CAMBRIDGE CONFERENCE IN CONVERSATION

APPLYING GEOSPATIAL INFORMATION TO CLIMATE CHALLENGES

Cambridge Conference

from Ordnance Survey

A time for action

Every country has been impacted by our changing global climate. Location data provides the clarity needed to understand the impacts, make investments for resilience and achieve net zero.

The global community of senior leaders from National Mapping & Geospatial Agencies (NMGAs) met to discuss how authoritative location data can support climate change action.

A pledge from the NMGA community

We recognise the importance of location data[1] in fighting the impacts of climate change and that our work has never been more important.

We will enable nations to respond better to climate challenges and we will act now to make ourselves sustainable organisations.

The role of NMGAs at COP26

To support the UN goals at COP26, national mapping and geospatial agencies (NMGAs) can support their country by enabling:

1. Collaboration across borders - we can enable all countries regardless of economic or political differences, to tackle common issues.
2. Collect and curate authoritative data - we help plan and deliver measures that can be trusted and relied upon by policy-makers and the international community.
3. Make foundational data accessible and reusable - we encourage others to expand on our work to tackle specific problems in innovative ways.
4. Sponsor and embrace agreed standards - we ensure technical solutions can tackle common problems in a consistent way.

Recommendations for NMGAs

Geography puts NMGAs in a unique position to bring together people and data to address climate challenges, therefore we should:

1. Take an active leadership role as advocates for location data in our countries, understanding its value in supporting government priorities, and showcasing the real benefits it can bring to national adaptation and mitigation policies. We should act as drivers of change, empowering organisations and individuals to use location data in new ways and to actively respond to the current and future needs of citizens.

2. Recognise that a changing climate is a global issue that affects all nations differently. Adaptation and mitigation strategies need to be based on best-available national data and considered in a global context. In recognition of this we should work with others, not alone, creating new networks, and move to using internationally agreed standards to enable the use of trusted data for adaptation and mitigation solutions.

Recommendations for governments

To recognise the value of location data to support policies to fight climate change, governments should:

1. Mandate the use of available authoritative location data from NMGAs as a framework for bringing together multiple sources of information linking critical data from governments, industry, research, academia, NGOs and civil society.

2. Improve data infrastructure and assets by investing in the collection and maintenance of high-quality geospatial data to make the best use of their national response and provide a location context to their Nationally Determined Contributions.

Introduction

The impact of climate change is a geographical issue. It touches every corner of our planet, but the impacts will not be evenly spread. Some places and people will be impacted more than others and resources will be needed to support the communities most affected.

Our task as national mapping and geospatial agencies (NMGAs) is to produce good, accurate, consistent data about where resources, people, and impacts are - to inform decision-making. However, location information[2] is not available for all parts of the globe equally and is not always easily accessible, usable or of the appropriate quality.

The importance of data to support decision making is highlighted in the UN's Bern Data Compact which calls out the need for 'the geospatial community to work with other data producers to maximize the value of geocoded data and information.'

Foundational location data can come from governments, national mapping and geospatial agencies, businesses, NGOs and the individual citizens. Much of this data comes from our measurements and observations on land and sea but about 30 out of the 54 essential climate variables being monitored today can only be measured from space. These include sea level monitoring, polar ice extent, land use and cover changes and greenhouse gas emissions[3] making satellite earth observation data critical too.

The challenge is to put it together to give a clear picture of how these complex systems work. Geography and data science allows us to look at a problem holistically. Geography is not just about seeing a point on a map, but explicitly understanding the relationships among places, people, policies and actions[4].

The collective effort to address our common problems comes into sharp international focus at the annual Conference of Parties of the United Nations Framework Convention on Climate Change, known as COP26. This year, delegates to COP26 will be discussing actions and commitments to reach four common goals:

1. Secure global net zero by mid-century and keep 1.5 degrees within reach
2. Adapt to protect communities and natural habitats
3. Mobilise finance
4. Work together to deliver

The following sections provide some examples of how location data can, and is, helping to achieve the proposed COP26 Goals and the unique role that mapping and geospatial agencies can, and are prepared, to play.

Goal 1. Secure global net zero by mid-century and keep 1.5 degrees within reach

Verification of carbon emissions is complex, so governments will need to integrate data from industry, agriculture, the environment, and citizens.

