



ERASMUS+ PROJECT

Making MAPS AND INFOGRAPHICS

A hands-on manual to teach how to make maps and infographics in the context of flood risk assessment, prevention, and response

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EXECUTIVE SUMMARY

This is a manual for all of those interested in teaching (and learning) the importance of maps and infographics in the context of flood risk assessment, prevention, and response, an issue demanding our attention as flood risks grow in Europe. Yet, its primary target group are high school teachers. It has been developed as part of the FloodStopping project, co-financed by the EU under the Erasmus+ programme.

The objective of this manual is to provide an actionable guide for teaching the concepts, approaches and tools to create maps and infographics with your students, enhancing their understanding of flood risk assessment, prevention, and response, while fostering critical thinking, creativity, digital literacy and visual communication skills. We know this is an ambitious objective and we have worked hard to make this manual a pleasant read. We want it to be a companion for you in your teaching activities. A lot of content is covered in the manual, although not exhaustively. Having this in mind, we added a lot of references for further reading and more in-depth learning for those who wish to dive further into the topics presented.

We have added **boxes** with case studies examples, selected research publications, and visualisation tools, to ensure that the material is related to current scientific evidence and good practices. **This manual is meant to be a teaching resource, but it is also meant to be inspirational.** We hope that if you are already a map and infographics enthusiast, that you will be even more excited about these communication tools. And if you are not... Well, we hope that you might become one! Or at the very least, that you will value maps and infographics a lot more, seeing their creation as a highly useful teaching approach.

The writing style of the guide is conversational (as you have probably already noticed). We opted for this approach to ensure that the material is more relatable and engaging, making it easier to convey the significance of the flood topic and providing key resources for both in class and extra curricular activities.

TABLE OF CONTENTS

Overview.....	1
Module 1: Maps.....	5
Introduction.....	6
Why Maps?.....	7
What Are Maps?.....	10
What about Flood maps?.....	26
Who Makes Maps?.....	33
When to Use Maps?.....	42
How to Make Maps?.....	50
Ideas for classroom activities and exercises.....	60
Module 2: Infographics.....	64
Introduction.....	65
Why Infographics?.....	68
What Are Infographics?.....	74
Who Makes Infographics?.....	85
When to Use Infographics?.....	89
How to Make Infographics?.....	91
Ideas for classroom activities and exercises.....	97
Conclusion - WHAT IF... SO NOW WHAT?.....	102

Overview

Welcome to the FLOOD STOPPING manual on how to create maps and infographics! As the name of our project suggests, our focus is not on any type of maps and infographics. We are interested in flood related maps and other communication materials related to this topic. We recognize the importance of flood awareness, both for their prevention and assessment, and for the adequate response and necessary adaptation to flood events and risks. And we want this manual to empower you, the teachers, and your students to actively engage with this topic, understanding the complex nature of floods and their relation to the climate emergency we are facing.

Here are some data points to call our attention to the floods topic:

In the EU ¹		
Almost 1500 flood events in Europe since 1980	Over 4300 deaths caused by flood events	More than €170 billion economic damage caused by flood events since 1980

Making maps and infographics are activities that will contribute to more spatial awareness and will empower those engaged with them to make informed decisions in the face of flooding. Maps and infographics are valuable resources for hazard and risk communication and can assist people in being better prepared and knowing how to prepare and respond to flood events. Engaging in their development is a challenging but rewarding activity.

The contents of this manual will equip you with the necessary knowledge and tools to effectively teach your students about flood maps, particularly flood risk maps, and about infographics, and their potential to be engaging visual representations that make smart calls to action. Throughout this manual, we will guide you through key steps related to the creation of maps and infographics, each with its dedicated module.

Each module starts with a section on why these resources are relevant, followed by a section dedicated to the definition of what maps and infographics are. The next two sections cover the topics of who is and should be engaged in the activities related to

¹ Source: Floods EU measures to manage the risks floods pose to human health, the environment, the economy and cultural heritage. Available at: https://environment.ec.europa.eu/topics/water/floods_en



their development, and when the maps and infographics should be used in the context of flood awareness, preparedness and response. In these sections we will delve into the significance of maps and infographics, discussing why they are essential in the context of flood education. It is noteworthy that we will highlight the diverse range of stakeholders involved in map-making and emphasise the value of community participation. Yes, you read it right, map-making becomes a social activity. We will get more into this in the dedicated section. You will also notice that we will provide practical examples, activities, and resources to help you integrate the creation of these visual tools into your classroom effectively and in an engaging way.

By equipping your students with the knowledge and skills to create maps and infographics, you will enable them to become critical thinkers, informed decision-makers, and active participants in their communities' flood prevention and response efforts. Moreover, you will also assist them in gaining digital skills, as most of the resources included in this manual have a digital component.

Together, let us embark on this journey to educate and empower the next generation, as we navigate the challenges posed by climate change and work towards building a more resilient future.

The 'We' Approach in Flood Education

We want to take a moment to highlight the significance of our **inclusive language**, specifically the use of the pronoun "**we**." This intentional choice serves as a strategy to create engagement and foster a sense of collaboration between the manual creators and you, our valued readers. By addressing you as part of the collective "we," we aim to establish a shared journey, where we embark together on the exploration of flood risk assessment, prevention, and response.

This inclusive approach emphasises that we are all active participants in this learning process, working towards a common goal of understanding and addressing the challenges associated with climate change in our territories, particularly with those related to flooding. It is through this collaborative effort that we can collectively enhance our knowledge, skills, and impact in the field.

If you want to collaborate with us, on this or future projects, don't hesitate to get in touch!



Here are some key aspects to motivate you to use this guide. It will give you great tools to engage your students, with confidence and ease, learn in the process, and, hopefully, have fun with it.

- **Hands-On Learning:** creating maps and infographics is like a dynamic puzzle that teaches while you engage. Students dive into their surroundings, learn geography, and grasp the art of visual storytelling.
- **Boosting Creativity:** Crafting maps and infographics empowers students to unleash their creativity. They can pick colours, craft symbols, and design layouts, infusing learning with excitement and personal expression.
- **Real-World Relevance:** Maps and infographics bring classroom lessons to life. Students visualise where they live, their school, and other places, bridging the gap between textbook knowledge and real-world connections.
- **Problem-Solving Skills:** Creating maps and infographics requires puzzle-solving. Students need to figure out how to graphically represent what they want with the information available and thinking about their audiences, fostering critical thinking and solution-oriented approaches.
- **Collaborative Skills:** Crafting maps and infographics can be collaborative endeavours. Students collaborate, exchange ideas, and build remarkable visual narratives. This nurtures teamwork capabilities and nurtures social bonds.
- **Real-world connections and application:** Crafting maps and infographics merges skills from various subjects – maths, art, geography – into one project. Students tangibly apply classroom knowledge to real-world projects.
- **Confidence Building:** Constructing a map or infographic from scratch is a considerable accomplishment. It instils pride and confidence, amplifying students' self-belief in their abilities.
- **Exploring Technology:** Modern map and infographic creation often involves digital tools. Students learn about technology's role in visualisation, preparing them for the digital landscape they'll navigate.
- **Career Insights:** Map and infographic creation extends beyond the classroom. These skills are valued in professions such as urban planning, disaster management, and environmental studies, opening doors to diverse and fulfilling career paths.
- **Engaging Learning:** Lastly, map and infographic creation transforms learning into an interactive experience that combines technical and creative aspects in the production process. It's more than just textbooks; it's about hands-on exploration, artistic expression, and acquiring valuable skills for life.



Interactive activities in the classroom

We have added some guidelines for map-making and infographic-making activities to work with students.

They are structured with objectives, materials and main steps, but can - and should - be adaptive to your lesson plans and teaching activities.

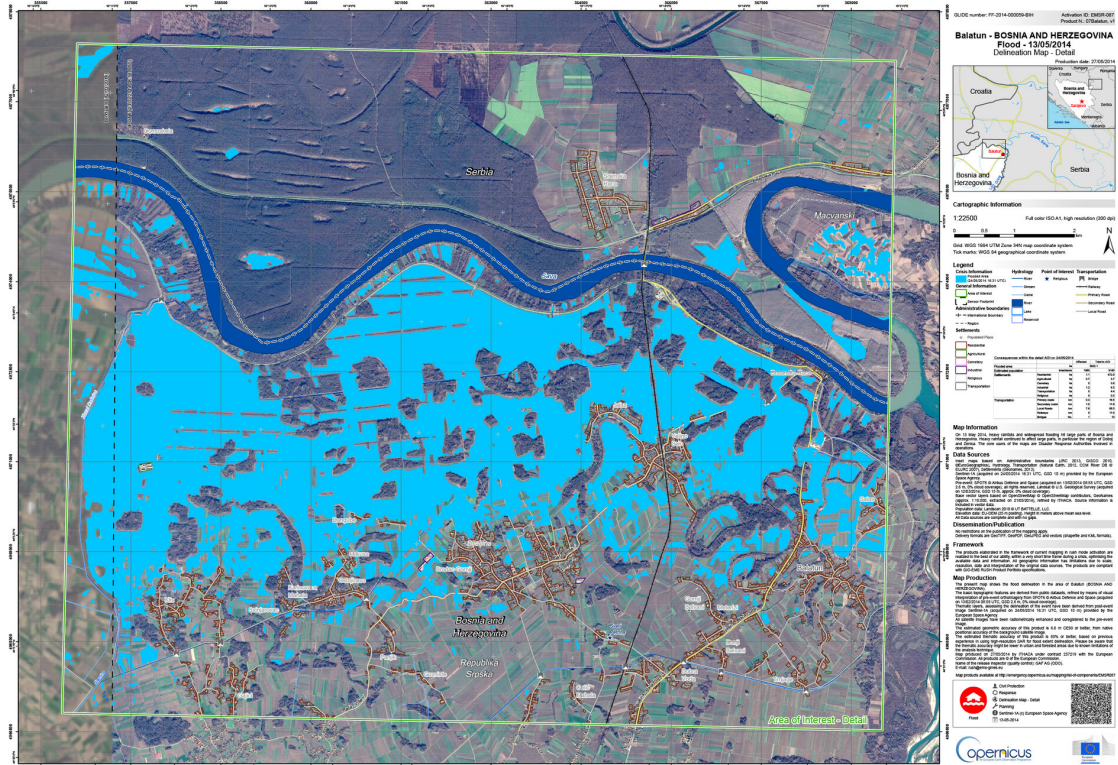
They include some references to facilitate their implementation.

If you do implement them, we would love to hear about it!

If you are sharing any of it in social media, tag our project and use the [#FloodStopping](#)



Module 1: Maps



Flood delineation map over the village of Balatun in northeastern Bosnia and Herzegovina based on Sentinel-1A data. Serbia lies to the north of the Sava river.

Source: https://www.esa.int/ESA_Multimedia/Images/2014/05/Flood_map



INTRODUCTION

In the section we will present an overview of the how to make maps module's objectives and the importance of maps in flood awareness education.

While technical skills remain vital, expanding the map-making circle to include a broader spectrum of individuals, including you, can **enhance flood resilience in our communities**. This is one of the main motivations to create this manual. We want it to be an instrument to empower learning, to promote spatial awareness and foster individual and collective agency!

As floods increasingly challenge our communities, the more hands contributing to map making, the stronger our collective ability to reduce our vulnerability and strengthen our adaptive resilience in the face of climate change.

As we will discuss in this section, **maps are a form of storytelling**. As such, **they offer one perspective**. They are embedded with several assumptions, they rely on certain available data and information, they reflect a range of decisions. Map-makers need to decide what to shed light on, and what needs to be left out. They are produced to respond to specific needs. Sometimes, they are designed with the main goal of persuasion. The "Persuasive Cartography" webpage has some great examples of maps that have been created with explicit - and sometimes not as evident - persuasion goals. <https://persuasivemaps.library.cornell.edu/>.

So, our advice is, never use only one map to get informed! Or at least, not only one static map (interactive maps can be many maps in one, so to speak). To have a more comprehensive understanding of complex phenomena, such as flooding, it is important to have a systemic and reflective approach.



WHY MAPS?

In this section we will explain why maps and mapping are a central part of flood awareness, preparedness and response. We will address 3 specific objectives:

- Explore the purpose and significance of maps in raising spatial awareness, and their instrumental role in flood risk.
- Discuss how maps can effectively communicate complex spatial information to diverse audiences.
- Highlight the role of maps in promoting understanding, decision-making, and community engagement.

From the early clay tablets of Babylonians to the impressive mapmaking prowess of ancient Greeks, and even the navigation-inspired charts of the age of exploration, maps have been a constant companion in human history. These maps not only guided adventurers but also chronicled evolving perceptions of our planet, depicting our expanding understanding of its geography, topography, and the intricate relationships between its various regions and inhabitants.

Maps serve as powerful **communicative tools** that **often transcend the boundaries of language and culture**. They have played an integral role in human history, charting the path of exploration, depicting the vast expanse of our planet, and contributing to our evolving perception of the world. In the realm of flood awareness, preparedness, and response, the significance of maps cannot be overstated.

Firstly, maps are instrumental in **raising spatial awareness** by visually presenting geographic information. They offer a unique perspective on flood-prone areas, providing a tangible, relatable view of the terrain, depicting water bodies, and potential risks. This spatial awareness is vital for individuals and communities to understand their flood risk and make informed decisions about safety measures and response strategies.

Secondly, maps excel at **communicating complex spatial information to diverse audiences**. Through innovative cartographic techniques, they can visually represent intricate details, such as floodplain boundaries, elevation changes, or emergency evacuation routes. This accessibility to information is essential for ensuring that people of all backgrounds and ages can comprehend the data and take appropriate actions.



Lastly, maps **facilitate not only understanding but also informed decision-making and community engagement**. They provide the context needed to plan for and respond to floods effectively. For instance, flood hazard maps can help local authorities and residents identify areas at risk, enabling the implementation of mitigation measures. Furthermore, maps can foster community engagement by involving individuals in the mapping process, allowing them to contribute local knowledge, which can be invaluable for accurate flood modelling and preparedness.

In the context of flood awareness and preparedness, maps are indispensable tools, bridging the gap between technical data and the public's understanding of flood risks. Their visual nature and ability to convey intricate spatial information make them pivotal in building resilient communities ready to tackle the challenges posed by flooding.

Visualising flood risk areas to raise awareness: an European interactive map

On October 13, 2023, the Directorate-General for Environment of the Commission introduced a new online tool designed to enhance awareness of significant flood risks in the European Union (EU): the [Flood Risk Areas Viewer](#). This innovative viewer combines data from EU Member States and the Commission, providing a comprehensive map of over 14,000 areas in the EU identified as having a potentially significant flood risk. This development arises from the EU Floods Directive, which outlines procedures for flood risk management and emphasises cooperation among Member States.

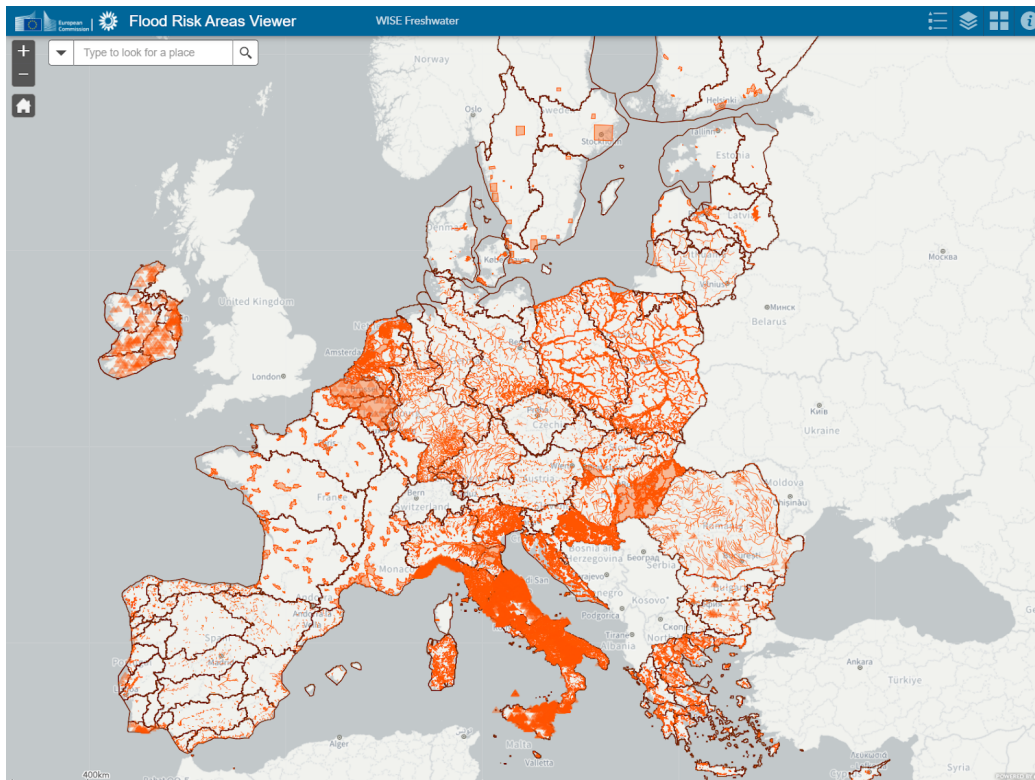
The viewer serves as a user-friendly resource, offering access to preliminary flood risk assessments, flood hazard and risk maps, and flood risk management plans provided by Member States. It acts as a unified gateway for these critical documents, facilitating easy access in the national language. This launch coincided with a meeting involving the Commission, Member States, and stakeholders, aligned with the Water Framework Directive and Floods Directive implementation strategy, emphasising the collaborative nature of water policy management.

The EU Flood risk areas viewer, created with assistance from the European Environment Agency, is a significant step toward elevating awareness about



flood risks. It underlines the need for periodic updates of flood risk assessments, maps, and management plans, as flood risk can change over time. Such updates are mandated every six years, with the current risk management plans spanning from 2022 to 2027.

The map allows users to zoom in and view areas of potentially significant flood risk marked in orange, as defined by individual Member States based on their unique circumstances. By clicking on these areas, additional information is accessible through pop-up windows. Those wishing to contact national authorities responsible for implementing the Floods Directive are encouraged to include specific codes related to the "Unit of Management" and "Area of Potential Significant Flood Risk" in their correspondence, especially if their inquiries are location-specific.



<https://discomap.eea.europa.eu/floodsvIEWer/>

Source:

https://environment.ec.europa.eu/news/commission-publishes-new-flood-risk-areas-viewer-raise-awareness-about-significant-flood-risks-2023-10-13_en

For enquiries about this viewer please contact env-water@ec.europa.eu

WHAT ARE MAPS?

This is a very broad question, isn't it?

To answer it, we will address two main specific objectives in this section:

- Provide a comprehensive overview of maps, including different types of maps (topographic, thematic, hazard maps) and their main components.
- Explore flood related maps and introduce some basic map reading skills, including the importance of data and probabilistic models and understanding key representational features.

We will start with a caveat: we will be mainly talking about **cartographic maps** here, in the sense that we will be referring to maps that portray a particular physical location, with correspondence between the graphical representation and the territory it represents. While we acknowledge that there are many other intriguing types of maps, such as mental maps, our focus within this manual will be maps that portray a specific territory and that use evidence and methods to be developed. We are using the term cartographic maps as a broad term that encompasses many different types of maps, such as topographic maps, flood risk maps, land use maps, etc. And we are assuming cartography as a practice that combines science and art, using both evidence-based knowledge and aesthetical elements to communicate topics spatially.

Cartography

Etymology

- The term cartography (in English) emerged from the French term "cartographie," which is the science of crafting maps. This term was formed by blending "carte," meaning "map," with "-graphie," meaning "representation by." This ingenious linguistic blend aptly captures the essence of cartography – the art of depicting our world's intricacies on paper or screens.
- cartography (n.)
- "the making of charts or maps," 1843, from French cartographie, from Medieval Latin carta (see card (n.1)) + French -graphie, from Greek -graphein "to write, to draw" (see -graphy).



- -graphy
word-forming element meaning "process of writing or recording" or "a writing, recording, or description" (in modern use especially in forming names of descriptive sciences), from French or German -graphie, from Greek -graphia "description of," used in abstract nouns from graphein "write, express by written characters," earlier "to draw, represent by lines drawn," originally "to scrape, scratch" (on clay tablets with a stylus), from PIE root *gerbh- "to scratch, carve".

Source: <https://www.etymonline.com/word/cartography>

Key elements of modern cartography

- Aerial photography
- Sensors
- GPS (Global Positioning System)
- Satellites
- Geographical Information Systems

Some modern applications of modern cartography

- Location intelligence
- 3D modelling
- Real time route

We are making this note because, **broadly speaking, maps can be any type of representation that establishes connections between different elements, providing some sort of spatial organisation among them.** On a stakeholder map for example, the relations between the different actors are portrayed with diagrams, with the most relevant and/or most powerful ones in the centre. But a map like this is disconnected from the physical space dimension. As a famous geographer ([Waldo Tobler](#)²) once said, back in the 70's: "everything is usually related to all else but those which are near to each other are more related when compared to those that are further away". When we map, we try to make these relationships more explicit and understandable.

Notice that in our broad definition of maps we have avoided using the term "visually". This is because some maps, although they are unfortunately not as common as they

² Waldo R. Tobler was a prominent geographer best known for Tobler's First Law of Geography. This law is often summarised as "Everything is related to everything else, but near things are more related than distant things." It's a fundamental principle in spatial analysis and geography, highlighting the idea that spatial relationships play a crucial role in understanding geographic phenomena. Tobler's work greatly influenced the field of geographic information systems (GIS) and had a significant impact on the study of spatial relationships and spatial analysis in geography.



should and therefore not very well known, are tactile maps. One of their objectives is to serve as a spatial awareness instrument for people who are blind, or with vision impairment or low vision.

Tactile Maps and inclusiveness **Navigating the World with Your Fingertips!**

Did you know that some maps are designed mainly to be felt rather than seen? And no, we don't mean that they are meant to spur more emotions. We're talking about maps created using three-dimensional techniques that can be explored through touch. These maps feature raised lines and tactile elements, enabling everyone to interact with their environment without relying on sight. These maps are especially valuable for people who are blind, have visual impairments, or experience low vision, granting them the independence to confidently navigate their surroundings.

These maps stand as remarkable models of inclusion, catering to individuals with diverse visual needs. And often, they're not only functional but also visually appealing (at least, we think so).

This is a great example of such a map in Valencia's historical city centre. It is a great example of how to be inclusive when valuing the architectural heritage of a city.

