Applying geospatial information to climate challenges

UN-GGIM Task Team on Geospatial Information for Climate Resilience

Background document to E/C.20/2024/12/Add.1 Geospatial information for climate and resilience[1].

[Notes for reviewer:

- *Text in italics as the beginning of each section have been used to provide guidance on the sections.*
- *This is an advanced unedited copy of the Background Document "Applying geospatial information to climate challenges".*
- *The Task Team will elaborate and build on this draft in the coming months, leading up to the seventh High-Level Forum on United Nations Global Geospatial Information Management (UN-GGIM) that will be convened in Mexico City, Mexico on 8-10 October 2024*
- *It is designed to be an updated version of the Discussion Paper "Geospatial Information for Climate and Resilience – What Does UN-GGIM do?" which was first introduced to the Committee at the Thirteenth Session*
- *Member States are asked to share their national, regional and global experiences demonstrating the role of geospatial information for climate and resilience, building up the body of evidence.*
- *It is expected that the national experiences will be published and made available through an interactive Storymap (or similar platform) which will be enhanced in the lead-up to the Seventh High-Level Forum]*

Call out box:

Quote:

"Geospatial information is crucial towards identifying how our communities are, and could be, impacted by climate change. Armed with this knowledge we can take action."

H.E. Ambassador Francois Jackman, Permanent Representative of Barbados to the UN

[*Notes for reviewers:*

- *Quote and relevant image will be used to open the paper.*

[1] See: https://ggim.un.org/meetings/GGIM-committee/14th-Session/documents/E_C20_2024_12_Add_1_Geospatial_information_for_climate_resilience_16Jul2024.pdf

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Chapter 1 – Introduction

Climate change, the long-term shift of temperature and weather patterns is changing our world, and not for the better. The accumulation of greenhouse gases in the Earth's atmosphere, primarily from burning fossil fuels, is leading to rising global temperatures, changing weather patterns, rising sea levels, and more frequent and severe disasters. These changes are already significantly impacting ecosystems, economies, and communities worldwide, and if left unchecked, will have even more devastating consequences for the future.

The *Paris Agreement*, adopted in 2015, represents a landmark international agreement to limit global warming to below 2deg C above pre-industrial levels, but human activities have caused around 1.1deg C of warming to date, and those impacts are being felt in every region. Recent United Nations Climate Change Conferences have underscored the need to fight the climate emergency, agreeing on the need for adaptation and mitigation (COP26 – Glasgow Climate Pact) and establishing a loss and damage fund for countries most vulnerable to the climate crisis (COP27 – Sharm el-Sheikh Implementation Plan). Further, COP-28 – Dubai, marked the conclusion of the first 'global stocktake' of the world's efforts to address all areas of climate change under the Paris Agreement. Noting that progress was slow across all areas of climate action – including resilience to a changing climate – countries responded by agreeing on methods to accelerate action by 2030.

The Fourth International Conference on Small Island Developing States adopted the *Antigua and Barbuda Agenda for SIDS (ABAS): A Renewed Declaration for Resilient Prosperity* which pledged to help SIDS achieve their priorities in the next ten years. The Declaration reiterated that SIDS remain a special case for sustainable development and that progress requires enhanced global partnerships. Section G(iii) of the ABAS Declaration focused on enhancing science-based and innovative approaches, including sustainable development-oriented, inclusive, and responsible use of artificial intelligence, in the non-military domain in full respect, promotion and protection of human rights and international law, for the collection, storage, analysis disaggregation, dissemination, and use of demographic data for Small Island Developing States, including the use of geospatial technologies.

Call out box:

What is UN-GGIM?

[*Notes for reviewers:*

- *This paper will be written for an external audience.*
- *The inclusion of a section about UN-GGIM will be critical for raising awareness of the Committee and its priorities]*

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Chapter 2 – The need of geospatial information for climate resilience

Geospatial information and management for adaptation and resilience

To build long-term resilience, countries and communities need to build systems that can prevent or better manage risk. This can include taking actions such as investing in resilient infrastructure that can withstand climate impacts, and improving economic and social opportunities that can reduce underlying vulnerability to hazards. This ability to withstand risk, and recover from disasters, in a manner that is transformative and bounces forward, is at the root of resilience.

Geospatial information is a critical component of the nation infrastructure and knowledge economy; a blueprint of what happens where, and the means to integrate a wide variety of government services. The role of geospatial information as foundational data acting as a lens to understand and mitigate the impact of our changing climate cannot by underestimated. Simply, geospatial information is at the intersection of human and physical geography and provides the basis to understand the impacts of climate change on our society and environment and mobilise investments for climate resilience supporting actions to achieve a net-zero increase of greenhouse gas emissions in our atmosphere.

Measuring and monitoring Greenhouse gas emissions

[*To include the opening statement of why we need to monitor greenhouse gas emissions – linked to the need that in order to keep temperature rises to below 1.5 deg we need to mitigate global GHG emissions. To do this you need to be able to measure and monitor. Without it… you can't support countries to adapt to the adverse impacts of climate change.]*

Greenhouse gases (GHGs) contribute to the greenhouse effect, keeping emissions in, and warming our atmosphere. It is important to monitor and measure these gases, to track where they are emitted from and to take action to reduce their impact on climate change where possible. There are many sources of greenhouse gas emissions, natural and anthropogenic, with each source falling into diffuse or point source emissions each of which as a geographic location.

Carbon Dioxide, and its sources and impacts, are well known, methane's impacts are less well known – even though it is the second largest contributor to climate change after carbon dioxide. Methane has a much shorter lifespan in the atmosphere than carbon dioxide, roughly a decade compared to hundreds of years. However, methane is 28 times as potent as carbon dioxide. It is estimated that 60% of today's methane emissions are from human sources. Methane has the potential to have a significant short-term impact of climate change. As a result, measuring and monitoring greenhouse gas emissions is vital to understanding and targeting resources to combat anthropogenic-caused climate change.

Data capture – the role of space

Monitoring and measuring GHG emissions historically occurred through ground-based sensors. These have helped build a picture of global emissions, but there were substantial data gaps, particularly in remote, hard to reach areas. As a result, there was a reliance on reporting, particularly from commercial companies, to be accurate. A substantial increase in the number of satellites able to measure GHG emissions has helped narrow that data gap. Those remote

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areas which caused challenges with ground-based monitoring previously, can now be monitored via satellites.

Space-based sensors have enabled GHG emissions to be measured on different scales. Satellites, which offer data free for end users tend to provide data on a regional scale as they have a spatial resolution on at a kilometre level. Spatial resolution is important as it determines how large an area on the ground each pixel represents. Commercial satellites, with a spatial resolution in the tens of meters, can provide emission measurements on a local scale. Local scale measurements can also be captured through ground-based sensors, some of which can provide real time measurements. Alternatively, air at a site can be sampled then analysed in a laboratory. In addition to the measurements, the ground-based sensors can also act as ground reference data for satellites, validating their measurements. This validation enables fine tuning of satellites' algorithms if required leading to an improvement in the accuracy of the data.

Measuring GHG emissions from space enables a quick feedback mechanism. Some satellites orbit on the same path around Earth, returning to the same point within two weeks. This data (which tends to be openly available to end users) can be accessed within 24 hours of capture. Having consistent data of the same area unlocks long term monitoring capabilities. Commercial satellites can be tasked, which means they can rapidly respond to a request for a site to be monitored. If a leak is detected remotely, a company could task a satellite and receive a measurement within days.

Geospatial data unlocking value from Earth observations

There are challenges with using raw satellite-derived GHG emission data, as users are often lacking the additional context needed to make sense of the data. A solution to this is to layer data from different datasets. With improved spatial resolution of satellites enabling the identification of point sources of GHG emissions, location data is key. If this point source data is not able to be translated into asset ownership on the ground, the potential impact of regulatory or enforcement action is limited. Trusted and authoritative geospatial data can underpin Earth observation data, unlocking its value. National mapping agencies have a vital role to play, as detailed information can be linked with high spatial resolution data to maximise the analysis that can be inferred from space-based data sources.

Changing technology – how data analysis is changing

Climate change is becoming more and more about the details, with each individual component combing to provide the full picture. Technology is advancing at a fast pace to try and fill this information gap. [Link to frameworks]. As noted above, increased spatial resolution in satellite data has revolutionised the level of analysis that can be undertaken. In the case of GHG emissions, low resolution data can provide an indication of a change in emissions of an areas against the expected baseline. Now, high resolution data can pinpoint individual emission events. When combined with foundational geospatial data an understanding of the specific context can be drawn. This data analysis can help close the information gap even further, leading to more targeted GHG reduction efforts. In addition to advances in spatial resolution, GHG detection thresholds have been reduced. This has led to smaller and smaller emissions plumes being detected, which helps to reduce emissions overall. In the past, only super-emitters could be detected, but smaller (and still impactful) emissions could go unmonitored.

Improvements in data analysis can enable countries to understand their emission profiles in more detail; encourage green investments; and increase transparency in GHG reporting.

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Looking ahead there are new satellite programmes scheduled with increased ability to capture data at high spatial resolution.

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Chapter 3 – Enabling Global to Local Decision-making

UN-GGIM as a coordinating mechanism

[*Notes:*

- *This paper will be prepared for publication at the Seventh High-level Forum of UN-GGIM in October 2024. In recognition of the publication date, the text in this section will be updated with relevant decision following the Fourteenth Session of the Committee of Experts.*
- *Efforts will be undertaken to engage with relevant functional groups and thematic networks to identify and report on relevant efforts by the Committee to advocate for and link activities to geospatial information being used for climate resilience.]*

At the global level the importance of geospatial information to combat the climate challenge has been a consistent theme of the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) since its inception. This can be seen through the number of references to climate and resilience within the decisions of the Thirteenth Session of the Committee of Experts across multiple topics.

13/107 - Geosptial information for sustainable development and climate resilience

- … emphasized that acting on climate resilience is now imperative for the Committee of Experts, that we should not delay this item further, and that it is critically important to advocate for and raise awareness of the potential of geospatial information for climate resilience.

13/108 - Integration of geospatial, statistical and other related information

- … regognized that addressing the many data integration challenges presented by complex issues such as climate change and disaster resilience, requires the full implementation of the Global Statistical Geospatial Framework at the national and raional levels.

13/109 - Application of geospatial information related to land administration and management

- … to consider the roles of effective land administration in the areas of climate change…

13/110 - Geospatial informaiton and services for disasters

- … consider guidance on how geospatial and statistical information can be applied in the development of indicators that measure preparation, mitigation and adaptation, in order to monitor the long-term vulnerabilities of communities and infrastructure to disasters and climate change.

13/111 - Integrated Marine geospatial informaiton

- Emphasized that it is strategically crucial for any national hydro or marine programs to increase their value and recognition within the broader national geospatial information management programs that support national development priorities, including the ability to address climate related challenges and improve resilience.

Multilateral Collaboration

Text

The UN-IGIF as the anchor

The role of UN-GGIM's frameworks and policies in achieving the Samoa Pathway (SIDS), Sendai Framework, Paris Agreement, 2030 Agenda

UN Integrated Geospatial Information Framework

Integration of geospatial, statistical and other related information

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Chapter 4 – Geospatial Information as a foundation for climate resilience

[Notes:

- *This section will form the main body of the report.*
- *The national experiences and case studies in this report are an indication of the types of content that will be used.*
- *As the number of national experiences and case studies increases, we will be able to extrapolate common themes.*
- *These common themes are likely to act as the foundation for wider advocacy efforts within the UN-GGIM community and also within external organisations]*

Call out box:

The following National Experiences are included in this paper:

1. AI frameworks for the prediction of bark beetle infestation risk in a continuous monitoring scenario [Submitted by Austria].
2. The impacts of climate change on human health and the health care system [Submitted by Austria].
3. Subsidence and landslide monitoring [Submitted by Austria].
4. Flood hazard mapping for Canada [Submitted by Canada].
5. Spatial data infrastructure enabling seamless sharing of geospatial data across borders and time for the Arctic region [Submitted by Canada].
6. Mapping the effects of heavy rainfall [Submitted by Germany]
7. Digital Twin for Germany [Submitted by Germany]
8. Integrating Geospatial Insights for Community Empowerment and Ecosystem Services: Isimangaliso Wetland Park [Submitted by South Africa]
9. US Virgin Islands's Street Addressing Initiative [Submitted by United States of America]
10. Analysis of coastal erosion and rising sea levels inform coastal erosion risk assessment and adaptation planning [Submitted by the United Kingdom of Great Britain and Northern Ireland]
11. Environmental monitoring and applied research to monitor hydrometeorological disasters [Submitted by Brazil].
12. [Check name for inclusion] Generation knowledge of Brazil and its population [Submitted by Brazil
13. Chile's response to wildfire event – January 2024 [Submitted by Chile]
14. Increasing climate resilience using geographic information system technologies [Submitted by Mozambique].
15. Improved resilience to natural hazards including those affected by climate change [Submitted by Barbados]
16. The Military Geographic Institute of Uruguay and its efforts to promote climate resilience [Submitted by Uruguay]

Geospatial information already plays a vital role in informing resilience, adaption, and mitigation efforts. Many Member States are already using geospatial information, coupled with other information such as Earth observations or environmental data, to make informed policy choices.

In collating the initial set of national experiences, it was decided not to limit the focus to a specific theme or geography. This meant that responses were received covering many different domains. It is clear, even from a small sample size, that geospatial information is already being used across a wide section of climate resilience activities.

These include the response to acute natural hazards such as wildfires in Chile, cyclones in Mozambique, or flooding in Canada.

Geospatial information also plays a role in the monitoring and preparedness for chronic/slower onset hazard events such as coastal zone risk in Barbados or forest health in Austria.

There is also a growing awareness of the potential impact of technology advances such as the use of digital twins in Germany or investing in foundational geospatial data such as the addressing initiatives in the US Virgin Islands.

By interrogating the case studies in more detail, a set of common themes begin to appear.

The importance of **shareable and public open data** was a prominent theme with the use of **dashboards and portals** already being deployed in South Africa, the USA and Brazil. Geospatial data are an integral component for these systems to work and to enable climate resilience decision making between organisations, regions and borders. It is understandable that there is a wide range of maturity levels in the use of geospatial information in…

Additionally, **collaboration** was mentioned across all case studies, either cross-sector or internationally (particularly small island states) highlighting the need for easy means of communication.

A number of case studies demonstrated how organisations collect and **utilise in-situ data and recording** stations, including Mozambique, Brazil, Uruguay, and Germany. Linked to this is an an emphasis on the **standardisation** of data for the purpose of creating and sharing datasets to inform decision making.

Geospatial location data is imperative as it unlocks value by providing context to different types of data and helps to visualise data on the ground, **simulate and model** processes and **monitor** change. Satellite and LiDAR data were mentioned as core data sets across the case studies (South Africa, Canada, Germany) especially when they are integrated with geospatial data.

