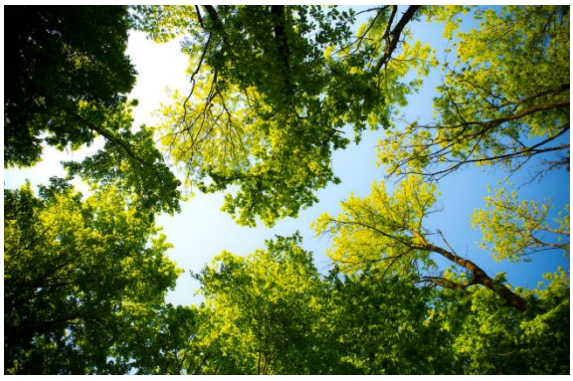
Welcome to the 8th GLOBE Ireland Air Quality Campaign!



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Introduction

Dear Teachers,

Welcome to the GLOBE Air Quality Campaign. Thank you for participating in this citizen-science initiative!

While Ireland's overall air quality is generally good by international standards it is now apparent that local air quality may not be as consistently good. It is now considered that any level of air pollution is not acceptable and poses a risk (World Health Organisation). There are often wide variations in local air quality going undetected that can have significant impacts on the health and wellbeing of local communities, so we want you to investigate the quality of the air around your school!

This project is coordinated by the GLOBE Team (Ireland), as part of The Environmental Education Unit (EEU) of An Taisce and is sponsored by the Irish Environmental Protection Agency (EPA). GLOBE is an international Environmental and Science Education program that is sponsored by NASA in the USA. GLOBE provides students and the public worldwide with the opportunity to participate in citizen science and contribute meaningfully to our understanding of the Earth system and global environment. There are many ways to participate in GLOBE, opportunities exist across multiple areas of Earth and Environmental Sciences – Atmosphere, Biosphere, Pedosphere and Hydrosphere. There are also a series of GLOBE educational measurement campaigns that teachers and their students can participate in.

Teachers are encouraged to sign up for a GLOBE Teacher account here. This is not necessary for participation in this air quality campaign, however GLOBE has some excellent teacher resources, provides access to a large dataset of earth observations, communicates on new measurement campaigns and has teacher e-training opportunities here.

About the GLOBE Ireland Air Quality Campaign

The GLOBE Air Quality Campaign is a citizen science project to assess traffic-related air pollution at schools. The campaign measures nitrogen dioxide gas in the air, a principal pollutant associated with vehicle emissions. This is an educational project designed to raise awareness about air pollution and showcase the potential of citizen science to gather unique datasets and insights into our environment. Last Year, 305 teachers registered to participate in the GLOBE Air Quality campaigns, collecting over 600 nitrogen dioxide measurements at schools. The campaign also provides a collaborative platform for schools to share their research and insights.

We want this investigation to be empowering. We will **invite you to share your findings and solutions** by creating either a research poster, a student blog post or a creative poster showing your results and interpretation of your local traffic-related air quality. This can be shared with the GLOBE Team at the end of the campaign period. Please also feel free to share your school's photos and campaign stories with **@GLOBEIreland** on Twitter.

This project is funded by the Irish Environmental Protection Agency (EPA). The EEU of An Taisce, the GLOBE programme and the EPA are partnering to encourage greater understanding and involvement of the public in air quality issues.

In Ireland, the EPA is responsible for monitoring outdoor air quality. Together with local authorities, the EPA manages a national network of monitoring stations that is being greatly expanded, with the aim of providing ongoing air quality data and forecasts to the public. You can find more information about the EPA at www.epa.ie and to find out more about citizen science initiatives in Ireland, please visit: www.epacitizenscience.ie.

This booklet is designed to support teachers in the implementation of the GLOBE Air Quality Campaign with their class. If you need any help during the investigation, please email globe@eeu.antaisce.org

Overview of Air Quality Campaign

In September/October, students across Ireland will measure nitrogen dioxide (NO_2) - a principal pollutant from car exhaust emissions - at three locations around their schools. Schools will be provided with the necessary equipment and guidance to carry out nitrogen dioxide measurements.