Tactile maps in Valencia historical city centre: the example of the L'Almoina Archeological Museum

The La Almoina Archaeological Museum, located in Valencia's historical center, has introduced tactile maps to a public plaza situated above the museum. These tactile maps are openly accessible to anyone passing by. The 3D maps offer three distinct scales. The first, on the left in the accompanying photo, presents key buildings in the vicinity, including the Valencia Cathedral and the Basilica of Our Lady of the Forsaken, along with the museum entrance. The other two scales provide more detailed depictions of the archaeological site. Each map is accompanied by Braille references, supported by Braille text explanations placed alongside the maps in both Spanish and Valencian. This initiative seamlessly combines the appreciation of Valencia's historical architecture with a commitment to inclusivity.



All of them are accompanied by braille references that are explained in braille texts placed on the sides of the maps, in spanish and valencian.



Source: <https://www.diariodelviajero.com/museos/plaza-almoina-nos-habla-pasado-valencia>



Source: Juliana Carvalho photograph, 2023.

On this photo from “inside” the larger map of the 3 tactile maps, it is possible to see the bridge that connects the two buildings (the Passatge d'Emili Aparicio Olmos) and the pointy architectural element of the Valencia Cathedral to the left.

If you are curious about it, have a look using the Google street view resource. https://www.google.com/maps/@39.475996,-0.3745572,3a,75y,17.38h,85.89t/data=!3m6!1e1!3m4!1sRaCvFuTlaO012TDV-5_ayq!2e0!7i13312!8i6656?entry=ttu

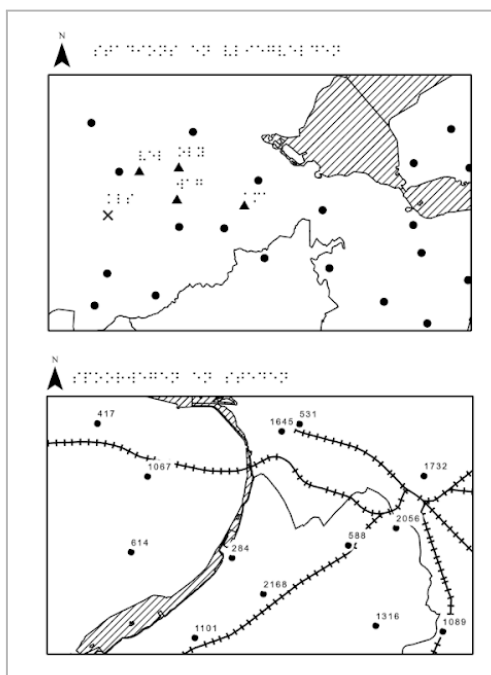
The link to the museum page: <https://www.valencia.es/val/almoina/inici>

Tactile maps from the Netherlands: co-creating maps

The Netherlands Cadastre, Land Registry and Mapping Agency (Kadaster) has ingeniously developed a series of tactile maps designed exclusively to make geospatial data accessible to individuals who are blind or visually impaired. These innovative maps employ raised black ink on specialised paper, complemented by Braille descriptions of highlighted features. The developmental process was meticulously based on user input from focus groups, ensuring alignment with the needs of the intended audience.

One of the key points raised in this initiative calls attention to the discretionary power of map makers on what to include or not include in their maps, and how to do so with the final user in mind. In their own words:

White space is key to producing tactile maps, so content is carefully chosen to ensure the information is clear and objects can be easily identified by touch alone. Due to the amount of space needed to include Braille, feature names are abbreviated and labelled by number. The corresponding name or information is confirmed by a separate legend. (https://eurogeographics.org/wp-content/uploads/2022/07/OME_Tactile_Map_Case_Study.pdf p.2)



Here are some pictures of the maps they are creating:

Another good news, they are now in the process of developing more maps like this for other European countries.

You can find a infosheet about this case here:
https://eurogeographics.org/wp-content/uploads/2022/07/OME_Tactile_Map_Case_Study.pdf

Another important point to highlight is that our focus is on **current maps**. We will be talking about real-world cartography since our overarching theme is flood awareness, prevention, and response. This does not mean that historical data is not important. It is actually very important. Past trends and characteristics of a given territory and previous events are an essential part of flood modelling, which in turn is a central piece of flood forecasting, risk management and resilience building.

MAPS, GEOGRAPHY, CARTOGRAPHY AND LATITUDES AND LONGITUDES

Maps are used in several study areas and for diverse reasons. Yet, **geography** is usually the main discipline associated with maps, and the main reference for their development.

Have you ever wondered why the **north** is (almost) always “facing up” in maps?

The convention of representing north as “up” on maps holds both cultural and navigational significance. Historically, the dominance of European explorers and conquerors played a role in shaping this convention. As European nations embarked on far-reaching voyages of discovery (and colonisation), they established cartographic traditions that favoured a “global north” perspective. The navigational aspect also played a crucial role in solidifying this convention. Compasses, which point towards magnetic north, have been essential tools for navigation throughout history. The magnetic properties of the Earth naturally align compass needles with the magnetic north, leading to a consistent reference point for orientation and route-finding.

Considering both cultural and navigational factors, the “north as up” convention offered consistency and ease of navigation for European explorers. This approach allowed them to better comprehend their surroundings and effectively chart their courses during their journeys into uncharted territories. Over time, this convention became widely adopted, influencing mapmaking practices worldwide. Today, the “north as up” convention continues to be deeply ingrained in cartography, offering a familiar and standardised way to read and interpret maps.

The tradition of depicting north as “up” on maps, influenced by both cultural and navigational factors, provides a fascinating backdrop for understanding the development of cartographic conventions. However, one cannot delve into this rich



history without exploring the pivotal role played by map projections. Particularly, the Mercator projection, developed by Gerardus Mercator in the 16th century, fundamentally altered the way we visualise our planet.

The Mercator projection's ingenious representation of latitudes and longitudes as straight, intersecting lines allowed for precise navigation and charting of routes across the globe. This revolutionary cartographic technique further solidified the "north as up" convention, as the Mercator projection's design catered to the navigational needs of its time. Understanding the implications of the Mercator projection on our mental maps of the world requires a closer examination of how latitudes and longitudes are portrayed in this famous map projection, and how it has influenced the way we perceive and interact with geographic information. The video below has a great explanation about this (and yes, it aligns with the argument that all maps are "wrong"), showing the types of projections and the resulting differences in the resulting maps.



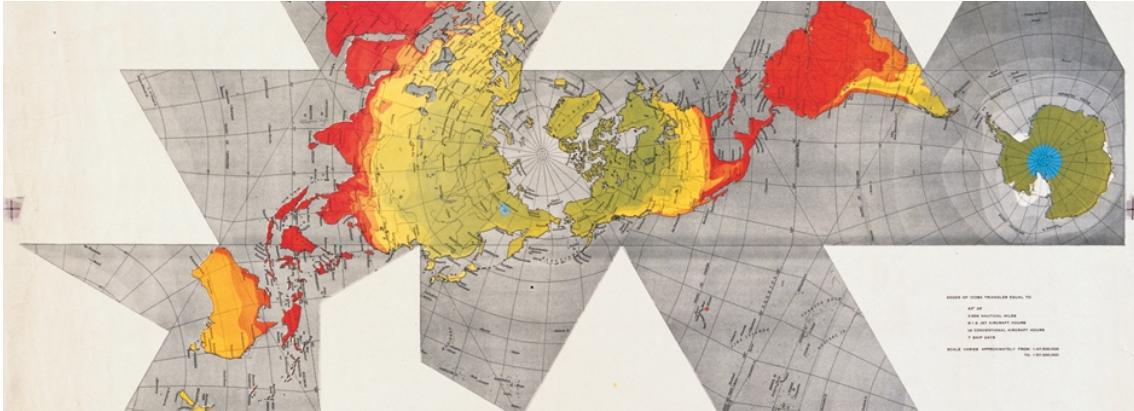
Why all world maps are wrong

https://www.youtube.com/watch?v=kIID5FDi2JQ&ab_channel=Vox

While the Mercator projection has had a significant impact on our perception of the world and our cartographic conventions, it's important to recognize that it's not the only way to represent our planet. Various alternative map projections exist, each with its unique characteristics and applications. For instance, the Fuller Projection Map, also known as the Dymaxion map, presents a different perspective. Designed by



Buckminster Fuller, this projection offers a more balanced depiction of Earth's landmasses, emphasising the interconnectivity of continents and minimising distortion in size and shape. Unlike the Mercator projection, the Fuller map doesn't prioritise a specific direction as "up" but instead showcases a more comprehensive view of our world.



Source: "Dymaxion Map," the Fuller Projection Map
<https://www.bfi.org/about-fuller/big-ideas/dymaxion-map/>
 Some comments about how this projection reduces overall distortion, but is not free of them either:
<https://pro.arcgis.com/en/pro-app/latest/help/mapping/properties/fuller.htm>

All maps are wrong, to some degree

If you are interested in learning more about this, have a look at this article "Why your mental map of the world is (probably) wrong: These are some of the most common geographic misconceptions that are both surprising and surprisingly hard to correct."³

Another great resource to put our perception to the text is an interactive map called "The True Size of". It basically lets us get a polygon for a specific country and move it around the globe map, but while we do it, it adapts its size to counterbalance the distortions of the mercator projection. So, you can see "the real comparable size" of different countries. If you get a country closer to the equator and move it to the poles, it will get larger, and vice-versa. Check it out

³

Source:
<https://www.nationalgeographic.com/premium/article/all-over-the-map-mental-mapping-misconceptions#:~:text=Mercator%20maps%20distort%20the%20shape,eight%20times%20larger%20than%20Greenland.>

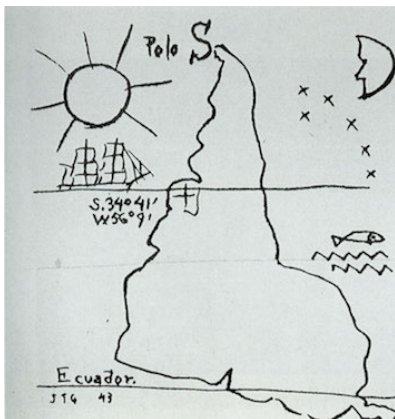
here <https://www.thetruesize.com/>.



In this example, we can see the size of Argentina in comparison to European countries.

Alternatives to the traditional north-up

One of the most famous representations that questions this north-facing convention is the “Inverted Americas”, of the Uruguayan artist Torres García. His drawing places the south at the top, proposing a different perspective of South America.



Joaquín Torres García, *América Invertida* (Inverted America), 1943, ink on paper, 22 x 16 cm (Fundación Torres García, Montevideo).

Source: <https://www.khanacademy.org/humanities/art-1010/latin-america-modernism/constructivism/a/torres-garcia-inverted-america>

TYPES OF MAPS (A SIMPLE TENTATIVE TYPOLOGY)

Broadly speaking, there are two main types of maps. Reference maps and thematic maps. And why did we add the “tentative typology” in our title? Well, because, as with any typology, we need to establish certain categories, and the establishment of those categories might vary depending on who is making them and for what purpose. Similarly, the types of subcategories might vary accordingly.

We can divide most maps that refer to territories between reference maps and thematic maps.

Reference maps

- **Purpose:** Reference maps, also known as general-purpose or topographic maps, are designed primarily to display geographic features and provide a broad overview of an area. They focus on accurately representing the physical features of a location.
- **Content:** Reference maps typically include natural features like rivers, mountains, lakes, and forests, as well as human-made features like cities, roads, boundaries, and landmarks.
- **Use:** They are used for general navigation, geographical orientation, and understanding the layout of an area. Topographic maps, for example, are reference maps that are commonly used for activities such as hiking and urban planning.
- **Examples:** Road maps, political maps, physical maps, and topographic maps are all examples of reference maps.

Thematic maps

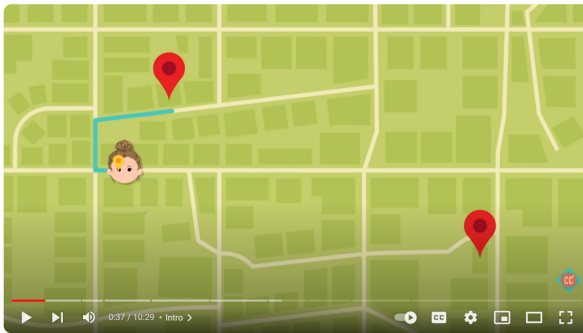
- **Purpose:** Thematic maps, also called special-purpose maps, are created to represent specific themes or subjects in a geographical context. These maps are designed to convey information related to a particular topic.
- **Content:** Thematic maps may include data related to demographics, climate, population density, land use, and other specific themes. They use various visual elements like colours, symbols, or patterns to represent the chosen theme.
- **Use:** Thematic maps are used to highlight and analyse spatial patterns and relationships within the chosen theme. They are particularly useful for researchers, planners, and policymakers when examining specific issues.
- **Examples:** Heat maps showing population density, choropleth maps illustrating political voting patterns, and weather maps displaying temperature variations are all examples of thematic maps.



In summary, reference maps provide a general overview of an area and emphasise geographical features, while thematic maps focus on specific themes or subjects and use visual elements to convey data related to those themes. Thematic maps are valuable tools for understanding spatial relationships and patterns within a particular context.

Curious about various types of maps? Here are some great videos about it

The entire Crash Course series on Geography is great. It is hosted by Alizé Carrère and you can find many interesting topics covered. Here, we have selected the “what is a map” video, a 10-min video that gives a great overview on different types of maps.



What is a Map? Crash Course Geography #2

https://www.youtube.com/watch?v=iHEMOdRo5u8&ab_channel=CrashCourse

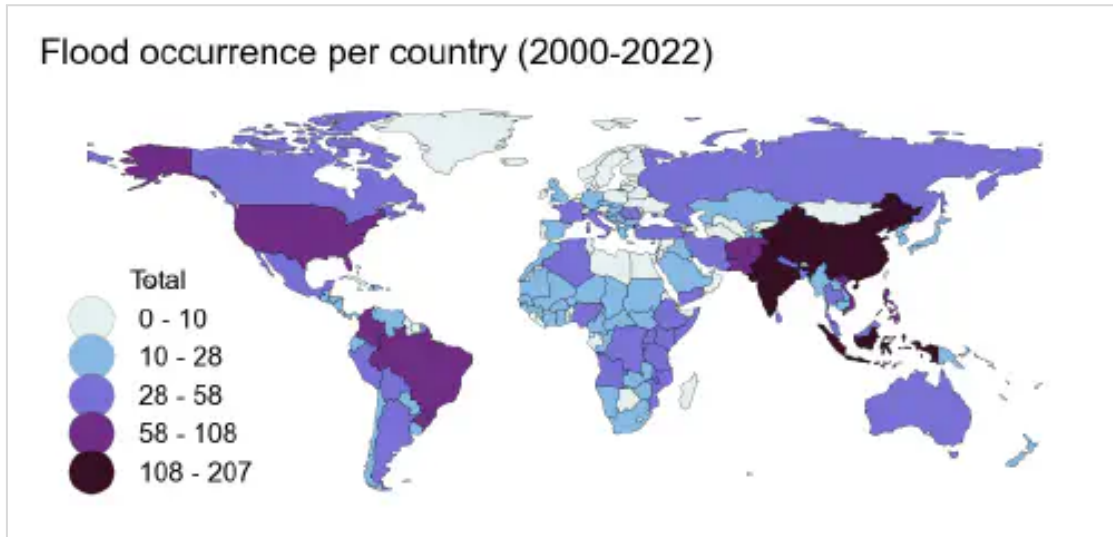
Another interesting topic on the types of maps, is how wrong certain maps were (and some might still be!). In the following video you can learn about some amazing mistakes in mapmaking history, mostly related to navigating the world.



The biggest mistakes in mapmaking history - Kayla Wolf

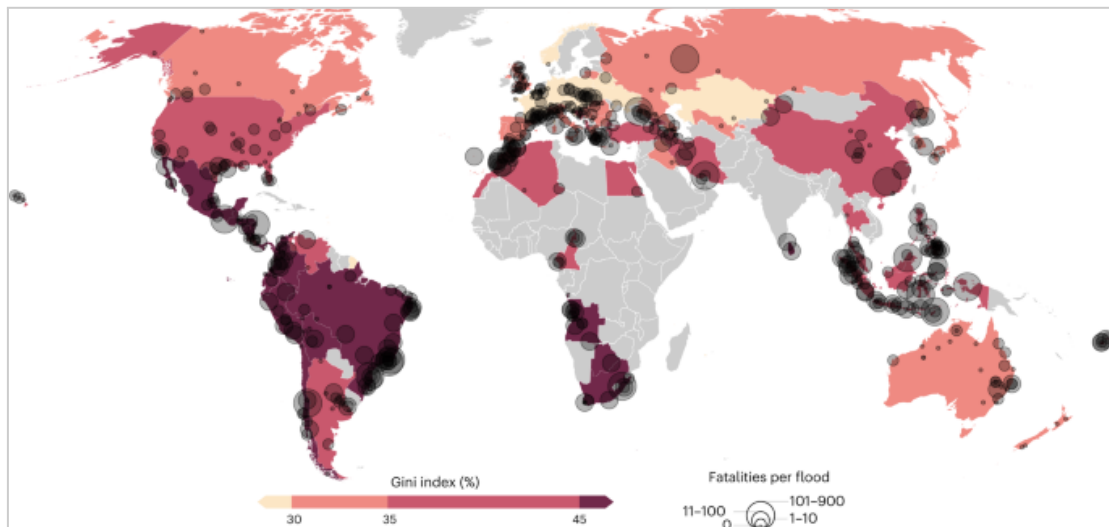
https://www.youtube.com/watch?v=77hLX8jO6e4&ab_channel=TED-Ed

And if you are wondering if a reference map can be used as a basis for a thematic map, you guessed right! Now, let's have a look at some thematic maps about floods:



Source: EM-DAT The International Disaster Database <https://www.emdat.be/>

Income inequality and flood fatalities in 67 MHICs.



"This map displays 573 major flood disasters (dots) that occurred between 1990 and 2018, with the size of the dots indicating the number of reported flood fatalities, and the colour of the countries indicating their average level of income inequality across the sample. The flood disasters are reports from the Emergency Events Database (EM-DAT31) that have been georeferenced to districts (or smaller subdivisions) using the Geocoded Disasters dataset (GDIS)⁴⁴. Basemap from Natural Earth"

Source: Lindersson, S., Raffetti, E., Rusca, M. et al. The wider the gap between rich and poor the higher the flood mortality. *Nat Sustain* 6, 995–1005 (2023). <https://doi.org/10.1038/s41893-023-01107-7>
<https://www.nature.com/articles/s41893-023-01107-7>

These maps are important for raising awareness about floods because they make a strong case not only about the occurrence of floods but also about their negative impacts. They also are a good discussion starter about the relation between flood hazard and flood risk, showing the correlation between socio-economic vulnerability and fatalities. From an international perspective, we can see how the lack of data and reporting is also an issue.

“ALL MAPS ARE WRONG, BUT SOME ARE USEFUL”: MAPS AND STATISTICS

Our subsection title makes a spin on a fairly well known quote that states “all models are wrong, but some are useful”. And why did we decide to do this? Well, because the underlying rationality that simplifications of reality, that try to predict or describe reality, are inherently limited is also present here. If we were to create an entirely accurate map that encompasses every detail of a territory, we would essentially have to recreate the entire territory itself. That might, in a sense at least, be happening in cyberspace, with digital twins and similar tech advances, but that is a topic for another conversation.

The famous quote is usually attributed to the statistician George Box. Its main idea is to acknowledge that there are inherent limitations of statistical models while valuing their utility. The same can be said about maps. Like statistical models, maps can't capture the entirety of reality, yet they hold value in conveying information. If a map were to capture all the details from a city for example, it would need to be the same size as the city, and that would defeat its purpose, right? In all simplifications to understand and represent our complex reality, some concessions need to be made. And we need to be aware of them.

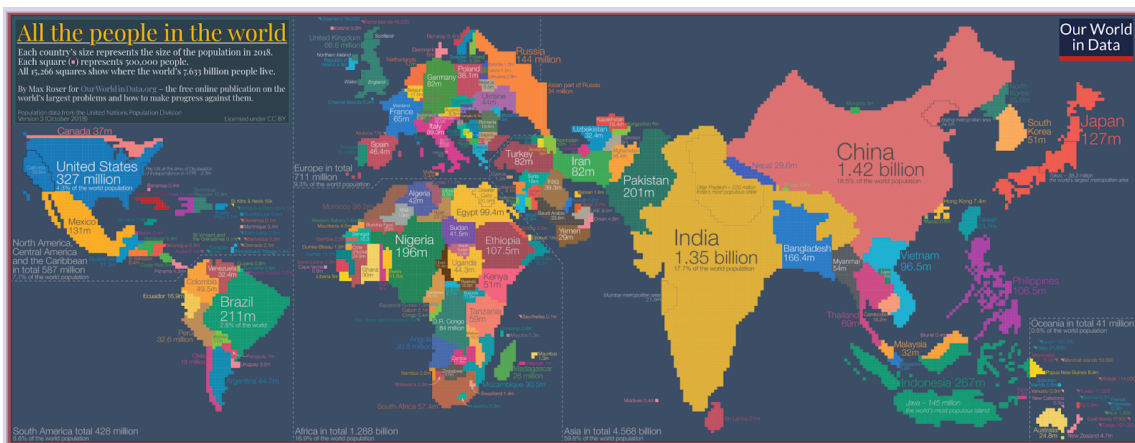
Both statistical models and maps are developed using certain assumptions, making certain concessions to simplify reality. The decisions that inform their development mean that these instruments tell a specific story, they assume a particular perspective. If we are to interpret them well, we need to be conscious of these limitations.

Furthermore, when we consider risk maps, it's important to recognize that they often rely on information generated by complex models, which adds an extra layer of intricacy. This inherent level of uncertainty should be taken into account. In the case of flood risk maps, they incorporate insights from hydrological models. These models require not only computational resources but also accurate and complete data to function effectively. Unfortunately, the data they rely on can sometimes be incomplete or lacking in the level of detail necessary for precise predictions. This is a crucial aspect to bear in mind when interpreting and utilising such maps for decision-making and planning.



A good example of maps that privilege statistical data over spatial form are **cartograms**. Have you ever heard about them?

