

Some funding for scientific research is available from UK Government departments. The most relevant for work of this kind is the Department for Environment, Food and Rural Affairs (DEFRA) which periodically issues calls for research at https://www.gov.uk/research-funding-from-defra. Research funding may also be available from the Department of Health http://www.prp-ccf.org.uk/ .

Other UK Government science and research work is funded through its seven research councils which provide grants for specific projects and programmes. The Medical Research Council (MRC) and

National Environment Research Council (NERC) are the most appropriate for environmental and health related citizen science work.

https://www.gov.uk/government/policies/investing-in-research-development-and-innovation/supporting-pages/science-and-research-funding

The MRC Public Health Development Scheme (PHIND) provides support for the early stages of public health interventions including instrument development which may be relevant to development of air quality sensors for use in citizen science.

http://www.mrc.ac.uk/Fundingopportunities/Grants/PublicHealthInterventionDevelopmentScheme/MRC009274

Scottish Government

The Government funds a wide range of research programmes; for environmental research, the main funding department is the Rural and Environment Science and Analytical Services Division (RESAS). However, most RESAS research (over 85%) is carried out by its Main Research Providers – a group of six organisations across Scotland.

http://www.scotland.gov.uk/Topics/Research/by-topic/environment

Other funding sources include the Chief Scientist's Office which funds research aimed at improving the health of the people of Scotland, but has a strong focus on NHS services research.

http://www.scotland.gov.uk/Topics/Research/by-topic/health-community-care/chief-scientist-office

Future Cities

https://futurecities.catapult.org.uk/

This is one of 7 'Catapults' launched by the UK's Technology Strategy Board, with the aim for each of them is to become a world-leading innovation centre in its own specialist area.

For smaller studies, potential funding sources include:

Local authorities

Small grants of funds or services in kind can be obtained from local authorities in Scotland, for example for work in schools or with community groups. In addition, the funding available for the introduction of low-emission zones and active transport could help to support monitoring activities to provide a measure of 'success' or uptake of specific activities.

Heritage Lottery Fund

http://www.hlf.org.uk/InYourArea/Scotland/Pages/Welcome.aspx#.U197iYE2xgg

The Heritage Lottery Fund in Scotland supports projects that "create opportunities for volunteering, learning and celebrating our culture. The projects that we fund help to give people a sense of place and identity, igniting a passion for heritage, and regenerating communities". The UK Heritage Lottery Fund has around £375m a year to invest in new projects across the UK. 'Heritage' ranges from museums, parks and historic places to archaeology, natural environment and cultural traditions.

At the time of writing the following grant programmes are the most relevant to environmental and citizen science research:

- Our Heritage - £10,000 to £100,000 for any type of project related to national, regional or local heritage in the UK;
- Sharing Heritage - £3,000 to £10,000 for any type of project related to national, regional or local heritage in the UK;
- Young Roots - £10,000 to £50,000 for projects that engage young people with heritage in the UK.

Big Lottery Fund

http://www.biglotteryfund.org.uk/about-big/our-approach/about-big-lottery-fund

The Big Lottery Fund (BIG) distributes around £600 million raised for good causes by the National Lottery each year. The BIG funds projects 'supporting health, education, environment and charitable purposes. 80-90 per cent of our funding is awarded to voluntary and community sector organisations'. Funding is available across the UK, with programmes tailored specifically to the needs of communities in England, Scotland, Wales or Northern Ireland as well as some programmes that cover the whole UK.

Current funding programmes relevant to citizen science and environmental research include:

Awards for All Scotland - £500 to £10,000 grants to help people become actively involved in projects that bring about change in their local community. This could be through a wide range of community, arts, sports, health, education and environmental activities;

Investing in Ideas - £500 to £10,000 for projects with outcomes including communities that are safer, stronger and more able to work together to tackle inequalities and people who have better and more sustainable services and environments.

Scottish Environment Protection Agency (SEPA)

http://www.sepa.org.uk/science_and_research.aspx

The Scottish Environment Protection Agency's main role is to protect and improve the environment. They will "consider the awarding of occasional, small-scale (generally less than £20 000) grants for scientific research and development through our Research Advisory Panel (RAP). RAP funds research projects that help deliver our Corporate Plan and priorities identified in our research strategy".

