Operation Earth Phase 2

A National Strategic Science Engagement Programme for families and communities

Final Report

31 March 2021

UK Association for Science and Discovery Centres

Contents

1. Executive Summary:

As a nation and as a global society we have some major challenges ahead, especially in relation to climate, energy, water and the other finite resources of our planet. Now, more than ever we need our young people, and society more widely, to be inspired by environmental science and innovative new approaches and technologies that can make the world a better place.

The UK Association for Science and Discovery Centres is delighted to be working in partnership with the Natural Environment Research Council (NERC) to create and deliver Phase 2 of 'Operation Earth', a national STEM programme which has Climate Change, environment, inclusion and communities at its heart. This programme follows on from the success of ASDC's Operation Earth Phase 1, which engaged 201,639 children and adults, including 37,145 who met and discussed the latest research directly with environmental scientists.

For Operation Earth Phase 2, ASDC selected eight Science Centres across England, Northern Ireland, Scotland and Wales to run this new programme. The project delivery was due to begin in communities just as the Covid-19 pandemic hit the UK in March 2020 which had a significant impact on the entire programme. In particular, the nation went into lockdown, and the Science Centres closed. Many remained shut for a year (the duration of this programme), with staff on furlough and widespread redundancies.

However, the Science Centres made astonishing efforts and pivoted their planned community events and hands-on activities to digital and blended delivery. They found innovative new approaches and new ways of working with communities to make up for the fact that neither the Science Centre staff nor the community groups were allowed to physically meet together for the majority of the year due to Covid-19 restrictions. Operation Earth Phase 2 began in early 2020 and completed in March 2021.

The Science Centres delivering Operation Earth worked in partnership with a total of 28 community groups, and together engaged with 5,239 people in communities who participated in their Operation Earth specific blended programmes. They engaged a further 85,959 people through various specific digital programmes highlighted in this report, making a total of 91,016. An additional 61,033 people interacted (briefly) through social media platforms. All together 152,231 people touched the programme at various levels of involvement. There is also an additional, but less well-defined social media reach of 126,500, taking the overall total to 339,764.

In partnership with ASDC, all the Science Centres redesigned their Operation Earth projects in the spring and summer of 2020, when it was clear the pandemic would prevent almost all the planned activities with community groups detailed in Science Centre's original proposals. From this point on, all delivery pivoted to digital or blended (hands-on and remote (e.g. Earthy boxes and resources with foodbanks), or other non-contact delivery, combined with a digital component.

Dynamic Earth in Edinburgh partnered with the Young Carers community group in Edinburgh and created and sent out bespoke 'Earthy Boxes' (also known as STEM Care packages) to 36 families from the most deprived areas of the city (mainly the most deprived 40% on the SIMD) who were also facing additional and considerable challenges. Glasgow Science Centre worked in partnership with two local

radio stations to engage with 14 different community groups in areas of deprivation, as well as creating activities within their Spark magazine, such as build your own Terrarium activity kits.
W5 in Belfast sent out bespoke Operation Earth activity packs through food banks to families and groups experiencing food poverty and other challenging socio-economic issues. Jodrell Bank Discovery Centre, Xplore! In North Wales and the National Space Centre in Leicester worked with libraries, schools and community groups in some of the most socio-economically deprived areas of their regions and combined the Operation Earth kit with their own newly created Operation Earth-themed activity packs to run online workshops and activities with families and groups of children from some of their most deprived regions, including opportunities to meet and talk (virtually) with NERC researchers. Thinktank ran a hugely successful online event throughout the summer called the #BigBrumBioBlitz campaign, which 74,393 children and adults participated with via the BigBrumBioBlitz website, blogs and video animations.

ASDC and Operation Earth trained all the Science Centre staff at a 2-day Training Academy with a host of external speakers and experts. This received hugely positive evaluations from the Science Centre staff. Fourteen Science Centre staff from 7 Science Centre were trained on all aspects of the programme including running the activities, using and maintaining the equipment, finding the latest environmental science, especially climate change and earth observation, and a masterclass in diversity and inclusion, along with one in behavioural psychology and its vital importance to having conversations about climate.

Although we had selected 8 centres in March 2020, in autumn 2020, one member sadly had to relinquish their role as a delivery partner due to the impacts of Covid-19 and their consequent redundancies and restructuring. Their staff were trained, and they already had the equipment and expect to run many of the experiments and activities in the future when they re-open.

Overall, the programme trained 33 NERC researchers and scientists at ASDC's bespoke Operation Earth Training Academy. Of those participating, 80% of researchers said the Training Academy was very successful or successful in increasing their confidence or ability to engage the public with environmental science. Some researchers told us they would like more time to network with the Public Engagement professionals from Science Centres (like it were an 'in-person' event). To help the researchers achieve this, and for the benefit of Science Centre staff, ASDC brought them together by organising two additional coffee morning events, where participants could talk in small groups. Further collaborations sprang from these.

The evaluation was light touch and was achieved in multiple practical ways outlined in the evaluation report. It focussed on the participants, the community groups and the staff. Overall, the results reveal the following:

- 87.5% of participants, following their family's participation in Operation Earth, said they felt they all learned something about our climate or environmental science.
- 87.5 % of participants, thought it was very important that Scientists research our planet and climate.
- 62.5% said they now felt more interested in reading or finding out about the science around climate and the environment? The remainder were not sure.
- 75% said they and their family enjoyed the activities, with the remainder saying they didn't know.

- 41 people took part in the Researchers Training Academy of which 33 were Environmental researchers.
- The results were overwhelmingly positive from both Training Academies (Science Centre staff and researchers) with great quotes showing how enthused and motivated they felt after the academy, and how it had increased their confidence to engage the public more.
- 100% said the Training Academy was successful in increasing their confidence and contacts to engage with their local science centre.
- 80% of researchers said the Training Academy was very successful or successful in increasing their confidence and/ or ability to engage the public with environmental science.
- We highlight we had evaluation forms returned in small numbers, as detailed in the full evaluation report. We have however also compared the results with other peoples quotes, and find them in harmony.
- Most UK hands-on interactive Science Centres plan to re-open to the public in mid-May 2021 when restrictions ease for the first time. They have all said they are keen to run Operation Earth content more in the future, and to ensure the legacy of Operation Earth continues.
- All the Phase 1 and 2 resources are on the updated website www.operationearth.co.uk

Through Operation Earth and ASDC's pioneering delivery model, ASDC has created a step-change in the way Science Centres and Museums use and share the latest environmental science to engage the public and communities with the issues and challenges around Climate Change and the environment. This has been achieved by creating a highly inspirational, new and exciting national hands-on environmental science programme and training UK Science Centres and museums to deliver it with communities. Operation Earth is also building relationships with researchers who in turn are helping Science Centres to embrace more challenging topics around climate and navigate global environmental issues with members of the public who may initially have no interest, or feel climate change is not happening.

The programme vision and mission

All the programme activities worked towards delivering the programme vision

The Vision: To inspire curiosity in a wide-range of families with school-age children to enjoy, contribute to, question and critically think about environmental science research and its processes, making the link between the environment and their everyday lives and interests, with a special focus on reaching people who would not have engaged with this programme before.

The Mission: To deliver an inspirational and exciting national hands-on environmental science programme that reaches widely, in partnership with eight selected UK Science and Discovery Centres and Museums, sparking conversations about science, sharing the latest evidence and ways to get involved, training Science Centre staff and researchers, and inspiring curiosity and critical thinking.

2. An Overview of the National Operation Earth STEM Programmes

Operation Earth Phase 1

Operation Earth Phase 1 made a step change in the area of public engagement with environmental science by selecting, training and equipping 11 UK Science Centres and museums to deliver an inspirational and exciting national hands-on environmental science programme using the latest NERC research. We stimulated conversations in family groups and with scientists, as well as inspiring children and adults to explore the science so they could together ask questions about the latest evidence and discuss matters and policies that will have a big impact on their lives.

In partnership with NERC, the Natural History Museum, Dynamic Earth and Eden Project, along with a wide range of other experts from across academia and the NERC Research Centres, ASDC created, developed and delivered an inspirational suite of hands-on activities, experiments and demonstrations for families to engage with in Science Centres and Museums, including a bespoke wearable 'Earthy suit'. ASDC also created a new interactive 'Operation Earth' family show and a series of busking activities, a meet the expert format and introductions to environmental scientists, a website, www.operationearth.co.uk, social media channels, project branding and a set of marketing assets along with a bespoke training handbook.

ASDC then selected, trained and equipped eleven Science Centres and Museums in England, Scotland, Wales and Northern Ireland to deliver the full Operation Earth Programme. This included bringing their staff together for a two-day Training Academy to learn all aspects of the programme including running the shows and activities, using and maintaining the equipment, training on the latest environmental science, and a guide to behavioural psychology as it relates to climate conversations. ASDC continued to support the Centres during their delivery with the public, answering questions and introducing them to experts.

ASDC also ran a similar National Training Academy for over 40 environmental researchers which took place at the Natural History Museum, London.

Operation Earth launched in UK Science Centres and Museums on February 10th 2018, and families participated across the summer until the October half-term 2018. Overall, the programme began in January 2017, and completed in January 2019 with an aim to reach 100,000 children and adults in family groups. In total, **201,639 children and adults** participated in the Operation Earth activities and

programmes for families. Of these, **89,742** participated in the Operation Earth family show, and **37,145** met and talked to one or more environmental scientists in 'meet the expert' events. All the resources and training materials were shared on the then newly created website www.operationearth.co.uk and are available free to use by the wider engagement sector.

Throughout Operation Earth, we aimed to create a step-change in the way Science Centres and Museums involve people in the latest science around the environment, ensuring the science was cutting-edge and engaging. We also aimed to bring in the latest from behavioural psychology and building relationships with researchers and helping centres to embrace more challenging topics and global issues with members of the public who may not initially be receptive to this science.

The programme evaluation was undertaken by an independent academic with a specialism in informal Science Learning in environmental science (Prof Justin Dillon), who analysed the responses of 1,130 children and 665 adults (1,795 people in total) who had taken part in The Operation Earth shows and activities.

The Operation Earth Phase 1 key findings are summarised below:

- 83% of children and 77% of adults said they were more interested in environmental science after the Operation Earth show or activities.
- 81% of children and 67% of adults said their understanding of our environment and the current issues faced had increased after watching the Operation Earth family show or taking part in the activities.
- 79% of children and 63% of adults said that their understanding of the range of people who study the environment had increased after watching the Operation Earth family show or taking part in the activities.
- 91% of children and 96% of adults said they thought environmental science is 'very important' after watching the family show or taking part in the activities.
- 87% of children and 92% of adults said that sharing the latest environmental science in this way was 'very important' after watching the family show or taking part in the activities.
- Children were slightly more positive in their answers than adults, this was a small but statistically significant difference.
- Girls (86%) were more likely to say they were more interested in environmental science than boys (80%). This was a small but statistically significant difference. Overall, there was no other difference in response to the questions due to the gender of children.

Centres unanimously reported that the programme had benefited their Centre. It has been a key part of many Centres' programming and had attracted large audiences whenever it was put on. Feedback from Science Centres and Museum staff indicate they and their visitors enjoyed and valued this STEM programme enormously, so much so, that they engaged considerably more families than their collective target of 100,000 people.

Operation Earth Phase 2

As a nation and as a global society we have some major challenges ahead, especially in relation to climate, energy, and the wider environmental issues across our planet. With COP26 on the horizon and the ambitions for the UK to have reached Net Zero by 2050, now more than ever we need our young people to be inspired by environmental science and be keen to consider careers in this exciting sector to pioneer solutions. We also need people of all ages to discuss the issues and new approaches and technologies and help decide together how we make the step changes needed at this time.

Following on from the success of Operation Earth Phase 1, The UK Association for Science and Discovery Centres is delighted to work in partnership again with the Natural Environment Research Council (NERC) to create and deliver Phase 2 of 'Operation Earth'.

Operation Earth Phase 2 put inclusion and diversity at the core of the programme, and in the early stages of the project we looked at how we needed to evolve the programme to get broader, more equitable involvement across communities. ASDC is currently running (and has run) many programmes focussed on EDI (equity, diversity and inclusion), including, Explore Your Universe Phases 3 and 4 since 2016 in partnership with STFC with 23 Science Centres, Science Capital in Practice with 15 UK Science Centres, and The Crunch with Wellcome, as well as now leading the development of an EDI Framework across Europe, with Ecsite. ASDC also created and secured the £30 million funding for the Inspiring Science Fund from BEIS and Wellcome with EDI at its core and works closely with all twelve Inspiring Science Fund recipient centres. ASDC aimed to bring all this learning into this new phase of Operation Earth.

ASDC invited applications from the existing 11 Operation Earth Partners and selected six Science and Discovery Centres to take part in the programme along with a special additional invitation to Techniquest in Cardiff as they were due to host part of the NERC 2020 Showcase. The showcase was cancelled due to Covid-19, and we swapped their involvement over to The National Space Centre.

Glasgow Science Centre were also added at the start of the project as an extra partner as they are hosting part of the engagement activities for COP26, which is now running in November 2021. Thus, in total there were 8 partners who were chosen to run Phase 2 of the programme. Due to the pandemic all the Science Centres were forced to close along with all visitor attractions in the UK on the 23rd March 2020 as the country went into lockdown.

This meant that ASDC and the partners quickly had to adapt to the new restrictions as different parts of the country went in and out of local lockdowns and tiers throughout 2020 and Science Centres only had a small window of time where they were able to open in 2020 with a very reduced capacity, covid restrictions, and a reduced team. Many have not reopened, and will only reopen 14 months later in May 2021.

In response to this ASDC hosted a Partner's meeting in August to discuss with the centres if they would still be able to deliver the Operation Earth programme and offered them the opportunity to re-submit their original applications with the new restrictions and closures in mind. We have been extremely impressed with how the Science Centres have managed to persevere and adapt in these unusual times so they could continue to deliver Operation Earth. Sadly Eden Project had to step out of the partnership due to the deep cuts they were making and the restructure, and feel sure they will deliver the content in various ways into the future. This left us with 7 Science Centres delivering at the end of the programme.

3. The Operation Earth Phase 2 Programme Goals

The key goals for this national programme, in order of importance, were as follows:

1. To reach inclusively across society. Specifically, this programme will focus on equity, diversity and inclusion (EDI) across all areas and approaches, engaging families who did not participate in Operation Earth 1.

2. To inspire children and their extended families who may not ordinarily engage with environmental science, to enjoy, contribute to, question and critically think about environmental science research and its processes, making the link between the environment and their everyday lives and interests.

3. To train and support science engagement professionals embedded in eight (then seven) ASDC member organisations across the UK to engage the public with the latest areas of NERC science so they can deliver in their regions.

4. To increase the public engagement opportunities of NERC environmental researchers enabling the public to meet them in informal settings and ask questions and discuss the research.

5. To bring alive some additional areas of NERC science that have the greatest impact on us all. These were around climate change, and earth observation, including how satellite data is used in climate and environmental research.

6. To inspire children and their families to explore, test, experiment and discuss the amazing range of science, engineering and technology needed to gather evidence to understand our planet's systems and to find innovative solutions to how we might live more sustainably on the planet.

7. To empower those who interact with us to consider our planet, our environment and our climate in a more systems-based manner, and to support them to access relevant information around contemporary environmental science, and for Science Centres to point people where to go for further information.

8. To inspire young people from all backgrounds to consider careers in environmental science, especially in the innovative new tech solutions side of NERC's work.

9. Legacy: Structuring the programme and the training from the start to inspire teams in Science Centres so they will want to continue to engage their visitors, providing a national educational legacy for this programme long into the future.

4. The Key Audiences

The key audiences for this national programme were:

1. Children aged 6-11 to explore how NERC's environmental scientists collect evidence to uncover what is happening on our planet, and how this can be used to inform society to make changes.

2. Parents and the extended families* of these young people so they are equally inspired and can continue to inspire and encourage their children's science learning and career dreams long into the future, seeking out other related activities to involve their children with.

   ** By 'families', we mean families in all the shapes and sizes they come in. Grant-parents, children, carers, step-siblings, mums, dads, aunties, parent's friends, step-mums and dads and all the other combinations of groups that people informally go out with on their weekends and days off.*

3. Science Centre and Museum staff who will ensure these NERC-focussed environmental science family activities, science shows and relationships with environmental scientists continue long into the future.

4. NERC researchers to give them the confidence and motivation to share their excellent research and the latest social science with the public by making it easy, convenient, positive and time-effective for them to do so.