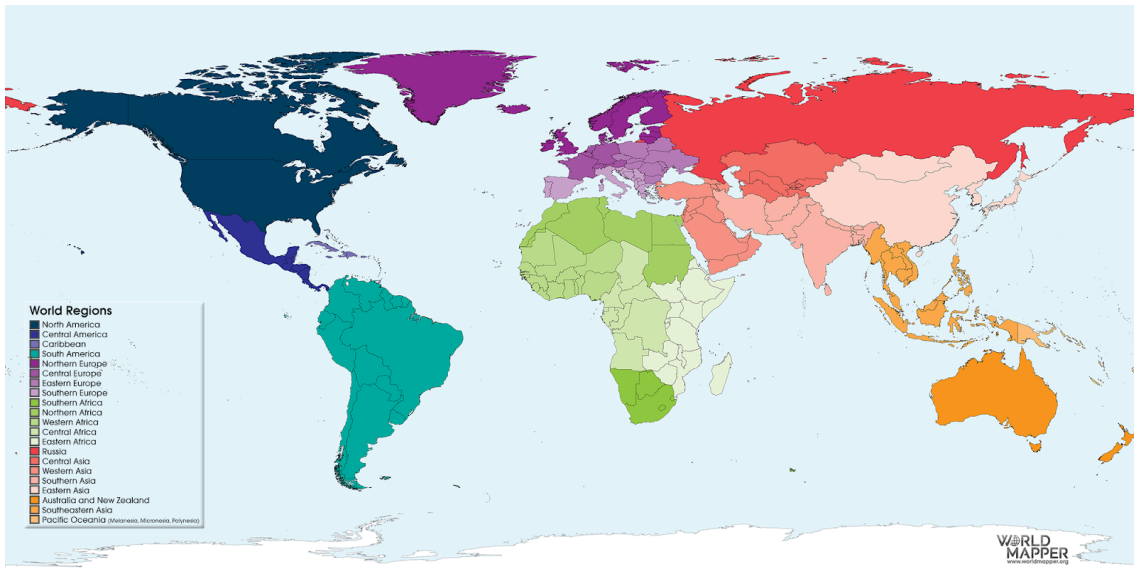
According to the Oxford dictionary, a cartogram is a “a map on which statistical information is shown in diagrammatic form”. The “diagrammatic form” usually implies distorting conventional polygonal shapes to make them proportional to the quantitative data being portrayed. It is important to highlight here that the “traditional polygonal shapes” we are used to associate with countries in global maps are also distorted. A “side-effect”, so to speak, of representing pieces of land that are around the Earth in a flat, 2D map. In order to get all countries neatly represented, geographical concessions were made. And we have all grown accustomed to it. So the pieces of land closer to the Ecuador line are much smaller, in proportion to the ones closer to the poles, than they actually are. We have already discussed this a bit in the “All maps are wrong, to some degree” Box (page 17), but If you want to explore this topic further with your students this is a good resource to spark the discussion: a 4 min animated video <https://www.youtube.com/watch?v=eTYslePy5zg> about why all world maps are wrong.



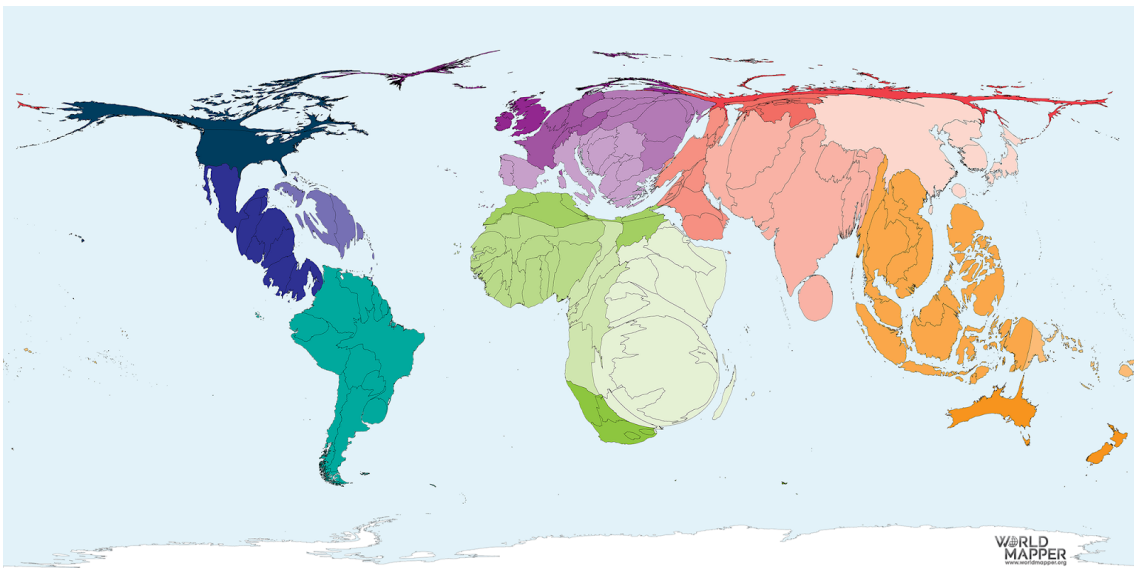
Source: <https://ourworldindata.org/world-population-cartogram>

One of the key references for cartograms is “The World Mapper” organisation, founded by Tina Gotthardt and Benjamin Hennig. You can check out many maps they have produced in their webpage <https://worldmapper.org/maps/>. These maps give a good example of how maps can be used to relate spatial information (in this case the countries and world regions) with other variables. In the first map, the countries and regions are represented in the more traditional proportions that we are used to when looking at an international map covering all the territories on the globe. However, if you notice the following maps, related to floods, flood damages and flood deaths. As you can see, they portray very different situations.

World map - traditional representation

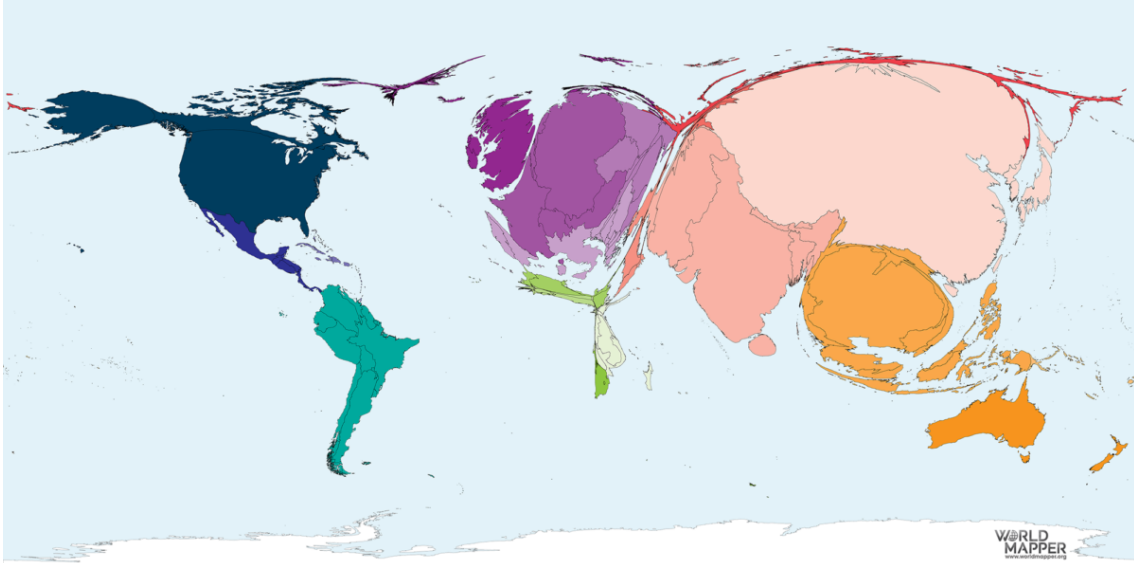


Floods 2001-2017



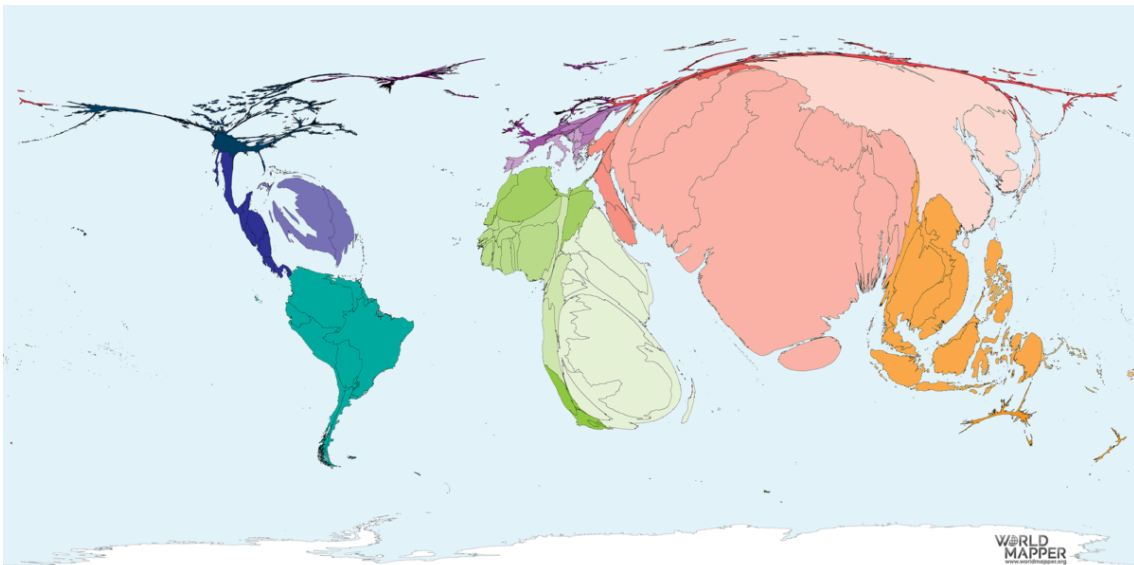
Source: <https://worldmapper.org/maps/floods-total-2001to2017/>

Flood Damages 2001-2017



Source: <https://worldmapper.org/maps/flood-damages-2001to2017/>

Flood Deaths 2001-2017



Source: <https://worldmapper.org/maps/flood-deaths-2001to2017/>

WHAT ABOUT FLOOD MAPS?

We have decided to add this subsection dedicated specifically to flood maps. Before we start, however, it is important to discuss the different types of floods.

According to the IPCC glossary:

Flood

The overflowing of the normal confines of a stream or other body of water, or the accumulation of water over areas that are not normally submerged. Floods include river (fluvial) floods, flash floods, urban floods, pluvial floods, sewer floods, coastal floods, and glacial lake outburst floods.⁴

These types of floods relate to the origin of the water that is overflowing and accumulating in certain areas. This is important from a mapping perspective because it informs the models that are used to calculate and estimate the reach of the floods. A good example to better understand this in practice is the World Resources Institute interactive mapping tool called Aqueduct Floods (<https://www.wri.org/applications/aqueduct/floods/#/>). In it, it is possible to identify coastal and riverine flood risks, selecting different

In Europe, the Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks⁵, is a key document. It is known as the **Floods Directive**. We will use it as a reference to introduce the topic of flood maps. In this directive it is stated that:

In order to have available an effective tool for information, as well as a valuable basis for priority setting and further technical, financial and political decisions regarding flood risk management, it is necessary to provide for the establishing of **flood hazard maps and flood risk maps** showing the potential adverse consequences associated with different flood scenarios, including information on potential sources of environmental pollution as a consequence of floods. In this context, Member States should assess activities that have the effect of increasing flood risks.

⁴ Source: https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-AnnexII_FINAL.pdf

⁵ Source: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32007L0060>



When we say flood maps, we are basically referring to 2 types of maps.

Flood hazard maps and **flood risk maps**.

What is the difference?

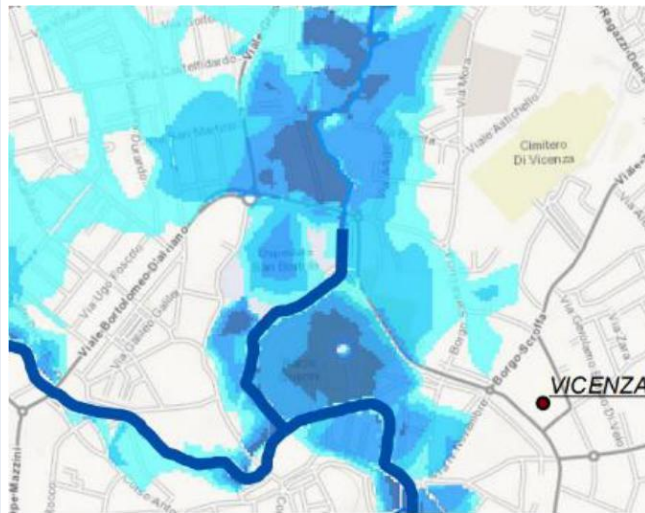
Flood Hazard Maps primarily focus on identifying areas that are susceptible to flooding based on various factors such as topography, rainfall intensity, river levels, and coastal influences. These maps display the potential extent of flooding in specific scenarios, illustrating the areas that could be affected by floodwaters. Flood Hazard Maps are essential for emergency preparedness, urban planning, and infrastructure development. They help authorities and communities understand which regions might experience flooding and to what extent, aiding in the formulation of strategies to mitigate the impact of floods.

Flood Risk Maps, on the other hand, go beyond identifying flood-prone areas and provide a more comprehensive assessment of the potential consequences of flooding. These maps take into account not only the physical hazard but also the vulnerabilities of assets, infrastructure, and populations within the flood-prone areas. Flood Risk Maps incorporate elements like property values, population density, critical facilities, and economic assets. By combining hazard data with exposure and vulnerability information, Flood Risk Maps offer a clearer picture of the potential losses—both in terms of property and human lives—in the event of a flood. These maps are essential for designing effective risk reduction strategies, insurance planning, and land-use decisions.

In summary, **Flood Hazard Maps highlight areas prone to flooding, depicting the spatial extent of potential inundation, while Flood Risk Maps provide a deeper understanding of the potential consequences by considering vulnerabilities and exposure of assets and populations.** Both types of maps are crucial tools in flood management and resilience-building efforts, helping communities make informed decisions to minimise the impact of floods on lives, property, and the environment. Flood Hazard Maps and Flood Risk Maps are both valuable tools in assessing and addressing flood-related challenges, but they serve different purposes and provide distinct insights. In the next page, you can see 2 maps of the same area, that exemplify the difference between hazard and risk maps.

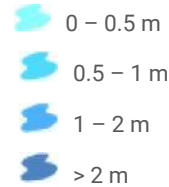


FLOOD HAZARD MAP



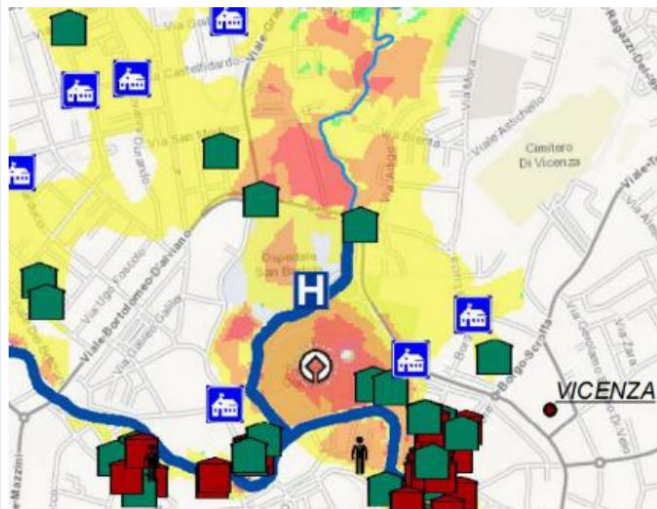
Legend:

Classes of water height:



Hazard map in the town of Vicenza, Italy in the case of a flood event with a 1 % probability of occurrence Source: Online maps published by Eastern Alps Hydrographical Basin, Italy.

FLOOD RISK MAP

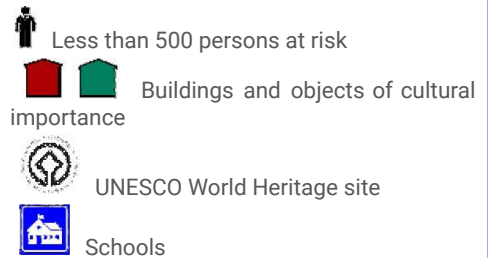


Legend:

Classes of risk:



Pictograms on the map represent:



Risk map in the town of Vicenza, Italy in the case of a flood event with a 1 % probability of occurrence Source: Online maps published by Eastern Alps Hydrographical Basin, Italy.

Source: European Court of Auditors, Floods Directive: progress in assessing risks, while planning and implementation need to improve, Special Report no 25, 2018. Annex II. <https://op.europa.eu/webpub/eca/special-reports/floods-directive-25-2018/en/#chapter5>

According to the **European Floods Directive**, hazard maps shall cover the geographical areas which could be flooded according to the following scenarios:

- (a) floods with a low probability, or extreme event scenarios;
- (b) floods with a medium probability (likely return period ≥ 100 years);
- (c) floods with a high probability, where appropriate

The fact that “**probability**” is a word that appears in all 3 types of scenarios is indicative of the crucial role that statistics and data play in the development of flood hazard maps. We will come back to this point in the “Who Makes Maps” section, exploring skills needed to map out flood-prone areas.

As we mentioned before, the European Union has released this year the [Flood Risk Areas Viewer](#), an interactive map viewer that depicts information related to the Floods Directive and is a valuable resource to understand flood hazard and risk in each country (see box on page 8).



Overview of Flood Risk Management in the European Union

This report, from 2021, includes several cases from member states for the following topics: assessing, mapping and communicating flood risk; climate change; land use planning; linking objectives to measures and monitoring progress; implementation of measures; working in partnership; working with the public; nature-based solutions; urban flood risk management. As we can see from the list, there are several aspects that need to be incorporated in flood risk management.

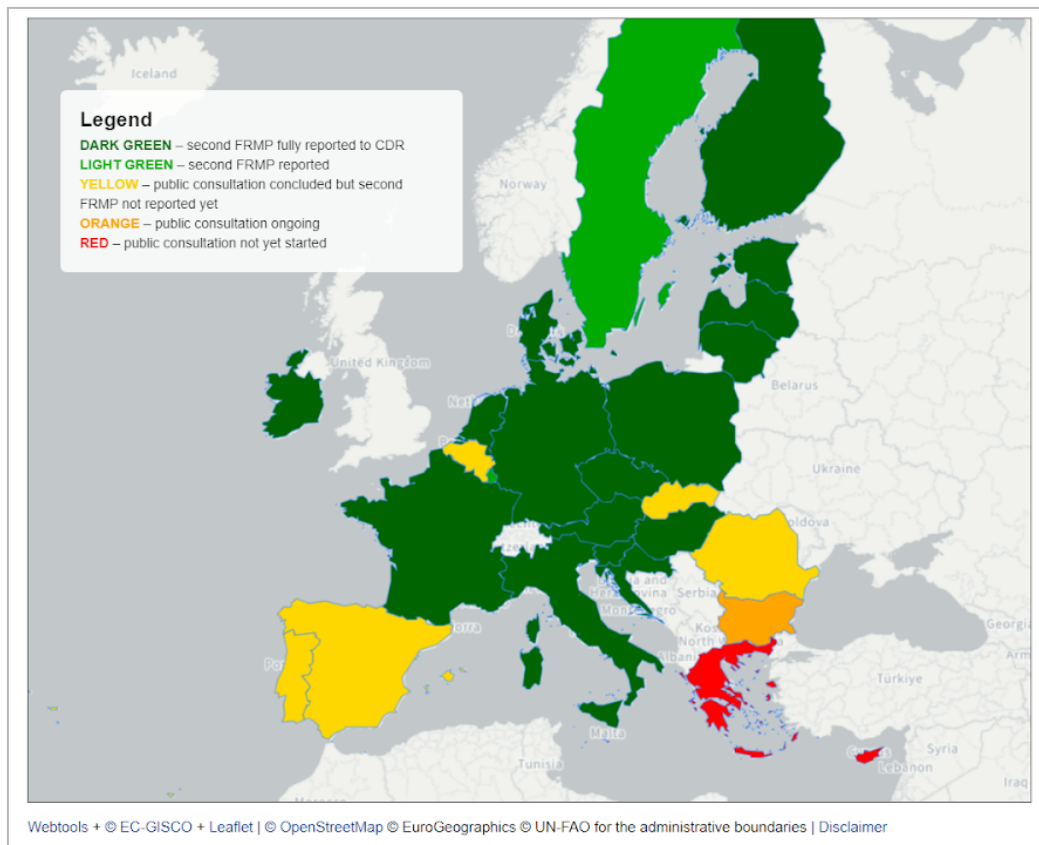
Source: Current practice in flood risk management in the European Union
September 2021

<https://op.europa.eu/en/publication-detail/-/publication/21d8c5c2-2199-11ec-bd8e-01aa75ed71a1/language-en/format-PDF/source-232431484>

What we want to highlight here, is that **flood maps**, or more specifically, flood hazard and risk maps are a central piece of **Flood Risk Management Plans (FRMP)**. Different countries in the EU have different internal processes to develop flood risk management instruments, and the map below showcases some of the current state plans' adoption. As we can see, public consultation is a part of the process and it has yet to be initiated in some countries for the second FRMP.

State of play of 2nd Flood Risk Management Plans adoption in EU 27

last update: 28 July 2023

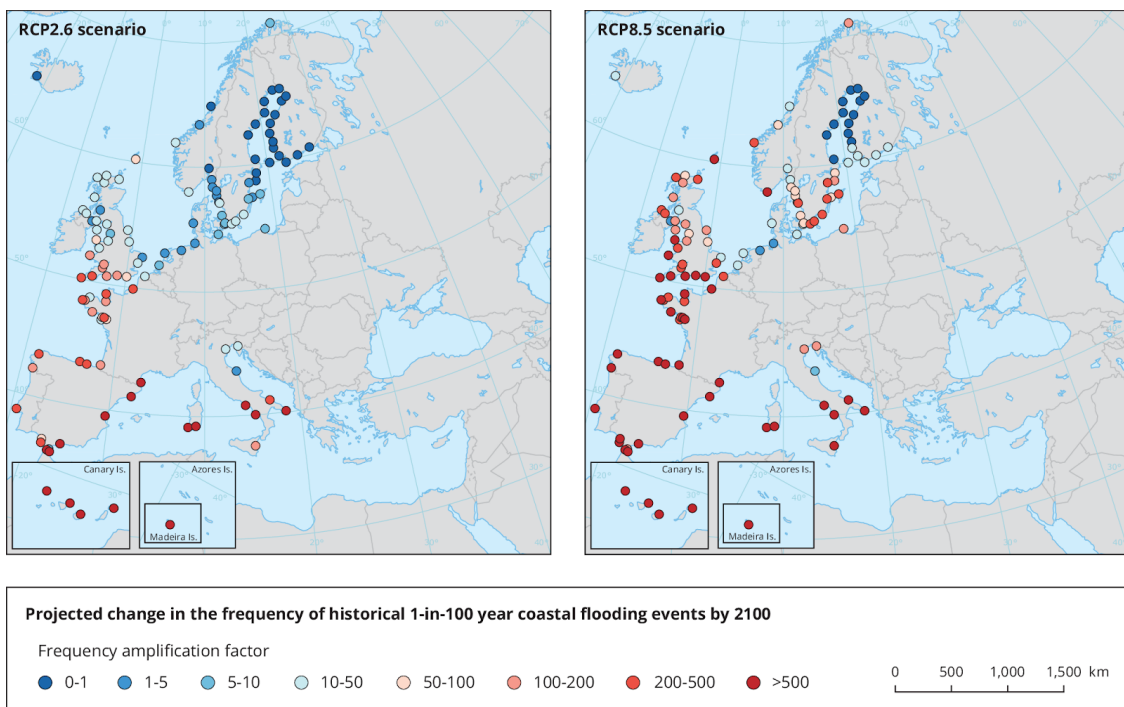


Source: European Commission (2023) Floods https://environment.ec.europa.eu/topics/water/floods_en

These plans are not one-size-fits-all; they are highly **tailored to the specific socio-spatial characteristics of each territory**. This means that what works for one region might not be effective in another. For example, **densely urbanised areas** often face an increased risk of flash floods due to the characteristics of the built environment. Paved surfaces prevent water from infiltrating the ground, leading to increased surface runoff during heavy rainfall. Consequently, adaptation and resilience-building measures in such areas will focus on managing rapid water flow.