Scottish Collaboration for Public Health Research and Policy (SCPHRP)

https://www.scphrp.ac.uk/

SCPHRP's mission is to strengthen the evidence base for public health by developing and testing complex interventions for health improvement; and to facilitate the rapid uptake of research evidence in the development of policy and practice. They provide seed funding to support feasibility and pilot studies that will inform the development of novel public health interventions and provide analytical capacity of ongoing or planned evaluation studies funded by other grant-giving bodies.

2 Project summaries

2.1 Schools near busy roads

Background

- The school environment plays an important role in the health and academic success of children;
- Many schools in cities are situated near busy roads, and in particular, many playgrounds are roadside;
- Children in playgrounds will often be active e.g. running about, playing football, resulting in higher breathing rates and potentially higher exposure to pollutants in outdoor air.

Aims of the project

The main objectives of the project are:

- Development of a method for children to monitor the air quality of their playground and surrounding area;
- Collection of data from the children and the staff – how do they perceive outdoor air quality - through simple questionnaires;
- Provision of simple and understandable visualisation of the data and easy access to the data for the children and staff;
- Development, in close co-operation with the schools, of simple and practical tools that can help the school to work systematically with outdoor air issues, for example:
    - Visualisation of the data on the web or other platform
    - Automatically generated reports
    - Tools (e.g. uploading photographs) for the children/staff to report environmental conditions and observations of things that may affect the outdoor environment such as planting barriers and trees within the vicinity of the playground etc.

Target participants

Pupils and teaching staff in primary or secondary schools.

Example methodologies

- Carry out measurements of outdoor environment parameters in the playgrounds of each of the schools studied using static and/or portable samplers . This could include some or all of
    - Particulate Matter
    - Carbon Monoxide
    - Nitrogen Dioxide
    - Ozone
    - Daily weather conditions and other observations;

- Working with each school, identify the issues and work with the school to define the tools that will help to address these e.g. factsheets, seminars and working together in classroom sessions;

- Collect subjective assessments on aspects of outdoor air e.g. perceptions of whether traffic emissions are noticeable in the playground.

Stakeholders and outcomes

The stakeholders will include Education Authorities, staff at the participating schools, parents and pupils.

Benefits

Potential benefits of this work may include:

- staff and children involved in the study will have increased knowledge about outdoor air quality;
- schools will have more information about the status of the outdoor air quality at their schools and how to improve it;
- potential to deliver a range of outcomes and experiences in the Curriculum for Excellence;
- the children will gain an understanding of the impact of the outdoor environment on learning and health and wellbeing;
- linking to other initiatives such as school travel planning and eco-schools, we can see how we all contribute to local air quality issues – helping towards long-term behavioural changes;
- provide some information for planning and school playground design.

Challenges

Potential challenges of this work may include:

- engagement and support time required will vary substantially from school to school;
- setting up equipment, collecting data and interpretation of the findings will need to be carefully controlled (e.g. by providing detailed factsheets on the study);
- sampling equipment will need to be calibrated before use, and some side-by-side on-site measurement may be beneficial.

Cost & timescale

Estimation of the costs and timescale for a project like this are necessarily approximate and will depend on the scale and scope of the study (e.g. number of schools involved, number and type of sensors employed at each school, time period of data collection, extent of data analysis).

An outline of estimated costs and timescale for implementation of this project at one school over a two week data collection period is provided below. Personnel costs per day for engagement with and training of volunteers and for data analysis will depend on whether the work is being carried out by volunteers, staff or external contractors and so only the number of days involved is estimated.