Finally, there was a clear focus on the need for **delivery against international policies**, such as Agenda 2030 and the Sustainable Development Goals and the use of international standards such as OGC and ISO (Chile, Germany, Mozambique, Brazil, the Arctic SDI, and Barbados) as important collaborations to support interoperable and centralised use of data sets.

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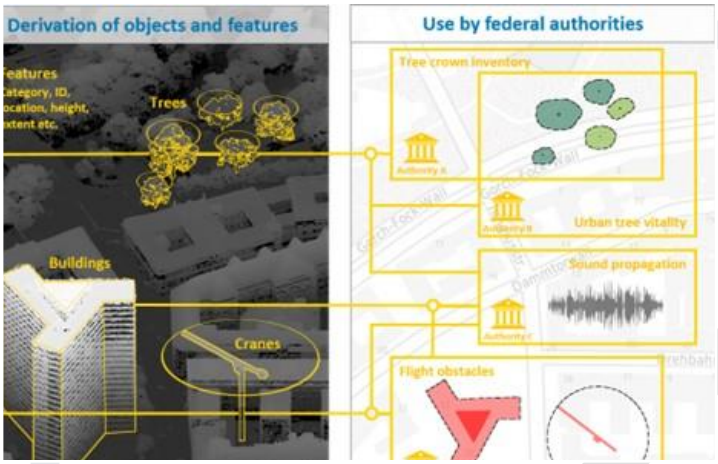
Examples of national experiences received



A Digital Twin for Germany

A tool to predict how humanitarian crisis and natural disasters will affect infrastructure and resources.

BKG is responsible for the development of a geospatial digital twin for Germany.

It operated an immersive 3D world digital lab, which allows decision makers to more directly experience disaster events and to develop better solutions for the future.

Chile response to wildfire event - Jan 2024

Geospatial data coordination, sharing and visualization in order to provide informatio for decision making in the context of wildfires in Valparaíso Region, Central Zone of Chile.

Chile SDI promotes technological neutrality, so a variety of technologies are used as necessary.

The SDI centralizes the storage of geospatial layers so that various institutions can conduct territorial analysis, visualize the deployment of authorities and aid services, and make evidence-based decisions.

Harmonizing Climate Resilience in South Africa

Integrating Geospatial Insights for Community Empowerment and Ecosystem Services: Isimangaliso Wetland Park, Umkhanyakude District, Kwa Zulu Natal, SA

The urgent need for building and harmonising climate resilience in iSimagaliso wetland Park, ecosystem is driven by the pressing need to address the adverse consequences of back-flooding and water ingress in the lower section of the Mfolozi floodplain

The utilization of geospatial information resulted in guiding proposals to mitigate the effects of climate change-induced back-flooding and water ingress on agricultural and settlement areas.

As the number of national experiences and case studies grows and the focus expands to include more Member States, the UN-GGIM thematic networks and the broader geospatial and data communities, it is expected that more common themes will emerge.

Call to Action: Member States, thematic networks and members of the wider UN-GGIM community to continue to share their national, regional and global experiences demonstrating the role of geospatial information for climate and resilience.

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Chapter 5 – 'Enabling action: Accelerating implementation, achieving resilience'

[Notes for Reviewers:

- *This paper will be prepared for publication at the Seventh High-level Forum of UN-GGIM in October 2024. In recognition of the publication date, the text in this section will be updated with relevant decision following the Fourteenth Session of the Committee of Experts.*
- *It will form part of the call to action as described in UN-GGIM Decision 13/107 (c-f) and as aligned with the Terms of Reference agreed for the Task Team.*
- *It will be forward looking in nature, and in recognition of an external audience, will not be tied directly to UN-GGIM and its Programme of Work.*
- Member States and representatives from relevant functional groups and thematic networks are invited to express their opinions on the next steps for this work noting that the Task Team is currently due to complete its work shortly after the Seventh High-Level Forum.*]*

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Acknowledgements

This paper has been developed by the UN-GGIM Task Team on Geospatial Information for Climate Resilience at the request of the United Nations Committee of Experts on Global Geospatial Information Management. The Task Team is led by Barbados, Tonga and the United Kingdom of Great Britain and Northern Ireland.

The Task Team is composed of relevant experts from UN Member States including Argentina, Australia, Austria, The Bahamas, Barbados, Brazil, Canada, Chile, Ethiopia, Germany, Mexico, Mozambique, Nepal, Singapore, South Africa, Tonga, Türkiye, The United Kingdom of Great Britain and Northern Ireland, United States of America.

Lead authors: 7

James Norris, Ordnance Survey, Great Britain

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The Task Team would like to acknowledge the expert contributions of Isabelle Crozier-Morris and Amy Wright from Ordnance Survey for support and input in preparing the report.

National Examples of Good Practice

Member State	Key Message	Topic(s)
Austria	The impacts of climate change on human health and the healthcare system exhibit complex interrelationships, varying across time and space.	Health
	AI frameworks for the prediction of bark beetle infestation risk in a continuous monitoring scenario	Forest Health, Biodiversity, and Artificial Intelligence
	Landslides are one of the most widespread geohazards in Europe, which are further responsible for significant social and economic impacts.	Landslides
Barbados	Improved resilience to natural hazards, including those affected by climate change	Natural Hazards
Brazil	Environmental monitoring and applied research to monitor hydrometeorological disasters	Hydrometeorological Disasters
	Knowledge of the territory and its population	Statistics and NSDI
Canada	Improving knowledge of where floods can occur helps plan mitigation and adaptation efforts	Flooding
Chile	Geospatial data coordination, sharing and visualisation in order to provide information for decision-making in the context of wildfires in the Valparaíso Region, Central Zone of Chile	Wildfires
Germany	Digital Twin for Germany: A tool to predict how humanitarian crisis and natural disasters will affect the infrastructure and resources	Digital Twins
	Mapping the Effects of Heavy Rainfall: Germany-wide standardised simulation of flood situations due to heavy rainfall	Rainfall and Flooding

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Mozambique	Increasing climate resilience using geographic information system technologies	Climate Resilience
South Africa	Integrating Geospatial Insights for Community Empowerment and Ecosystem Services: Isimangaliso Wetland Park, Umkhanyakude District, Kwa Zulu Natal, SA	Community Empowerment and Ecosystem Services
United Kingdom (Scotland)	Adapting to our future coastal change: GIS analysis of coastal erosion and rising sea levels inform coastal erosion risk assessment and adaptation planning to kick-start national adaptation actions	Coastal Erosion and Sea-level Rise
United States (United States Virgin Islands)	US Virgin Island's Street Addressing Initiative - Building Geospatial Infrastructure for Climate Resilience. USVI's Street Addressing Initiative (SAI) is building the basic geospatial data infrastructure needed for climate resilience, disaster planning, and disaster recovery efforts.	Addressing
Uruguay	The Military Geographic Institute of Uruguay and its efforts to promote Climate Resilience (EN/ES)	Geodesy

Other

Arctic SDI	Circumpolar Arctic – Canada*, Finland, Iceland, the Kingdom of Denmark, Norway, the Russian Federation, Sweden, United States *Case study submitted by Canada Spatial data infrastructure enabling seamless sharing of geospatial data across borders and time for the Arctic region Enables discovery, accessibility and use of pan-Arctic geospatial information for diverse applications, including decision-making for climate resilience	Spatial Data Infrastructure

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The impacts of climate change on human health and the health care system exhibit complex interrelationships, varying across time and space.

Gesundheit Österreich GmbH, Federal Ministry of Social Affairs, Health, Care and Consumer Protection

Austria

Your agency's work to build climate resilience (250 Words)

Those population groups that are already disadvantaged due to their demographics, health, or socioeconomic status tend to be more affected by the impacts of climate change and are particularly vulnerable to climate-related health risks due to their specific vulnerabilities. Moreover, the health care system will be affected by the impacts of climate change in different ways. Accordingly, a key determinant of future population health is the effectiveness of existing or planned policies and measures to reduce climate-sensitive diseases and health outcomes. The WHO (2021b) Framework on Climate Change and Health Vulnerability and Adaptation Assessment provides an internationally established method for using quantitative analyses of climate change impacts on population health and the health system to develop local or regional climate change adaptation measures for the health sector and thus sustainably strengthen the climate resilience of the health system.

The present Klimaresilienz-Check Gesundheit (KLIC Gesundheit) for Austrian municipalities and regions was developed based on the WHO Guidelines (2021b) for a Vulnerability and Adaptation Assessment Plan. The tool serves to systematically identify existing and future challenges of climate change for population health and the health care system in Austria and, in a further step, – based on already existing adaptation strategies – elaborates adaptation needs.

The present work has laid a foundation for Austria to develop necessary climate change adaptation measures for the health system in a structured approach. The KLIC Gesundheit offers a standardized method to achieve a climate-resilient population and a climate-resilient health system.

The geospatial tools used for building climate resilience (150 Words)

Selection of indicators: The Health Atlas currently only presents indicators for which data from at least two calendar years and for all federal states are available.

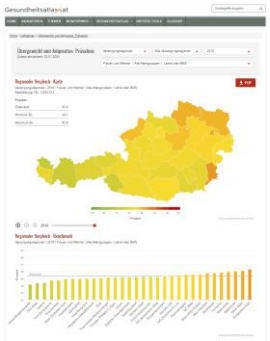
Regional differentiation: The health atlas currently presents data and results at the level of the federal states and supply regions. Further regional differentiations (e.g. at district level) are only taken into account in the health atlas when the set of indicators for which a more in-depth regional differentiation is possible on the basis of suitable data bases goes beyond individual indicators.

Data bases: The Health Atlas uses various data sources and presents data from the year 2000 onwards. Depending on the indicator, administrative data or survey data is used.

Regional comparisons are only presented in the health atlas if there is sufficient data for all regions (i.e. at least for all federal states), i.e. H. a minimum number of cases of 40 cases per region, year and comparison group.

Pictures, Dashboards, Supporting Evidence

[Photo of Dashboards / Resource / Dataset(s)]



https://gesundheitsatlas.at/indikatoren/%C3%BCbergewicht-und-adipositas-pr%C3%A4valenz

Link to metadata :

https://gesundheitsatlas.at/gesundheitsatlas/methodik

Horváth, Ilonka; Delcour, Jennifer; Krisch, Astrid; Schmidt, Andrea E. (2023): Nationaler Klimaresilienz-Check Gesundheit für Gemeinden und Regionen. Grundlagenbericht. Gesundheit Österreich, Wien. https://jasmin.goeg.at/id/eprint/2824/

https://jasmin.goeg.at/view/subjects/A=5FKOKUG.html

https://jasmin.goeg.at/id/eprint/3446/

https://goeg.at/KLIC

Contact Details – Organisational and Focal Point

Austrian National Public Health Institute (GÖG), Stubenring 6, 1010 Vienna, Austria, T: +43 1 515 61-661

Key Statistics / Insights

- Austrian National Public Health Institute (GÖG) (https://goeg.at/OEGIS),
- Federal Ministry of Social Affairs, Health, Care and Consumer Protection

AI frameworks for the prediction of bark beetle infestation risk in a continuous monitoring scenario

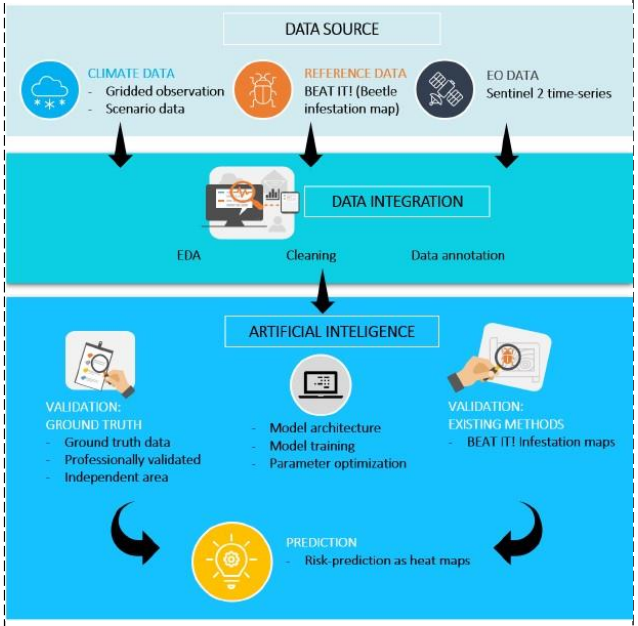
Geosphere Austria (https://www.geologie.ac.at/en/)

Austria

Your agency's work to build climate resilience (250 Words)

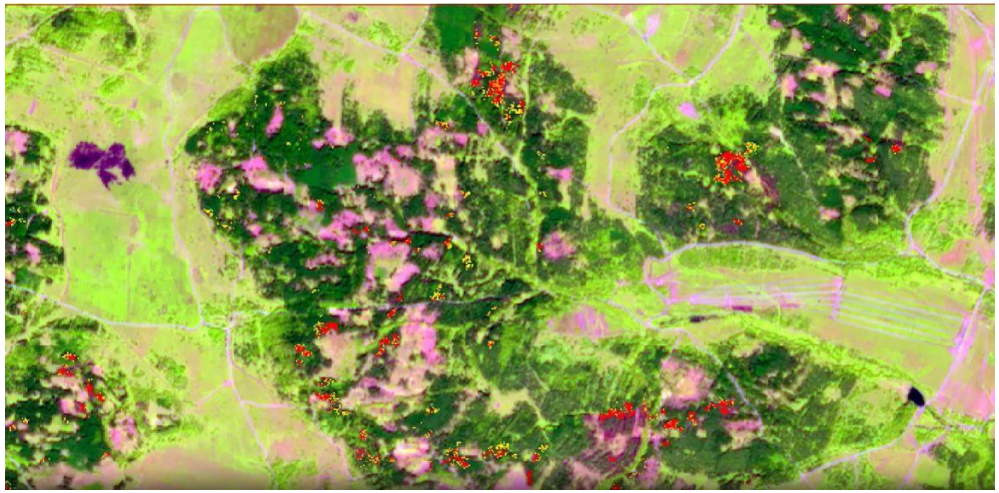
Sentinel-2 based classification of bark beetle infestation mostly maps the red attack stage, where needle color changes indicate the dying infested trees. At this infestation stage, the beetles have often left the host tree and spread to other forest stands in the neighborhood. AI frameworks are trained on rule-based risk maps and Sentinel-2 data. Our risk prediction solutions take into account the vicinity of infested areas and critical meteorological conditions, such as drought stress. This allows us to identify and monitor forest areas with high risk of infestation.