Conversely, **coastal regions** are particularly exposed to the risk of flooding, primarily due to rising sea levels and storm surges. Here, strategies will emphasise measures such as the construction of coastal defences and early warning systems. Understanding these localised challenges is paramount in developing effective FRMPs and flood risk maps that cater to the unique needs and vulnerabilities of each region.

According to the **European Environment Agency**, sea level risings will drastically affect the occurrence of coastal flooding events. In the image below, you can see how future scenarios connect extreme sea levels with coastal flooding in many places in European coastlines.

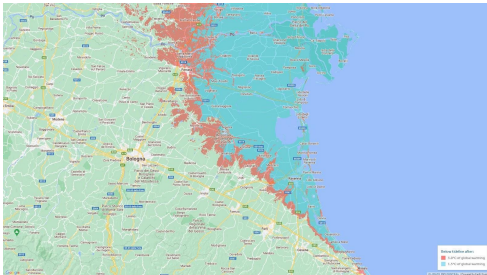


Source: European Environmental Agency (2022) Extreme sea levels and coastal flooding <https://www.eea.europa.eu/ims/extreme-sea-levels-and-coastal-flooding>

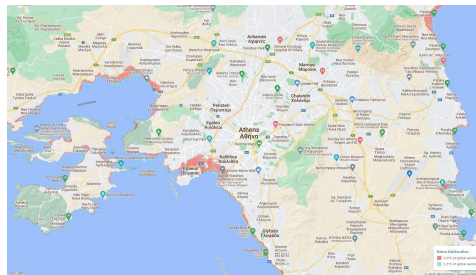
Observation: "This indicator reports changes in the frequency of historically 1-in-100-year floods along the European coastline. Such floods are caused by extreme sea levels, particularly during storm surges. "

Furthermore, it's essential to recognize that **flood risk management often requires a transboundary approach**. Water basins, which do not necessarily align with political-administrative borders, are critical areas for coordinated efforts. Flooding knows no borders, and effectively managing this risk often necessitates collaboration between neighbouring regions and countries within the same watershed to ensure a comprehensive and harmonised strategy.

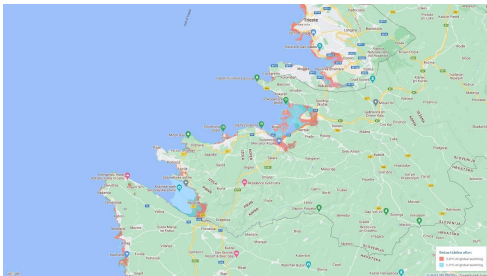
If you are interested in exploring maps that use probabilistic models, another great resource that connects sea level rises with the future scenarios is the “Picturing our Future” project, from the Climate Central organisation. They have created impactful visualisations - including photorealistic images, flyover videos, Google Earth images, and animated GIFs - that depict possible futures for 190 locations around the world (available here <https://picturing.climatecentral.org/>). They also have an interactive map that showcases projected sea level rises for different climate change scenarios. It is quite worrisome to explore some of the potential futures we will face.



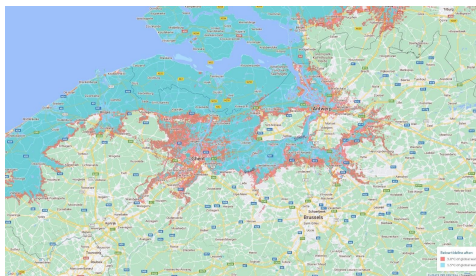
Coast of Emilia-Romagna region, Italy



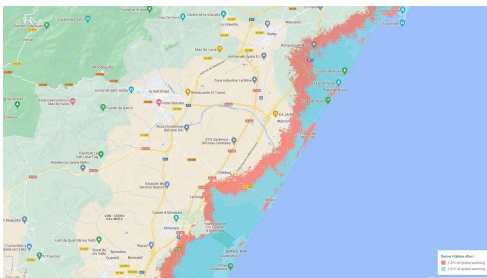
Coast of Athenas, Greece



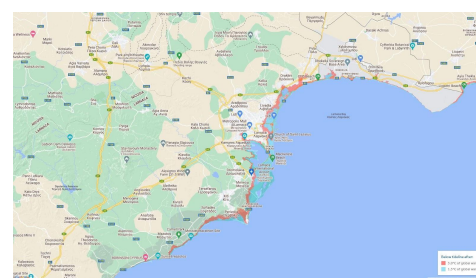
Coast of Slovenia



Part of the Coast of Belgium



Portion of the coast of Spain



Part of the coast Cyprus (close to school)

Screenshots, at various scales, illustrating a visualisation from the “Picturing our Future” interactive map. Selected frames cover areas that encompass the locations of the FloodStopping project partner organisations in their home-countries. Source: <https://coastal.climatecentral.org/>

As we can see, when looking at the maps about potential floods, it becomes clear that we need to be more proactive in preparing for floods, raising awareness and fostering resilience.



WHO MAKES MAPS?

Answering this question of who makes maps, we will tackle the following specific objectives:

- Present an overview of the professional profiles and skill sets involved in the development of technical flood maps.
- Emphasise that creating maps is not limited to technicians or experts, calling attention to the importance of involving local communities, students, and teachers in map-making processes.

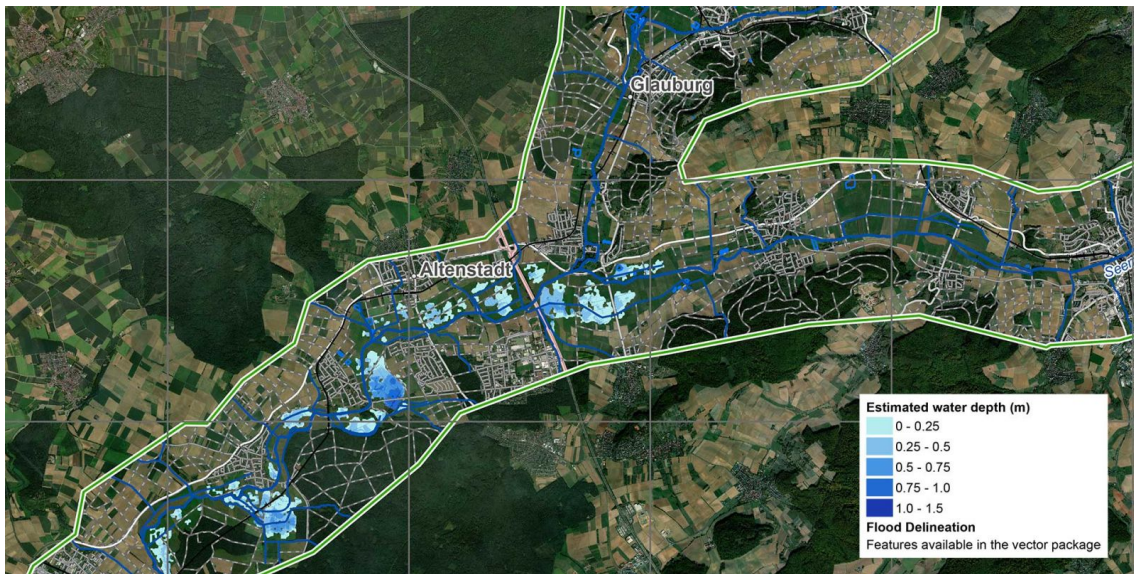
WHO MAKES TECHNICAL FLOOD MAPS?

Creating technical flood maps requires a **specialised skill set** that encompasses **statistical analysis, hydrometeorological expertise, and computational proficiency**. This multifaceted skill set is essential for accurately assessing and predicting flood risks.

A collaborative effort from various professionals with diverse backgrounds can contribute to the successful development of flood maps. Among those who possess these requisite skills are hydrologists, who understand water flow dynamics; hydrometeorologists, who specialise in the interactions between atmospheric and hydrological processes; hydraulic modellers, who use computer simulations to model water behaviour; and mathematicians, engineers or data scientists, who contribute to the precise calculations required for flood mapping accuracy.

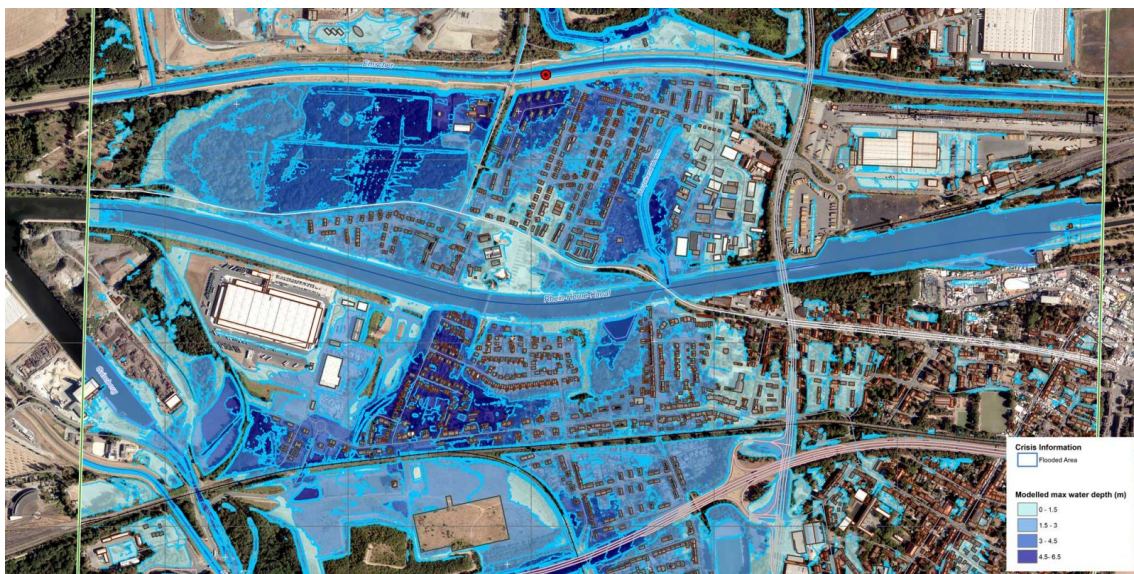
At the **European level** the Copernicus Emergency Management Service (CEMS) is the main body responsible for mapping. It employs satellite imagery and various geospatial data to offer a no-cost mapping service for natural disasters, human-induced emergencies, and humanitarian crises globally. This service encompasses events such as floods, and offers services related to rapid flood mapping and risk and recovery mapping. They use inputs such as satellite images, topographic maps and modelling to develop the maps.





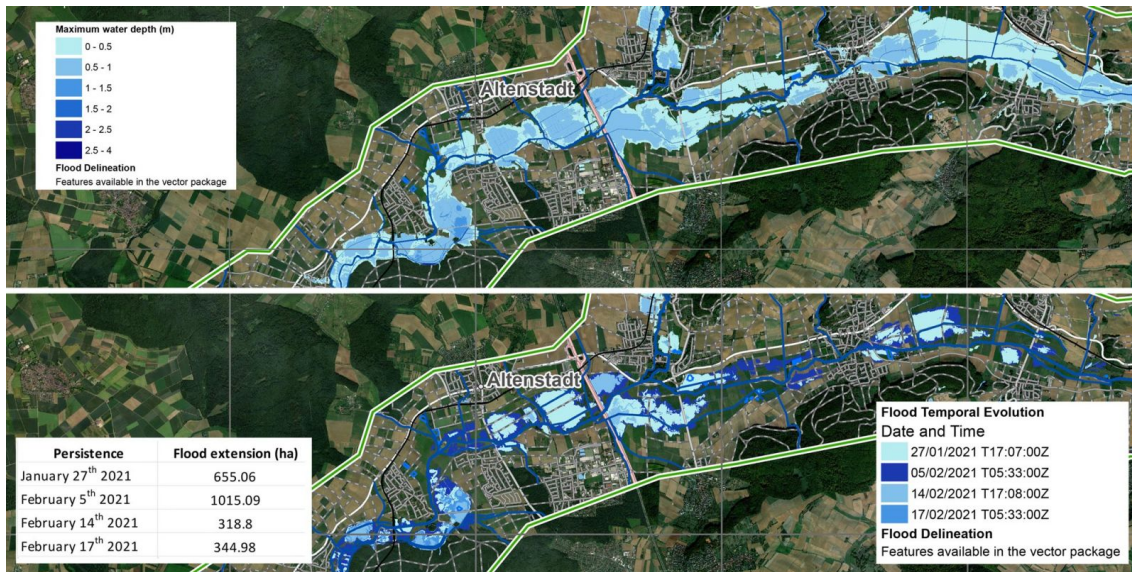
Flood delineation reference image

Source: <https://emergency.copernicus.eu/mapping/ems/rrm-portfolio-p04>



Modelled Flood Extent for Major Events

Source: <https://emergency.copernicus.eu/mapping/ems/rrm-portfolio-p05>



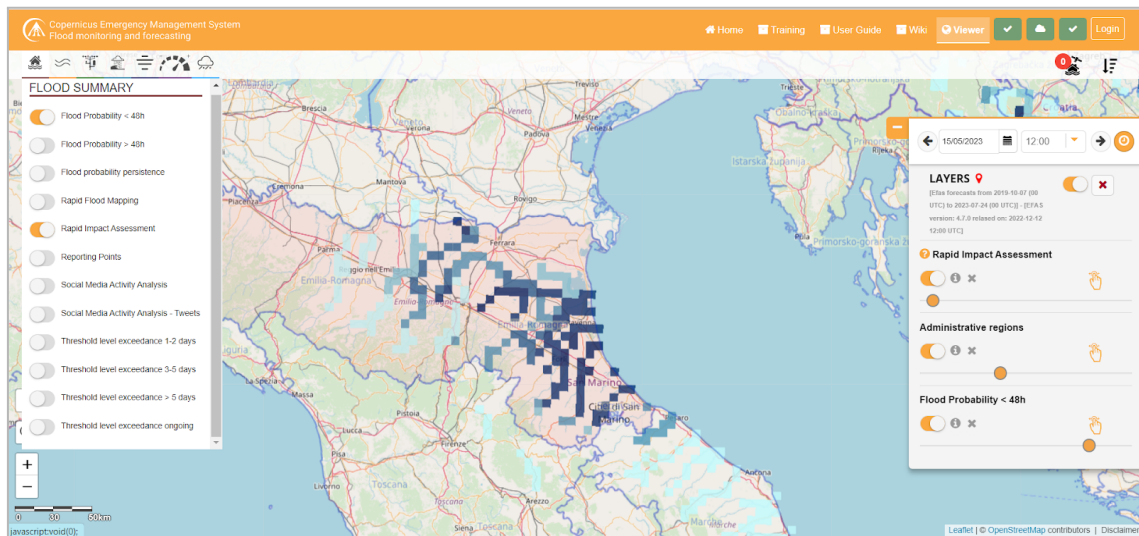
Temporal analyses of occurred flood events

Source: <https://emergency.copernicus.eu/mapping/ems/rrm-portfolio-p06>

Authorised users (that include National Focal Points (NFPs) in EU Member States and in countries participating in the European Civil Protection Mechanism as well as EC Services (DGs), the Situation Room of the EEAS and the EU delegations). Associated users can contact the authorised users to request for certain services. The general public cannot activate the services, however, unless some sensitivity restrictions apply, they can be informed about activation requests in the web portal.

The **Copernicus Emergency Management Service (CEMS)** web portal hosts the **European Flood Awareness Systems**, which includes a **Flood Monitoring and Forecasting map viewer** with great features. It is an interactive map that allows us to revise some past forecasts (real time use is restricted to authorised members). In the image below, you can see an example of a map from the Emilia-Romagna region, where 2 of our partner organisations are based. The map depicts a particular time in 2023, when the region was affected by severe flooding.





Screenshot from the EFAS map. The region shown is Emilia-Romagna, in northern Italy. The date selected is May 15th, 2023. The layers activated are: Flood Probability < 48h; Rapid Impact Assessment (with less opacity), Administrative regions (also with less opacity). The basemap is a GISCO OpenStreet map.

Source: https://www.efas.eu/efas_frontend/#/home

At the national level, several public bodies commonly engage in the development of maps, particularly those related to floods. Some of the most prominent ones include:

- **National Mapping and Cadastral Agencies (NMCAs):** These agencies are responsible for cartographic and geospatial data collection, management, and dissemination. They often collaborate on flood mapping projects due to their expertise in spatial data.
- **Environmental and Water Management Agencies:** These agencies focus on environmental protection and resource management, including water bodies. They play a significant role in flood risk assessment and mapping, as well as floodplain management.
- **Meteorological and Hydrological Institutes:** These institutes specialise in weather and hydrological forecasting and monitoring. They provide critical data for flood predictions and contribute to flood hazard mapping.
- **Civil Protection Agencies:** These organisations are responsible for disaster preparedness, response, and recovery. They collaborate on flood risk assessment, emergency planning, and communication efforts through various mapping initiatives.
- **Ministry of Environment and Spatial Planning:** This governmental department often oversees policies related to environmental management, land use planning, and disaster resilience. They are involved in flood risk mapping and management strategies.



- **Geospatial Information Agencies:** These entities handle the collection, maintenance, and dissemination of geospatial information, which is crucial for accurate flood mapping and analysis.
- **Water Authorities:** Responsible for managing water resources, water quality, and water-related infrastructure, these authorities are integral in flood risk management and mapping, particularly in areas prone to flooding.
- **Ministry of Interior or Interior Affairs:** These ministries often oversee disaster management and coordination efforts, including flood preparedness, response, and recovery, which involves mapping various aspects of flood-related risks.

It is noteworthy that **research institutes and universities** are also often involved in mapping, as well as private actors, such as consultancies. They can be engaged in flood mapping research, technology development, and the creation of innovative flood hazard and vulnerability maps. Moreover, it is common that they collaborate with public bodies and among themselves, often in transnational projects, given the transboundary nature of many water bodies and flood dynamics and events.

Does this mean that **only trained professionals should be involved in map making exercises** when the topic is floods?

Short answer: **No.**

If we are talking about highly technical maps, of course, trained professionals with a particular set of skills need to be involved. However, there are several reasons why more people should be involved in map making. Including you! And we hope that if you read the “Why maps” section, we have already convinced you of this.

We advocate that Involving a broader spectrum of individuals in map making, especially in the context of flood awareness, not only spreads the workload but also offers multiple benefits. It equips students and communities with essential skills, fostering their growth and empowering them to actively engage with local authorities to enhance their living environment's safety and resilience. Here are the **main skills that can be developed or enhanced through involvement in map making**:



- **Spatial awareness:** Map making enhances spatial awareness, allowing individuals to better understand the geography of their surroundings. This knowledge empowers people to make informed decisions related to their local environment, especially in the context of flood risk. It enables them to identify flood-prone areas, drainage issues, and potential vulnerabilities.
- **Statistical analysis and data science:** Creating maps often involves working with data and statistics, fostering skills in data interpretation and analysis.
- **Socio-spatial analysis:** Maps provide a unique perspective on the relationship between human society and physical space, fostering socio-spatial analysis capabilities. A clear understanding of the relation we have with the spaces we live and circulate in is paramount for map making.
- **Digital skills:** Modern map making frequently relies on digital tools and software. This engagement helps individuals develop proficiency in digital technologies.
- **Communication skills:** Designing maps requires clear communication of complex information. Map makers develop skills in visual communication and design, ensuring that data and insights are effectively conveyed to the audience.
- **Critical thinking:** Analysing data and creating maps require critical thinking skills to process information effectively. As we have highlighted, many decisions need to be taken in map making, and reflecting upon them, with a systemic, interdisciplinary approach, is an essential skill for creating quality maps.

In sum, map making equips individuals with a diverse skill set, enabling them to engage actively in flood risk management and build resilience within their communities.

COLLABORATIVE MAPPING

Participatory map-making is a powerful tool for raising flood awareness and supporting resilience building efforts. By involving local communities in the map-making process, we can create maps that are more accurate, relevant, and useful for local people.

Local communities have a wealth of knowledge about their environment, including the areas that are most at risk of flooding. They also have a deep understanding of the social and economic impacts of flooding. By involving local communities in participatory map-making, we can tap into this knowledge and create maps that are more accurate and relevant to the needs of local people.

Participatory maps can also be used to raise awareness of flood risk and to support resilience building efforts. For example, maps can be used to identify flood evacuation



routes, to locate safe areas, and to plan for the recovery process. Maps can also be used to communicate flood risk to the public and to advocate for flood protection measures.

A great example is Humanitarian OpenStreetMap (HOT): a global community of people who use open source tools and data to create and maintain maps of the world. HOT has a long history of working with local communities to map areas that have been affected by disasters, including floods.

Here are some specific examples of how participatory map-making has been used to raise flood awareness and support resilience building efforts:

- In Bangladesh, participatory mapping was used to identify and map the areas that are most at risk of flooding. As one of the most flood prone areas of the world and with few resources, collaborative mapping has been essential to better understand the territory. <https://www.hotosm.org/where-we-work/bangladesh/>
- In Nepal, participatory mapping was used to identify and map the areas that were most affected by the 2015 earthquake and floods. This information was then used to plan for the recovery process and to identify the areas that were most in need of assistance. <https://tasks.hotosm.org/projects/1047>
- In Mozambique, participatory mapping was used to identify and map the areas that were most at risk of flooding from Cyclone Idai. This information was then used to warn people about the dangers of flooding and to plan for evacuations. <https://tasks.hotosm.org/projects/5839>

If you want to join their mapping efforts, you can check all the open mapping tasks on their website: <https://tasks.hotosm.org/>

These are just a few examples of how participatory map-making can be used to raise flood awareness and support resilience building efforts. Collaborative map-making is a powerful tool that can be used to help communities prepare for, respond to, and recover from floods.



Community based mapping to promote flood risk awareness and foster local resiliency: evidence from a study

The paper “Using community-based flood maps to explain flood hazards in Northland, New Zealand” was published in 2022 and is a good example of how community-based flood mapping can play a crucial role in effective hazard risk communication, particularly in safeguarding flood-prone communities. The authors emphasise the critical role of these maps in enhancing community resilience and shedding light on potential hazards. The authors emphasise the critical role of effective hazard risk communication in safeguarding flood-prone communities. By focusing on community-based flood mapping, the study highlights its pivotal contribution to enhancing community resilience.