To support this, a 'data infrastructure'[5] is required to provide the standards and rules so data can be brought together and compared.

NMGAs are already working to support a wide range of these policy interventions, technological developments and behavioural changes. Authoritative location information is key to identifying the geographies and activities that have greatest impact on global carbon emissions. At the same time, actions to mitigate or adapt will require authoritative data, with an increasing rate of currency and greater accuracy. Functional requirements will mean that national mapping and geospatial agencies must use new and varied inputs to enrich our existing data assets.

Changing our sources of energy is a top priority for most countries but to do that we need to know where the new energy resources are, where the consumers are and how to plan the distribution infrastructure. Here are some examples.

The Netherlands has used their mapping information together with artificial intelligence to produce data on the solar potential of roofs. This provides an insight on not only where the potential lies, but also categorises it by building and owner type, which is of great benefit to the policymakers[6].

In the United Kingdom the ParkPower initiative in Scotland has drawn together data on the green and blue spaces in urban environments to identify locations for installing ground source heat pumps which can supply energy to local residents[7].

Curtailing deforestation is the flip side to reducing emissions. For example:

In Mexico they are using regular updates on forest cover to identify areas under threat, plan policy incentives, regulation and enforcement, while also combining it with other geospatial data to support communities in forest areas. Geospatial Forest Data is used by the Natural Resources and Environment Ministry (SEMARNAT) to assess and conduct policy, and by the Ecology and Climate Change National Institute to estimate GHG emissions from land cover and land use changes.

Goal 2. Adapt to protect communities and natural habitats

As the Earth's climate warms, our governments and societies are changing to adapt.

Complex systems, such as cities, natural habitats and agriculture, will be impacted by climate-induced changes.

Location data helps identify and assess where and when the impacts of climate change will be felt most, and where the most vulnerable citizens are. Better location information will help governments target their resilience measures and efforts to protect those areas that are most at risk.

Here are some examples.

Chile has developed a tool called ARClim - Atlas of Climate Risks for Chile[8]. This brings together all the data they need from a variety of sources to show the impact chains of climate risk, exposure and sensitivity leading to an overall risk and the time horizons for a particular location. This is a critical input to the design of public policies and the implementation of adaptation measures to climate change to tackle, for example, threats to aquaculture, biodiversity and coastal communities. The ARClim Project has shown that the impacts of climate change for the country are mainly negative, especially for some cities. However, opportunities for adaptation to climate change are still detected, and this tool can contribute as a relevant input, in understanding and strengthening the challenges of climate change and, thus, facilitate the construction of adaptation strategies at a national scale, local and sectoral.

Costa Rica has created a monitoring system known as SIMOCUTE[9] . Location information from more than 40 government, academic, international, and other institutions is brought together to create one national monitoring system for land use and ecosystems. SIMOCUTE is founded on three interrelated elements – What? (classification), Where? (mapping) and How Much? (inventory and registries). It was constructed in a highly participatory fashion. Importantly, it harmonises the classification of land cover, land use and ecosystems which has enabled the government to have a coherent view of the whole country and make informed decisions and hence implement sound land management policies.

In Singapore where 30% of the land is below 5m above sea level, detailed location data has been used to identify which parts of the coast should receive protection, and to develop planning regulations to prevent flash flood damage to critical infrastructure such as power facilities and metro stations.

At a more granular level the pressures and competing interests in land use are hard to manage but even harder, if not impossible, without a good information base of who owns what and the current use of the land.

Rwanda has realised this and has completed an ambitious programme to record every one of its 10.3 million land parcels[10]. This is now forming the basis for its spatial planning process as part of its National Strategy for Transformation which includes actions to address climate challenges by, for example, the creation of the first mining and forest cadastres to allow delivery of policy focused on those sectors[11]. Similarly, Romania collects data on land use, building function for both urban and rural areas which supports Romanian stakeholders who are dealing with environmental monitoring and reporting, climate-related disaster preparedness and mitigation, and adaptation to the effects of climate change.

The combined effects of drought, temperature change and agricultural practices have meant that food security is threatened for many countries.

The GEOGLAM Crop Monitor[12] from the Group on Earth Observations (GEO)[13] is a significant information resource and mandated by the G20. It integrates data from satellites together with ground-based information on crop conditions to provide a monthly crop monitor report. This provides early warning of crop failures and hence allows government to take early action to protect communities threatened by food scarcity.