The workflows integrate meteorological data from the SPARTACUS data set, Sentinel-2 data, bark beetle infestation maps and various forest stand related and topography related parameters to train several AI models. Partners: Joanneum Research; Beetle ForTech, Geosphere Austria



Pictures, Dashboards, Supporting Evidence

[Photo of Dashboards / Resource / Dataset(s)]



Link to metadata

https://www.joanneum.at/digital/projekte/aidforheri/

AI Driven Forest Health Risk Indicator https://boost.austria-in-space.at/project/aidforheri/

Artificial Intelligence for Automated Mapping of Land Use and Land Cover
https://boost.austria-in-space.at/project/ai4lulc/

DIGITAL Institute for Information and Communication Technologies Steyrergasse 17 8010 Graz, Austria
Phone: +43 316 876-1776 Fax: +43 316 8769-1735 Mag. Janik Deutscher

Key Statistics / Insights

- JOANNEUM RESEARCH Forschungsgesellschaft mbH https://www.joanneum.at/digital/
- Geosphere Austria https://www.geologie.ac.at/en/

Landslides are one of the most widespread geohazards in Europe, which are further responsible for significant social and economic impacts.

Geosphere Austria (https://www.geologie.ac.at/en/)

Austria

Your agency's work to build climate resilience (250 Words)

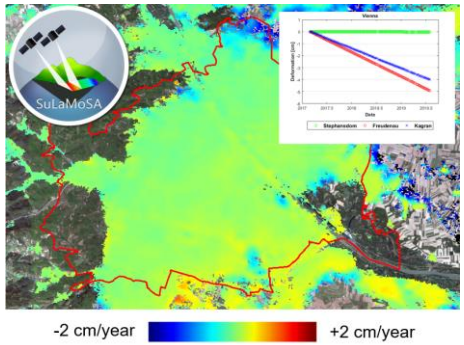
Land subsidence may occur gradually over many years in form of ground surface depressions and seriously harms the sustainable development of society and economy. Until now, not only in Austria no standard method to monitor landslides and subsidence continuously is implemented, but a diversity of approaches based on inhomogeneous data has been rather used in isolated applications. Meanwhile, advanced differential SAR interferometry (D-InSAR) techniques are increasingly accepted to be a well suited method to provide continuous, homogenous and large-area monitoring service. This is not only confirmed by many scientific publications but also by many present as well as future national and supra-national initiatives to set-up ground motion services based on these techniques. The national funded project "Subsidence and Landslide Monitoring Service Austria (SuLaMoSA)" introduces for the first time in Austria a national monitoring service regarding subsidence and landslide mapping based on D-InSAR-technologies. The service will be implemented into and operated by the EODC, Vienna, and developed by Joanneum Research and the Geological Survey of Austria. It delivers unprecedented homogeneity of deformation products with an update rate of few weeks down to couple of days. Based on systematic utilization of Sentinel-1 data the service will guarantee consistent products for a very long period of time.

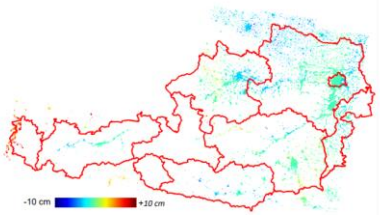
SuLaMoSA can be seen as complementary service to EGMS due to its better temporal and geometrical resolution as well as processing level. With respect to regional or local applications of this technique, SuLaMoSA differs because of its unprecedented homogeneity, anticipated open data policy and sustainability due to its systematic utilization of Sentinel-1 data. Finally yet importantly, SuLaMoSA benefits from the integration into the ACUBE environment, which is more and more establishing as standard user interface of Copernicus products in Austria.

https://sdg.esa.int/sulamosa

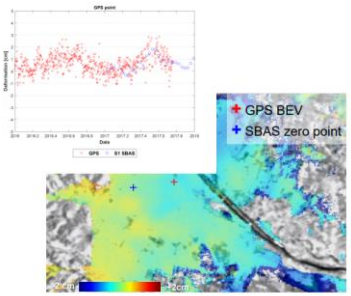
Pictures, Dashboards, Supporting Evidence

[Photo of Dashboards / Resource / Dataset(s)]





Cumulative Displacement



Link to metadata

https://www.geologie.ac.at/fileadmin/user_upload/dokumente/pdf/poster/poster_2018_eo4alps_kociu_et_al.pdf

https://sdg.esa.int/sulamosa
https://www.geologie.ac.at/fileadmin/user_upload/dokumente/pdf/poster/poster_2018_eo4alps_kociu_et_al.pdf
https://esdac.jrc.ec.europa.eu/ESDB_Archive/eusoils_docs/other/EUR23785EN.pdf
https://opac.geologie.ac.at/ais312/dokumente/BR0082_001_A.pdf
https://www.geologie.ac.at/index.php?id=225&projectid=22&L=1

DIGITAL Institute for Information and Communication Technologies Steyrergasse 17 8010 Graz, Austria
Phone: +43 316 876-1735 Fax: +43 316 8769-1735 DI Dr. Karlheinz Gutjahr

Key Statistics / Insights

- JOANNEUM RESEARCH Forschungsgesellschaft mbH https://www.joanneum.at/digital/
- Geological Survey of Austria Department of Engineering Geology www.geologie.ac.at
- EODC Earth Observation Data Centre for Water Resources Monitoring GmbH www.eodc.eu

Key Message

Improved resilience to natural hazards including those affected by climate change.

Coastal Zone Management Unit

Barbados

Your agency's work to build climate resilience (250 Words)

- Under the Coastal Risk Assessment and Management Programme (CRMP), the government of Barbados sought to build resilience to coastal risks (including those associated with coastal hazards, natural disasters and climate change) by building capacity in integrated coastal zone management via incorporating disaster risk reduction and climate change adaptation into the coastal planning framework.
- The CRMP was funded by the Inter-American Development Bank (30 million USD), along with counterpart funding by the Government of Barbados (12 million USD)
- The data and information developed under the CRMP was integrated within various data management and analysis platforms managed by the Unit or managed by the Ministry for Innovation, Science and Smart Technology, one of which is the National Coastal Risk Information and Planning Platform (NCRIPP)
- The datasets developed include geodatabases, shapefiles, rasters, delimited text files. Most data described by the ISO 19135 metadata standard
- The platforms, data and derived information have been utilized across Government, NGOs, the private sector and academia

One of the primary outputs of the CRMP was the National Coastal Risk Information and Planning Platform (NCRIPP), a web-based set of risk evaluation and communication tools to support risk-based decision making regarding development planning, emergency management and climate change adaptation.

Pictures, Dashboards, Supporting Evidence

See next page

Not online

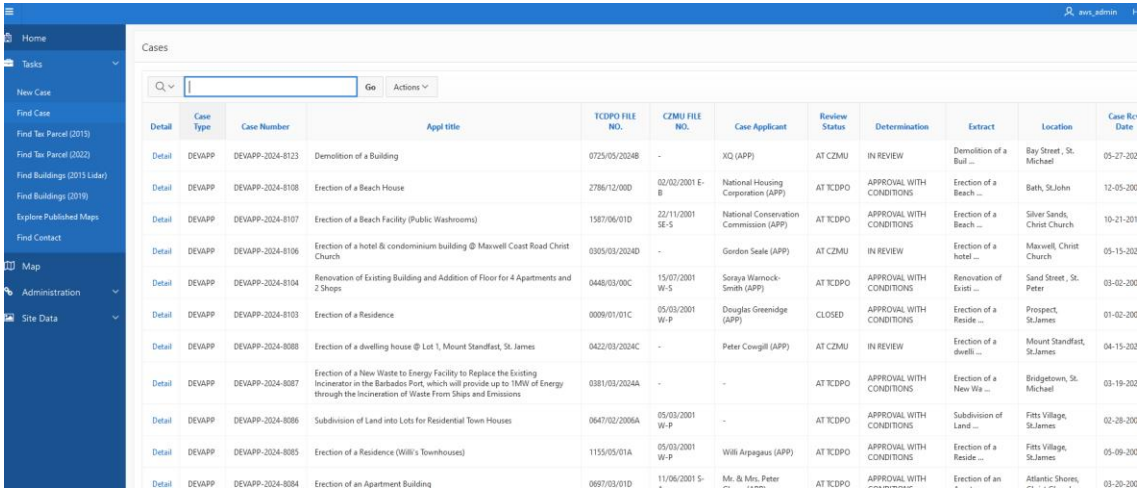
Coastal Zone Management Unit, 2024

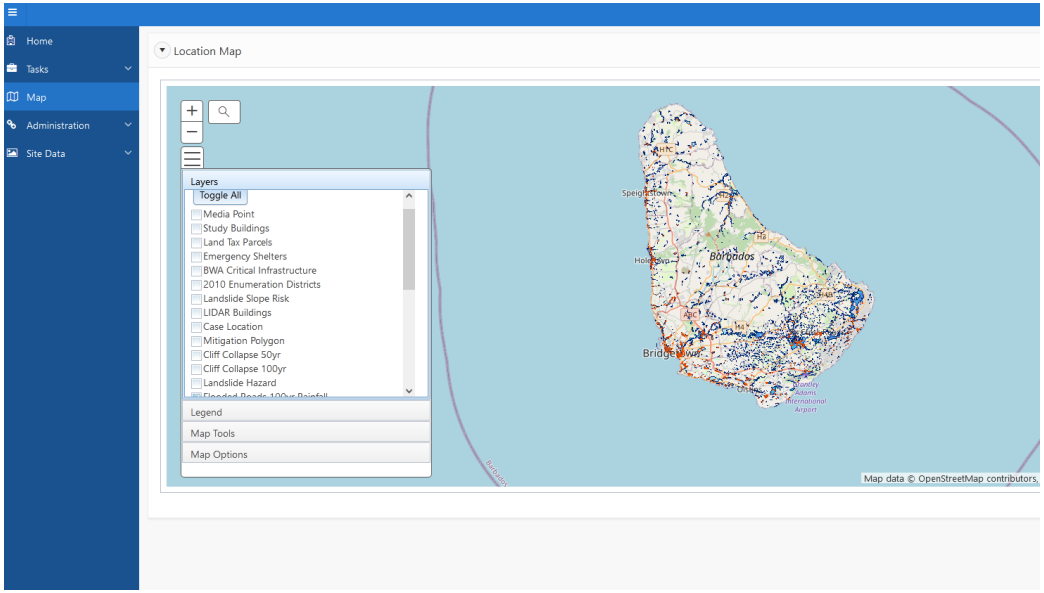
CZMU COASTAL ZONE MANAGEMENT UNIT

Warrens Towers 2. Warrens. St. Michael. Barbados

Key Statistics / Insights

- Dashboard not currently public
- Over 30 datasets represented on NCRIPP
- Local to Barbados
- CZMU, Planning Development Department, Department of Emergency Management


Home
Tasks
New Case
Find Case
Find Tax Parcel (2015)
Find Tax Parcel (2022)
Find Buildings (2015 Lidar)
Find Buildings (2019)
Explore Published Maps
Find Contact
Map
Administration
Site Data
Cases
Go
Actions
Detail
Case Type
Case Number
Appl title
TCDPO FILE NO.
CZMU FILE NO.
Case Applicant
Review Status
Determination
Extract
Location
DEVAPP-2024-8123
Demolition of a Building
DEVAPP-2024-8108
Erection of a Beach House
DEVAPP-2024-8107
Erection of a Beach Facility (Public Washrooms)
DEVAPP-2024-8106
Erection of a hotel & condominium building @ Maxwell Coast Road Christ Church
DEVAPP-2024-8104
Renovation of Existing Building and Addition of Floor for 4 Apartments and 2 Shops
DEVAPP-2024-8103
Erection of a Residence
DEVAPP-2024-8088
Erection of a dwelling house @ Lot 1, Mount Standfast, St. James
DEVAPP-2024-8087
Erection of a New Waste to Energy Facility to Replace the Existing Incinerator in the Barbados Port, which will provide up to 1MW of Energy through the Incineration of Waste From Ships and Emissions
DEVAPP-2024-8086
Subdivision of Land into Lots for Residential Town Houses
DEVAPP-2024-8085
Erection of a Residence (Willi's Townhouses)
DEVAPP-2024-8084
Erection of an Apartment Building


Home
Tasks
Map
Administration
Site Data
Location Map
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Toggle All
Media Point
Study Buildings
Land Tax Parcels
Emergency Shelters
BWA Critical Infrastructure
2010 Enumeration Districts
Landslide Slope Risk
LIDAR Buildings
Case Location
Mitigation Polygon
Cliff Collapse 50yr
Cliff Collapse 100yr
Landslide Hazard
Legend
Map Tools
Map Options
Barbados
Bridgetown
Map data © OpenStreetMap contributors,

Key Message

[Environmental monitoring and applied research to monitor hydrometeorological disasters]

National Center for Monitoring and Early Warning of Natural Disasters (CEMADEN)

Brazil/ South America

Your agency's work to build climate resilience (250 Words)

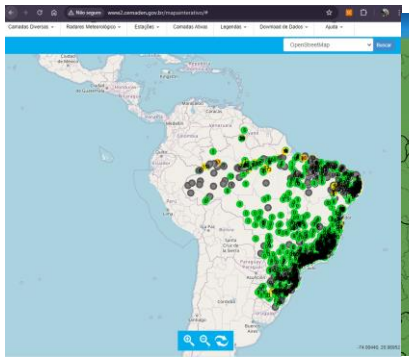
The National Center for Monitoring and Early Warning of Natural Disasters (CEMADEN) is a research unit of the regimental structure of the Ministry of Science, Technology and Innovation (MCTI). The Center has established a climate-related disaster early warning system, adopting the scientific, technological and innovation capacity to continually improve the early warning for the national territory. For this, CEMADEN uses a hydro-geo-meteorological monitoring networks, modeling technologies and forecasts to anticipate, as efficiently and effectively as possible, the impacts of disasters on society, infrastructure and the environment.

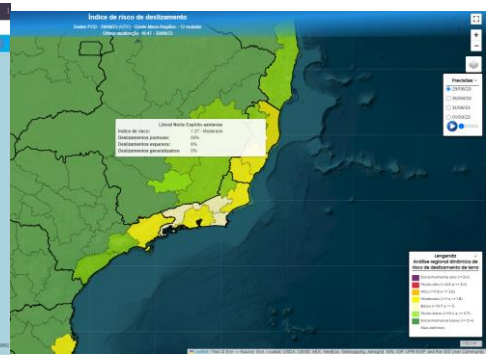
Based on data and information of several sources and observational networks, CEMADEN analyses and issues early warning of risks of geodynamic processes of landslides, hydrological alerts associated to floods and impacts of severe droughts. This network consists of nine dual-polarization S-Band weather radars, 3500 telemetric rain gauges, 301 hydrological stations equipped with pluviometers, water level sensors, and cameras, 130 geotechnical stations with soil moisture sensors for different depths, and 595 automatic weather stations equipped with soil moisture sensors.