A significant finding underscores the essentiality of the **visual design aspect** of these maps in conveying risk information comprehensively. It also emphasises the positive impact of active publication on fostering collaboration within communities for improved flood risk management.



Fighting the False Sense of Security:

A critical outcome of the study is the revelation that inadequate risk communication can lead to a false sense of security within communities. Without clear and comprehensible information, individuals may underestimate the magnitude of potential hazards, leaving them ill-prepared for emergency situations. Overall, this research is a good example of the state-of-the-art when it comes to effective risk communication, presenting a case study that highlights the synergy between clear communication, visual design, community engagement, and active publication for building resilience against floods.

Auliagisni, W., Wilkinson, S., & Elkharboutly, M. (2022). Using community-based flood maps to explain flood hazards in Northland, New Zealand. *Progress in Disaster Science*, 14, 100229. <https://doi.org/10.1016/J.PDISAS.2022.100229> Open-access peer-reviewed paper available at: <https://www.sciencedirect.com/science/article/pii/S2590061722000163>

Key takeaway: Using maps that communities help to create amps up their resilience against floods and fight the false sense of security!



Participatory mapping references

Here are some other references in participatory mapping. Not all of them are connected to flood topics primarily, but they are good evidence that support the use of community mapping as a resilience building practice.

- **Good practices in participatory mapping:** A review prepared for the International Fund for Agricultural Development. 2009. Available at: https://www.ifad.org/documents/38714170/39144386/PM_web.pdf/7c1eda69-8205-4c31-8912-3c25d6f90055#:~:text=Participatory%20mapping%20is%20a%20map,and%20recognized%20language%20of%20cartography.
- **Community and Participatory Mapping in Planning:** A primer on what community mapping processes are, and how they might be useful in participatory planning. Authors: Andrew Figueiredo, Florence Zheng, Joanne Nellas, and George Van, 28 October 2020. Available at: <https://storymaps.arcgis.com/stories/474dbf1a1f8f491199ad0489877153b9>
- **Participatory Mapping for Decision Making,** by Juri Lienert. Available at: <https://sswm.info/planning-and-programming/decision-making/deciding-community/participatory-mapping-for-decision-making>
- **Integrated Participatory and Collaborative Risk Mapping for Enhancing Disaster Resilience,** Liu, W.; et al. International Journal of Geo-Information, 2018, Available at: <https://floodresilience.net/resources/item/integrated-participatory-and-collaborative-risk-mapping-for-enhancing-disaster-resilience/>

We are also developing, as part of this project, more resources connected to collaborative mapping, so we also invite you to check out other results from the project in our website: <https://floodstopping.eu/project-results/>



WHEN TO USE MAPS?

In this section, we have two specific objectives. We will:

- Advocate for the use of maps before, during and after flood events, calling attention to the different role maps might have in these different moments.
- Highlight the importance of updating maps before and after flood events to reflect changes in risk and impact.

We use maps, from a geographical perspective, to understand, interpret and analyse spaces, in various scales. They also serve as instruments to examine the interplay between us and our environment. They can come in various forms, depending on the use we want to give them. If it is to study the geopolitical borders at the international level, we might use an atlas (which is basically a book full of maps and charts). If we want to find our way from place A to place B, nowadays, we will probably use a digital map on our smartphones, tapping into GPS technology to pinpoint us in the map and offer route alternatives.

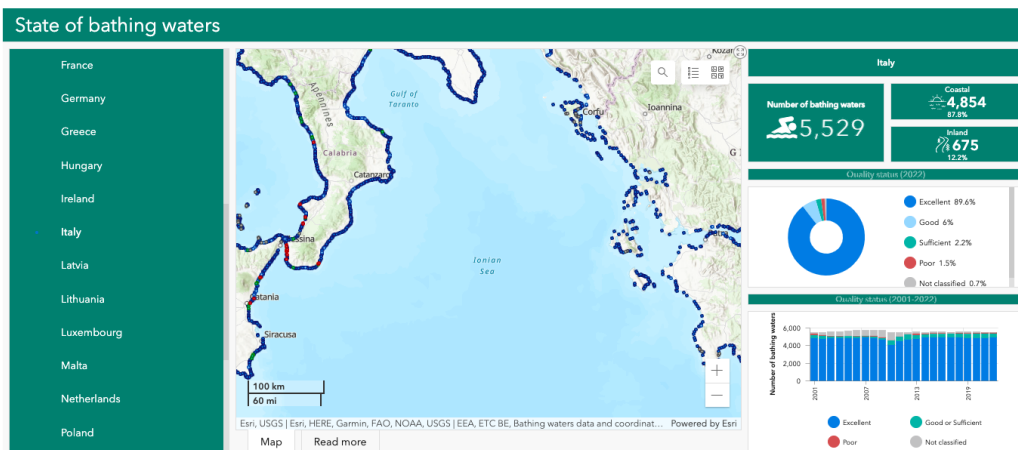
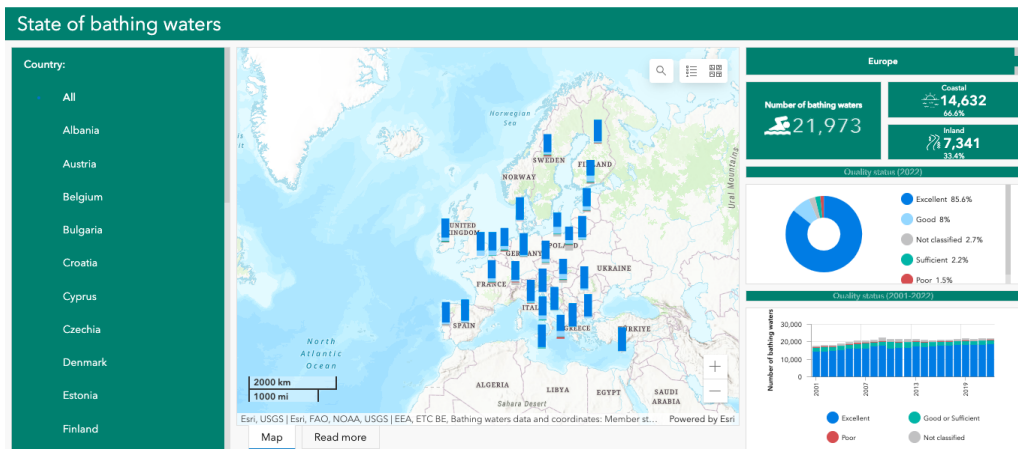
Interactive map on bathing water quality for Europe

Did you know, you can check the water quality for bathing around Europe? The WISE-Freshwater platform has a diverse set of information and data about fresh waters all around Europe. One of its incredible resources is an interactive map where you can learn about the quality of bathing water around Europe.

You might be wondering how this relates to floods. At first glance, it might seem unrelated, but when we consider the broader implications of the water cycle and the potential risks of water contamination that can emerge during floods, especially with blackwaters – highly polluted water from urban areas, industrial sites, and sewage – monitoring the quality of bathing water becomes more relevant than ever.

By understanding the connections between water quality, flooding, and public health, we can take steps to safeguard our communities and environments from potential hazards that arise from extreme weather events.





As you can see in the reference images, the map is accompanied by a dashboard with statistical data. When you zoom in (second image), each of the dots presents data for a specific location, with historical data for the quality of water for that place.

Source: <https://water.europa.eu/freshwater/data-maps-and-tools/bathing-water-quality>



WHEN TO USE FLOOD MAPS? ALWAYS!

We don't mean always as in everyday. But, in the context of floods, maps can - and should! - be used **before, during and after a flood**. And they should be revisited often. As we discussed, some of the variables related to floods might change drastically from the time the flood models received inputs to run their calculations and estimate the risk areas and the moment we are living in. For example, an area of the city that previously had a lot of vacant lots, with some vegetation and low levels of impermeabilization, might now have been urbanised, altering the permeability of the area and the surface runoff.

Before a flood, maps need to be used to better understand the flood risk. What areas will get flooded? Is this valid for all scenarios? That is, is this a "50 year flood" estimation? Or is this a "100 year flood" estimation? Is the map I'm looking at detailed enough for me to prepare a personalised flood response plan? Or is it at the regional or city level, and doesn't have enough granularity/detail for me as an individual?

Furthermore, being aware of flood risk maps in our territories is crucial. These maps provide essential information on the flood-prone areas, helping individuals and communities to prepare for potential flooding and act with safety in the case of a flood. They offer a clear overview of the flood risk, its extent, and the probable scenarios. This knowledge equips us to develop tailored flood response strategies and enhance our resilience in the face of varying flood magnitudes and frequencies. So, whether it's a 50-year flood or a 100-year flood, understanding your local flood risk maps can be the key to effective preparedness and response.

Fictional series inspired by true events: High Water

We don't want to give spoilers, since this is an interesting series to watch if you can. It is inspired by true events of a massive flood that happened in Central Europe in 1997, affecting Poland, Czech Republic and Germany. It was called a "1.000 year flood".

In the frame below you can see a hydrologist explaining the areas that will likely be affected by flood, based on her calculations.





Source: <https://www.netflix.com/pt-en/title/81318108>

In the series, the importance of having updated data to run the hydrological models is highlighted intensely, showcasing the huge differences they can have on possible response measures and impact of the flood.

To understand what a "1.000-year flood" means, let's break it down. This term indicates that a flood of that size or bigger has only a 1 in 1,000 chance of happening in a year. To put it simply, it's a rare event, with a probability of just 0.1% in any given year. These numbers are based on real data, showing just how infrequent such massive floods are.

The television series High Water (from Netflix) portrays the scientific-political dynamics that go on in flood risk management and response in Poland. Throughout the series we can see how maps and socio-spatial dynamics are pivotal.

In this frame we can see the level of devastation that the flood caused in the city of Wrocław.



Source: <https://www.netflix.com/pt-en/title/81318108>

During a flood, flood maps play a critical role in real-time decision-making. They can help emergency responders, local authorities, and individuals make informed choices to ensure safety and minimise damage. In this phase, flood maps can assist in identifying evacuation routes, assessing the extent of the flooding, and pinpointing areas at immediate risk. In this sense, maps can be used during flood events to help people:

- **Visualise the situation:** Maps can help people to visualise the location and severity of floods. This information can help people to understand the risks they face and to make informed decisions about their safety.
- **Identify evacuation routes:** Maps can help people to identify evacuation routes and to avoid flooded areas. This information can help people to get to safety quickly and safely.
- **Locate emergency resources:** Maps can help people to locate emergency resources, such as shelters and food distribution centres. This information can help people to get the assistance they need during a flood event.

In order for maps to be more useful during floods, real-time data is central since it feeds into maps and can help to:

- **Stay informed about the situation:** Real-time data can provide people with information about the location and severity of floods, as well as evacuation orders. This information can help people stay safe and make informed decisions about their safety. For example, real-time data from water level sensors can be used to generate flood maps that show the areas that are at risk of flooding. This information can be used to issue evacuation orders and to warn people about the dangers of flooding. Moreover, real-time data from social media can be used to identify areas that are experiencing flooding. This information can be used to deploy emergency responders to the affected areas and to provide assistance to those who need it.
- **Make timely decisions:** Real-time data can help people make timely decisions about whether to evacuate, how to get to safety, and how to avoid flooded areas. This information can help people protect themselves and their property.
- **Coordinate emergency response:** Real-time data can help emergency responders coordinate their response to floods. This information can help them to identify the areas that are most in need of help and to deploy resources efficiently.

After a flood, flood maps serve as invaluable tools for damage assessment, recovery planning, and resilience building efforts. They provide a reference for understanding the



scale and scope of the flood's impact. Local authorities can use them to prioritise post-flood recovery efforts, allocate resources, and plan for future resilience. Additionally, individuals and communities can use these maps to assess their vulnerability and implement long-term measures to reduce flood risks, such as elevating structures, improving drainage systems, or relocating properties to safer zones.

Revisiting flood maps regularly is essential to account for changes in urbanisation, land use, climate conditions, and other factors that influence flood risk. Keeping maps up to date ensures that they remain relevant and effective tools in flood risk management. Regular reviews and updates help to adapt to evolving conditions and make more accurate predictions and preparations for potential future floods.

Flood Monitoring at a global scale and international collaboration for map making

The United Nations Platform for Space-based Information for Disaster Management and Emergency Response, or [UN-SPIDER](#), was established by the United Nations General Assembly in 2006 with a unique mission: "Ensure that all countries and international and regional organisations have access to and develop the capacity to use all types of space-based information to support the full disaster management cycle." While various initiatives have focused on space technologies for humanitarian aid and emergency response, UN-SPIDER stands out as the first program dedicated to ensuring access and utilisation of these technologies across all phases of the disaster management cycle, including risk reduction. This emphasis on risk reduction is crucial for minimising loss of lives and property. UN-SPIDER serves as a gateway to space information for disaster management support, connecting various communities - disaster management, risk management, and space - while facilitating capacity-building, particularly in developing countries.

Within UN-SPIDER's extensive satellite data and product repository, there are more than 250 valuable data sources dedicated to space-based disaster risk reduction and emergency response. These resources encompass a wealth of free satellite data and final analysis products, among them hazard maps.



Utilising satellite data holds significant potential for a variety of purposes, including flood prediction, real-time monitoring, risk assessment, and damage evaluation. Frequently, this data is complemented by in situ information and physical models, further enhancing its utility. On this webpage, they have compiled over 20 web based maps that “shed light on disaster management for floods from various perspectives”:
<https://www.un-spider.org/links-and-resources/data-sources/daotm-flood-web-maps>

A great example of flood interactive maps: Aqueduct Floods

One of the interactive maps that we find really interesting is the [Aqueduct Floods](#): a web-based tool that offers interactive maps for flood hazard and resources to assess risk and make cost-benefit analysis.

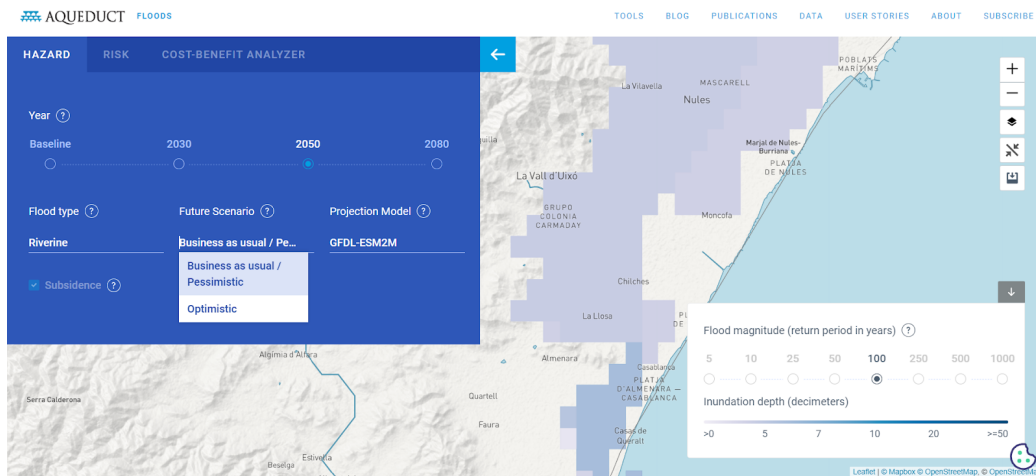
Aqueduct Floods is a valuable tool for policymakers, planners, and other stakeholders who are working to manage flood risk. And we believe it is also a great resource for flood awareness! For example, community leaders can use Aqueduct Floods to raise awareness of flood risk and to advocate for investments in flood protection. The tool can be used to identify areas that are at risk of flooding, to assess the potential impacts of flooding, and to evaluate the costs and benefits of investing in flood protection measures.

Aqueduct Floods uses a variety of data sources to create its flood hazard and risk maps. These data sources include:

- Digital elevation models (DEMs)
- Land cover data
- Rainfall data
- River discharge data
- Tide data
- Population data
- Asset data

Aqueduct Floods uses these data sources to create maps that show the areas that are at risk of flooding, as well as the potential depth of flooding. It offers several resources to explore different scenarios and flood projections.





Source: <https://www.wri.org/applications/aqueduct/floods>

Aqueduct Floods is the result of a collaboration between the World Resources Institute (WRI), Deltares, the Vrije Universiteit Amsterdam's Institute for Environmental Studies, Utrecht University, and Planbureau voor de Leefomgeving (PBL Netherlands Environmental Assessment Agency). It is funded by the Dutch Ministry of Infrastructure and Water Management.



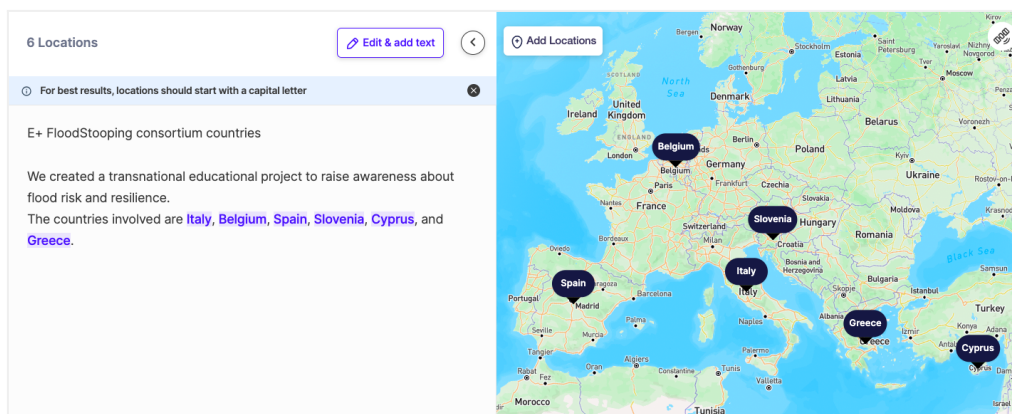
HOW TO MAKE MAPS?

This section is the most operational of this section of the manual. In it, we will address the following objectives:

- Provide step-by-step guidance on creating maps, including data collection alternatives and sources, and an overview of map design principles.
- Introduce user-friendly mapping tools and software that can be utilised by students and teachers.
- Advocate for a participatory approach to map-making, highlighting the potential value of involving local communities to raise flood awareness and support resilience building efforts.

Using AI to make (for now very simple) maps

With the exponential growth of technological resources, it is no wonder that everyday new tools come to life. As for mapping, there are new options available to turn text into map, in just a few clicks. Here is an example where we entered a simple paragraph about our project and named the countries of the coordinator and partners, and voilà! After one click, you have a simple map.



Source: textomap.com



Before you start:

- **Define your objectives:** Clearly establish the purpose of your flood map. Decide whether it's for local flood awareness, city-scale risk assessment, or a national-scale disaster preparedness plan. Objectives drive your map's focus and need to be clearly established.
- **Gather reliable data:** Collect accurate data related to floods in your chosen area. This may include historical flood records, elevation data, drainage systems, and floodplain maps. Ensure your sources are trustworthy and up-to-date.
- **Choose your tools:** Select the tools for creating your flood map. Depending on your objectives, you may use Geographic Information System (GIS) software (check the box below), hand-drawn techniques, or other mapping tools. Pick what suits your project best, while also acknowledging the level of expertise of the people involved.
- **Consider collaboration:** Depending on the scale and complexity of your flood map, consider collaborating with experts or community members. Teamwork can bring diverse skills and resources to your project.

It is important to keep in mind that you might need to revisit some of the decisions you take before you start depending on the challenges and opportunities you encounter in the map making process.

Powerful tools for digital map making

In the digital age, the most prominent way of making maps is using Geographical Information Systems (GIS) software. Two prominent software programs in this realm are ArcGIS and QGIS (Quantum GIS). They offer the means to create, analyse, and visualise geographic data, but they cater to different needs and audiences.

QGIS (Quantum GIS): is an open source desktop GIS application that can be used to create, edit, and manage geospatial data. It has a wide range of features, including support for vector, raster, and 3D data, as well as a variety of tools for analysis and visualisation.



Main Features:

- Open Source: QGIS is an open-source and free-to-use GIS software, making it accessible to a wide range of users.
- User-Friendly: It's known for its user-friendly interface, making it a great choice for beginners in GIS.
- Multiplatform: QGIS is available for Windows, Mac, and Linux, ensuring compatibility with various operating systems.
- Data Formats: It supports a wide range of data formats, including vector and raster data.
- Customization: Users can create plugins using Python for customization and extending the software's capabilities.
- Data Editing: QGIS has features for creating, editing, and managing geographic data.
- Interoperability: It works well with other GIS software and can be used alongside proprietary software.

Developed By: QGIS Development Team

If you want to venture into map making with QGIS, they have a lot of documentation online, including several tutorials. Here is a good starting point:

https://www.qgistutorials.com/en/docs/making_a_map.html

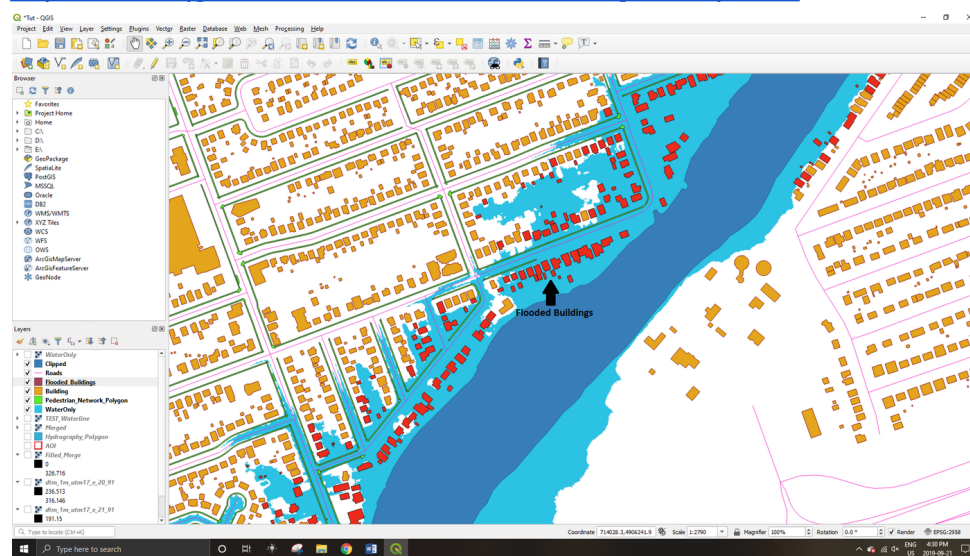


Image of Flood Risk Assessment in QGIS:

https://dges.carleton.ca/CUOSGwiki/index.php/Flood_Risk_Assessment_in_QGIS



ArcGIS: is GIS software that offers a wide range of features for creating, editing, and managing geospatial data. It includes tools for analysis, visualisation, and mapping, as well as a variety of add-ins and extensions.