5. Science Centres to showcase their own environmental science actions and to engage political and other local stakeholders so they better understand the issues and the range of world-leading NERC environmental science, and that Science Centres are sharing this with the public. (This was somewhat curtailed as the Science Centres were shut and the politicians were rather busy tacking the pandemic).

5. The Outputs of Operation Earth Phase 2

This project had the following outputs. Please note some additional outputs were added by ASDC since our grant agreement (marked * below). This was to mitigate the major impacts of the Covid-19 pandemic and resultant closure and furlough at the Science Centres and to support engagement with Operation Earth by disadvantaged communities as much as possible across this period.

1. An Invitation to Participate (with specifics as agreed in partnership with NERC at the kick-off meeting), a grant application process, and selection process to select seven Science Centres from Operation Earth Phase 1 to deliver Phase 2. An eight Science Centre was added later, which was Glasgow Science Centre.*

2. A National Training Academy for the 7 Science Centres and Museums across the UK to enable them to run the updated programme (2 staff per Centre attending). This had a focus on working with new audiences and sharing the learning from their current EDI programmes, as well as new content.

3. New content around two areas identified by NERC. These were Earth Observation and Climate Change.

4. New digital content developed and added to enable delivery by the Science Centres even when Science Centres were shut and community groups not convening, due to the Covid-19 Pandemic.*

5. A National Training Academy for 30 NERC-funded researchers to enable them to undertake public engagement in this area and to work with Science Centres during and after the pandemic restrictions lift. In the end we trained 33 NERC-funded researchers*.

6. Specific guidance on community engagement and working with audiences who do not currently engage, including a sharing of best practise between all those in the partnership.

7. Support for every Science Centre during Covid-19 to adapt the family show and activities, content and equipment to be able to pivot to digital across the UK to engage new audiences, with a particular focus on engaging 6-11 year olds and their families.*

8. Some additional funding for low-cost activities for Centres to extend Operation Earth with the latest science and new content areas and deliver during Covid-19, and potentially to use to create STEM boxes, home activities and other new opportunities to deliver for Operation Earth during the pandemic.*

9. To explore ways to develop embedded and long-term relationships between the Science Centres and NERC researchers, for example by bringing the two groups together at coffee events*, making introductions to the researchers we train so in the future when Science Centres are allowed to re-open it will encourage Science Centres to invite local researchers for ‘meet the expert’ sessions.

10. A mechanism for science engagement professionals across the UK to easily share the latest climate resources so they can more easily engage and support children and families investigate climate evidence. This has been created and is called ClimateHub.uk, funded by the Scottish Government.*

11. An update to the Operation Earth website so it contains all the resources that Science Centres needed to run the full updated programme. This included adding a host of new digital resources.*

12. An updated 'Press and Marketing Pack', with updated NERC logos, and agreed logo presentations, sample press releases and approved copy for web, developed in collaboration with the NERC press team, and delivered in a flexible manner for Centres to celebrate NERC research.

13. Training on the 'Advocacy Guide' and updated Resource Pack' to help Science Centres approach MPs, political stakeholders and to inspire Centres to give evidence to select committee inquiries, showcasing the great public engagement work they are doing around NERC environmental science and science learning more widely. Science Centres were trained in how to do this, but the restrictions of the pandemic made it not possible for MPs to visit centres.

14. Information and training for Science Centres around all we know from social science and behavioural psychology of the very best way to engage people with climate science. We also brought in CAST and Climate Outreach to share their resources.

15. A light-touch Evaluation Programme, to assess the overall impact on the children and adults, and the science centre staff and researchers. This was by self-report and delivered by ASDC, severely limited by the pandemic.

16. Legacy, with Science Centres using the equipment and delivering Operation Earth activities into the future, including working with the NERC Public Engagement teams long in the future to share content and invite researchers.

6. The Steering Group

The Steering Group for Operation Earth was responsible for the programme governance and strategic direction. This board met twice at the start of the programme for the kick-off meetings to shape the initial programme direction, and then quarterly across the programme. At least one member of the Board was also present at the Charettes and Training Academies. The board also gave advice and guidance through email discussions in between meetings and via extra zoom calls where required.

Name	Organisation
Hannah King	Natural Environment Research Council
Hannah Lacey	Natural Environment Research Council
Dr Penny Fidler	ASDC, CEO and Programme Director
Cait Campbell	ASDC Project Associate

7. The Project Team

This programme was directed and project managed by the UK Association for Science and Discovery Centres who have considerable experience managing national strategic multi-partner science engagement programmes.

Phase 1 was delivered in collaboration with three expert content partners: Natural History Museum, London; Eden Project, Cornwall; and Dynamic Earth, Edinburgh. In Phase 2 we asked Dynamic Earth, Edinburgh to assist with various content areas in the Training Academies and coffee meetings and to share their experiences of delivering the programme with families.

In the Programme budget at the outset, ASDC had around 100 ASDC staff days at various levels across the 17 months from its start until March 2021, mostly concentrated in the first months. This equates to an average of 1.3 days per week of ASDC staff time including time from the ASDC director, project associate, administrators and other project staff. Unlike the larger Phase 1, we could not have a full-time project manager for this programme and the programme was successfully delivered between the ASDC CEO and ASDC Project Associate.

We note, due to the impacts of Covid-19 and the Pandemic, Science Centres had to close for most of the year of this programme, and Operation Earth had to be completely adapted and re-shaped and renegotiated at several points during the year, as new restrictions, tiers and lockdowns were put in place. This took considerable extra ASDC staff resource and was, in discussion with the Project board, balanced by the reduced planned costs to hold the training academies online rather than the more costly in person Academies, with travel and accommodation paid for staff from the Science Centres. This trade-off enabled the programme to be delivered successfully and on budget.

8. Selecting the partner Science and Discovery Centres

ASDC sent out a carefully planned Invitation to Participate document 18th February 2020, along with an application form to all ASDC members. We sought seven partners for delivery, with Glasgow as the eighth.

ASDC also held a bidder's conference call in in January 2020 where all Science Centres and Museums interested in applying had the opportunity to dial in, hear about the programme from the ASDC CEO, have their questions answered and hear the responses given to others who would be bidding. This open framework has been used in all previous ASDC programmes, to answer questions and give clarity over what Centres need to deliver, schedules, audiences, grants, budgets, and reporting before each Centre applies.

This methodology has been used in most previous ASDC programmes and the Invitation to Participate means there is absolute clarity about what centres need to deliver, schedules, audiences, grants, budgets, and reporting before each Centre applies. Only Science Centres who delivered Operation Earth Phase 1 were eligible to apply.

The Selection Panel

ASDC received applications from members of Operation Earth Phase 1 to take part in Operation Earth Phase 2. The applications were reviewed by the Selection Panel, which met on 30th March 2020 and included staff from ASDC and NERC.

9. The Eight Selected Science Centre Delivery Partners

The following Science Centres were selected to deliver Operation Earth Phase 2:

1. Dynamic Earth
2. Glasgow Science Centre
3. Jodrell Bank Discovery Centre
4. Xplore! Discovery Centre
5. ThinkTank, Birmingham Museums Trust
6. W5, Belfast
7. National Space Centre (replaced Techniquest*)
8. The Eden Project**

(asterisks explained in text following the map)


Operation Earth Phase 2
Partner Science and Discovery Centres
www.sciencecentres.org.uk
Thurso Newton Room
Aberdeen Science Centre
Fort William Newton Room
Dundee Science Centre
Dynamic Earth
Scottish Seabird Centre
Royal Botanic Garden Edinburgh
Glasgow Science Centre
National Museums Scotland
Royal Observatory Edinburgh
Kielder Observatory
Tyne and Wear Museums (Discovery Museum)
Centre for Life
W5
Armagh Planetarium
Lakeland Wildlife Oasis
National Science & Media Museum
National Railway Museum
Eureka! The National Children's Museum
National Coal Mining Museum
Daresbury Laboratory
The Deep
Science and Industry Museum
National Museums Liverpool
MAGNA
Catalyst
Jodrell Bank Discovery Centre
Xplore
Woolsthorpe Manor, National Trust
Centre for Alternative Technology
National Space Centre
Thinktank, Birmingham Science Museum
Cambridge Science Centre
Oxford University Museum of Natural History
Cheltenham Science Group
Science Oxford
Wellcome Genome Campus
Science and Technology Facilities Council (STFC)
Natural Environment Research Council (NERC)
RAL
The Royal Institution
Wellcome Trust
The Royal Astronomical Society
Francis Crick Institute
British Science Association
Institute of Physics
Science Museum
Natural History Museum
Centre of the Cell
Royal Museums Greenwich
Royal Botanic Gardens Kew
King's College London
The Royal Society
Horniman Museum and Gardens
London
Amgueddfa Cymru National Museum Wales
The Living Rainforest
We The Curious
The Look Out Discovery Centre
Techniquest
Winchester Science Centre
The Observatory Science Centre
Eden Project
Explora Science
National Marine Aquarium
Porthcurno Telegraph Museum
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Changes to originally selected Science Centres due to Covid-19

***Tecniquest, Cardiff**

As the nation went into lockdown in March 2020, all UK Science Centres, including Techniquest, closed their doors for the foreseeable future. Some have not yet reopened and hope to do so on May 17 2021. At the start of the lockdown, in spring 2020, Techniquest reviewed all its commitments and decided that they were unable to sign the grant agreement to deliver Operation Earth with their enforced closure due to Covid-19. Techniquest were brought on as a partner specifically because prior to the pandemic, they would have been hosting part of The Cardiff NERC showcase in July 2020. However, it was also becoming clear in March/April 2020 that this would not be going ahead due to Covid.

In discussion with the management board, ASDC then approached the best application we had from the Phase 1 partners who had applied for Phase 2, but that we were not able to fund, and discussed the opportunity with them. This was the National Space Centre. We also held a discussion with the Natural History Museum, who were similarly closed and keen to participate but not in a position to deliver until the impacts of the pandemic became clearer. We therefore selected The National Space Centre as the eighth partner.

****Details for The Eden Project involvement**

The team from the Eden Project had been part of the Project Team for the development of the ideas for Phase 1 of Operation Earth and were extremely keen to take part in Phase 2. They applied, were selected, and were preparing to start the programme working with communities when Covid hit in March 2020. They had been planning to participate in local community festivals which were also all cancelled due to Covid. In addition, Eden had to make substantial redundancies in the summer of 2020, including to the team involved with Operation Earth. After many discussions, in the autumn of 2020, and when the Science Centres were likely to be closed again for the whole winter, Eden sadly had to withdraw their role as a partner. They plan to re-open on 17th May 2021, as soon as restrictions allow.

In the future, Eden plan to continue using the kit, resources and knowledge gained through Operation Earth to highlight both Climate Change and Earth Observation, as laid out below in the note from Eden. They have told us:

"We were looking forward to running Operation Earth, again, given the success of Phase 1 and our involvement in developing the core ideas for that programme. However, the Covid-19 pandemic and the consequent closures and redundancies at Eden sadly made our participation not possible. In the end Eden had to lose 169 of its staff as part of a restructure required to save the business.

When restrictions ease and we can be more hands-on into the future, we will be running lots of climate activities and environmental science activities as a team. I would expect Eden to use the Operation Earth experiments and resources, especially the Earthy costume which we have found to be really engaging with visitors of all ages across the Eden Project, to help bring those complex stories to life. We will also for example be highlighting earth observation as we are close to the new proposed spaceport in Newquay and are aware there are many new digital resources on the Operation Earth website."

10. Training and equipping Glasgow Science Centre

COP 26 was scheduled to be in Glasgow in November 2020. Covid meant this was postponed and it has now been rescheduled for 1-12 November 2021.

Glasgow have always been keen to be part of Operation Earth but were not part of Phase 1 and therefore ineligible to apply for Phase 2. In discussions between ASDC and NERC, and because of COP26, it was thought a very positive step if ASDC and the project could train and equip Glasgow Science Centre to also deliver Operation Earth Phase 2.

In particular, Glasgow Science Centre will be the Green Zone for COP 26 activities taking place for the duration of COP 26, and so Operation Earth ideas and content will be part of their thinking and COP26.

ASDC applied to NERC for the following additional budget to train, equip and support Glasgow Science Centre. ASDC then commissioned the team at Dynamic Earth to undertake some of the training for the Glasgow Science Centre team and ASDC supported throughout to help them purchase all the equipment. The Glasgow Science Centre team also took part in the main Operation Earth Training Academy and other support. Below is our proposal for the additional funds. We note that in the end, there was a small variation in the travel costs and equipment costs which was discussed and agreed with the Management Board and reallocated.

Costs for the addition of Glasgow Science Centre (training and equipment)	
Grant	£4,000
Earthy Suit	paid direct by NERC
Operation Earth Equipment	£3,500
Training of Glasgow staff by Dynamic Earth, Edinburgh Edinburgh staff costs: 2 staff, 2 days = 4 days at £250 Glasgow Science Centre staff costs contribution for training x 4 staff: Glasgow staff, travel costs to Edinburgh **Total:**	 £1000 £1000 £200 **£2,200**
ASDC staff time to organize training for Glasgow team 1 day @400 Management, grant allocation, reporting, evaluation of additional partner, support and assistance with purchase for new kit and equipment lists 4 days @400	£2,000
Total to train Glasgow from the start and support them as an additional partner:	**£11,700**

11. Equipping Xplore In North Wales with a full Operation Earth kit

Techniquest Glyndwr in Wrexham North Wales, now renamed Xplore!, were Operation Earth partners in Phase 1. However, uniquely, because of the large number of people they needed to reach in 8 months in Phase 1, they had put in a joint application with Catalyst Science and Discovery Centre in nearby Widnes. They had, for the whole of Phase 1, shared not only the grant, but also the equipment.

In discussions between ASDC and NERC, it was agreed that if ASDC put in a proposal and costings, and supported Xplore! to purchase the equipment, NERC would fund Xplore! to have a full set of Operation Earth Equipment. The cost was £3,900, for the equipment and included 1-2 days of ASDC time to support the team in North Wales and ensure they knew what to purchase and help them with this process.

The equipment was purchased, and an Earthy suit was also created for the Science Centre. The Earthy suit was commissioned direct by NERC from the ASDC-commissioned costume maker Alison Stevenson, and the cost was separate to that listed above.

Total costs for ASDC to train and equip Glasgow Science Centre and Xplore!

Total to train Glasgow from the start and support them as an additional partner, including a £4000 grant and all the equipment	**£11,700**
Total for Additional Operation Earth Kit cost for Xplore! And support to purchase the kit.	**£3,900**
Grand Total	**£15,600**

12. Impacts of Covid-19 Global Pandemic on UK Science Centres

Temporary closure of Science Centres due to Covid

In March 2020, the global Covid-19 pandemic struck the UK and towards the end of March 2020 all public venues, including the UK's entire lively and successful national network of charitable Science Centres, along with all the UK's Museums were forced to close to contain the Pandemic.

For the charitable Science and Discovery Centres in every city and region of the UK, this meant they had to close their doors to every source of income that has previously kept these Educational Charities operating, including for example their corporate event operations (as events and gatherings were not permitted), schools programmes, families paying an entry fee, cafes, shops and other income streams. These robust and entrepreneurial STEM education charities had their entire incomes cut off overnight.

Many have remained shut ever since, with some opening over the summer holiday period.

A furlough scheme was announced quickly which has been a lifeline to the UK Science and Discovery Sector. However, it has not been sufficient and whilst the Government chose to support museums and the arts with a £1.57 billion Cultural Recovery Fund (adding a further £300 million in 2021) most of the Science Centres were excluded from applying for this fund - unless they happened to have their Science Centre in a heritage building or had a small, accredited collection so could access museums funding. The result of the pandemic and lack of funding was large numbers of skilled and trained Science Centre staff being made redundant in 2020.

The exception to this is the Scottish Government which pioneeringly provided around £2 million of support for the four Scottish Science Centres, which has played a large part in protecting them from staff redundancies until 2021.

98% of Science Centres told us they can't break even operating at the reduced capacity of 30% of visitors, however timed tickets have helped smooth out the visitors across the day which has helped. Some opened across the summer holidays when visitor numbers are at a peak, but for many centres the regional tier system and of restrictions meant they could not open for the October half-term, then the February half-term and easter which was a huge financial blow and impacted what they could deliver for this programme.