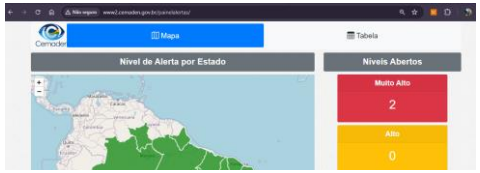
The geospatial tools used for building climate resilience (150 Words)

- Disaster risk maps of landslides and floods.
- Data Visualisation Platform for monitoring and issuing early warnings.
- Database of disaster occurrences and impacts for the monitored municipalities by CEMADEN.
- Integrated Drought Index (IIS): index for drought monitoring and impact assessment
- Operational Index for Vulnerability Analysis (InOV): index for populational vulnerability evaluation applied for an early warning system.
- Hydrological modelling for flood disaster prediction and reservoir level forecast

Pictures, Dashboards, Supporting Evidence







Link to metadata

http://www2.cemaden.gov.br/mapainterativo/
http://www2.cemaden.gov.br/painelalertas/
https://mapasecas.cemaden.gov.br/

Sources

https://www.gov.br/cemaden/pt-br

Regina Célia dos Santos Alvalá – Director (regina.alvala@cemaden.gov.br)

Key Statistics / Insights

- Monitoring and issuing early warnings for 1,133 Brazilian municipalities affected by landslides and floods.
- Drought impact assessment for the 5,570 Brazilian municipalities
- 28,000 monthly visits to Mapa Interativo (http://www2.cemaden.gov.br/mapainterativo/)
- 21 insititutional partnerships for research, development and innovation (reference year: 2023)
- 143 scientific papers published in 2023.

Key Message

Knowledge of the territory and its population

Lead/Coordinating Agency Name Brazilian Institute of Geography and Statistic

Country / Region Brazil

The IBGE works on research that portrays the territory, such as the Geographic Reference Framework for the Production, Analysis and Dissemination of Statistics; the Continuous Cartographic Base (https://www.ibge.gov.br/en/geosciences/territorial-organization/territorial-organization/24298-geographic-chart-of-reference-for-the-production-analysis-and-dissemination-of-statistics.html?lang=en-GB); the Altimetric (https://www.ibge.gov.br/en/geosciences/geodetic-positioning/geodetic-networks/19204-altimetric-network.html) and Tide gauge networks (https://www.ibge.gov.br/en/geosciences/geodetic-positioning/geodetic-networks/19307-geodetic-permanent-tide-gauge-network.html); the Hydrographic Basins and Divisions (https://www.ibge.gov.br/en/geosciences/environmental-information/environmental-studies/31715-bacias-e-divisoes-hidrograficas-do-brasil-2.html); Land Cover and Land Use (https://www.ibge.gov.br/en/geosciences/environmental-information/land-use-and-cover/19098-changes-in-land-use-and-cover.html); Landslide Susceptibility (https://www.ibge.gov.br/en/geosciences/environmental-information/geomorphology/24512-macrocharacterization-of-natural-resources-in-brazil.html?edicao=26196); and the mapping of Geology, Geomorphology, Pedology, Vegetation (https://bdiaweb.ibge.gov.br/#/home) and Biomes (https://www.ibge.gov.br/en/geosciences/environmental-information/vegetation/18341-biomes.html). It also works with the knowledge of its population, such as for the Demographic and Agricultural Census surveys, and also has research into the integration of geospatial risk data with population data from the Demographic Census to identify the Population in Risk Areas (https://www.ibge.gov.br/en/geosciences/environmental-information/environmental-studies/22187-population-in-risk-areas-in-brazil.html).

The research is mostly funded by permanent resources from the Federal Government.

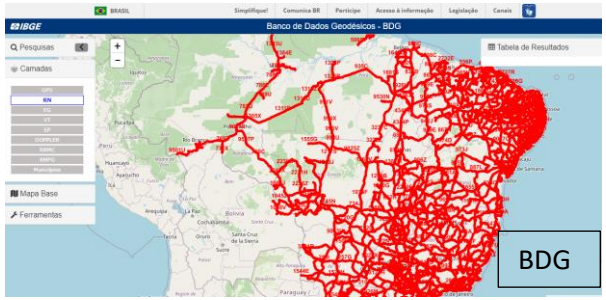
All the surveys are stored in secure databases, have statistical and geoscientific metadata and are all available on the IBGE Portal, in addition to some specific applications, for the entire population. Data on the population follows strict rules to guarantee statistical confidentiality, including those made available geospatially. All of them have technical, methodological and/or analysis notes. The norms regarding metadata standards, the fundamental principles of official statistics or the structuring of vector geospatial data, among others, follow international standards and are available in publications dedicated to the topics.

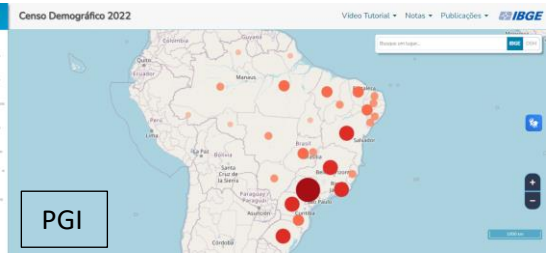
In addition, the IBGE is the General Coordinator of the Sustainable Development Goals, and coordinates some of the goals such as 13, Action Against Climate Change, and 15, Life on Land (https://odsbrasil.gov.br/objetivo/objetivo?n=15).

The geospatial tools used for building climate resilience (150 Words)

The IBGE does not have a tool dedicated to climate resilience, but it does produce data that is used by public policies for different purposes, including this one. Among the existing platforms are the Geodetic Database - BDG (http://www.bdg.ibge.gov.br/appbdg/)-; the Interactive Geographic Platform – PGI (https://censo2022.ibge.gov.br/apps/pgi/#/home) - the Environmental Data and Information Bank – BdiA (https://bdiaweb.ibge.gov.br/#/home) - and the IBGE Automatic Retrieval System – SIDRA (https://sidra.ibge.gov.br/home/pnadcm).

In addition, the IBGE coordinates the National Spatial Data Infrastructure – INDE (https://inde.gov.br/) - which seeks to centralize all public geospatial information in the different spheres of government.





Link to metadata

https://metadados.ibge.gov.br/consulta

Sources

https://bdiaweb.ibge.gov.br/#/home

https://www.ibge.gov.br/apps/populacaoareasderisco/#/home

Logo Name

IBGE - Brazilian Institute of Geography and Statistics Foundation
Avenida Franklin Roosevelt, 166, Centro, Rio de Janeiro - RJ. CEP 20021-120
Focal point Therence Paoliello de Sarti – therence.sarti@ibge.gov.br

Key Statistics / Insights

- Number of Public Dashboard Views
- Number of Geospatial Datasets harmonised
- Number Geographies
- Participating Agency/Entities

Flood Hazard Mapping for Canada

Improving knowledge of where floods can occur helps plan mitigation and adaptation efforts

Canada Centre for Mapping and Earth Observation (CCMEO)

Canada

Flooding represents Canada's most costly disaster causing ~$1 billion in damage each year. Climate Change is expected to increase the risk of flooding across much of the country through increased rainfall, more extreme rain events and coastal storm surges. Geospatial information is key for understanding where flood risks will exist under a changing climate, allowing governments to take adaptation and mitigation decisions to reduce future flooding impacts across the country.

As the lead agency for flood mapping in Canada, the CCMEO undertakes several areas of work to help manage flooding today and in the future:

- Enables collaborations with the flood mapping community to improve flood hazard mapping across Canada
- Provides access to data related to flood mapping such as historical flood maps and foundational geospatial information
- Creates real-time maps of flood extents and river ice break-up to inform emergency responders
- Completes research to develop new tools, methods and applications for flood mapping, including artificial intelligence driven techniques

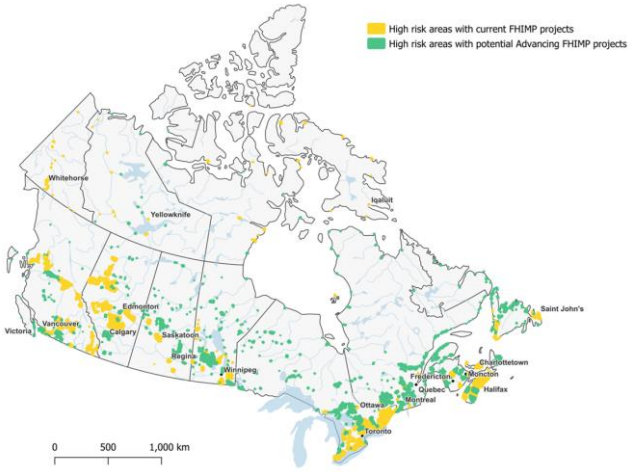
Key to this effort is advancement of the Federal Flood Mapping Guidelines Series, a set of resources to help standardize how flood mapping activities are completed nationally. This includes guidelines for activities such as acquiring Light Detection and Ranging (LiDAR) data, estimating flood damage costs for infrastructure, and approaches for incorporating climate change considerations into flood mapping. Canada is also investing in the creation of modern flood hazard maps through the Flood Hazard Mapping and Identification Program (FHIMP). Through FHIMP, Canada is providing $164.2 million to help its provinces and territories complete flood mapping for higher risk areas to better inform land use planning, flood mitigation, and climate change adaptation decisions.

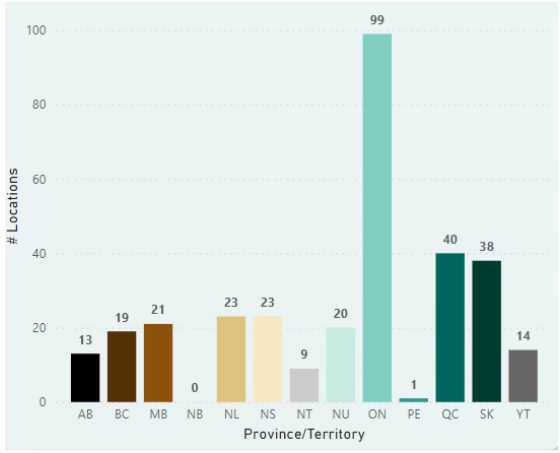
The CCMEO uses a range of geospatial data and tools to support its flood mapping work. Examples include:

- Earth observation data such as LiDAR and satellite imagery represent foundational data sources for creating flood maps.
- ClimateData.ca provides tools to access, visualize and analyze historical and future climate data from across the country. This information supports flood map development.
- The High Resolution Digital Elevation Model (HRDEM) provides elevation data at 1-2 metre resolution for all of Canada. This data helps with understanding where water may flow during flood events.
- The Flood Susceptibility Index uses historical flooding information with machine learning to identify flood-prone regions across Canada.
- Geospatial Artificial Intelligence (GeoAI) is increasingly being used to rapidly identify geographic features like lakes and rivers. GeoAI is an emerging tool for supporting CCMEO's flood mapping work.

Pictures, Dashboards, Supporting Evidence

Left figure shows flood hazard mapping priorities with current projects highlighted in yellow. Right figure shows the number of flood hazard mapping related projects underway in each province and territory.





Links on p. 1 provide access to metadata for noted geospatial information sources. Metadata for all open geospatial datasets available in Canada can be found through Geo.ca.

Sources :

- Flood mapping in Canada
- Climate change and floods in Canada

Key Statistics / Insights

- **Number of Geographies:** 248 projects covering 320 locations across Canada
- **Participating Agency/Entities:** Agreements defined between CCMEO and each of Canada's provinces and territories to deliver flood hazard mapping solutions
- **Participating Stakeholders / Research Partners:** Research collaborations exist with leading academic institutions on regional flood hazard modelling (Concordia University, University of Waterloo, University of Prince Edward Island) and with Indigenous communities on integration of Traditional Knowledge into flood mapping processes

Natural Resources Canada | Ressources naturelles Canada

floodhazardidmapping-iddecartographiedesaleasdinondation@nrcan-rncan.gc.ca

Chile Response to Wilfire Event – January 2024

Geospatial data coordination, sharing and visualization in order to provide information for decision making in the context of wildfires in Valparaíso Region, Central Zone of Chile

National Geospatial Data Infrastructure - Chile SDI

Chile / South America

Your agency's work to build climate resilience (250 Words)

One of the main objectives of Chile's Spatial Data Infrastructure (Chile SDI) is to coordinate various state institutions that generate geospatial information. The goal is to have as much geospatial data as possible available for different stages: preparation, response, and recovery, to anticipate, respond to, and be more resilient against the effects of natural disasters, which are exacerbated by climate change and the vulnerability of the population.

Chile SDI has the "Geoportal of Chile" which features a catalog of geospatial data updated and validated by the responsible institution. This data is documented and complies with interoperability and data quality standards. Additionally, during emergencies, IDE Chile activates the "Multisectoral Emergency Working Group (GTM)," coordinating 43 public institutions that upload key emergency data to an internal platform.

These efforts centralize the storage of geospatial layers so that various institutions can conduct territorial analysis, visualize the deployment of authorities and aid services, and make evidence-based decisions.

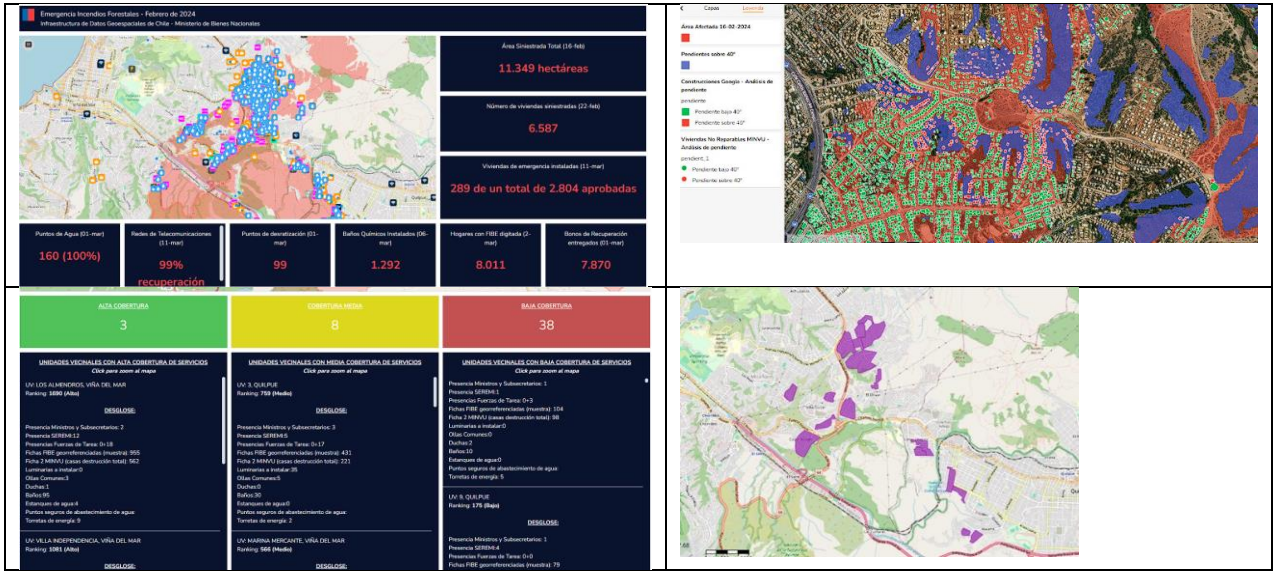
The geospatial tools used for building climate resilience (150 Words)

Chile SDI promotes technological neutrality, so a variety of technologies are used as necessary. For data storage in internal work instances, Geonodo is used, which is a geospatial data management software that provides a visual output for data, making it shareable with decision-makers. Additionally, Geonodo was crucial for collecting field data to monitor the deployment of authorities in affected areas. For sharing large layers, such as drone images or elevation models, the OneDrive platform is utilized.