Main Features:

- **Comprehensive GIS:** ArcGIS is a comprehensive Geographic Information System (GIS) software. It offers a wide range of tools for creating, analysing, and managing geographic data.
- **Variety of Maps:** It allows users to create various types of maps, including thematic maps, topographic maps, and interactive web maps.
- **Data Integration:** ArcGIS supports the integration of diverse data formats, making it a powerful tool for handling large datasets.
- **Geospatial Analysis:** It provides advanced geospatial analysis capabilities for tasks like spatial modelling, network analysis, and suitability modelling.
- **Customization:** Users can customise maps and applications using programming languages like Python.
- **Collaboration:** ArcGIS Online, a cloud-based component, facilitates sharing maps and data with others.

Developed By: Esri (Environmental Systems Research Institute)

Both ArcGIS and QGIS are powerful tools in their own right, but the choice between them may depend on factors like budget, specific requirements, and user familiarity with GIS software. ArcGIS is widely used in professional and enterprise environments and is known for its advanced capabilities. QGIS, on the other hand, is a popular choice for individuals, smaller organisations, and open-source enthusiasts due to its user-friendliness and cost-effectiveness.

Another interesting option for digital map making are Google's tools. Google Earth and Google Maps are two powerful tools for digital map making. They offer a wide range of features for creating, editing, and managing geospatial data, as well as a variety of tools for analysis and visualisation.

Google Earth is an application that allows users to explore the Earth in three dimensions. It includes a variety of features, such as the ability to view satellite imagery, aerial photography, and 3D models of buildings and other structures. Google Earth also includes a variety of tools for creating and editing maps, such as the ability to add placemarks, lines, and shapes. Google Earth was originally only available through a desktop application, but it was later made available as a web-based application in 2017. The web-based application is available on most popular web browsers.

The web-based application of Google Earth offers many of the same features as the desktop application, including the ability to view satellite imagery, aerial photography, and 3D models of buildings and other structures. It also includes a variety of tools for creating and editing maps. One of the main advantages of the web-based application of Google Earth is that it does not require any installation. Users can simply access the application through their web browser. This makes it a good option for users who do not have the ability to install software on their computers. However, the web-based application of Google Earth does have some limitations. For example, it does not offer as many features as the desktop application, and it may not perform as well on some computers.

Overall, the web-based application of Google Earth is a good option for users who need a lightweight and easy-to-use mapping tool. However, users who need more advanced features or who need to use Google Earth on a computer with limited resources may want to consider using the desktop application.

Google Maps is a web-based application that allows users to view and interact with maps. It includes a variety of features, such as the ability to view street maps, satellite imagery, and traffic conditions. Google Maps also includes a variety of tools for creating and editing maps, such as the ability to add placemarks, lines, and shapes. Google Maps allows users to collaborate on maps. This means that multiple users can work on the same map at the same time.

If you want a more detailed comparison between these two google tools, this is a good reference to start:

<https://gisgeography.com/google-earth-vs-google-maps/>



Keep in mind the following map design principles:

- **Legibility:** The map should be easy to read and understand. This means using clear and concise labels, symbols, and colours. For example, use bold and contrasting colours for high-risk areas and lighter colours for low-risk areas. Use simple symbols that are easy to understand, such as a triangle for floodplains and a circle for levees.
- **Accuracy:** The map should be accurate and up-to-date. This means using reliable data sources and careful cartographic techniques. Use reliable data sources from government agencies or other reputable organisations. Some good sources include:
 - [EU Science Hub - Floods](#)
 - [Global Flood Monitoring](#) and its [map viewer](#)
 - [European Flood Awareness system](#) and its [map viewer](#)
- **Clarity:** The map should be clear and concise. This means avoiding unnecessary clutter and focusing on the most important information. For example, you may want to include a legend that explains the meaning of all the symbols and colours on the map. You may also want to include a title and subtitle that clearly state the purpose of the map.
- **Balance:** The map should be visually balanced. This means placing elements in a way that is pleasing to the eye and that does not overwhelm the reader. For example, you may want to use a grid to help organise the elements on the map.
- **Purpose:** The map should have a clear purpose. This means knowing what you want to communicate with the map and designing it accordingly. What do you want to communicate with the map? Are you trying to identify individual flood risk zones? Are you trying to raise awareness of flood risk in the community? Once you know the purpose of the map, you can design it accordingly.

Here are some great resources on this topic

- [Make Maps People Want to Look At: Five primary design principles for cartography \(By Aileen Buckley, Esri\)](#)
- [Principles of Map Design: Using GIS to make maps](#)
- [How to design a map: successfully communicate geographic information using the map design process](#)
- [33 Map Elements to Include in Cartographic Design](#)

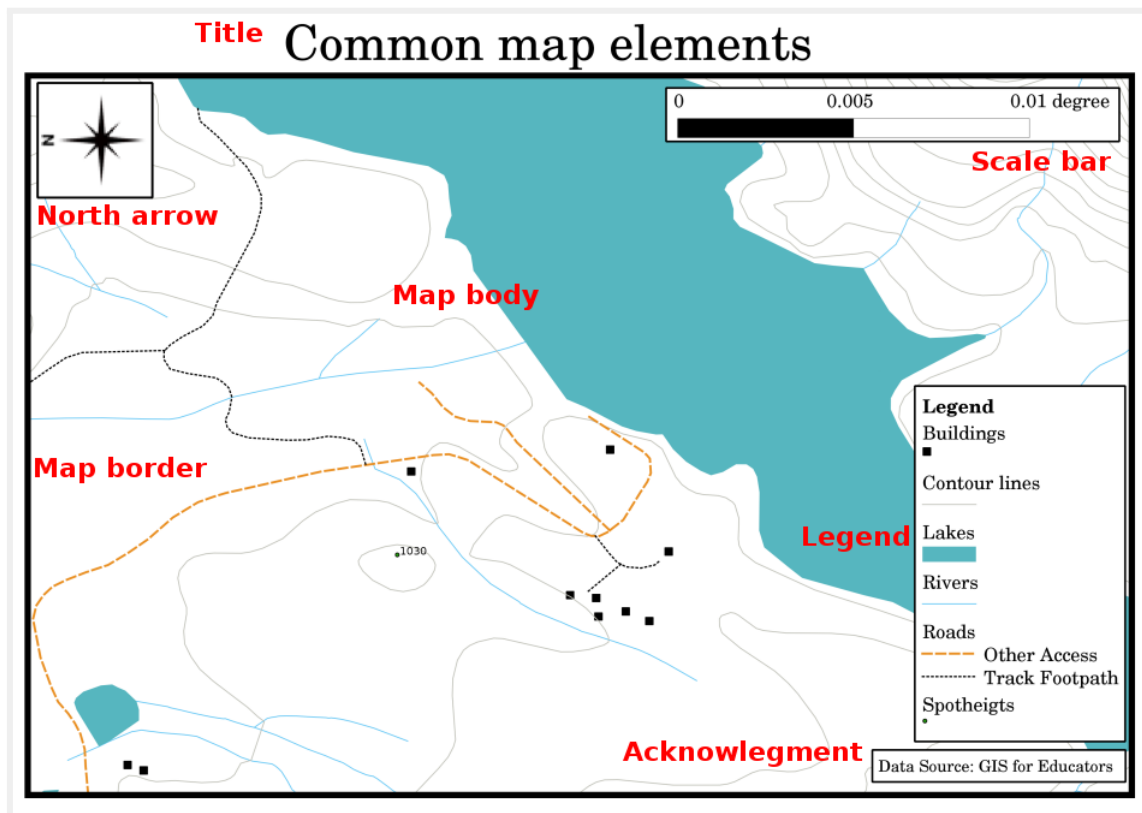


In addition to these general principles, there are also some specific principles that should be considered when designing flood hazard and risk maps:

- **Scale:** The map should be at a scale that is appropriate for the purpose of the map. For example, a map that is used to identify individual flood risk zones will need to be at a larger scale than a map that is used to identify broad flood hazard areas.
- **Symbology:** The map should use clear and concise symbols to represent different flood hazard and risk levels. The symbols should be easy to distinguish from each other and should be consistent with other maps that are used in the same community.
- **Colour:** The map should use colour effectively to communicate flood hazard and risk levels. For example, red is often used to represent high-risk areas, while green is often used to represent low-risk areas.
- **Labels:** The map should use clear and concise labels to identify different features on the map, such as floodplains, rivers, and levees. The labels should be easy to read and should not obscure other important information on the map.
- **Legend:** The map should include a legend that explains the meaning of all the symbols and colours that are used on the map. The legend should be easy to find and understand.

In the image below you can see the most common map elements. But depending on the objective of the map, level of detail you are looking for, you might need a different set of elements. From a technical point of view, these common elements are essential for a cartographic approach to map making.





Source: https://docs.qgis.org/3.28/en/docs/gentle_gis_introduction/map_production.html

General steps to create your flood map:

- 1. Define map boundaries:** Begin by outlining the area of interest on your map. This could be the boundaries of a city, a specific neighbourhood, or an entire nation. This will reflect the decision you have made on why you are making this map, what it is your map's objective, who will be involved in making it and what skill sets they bring to the table, and when you are planning on using this map.
- 2. Plot flood features:** Add features related to flooding, such as rivers, lakes, floodplains, and other water bodies. Represent them with suitable symbols and labels.
- 3. Include Key Information:** water bodies, label flood-prone areas, existing flood defences, and emergency facilities. Use clear and legible text.
- 4. Scale and direction:** Include a scale bar to indicate real-world distances and a compass rose to show north or the direction. These elements are vital for map interpretation.

5. **Create a Legend:** Develop a legend that explains the symbols, colours, and labels used on your flood map. This makes it accessible to a wider audience.
6. **Indicate your sources:** Always credit the sources of your data. This not only ensures transparency but also helps users understand the reliability of the information. Include a section in your map's metadata or caption that lists the sources, including government agencies, scientific studies, or other references you used to compile the data. It is also a good idea to include the date the map was produced.

Aspects to consider:

- **Add grid references:** Add grid references, especially if your map covers a large area. Grid references help locate specific points on the map.
- **Review for accuracy:** Step back and review your flood map for accuracy. Verify that all features and labels are correctly placed and that the map aligns with your objectives.
- **Save your map:** If it's digital, save it in the appropriate format and try to avoid keeping unnecessary versions of it, to minimise the digital footprint of your map making activities. For hand-drawn maps, consider scanning for digital preservation.
- **Share your map:** Once your flood map is complete, it's essential to share it with the intended audience or stakeholders. Digital maps can be uploaded to websites or shared through online platforms for easy accessibility. Hand-drawn maps can be scanned and shared digitally. In community-based projects, consider organising presentations or workshops to engage the community and raise awareness regarding flood-related issues and preparedness measures. Sharing your map effectively ensures it serves its purpose in increasing flood awareness and preparedness.
- **Combine your map with an infographic:** To enhance the map's impact and make the information more accessible, consider combining it with an infographic. Create an infographic that summarises key findings, statistics, or recommended actions based on the flood map's data. Infographics are an excellent tool for conveying complex information in a visually engaging and straightforward manner. They can be shared on social media, included in educational materials, or presented during community events to reach a broader audience.



Aspects that might be interesting to portray (but hard to get data about):

- **Indicate Water Depth:** If your map involves flood depth, use contour lines or colour-coding to represent varying water depths during floods. It might be difficult to have water depth data, but for more advanced map makers, digital elevation models could be useful to estimate water depth and represent it in a 2d map using visual resources such as colour scales to represent the different depths.
- **Indicate previous flooded areas:** While obtaining precise historical flood data can be challenging, it's valuable to indicate previous flooded areas if data is available. Highlighting past flood-prone regions on your map can provide essential insights into recurring flood patterns and their impact on communities. Additionally, it serves as a reminder of the potential risks and emphasises the importance of flood preparedness and resilience in these areas.

Creating a flood map is a crucial step in understanding and mitigating flood risks. Whether your map is intended for local awareness, city planning, or national preparedness, following these steps will help you produce an informative and accurate representation of flood-prone areas and related features. Most likely, at the school environment, the best type of map to create with the students will be a map of the area of the school, helping them not only how to make maps, but also raising their awareness about their surroundings. This will help them to better understand the aspects that the built environment has on the impacts of floods.

For those who want to map floods a step further!

In this section of how to make maps we have presented an overview of map making related to floods. However, if you're eager to take your flood mapping skills a step further and delve into more advanced methods and tools, here is an interesting resource for those that want to learn more about flood mapping:

- **Trainings of the European Flood Awareness System:**
<https://www.efas.eu/en/training>
They have recorded their training webinars and they are available on their webpage. Several topics are covered. They also have a detailed user guide for the European Flood Awareness System in this section.



IDEAS FOR CLASSROOM ACTIVITIES AND EXERCISES

LET'S MAKE A MAP ABOUT OUR SCHOOL SURROUNDINGS

Objective: In this activity, students will participate in mapmaking to gain a better understanding of our school's surroundings, emphasising the identification of flood-prone areas, assessing the condition of drainage points, and recognizing some key aspects of the built environment. The primary goals include improving flood awareness and preparedness and fostering a sense of community engagement.

Materials Needed:

- Printed base map or access to a mapping app on a mobile device. We recommend the use of the Flood Stopping app <https://floodstopping.eu/app/> (that is coming soon!)
- Markers or digital drawing tools for adding map details.
- Measuring tools (ruler or GPS) for accurate mapping.
- Clipboards or hard surfaces for drawing.

Step 1: Introduction (10 minutes)

- Begin by discussing the importance of comprehending the school's environment, particularly in the context of potential flooding and drainage issues.
- Explain the objectives of the activity: to collaboratively create a detailed map of our school's immediate vicinity, highlighting areas prone to water accumulation, locating drainage features, and identifying items that might be vulnerable in the event of flooding.

Step 2: Map Boundary (5 minutes)

- Define the boundaries of the map, specifying the area around our school that students will focus on.
- Optionally, establish a grid system to divide the territory into manageable sections, especially if students can explore the area independently.



Step 3: Exploring the surroundings and identifying key elements (30 minutes- 45 minutes)

- Encourage students to explore the school surroundings, identifying locations where water typically accumulates during heavy rains.
- Mark these areas on the map with symbols or colours to represent water-prone spots.
- Locate and assess the condition of drainage points, such as storm drains, gutters, or ditches, in the vicinity.
- Mark these on the map, providing details about their condition (clear, obstructed, etc.).
- Identify the types of surface that you encounter (is it permeable? partially permeable?), observe the topography of the space and try to identify safe places and routes in the case of flooding.
- Add these elements to the map with suitable symbols and labels.

Step 4: Consolidating the elements mapped (15-30 minutes)

- If the activity in step 3 was performed with printed maps, digitise the elements mapped using a computer or mapping software.
- Ensure that the digital map maintains the same information, including water-prone areas, drainage points, and vulnerable items.
- Include information about official flood hazard and risk, adding another layer of information to the maps

Step 5: Discussion (15 minutes)

- Conclude the activity with a discussion on the students' findings and insights.
- Encourage them to propose ideas or solutions for improving drainage and minimising flood risks in the school surroundings.
- Prompt students to reflect on how this mapmaking exercise can contribute to the school's preparedness for flood events.
- Discuss the importance of community engagement and responsibility in maintaining a safe school environment.

By engaging in this activity, students can actively participate in enhancing their flood awareness, understanding local drainage features, and recognizing potential vulnerabilities. This not only fosters a sense of responsibility but also contributes to the school's preparedness and overall safety.



THINKING CRITICALLY ABOUT THE FUTURE CLIMATE-LED MIGRATION GLOBALLY

Intersections between floods, vulnerability and human mobility

Objective: To engage students in hands-on map making using an online interactive platform while exploring the intersection between natural hazards, such as floods, and future migration patterns. This activity encourages critical thinking about human mobility, climate refugees, and vulnerable regions. It also fosters futures literacy skills, as it promotes students to imagine different futures considering climate change and socio-spatial dynamics.

Materials Needed:

- Computers or tablets with internet access
- Online interactive map making platform (This activity was designed with the National Geographic MapMaker platform, but other options such as Google My Maps or ArcGIS Online can be used with some adaptations).
<https://mapmaker.nationalgeographic.org/>
- Paper and pencils for brainstorming and planning

Step 1: Introduction (10 minutes)

- Begin by discussing the concept of human migration and its different factors, including natural hazards and climate change.
- Introduce the objective of the activity: to create a map that showcases potential migration patterns influenced by flooding and other natural hazards.

Step 2: Brainstorming and Planning (15 minutes)

- Distribute paper and pencils to students.
- Prompt students to brainstorm ideas about how flooding and natural hazards might impact migration. Ask them to think long-term, 2050 time horizon for example.
- Encourage them to consider vulnerable regions and potential human mobility patterns that are climate-lead.
- Have students sketch a rough outline of the flows they imagine will happen in their global maps internationally, identifying key areas prone to flooding or other natural hazards, as well as the origins and destinations of climate-lead migration.



Step 3: Online Map Creation Introduction (10 minutes)

- Provide access to the chosen online interactive map making platform.
- Walk students through the platform's basic features, such as adding markers, lines, shapes, and pop-up information. If using the National Geographic MapMaker, show them the Asylum-seeking layer.
- Assign students to create their maps based on their sketches and ideas from the classroom at home and let them know that they will be presenting their maps in the next class.
- Encourage them to use accurate data and reliable sources for their map's information.

Step 4: Independent Map Creation (At Home)

- Encourage students to add details to their maps, such as labels explaining the vulnerability of regions, potential migration patterns, and climate refugee scenarios.
- Guide students to use accurate data and sources for their map's information.
- Discuss how their maps can effectively communicate the intersection between natural hazards and human mobility.

Step 5: Presentation and Sharing (30 minutes)

- Have each student present their map to the class.
- Ask them to explain their map's theme, key points, and how flooding and natural hazards influence migration and asylum seeking patterns.
- Encourage class discussions about the potential consequences of climate-related migration and the concept of climate refugees.

Step 6: Reflection and Discussion (10 minutes)

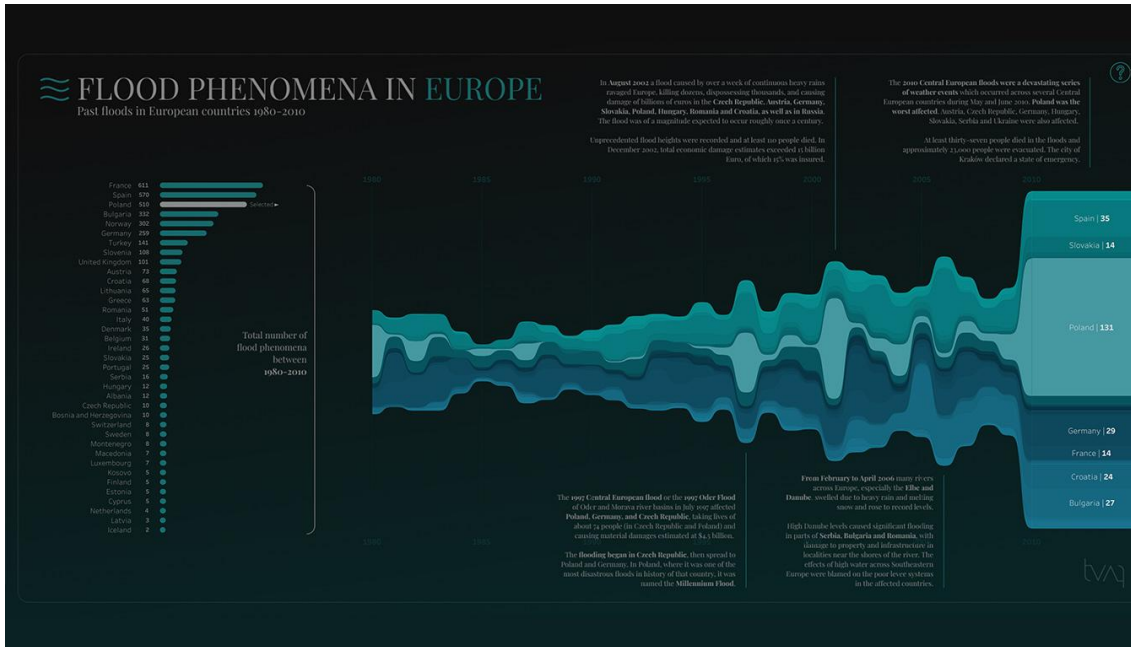
- Lead a discussion on the critical implications of climate-related migration and the role of natural hazards.
- Ask students to reflect on how their maps made them consider the challenges and complexities of human mobility in the face of environmental changes.

Step 7: Homework Extension - follow up (Optional)

- Assign students to research real-world examples of climate-related migration due to flooding and other natural hazards.
- Ask them to write a short essay reflecting on the ethical, social, and political dimensions of climate refugees and the responsibilities of the global community.



Module 2: Infographics



Floods have continuously rampaged throughout parts of Europe, hitting France the hardest with over 600 flood events since 1980. Check out this visualisation by Tamás Varga to learn more about the history of the flood phenomena in Europe from 1980-2010.

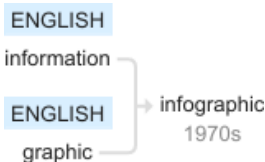
Source: <https://public-pantheon.tableau.com/pt-br/s/gallery/flood-phenomena-europe>

Infographic

/ˌɪnfə(ʊ)'græfɪk/
noun

a visual representation of information or data, e.g. as a chart or diagram.

"a good infographic is worth a thousand words"

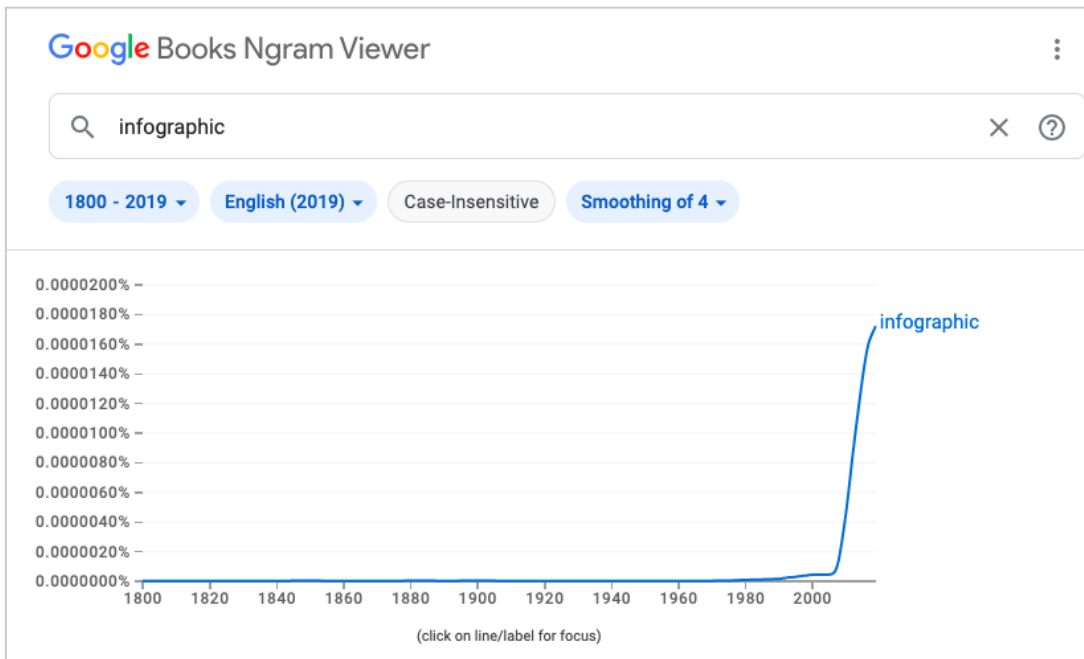


Source: [Dictionary boxes on Google - Definitions from Oxford Languages](#)



INTRODUCTION

We know that infographics are gaining popularity. Just take a look at the line graph below. Before the turn of the century, the term infographics hardly made the line move from the horizontal axis, and from the yearly 2000's until now it has been growing steadily! Great to see a visual that is so clear and straight-foward, right?