Since March 2020, ASDC has undertaken a large amount of advocacy and lobbying to try to change this situation, culminating in a Parliamentary Debate on the subject of Science Centre funding on 24 March 2021.

13. The impact of Covid-19 on The Operation Earth Programme

The impact on Operation Earth Phase 2, has been considerable, especially that most UK Science Centres had to make over half of their Education and outreach teams redundant (50 – 80%) in the summer of 2020. This includes some of the teams that ASDC would have trained to run the workshops and activities of the Operation Earth programme, and some staff that were trained as part of Phase 1.

The closure of the Science Centres meant that they could not deliver what they originally proposed to deliver, as it was all hands-on and face to face in communities and Science Centres. To mitigate, the ASDC team have worked tirelessly all year to replan and reshape all our national STEM programmes. In

particular, for Operation Earth we asked every centre to resubmit proposals of what they could deliver given the pandemic restrictions, retrained centres on digital approaches and worked with teams to help their new programmes. Each centre has recast what they can do, adding digital and blended delivery to their programme whilst their centre is closed.

Pivoting to online and remote delivery

On July 23rd 2020, ASDC hosted a conference call with delivery partners to discuss their plans around adjusting in-person delivery of this project to online and remote 9or blended) engagement methods. This was an opportunity for centres to share their plans and discuss ideas together.

Also in July, ASDC ran an additional (second) Charette to gather and generate more ideas, particularly finding more digital resources on Climate Change and Earth Observation, and to mix these new digital resources with ideas from the first meeting, and put the best onto the Operation Earth website.

In August 2020 ASDC asked for and received re-submissions of the Science Centre's proposals that were needed due to continuing Covid-19 restrictions and centre closures. On 24th September 2020, ASDC hosted a session for the wider ASDC network about evaluation of online engagement and many Operation Earth Delivery Partners participated in this.

ASDC carefully supported all the Science Centres to pivot to digital and remote engagement delivery of Operation Earth activities so that families in disadvantaged areas of the UK could still have access to this content, even through such difficult times. The comments and quotes from families who took part show this was appreciated.

Challenges with timing

The main issue for Science Centres delivering Operation Earth was the timing of the pandemic. They were just submitting their proposals for the March 20th deadline, after months of planning and development by both ASDC and the centres, when the pandemic hit. Due to the grants needing to be given out in the 2019 – 2020 financial year, the judging was done on March 30th with contracts signed and grants award immediately afterwards. By this time the enormity of the pandemic was clear and ASDC, with agreement from NERC, offered every centre the opportunity to reshape and resubmit their proposal once the restrictions and national picture became clearer in the summer. This happened as planned.

This meant that due to the Covid lockdown no centres could work closely with and deliver significant community activity programmes as planned across the may half-term or summer holiday of 2020. By August we had worked with all centres to pivot to digital completely as the schools had been shut and it was clear that community events would not be going ahead until the following year so everything would need to be remote or blended delivery. We then also delayed the full project schedule to fit better with furlough and the pandemic changing the content and timing. For example, the Training Academy took place in September 2020.

Some centres began delivering activities in the October half-term however the majority, due to continued local tier lockdowns and national lockdowns until the end of the year, had to await until February 2021 before they were able to start delivering the majority of their Operation Earth activities.

This has definitely affected the number of activities, families participating and level of co-creation with communities achieved on this project and without Covid closures or furlough we would expect to have reached many more people, and in person, with the Operation Earth content.

What the Future holds

As we work to build our nation's future and grow our innovation economy, inspiring young people with Science is vital. This is particularly important to deliver the Government's ambitious Industrial Strategy, increasing our R&D to 2.4% of GDP. It is also critical in this year of COP26 as we, as a nation, collectively strive to address Climate Change and drive towards Net Zero.

Together, our nation's Science museums and independent, charitable future-focussed Science and Discovery Centres and engage over 25 million people with science every year. Their curriculum-linked STEM workshops support millions of school students with the latest science and invigorate their interest in school science. We have independent academic evidence showing that children from the UK's most disadvantaged communities are equally engaged and interested in science through Science Centre programmes as children from more advantaged backgrounds. We also know from another large-scale academic study, that on all measures (such as interest, enjoyment and desire to study further) for our hands-on physics and engineering programmes, girls are just as inspired and interested as boys.

Before the pandemic Science Centres saw a huge demand from schools and teachers for the innovative and exciting curriculum-linked schools workshops covering KS1 to KS4. The demand was limited by capacity (staff resource) at the science centres. The school workshops in disadvantaged communities, like the community outreach, are part of the science centre's educational charitable mission. Whilst most schools pay much of the cost of these, the remainder is covered by mission-enabling activities such as hosting corporate events, weddings etc (now cancelled) and in part by the large numbers of families who can afford to pay the entry fee visiting at weekends and holidays. This and much other charitable work is specifically what separates Science Centres from other visitor attractions.

Science Centres have a major role to play in supporting the quickest recovery and the nation's future ambitions. 2021 sees COP26 come to the UK, bringing a huge opportunity to celebrate all the green innovation and career potential for young people across the UK. We know that many young people, especially girls, are interested in being part of addressing climate challenges and being part of the green STEM revolution and this is a fabulous opportunity we must not miss.
Science centres are entrepreneurial and earn their own incomes to operate and thrive. During the pandemic they have used all opportunities open to them, including the generous furlough scheme and loans.

Most Science Centre plan to open on May 17th or for the May half-term. For the Science Centres however, there are financial hazards to opening, even when they are allowed. These include:

- How to break even with such restricted numbers to allow for social distancing.
- How to ensure the experience – which is so collaborative and hands-on - can be matched in these Covid times.
- Sustaining the charity when income from Corporate hire and Events is reduced to zero until 2022.

- Teachers being over-stretched and not bringing large school parties in the traditionally very busy June and July end of year school visits.
- Income from families during the summer holidays reduced due to restricted numbers, and having to be shut for the busiest weeks of the year in the May and October half terms and much of the summer holidays.
- There is some indication income to the Café and shop may increase, as it did after the last lockdown, but this depends also on consumer confidence in the economy and job market.

The UK went into a further lockdown in November 2020 and remained mainly that way until May 2021 when Science Centres will be allowed to open again. This is after the March 31 deadline of this programme and Science Centres have told us they would like to deliver hands-on elements of Operation Earth when they re-open, especially with COP26 on the horizon.

14. The Schedule of Operation Earth

This project set out to deliver (and delivered) the following:

Key dates of Operation Earth Phase 2 programme 2020 - 2021	
2020	
January 2020	Project starts. Arranging meetings and project planning and development Contract signature
13th February 2020	Kick off meeting in Bristol
18th February 2020	Invitation to Participate sent to Science and Discovery Centres
5th March 2020	Bidders Conference call
20th March	Proposal Application Deadline
26th March 2020	First Ideas Charette to come up with ideas to add new content particularly on Climate Change and Earth Observation. Held on zoom.
MARCH 2020:	**Covid strikes the UK. All UK Science Centres and Museums had to close on 23 March 2021. Many have had to remain closed until now and will re-open in May 2021. Some opened for 2 months in the summer.**
30th March 2020	Panel meets to judge proposals 30th March Delivery centres announced
31st March 2020	Stage 1 Grant Invoices received from Selected Science Centres to ASDC and Grants for £2000 paid to all centres
Easter holidays 12th April 2020	Science Centres all shut due to Covid-19 lockdown and could not deliver activities as planned Easter Day and Easter holiday
May Half-term	Centres still shut due to Covid-19 and could not deliver activities as planned
22nd July	Second online Ideas Charette to gather and generate more ideas, particularly on digital resources on Climate Change and Earth Observation, and to mix these with ideas from the first meeting
23rd July	ASDC convened a Partners meeting to discuss all the changes to Centre's proposals due to Covid-19 restrictions and to support this transition

Summer Holidays	Many Centres still shut due to Covid-19 and could not deliver activities as planned, or couldn't do it hands-on and had to pivot to digital and blended delivery
11thAugust 2020	Re-Submissions of proposals due to Covid-19 restrictions and centre closures
28 & 29th September 2020	Two-day Training Academy on zoom for Science Centre professionals
September 2020	New Delivery period begins by Science Centres and Museums
October Half-term	Back in lockdown for many tiers
5th Nov 2020	ASDC convened a Content Development meeting for Partners to co-develop blended and remote digital delivery programmes
Early November 2020	Pre-Covid date for COP 26 in Glasgow – this was postponed until November 2021
Christmas holidays	Back in lockdown. Science Centres shut
2021	
20th January 2021	Training Academy for NERC Researchers and Environmental Scientists on zoom over one afternoon
3rd February 2021	Coffee morning for NERC Researchers and Science Centre professionals including presentation from Dynamic Earth on how they work with local scientists
February Half term	Back in lockdown. Science Centres shut
28th February 2021	Last date of planned delivery, but most centres had to extend delivery into March due Covid lockdown and restrictions
3rd March 2021	Second Coffee morning for NERC Researchers and Science Centre professionals to network
15th March 2021	Final Reports from Science Centres to ASDC. This date was extended to 15th March due to most centres still delivering after delays caused by the pandemic.
17th March	All evaluation data submitted by Science Centres and Museums to ASDC
19th March 2021	Final Grant Claims from Centres for £2000
31st March 2021	Completion of the programme. Final report from ASDC to NERC.

15. Grants to Centres and Budget

Each of the 8 Science Centres was given a grant agreement awarding a grant of £4000. This was paid in two instalments, the first on March 31 2020 and the second on March 31 2021. All grants were paid, except the second grant payment to Eden Project as they had to withdraw part way through (in Autumn 2020)

The overall budget of the main programme was £94,993. Adding the training and equipping of Glasgow Science Centre for its COP26 connection, and adding the equipment for Xplore was funded in addition to this, as detailed in this report.

16. The Ideas Charettes

ASDC have run a number of Charettes for other programmes and each has proven to be absolutely key to ensuring inspirational, new and highly engaging content for the project. The Charette was led by the ASDC CEO, Dr Penny Fidler with assistance from the ASDC Project Associate Cait Campbell.

The Charettes drew together people from a variety of academic and research backgrounds to share their considerable knowledge and experience in the subject area of this programme, as well as those with expertise in engaging families with the great stories and science in this area.

At the start of phase 2 of the programme, in March 2020, ASDC ran the first 'Ideas Charettes', which efficiently brought together these people from different backgrounds to share inspirational ideas, and knowledge that could be incorporated into the project. Due to the Covid Pandemic both Charettes were held via zoom.

Participants at the First Operation Earth Charette 26th March 2020

Delegate List		
Dr Penny Fidler	CEO & Project Director	ASDC
Shaaron Leverment	Deputy CEO	ASDC
Cait Campbell	Executive Assistant, Project Associate	ASDC
Rachael Tapping	Communications and Digital Manager	ASDC
Hannah King	Senior Public Engagement Programme Manager	Natural Environment Research Council
Hannah Lacey	Public Engagement Programme Manager	Natural Environment Research Council
Sally Stevens	Marketing & Communications Manager	Institute for Environmental Analytics
Dr James Pope	Climate Scientist	UKCP Science into Services, Met Office
Felicity Liggins	Education Outreach Manager & Acting head of MET Office College	Met Office
Catherine Fitzsimons	NCEO Outreach	National Centre for Earth Observation
Dr Tom August	Computational Ecologist	UK Centre for Ecology & Hydrology
Dr Claire MacIntosh	Research Associate	National Centre for Earth Observation, University of Reading
Jeremy Lelean	Communications Officer	University of Reading
Dr Erinma Ochu	Senior Research Fellow Engaging Environments	Department of Geography and Environmental Science, University of Reading

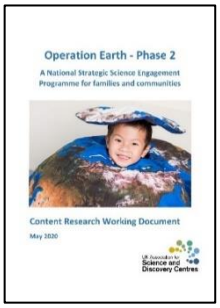
Participants at the Second Ideas Charette 24th July 2020

ASDC held a second Ideas Charette on 24th July 2020 to continue sharing and discussing ideas for new content to add to Operation Earth, specifically focussing on options for digital or remote engagement due to the restrictions faced by Science Centres during the pandemic. We invited everyone who attended the first Charette as well as some additional experts. Please see below the delegate list, the agenda is included in the Appendices.

Delegate List		
Dr Penny Fidler	CEO & Project Director	ASDC
Cait Campbell	Executive Assistant, Project Associate	ASDC
Abi Ashton	Space & Physics Project Manager	ASDC
Hannah King	Senior Public Engagement Programme Manager	Natural Environment Research Council
Hannah Lacey	Public Engagement Programme Manager	Natural Environment Research Council
Sarah Staunton Lamb	Senior Engagement and Learning Manager	Earthwatch Institute
Dr Neil Humpage	Postdoctoral Research Associate Colleague of Catherine Fitzsimons, NCEO Outreach	University of Leicester
Dr James Pope	Climate Scientist	UKCP Science into Services, Met Office
Sally Stevens	Marketing & Communications Manager	Institute for Environmental Analytics
Dr Enda Hayes	Associate Professor	University of the West of England
Dr Claire MacIntosh	Research Associate	National Centre for Earth Observation, University of Reading
Beth Stone	Head of Learning and Audiences	Natural History Museum
Kierann Shah	General Manager	National Space Academy
Dr Tom August	Computational Ecologist	UK Centre for Ecology & Hydrology
Jeremy Lelean	Communications Officer	University of Reading
Dr Erinma Ochu	Senior Research Fellow, Engaging Environments	Department of Geography and Environmental Science, University of Reading
Joyce Ternenge	Projects Officer	Department of Geography and Environmental Science, University of Reading

The Content Research Document

All the ideas, content and activities from the two Charettes and wider research were collated by the Project associate and put into a research report. This is a working document and ASDC is happy to make it available to NERC at any point. It is not in publishable format, rather a collation of all the ideas some of which were developed and used in this programme to write the new online content for Phase 2.



17. The Training Handbook

In phase one of Operation Earth the project team created a vibrant, engaging and informative training handbook. The handbook is 130 pages long, in a bespoke A4 ring binder and has been hugely well received. All the Science Centres in Phase 2 had two copies of this. We did not print extra pages to cover the new content areas of Earth Observation and climate Change, as instead we added everything to the website for centres to access more easily from their home locations during Covid.

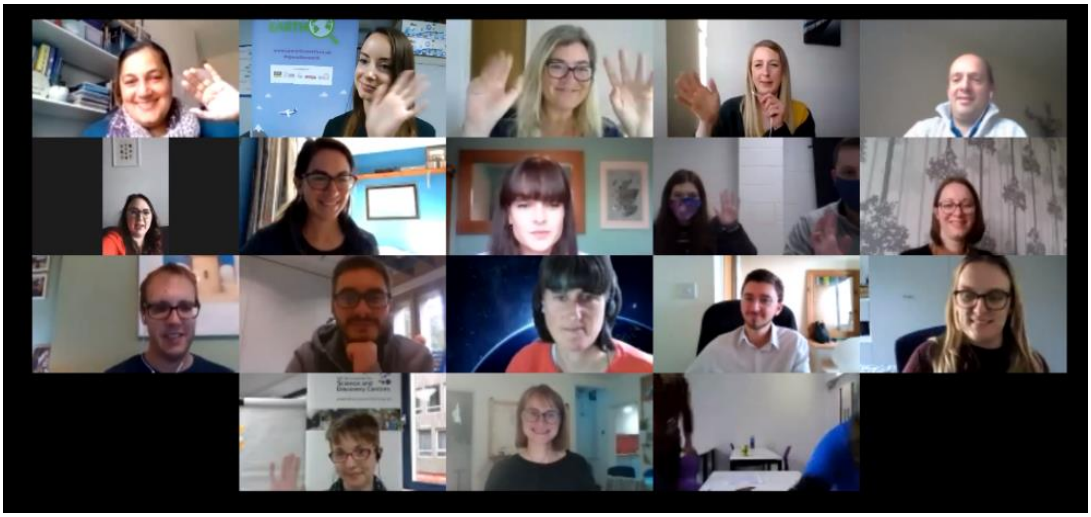
The handbook contained the following information:

- The family show and full script
- Detailed information on all the activities, and equipment
- Experiments to try
- Further ideas and information
- An advocacy guide for Centres looking to engage with policy makers
- Marketing information, branding and PR
- Evaluation guidance
- Health and safety

18. The Training Academy for Science Centre Professionals

The training programme is fundamental to the success of this programme and considerable resource is put in to achieving excellence. Professional staff who are enthused and fully confident to impart the latest knowledge to their colleagues, children and family visitors back in their part of the UK are the key to success in all ASDC programmes.