Resource	Time/Cost
Equipment	
Per sensor	£500 - £1000
Production/printing of user guide, log, diary (per 10 copies)	£50
Personnel	
Volunteer Engagement – initiating contact, meetings (phone, face-to-face) to explain the project, agreement on timing and scope of the work	2 days
Volunteer training & support – training of those participating in sensor use, collection of contextual information	1 day
Data analysis & feedback – retrieval and summarising data collected, one or more meetings to feedback to participants	3 days
Total	**6 days**

Timescale	Time
Engagement (dependent on school)	12 weeks
Project preparation	2 weeks
Project duration	2 weeks
Feedback and addressing findings	4 weeks
Total	**20 weeks**

2.2 Cars idling outside schools

Background

- Studies have shown that cars and school buses parked outside schools with their engines running can have a significant adverse effect on air quality;
- Idling engines can produce more emissions than engines in motion and children waiting to be collected from the school may be exposed to poor air quality on a daily basis;
- There is already a move towards banning the practice (local authorities, Clean Air Campaign, Earth Day);
- There are existing programmes to minimise the use of cars to travel to school, e.g. Active School Travel, Eco-schools (transport).

Aims of the project

The main objectives of the project are:

- Monitoring of outdoor air quality outside schools to compare levels at pick-up/drop-off times with other times of day;
- Provision of simple and understandable visualisation of the data and easy access to the data for the children and staff;
- Development, in close co-operation with the schools, of simple and practical tools and materials that can help the school to reduce the practice of leaving car and bus engines idling outside the school e.g. by improving travel plans, behavioural change and active travel for school children.

Target participants

Pupils and teaching staff in primary or secondary schools.

Example methodologies

- Carry out measurements of outdoor environment parameters close to the areas where children are dropped off and picked up from school. Fine Particulate Matter (e.g. using a Dylos device) and daily weather measurements easy to measure;

- Make measurements at all times of day, identifying the busiest time periods for traffic outside the school;

- Undertake travel surveys and (where possible) traffic surveys to identify volume of traffic and potential for change;

- Working with each school, identify the issues and work with the school to define the tools that will help to address these e.g. factsheets and working together in classroom sessions;

- Work with the schools and schoolchildren to design materials to communicate to parents and other drivers the effects of leaving the car engine running, using the information provided and data collected.

Stakeholders and outcomes

The stakeholders will include Education Authorities, staff at the participating schools, parents and pupils.

Benefits

Potential benefits of this work may include:

- reduction in the idling of car and bus engines outside the school, may be an increase in active travel to school;
- staff and children involved in the study will have increased knowledge about outdoor air quality;
- schools will have more information about the status of the outdoor air quality at their schools and how to improve it;
- potential to deliver a range of outcomes and experiences in the Curriculum for Excellence;
- the children will gain an understanding of the impact of the outdoor environment on learning and health and wellbeing;
- linking to other initiatives such as school travel planning, we can see how the school run contributes to local air quality issues, particularly within the proximity of the school grounds – helping towards long-term behavioural changes;
- provide some information for planning.

Challenges

Potential challenges of this work may include:

- engagement and support time required will vary substantially from school to school;
- setting up equipment, collecting data and interpretation of the findings will need to be carefully controlled (e.g. by providing detailed factsheets on the study);
- sampling equipment will need to be calibrated before use, and some side-by-side on-site measurement with standard, more accurate instruments may be beneficial.

Cost & timescale

Estimation of the costs and timescale for a project like this are necessarily approximate and will depend on the scale and scope of the study (e.g. number of schools involved, number and type of sensors employed at each school, time period of data collection, extent of data analysis).

An outline of estimated costs and timescale for implementation of this project at one school over a two week data collection period is provided below. Personnel costs per day for engagement with and training of volunteers and for data analysis will depend on whether the work is being carried out by volunteers, staff or external contractors and so only the number of days involved is estimated.