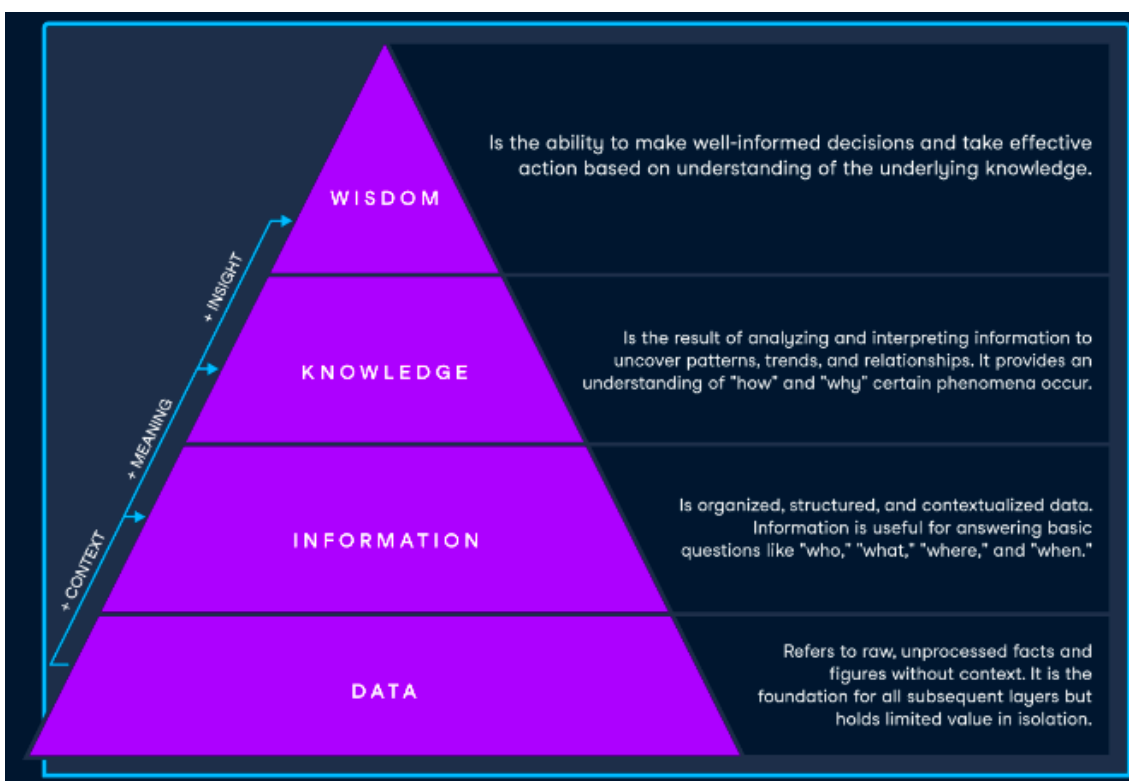
Source: <https://books.google.com/ngrams/> Using the term Infographic and de-selecting the case-insensitive option.

Unfortunately, many relevant issues are not as simple to grasp and visualise in graphs as the use of a very specific term in a very specific database. Floods are a good example of a complex issue that involve an intricate interplay between natural and socio-technical systems. Surely, we can make one graph about flood occurrences for example, but what is the value of this type of information without context? Data, by itself, is not enough to change behaviours. Data is not enough to make us care. It can call our attention or spark our interest. Sure. Do you remember the data we presented in the overview of this document? In the the EU, we have seen: “almost 1500 flood events in Europe since 1980; over 4300 deaths caused by flood events; and more than €170 billion economic damage caused by flood events since 1980”⁶.

⁶ Source: Floods EU measures to manage the risks floods pose to human health, the environment, the economy and cultural heritage. Available at: https://environment.ec.europa.eu/topics/water/floods_en

The figures are quite daunting aren't they? But they have no call to action by themselves. They serve as an alert and can make us more aware of the frequency and severity of the negative impacts of floods.

So why did we decide to include infographics in our FloodStopping project and not just data about floods? Because we recognise their intrinsic value as communication resources, and we acknowledge that **risk communication** is a vital part of **resilience building**. We want to move from evidence-based descriptions to actionable insights. On this note, have you ever heard of the Data-Information-Knowledge-Wisdom pyramid? If you google it, you will find lots of references about this, but the core idea is that there is a hierarchy among these categories. Data is at the basis and helps to contextualise information, which in turn helps to give meaning to knowledge. Lastly, knowledge can be used as insights to decision making processes, so that we can make better decisions. Here is a graphic that illustrates the DIKW pyramid.



Source: <https://www.datacamp.com/cheat-sheet/the-data-information-knowledge-wisdom-pyramid>

Taking this reference to the Flood Stopping context, we would have:

Data: At the base of the pyramid, we have "Data." In the context of flood awareness, this refers to the raw, unprocessed facts and figures related to flood events, including factors like water levels, rainfall, and geographical information. While data is the foundation, it holds limited value on its own. For example, data may include historical flood records, weather statistics, and topographical details.

Information: Building upon the data, "Information" is the next level. Here, data is organised, structured, and contextualised. Information answers basic questions such as "who," "what," "where," and "when" regarding flood events. In the flood awareness context, this involves compiling and presenting the data in a comprehensible format. For instance, this could include maps, charts, and statistics that provide insights into past flood occurrences and their locations.

Knowledge: Moving up the pyramid, we arrive at "Knowledge." Knowledge results from analysing and interpreting information, revealing patterns, trends, and relationships within the flood data. It allows us to understand the "how" and "why" of flood occurrences. In the flood context, knowledge might include recognizing patterns in rainfall that lead to flooding, understanding the impact of urban development on flood risk, or identifying historical flood-prone areas.

Wisdom: At the pinnacle of the DIKW pyramid is "Wisdom." Wisdom represents the ability to make well-informed decisions and take effective actions based on the understanding derived from knowledge. In the flood awareness and resilience context, wisdom means using the insights gained from data, information, and knowledge to make informed decisions on flood risk management and preparedness. This includes not only understanding the flood data but also knowing how to apply this knowledge to enhance community resilience.

Our bet with the making of infographics is that we will help you and your students to move up the pyramid, being able to understand the data and use it as a basis not only for getting informed, but also for having actionable knowledge and effective insights to foster your climate change awareness and flood resilience.



WHY INFOGRAPHICS?

In this section we will address the following specific objectives:

- Discuss the value of infographics in simplifying complex flood-related information and statistics.
- Explore how infographics can engage and capture the attention of different audiences.
- Highlight the role of infographics in storytelling, emotion-driven communication, and behaviour change.

Infographics are great instruments for simplifying and synthesising information. In a society where **information overload** is a real challenge, infographics offer a breath of fresh air, encapsulating intricate concepts in an attractive and enticing manner. They become an instrument to grab attention and to break down complex subjects, making them accessible to a wider audience. They distil intricate data into engaging visuals, becoming instruments that spark curiosity and promote understanding.

However, just as with maps, the effectiveness of an infographic lies not just in its aesthetics, but in its thoughtful use of contents. References and reliable sources underpin the accuracy and reliability of both mediums. To create impactful infographics that promote the changes we need to face the challenges of climate change in general and of floods in particular, ensuring the quality and integrity of the underlying data is paramount.

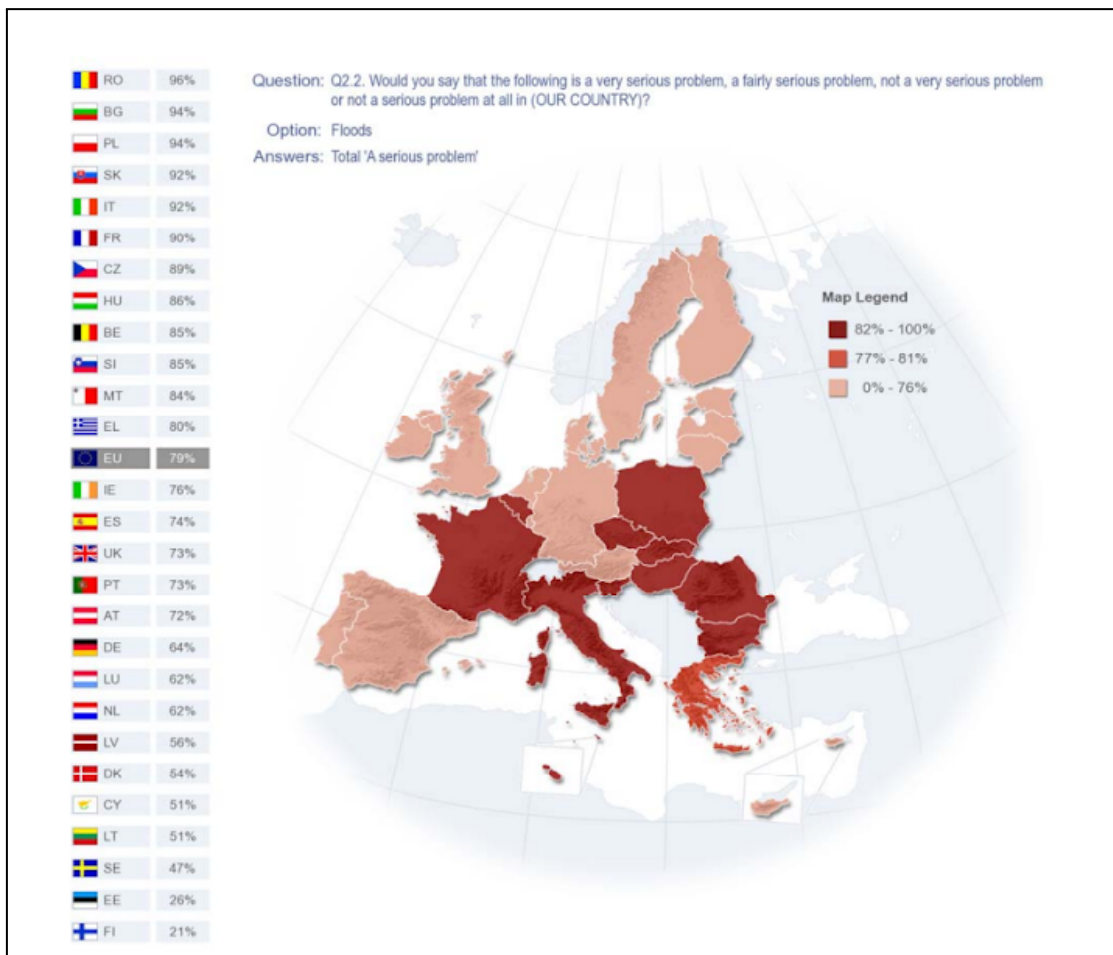
A famous author that is an expert in data communication, Hans Rosling, once said “let my dataset change your mindset” (if you are curious to learn more, watch his [TED talk here](#)). He has been the inspiration for many other data visualisation professionals, including David McCandless, founder of the “Information is Beautiful” project. He is also a great reference for making data interesting and understandable (and also has a great [TED talk you can watch](#)).

Now, let’s move to flood awareness examples, to see how we can visualise data related to floods and why infographics can be relevant here.

According to a Eurobarometer survey conducted in 2012: “Eight out of ten Europeans agree that floods are a serious problem in their country” (p. 18). However, when we look at the data beyond the European mean, we can see that there are many territorial and intergenerational differences between the respondents.



The socio-demographic analysis shows that women are more likely than men to consider floods a serious problem (82% vs 75%). **Respondents aged 15-24 are less likely than older age groups to say that floods are a serious problem. In fact, almost half of those aged 55+ think floods are a very serious problem (48%), compared to 32% of 15-24s.** Students also are less likely to say that floods are a serious problem than those who have completed their education.



Source: <https://europa.eu/eurobarometer/surveys/detail/1047>

When we look at the infographic map we can see that there is a clear spatial gap between the respondents that perceive floods as a serious problem. In this sense, this visual support helps us to discuss the topic of awareness, at an European level.

What would you say about floods? Discussion prompt

The results presented above for the EUrobarometer are from 2012.

A decade has passed since.

Do you think we would have similar results now? How different would they be?

We invite you to make a quick survey with your students. You could use a real-time graphic to showcase the results, using tools like [Mentimeter](#) or [Slido](#). How many of them think that floods are a serious problem? Give them the same options of the Eurobarometer:

- A very serious problem
- A serious problem
- Not a serious problem
- Don't Know /NA

This can be a good opportunity to discuss the value of the EU barometers.

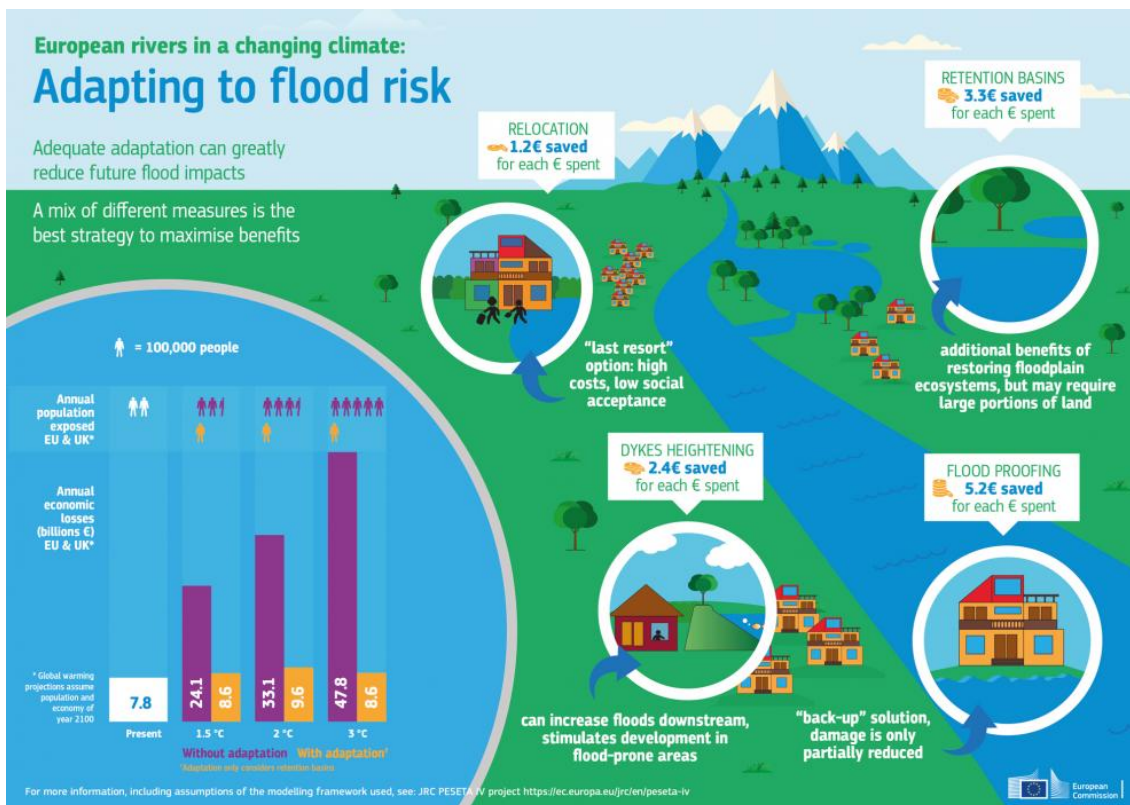
<https://europa.eu/eurobarometer/screen/home>



Floods in Ivrea, Italy (courtesy "la Repubblica"), October 2000 Source: https://www.esa.int/ESA_Multimedia/Images/2000/10/Floods_in_Ivrea_Italy2

Now let's have a look at some infographics about floods.

In the infographic below, the European Union Joint Research Center summarises some of the main aspects related to adaptation measures needed to face flood risk. They have chosen to highlight the amount of financial resources that are estimated to be saved if the recommended adaptation measures are implemented, showcasing how it is strategic from a cost-benefit analysis that takes into consideration the potential impact of floods.



Source: https://joint-research-centre.ec.europa.eu/peseta-projects/jrc-peseta-iv/river-floods_en

Regarding a more local level of action, infographics about floods can give us key information about how to prepare for floods. In the example below, by simply looking at the image we can see that the built environment we find ourselves in and transport options are central to the call to action expressed in the title: "Be Ready! Floods". It is a comprehensive info sheet with some key points on what to do during and after a flood.

BE READY! FLOODS

DURING

Unplug appliances to prevent electrical shock when power comes back on.

Do NOT drive or walk across flooded roads. Cars and people can be swept away.

Gather emergency supplies and follow local radio or TV updates.


WEATHER ALERT!


RECOGNIZE FLOOD RISK

- Identify flood-prone or landslide-prone areas near you.
- Know your community's warning signals, evacuation routes, and emergency shelter locations.
- Know flood evacuation routes near you.

When power lines are down, water is in your home, or before you evacuate, **TURN OFF** gas, power, and water.

PRACTICE SAFE HYGIENE

 Wash hands with soap and water to help prevent germs.

 Listen for information from your local officials on how to safely use water to drink, cook, or clean.

AFTER

Tie down or bring outdoor items inside.


Throw away items that cannot be disinfected, like wall coverings, cloth, rugs, and drywall.

Use fans, air conditioning units, and dehumidifiers for drying.

For cleanup, wear rubber boots and plastic gloves.

Clean walls, hard floors, and other surfaces with soap and water. Use a mixture of 1 cup bleach and 1 gallon water to disinfect.

Caution! Flood water may contain trash.



For more information visit
<http://emergency.cdc.gov/disasters/floods/>

Source: <https://www.cdc.gov/orr/infographics/br-floods.htm>

We could add many more examples (and some more are coming in the following pages), but we want to highlight some key points that justify the use of infographics in the context of flood awareness, response and preparedness:

- **Simplified communication:** Infographics distil complex flood-related information into easily digestible visual formats. They break down intricate concepts into simple, clear visuals and concise text, making it accessible to a wide audience, including those with varying levels of literacy. They help to highlight key information that can vary depending on the target audience.
- **Enhanced memorability:** People tend to remember visual content more effectively than text alone. Flood-related infographics with striking imagery are more likely to leave a lasting impression and improve retention of essential information.
- **Promotes engagement:** Infographics engage the audience by capturing their attention and sparking interest. A well-designed infographic can motivate individuals to explore flood-related topics further and take action in terms of preparedness.
- **Higher accessibility:** Infographics have the potential to transcend language barriers. By balancing visuals and shorter chunks of text, they can communicate key flood-related information to diverse communities, both locally and globally.
- **Support informed decision-making:** Well-crafted flood infographics empower individuals and communities to make informed decisions, whether related to evacuations, resource allocation, or risk mitigation and adaptation strategies.
- **Advocacy and awareness:** Infographics are potent advocacy tools. They can raise awareness of flood-related issues, stimulate public support for preparedness measures, and drive action on climate adaptation and resilience efforts. They can be used in several scales, ranging from more policy related topics, to individual action.

By embracing infographics, flood awareness, response, and preparedness initiatives can harness the power of visual communication to effectively reach and mobilise individuals, ultimately contributing to safer and more resilient communities.

WHAT ARE INFOGRAPHICS?

We have already seen why infographics are relevant for effectively communicating flood topics, but what exactly are they? In this section, we will address the following objectives:

- Provide an overview of the main types of infographics
- Present an overview of design principles for creating effective infographics, including layout, colour choices, typography, and data visualisation techniques.

Infographics - etymology

info-

- word-forming element abstracted from information.
- information (n.)
- late 14c., informacion, "act of informing, communication of news," from Old French informacion, enformacion "advice, instruction," from Latin informationem (nominative informatio) "outline, concept, idea," noun of action from past participle stem of informare "to train, instruct, educate; shape, give form to" (see inform). The restored Latin spelling is from 16c.
- Meaning "knowledge communicated concerning a particular topic" is from mid-15c. The word was used in reference to television broadcast signals from 1937; to punch-card operating systems from 1944; to DNA from 1953. Information theory is from 1950; information technology is from 1958 (coined in "Harvard Business Review"); information revolution, to be brought about by advances in computing, is from 1966. **Information overload is by 1967.**

-graphy

- word-forming element meaning "**process of writing or recording**" or "**a writing, recording, or description**" (in modern use especially in forming names of descriptive sciences), from French or German -graphie, from Greek -graphia "description of," used in abstract nouns from graphein



"write, express by written characters," earlier "**to draw, represent by lines drawn,**" originally "to scrape, scratch" (on clay tablets with a stylus), from PIE root *gerbh- "to scratch, carve".