The Operation Earth two-day National Training Academy took place via zoom on 28th and 29th September with 23 participants, including 2 members of staff from each Science Centre.



The training academy programme is in the appendix and was a mix of external speakers and ASDC-led sessions and group discussions. Science Centre staff were trained in how to use behavioural psychology to shape engagement with environmental science, a refresher on how to use the Operation Earth kit

due to a lot of the staff being new to the project, and introductions to the new online activities and resources that had been added to the Operation Earth website.

Topics covered in the Training Academy included:

- An introduction to Operation Earth Phase 1 and 2
- An introduction to the research and work of NERC and affiliated Research Centres
- Changes to phase 2 and the centre's projects due to Covid-19
- Introduction to Phase 2 and the focusses of Climate Change and Earth Observation
- Using Behavioural Science to shape our engagement with environmental Science
- How to use all the kit, activities, and resources
- Top tips and new ideas an any Covid-19 adaptations
- Introduction to the new digital activities on the website for Climate Change and Earth Observation
- Health and safety throughout the project
- How to ensure scientific accuracy of their new resources
- Climate change and what is the latest evidence on warming
- Guide to advocacy and raising the project profile with local MPs and policy makers
- Environmental citizen science opportunities
- A full review of the project branding, logos, and website
- Resources, images, videos and more
- Evaluation and reporting
- Ideas to engage children from disadvantaged areas and gender equity

ASDC invited expert guest speakers to present over the two day session, as detailed below:

Dr Kris de Meyer,
Centre for Neuroimaging Sciences, King's College London.

Dr Kris de Meyer presented on the first day of the training academy on *Engaging audiences with environmental science: Using the latest evidence from behavioural psychology to understand the way people think.*

Dr Kris De Meyer is a Research Fellow in neuroscience at the Department of Neuroimaging and a Visiting Lecturer at the Department of Geography. He specialises in how people become entrenched in their beliefs, how this leads to polarisation in society, and how to overcome this.

Kris works with environmental scientists, policymakers and conservation NGOs to support them in communicating more constructively about controversial environmental topics, such as climate change.

Dr Roz Pidcock,
Senior Programme Lead at Climate Outreach

Dr Roz Pidcock presented on the second day of the training academy on the research and resources they can provide at Climate Outreach. Climate Outreach is a team of social scientists and communication specialists working to widen and deepen public engagement with climate change. Through their research, practical guides and consultancy services, the charity helps organisations communicate about climate change in ways that resonate with the values of their audiences.

Resources include:

- Britain Talks Climate: a toolkit for engaging the British public on climate change
- Theory of Change: creating a social mandate for climate action
- Communicating Climate Change during rhe COIVD-19 Crisis
- Climate visuals: Seven principals for visual climate change communication

These have all been made available on the Operation Earth website [here]

Dr James Pope, Researcher at the MET Office

Dr James Pope has been a climate modeller and climate scientist since 2009; with a varied career from paleoclimate, polar climate and UK climate; principally through the design, running and analysis of climate model simulations. Since July 2019, he has been a member of the UK Climate Projections (UKCP) team at the Met Office. James was also the chair of the Operation Earth Phase 1 management board.

James was a guest speaker on the second day to present on *Climate Change: How do we know what we know? What is the latest evidence on warming and where does it come from?*

19. The Training Academy for Scientists and Researchers

In addition to training Science Centre and Museum staff on the Operation Earth programme, ASDC ran a separate Training Academy for scientists and researchers affiliated with NERC who wanted to get involved in Operation Earth and engaging the public with their research.

Fifty people representing thirty-six institutions took part in the Operation Earth Scientist Training Academy, which was a one-day event held on zoom Wednesday 20th January 2021.

We were joined by expert guest speakers Dr Kris de Meyer, who presented his Masterclass on Engaging audiences with environmental science: Using the latest evidence from behavioural psychology to understand the way people think.

We were also joined by

- Dr Roz Pidcock who presented the research and toolkits available from Climate Outreach.
- Laura Gordon from Dynamic Earth introduced everyone to the Operation Earth kit and resources
- Candice Snelling and Sarah Tranter from NERC who presented NERC's policies on Sustainability in Public Engagement,
- Dr Jamie Gallagher a digital trainer and consultant who did a mini workshop on 'Effectively engaging people with your research using digital in these Covid times'.
- The full programme is available in the Appendices.

Overall the Training Academy was a great success and we received some wonderful feedback from attendees, some of which is included below:

Feedback from Environmental Science Researchers on the Training Academy

- *"I thoroughly enjoyed being part of the event. So many interesting ideas for future efforts of outreach and public engagement. At the end of the afternoon, I felt inspired and motivated to put even more effort in sharing our research, and environmental science in general, with the public."*

- *"I am often thinking about how I can communicate my research to a wider audience, and this training has provided some useful insights into how I can incorporate more of a public engagement angle into my work."*

- *"The Training Academy has given me far more ideas and allowed me to understand how to engineer my engagement to more effectively enthuse a variety of audiences."*

- *"There were two parts I found very interesting and inspiring:*
  - behavioural science, as it provided interesting insight and good practical ideas on how to change our approach to public engagement, in order to make it much more effective.
  - use of digital resources, as there were so many tips to improve the quality of meetings and events online. They are often quite hard to organise, and even more to keep interesting and engaging when talking about complex subjects. The tools mentioned in the talk are going to massively benefit our public engagement using digital media, but they will also be helpful during meetings with collaborators."

20. Virtual Coffee Morning Networking Event

We asked the researchers if they would be interested in building relationships with the Science Centre teams and they all said yes so ASDC organised two informal coffee morning style networking sessions on zoom where we invited all the researchers that attended the training academy and all the science centre staff who are delivering Operation Earth to attend.

At the first one, chaired by ASDC's Cait Campbell, Laura Gordon, science communicator from Dynamic Earth did a short presentation on how her team run 'Meet the Expert' sessions and utilise the Operation Earth kit. We then put everyone into small break out rooms so that they could meet, talk and ask questions.

In these sessions we provided an opportunity for researchers to ask what it is like to work with communities to co-create materials or to bring research and expertise to engage the public at a science centre.

The first session was attended by 12 people from a mix of Science Centres and universities and research facilities.

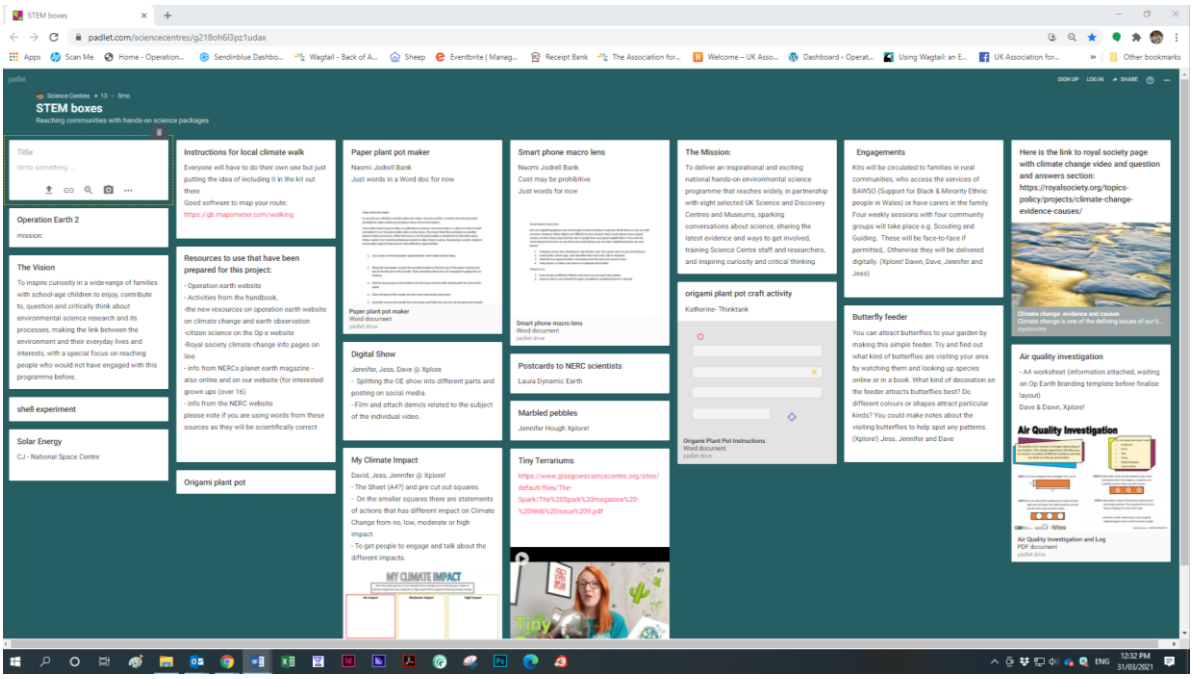
After the first session everyone agreed they would like the opportunity to get together again so we held a second session which was attended by 10 people. The attendees said they were grateful for this networking opportunity and some have gone on to work with their local Science Centre. For example, Gah-Kai Leung from the Department of Politics & International Studies, University of Warwick, who took part in Xplore!'s 'Meet an Expert' virtual sessions with their community partner along with three other scientists.

21. Partner Meeting and Proposal Re-submissions

The UK went into a national lockdown on 23rd March 2020 which meant that all public spaces including Science Centres were instructed to close until further notice. This of course had a large impact on the project as centres would not be able to deliver the activities they proposed in their applications. On 23rd July 2020, we invited Operation Earth partners to a meeting to discuss how they would continue to deliver Operation Earth under the new Covid restrictions and we some of the centres remaining closed. The meeting was an opportunity for the centres to get together and share ideas of how they would adapt their proposals.

The teams came up with some great ideas of ways they could adapt their delivery of the project such as digital after school clubs, radio shows, virtual 'Meet the Expert' sessions, and magazines and STEM boxes being sent to their community groups. We were also joined by Hannah Lacey from NERC for the last 20 minutes to answer any questions from the centres and to confirm how much flex there was on delivery and how many people they would reach. During this meeting we set up a padlet for the centres to share their delivery ideas and resources. The centres confirmed that they found the meeting really useful in particular sharing how each other has adapted their delivery for example after hearing about the Dynamic Earth Earthy Boxes nearly all the centres went away and designed their own Operation Earth boxes or activity packs to share with their community groups. After this meeting we asked the

partners to re-submit their proposals on 11th August and then held a review panel with members of NERC to approve these changes to the original applications. Link to padlet: https://padlet.com/sciencecentres/g218oh6l3pz1udax



22. Operation Earth Website and Online Activities

The ASDC Project team chose the best activities from the Content Research Document and added activity pages to the Resources section of the Operation Earth website. The activities were grouped into two categories: Climate Change and Earth Observation and Satellite Activities to stick to the focus of Phase two chosen themes.

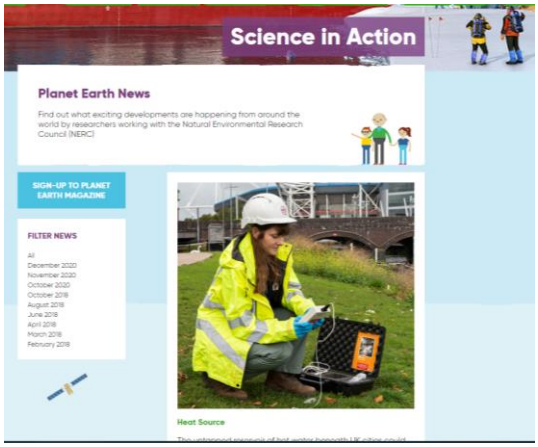
Climate Change Activities and Resources online

The additional Climate Change activities and resources

Climate Spirals and Climate Stripes, by Ed Hawkins

- The Climate Walk, created by Dave Kell and developed with Dr Penny Fidler
- Historical Weather Data
- Cookbook for Climate Action
- Wasplove
- Cricket Tales
- IMPREX
- Impacts of Covid-19
- DRY: the diary of a water superhero
- The Royal Society Climate Change pages
- Climate Outreach resources

Earth Observation Activities



The additional Earth Observation and Satellite activities and resources that we added to the Operation Earth website were:

- EUMETSAT's Learning Zone
- Local Satellite Maps
- Infrared Camera
- Minecraft

We also updated the Science in Action page of the website which links to Planet Earth News and the NERC Planet Earth Magazine.

23. Evaluation of Operation Earth Phase 2

Methodology

ASDC created the evaluation methodology, tools and online mechanisms to allow the multicentre evaluation of Operation Earth Phase 2. Three separate evaluation questionnaires were created by ASDC and can be found in the Appendices. These are mainly qualitative and each was discussed with the Science Centres to consider their approach and then sent to the Science Centres for them to evaluate the impact of Operation Earth Phase 2 within the following groups:

1. Their staff
2. Their community partners
3. Their Participants (families and children)

The evaluation was run by ASDC and looked for:

- Delivery against the vision, goals and key audiences
- Increased curiosity and enthusiasm for learning more about environmental science
- A desire to know more about climate and other areas of environmental science
- Attitudes to environmental science
- Awareness and knowledge of the key content areas
- Who they had as their participants
- How they worked or would work with researchers in the future.

This has been a light touch evaluation not on the budgetary scale of Operation Earth Phase 1. Due to Covid and the subsequent changes in all the programmes and what was possible, all the centres returned rather differing formats. The ASDC team analysed the Science Centre final reports, metrics and quantitative and qualitative evaluation data, and compiled this evaluation report of Operation Earth Phase 2.

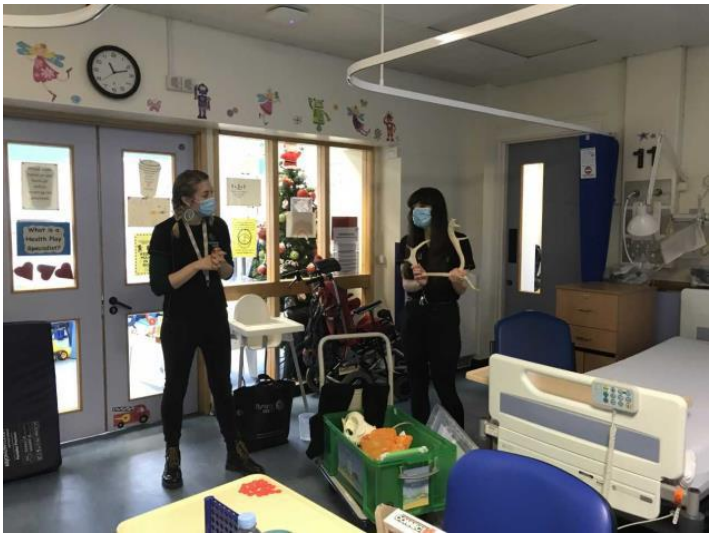
Please see the evaluation report for more specific details

24. How many people took part and what did they do?

This project aimed for depth and community engagement and participation rather than numbers.

The evaluation showed there were 5,239 participants in specific Operation Earth programmes, activities and interactions through the Science Centres programmes. The interactions are all very different making it hard to summarise approaches and collate numbers, so we have detailed these activities in the following three tables below.

Science Centre Name	Number of activities	Number people engaged directly	Notes
Dynamic Earth	5	36	Young carers
Jodrell Bank Discovery Centre	15	881	Virtual workshops and school take-home activities
National Space Centre	3 of 6	48	Newly created Operation Earth STEM Activity packs
Thinktank	38	973	Kitchen science video, smile stones, earthy boxes, NERC researcher takeovers, craft bags
Xplore!	16	457	4 x virtual sessions, family show, activity packs
Glasgow Science Centre	15	2,624	Through Operation Earth activities in the Spark magazine and distribution of Terrarium kits
W5	6	220	100 physical resource packs used and 27 digital packs
Total:	**95**	**5,239**	



25. Digital Engagement Metrics

Overall, the evaluation showed there were 85,959 reported online digital engagement of various types. They are all also quite different in approach and scale and so are separated out here and detailed in the Science Centre final reports.