The main purposes of the campaign are to:

- Raise awareness about air pollution through a practical investigation
- Collect accurate data that can be used in students' research projects

- Share knowledge with school communities
- Complement official air quality monitoring performed by the EPA on local air quality
- Promote behaviour change

Teachers, please see an approximate air quality **campaign timeline** in the appendices to help you plan your classes. You will also find a list of **available resources** to help guide your class.

The campaign is easy to follow but we will hold a teacher information session in September to give teachers an opportunity to hear more about the campaign and ask questions. A zoom link will be shared in September to all registered teachers.

We hope you enjoy participating!

Teacher Instructions

Prepare your class for the investigation

We encourage teachers to prepare for the campaign by introducing the topic of air quality to your students. Teachers may like to use the GLOBE Air Quality module as a guide, it contains ideas around engaging the class, links to current air quality reference material and further content to help guide your students. You can also find PowerPoint Presentations on traffic-related air pollution to assist classroom teaching:

- Primary School Presentation
- Secondary School Presentation

In addition, schools may wish to use the Green Schools resources designed for the Travel and Global Citizenship – Travel flags.

We recommend that students begin their investigation by creating a map of their school area. The purpose of this task is to choose where to install the tubes on the school grounds. We encourage student involvement in the planning of this investigation to promote ownership and interest in the outcomes.

Watch out for your air quality pack's arrival

The air quality packs will be arriving in schools just before the beginning of the measurement period. For this campaign, we plan on the packs arriving between September 22nd - September 28th * (please note this date may change, watch your email for any updates). Please keep an eye out for your air quality pack, occasionally they can sit on desks/in mail slots for weeks! Your pack will contain 3 diffusion tubes with caps, mounting hardware (cable ties and tube holder), mounting instructions and a pre-addressed/pre-paid envelope to return your tubes after exposure.

Please install your tubes on time

We appreciate the school schedule does not allow for every teacher to install tubes on the exact same date, please try to install them as close to the beginning of the scheduled monitoring period as possible. This allows the EPA to use the results for research purposes and allows schools to compare results to other participating schools' results for the same measurement period.

Figure 1. Mounted Diffusion Tube - Photo credit to Dominican College Sion Hill

Please record your actual tube installation date and collection date

You will receive a link to an online tube installation form and after the measurement period, a tube collection form, these should only take 2-3 minutes to complete. You will be asked to enter your tube number (on sticker on side of tube), the date and the time of installation and, following the 4-week measurement period, the date, and the time of collection. The laboratory conducting the tube analysis uses this tube exposure duration to fine tune it's

analysis and provide an accurate result. We will be sending an online form to collect this exposure information with your installation instructions.

Collect supplementary information

There are factors that influence the concentration of nitrogen dioxide NO_2 in the air. The primary factor is traffic, which is the principal source of NO_2 in Ireland, the higher the volume of traffic, the higher the concentration of NO_2 in the air. We recommend that the students conduct a short traffic count at/near the school during the measurement period (while tubes are mounted) to support the interpretation of their results. Weather can also influence air pollutants – see here for more details, we encourage students to collect weather observations around wind direction, wind speed and rainfall while the tubes are mounted. The weather observations will also aid result interpretation. Check out GLOBE Atmosphere protocols for more information.

Please post your tubes back ASAP

The first batch of tubes will be sent to the UK laboratory approximately 1 week after the measurement period ends, meaning schools that return their tubes promptly should have their results by late November 2022.

Air Quality Campaign results and data analysis

You will receive your results by email from GLOBE Ireland directly. Your results will be shared with the EPA Analytics team who will add your NO_2 results on to the EPA GLOBE air quality map viewer – feel free to share this with students to help them see past results and their own school's NO_2 levels when received. The EPA analytics team also create summary graphs of NO_2 concentration at schools located in different settings (urban, suburban, large towns > 5000, small towns <5000, and rural areas). It is clear from looking at past campaign results (below) that the concentration of NO_2 is higher in urban/suburban settings compared to rural areas and smaller towns.