Geospatial analysis is achieved using QGIS.

MAXAR platform to download satellital imagery.

Pictures, Dashboards, Supporting Evidence



Built buildings after emergency: https://idembn.bienes.cl/emergenciaseremi/dashboard/1044

Neighborhood Unit Analysis : https://idembn.bienes.cl/emergenciaseremi/dashboard/969

Affected companies : https://www.geoportal.cl/Economia/dashboard/106

Deployment of authorities : https://idembn.bienes.cl/idembn/map/1012

Cross-analysis of housing variables with slope: https://idembn.bienes.cl/emergenciaseremi/map/1130

INE – Pre-census 2023 (neighborhood units); MINSAL – Health points and sanitation booths; SENAPRED – Emergency housing; MINVU – Forms 1 and 2 (Updated); Security – Patrol and surveillance coverage; Energy – Replaced connections; SAG – Rodent control points; Ministry of National Assets - Deployment of authorities. Satellital Imagery : SAF, MOP, MBN.

Ministerio de Bienes Nacionales
IDE CHILE
Infraestructura de Datos Geoespaciales

Contact Details:

- Sofía Nilo – sofia.nilo@mbienes.cl – Executive Secretary Chile SDI
- Raffaella Anilio – ranilio@mbienes.cl – Chile SDI Analyst.

Number of Geospatial Datasets harmonised:

429 geospatial points about the deployment of authorities.

1562 points of information about delivered aids in the affected area that gather the data of more than 15 datasets from different institutions.

Participating Agency/Entities

Around 40 institutions in total.

- Municipalities
- Center for Natural Resources Information.
- National Institute of Statistics.
- National Service of Geology and Mining.
- Superintendency of Sanitary Services.
- Ministry of National Defense.
- National Monuments Council.
- Ministry of Energy.
- Ministry of Economy, Development, and Tourism.
- Ministry of Housing and Urban Development.
- Ministry of the Environment.
- Aerophotogrammetric Service of the Chilean Air Force.
- Ministry of the Interior and Public Security.
- Ministry of Public Works.
- Ministry of Social Development and Family.
- Ministry of Agriculture.
- …

Digital Twin for Germany

A tool to predict how humanitarian crisis and natural disasters will affect the infrastructure and resources

Federal Agency for Cartography and Geodesy (BKG)

Germany

- **Drivers for the work (Motivation)**
  - The Federal Government including aid organizations
  - Requirement for a tool to simulate and predict different response strategies to crisis and disasters
  - Decision-makers shall be sensitized and trained for emergencies
  - Need to improve the coordination of rescue forces in a federal system
- **Funding**
  - Additional budget of ca. 60 Mill. Euro from the Federal Government for data collection and staff at BKG
- **Data management best practice**
  - Existing federal geodata is made available as a data basis, as well as a 3D-data acquisition of the surface area of Germany
  - A number of pilot use cases: environment, security, agriculture, prediction of heavy rainfall, promotion equal living conditions
- **Data specification of 3D-data and standards**
  - LIDAR technology
  - 40 points/m^2 density
  - Point cloud classification in accordance with ASPRS standards
- **Impact and evaluation**
  - In Germany, BKG will provide a digital twin in 2026 which will help the Federal government to model, simulate and test the impacts of humanitarian crises that affect the infrastructure and resources of specific areas. This allows to propose possible solutions and to gain new insights into underlying effects. On this basis actions can be taken.

BKG uses increased processing capabilities through cloud computing and artificial intelligence, or improved surveying techniques and methodologies.

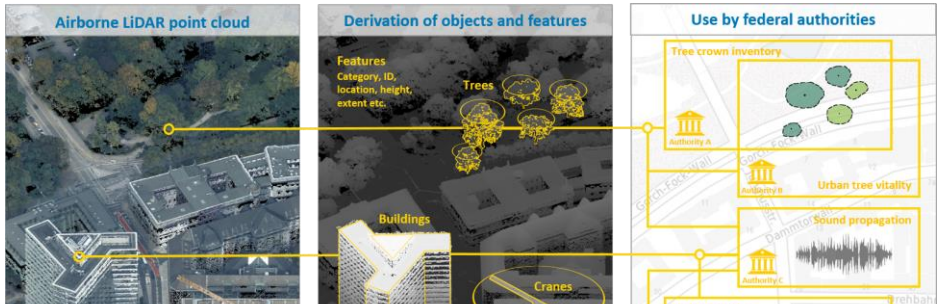
A keystone of a geospatial digital twin is a standard inventory of assets. That includes 3 D models and topography, Points of interest such as buildings or expert knowledge to bring it all together in an interoperable way.

BKG is responsible for the development of a geospatial digital twin for Germany

BKG operates an immersive 3D World digital lab, which allows decision-makers to more directly experience disaster events and to develop solutions for the future.

Pictures, Dashboards, Supporting Evidence

[Photo of Dashboards / Resource / Dataset(s)]



Link to metadata

Not yet available, but link to website: https://www.bkg.bund.de/DE/Forschung/Projekte/Digitaler-Zwilling/Digitaler-Zwilling_cont.html

Geospatial World, May 2023: https://www.geospatialworld.net/prime/prime-opinion/value-geospatial-digital-twin-germany/

Key Statistics / Insights

- Number of Geospatial Datasets harmonised
- Number of Participating Agencies/Entities

Not yet available

BKG
Wir geben Orientierung.

Federal Agency for Cartography and Geodesy
Department Geodata
Richard-Strauss-Allee 11
60598 Frankfurt am Main, Germany
Contact information: AufbaustabDZ@bkg.bund.de
www.bkg.bund.de

Mapping the Effects of Heavy Rainfall

Germany-wide standardized simulation of flood situations due to heavy rainfall

Federal Agency for Cartography and Geodesy (BKG)

Germany

Motivation

- Recent climate change studies show an increasing trend in the frequency of extreme weather events, these include storms with high-intensity precipitation, known as heavy rainfall.
- The amount of precipitation can be so high in a very short period of time that catastrophic flooding can also develop far away from rivers and lakes.
- Heavy rainfall events have occurred more frequently in Germany in recent years, resulting in severe damage. Higher attention on risk management and prevention.

Project description/Goal

- Development of a German-wide indication map representing simulated flood situations after heavy rainfall events based on standardized guidelines and geodata for an easy comparison.
- Cooperation with hydrological federal and state authorities to achieve a realistic simulation result
- Contribution to an optimal preparation for the consequences of heavy rainfall events
- Funded by the current budget of the federal government/BKG

Background and impact

In July 2021 Germany and neighbouring countries faced one of the most disastrous flooding in younger history. The floods followed heavy, unexpectedly prolonged rainfall. As a result, whole settlements were destroyed and many people lost their life.
The indication map for heavy rainfall provides an initial assessment of the risk potential and serves as an important tool for identifying zones at risk from heavy rainfall. Resulting in an easy-understandable map, it enables planners and emergency services to derive appropriate measures and will help minimizing the extent of damage and life danger both preventively and in the event of an actual disaster. The final model will be integrated into a digital twin in combination with short term rainfall predictions. A European initiative for transnational extension in the interest of joint civil protection is currently being discussed within BKG.

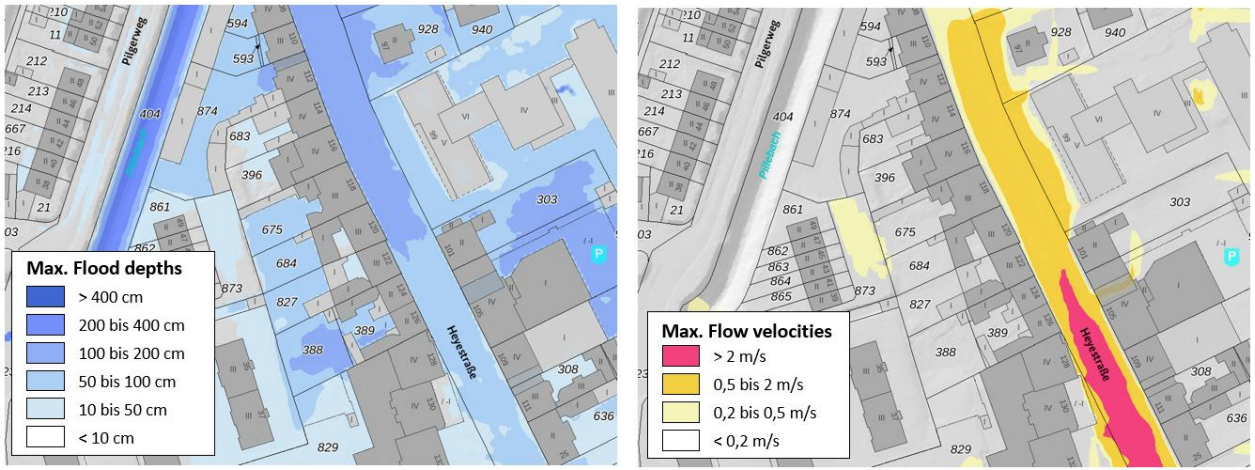
Essential geo-datasets

- Digital Terrain Model (DTM, 1m resolution) of the German federal states
- 3D-building models
- Land-use data
- River catchment areas
- Location, dimension and capacity of pumping stations and culverts
- Heavy rainfall evaluation data of the German Weather Service (DWD)

Methodology

- Hydronumerical non-stationary 2D-simulation, exact solution to the shallow water equation
- Hydrologically effective modification of the DTM for a realistic discharge:
  - 3D-Building models with standardized roof shapes act as a flow barrier
  - Integration of terrain roughness and road culverts

Mapping simulated flood depths and flow velocities



Heavy rainfall caused flood depth and flow velocity maps provide an initial assessement of the risk potential for deriving preventive and event-based measures in planning and civil protection.

References

BKG press release on website (German), 11-05-2023: https://www.bkg.bund.de/SharedDocs/Pressemitteilungen/BKG/DE/PM_2023/230511-Kickoff-Starkregen.html

Wimmer, L., Hovenbitzer, M., and Merita, P., 2024: Establishing a Germany-wide Standardized Indication Map Representing the Flood Situation Caused by Heavy Rainfall, EGU General Assembly 2024, Vienna, Austria, 14–19 Apr 2024, EGU24-15605, https://doi.org/10.5194/egusphere-egu24-15605, 2024.

Wimmer, L., Hovenbitzer, M., Lenk, M., Katz, E., Engel, M., 2023: Reference Maps Showing Heavy Rain Hazards: A Project by the German Federal and State Governments (German). KW Korrespondenz Wasserwirtschaft 2023 (16), Nr. 11. https://doi.org/10.3243/kwe2023.11.001, 2023.

Status

- Federal state of North Rhine-Westphalia finished as pilot in 2021.
- Eleven federal states are currently being processed.
- German-wide coverage planned by end of 2025.

Key Insights

- Standardized *data basis*, *precipitation scenarios* and *visualisation* enable a comparable assessement of flood situations for planning and civil protection.
- Publication as *OpenData* Web-Map-Service and download.
- High visitor traffic to the data of North Rhine-Westphalia reflects *continuing interest* and *strong demand.*

BKG
Wir geben Orientierung.

Federal Agency for Cartography and Geodesy
Department Geodata
Richard-Strauss-Allee 11
60598 Frankfurt am Main, Germany
Contact information: starkregen@bkg.bund.de
www.bkg.bund.de

Key Message

"Increasing climate resilience using geographic information system technologies"

Lead/Coordinating Agency Name: **GREPOC**

Country / Region: **Mozambique**

The National Agency for Geospatial Development (ADE) played a crucial role in increasing climate resilience in Mozambique, particularly in supporting GREPOC to reassemble the victims of cyclones Idai and Kenneth. Using Geographic Information Systems (GIS), ADE developed detailed maps that identified safe zones for resettlement, categorizing inundation risk areas into high, medium and low levels, as well as demarcating regions where surface water exceeded one meter in depth. This initiative included the application of best data management practices, ensuring that the information collected was rigorous and updated. Data specifications and standards were strictly followed, ensuring the consistency and reliability of geospatial information. ADE also carried out an impact assessment to measure the effectiveness of the maps in mitigating disaster risks, showing that these tools were indispensable in identifying safe areas for the resettlement of affected communities. With GIS, ADE provided GREPOC with the necessary tools to plan and implement the resettlement efficiently and safely. As a result, residences were built in safe zones, allowing families affected by the cyclones to resettle in areas less vulnerable to future natural disasters. This work not only contributed to the recovery of the communities, but also established a model for disaster management and climate change adjustment in Mozambique. ADE's use of GIS exemplifies how this technology can be used to combat complex environmental challenges, promoting sustainable and resilient development. The collaboration between ADE, GREPOC and other partners was fundamental to the success of these initiatives, highlighting the importance of cooperation and knowledge sharing in disaster management and in building safer, more future-proof communities.

All the information about our climate resilience is under our website and PREPOC report

http://www.grepoc.org.mz

The geospatial tools used for building climate resilience:

GREPOC is currently using Drones for capturing the actual scenarios, for WASH, Agriculture and Infrastructure projects. Additionally, they use ArcGIS, Meta shape, Kobo Tool Box and PowerBI.

The National Agency for Geospatial Development (ADE) used geospatial tools and technologies to support the resettlement of victims of Cyclones Idai and Kenneth. ADE produced detailed spatial analyses and created maps that identified risk areas for inundation, categorized as high, medium and low risk. These tools enabled effective management of geospatial data, ensuring that the information was appropriate and updated. ADE made easier to identify safe areas for resettlement. Data visualization helped GREPOC make informed decisions, promoting the safety and resilience of affected communities. The detailed maps and spatial analyses were crucial for designing and implementing effective disaster mitigation strategies.