Resource	Time/Cost
Equipment	
Per sensor	£500 - £1000
Production/printing of user guide, log, diary (per 10 copies)	£50
Personnel	
Volunteer Engagement – initiating contact, meetings (phone, face-to-face) to explain the project, agreement on timing and scope of the work	2 days
Volunteer training & support – training of those participating in sensor use, collection of contextual information	1 day
Data analysis & feedback – retrieval and summarising data collected, one or more meetings to feedback to participants	3 days
Total	**6 days**

Timescale	Time
Engagement (dependent on school)	12 weeks
Project preparation	2 weeks
Project duration	2 weeks
Feedback and addressing findings	4 weeks
Total	**20 weeks**

2.3 Pollution hotspots

Background

- Frequent concerns expressed by media and local residents about air quality related to particular locations or through particular building works;
- Some (semi-) indoor public spaces fall between local authority responsibility to control air quality and the much higher limits that can be applied through Workplace Exposure Limits;
- Obvious sources of pollution (e.g. diesel trains or rush-hour congestion) result in perception of poor air quality and expression of acute and chronic health problems among those in the area;
- Those with existing health problems such as asthma and cardiovascular disease may be vulnerable even during transit through the hot-spot.

Aims of the project

The main objectives of the project are:

- Develop ways for interested parties to deploy and use a small portable tool to measure air quality in a given location over short periods of time. The methods may involve a mixture of fixed location and personal sampling methods;
- Measurement of a range of air pollutants across a number of representative days with provision of real-time data for some pollutants in order to provide information on how levels vary by time of day and weather conditions;
- Communication of air pollutant concentrations through simple graphical outputs;
- Provision of context on how the levels relate to those found in other locations and how they compare to health-based guidance/limit values.

Target participants

Anyone (individual or local community group) with an interest in air quality.

Example methodologies

- Work with a group such as Friends of the Earth Scotland to carry out measurements of outdoor/semi-enclosed air quality parameters at three sites (e.g. a transport hub; Glasgow Hope St; Commonwealth Games low emission zone). These will include:
    - Particulate Matter <2.5 microns
    - Carbon Monoxide
    - Nitrogen Dioxide
    - Nitric Oxide;

- At each site identify the sources and examine variability over the course of the day and between days;

- Work with the stakeholder to propose ways of reducing emissions, reducing personal exposures or both.

Stakeholders and outcomes

The stakeholders will be those with an interest in air quality within that particular location, as well as organisations such as Local Authorities, Transport Scotland etc. The project will aim to empower those taking the measurements with knowledge of quantified concentrations and the potential health effects associated with such exposure. This assets-based approach will provide the local community with the evidence and skills to bring about greater engagement with local and national policymakers and involvement with the media.

Benefits

Potential benefits of this work may include:

- those involved in the study will have increased knowledge about air quality with particular attention paid to their local study location and the potential effects such exposure can have on health;
- information about the temporal variability in air pollution and how to avoid highest concentrations will be made available.

Challenges

Potential challenges of this work may include:

- some semi-outdoor spaces (e.g. railway stations) are not covered by outdoor air quality legislation and communicating the difference in permitted exposure levels to stakeholders may be challenging;
- gaining access to make measurements at some sites may prove problematic;
- setting up equipment, collecting data and interpretation of the findings will need to be carefully controlled (e.g. by providing detailed factsheets on the study);
- sampling equipment will need to be calibrated before use, and some side-by-side on-site measurement may be beneficial.

Cost & timescale

Estimation of the costs and timescale for a project like this are necessarily approximate and will depend on the scale and scope of the study (e.g. number of sites involved, ease of access to relevant sites, number and type of sensors employed at each site, time period of data collection, extent of data analysis). Time required for volunteer engagement and training is likely to be greater than for school-based projects as the participants could be a diverse group based in a number of different locations.

An outline of estimated costs and timescale for implementation of this project at one site over a two week data collection period is provided below. Personnel costs per day for engagement with and training of volunteers and for data analysis will depend on whether the work is being carried out by volunteers or external contractors and so only the number of days involved is estimated.