Science Centre	Reported project digital engagement	Notes
Dynamic Earth	1,390	Total number of time the activities were downloaded from the website.
Jodrell Bank Discovery Centre	See previous table	The Operation Earth engagement was via live stream into schools in disadvantaged areas and is reported in the previous table.
National Space Centre	9,500	This is largely from video views across social media
Thinktank	74,393	This is predominantly from the Bioblitz event on the following hashtag #BigBrumBioBlitz
Xplore!	100	Digital release of family show
Glasgow Science Centre	See previous table	They didn't report this type of engagement
W5	576	Engagement with the activities on their webpage and activity downloads
Total:	**85,959**	

26. Social media engagement and overall reach

As the Covid pandemic prevented in person and hands-on engagement, a key part of this programme became digital. Science Centres also asked by ASDC to separate out their social media reach and share this as part of their reporting. The following was recorded for interactions and reach through Facebook, Twitter and Instagram and YouTube views. Many used the #OperationEarth hashtag.

Science Centre Partner	Social media interactions and views, including Facebook, Twitter and Instagram and YouTube views
Dynamic Earth	5,219
Jodrell Bank Discovery Centre	5,152
National Space Centre	9,550 views and **126,500** total reach via all social media channels
Thinktank	4,534
Xplore!	9,096
Glasgow Science Centre	Did not receive social media numbers
W5	27,482
Total:	**61,033 (+ if 126,500 = 187,533 if we include all the social media reach above)**

27. What did the children say? Key findings

Evaluation was also undertaken on a small subgroup of children who took part in Operation Earth Phase 2. Quotes were recorded from children, and eight children answered the following questions: ages 7-10, with one 12-year-old.

Quotes from Children

- *It was fun*
- *"More please! We learned about our environment and we want to learn more about our environment. We enjoyed watching the practical experiment we would love to do our own experiments!" - Amaan & Imran Miah (twins age 10) and Zahraa Miah (age 7)*
- *"It's lovely"*
- *"I felt excited and I learnt how much water there I in the world"*
- *"I enjoyed the session and learnt new science facts too" - Kishi age 8*
- *"I liked looking at different things on the computer to find out about the polar regions" – age 7*
- *"It was fun for me and glad to learn from it – Kiiti age 7*
- *"I really liked it and all the fun things we did" - Kiite age 6*
- *The sessions have been excellent T has thoroughly enjoyed them all! -H's enjoyed the sessions. Thank you very much.*

Quotes from Young Carer's in Edinburgh:

- *We really enjoyed these sessions. Thank you so much.*
- *The box is absolutely amazing!!!!!!*
- *Thanks so much*
- *Thank you so much for Cam's Earthy box! He is made up! It's like Christmas again 😊 it's lovely to see him away from screens*
- *The STEM box is fabulous! We have been building Lego all day. Had great fun*
- *Kayden liked everything and especially loved the Lego, toy building and magnifying glass. He enjoyed playing the card game with me and thanks as he liked everything*
- *Lily loved her wee box - it's amazing actually! We got some lovely photos!*
- *The boys loved it*

Following the activity, how do you feel about Climate change, and the issues we face?

- 75% said more interested and 25% felt the same interest / already interested
- 75% said they were more interested in science in general and 25% felt the same interest following the Operation Earth activity (no one said less interested).
- 50% said they were more interested in environmental science following their Operation Earth involvement and 50% the same (no one said less interested).

28. What did the parent say?

"*We have really enjoyed the sessions. I remember visiting the Space Centre as a child and always bring this up with Emily. It truly inspired me and so when we heard of these activities it was a must that we signed up. Emily has loved the sessions and is always ready for the online sessions each week. She is learning new things each week in a fun way and even corrects me if I leave a tap on in the house or leave plugs switched on! I think it is great and I hope it continues*." - **Monica (parent) and Emily (8) National Space Centre community group**

"*I often listen in to the Tuesday sessions, I think the staff do a fab job of being informative and friendly on what can be difficult topics to cover, I find myself learning new things too as questions are in simple form for me to understand, really good sessions*" – **Fayza (parent) National Space Centre community group**

"The sessions prove that learning about science can be fun if done in the right way, the topics can be hard to follow but you really make it understandable and engaging with the activities and experiments" – **Hassnain (12), National Space Centre community group**

29. Community Partner Evaluation and Quotes

The 7 centres worked with 28 different community partners most of which they hadn't already worked with previously.

1. BuzzTeens - Disability Positive, Cheshire
2. Ethnic Minorities and Youth Support Team Wales
3. WCD Young Carers, Across Wrexham, Conwy and Denbighshire
4. Together NI, Northern Ireland
5. Ligoniel Improvement Association, Northern Ireland
6. Edinburgh Young Carers, Edinburgh
7. Marlfields Primary Academy, Congleton
8. Ash Grove Primary Academy, Macclesfield
9. St Alban's Catholic Primary School, Macclesfield
10. Sense, Birmingham
11. Athac, Birmingham
12. Refugee Action, Birmingham
13. Spurgeons Children's Charity and Home Group, Birmingham
14. Leicester Library Services
15. Make Do and Grow, Govan
16. The Pyramid at Anderston
17. Govanhill Housing Association, Govanhill
18. NG Homes, Possilpark/ Ruchill
19. Ardenglen Housing Association, Castlemilk
20. Finn's Place, Langside
21. Govan Stones, Govan
22. The Concrete Gardens, Possilpark
23. Indigo Childcare, Castlemilk
24. Jeely Piece Club, Castlemilk
25. Miller Primary School, Castlemilk
26. The Daisy Project, Castlemilk
27. Young Peoples Futures, Possilpark
28. Southside Housing Association, Cardonald

Quotes from Community Partners about participants in Operation Earth

ASDC received a host of lovely quotes and comments from Community Partners working with the Science Centres, all of which were very positive and in the evaluation report we have selected 10 representative quotes and comments to give flavour. Here are just a few.

- *I felt this opportunity was a great initiative on many levels. I felt it was an opportunity to deepen the understanding/awareness of/or introduce children and young people to Science. It was a warm and well facilitated session that became fun and exciting to be a part of for participants. I think taking part in actual science experiments increased interest in the topic and I know will have inspired some to learn more because of this. I think having a physical pack for children and young people to engage with encouraged curiosity and, in the digital age of Covid-19, led to a bigger online zoom turn out compared to other all wales online opportunities. There has been interest from Children and Young People and their families to do more and I know there will be take up from the initial positive feedback. I'm really happy the session expanded learning and knowledge about the environment and critical consciousness in Children and Young People to think about our consequences we have as individuals and a species*. - **Ethnic Minorities and Youth Support Team Wales**

- *By providing access to STEM care packages during the pandemic, Dynamic Earth have given young carers and young adult carers across the City, access to resources, books, craft materials and games, which are inspiring a curiosity and awareness of STEM and the natural world. Moreover, these care packages are also bringing families together through learning and play at this difficult time, as well as providing young carers with something exciting and fun, just for them, in what has been very isolating times of the pandemic for children and young people with caring roles.* – **Edinburgh Young Carers**

- *All of the children have developed a sound understanding of climate change and the impact on the environment. It has made some of the children go away and do their own research to bring in to share with the children in class. Other children commented on what we could do to protect the environment and the children already using their reusable sandwich wraps. All of the children were really inspired by the resources that were sent home and are now keen to try more things to protect the environment.* – **Teacher, Marfields Primary Academy**, The children are 9, 10 and 11 years old (Years 5 and 6) in the town of Congleton

30. Quotes from Science Centre Staff

"The resources and experience we have gained will be invaluable for us going forward. The vision and mission of Operation Earth is so closely aligned with our own as a centre that many of the resources are a perfect fit for lots of activities we have planned. We hope to celebrate COP26 being in Scotland so all the climate themed resources will be fantastic for any events we run surrounding the conference. The relationship that we have built with our community partner will also continue into the future with more work on Operation Earth and also other projects."- **Laura Gordon, Science Communicator, Dynamic Earth**

"*Using Operation Earth resources and expertise has enabled GSC to connect with existing and new community groups and their participants; to build long-term relations with NERC Scientists and to continue to engage with families despite lockdown measures. We look forward to continuing to use the*

resources as part of our in-house offer; our external CLD engagement; as well as part of the COP26 green zone programme (public engagement).” **Dr Robin Hoyle, Science Director, Glasgow Science Centre**

“*Operation Earth 2 has enabled Xplore! Science Discovery Centre to establish relationships with community partners in our region. Our staff have fully engaged with the topics for phase two and it has been wonderful to turn these into virtual live-stream sessions for families with accompanying resource packs. It has been brilliant to still be able to deliver environmental science related activities and to have supported families who have not engaged with the programme before, especially at a time when opportunities have been especially hard to come by for those living in the most deprived areas of Wales*.” - **Projects Officer, Xplore! Science and Discovery Centre**

31. Quotes from Scientists and Academics

“*The Operation Earth sessions run by Xplore! demonstrated a real success of translating the energy and accessibility of science outreach to the medium of video calls. I enjoyed contributing my research within the themes of the sessions and trying to get the children to draw links between the activities they had done and the work I do. It felt from the questions posed that the children had engaged and thought about both the activities and my contribution, which made the experience as a whole feel like it may have been useful to them. I would happily interact in a format like this again*.”, **Dr Tomás Sherwen, Research Scientist, National Centre for Atmospheric Science.**

“*I really enjoyed taking part, the group were a real bunch of characters. Interacting with the young people was brilliant and fun; they really made me laugh when they edited by powerpoint slides and some of those questions! They seemed genuinely interested in my trip to Chernobyl and the Predatory Bird Monitoring Scheme. It would have been great to have more time to ask the children to tell us what they like about the environment/science (taking turns*).”, **Jacky Chaplow, Informatics Liaison, UK Centre for Ecology and Hydrology.**

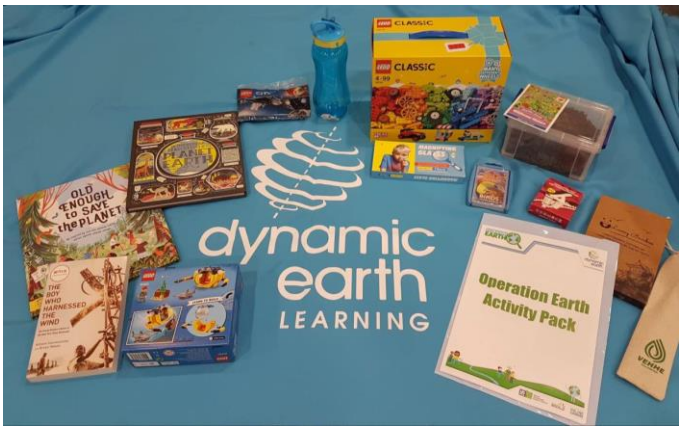
32. Quotes from Science Centre’s Teacher Partners

“*The workshops enthused the children about Science and the Earth around them. Naomi did a brilliant job in including the children both at home and at school, which is a difficult task. The mix of presenting and experiments worked well to keep the children engaged and covered a wide range of learning*” **- Mrs Pearce, teacher, Jodrell Bank Digital classroom session**

“*Overall, the children and staff enjoyed the workshops and the activities involved. They provoked lots of follow up questions and one boy even brought in some of his own liquids from home to test (acid/alkaline). Online definitely worked better with a smaller group*.” T**eacher, Jodrell Bank Digital classroom session**

33. Reports from Science Centres and Museums

Dynamic Earth



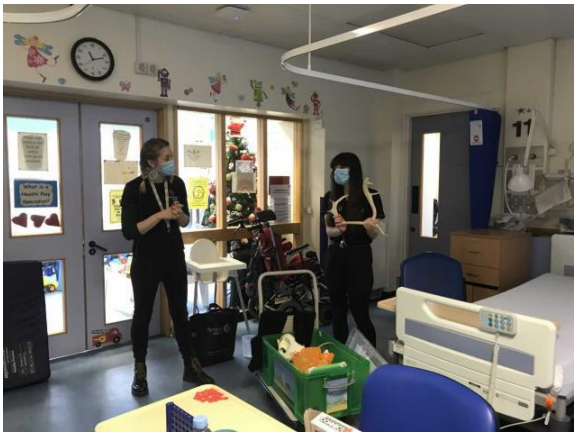
Dynamic Earth worked with local community group, Edinburgh Young Carers to create and deliver STEM care packages for 30 families with young carers who are affected by parental substance abuse. Included in the boxes were a range of STEM activities, games and books to bring families together around the themes of environmental science, inspiring curiosity in the natural world and building confidence with STEM subjects. In many cases, the families fall within the lowest 40% IMD and would have been unlikely to have engaged with the previous phase of the project. We chose to create physical care packages as opposed to online engagement, to take into consideration digital poverty and the lack of guarantees that families would be able to access Wi-Fi and electronic devices.

The activity pack consisted of different Operation Earth activities to do at home, including making paper plant pots, the air quality monitoring craft, and Earth observation satellite before and after images and Lego activity. Each of the activities came with an instruction card and all the materials needed to complete the activity such as seeds, compost, magnifying glasses and even mini microscopes. Each activity was also connected to 'Old Enough to Save the Planet', a book telling the stories of many different environmental campaigns carried out by young people across the world, providing inspiration of positive actions that can be taken to protect the environment. Games such as Lego model building, and wildlife Top Trumps were also included in an aim to get the whole family involved in environmental topics in as informal and fun a setting as possible.

The boxes were delivered to families with young carers of a range of different ages. We, therefore, modified the box contents to suit the age of the young person receiving the package. The staff at EYC told us that the older young people (13-16) were very concerned with sustainability, so their boxes contained items aimed to cut down on the use of single-use plastics such as reusable water bottles and bamboo toothbrushes. They also received an eco-brick activity that makes use of non-recyclable household plastic waste, preventing it from reaching landfill.

Each family also had the opportunity to engage with NERC research and researchers. The boxes contained a set of profiles of NERC scientists working in a range of different jobs. These provided a range of different role models in environmental science to inspire the young people with what a career in environmental science could be like and what environmental scientists themselves are like too. It

allowed participants to think critically about the process of environmental science research itself too. Once they had learned about the scientists' interests, families were invited to open a dialogue with them. We included a stamped addressed postcard, on which families could write questions to any of the scientists profiled and the scientists will answer them. Once we have enough questions returned, we plan to issue a newsletter to all the families involved featuring all the questions and answers.



The project will leave a strong legacy at Dynamic Earth and with EYC. We hope to be able to have the young carers and their families who received the boxes to come to the centre on supported visits to expand on the science and stories from the care packages and to reinforce that environmental science can be amazing and fun and something they can be involved in. The themes of Operation Earth are also a perfect fit with COP26. We hope to celebrate it happening right here in Scotland with extensive engagement with the public and community groups with activities and meet the scientist events. Our work with Edinburgh Young Carers has reinforced our relationship with them 3 and we hope to work with them further not just on this project but on other STEM engagement activities in the future.

Glasgow Science Centre

From the day Glasgow Science Centre (GSC) closed its doors in March 2020 due to the pandemic, we continued to engage with existing audiences as well as new audiences though innovative approaches to STEM programming. We have built on these successful engagement methods to bring the Operation Earth programme as well as NERC researchers and their work to communities in areas of deprivation. We delivered Operation Earth from October 2020 to February 2021, reaching families regardless of lockdown measures. We estimate the total number of participants to be a minimum of 3,867 – if counting extended families reading the magazine or accessing video content - around 15,000 people have benefitted.

We have reached families through:
- A special edition of the '**Spark' family magazine** with a NERC scientist profile, hands-on activities as well as themed puzzles and games based on Operation Earth content and themes. The magazine was distributed in October 2020 through 14 Glasgow community groups and 5 Scottish local authorities to families in areas of high deprivation. In total, 2,524 issues of the 'Spark' were distributed to families at a time that coincided with the October half term holidays. Anecdotal feedback shows that the magazine was very well received with evidence of families being able to do the hands-on activities together.

- **Terrarium** kits distributed through one of the community groups that received the magazine. The terrarium kits provided the resources necessary to participate in the 'Tiny Terrariums' featured in the special edition (Issue 9) of the 'Spark'. 100 terrariums were distributed to Make Do and Grow in Govan, Glasgow. Make Do and Grow are a not-for-profit social enterprise in Glasgow, focused on supporting

growing families with children aged 3-12, developing creativity and encouraging re-use and recycle. All the families live in a high areas of deprivation.

- A themed 'A Spark of Science' **radio slot** on community radio, a short 2 minute science sound bite to spark imagination and curiosity. Slots included 'ocean acidification', 'biodiversity' or 'food waste' aired on Sunny Govan (SunnyG) radio and Paisley FM. SunnyG and Paisley FM are community based radio stations in areas of SIMD 10%.