Link to Applications

Contingency Plan 2020/2021: https://analisepc.mozgis.gov.mz

Atlas of Preparation and Response to Natural Disasters in the Limpopo Basin: https://shre.ink/DiSE

Key Statistics / Insights (from GREPOC)

- 02 Public Dashboard Views
- 01 Geospatial Datasets harmonised
- 05 Participating NGOs

Sources:

http://www.grepocmis.org.mz

www.mozgis.gov.mz

GREPOC

Contact Details – Organizational and Focal Point

Focal Point: Executive Director, Luis Paulo Mandlate

MIS Administrator & IT Specialist: Délcio Mucombo

Pictures, Dashboards, Supporting Evidence

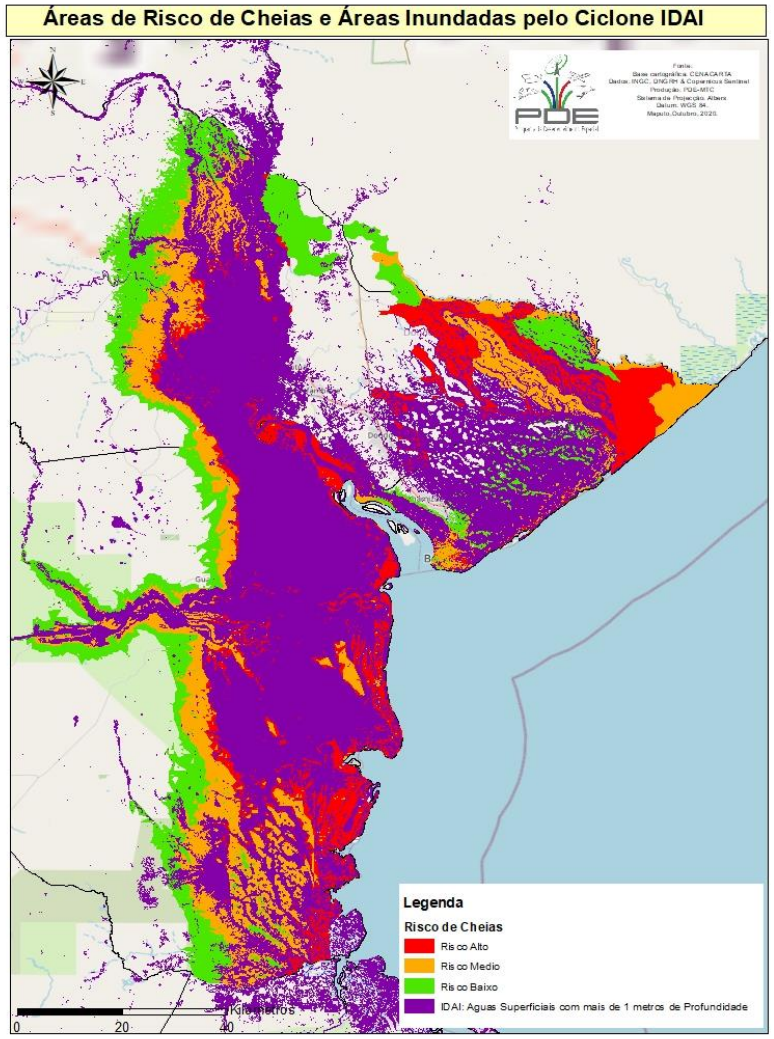


Figure 1 Map of Inundation Risk Areas and Areas Inundated by Cyclone IDAI

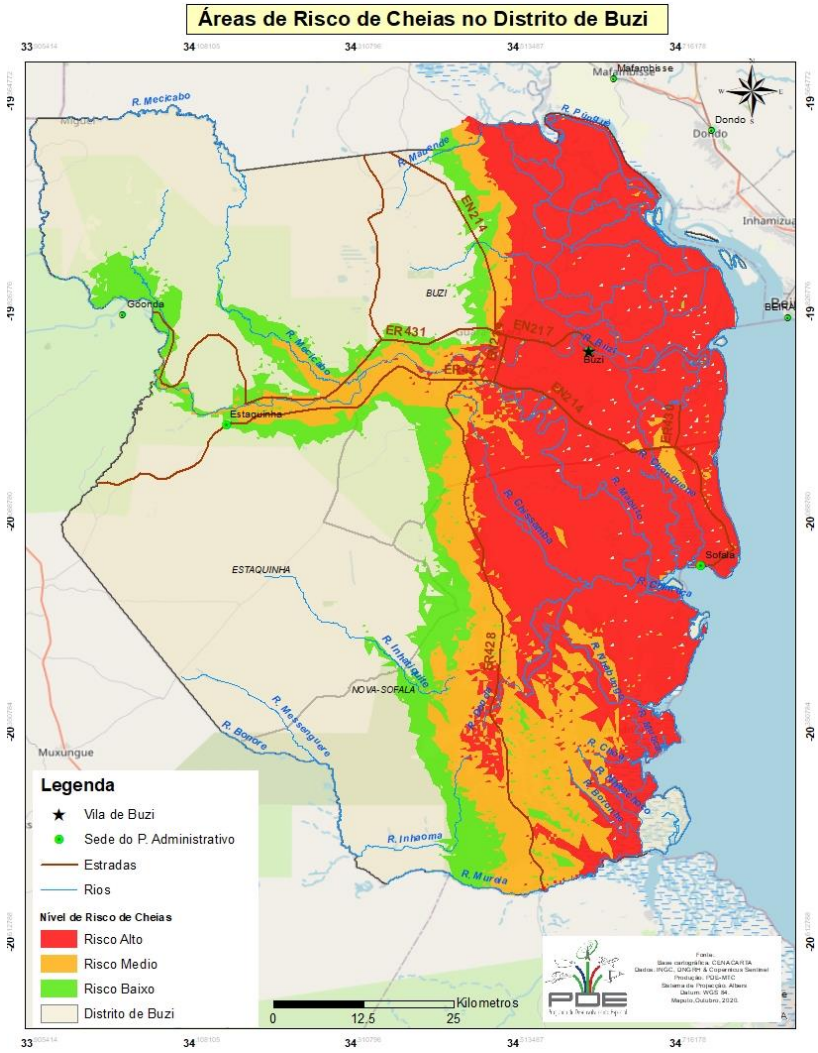


Figure 2 Map of Inundation Risk Areas in the Buzi District

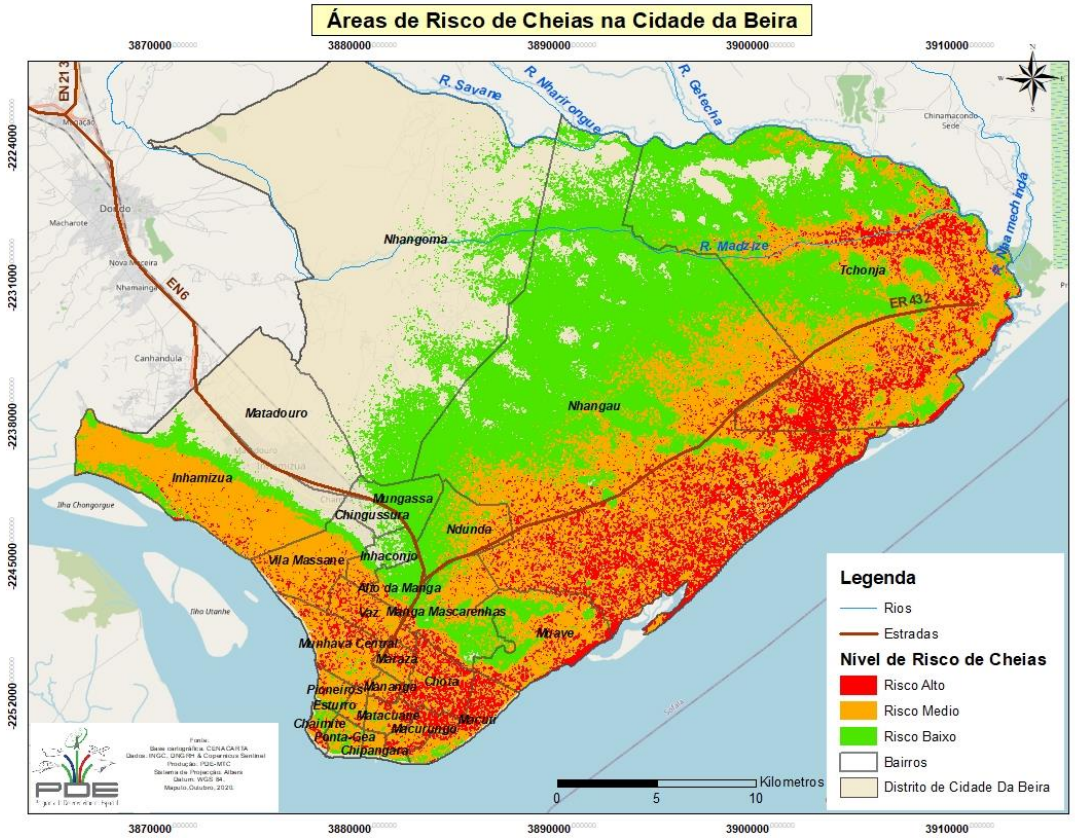


Figure 3 Map of Inundation Risk Areas in Beira City

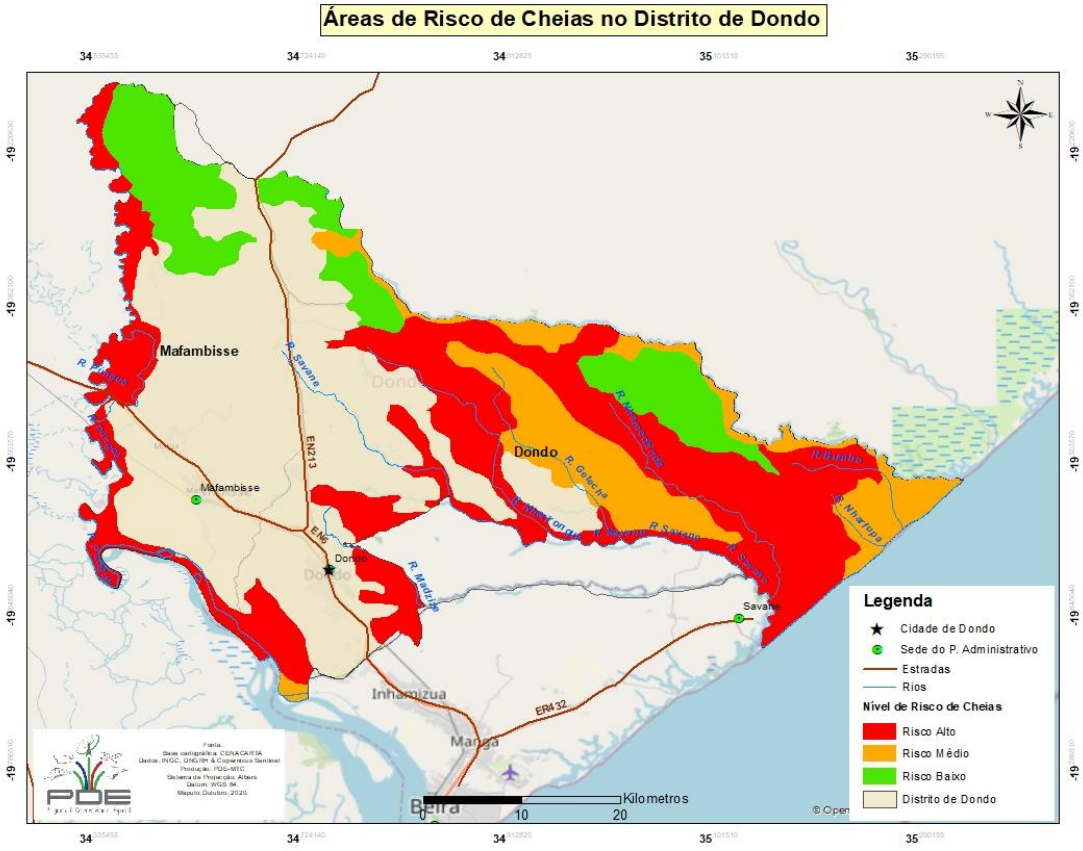


Figure 4 Map of Inundation Risk Areas in Dondo District

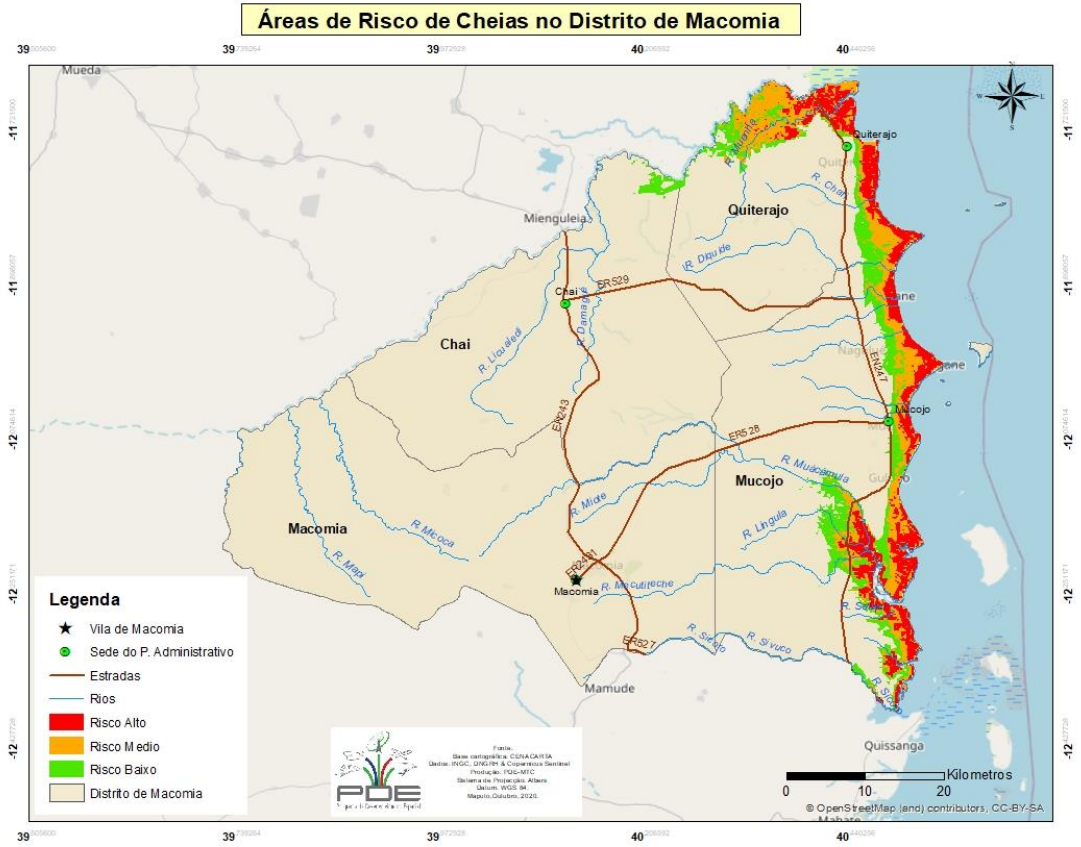


Figure 5 Map of Inundation Risk Areas in Macomia District

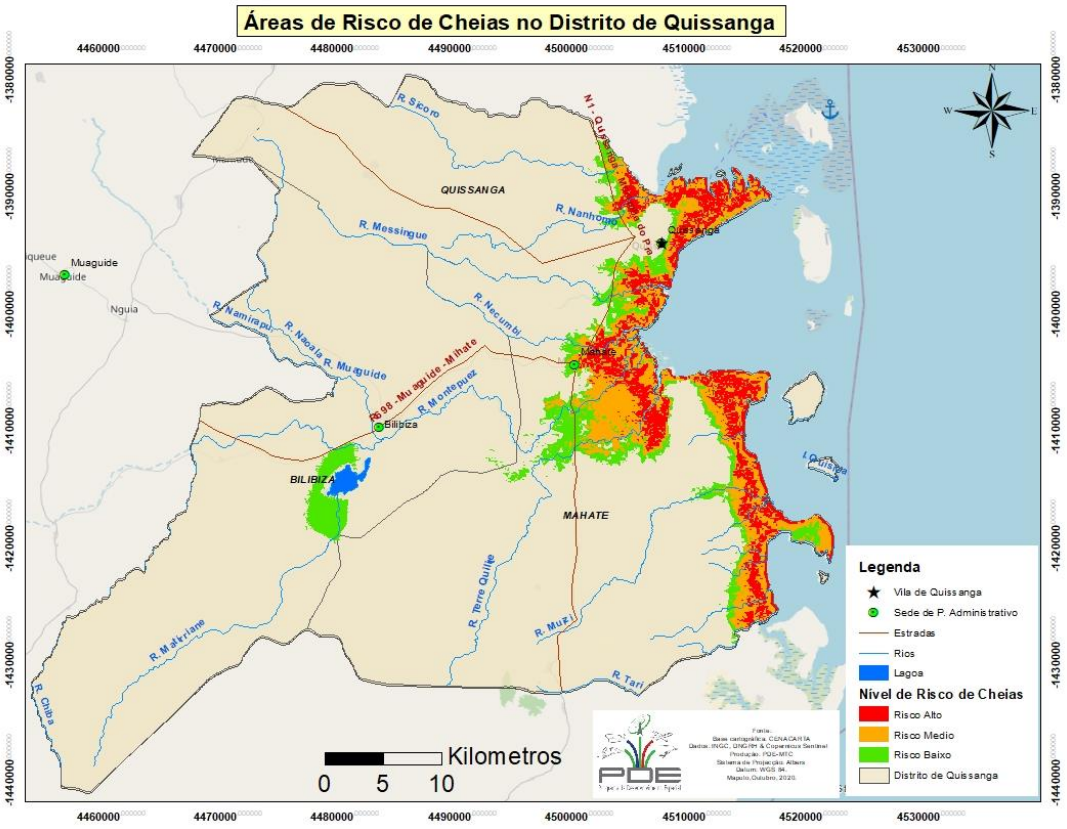


Figure 6 Map of Inundation Risk Areas in Quissanga District

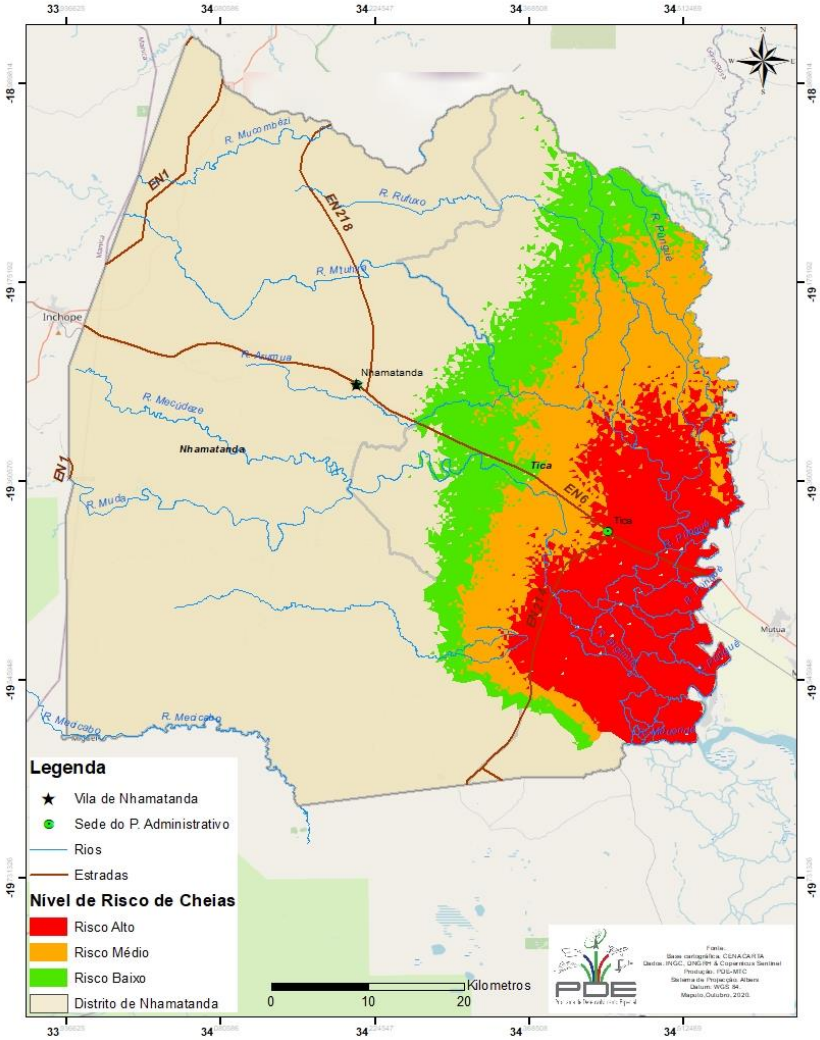


Figure 7 Map of Inundation Risk Areas in Nhamatanda District

Figure 8 Population resettled in safe zones identified using geospatial information

Figure 9 Population resettled in safe zones identified using geospatial information

Figure 10 Residences constructed by GREPOC in safe zones identified using geospatial information

Figure 11 Residences constructed by GREPOC in safe zones identified using geospatial information

Harmonizing Climate Resilience

Integrating Geospatial Insights for Community Empowerment and Ecosystem Services: Isimangaliso Wetland Park, Umkhanyakude District, Kwa Zulu Natal, SA

Department of Agriculture Land Reform and Rural Development, South Africa, Africa

Your agency's work to build climate resilience (250 Words)

Drivers of the work: The urgent need for building and harmonising climate resilience in iSimagaliso wetland Park, ecosystem is driven by the pressing need to address the adverse consequences of back-flooding and water ingress in the lower section of the Mfolozi floodplain within the iSimangaliso Wetland Park serves as a driving force for the department work. Which has affected farming and human settlement activities. This disruption extends beyond ecological concerns to the socio-economic stability of local communities reliant on the ecosystem's services.

Funding: Funding for the project comes from an intergovernmental forum, with the Department of Agriculture and the National Agriculture Marketing Council conducting land-use analyses and socio-economic assessments respectively. iSimanagaliso Wetland Park Authority conducted the Basic Assessment Report (BAR).

Data management best practices Geospatial data management practices demonstrated a commitment to high precision data acquisition using geospatial tools and local knowledge to accurately identify flood-prone areas, facilitating informed decision-making in land management practices while considering socio-economic factors and stakeholder involvement.

Data Specification and Standard: Ground-Truth employed geospatial tools, local knowledge, and UAV-based LiDAR surveys to accurately predict flood-prone areas, showcased a commitment to high precision data acquisition, and meticulously identified various land uses, enabling comprehensive datasets crucial for informed land management practices despite challenges.

Impact and Evaluation The utlisation of Geospatial information resulted in guiding proposals to mitigate the effects of climate change-induced back-flooding and water ingress on agricultural and settlement areas. Evaluation considers cost, socio-economic indicators, and stakeholder input, ensuring a holistic approach to resilience building in the Mtubatuba area.

The geospatial tools used for building climate resilience (150 Words)