Resource	Time/Cost
Equipment	
Per sensor	£500 - £1000
Production/printing of user guide, log, diary (per 10 copies)	£50
Personnel	
Volunteer Engagement – initiating contact, meetings (phone, face-to-face) to explain the project, agreement on timing and scope of the work, ensuring access to relevant sites	3 days
Volunteer training & support – training of those participating in sensor use, collection of contextual information	2 days
Data analysis & feedback – retrieval and summarising data collected, one or more meetings to feedback to participants	3 days
Total	**8 days**

Timescale	Time
Engagement (dependent on site)	6 weeks
Project preparation	4 weeks
Project duration	2 weeks
Feedback and addressing findings	4 weeks
Total	**16 weeks**

2.4 Transport corridors

Background

- Exposure to air pollution during commuting often accounts for a substantial part of total daily intake;
- Transport corridors and the vehicles (cycles, buses, taxis) that use them offer the opportunity to gather large quantities of data on air pollutants across a city in real-time, and covering a wide area;
- Public transport vehicles are often tracked in real-time so geo-location data is already collected;
- Data could be made available online and could help users avoid particular areas or times when air pollution is identified as being high.

Aims of the project

The main objectives of the project are:

- Provide a cyclist or transport provider with a number of air pollutant measuring devices to attach to cycles or vehicles within their fleet;
- Develop methods to access collected data in real-time with minimal need for the cyclists or on-vehicle staff to interface with the instrumentation;
- Examine web-based methods to provide the air quality information collected to those with an interest in air pollution within the city being studied.

Target participants

Cycling groups (e.g. SPOKES), cycle couriers, local transport providers such as Lothian Buses, Edinburgh Trams, First Bus Group and others, taxi firms. Stakeholders could also include those commuting by bike.

Example methodologies

- Work with a cyclists' group to provide portable air pollution monitors and GPS units for use by members as they cycle to and from work along a range of road-types (residential streets, transport corridors);

- Work with a local transport provider to place air pollutant monitoring equipment on their vehicle. The device would be located inside the vehicle but would be able to measure outdoor air quality. Vehicles that perform cross-city routes, particularly at peak times would be selected;

- As air quality data would be required with a high spatial-temporal resolution it is likely that PM would be the primary parameter assessed;

- Wi-Fi or GPRS communication with the device would be integrated with the existing vehicle geo-location information system. This would enable the data to be uploaded to a server and web-interface in near real-time;

- Integration with SEWeb and/or the Scottish Air Quality database could be developed to provide local residents of the city with access to the uploaded data. It may be possible to integrate this with existing web-services such as Lothian Buses bus tracking service, or by the inclusion of displays via QR codes on bus stops or in other public locations;

- An add-on component would be to investigate how residents of the city use the information provided. A group of regular commuters with pre-existing respiratory disease (e.g. asthma) could be recruited to use the web-interface and explore how it changes their travel behaviour.

Stakeholders and outcomes

Stakeholders will include those with an interest in outdoor air quality within the city. The local authority would benefit from a much wider and more detailed coverage of measurement activity across the city while local residents would be able to identify pollution hotspots by location and time of day both in real time and historically. The outcome of the project would be to increase understanding about air quality within a city and how to avoid particularly high exposure levels.

Benefits

Potential benefits of this work may include:

- a much greater spatial network of air pollutant sensors across a city;
- increased resident awareness of the measurement of air pollution and reduction of the perception that monitoring only takes place in the city centre;
- local residents will be able to identify in near real-time where pollution is highest and modify their travel plans accordingly;
- provides information that can be used in AQM and to help develop transport corridors etc. aimed at reducing AQ or reducing the contribution from some public transport sectors.

Challenges

Potential challenges of this work may include:

- technically detailed project that relies on a high degree of Wi-Fi/GPRS/server communication;
- setting up equipment, collecting data and interpretation of the findings will need to be carefully controlled (e.g. by providing detailed factsheets on the study);
- sampling equipment will need to be calibrated before use;
- large quantities of data will be generated in a short space of time and there will be computer/server and data analysis implications in gathering, validating and displaying the results from such a large data set.

Cost & timescale

Estimation of the costs and timescale for a project like this are necessarily approximate and will depend on the scale and scope of the study (e.g. number of participants involved, number and type of sensors employed, time period of data collection, extent of data analysis). Time required for volunteer engagement and training is likely to be greater than for school-based projects as the participants could be a diverse group based in a number of different locations and the sensors are likely to be more complex and may require more detailed training.