Disaster management is, regrettably, becoming an increasingly important subject as climate-induced disasters become more frequent and severe[14]. Whether it is forest fires, high temperatures, floods or hurricanes, the location of both people, infrastructure and resources is an indispensable element in the planning of mitigation, preparedness, response, and recovery.

One example is the use of satellite imagery after hurricane and tornado damage in the USA to identify rubble piles and buildings covered by tarpaulins thus identifying locations which are probably in need to target assistance[15].

Many mitigation and early warning system technologies are coming from the private sector as businesses begin to understand their exposure to climate risks and take action. It is fundamental that private and public sectors work together to produce the best solutions to both adaptation and mitigation challenges.

Goal 3. Mobilise finance

Mobilising finance to tackle the impacts of climate change requires quality information and clear evaluation of the risks.

Natural disasters generate significant fiscal risk and create major budget volatility for countries impacted. Even countries with robust disaster risk management programs can still be highly exposed to the economic and fiscal shocks caused by major disasters.

Key to assessing the disaster risk and evaluating impact is location information. The better the information the clearer the actual risk and the more accurately we can judge the effectiveness of climate mitigation measures and economic impact. The challenge is to turn the location data into risk metrics understood by the finance community. For example:

The World Bank has worked with the Bank of Morocco to assess the risks associated with extreme climate events[16]. They used data at a granular level – buildings, blocks - and aggregated to determine the financial risk from various IPCC scenarios to specific sectors, areas and clients.

Many of the actions we need to take to mitigate, or adapt to, climate change requires change to the way we use land. In many places occupants of land are unwilling to invest in their land due to a lack of security of tenure[17]. This makes any investment in property risky as land cannot be used as collateral for a loan. At a governmental level taxation can be raised from land, but only if there is information on who to tax and for what. Underpinning both aspects is the need for a comprehensive land administration system – to record ownership and provide security of tenure to support investment and allow taxation. Such a system holding details of each land parcel can also form the basis for other services.

Some examples are:

In Vietnam and Romania considerable investment has gone into creating a trusted land administration system. In both countries there is evidence that this has improved land management, freed up capital and increased revenues from taxation[18].

Efficient collection and management of location data and sharing it across government can release financial resources by removing unnecessary duplication.

Goal 4. Work together to deliver

The challenges of climate change are universal – location information helps countries work together.

The response to climate change is sometimes fractured and divided by administrative boundaries and political priorities. This can lead to differences in response, sometimes pushing the problem from one jurisdiction to another.

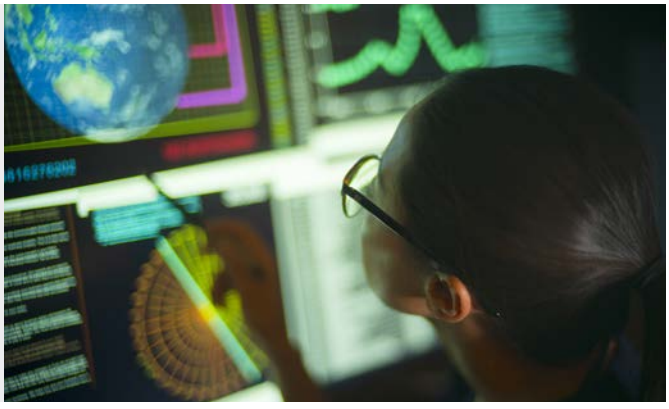
But working from a shared foundation of location information can enable governments to take a collaborative approach to problems. This requires relationships to help build an agreed set of data standards and a common approach to climate data management. Many countries have realised that geography, and the location data which describes it, can form the binding agent to bring together the sometimes disparate parts of government.

For example:

Abu Dhabi has brought together parts of government by building a single source of location data to support environmental decision making through the Emirate[19]. In Singapore it is recognised that location information is foundational and plays a vital role in supporting climate change related research studies, prediction and simulation of climate impacts, urban design and city planning, and decision making. Agencies work together in a 'whole-of-government' way to address coastal protection, flood risk mapping, and have developed a ground-breaking virtual 3D city model to address urban challenges, such as urban heat islands, increased wind speeds, adoption of solar energy, and natural capital estimation.

This is relevant at regional as well as national level.