- NERC researchers' showcase through online 'Meet the Expert' videos as part of our **Curious About: Our Planet festival** that took place virtually from the 18th February to 20th February. We liaised with NERC scientists and curated content which included 7 videos/content from the British Antarctic Survey; videos and resources related to the FIT count (flower-insect timed count) from the Centre for Ecology and Hydrology; an animation and an interview about the BiB Breathes project researching the effect of air pollution on children in Bradford. Altogether, NERC scientists' content received 1,430 views from 8th February when we went live to 21st February after the live content1. Some of the sessions, for example the Arctic and Antarctic sessions, were singled out as best sessions of the festival by participants.

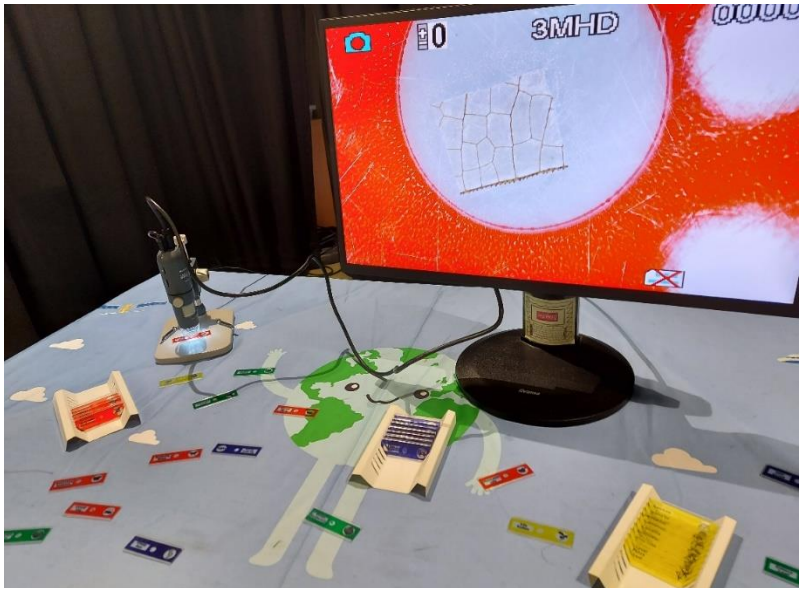
We have built long lasting relationships with 19 community groups and with NERC scientists. We have increased awareness of climate science among families. Families said they enjoyed the activities and as a result felt positively encouraged to take action to halt climate change. In terms of legacy, we will continue to work with existing community groups and use Operation Earth resources to engage with new families as part of our in house offer (including the workshops and show when GSC re-opens to the public), in our CLD external engagements as well as part of the COP26 green zone programme (the public engagement area of COP26). We will continue liaising with NERC scientists inviting them to take part public engagement events either in house or virtually.

Jodrell Bank Discovery Centre

Jodrell Bank Discovery Centre's (JBDC) project was to deliver after school science clubs to local primary school children in socially deprived areas. We originally planned to deliver these in person but after the first lockdown of spring 2020 the plan was changed to deliver the science clubs remotely, through online platforms such as Zoom and Microsoft Teams. The schools who took part were originally meant to visit JBDC on two occasions with their families in addition to the after-school club sessions, however

due to Covid restrictions this was not possible. Instead, we organised some additional activities for the children to take home and enjoy with their families.

The schools who took part were selected by first identifying all the schools within a ten-mile radius of Jodrell Bank which were located in the lowest 40% of areas using the indices of multiple deprivation (IMD). There were no schools in the lowest two deciles but there were nine schools identified in the third and fourth deciles. We then looked at whether the schools had visited Jodrell Bank on school trips in the last 5 years and ranked those who had not visited as higher priority than those who had visited. We used IMD rank, distance from Jodrell Bank and date of last visit as tie breakers where necessary.



Activity looking at microscope slides and guessing what you were looking at to show how things look different in the microscopic world

The schools were then contacted and invited to take part. We had positive responses from the following schools (these were third, sixth and seventh as ranked using the factors above):

- Marlfields Primary Academy, Congleton
- Ash Grove Primary Academy, Macclesfield
- St Alban's Catholic Primary School, Macclesfield

In order to operate in a Covid-secure manner we decided to run the set of four workshop sessions over a single week for each participating school. This limited the amount of back and forth to schools to deliver equipment, also allowing equipment to be quarantined before use. Equipment was thoroughly cleaned after collection from one school before being delivered to the next school the following week. All workshops took place in January and February 2021.

Due to the national lockdown which was announced at the beginning of January 2021 the sessions had to be changed from after school sessions for pupils to attend voluntarily, to sessions delivered in school time to key worker and other vulnerable children who were still attending school. One of the schools who took part also allowed children who were learning from home to participate. In all cases the children who took part were in years 5 and 6 (9–11-year-olds). In total 76 children took part in the sessions in school with an additional 27 viewing the sessions from home.

The kit which workshop participants took home to their families

The feedback received from the children and teachers involved in the project was very positive. Children reported that they enjoyed

the activities and learned new things through taking part. For JBDC the learning was concentrated in the area of digital delivery, as we had very limited experience of this prior to taking part in this project.

Participation in this project has helped to develop confidence of JBDC staff in delivering workshops to schools via online platforms. We also have a new set of workshops which we can continue to deliver in the future, addressing a subject area which our schools' program did not cover before. With COP26 on the horizon we will consider how we can make this available for schools and other groups (such as uniformed groups and home educators) to book.

National Space Centre

Presenter Claire handing over packs to participants from one of our target areas local library in Leicester.

The National Space Centre has supported the delivery of Operation Earth Phase 2 by providing its local community with the opportunity to engage with its local Science Centre and undergo new learning experiences via STEM, Environmental and Climate Science.

Through collaboration with our Local Authorities and their Neighbourhood Services Library Team, a strategic relationship led to the recruitment of families with school aged children aged 7-11 to voluntarily take part in our Operation Earth remote activities.

Due to Covid-19 restrictions, face to face recruitment was not possible nor was recruiting directly through the Library Services database due to GDPR. Nonetheless, recruitment took place via Primary schools acting as a gateway to families, this also allowed the Library Services Team to maintain relationships with schools during their restricted engagement caused by the pandemic. Our target children were those who; a) have an interest in STEM, b) receive FSM and c) would benefit from extra-curricular activity for social or academic purposes. School Literacy and Science leads were provided with the necessary information, including an invitation, for those most applicable, this would be passed on via the school lead to the child and parent for permission to engage; liaison from then on would be direct with ourselves and the families.

A total of four schools were identified from four different areas within Leicester, each being allocated 12 invitations for their students. The targeted schools each reside in an area of a low socio-economic demographic, providing a more targeted and meaningful engagement. Upon receiving the invitation, parents would be asked to confirm participation via email before being sent a link to fill out a short questionnaire that ensured digital accessibility and attendance to the online sessions that accompanied the resource packs that family received. A total of 48 out of 50 resource packs were distributed amongst 32 families, some families received multiple for siblings on request, fortunately we were able to provide this as not all schools had occupied their invitation allocation.

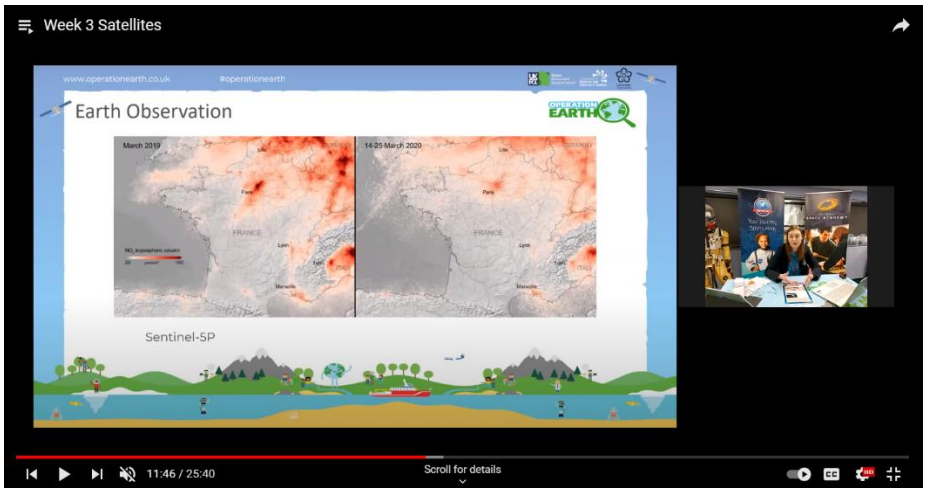
Science Presenter Claire demonstrating the impact of Carbon Dioxide when infused with water.

In addition to the areas identified, another strategic element was to support libraries within the same vicinity of the school and residing area and to promote these by using them as collection hubs for the resource packs. Due to the pandemic causing school closures, we wanted to provide a social element to the project and therefore, with social distancing measures, distribute the packs face-to-face. Over four days during the February half term, we visited each library and allocated those families from that area a collection time to which they would collect their packs and meet the Science Presenters who would be leading on Operation Earth. This helped to breakdown any barriers, ease anxieties, provide additional detail and develop a relationship by introducing ourselves prior to the online sessions. Due to the library being within the vicinity of the school, families were able to collect their packs with ease, a total of 27 families had taken up this option with the additional five requiring an alternative arrangement such as doorstep drop-off to their home address.

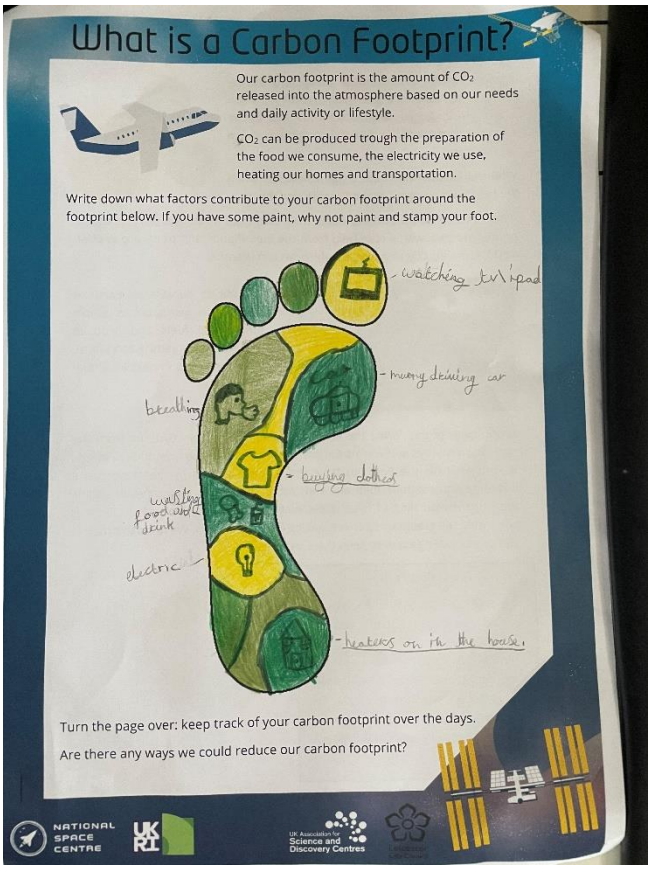

Participant, Edi Mowbray (aged 8) – Carrying out her ocean acidification experiment.

The resource packs, referred to as Scientist Research Kits, included 5 worksheets and all the resources required to carry out the experiments and activities. To enhance the learning experience, we arranged for participants to attend 6 weekly video sessions via Zoom that would; create a space to elaborate on the worksheet and topic for that week, provide additional information and allow for questions. Sessions are recorded and uploaded online for participants to access if they need to revisit or missed the online session for that week.

Thanks to Operation Earth and the initiative behind remote activities, this has led to a strengthened partnership with the Neighbourhood Services. In addition, the programme has laid the foundations for follow-up remote activities on the completion of Operation Earth whilst restrictions are in place, this will be to retain our current participants as well as engage new families and widen our reach of engagement across the City.



YouTube screen shot of the recorded Zoom session that participants can re-watch.



Example of activity sheet What is a Carbon Footprint?

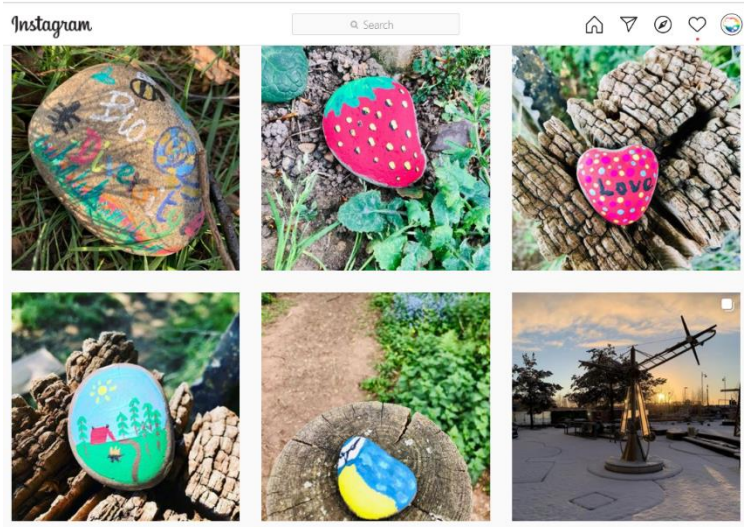
Thinktank

Thinktank, Birmingham Science Museum engaged with over 78,000 visitors online and in person at our Historic Properties events and temporary exhibition at Birmingham Museum and Art Gallery during the past year. This engagement has shared NERC research and science capital with families who would not necessary visit Thinktank, supporting them to see the importance of environmental science and the changes to our climate today.

Beki from Thinktank at the #BigBrumBioBlitz

The Operation Earth 2 project gave an opportunity to reach out to visitors who may have not interacted with Operation Earth 1, though events at different sites across Birmingham Museums Trust, an online audience, and local communities who had joined a new membership scheme in 2020. The highlights of the project include the online #BigBrumBioBlitz campaign which saw 620 new species identified on our iNaturalist project page, a temporary display as part of the Wildlife Photography of the Year exhibition from the Natural History Museum which engaged with over 2,000 visitors and 'Earthy Boxes' sent out to 50 local community families through Sense and Home Group.

The project from Operation Earth 1 and 2 will leave a long-lasting legacy at Thinktank, Birmingham Science Museum. In particular, the resources provided will be used in future BioBlitz events for years to come and NERC research has impacted on the interpretation for a new permanent gallery at Thinktank called Our Changing Planet.



Smile Stones shared on Thinktank's Instagram page

W5 Science and Discovery Centre

The Operation Earth Phase 2 project has provided an exciting opportunity for W5 to develop science based, family focused, activity packs that can be used in the home, contain all the resources needed to take part and are packed with supplementary information linked to NERC science and environmental awareness.

After an extended period of furlough due to the pandemic and a significant adjustment in timescales, staff availability and access to resources we were able, from mid-January to reach out to key local organisations to be involved in the roll out of these packs. This ensured that the key aims of OE2, to showcase important environmental science (during the COP26 lead up), link this with NERC research and information sources and offer pathways to enhance motivation, interest and engagement for hard to reach sectors of the community was possible.

In Belfast, it is key to work across the communities and we achieved this by working with Ligoniel Community Improvement Association a West Belfast, active, community group and Together NI, an East Belfast based community organisation. Both groups work closely with individual, families and groups experiencing challenging socio-economic issues often linked to food poverty and both are involved in food banks and handing out food parcels to a range of community family members.

We have developed our environmental science packs in both physical and digital form. The physical packs have been given to both community groups to hand out to families (with children in the 6-11yr range) when delivering food parcels. Fifty physical packs have been given to both groups (with the Together NI packs being distributed w/c 15th March 21), each containing all printed materials, welcome and explanation sheets, postage paid evaluations and resources for experiments. We also launched our OE2 digital packs on the W5 website and social media platforms to encourage members of the wider public and/or schools to download the packs and use them wherever possible.