An outline of estimated costs and timescale for implementation of this project over a two week data collection period is provided below. Personnel costs per day for engagement with and training of volunteers and for data analysis will depend on whether the work is being carried out by volunteers or external contractors and so only the number of days involved is estimated.

Resource	**Time/Cost**
Equipment	
Per sensor	£1000 - £2500
Production/printing of user guide, log, diary (per 10 copies) – only required if contextual data collection not built-in to sensor	£50
Personnel	
Volunteer Engagement – initiating contact, meetings (phone, face-to-face) to explain the project, agreement on timing and scope of the work	2 days
Volunteer training & support – training of those participating in sensor use, collection of contextual information where required	3 days
Data analysis & feedback – retrieval and summarising data collected, one or more meetings to feedback to participants	3 days
Total	**8 days**

Timescale	**Time**
Engagement	3 weeks
Project preparation	3 weeks
Project duration	2 weeks
Feedback and addressing findings	3 weeks
Total	**11 weeks**

2.5 Parks and greenspaces

Background

- Increasing scientific evidence that access and 'exposure' to greenspace is beneficial to physical and mental health;
- Often considerable pressure to build on existing greenspace or for local authorities to make cuts in maintenance of local greenspace areas particularly where these are under-utilised;
- Measurement of air quality in outdoor greenspaces is likely to illustrate that pollutant concentrations here are lower than indoors at home;
- Greenspace is beneficial at reducing exposure with many areas exhibiting significantly reduced levels of pollutants the further away from roadsides;
- Studies across London parks have shown that sensitive lichens are returning to some areas, despite AQ objectives still being breached across built-up areas and at roadsides.

Aims of the project

The main objectives of the project are:

- Provide users with a simple tool to measure personal exposure to air pollutant levels while spending time in local greenspace areas and/or have them look for specific species of lichen on the trees to detect the general quality of the air – these should be mapped to illustrate healthy greenspace areas within cities etc;
- Develop simple questionnaire and observational tools to quantify the effect of spending time in greenspaces on their personal health;
- Communication of air pollutant levels through simple real-time numerical feedback;
- Provision of context on how the levels relate to those found in other locations and how they compare to health-based guidance/limit values.

Target participants

Those who need to change their behaviour for health reasons. These may include those with mental health problems, those who have suffered a recent cardiovascular event and any others who have been recommended to increase their daily exercise. More generally, the project could be used with any interested local group with access to a local park or greenspace.

Example methodologies

- Work with a group such as a mental health or rehabilitation charity to engage with those who have been recommended to undertake more physical exercise in an outdoor setting. The user will be asked to make observational and/or objective measurements of air quality e.g. by wearing a personal logging device for fine particulate matter;

- The user will also make comparative measurements of air pollutant concentrations for short periods at other locations including their home and close to a local road or high street. Comparison with Scottish Air Quality Network sites would also be possible;

- The participant will use simple questionnaire tools to note how they feel prior to and after their visit to the greenspace over a period of 1-2 weeks, and also how the air quality information influenced those feelings;

- Participants, or the charity they work with, may consider using the information they have collected to engage with local media about the health benefits of spending regular time within the local greenspace to encourage others to do the same.

Stakeholders and outcomes

Stakeholders will include those with an interest in promoting the use of local parks and greenspace and highlighting the potential benefits of spending time in such environments. Potential stakeholders will include local authorities, NHS boards/GP practices, community action groups, health charities working with individuals with conditions that would benefit from greater physical exercise or time spent outdoors. The outcome of the project may include greater partnership communication and working with all those with an interest in the amenity provided by a particular greenspace.

Benefits

Potential benefits of this work may include:

- those involved in the study will have increased knowledge about air quality within the greenspace and how spending time there impacts on their health and well-being;
- participants will gather personalised, objective measures of air quality while in the greenspace;
- participants will be given a tool to engage and communicate with other stakeholders in the greenspace.

Challenges

Potential challenges of this work may include:

- comparative measurements of air quality within the home may raise some concerns for participants;
- need to ensure that participants with existing health conditions are not made anxious or stressed by the technology involved in gathering data;
- Location of active play areas near busy roads/transport corridors.