The analysis conducted to guide building spatial resilience in the iSimangaliso Wetland area employed a sophisticated spatial analysis approach, integrating various geospatial tools and methodologies. Leveraging Survey 123, data on settlements affected by water ingress and land-use patterns were meticulously collected, providing valuable insights into community vulnerabilities. Additionally, UAV-based Light Detection and Ranging (LiDAR) surveys were conducted to generate detailed datasets for hydraulic modeling and vegetation health assessment, enhancing our understanding of ecosystem dynamics. Existing cadastral information was utilized to map different land-ownership categories, complemented by data from local planning studies and municipal documents. A participatory GIS/mapping approach identified smallholder/subsistence farming areas, previously unmapped, while Google imagery timeline aided in identifying uncultivated areas due to backflooding. Through qualitative surveys, community participation and understanding of prevailing land-use issues were ensured, guiding the identification of areas affected by back-flooding and inappropriate land uses. This comprehensive spatial analysis methodology provided a nuanced understanding of land ownership, land use dynamics, and the impact of climate-related events, serving as a crucial guide for building spatial resilience in the region.

Pictures, Dashboards, Supporting Evidence

https://storymaps.arcgis.com/stories/c807d73197e04fa7b23bf8d9ac2a04ff

https://storymaps.arcgis.com/stories/1754b09affc64f6a9943d506c21a36bf

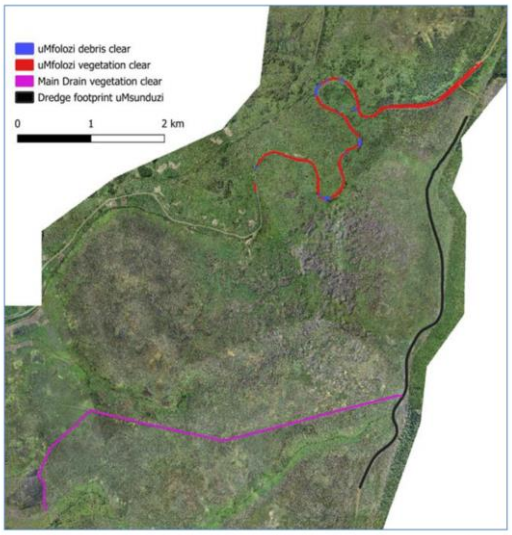


Figure 3: Location of the proposed vegetation and woody debris clearing and dredging. The vegetation hotspots, as identified in Fig. 2, are located along the black line (Msunduzi).

Key Statistics / Insights

- Number of Public Dashboard Views: **2 (Story maps)**
- Number of Geospatial Datasets harmonised: **5-10**
- Number Geographies: **1**
- Participating Agencies: **Department of Fisheries, Forestry and Environment(DFFE);**
- **iSimangaliso Wetland Park Authority;**
- **Department of Water and sanitation**
- **National Agriculture Marketing council;**

Link to Metadata:

SASDI EMC: http://www.sasdi.net/

Sources : GroundTruth Environment and Engineer, 2023: **LiDAR SURVEY OF THE UMFOLOZI FLOODPLAIN AREA GIS DERIVED PRODUCTS AND UAV SURVEY SUMMARY REPORT. Report prepared for Isimangaliso Wetland park Authority**

iSimangaliso EMPr , 2024. Basic Assessment Report for Clearing of the Mfolozi Flood plain

DALRRD : Land use Land Reform Data, Cadastral Data& Climate change Risk and vulnerability for Umkhanyakude District, Department of Agriculture, Land Reform and Rural Development (DALRRD)

iSimangaliso , 2023 Specialist Studies on the Basic Assessment Report

agriculture, land reform & rural development
Department:
Agriculture, Land Reform and Rural Development
REPUBLIC OF SOUTH AFRICA

Adapting to our future coastal change

GIS analysis of coastal erosion and rising sea levels inform coastal erosion risk assessment and adaptation planning to kick-start national adaptation actions.

Dynamic Coast

Scotland, United Kingdom

Sea level Increases are expected to greatly increase coastal erosion and flood frequency on erodible shores. Scotland's latest climate risk assessment highlighted a need for action to address the coastal erosion risks anticipated to impact society (infrastructure, communities, businesses). Scottish local authorities have policy responsibility for this, but most have no plan to manage increasing coastal erosion risk. Whilst it is recognized that '*Adaptation needs to be embedded across the full range of Government activities*' it remains clear that improvements in risk-monitoring are urgently required.

The Scottish Government established Dynamic Coast to compile a coastal change evidence base (1890 to date) and anticipate coastal change to 2100, to support better public sector decision making. With £500k of funding, the University of Glasgow developed DynamicCoast.com, an interactive evidence base to guide coastal adaptation at national, regional and local levels.

GIS analysis identified at least £20bn of coastal assets. Natural coastal defences (beaches etc) protect £15bn of these assets, whilst artificial defences (sea walls etc) protect £5bn. Coastal erosion currently affects 46% of soft shorelines with an average erosion rate of 0.43 m/yr. Under a High Emissions Scenario, 75% of soft coasts are expected to be eroding by 2050, and 84% by 2100. At least £1.2bn of coastal assets are at erosion risk by 2050, unless we act. A low emissions future saves only 1/3 of these assets. So, adaptation is as essential as mitigation.

Dynamic Coast has kick-started coastal adaptation in Scotland, securing £12m of government funding for local authorities to develop Coastal Change Adaptation Plans along with studies to show-case adaptation projects and learn-by-doing.

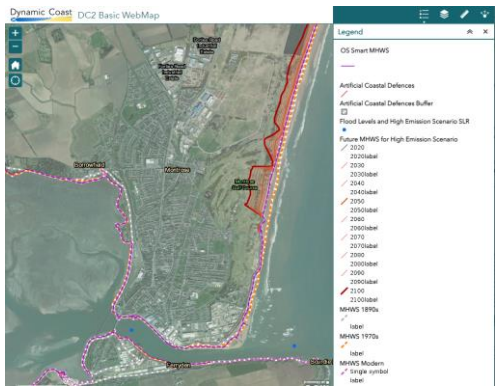
The award-winning Dynamic Coast project works with all coastal local authorities, national and local partners to support more sustainable adaptive decision making across Scotland's coast.