In Europe, EuroGeographics[20] - a not-for-profit association - brings together over 60 national administrations of 40 countries. Addressing climate change is core to their concerns and activities. EuroGeographics promotes the value of authoritative geospatial data and has created pan-European datasets which are harmonised and consistent across the continent. This data is critical to decision makers concerned with the cross-border aspects of climate change such as the European Commission.



Collection of information, whether location or not, was once largely the preserve of governments and others in authority. This is no longer the case. Vast quantities of data are now being collected by businesses, communities and individuals. Privately owned satellites criss-cross our skies, our cities are covered in cameras and sensors and one mobile phone in the hands of a citizen can record data not just from the citizen's direct input but from its inbuilt sensors.

To get insight from this ever-growing mass of information will require collaboration on a huge scale - something NMGAs are well placed to do. One critical aspect being tackled is standards to allow data to be brought together. Without standards, satellite position navigation and timing systems, for example, could not work together to generate more accurate positions.

For example:

The Open Geospatial Consortium[21] brings together universities, research organisations, NGOs, companies and government organisations. Standards have been developed for the interchange of location data without which many information systems used by governments today would not function.

Collaboration is a key tenet of the United Nations, whether at an international, national or sub-national level. This is evident in the work of the UN and World Bank to develop a framework to assist countries to develop the right location information infrastructure to support their national strategies. The Integrated Geospatial Information Framework (IGIF)[22] provides a roadmap and guidebook to do this, bringing together stakeholders in government, academia, private sector, civil society and the citizen. The Framework has been successfully used by a number of countries to develop their location data infrastructure.

For example:

In Mongolia the IGIF structure has been used to produce an Action Plan and a change in law which now mandates a single source of location data and platform to be shared by all, no duplication of effort and coordination of stakeholders.

Looking forward

This paper illustrates how location data is critical and valuable to a country seeking to mitigate and adapt to the impacts of climate change. The technology is available. What is needed is commitment to invest in the collection, management, coordination and intelligent use of location data for the benefit of all.

The National Mapping and Geospatial Agencies are central to this. We are the custodians of fundamental location data and have the knowledge and ability to bring data, technology and people together to realise the benefits of location data. We call on all governments to recognise this value and commit to creating appropriate data infrastructures to help propel us all to a sustainable, safer and fairer world.

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Recommendations for governments

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Background to the Cambridge Conference

Every four years since 1928, Ordnance Survey's Cambridge Conference has given mapping and geospatial organisations around the world a chance to connect, share insights on common challenges, and collaborate on matters of global importance.

For more information see cambridgeconference.com or email cambridgeconference@os.uk

Footnotes

[1] This data is called 'location' data here although other terms are used such as 'geographical', 'geospatial' or 'place'.

[2] This data is called 'location' data here although other terms are used such as 'geographical', 'geospatial' or 'place'.

[3] What are ECVs? (esa.int)

[4] GIS Technology Can Back The Pledges Made At Biden's Climate Summit (forbes.com)

[5] Spatial data infrastructure - Wikipedia

[6] EG_annual_review_2020_2021_06_14.pdf (eurogeographics.org)

[7] ParkPower - green energy in urban spaces | Greenspace Scotland and Greenspaces for green energy | Success story (ordnancesurvey.co.uk)

[8] https://arclim.mma.gob.cl

[9] https://simocute.go.cr

[10] Modernising Rwanda's mapping | Success story (ordnancesurvey.co.uk)

[11] LTRP Project Completion Review

[12] GEOGLAM Crop Monitor

[13] GEO (earthobservations.org)

[14] Effectively Use Geospatial Data in the Disaster Management Cycle - L3Harris Geospatial

[15] Effectively Use Geospatial Data in the Disaster Management Cycle

[16] Presentation by Antoine Bavandi, World Bank, at GEO Climate Policy and Finance Workshop, 21-23 Sept 2021

[17] Subedi, Gandhi. (2016). Land Administration and Its Impact on Economic Development

[18] Land tenure and economic development: Evidence from Vietnam - ScienceDirect

[19] Geospatial policy safeguarding in Abu Dhabi | Success story (ordnancesurvey.co.uk)

[20] Home | EuroGeographics

[21] The Home of Location Technology Innovation and Collaboration | OGC

[22] UNSD - UN-GGIM