µg/m³	Colour Code	NO_2 Level Description
>40		High
30-40		Medium to High
20-30		Medium
10-20		Low to Medium
0-10		Low

Figure 2. Nitrogen Dioxide concentration scale, shown in microgram per cubic metre (µg/m^3) with associated NO_2 level description.

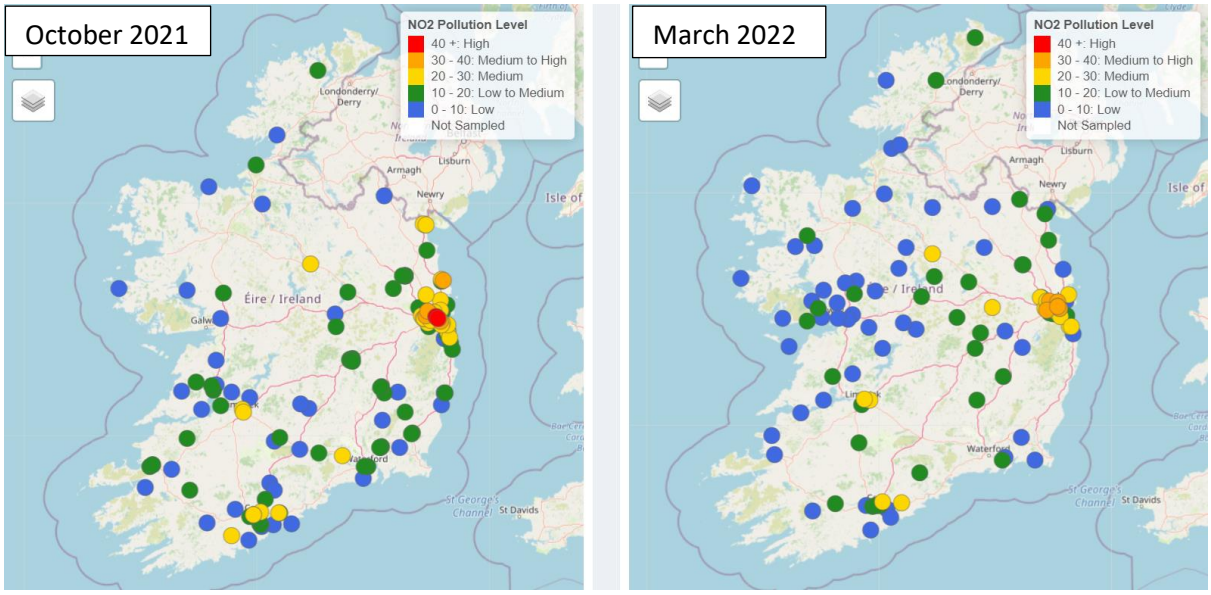

Figure 3: EPA Map view of school air quality measurements for the GLOBE 2021/22 Air Quality Campaigns (https://analyticsepa.shinyapps.io/GlobeMar22/)

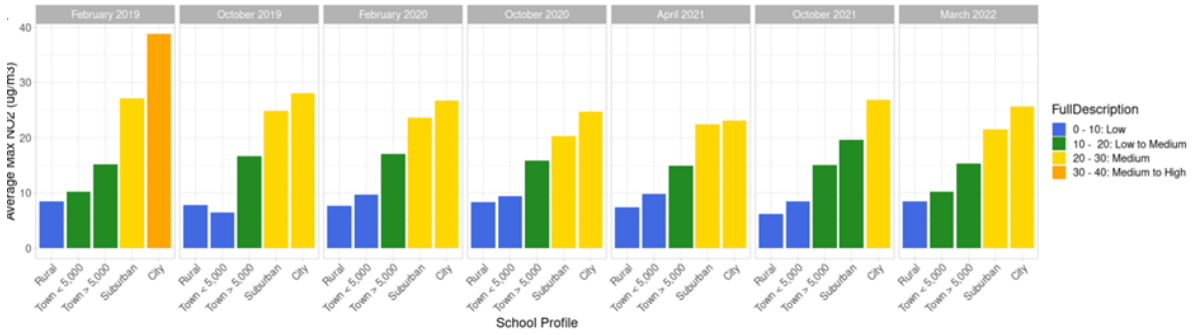

Figure 4. EPA Analytics summary graphs of GLOBE Air Quality Campaign nitrogen dioxide results from 2019 through 2022 (https://analyticsepa.shinyapps.io/GlobeMar22/)