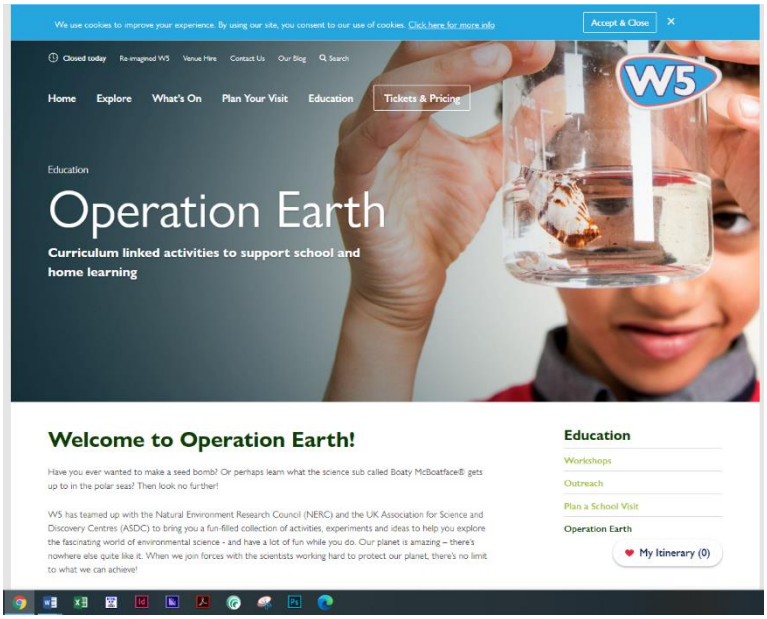
The community group post codes, meet high levels of deprivation as defined by the 2017 Indices of Multiple Deprivation NI (Ligoniel 161 of 890 IMD/Together NI HQ falls outside of this range but works with groups within the top deprivation levels) and providing both physical packs and digital opportunities ensured that we were reaching those without internet access, families not aware of the activities on offer and those without a range of learning resources at home during the school and wider society closures.

Evaluation data provided a challenge in relation to the packs handed out by the community groups. Through discussion we agreed to put physical evaluation forms in the packs with reply paid envelopes in the hope that some may be returned with feedback. To date we have received two returns from the physical packs but we had expected number of return to be very low and the Together NI packs have only just been released due to time constraints. One of the centre managers from Ligoneil, who was handing out the packs did report that the 'packs looked good and the families were excited to receive them'. We have a request out for any ongoing informal feedback and would hope to hear soon, during w/c 22/3/21.

The *physical packs* were given to families with at least 1 child in the correct age range so potential for involvement will be at least 100 children and 100 adults if all use the packs.

The *digital packs* (Operation Earth | W5 (w5online.co.uk) were downloaded by a range of groups with 25 families, 1 school and 1 community group completing the survey monkey link when downloading. This gave us figures of 48 adults involved and 72 children completing the activities.

All of these groups would have had access the the NERC information in all the packs that included experiments on biodiversity and wildflower planting, the carbon cycle, ecosystems, air pollution, marine health and GHG emissions.



Screenshot of digital pack

The project legacy includes the materials remaining on our website to be used by the public and schools, the targeted use of the experiments with specific groups we continue to work with and the capacity for further development such as 'how to' videos, more physical resources, linking the activities to NERC scientist interviews as our centre opens up and more staff become available as well as activities linked to COP 26.

Xplore! Science and Discovery Centre

Filming the Operation Earth Family show

Xplore! Science Discovery Centre delivered a virtual program of Operation Earth Phase 2 in several ways. Firstly, through the provision of an online recording of the family show in both English and Welsh. This was released through the Olion//Footprints festival organised by National Museum Wales and reached an audience of 300.

A second approach was deeper engagement with community youth groups by holding four weekly sessions for 1-hour apiece through Spring 2021. Each session followed one of the Operation Earth phase 2 themes: earth, air, ocean, climate change & earth observation. The sessions comprised of information sharing using slideshows and Natural Environment Research Council (NERC) expert videos, presenter demonstrations and activities. For some of the sessions, a NERC scientist or researcher contributed with live presentations and discussions about their work. These sessions were complimented with an activity pack sent out to each participating family, which contained activity sheets and resources so that they could recreate experiments and activities at home.

Three groups have completed this stream of engagement: Wrexham Conwy Denbighshire Young Carers, Disability Positive and The Urdd, a Welsh language youth group, reaching a total of 79 young people and their families. A fourth group, coordinated by the Ethnic Minorities & Youth Support Team Wales, is set to engage with 37 families in March / April 2021. None of the four community partners nor many of the families they work with have engaged with Xplore! before and certainly not with Operation Earth. The virtual nature of our engagements allowed our centre to reach families from across the whole of Wales and in Cheshire.

All participants completed pre and post questionnaires to gather feedback around understanding of environmental science, climate change and the impact of Xplore!'s sessions. 90% of participants felt they knew more about climate change following the sessions and 95% reported that their understanding of environmental science had improved. 100% of respondents said they felt it was important or very important to look after the planet. Responses from participants showed that the sessions were fun, engaging and linked to everyday lives with the following comments relating to the young people's favourite part: "Listening to the story's because they were very interesting", "I liked the activetys as they make you realisie you can do as much as anyone else!", and "I cant decide it was all to good!!".

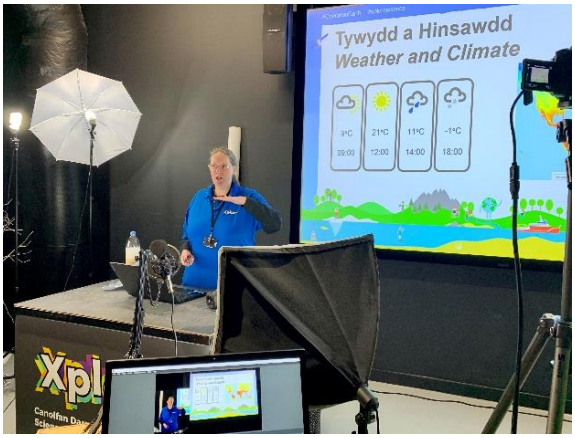


Image from the live stream recording at Festival of Tomorrow 2021

For the centre as a whole the delivery of Operation Earth was part of a shift to virtual engagements, which was a new experience for all staff involved. It was also a development opportunity for staff in terms of developing and delivering content for projects. Additionally, staff not directly involved with the project were briefed on the new phase and how the project would be delivered. They provided to support to the delivery team through testing new activities, providing feedback and technical support. Training was also carried out so that staff were familiar with the activities and could deliver them in future.

Activity Pack

The team at Xplore! are very grateful to have been part of Operation Earth phase 2 and to have been granted our own set of equipment. It has enabled the organisation to forge new community partnerships, engage families virtually, work with NERC researchers from across the UK and develop sustained activity that encourages participants to think critically about environmental science research and link it to their everyday lives.

34. Legacy of Operation Earth

Extracts are taken from Science Centre final reports.

Dynamic Earth

One of our digital event pages as part of Glasgow Science Centre's Curious About: Our Planet festival Operation Earth will leave a strong legacy at Dynamic Earth and with Edinburgh Young carers (EYC). We hope to be able to expand on the initial scope of the project by having the young carers and their families who received the boxes to visit the centre on supported visits. We hope this will further instil in them the perception that environmental science is fun and something they all see as 'for them' that is connected to their daily lives.

The programme has strengthened our ties with Edinburgh Young Carers and in addition to Operation Earth work we now also hope to work with them on additional schemes such as the book group, COP26 engagement and online sessions in the meantime.

We plan to engage the public and community groups extensively with COP26. As the themes of Operation Earth fit so well with the conference, we plan to make use of the resources we were provided with and the resources we have developed as part of the project during this time.

While Covid certainly posed many challenges to us in terms of continuing engagement with the restrictions it imposed, our adaptability has ensured that we have continued to engage a wide range of audiences through the programme. The switch to online engagement styles has provided us with an opportunity to engage audiences from potentially anywhere in the world. The suite of digital resources we've created will be a lasting legacy of the project, which will remain on our website for anyone to access for free whenever they like.

Operation Earth Phase 2 has been a fantastic opportunity for Dynamic Earth to be involved in. The themes align so strongly with many of our own aims and we would welcome the opportunity to be involved with any other phases the programme may go on to have.

Glasgow Science Centre

We have built up relationships with 19 community groups – including some in deprived areas. We will continue to work with these and other groups as part of our wider climate change programme, Our World Our Impact, in preparation for COP26.
We have acquired additional resources that can also be used as part of our wider climate change programme – including the terrarium kits that were well received by families. We will use Operation Earth's resources (including workshops and shows) as part of our in house programmes (when we re-open), our CLD engagement programmes and as part of COP26 green zone programmes.
We will also invite NERC experts to take part in future programmes such as Meet the Expert type of interactions which we know both schools and families like. These could be delivered either in house or virtually, bypassing any issues of geographical distance or cost of entry and transport.

Jodrell Bank Discovery Centre

Operation Earth has been a steep learning curve for all involved in many ways and it has brought many benefits to those involved. Jodrell Bank Discovery Centre (JBDC) has developed a strong working relationship with three new schools and we aim to continue these relationships with other activities and projects in the future.

JBDC has developed a set of four new workshops which can be used in the future for both school groups and other young people's organisations such as Cubs, Scouts, Brownies and Guides as well as home educators. It is our intention to make these workshops available to anyone to book as soon as possible.

In addition to the knowledge gained by the participating teachers, children and their families, JBDC staff involved in this project have learned lots of new things about environmental science. This learning will be shared with colleagues and brought into future schools and general public programmes at our Centre. Both JBDC staff and the schools involved have also learned about delivering and engaging in sessions online and the challenges and advantages of remote engagement in this manner.

Additionally, the take home activities which were given to the children have allowed there to be a legacy within the children's homes. The activities will act as a reminder of their experience and we hope will encourage them to continue to act in an environmentally responsible way.

National Space Centre

The legacy for this project will be to build on the current delivery method during the pandemics restrictions to continue remote engagement via a varying topic, build on current learning or to deliver the same content to a new audience, yet to be decided with collaborative partners.

In addition to the above, the legacy will be to continue to use NERC resources and content to shape our research and public facing content via our media platforms. The National Space Centre is undergoing internal renovations, to which a gallery dedicated to Earth observation, environment and climate

science will be developed. This partnership with Operation Earth and NERC will influence the content design of the new exhibit gallery.
For the participants, we hope to have inspired and raised aspiration about the importance of protecting the Earth and living a more sustainable lifestyle. With the additions of new projects that will be developed and delivered we hope to see returning faces and individuals to take part in our activities and influence their decision to take up a STEM subject in the future and perhaps a career within environmental science.

Thinktank

The legacy of Operation Earth for Thinktank will be that NERC research and information will continue to feature in the new gallery, Our Changing Planet. The second phase of the gallery in particular, is looking at the latest data from research and the type of solutions to support the climate crisis. Our relationship with NERC will continue after this project. Due to the Operation Earth project, we have been able to continue our partnerships with our local communities during the COVID pandemic whilst the centre has remained closed. This has been extremely beneficial to keep the community groups engaged with Thinktank as the relationships were only made in February 2020.

Xplore! Science Discovery Centre

Xplore! are planning to work with families accessing services from the Ethnic Minorities & Youth Support Team Wales, the fourth set of virtual sessions weekly from the 18th March 2021. We have already sent out 30 resource packs to families across Wales, from predominantly BME or Refugee/Asylum Seeker backgrounds.

The pre-recorded Operation Earth show (in both English and Welsh) and the 90-minute session delivered for Swindon Science Festival, will be released on our YouTube channel. We are currently deciding on the best way to ensure we keep to the original aims and objectives of the programme and we may decide to send the links privately to partner organisations rather than advertise it to all our social media followers.

Xplore! plans to continue to collaborate with the four community partners as well as National Museum of Wales with future family events. The NERC researchers were from across the UK and we will definitely consider virtual sessions with experts going forward, even when face-to-face is possible, as it is much less of a commitment for the researchers than having to travel to deliver a session for us in Wrexham.

The content of Operation Earth Phase 2 has been embedded into the staff working at Xplore! and we will continue to utilise the activities and family show once the centre can re-open.

A school in northwest Wales has requested an environmental virtual session for years 3 & 4 after Easter with accompanying investigation activities they can complete in their school grounds as a class bubble. We will adapt the activity sheets and sessions developed for the family sessions and if a success, we can role this out to other schools too.

W5 Science and Discovery Centre

W5 outlined the following areas of legacy for their Science Centre:

- Continued links with both community organisations
- Additional programmes directed to supporting communities with high IMD levels.
- Opportunity to add to the resources, the Operation Earth Phase 2 show and other video and online content.
- Opportunity to engage schools with the curriculum linked activities and virtual or face to face programme
- The project would have benefitted from more time to run so we will be leaving materials available online, posting to remind families and retaining links to our two community partners.

W5 also included a short survey link for the digital packs and a shorter survey for physical packs. When the children were asked what other activities they would like in the future, they said:

- More science experiments
- Easy experiments using household items
- Artwork and colouring
- Growing Tress
- Activities and experiments that can be done outside in nature
- Video tutorials for lots of experiments

Thank You from all the team at ASDC

35. The Appendices

Appendix 1. Ideas Charette Agenda

A Charette brings together people from a variety of backgrounds to come up with new ideas and to address specific questions. The purpose of this Charette is to bring together some of the very best people in the UK at the start of Phase 2 of this exciting national project to work collectively for one day to share ideas with the project team to contribute to the development of resources for the project. For this Ideas Charette we are delighted to be joined by NERC scientists and university researchers as well as public engagement professionals from ASDC and others.

Charette 1: Thursday 26th March 2020

2:00 – 4:15 pm, On Zoom

1.	Dr Penny Fidler	CEO & Project Director	ASDC
2.	Shaaron Leverment	Deputy CEO	ASDC
3.	Cait Campbell	Executive Assistant, Project Associate	ASDC
4.	Hannah Lacey	Public Engagement Programme Manager	Natural Environment Research Council
5.	Sally Stevens	Marketing & Communications Manager	Institute for Environmental Analytics
6.	Dr James Pope	Climate Scientist	UKCP Science into Services, Met Office
7.	Catherine Fitzsimons	NCEO Outreach	National Centre for Earth Observation
8.	Dr Tom August	Computational Ecologist	UK Centre for Ecology & Hydrology
9.	Dr Claire MacIntosh	Research Associate	NCEO, University of Reading
10.	Jeremy Lelean	Communications Officer	University of Reading

2:00		
	A Welcome from ASDC	**Dr Penny Fidler (Chair) ASDC CEO**
	Introduction to the project team, NERC and all the Charette participants	**Dr Penny Fidler**
	A Welcome from NERC	**Hannah King and Hannah Lacey, NERC**
	Introduction to the project and Goals of the day Presentation by powerpoint	**Dr Penny Fidler**

	Seeking great ideas, hands-on activities and digital tools on the 2 key areas: **1. Earth Observation** **2. Climate change** We would also like to 1. Discuss COP26 2. Ask if any of you have any recent satellite data showing the drop in carbon output due to COVID 19.	**All** **Dr Penny Fidler**
	Content creation and collation	
	Your amazing hands-on and digital engagement ideas We want this project to bring together the best existing ideas and tools, and create some brilliant fabulous new activities for families and children to inspire them with your environmental science and how researchers are working together to better understand the world and tackle the issues around environment and climate change. We are keen to find new ideas and activities around the 2 key areas of climate change and earth observation, so we can get families thinking about and questioning how the environment affects them and how they themselves can make a difference. These activities will complement the already existing kit. In this session, we are asking you to share ideas, online activities, apps, citizen science projects and hands-on activities that bring alive the stories and science behind NERC's environmental science. We would like to collate ideas and play with some new possibilities.	
	Earth Observation and interesting satellite data **Suggestions from the group. Please bring items to present**	**Suggestions from the group.**
	Recent satellite data on the drop in carbon output due to COVID 19. **What do we have? what can we share?**	**Suggestions from the group.**
	Climate change **Please bring items to present**	**Suggestions from the group.**
	Virtual Round table Discussion: What are the most important stories to tell? What are the best activities, stories and pieces of equipment to share these stories?	**Dr Penny Fidler**
3:45- 4: 00	**You really shouldn't miss ….** In this session, we will ask you to tell us about remaining excellent ideas, demos, websites, apps, experiments, social media, people, projects and equipment you would love to see play a part in the wider project. From climate demos to great earth observation tools and apps to great citizen science projects, what shouldn't we miss as we create our digital kit?	**Chaired by Dr Penny Fidler, this will be a combination of individual and group work** **Please write on paper, or type**
4 00 - 4:15	**Sharing all the ideas, cross-pollinating, and the next steps** How would you like to be involved?	**Chaired by Dr Penny Fidler**
4:15	**Close.**	