Cost & timescale

Estimation of the costs and timescale for a project like this are necessarily approximate and will depend on the scale and scope of the study (e.g. number of participants involved, time period of data collection, extent of data analysis). Time required for volunteer engagement and training is likely to be greater than for school-based projects as the participants could be a diverse group based in a number of different locations.

An outline of estimated costs and timescale for implementation of this project over a one week data collection period is provided below. Personnel costs per day for engagement with and training of volunteers and for data analysis will depend on whether the work is being carried out by volunteers or external contractors and so only the number of days involved is estimated.

Resource	Time/Cost
Equipment	
Production/printing of survey, ID guide, questionnaires (per 10 copies)	£50
Personnel	
Volunteer Engagement – initiating contact, meetings (phone, face-to-face) to explain the project, agreement on timing and scope of the work	2 days
Volunteer training & support – training of those participating completion of surveys and questionnaires, recording of data	2 days
Data analysis & feedback – retrieval and summarising data collected, one or more meetings to feedback to participants	2 days
Total	**6 days**

Timescale	Time
Engagement	4 weeks
Project preparation	2 weeks
Project duration	1 week
Feedback and addressing findings	4 weeks
Total	**11 weeks**

3 Pilot studies

3.1 Introduction

The next stage of the study was to carry out two small pilot studies of methodological aspects of some of the proposed projects. These were carried out in the early months of 2014. The two pilot studies were selected to cover both schools and transport, and preliminary discussions carried out. These are summarised below. The schools pilot work focussed on the issue of cars idling outside schools, the transport pilot study examined air pollution along transport corridors with samplers carried by cyclists. Full details of the outcomes of these projects is provided in the Phase 3 report[1] for this project.

3.2 Schools' project

A discussion regarding a proposed project in schools was carried out with a group of 12 teachers and education professionals on 12th Nov 2013. After a brief demonstration of the equipment, the group provided feedback summarised below:

Support: careful introduction and training are required, enable learners to interface with 'proper' scientists during the project, feedback after monitoring activity is essential;

Project design: Pilot should include opportunity for learners and teachers to input into wider roll of programme, activity could tie in with wide range of curriculum areas & initiatives, linking to changed behaviour in or around school would be productive;

Activity: Data needs to be relevant to schools/pupils AND 'real' scientific data users, integrate pupils as much as possible into activities, activities must be relevant and interesting and easily understood & interpreted;

Wider potential for future use: opportunity for pupils to contribute actively to SEWeb, build a community of school AQ monitoring practice, actively contribute to STEM careers promotion.

3.3 Transport project

A consultation with potential project participants SPOKES (Lothian cycling campaign) was carried out on 21st November. Feedback is summarised below:

Project Design: consider using cycle couriers for test, try and identify hotspots on regular journeys, equipment needs to be easy to use;

Support: volunteers would need briefing on use and recharging of equipment, need to see the results & feel some ownership, but wouldn't want raw data – so results need to be easily communicated to lay audience, involve volunteers in identifying routes;

Wider potential: Video could be turned into an art project: science in action, a video could provide a time lapse of the journey and readings (YouTube?), run trial on different forms of transport over same journeys, cars, buses, pedestrians, compared to biking figures.

[1] Available at http://www.environment.scotland.gov.uk/about-us/lifeplus-project/lifeplus-project-news-and-updates

Appendix 1: Study Advisory Group

The study team would like to thanks the members of the study Advisory Group for their participation in discussions and contributions to the programme of projects.

The members of the group were:

Alan Cameron – Scottish Natural Heritage

Andrew Taylor – Scottish Government

Anne Ellaway – MRC Social and Public Health Sciences Unit

Claire Campbell – SEPA Biodiversity

Colin Ramsay – Health Protection Scotland

David MacGregor – Scottish Government

Drew Hill – Transport Scotland

Edith MacQuarrie – Education Scotland

Emilia Hanna – Friends of the Earth Scotland

Jackie Hyland – NHS Fife

Richard Dixon – Friends of the Earth Scotland