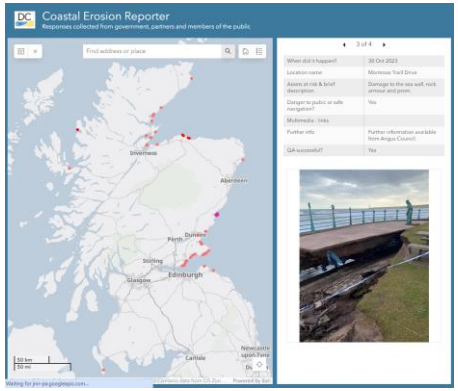
The University of Glasgow analyzed historic, recent and current shorelines within a GIS. The Python codes developed to create an analysis framework were then used to identify past coastal changes. Past rates of coastal change were projected into the future to produce anticipated decadal positions of shores (2020-2100) under various climate change and sea level rise scenarios.

The anticipated coastal change, overlaid with national mapping data (Ordnance Survey's MasterMap data etc), informed a National Coastal Erosion Risk Assessment which identified the location of £1.2bn at risk assets out of £20bn coastal assets.

Interactive maps were developed in Esri's ArcGIS online suite, allowing public access to easy-to-use maps. Our data is also published as Web Mapping Services and is available for download. This work supports awareness raising and adaptation within communities and organisations.

A recent 'erosion reporter' tool has been developed in readiness for next year's storms (link).



(1) Interactive map from Dynamic Coast. (2) data available on the beach. (3) Citizen erosion reporting tool.

DynamicCoast.com for reports, interactive maps, data-download, adaptation guidance and videos.

Watch our short video here: COP26-Video

Dynamic Coast on Flikr for pictures to illustrate coastal change adaptation in Scotland.

Data (including metadata) is avalable from DynamicCoast.com/downloads

Dynamic Coast has recieved funding from Scottish Government, Centre for Research Excellence for Waters, NatureScot and the St Andrews Links Trust.

Dynamic Coast

DynamicCoast.com @DynamicCoasts

www.DynamicCoast.com

Dynamiccoast@nature.scot

https://x.com/DynamicCoasts

Since launch the Dynamic Coast website has been visited {x} times, across {y} countries.

Scotland has at least 21,000km of long and complex shore. Whilst much of this is rocky and relatively erosion resistant, we have analysed all of the 3,800 km of the soft / erodible shore.

Our analysis has also updated over 6,000km of shoreline data , using over 5.5m calculations to explore coastal erosion risks under high, medium and low climate and sea level scenarios.

For the first time in the UK, we have considered future coastal change overlap onto araes of social vulnerability to inform ‘coastal erosion disadvantage’. Such work allows local authorties to be aware of and anticipate Climate Justice aspects within local communities.

32 different national datasets are available to national, regional and local partners to support their adaptation work.

Key Message

[Sub heading highlighting aspect of climate resilience being adressed]

Lead/Coordinating Agency Name

Country / Region

Your agency's work to build climate resilience (250 Words)

- Drivers for the work
- Funding
- Data management best practice
- Data specification and standards
- Impact and evaluation

The geospatial tools used for building climate resilience (150 Words)

Pictures, Dashboards, Supporting Evidence

[Photo of Dashboards / Resource / Dataset(s)]

Key Statistics / Insights

- Number of Public Dashboard Views
- Number of Geospatial Datasets harmonised
- Number Geographies
- Participating Agency/Entities

Link to metadata

Sources

Contact Details – Organisational and Focal Point

Key Message: US Virgin Island's Street Addressing Initiative - Building Geospatial Infrastructure for Climate Resilience.

USVI's Street Addressing Initiative (SAI) is building the basic geospatial data infrastructure needed for climate resilience, disaster planning, and disaster recovery efforts.

Project is lead by Chris George of the USVI Office of the Lieutenant Governor

US Virgin Islands, USA

Your agency's work to build climate resilience (250 Words)

- Drivers for the work
  - The US Virgin Islands are composed of three major inhabited islands (St. Croix, St. John, and St. Thomas) with a population of 87,000 as of the 2020 Census. Currently, the majority of the territory has no regular physical or mailing addresses, with no standardized housing or building identifiers, and many areas even lack standardized street names. In 2017, back-to-back category 5 Hurricanes Irma and Maria were devastating, and not only revealed the vulnerability of physical infrastructure, but also underscored how the lack of basic geospatial information necessary for location-based response and recovery activities created nearly insurmountable challenges to responders. The lack of a standardized addressing hampers the deployment of navigation and directional systems and creates issues with reliability and response time for emergency responders and hampers resilience planning efforts. For example, in the event of severe events, emergency responders arriving from outside the territory to support rescue and recovery efforts are frequently unable to rapidly and efficiently participate in life-saving services without additional local navigational support.
  - The SAI project is intended to dramatically improve navigation capabilities in the territory and support economic development, facilitate efficient government services, and assist private enterprise by finalizing the Master Address Repository System (MARS). The MARS will store street addressing information for all existing and future roadway infrastructure, assigning road names and house numbers, creating a single, comprehensive resource for the territory.
- Funding
  - Consortium of federal agencies and local (USVI) sources, additional details here: 20240227 OLC No. 0064-2024 MOA Between DPP OLG and UVI-Executed.pdf - Google Drive
- Data management best practice/Data specification and standards
  - The project follows current US national addressing standards, which are in alignment with and driven by ISO addressing standards. The US Postal System (USPS) is another critical stakeholder, and every effort is being made to meet their requirements.
- Impact and evaluation
  - USPS delivery, Emergency Management Services response time, territorial access to a variety of location-based services

The geospatial tools used for building climate resilience (150 Words)

Basic location reference data is critical to fundamental geospatial processes. Identified as fundamental data, the Master Address Repository System (MARS) has been developed with geospatial information systems (GIS) to meet the needs of USVI stakeholders and build a resilient geospatial infrastructure to support location-based services. Critically, this is a community effort, engaging citizens to help them understand the project and to engage as full participants. Unless the public accepts – and begins to use – the new addresses, the project will ultimately fail. The residents of USVI need to understand the importance of this fundamental change in how they navigate their community - from vernacular, colloquial, relative references (the corner store, the red house at the end of the street, "Jane's house") to specific register based references (1342 Sagebrush Road) which can support modern geospatial infrastructure and address based services.

Pictures, Dashboards, Supporting Evidence

[Photo of Dashboards / Resource / Dataset(s)]

STREET ADDRESSING INITIATIVE (google.com)

Link to metadata

Sources

STREET ADDRESSING INITIATIVE (google.com)

Logo Name

Organisational contact: Chris George, USVI, Office of the Lt. Governor

UN-GGIM Focal Point Contact: Joshua Coutts, U.S. Census Bureau

Key Statistics / Insights

- Number of Public Dashboard Views
- Number of Geospatial Datasets harmonised
- Number Geographies
- Participating Agency/Entities
- **TBD - Still developing appropriate metrics.**

The Military Geographic Institute of Uruguay and its efforts to promote Climate Resilience

Military Geographic Institute

Uruguay / South America

The Military Geographic Institute of Uruguay, within the framework of its main Mission and the tasks derived from it, actively collaborates to develop climate resilience, providing high-precision geospatial information to the Uruguayan Institute of Meteorology (INUMET), for the planialtimetric determination of the Automatic and Conventional Meteorological Stations under its administration. Using the National Leveling Network and the Active National Geodetic Network of Uruguay as a basis for planialtimeter determination, it carries out High Precision Leveling and High Precision GNSS Observation work, providing INUMET with updated and precise geospatial information for the location of its Meteorological Stations.

The geospatial tools used for building climate resilience.

- Continuous Operating Reference Stations (CORS).
- High precision GNSS receivers (Geodetic).
- High precision Leveling equipment.
- GNSS Network administration software.

Pictures, Dashboards, Supporting Evidence

Link to metadata

\\dell7000\Geodesia\5-INUMET

Sources

Geodesy & Topography Division – Military Geographic Institute (Uruguay)

Contact Details – Organisational and Focal Point
Colonel Andrés F. Moraes
Director – Military Geographic Institute
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Tel.: (+598)24871810
Web: https://www.igm.gub.uy/
E-Mail: igm@ejercito.mil.uy

Key Statistics / Insights

Participating Agency/Entities:

- Military Geographic Institute.
- Uruguayan Institute of Meteorology.

El Instituto Geográfico Militar y sus esfuerzos para la promoción de la resiliencia climática.

Instituto Geográfico Militar

Uruguay / Sudamérica

El Instituto Geográfico Militar del Uruguay, en el marco de su Misión principal y las tareas que de ella se derivan, colabora activamente en el desarrollo de la resiliencia climática, proporcionando información geoespacial de alta precisión al Instituto Uruguayo de Meteorología (INUMET), para la determinación planialtimétrica de las Estaciones Meteorológicas Automáticas y Convencionales bajo su administración. Utilizando como base para la determinación planialtimétrica la Red Nacional de Nivelación y la Red Geodésica Nacional Activa del Uruguay, realiza trabajos de Nivelación de Alta Precisión y Observación GNSS de Alta Precisión, proporcionando a INUMET información geoespacial actualizada y precisa para la ubicación de sus Estaciones Meteorológicas.

Herramientas geoespaciales utilizadas para la construcción de resiliencia climática.

- Estaciones de Referencia de Operación Continua (CORS, por sus siglas en inglés).
- Receptores GNSS de Alta Precisión (Geodésicos).
- Equipamiento de Nivelación de Alta Precisión
- Software de administración de redes GNSS.

Imágenes y otra evidencia de apoyo.

Enlace a metadatos

\\dell7000\Geodesia\5-INUMET

Fuente

División Geodesia y Topografía – Instituto Geográfico Militar (Uruguay)

Detalles de Contacto – Organizacional y Punto Focal

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Tel.: (+598)24871810
Web: https://www.igm.gub.uy/
E-Mail: igm@ejercito.mil.uy

Estadísticas clave/perspectivas

Agencias/Entidades participantes:

- Instituto Geográfico Militar
- Instituto Uruguayo de Meteorología

Spatial data infrastructure enabling seamless sharing of geospatial data across borders and time for the Arctic region

Enables discovery, accessibility and use of pan-Arctic geospatial information for diverse applications, including decision making for climate resilience

Historically, management of Arctic geospatial information occurred nationally or for specific issues. This challenged enabling geospatial knowledge for the pan-Arctic. Founded in 2014, Arctic SDI aims to harmonize national geospatial datasets of the Arctic, creating pan-Arctic information that can be easily discovered and used.

Arctic SDI's activities are informed by and support the Arctic Council's biodiversity working group, the Conservation of Arctic Flora and Fauna (CAFF). CAFF takes a circumpolar ecosystem approach to data and science. Cooperation across Arctic Countries ensures an Arctic ecosystem perspective. This level of data interoperability is achieved with standards from the Open Geospatial Consortium; a key activity for enabling climate resilience efforts across the Arctic.

The 8 Arctic countries collaborate on the development of Arctic SDI through governance, policy and geomatics data/technology. Arctic SDI's governance prevents exchange of funds between countries. To support operations, each country voluntarily provides in-kind contributions based on their expertise (e.g. legal frameworks, policy, web hosting, and analysis ready geospatial data).

Each country hosts their own geospatial data that are harmonized to create pan-Arctic layers. Countries implement Open Geospatial Consortium (OGC) standards to support interoperable use of their datasets for inclusion within Arctic SDI. Examples of available data include place names, topography, elevation, and emerging circumpolar earth observation data on wetlands, methane and black carbon. Data discovery and access is enabled through the Arctic SDI Geoportal, which uses OGC approaches to support interoperable use of Arctic SDI products.

Arctic SDI is regularly evaluated through an assessment process which includes annual measurement of key performance indicators, chairship biennial reports and evaluations every 5 to 8 years of alignment with the Arctic SDI Strategy and Roadmap. These ensure user requirements are being met and to identify areas for future improvement.

Arctic Spatial Data Infrastructure (Arctic SDI)

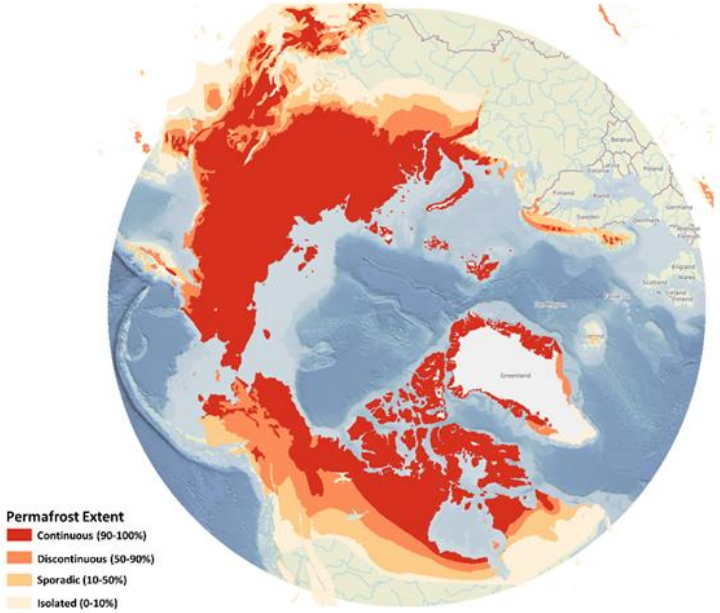
Circumpolar Arctic – Canada, United States, Kingdom of Denmark, Finland, Norway, Sweden, Iceland, Russia

Arctic SDI provides a diverse array of geospatial data and tools to suppose climate resilience activities across the Arctic region. Examples include:

- Comprehensive pan-Arctic geospatial datasets for 14 themes (e.g. climatology, environment, elevation, oceans, society), totalling more than 90 layers.
- Arctic SDI Geoportal supporting visualization, access and use of available layers. Supports timeseries analysis for key data.
- Implementing earth observation-derived products that will contribute to monitoring essential climate variables from the United Nations Sustainable Development Goals. Products in development include wetlands, methane and black carbon. Monitoring of changes to these products over time will help identify actions needed to achieve climate resilience across the Arctic.

Pictures, Dashboards, Supporting Evidence

Map at right shows permafrost extent for the circumpolar Arctic as displayed in the Arctic SDI Geoportal



Key Statistics / Insights

- **Number of Geospatial Datasets Harmonised**: 90+ layers comprising geospatial data from the 8 Arctic nations
- **Coverage:** Circumpolar Arctic including lands and waters
- **Participating Agency/Entities:** Canada, United States, Kingdom of Denmark, Finland, Norway, Sweden, Iceland, Russia

Link to Metadata

Metadata for Arctic SDI layers is available through the Arctic SDI Geoportal: https://geoportal.arctic-sdi.org/

Sources

- Arctic SDI Website: https://arctic-sdi.org/
- Arctic SDI Geoportal: https://geoportal.arctic-sdi.org/
- Conservation of Arctic Flora and Fauna: https://www.caff.is/

ARCTIC SDI Arctic Spatial Data Infrastructure

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