Charette 2: Thursday 23rd July 2020

2:00 – 3:15 pm

2:00	Agenda	
	A Welcome from ASDC	**Dr Penny Fidler (Chair)** **ASDC CEO**
	Introduction to the project team, NERC and all the Charette participants	**Dr Penny Fidler**
	A Welcome from NERC	**Hannah King and Hannah Lacey, NERC**
	Introduction to the project and Goals of the day **Presentation by powerpoint**	**Dr Penny Fidler**
	Seeking great ideas, hands-on activities and digital tools on the 2 key areas: **3. Earth Observation** **4. Climate change** We would also like to 3. Ask if any of you have any recent satellite data showing the drop in carbon output due to COVID 19. 4. Summary of what we had before	**All** **Dr Penny Fidler**
	Content creation and collation: OPEN FORUM	
	Your amazing hands-on and digital engagement ideas We want this project to bring together the best existing ideas and tools, and create some brilliant fabulous new activities for families and children to inspire them with your environmental science and how researchers are working together to better understand the world and tackle the issues around environment and climate change. We are keen to find new ideas and activities around the 2 key areas of climate change and earth observation, so we can get families thinking about and questioning how the environment affects them and how they themselves can make a difference. These activities will complement the already existing kit. In this Open Forum, we are asking you to share your ideas, online activities, digital resources, apps, citizen science projects and hands-on activities that bring alive the stories and science behind NERC's environmental science. We would like to collate ideas and play with some new possibilities.	
	Earth Observation and interesting satellite data **Suggestions from the group.**	**Please bring slides, photos and digital resources to showcase what you have.** **Open forum and Suggestions from the group.**
	Climate change **Please bring items to present**	
	Recent satellite data on the drop in carbon output due to COVID 19. **What do we have? What can we share?**	

	Virtual Round Table Discussion: What are the most important stories to tell? What are the best activities, stories and pieces of equipment to share these stories?	**Dr Penny Fidler**
3:00- 3:10	**You really shouldn't miss ….** In this session, we will ask you to tell us about remaining excellent ideas, demos, websites, apps, experiments, social media, people, projects and equipment you would love to see play a part in the wider project. From climate demos to great earth observation tools and apps to great citizen science projects, what shouldn't we miss as we create our digital kit?	**Chaired by Dr Penny Fidler, this will be a combination of individual and group work** **Please type into the chat**
3:10	How would you like to be involved in the future?	**Chaired by Dr Penny Fidler**
3:15pm	**Close.**	

Appendix 2. Science Centre Training Academy Agenda

The Training Academy for Phase 2

Monday September 28th 1.30pm - 5pm

Tuesday September 29th 2pm - 5pm on Zoom

Day 1 Agenda		
1.30 - 5pm		
1.30 – 2.30pm	Welcome Introductions to the Project Team and NERC team	Dr Penny Fidler, CEO of ASDC
	Introductions by all the participants	All Delegates
	Operation Earth Phase 1 and 2 • The project vision & mission • The differences between Phase 1 and 2 • An overview of the equipment and resources • New logo	Presentation by Dr Penny Fidler
	• Changes to this phase due to Covid-19 • Changes to your projects due to Covid-19 • Your grant dates and delivery timeframes	
	The Phase 2 additions: Earth Observation and Climate Change	
	A welcome from the Natural Environment Research Council Public Engagement Team including: • Their vision for this project • The NERC centres and facilities • Keeping updated on NERC news & Planet Earth • Working with Scientists	Hannah King, Senior Public Engagement Programme Manager Hannah Lacey Public Engagement Programme Manager
	Familiarising yourself with the training handbook	
2.30 – 2.45pm	**10-15 Minute Coffee break**	
2.45pm – 3:20pm	**Using Behavioural Science to shape our engagement with environmental Science**	
	Understanding how we humans think, and why it is critical here: Introducing Behavioural Science	by Dr Penny Fidler
	Engaging audiences with environmental science: Using the latest evidence from behavioural psychology to understand the way people think.	Dr Kris De Meyer, Research Fellow, Centre for Neuroimaging Sciences King's College London
	Questions and discussion	
3.20 -3:30	**10 minute refreshment break**	
3:30 – 5pm	**The Operation Earth Kit, activities and resources** **Top tips and new ideas, and any Covid-19 adaptations**	Presented by a range of staff from Science Centres
	The Earthy Suit: What worked well?	Everyone
	The Biodiversity Mat: how did it work for you?	Everyone
	The Ocean acidification demo (shells)	Everyone

	Origami plant pot and paper plant pot maker	Everyone
	Other activities	Everyone
	The Family show and the PowerPoint	A Video of the show is online
	New digital activities on the website	
4.15pm	**1. Climate Change** **2. Earth Observation**	Dr Penny Fidler
	• Cross-over with other ASDC programmes • The Earth Observation activities: How did you use the resources? • Did you share anything from Destination Space?	Thermal imaging camera
	Health and Safety across the project	
	Your Questions	
5pm	**Close**	

All of your centres have run Operation Earth programmes before, and we will assume your centres are training you on the detailed use of the kit, show and running all the specific activities. We will offer a short refresher.

Preparation: Monday morning, please read the **Training handbook**. You will have two hard copies in your centre, if possible can you retrieve one in advance of this meeting. Otherwise access it online here: https://www.operationearth.co.uk/resources/handbook/

The afternoons are a mix of presentations and opportunities for sharing knowledge and ideas, discussions and delegates presenting what they have done and are doing. During the presentations you may switch off your own videos to relax and focus on the sessions. During the group discussions we would ask you to have your videos on.

Day 2: Tuesday 29th September

Time	**Session**	
2pm	Welcome back	
	Operation Earth: Reaching Communities in new ways due to Covid-19	
2:00 -3.15	**Presentations from each centre on Your Plans for your newly adapted Covid-19 secure projects, and what new resources you plan to create. 4 mins each.** (if you wish to show any photos, please have slides ready) Due to Covid-19, everyone has had to change their programmes. Thank you for your submission, this is your opportunity to share what new ways you are reaching your communities, gain ideas and discuss and set up collaborative development opportunities with others	1. Dynamic Earth 2. Thinktank 3. Xplore! 4. National Space Centre 5. Jodrell Bank Discovery Centre 6. W5, Belfast 7. Glasgow Science Centre
	How to ensure scientific accuracy of your new resources? How to find experts and how NERC can help	Penny Fidler and NERC
	Group discussion around creating new resources and what you can share or develop together	All Delegates
	Summation of next steps. **How do you want to discuss ideas with one other?**	All Delegates
3.15 – 3.30	**Coffee break**	

3.30 – 4.30	**Climate Outreach and the Centre for Climate Change and Social Transformations (CAST)** www.climateoutreach.org https://cast.ac.uk/	Dr Roz Pidcock, Senior Programme Lead Experts Programme, Climate Outreach
	Climate Change: How do we know what we know? What is the latest evidence on warming and where does it come from?	Dr James Pope MET office
	Activities, Questions and discussion	All Delegates
	Guide to advocacy and raising the project profile with local MPs and policy makers	NERC and ASDC
	Environmental citizen science opportunities	
	Quick fire finale Session, Questions, Answers & Next Steps	
4.30 – 5:00	Contractual commitments	Dr Penny Fidler
	The marketing resources, logos and website	ASDC and NERC
	Evaluation: How do you show you are reaching those who have not engaged before?	ASDC
	Training your staff and ensuring quality and accuracy of the content	Dr Penny Fidler
	Any questions about the experiments, activities and the show	
	Final questions and your next steps	
5:00	**Close**	

Information for Day 2: Tuesday

On Tuesday morning before Day 2 of The Academy please:

1. Review www.OperationEarth.co.uk website and additional resources
2. Please watch the show. It is 40 mins long and via this link:

https://www.youtube.com/watch?v=KpyvNz8-oMI&t=2s

Information on Climate Outreach and CAST

The charity Climate Outreach has central role in a major new £5 million research centre, led by Cardiff University and funded by the Economic and Social Research Council, which will be the UK hub for the social science of climate change. CAST – the Centre for Climate Change and Social Transformations – will focus on the crucial role of people at the heart of the transformations needed to bring about a low-carbon, sustainable society.

The Centre will focus on four challenging areas of everyday life that are critical for making progress on carbon emissions, but which have proven stubbornly resistant to change: the food we eat; the way we travel; the way we heat and cool our homes and buildings; and the consumption of high-carbon goods and physical products.

Climate Outreach is a core partner of the CAST Centre, alongside Cardiff, Manchester, York and East Anglia Universities. The Centre will mark a step-change in the way that sustainable behaviours, lifestyles and practices are studied by social scientists.www.climateoutreach.org

https://cast.ac.uk/

Appendix 3. Training Academy for NERC Researches

Training Academy Programme: Wednesday January 20th, 1-5pm

1pm - 5pm		
1pm	Welcome Introductions to the Project Team and NERC team Introducing the national network of science centres	**Dr Penny Fidler** (10) CEO of ASDC
	Operation Earth Phase 1 and 2 • The Operation Earth vision & goals • Partnering Science Centres • An overview of the equipment • Digital resources and changes due to Covid-19 • Focus on Earth Observation and Climate Change	**Dr Penny Fidler** CEO of ASDC and Director of Operation Earth (15)
	A welcome from the NERC Public Engagement Team including: • Their vision and ambition for this project • The NERC centres and facilities, and NERC public engagement programme • Borrowing the Operation Earth Kit from NERC	**Hannah Lacey** Public Engagement Programme Manager **NERC (10)**
1.35 – 2.15	**Training on the Operation Earth Hands-on equipment**	
	The Training Handbook	Dr Penny Fidler (2)
	The Operation Earth Kit, activities and resources	**Laura Gordon** (30) Science engagement Professional at **Dynamic Earth, Edinburgh**
	The Earthy Suit	
	The Biodiversity Mat and coral reef	
	The Ocean acidification demo (shells)	
	Origami plant pot and paper plant pot maker, and other activities	
	The Climate Walk and Online resources	Dr Penny Fidler (8)
	How to work best with Science Centres	
	Making it easy: collated accurate data from other fields of environmental research from the Royal Society	
	Questions and discussion	
2.15 - 2.25	**10 Minute Coffee break**	
2.25 – 3:00	**Using Behavioural Science to shape your environmental engagement**	
	Introducing Behavioural Science: Understanding how we humans think, and why it this critical in public engagement?	Dr Penny Fidler (5)
	Masterclass on Engaging audiences with environmental science:	**Dr Kris De Meyer,** (20)

	Using the latest evidence from behavioural psychology to understand the way people think.	Research Fellow, Centre for Neuroimaging Sciences King's College London
	Questions and discussion with Kris	(10)
3:00 – 3.30	Climate Outreach and the Centre for Climate Change and Social Transformations (CAST). www.climateoutreach.org https://cast.ac.uk/	**Dr Roz Pidcock**, Senior Programme Lead Experts Programme, Climate Outreach(20 +10)
3.30 - 3.40	**10 minute Coffee break**	
3.40 – 4:00	Introduction to sustainability in Public Engagement	**Candice Snelling** **Sarah Tranter (15+5)**
4:00 – 4.45	Effectively engaging people with your research using digital in these Covid times	**Dr Jamie Gallagher** Digital Trainer and consultant (35 + 10)
4.45	Quick Guide to advocacy and raising the profile of your work with local MPs and policy makers, and COP26	ASDC (5)
	The marketing resources, logos and images you can use	ASDC (3)
	Working with your universities and NERC going forward • Keeping updated on NERC news & Planet Earth • Join the Coffee chats	NERC (5)
5pm	**Close**	ASDC and NERC

Appendix 4. Evaluation Questionnaire for Community Partners

Evaluation Form for Your Community Partners

(We will combine this with answers from your final report)

Your name and Job title …… Your Science Centre …….

Your Community Partner's Name

Your Community Partner's organisation …….

Postcode of the area you work in (or of your organisation if they are similar)

This evaluation form is to find out about how useful the project was from the perspective of your community partner and the people they work with. If you mention any challenges, please say if they were due to Covid or another reason.

1. **Did you enjoy working on this project with the Science Centre?**

Yes / No /A little but it was a challenge

2. **Please tell us in a few lines about the children and/or adults you work with**

3. **Please tell us about the best bits of the project for you, colleagues and your organisation. (Do include any impact, environmental science knowledge, new relationships or happy outcomes.)**

4. **Please tell us about how you feel the project impacted on the children and adults you work with? What did they enjoy? What really worked?**

5. **Do you think there will be any legacy from this project, relationships, ideas or impact that will continue after March 31 2021**

6. **Approximately how many participants do you think got involved – please give any details eg they were children aged 7-10 or adults with special needs, or families using a foodbank.**

7. **Do you think they learned about environmental science and climate science? Did they ever say anything to you?**

8. **If the Science Centre was to run something similar again, how would you improve it?**

9. **How many of your staff took part**

Appendix 5. Evaluation Questionnaire for Participants

Evaluation Form for Participants

Operation Earth is a National Environmental Science Programme with lots of different projects in different cities, all of which took place over the Covid year. We would like to find out if you enjoyed taking part and felt it was beneficial for you, and those you participated with.

Which organisation or Science Centre did you get involved through …….

Which part of the country are you in (you can use post code if easier) ……

1. Did you find the activities fun?

Yes	Don't Know	No

2. Do you feel you learned something about climate or our environment?

Yes	Don't Know	No

3. Do you feel more interested to find out more about our environment

Yes	Don't Know	No

4. What type of thing did you take part in?

5. What did you most enjoy, and why?

Children's responses (give approx. ages)

Adult's responses

6. Did anything surprise you?

7. Following the activity…

		More Interested	The Same	Less Interested
How do you feel about environmental science?	Adult			
	Child 1			
	2			

8. Did you feel these activities changed your understanding of…

	Increased	No change	Decreased

Our environment, and the current issues faced?	Adult			
	Child 1			
	2			
	3			
The range of people who study the environment?	Adult			
	Child 1			
	2			
	3			

9. How important is …

		Very	A little	Not at all
a) Environmental science and climate science?	Adult			
	Children			

10. Is there anything you found out today that you would tell your friends or family about?

Children's responses

Adult's responses

11. What are the ages of your children? (Interviewer can estimate).

	Gender (interviewer please indicate)	**Age**
Child 1		
Child 2		
Child 3		

THANK YOU FOR YOUR TIME TODAY

Additional Information for the interviewer

TODAY'S DAY and DATE…… CENTRE ……..

A Quote

- **We would love a quote from you that we can give to the project organisers to say how you felt about taking part**

Appendix 6. Evaluation Questionnaire for Science Centre Staff

Evaluation form for Science Centre staff
How Operation Earth 2 worked for you, your colleagues and your Centre

(We will combine this with answers from your final report)

Centre …….

Job title ……..

Name and phone number, unless you wish to be anonymous. …….

This evaluation form is to find out the impact on you, and your Science Centre and what you have learned through this programme and the legacy this learning, approach, content and relationships will bring to you and your organisation in the future.

1. **Following this project and the relationships you have built, do you feel more confident in delivering environmental science, finding NERC scientists and knowing where to get the latest environmental science?**

   Yes /A little/No

   Please tell us why you gave your answer:

2. **A focus of this project was around Equity, Diversity and Inclusion. Tell us how you and your organisaton focussed on this, and how you ensured your participants were from the target demographic, and how you ensured you offered something they wanted**.

3. **Have you built relationships with community partners Yes / No**

4. **Have you worked with environmental scientists? Yes / No**

   If yes how many and where were they from, if no what were the barriers and will you do so in the future?

5. **How will you continue to use the kit, knowledge, resources and science you have gained from Operation Earth into the future into the future.**

6. **How did you and your colleagues feel about delivering Operation Earth during the Covid year?**
7. **In the future, when centres are open, will you continue to engage audiences with environmental science? Yes /No. how will you do this?**

8. **How could Operation Earth could have been more impactful for your participants?**

9. **How many staff members took part in Operation Earth, or have benefited from the knowledge or training?**

10. **Please ask 2 other members of staff who have worked on this project if their confidence in delivering environmental science, finding NERC scientists and knowing where to get the latest science has increased due to Operation Earth. What did they say**

11. **How would you and your centre like to see Operation Earth and working with ASDC and NERC develop into the future. Be as ambitious as you like.**

Quotes

- **Please give us a quote from you, that we can use in our report about what you and your centre learned or gained from operation Earth.**

- **Please give us a quote from a senior manager, that we can use in our report about what you and your centre learned or gained from Operation Earth – include what is most important to you and your centre, eg legacy of the kit or training , relationships you built, doing good work during lockdown.**

Appendix 7. Infographic of Operation Earth Phase 1