Share your results

We invite schools to create either a research poster, a student blog post or a creative poster showing your results and interpretation of your local traffic-related air quality. This can be shared with the GLOBE Team at the end of the campaign period – see examples of previous research posters and creative artwork below and on our GLOBE air quality campaign page. We typically organise a national GLOBE air quality event at the end of the school year to give students an opportunity to share their air quality investigation story. Last May 2022, we were joined by over 200 participants that included teachers, students, and scientists at our online event. We were delighted to have the EPA Programme Manager and GLOBE Director join our event and share their thoughts with schools on the importance of school-based citizen science.

Share your results on Twitter! **@GLOBEIreland**

Figure 5. School engagement – St Malachy's NS (Left) and Oatlands College secondary school (right)

Figure 6. Research poster submitted by Rockford Manor Secondary School based on measurements from the October 2021 campaign.

Figure 7. Creative artwork and photos submitted by Bawnmore National School

Appendices

GLOBE Air Quality Campaign Timeline – September - November 2022

Phase	Activity	Time
Getting ready	**Introduce the Air Quality Campaign** to your students.	Before the measurement period – **September 2022**
	Pick locations for the NO_2 tubes - you are welcome to use our mapping lesson plan resource as a guide.	
	Install the NO_2 tubes following the protocol instructions (instructions will be sent via email and included in your air quality package)	**September 29th**
Collecting supporting data	**Optional** - Use GLOBE educational materials to gather supporting information: conduct a traffic count, record weather conditions, and examine your school's local topography.	**September 29th to October 26th**
Receive your NO_2 results	**Analyse and interpret your NO_2 results and compare your results to other schools around Ireland**	**Late November**
Findings	**Share your findings and solutions with the GLOBE Team, EEU.**	**December**
Conclusion	Reflect on what has been learned and how it can be used for positive change.	

GLOBE Air Quality Campaign Resources -

Resource Type	File Name	Purpose	Curriculum link	Learning Outcome
Module	TY Module on Air Quality	Introduce the topic of air quality	TY group. JC Science, JC/LC Geography	Build knowledge and awareness around air quality
Lesson plan – design your Air Quality campaign study	AQC2 Mapping	Create a map of your local school and surroundings to guide NO_2 tube placement for AQ campaign	JC Science (scientific process), JC/LC Geography (map creation, weather)	Develop: research skills, improve map work skills, observational methods, identifying prevailing winds and understand the practical scientific process

Lesson plan Cloud and weather observations	AQC3_Cloud and TY Module on Weather	Gather cloud and weather information to support AQ campaign	JC Geography (weather) and Science (Earth)	Build knowledge base around what drives weather, how weather can impact air pollution and develop hands-on data recording skills
Lesson Plan Conduct traffic count survey	AQC4_Traffic Count	Gather data on traffic levels close to the school to support AQ campaign	JC Mathematics (graphs, statistics) Geography (Transport)	Develop hands-on data recording skills and data analysis skills. Increase understanding around link between traffic and NO_2
Lesson Plan Examine your local terrain	AQC5_Topography	Examine the landscape features around school to support AQ campaign	JC Geography (landscape, map reading)	Develop map reading skills, identification of landforms (valley, hills) on maps. Build knowledge on the effect of landscape on air pollution.
Fact Sheet	Traffic-related Air Pollution	Raise Awareness	TY group. JC Science, JC/LC Geography	Increase knowledge base on basic facts on topic of traffic-related air pollution and air quality.
Fact Sheet	Air Pollution and weather			
Fact Sheet	Air Pollution Health and Environment			