Source: <https://www.etymonline.com/word/cartography>

Dictionary definition

Infographic : a chart, diagram, or illustration (as in a book or magazine or on a website) that uses graphic elements to present information in a **visually striking way**

Source: <https://www.merriam-webster.com/dictionary/infographic>

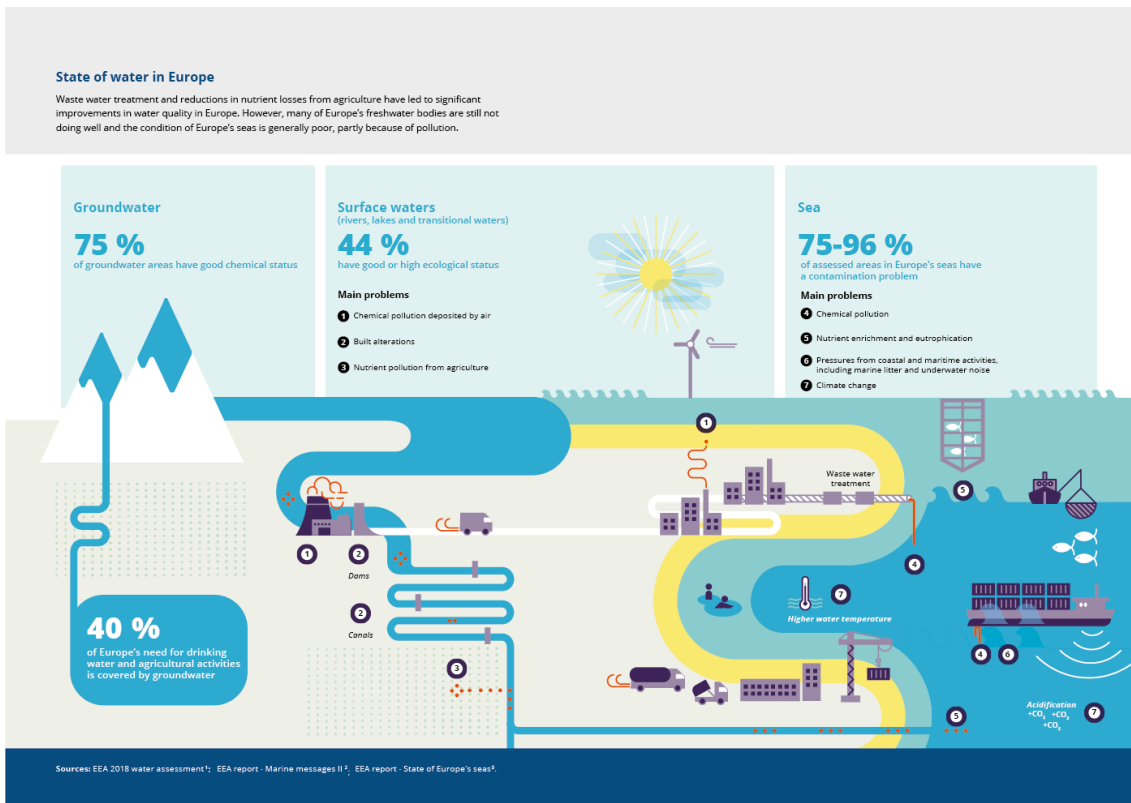
In brief, infographics are visual representations of information that are designed to be easy to understand and share. They can be used to communicate a wide range of information, from simple facts and figures to complex data sets and research findings. But what are the main types of infographics? Let's have a look at some categories and examples.

TYPES OF INFOGRAPHICS

As we mentioned in the map making module, typologies can be contested. Our list of types of infographics highlights some of the main types, but often infographics combine certain aspects and are mixed, so to speak. And if you search the internet for "types of infographics" you will soon realise that the lists vary in numbers quite a lot, showcasing how there is no typology of infographics that is largely accepted. Here are some of the most common types of infographics (with examples).



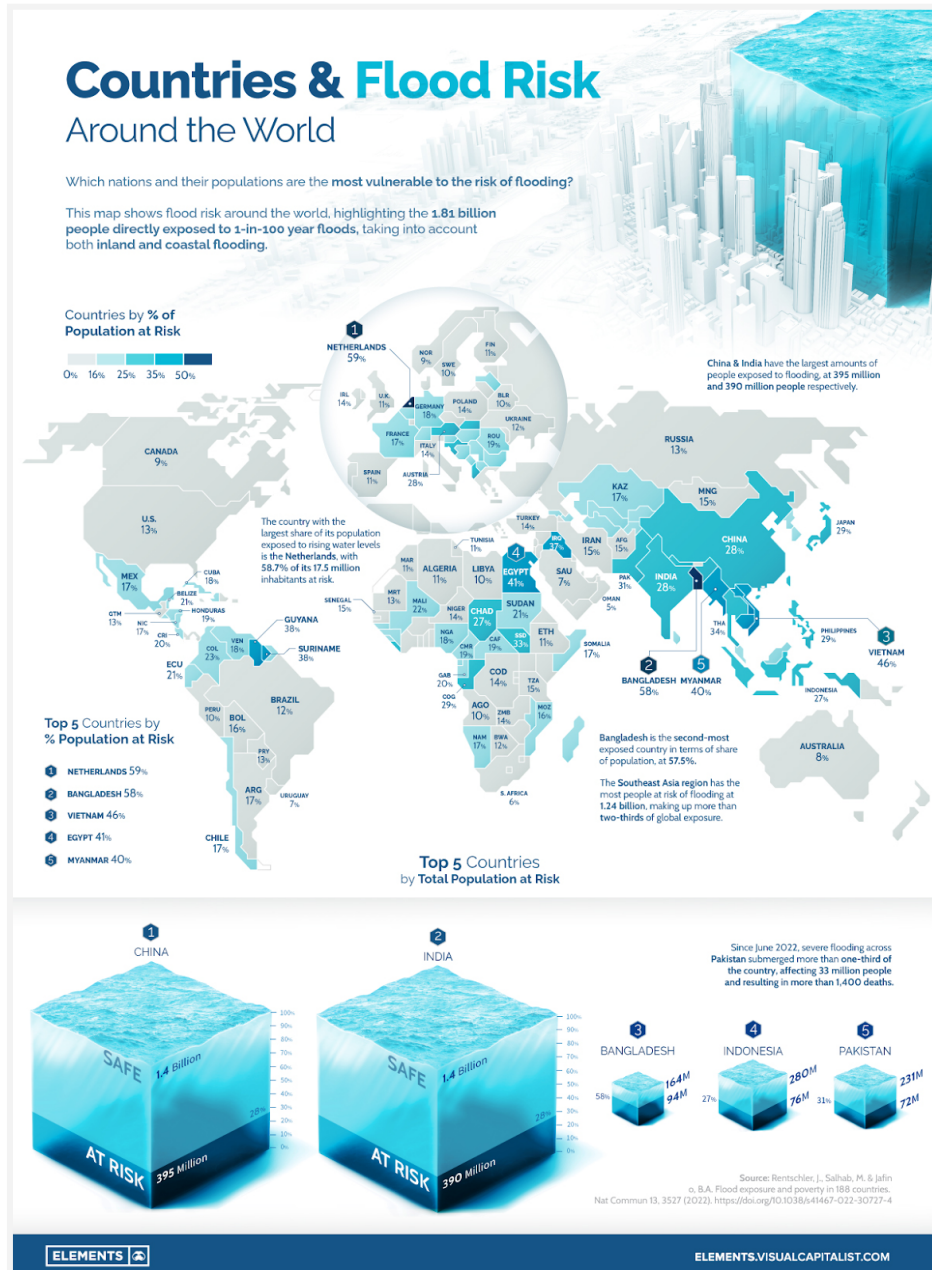
- Informational infographics:** These infographics provide general information about a particular topic or issue. They may include definitions, explanations, and other factual information. They may also include images, videos, and other multimedia elements. In the example, some data about the state of water in Europe is associated with a schematic diagram of where some of the main problems arise in the wastewater treatment.



Source:

<https://www.eea.europa.eu/signals-archived/signals-2020/infographics/state-of-water-in-europe/view>

- Statistical infographics:** These infographics use data visualisation techniques to present statistical information in a clear and concise way. They often use charts, graphs, and other visual elements to make the data more accessible and engaging. The example here showcases statistical information associating it with the countries, so it also has a geographical element.



Source: <https://elements.visualcapitalist.com/mapped-countries-with-the-highest-flood-risk/>



- Timeline infographics:** These infographics use a timeline format to present information about a sequence of events. They can be used to track the progress of a project, to highlight key milestones, or to tell a story. In the example, we can see the main normative documents, in order of their publication.

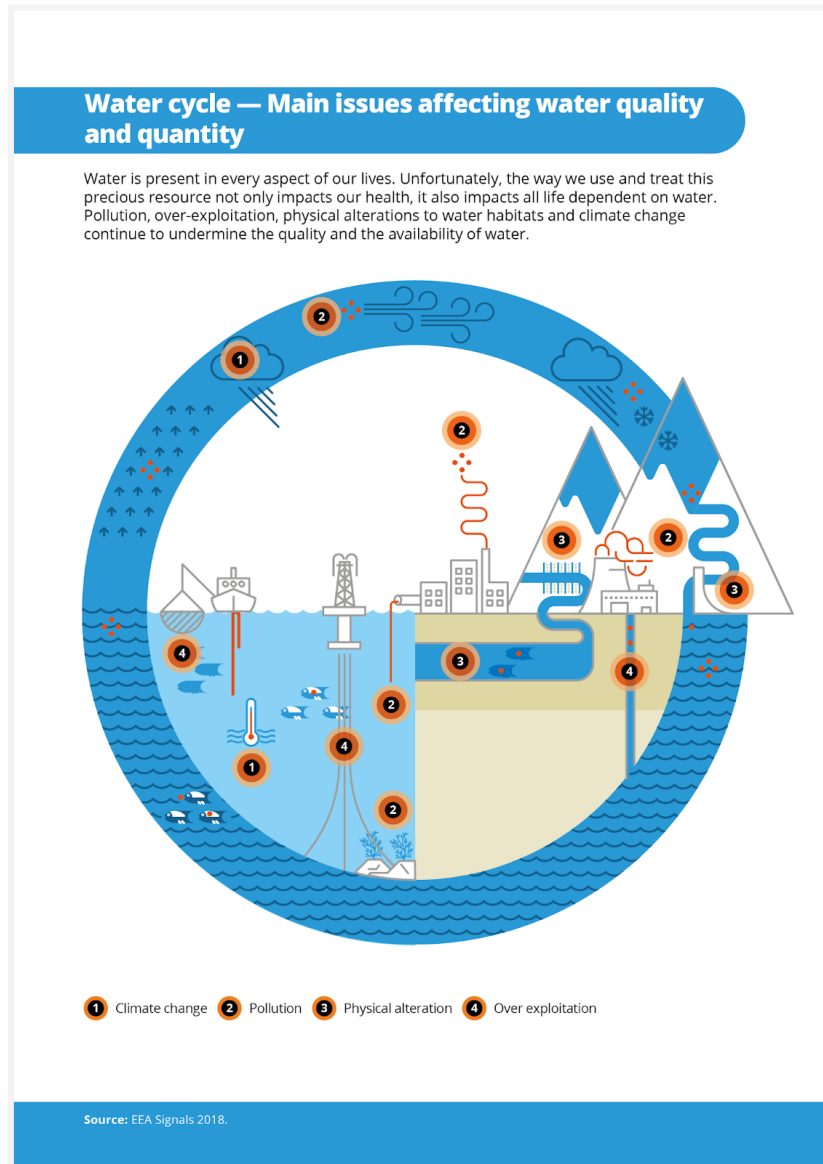


Source:

<https://www.eea.europa.eu/soer/2020/soer-2020-visuals/state-of-the-environment-reporting-2/view>

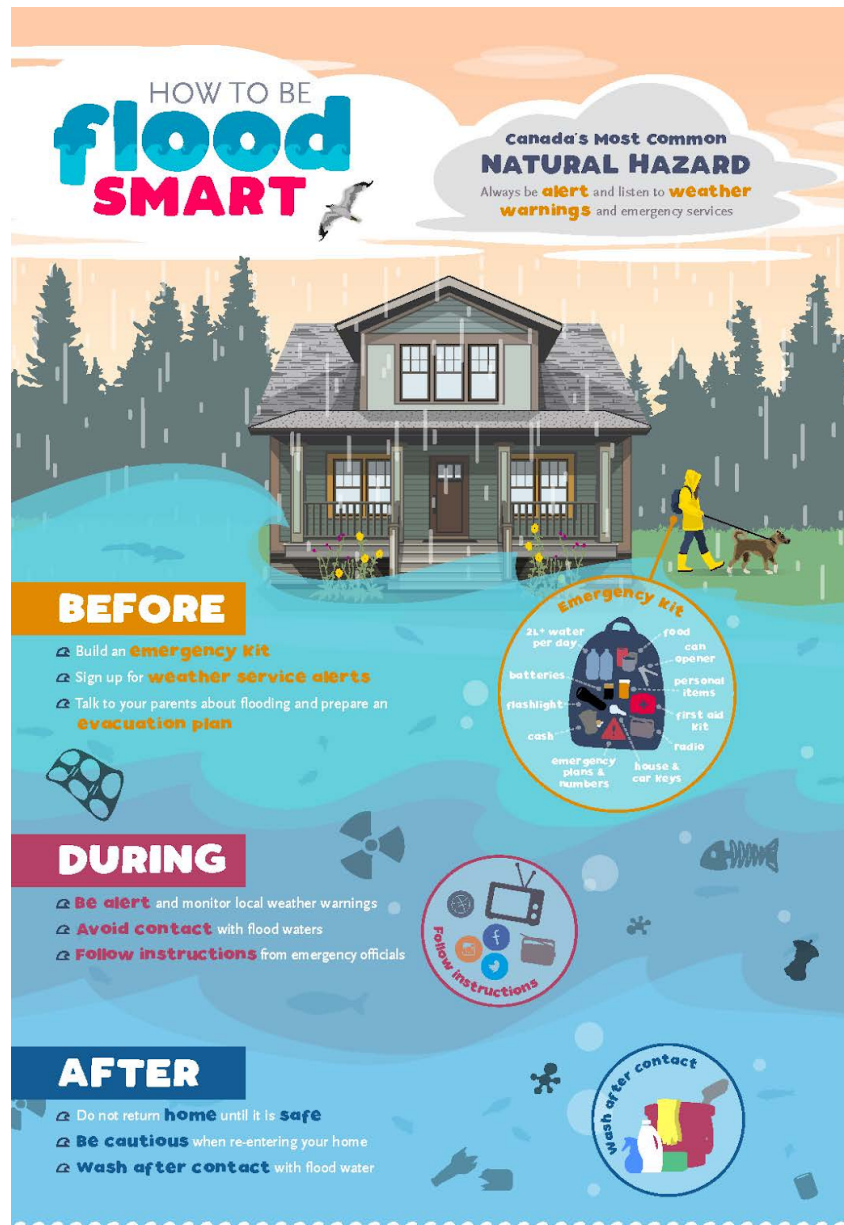


- Process infographics:** These infographics illustrate the steps involved in a process. They can be used to explain how something works, to provide instructions, or to troubleshoot problems. In the example below, we can see how certain issues are affecting the process associated with the water cycle, negatively affecting its quality and availability.



Source: <https://www.eea.europa.eu/signals-archived/signals-2018-content-list/infographic/water-cycle-2014-main-issues/view>

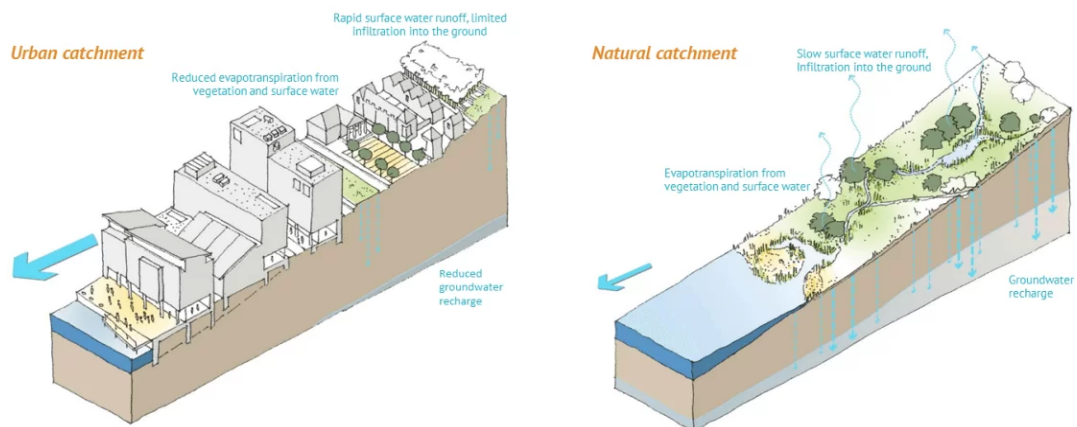
- **List infographics:** These infographics present information in a list format. They can be used to rank items, to compare and contrast different options, or to provide a step-by-step guide. In the example, we can see a list of items to be prepared before, during and after a flood.



Source: <https://floodsmartcanada.ca/educational-resources-on-flooding-in-canada/>



- Comparison infographics:** These infographics compare and contrast two or more items or options. They can be used to highlight the benefits of one option over another, to help people make decisions, or to simply provide more information about a topic. In the example, we have two illustrations, comparing urban catchment and natural catchment, and the impact it has in surface water runoff.



Source: <https://platformurbangreening.eu/inspiration/sustainable-urban-drainage-systems-suds-versus-conventional-drainage-systems/>

Characteristics of our built environment: a key aspect of urban floods

In urban areas, paved surfaces, such as roads, sidewalks, and rooftops, limit the natural infiltration of water into the soil. As a result, during heavy rainfall or when the **capacity of drainage systems is exceeded**, the water accumulates on these impermeable surfaces and quickly forms surface runoff. The technical term to address this is **surface runoff** and as you can see it is particularly relevant in urban environments when it comes to floods.

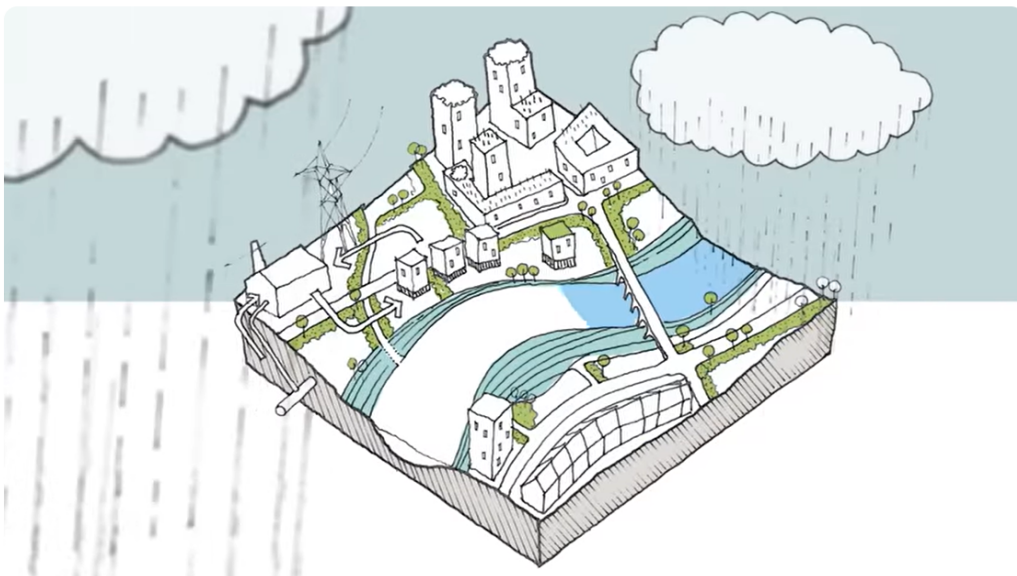
Managing surface runoff in urban areas is crucial for flood prevention and mitigating the impacts of heavy rainfall. Implementing sustainable drainage systems, such as green spaces, permeable pavement, rain gardens, and retention ponds, can help reduce the volume and velocity of surface runoff.

These measures promote natural infiltration, storage, and slow release of stormwater, minimising the risk of flooding and improving the resilience of urban areas to heavy rain events.

This is one of the reasons that the term “sponge cities” is becoming more widely known, have you ever heard about it? If you are curious, we recommended to start with this article

[What are ‘sponge cities’ and how can they prevent floods?](#)

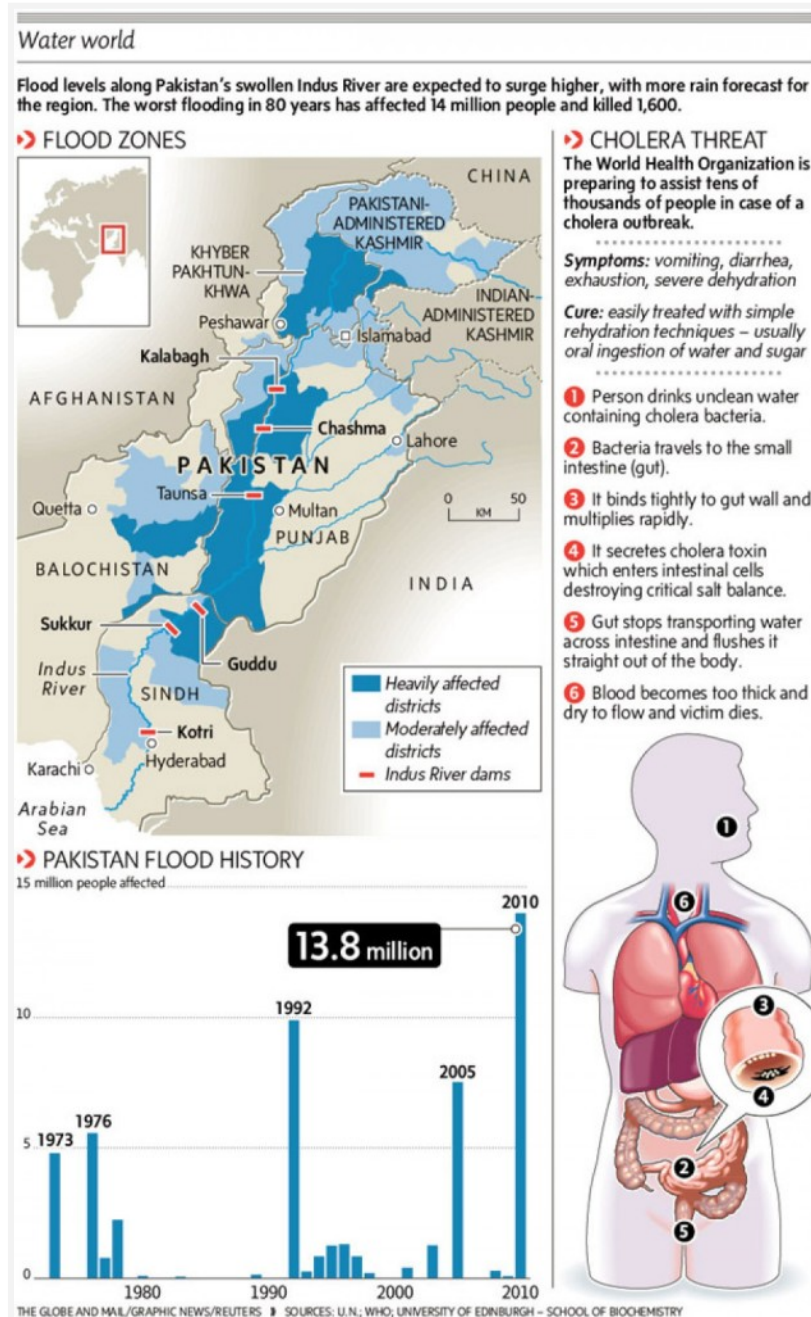
The overall rationale behind sponge cities has to do with water sensitive urban design and with the acknowledgement that we will face more extreme weather events in the years to come. A great resource to learn more about this approach is the “Water Sensitive Urban Design” animated video.



Water Sensitive Urban Design

Source: https://www.youtube.com/watch?v=b_DTnOzYTR4

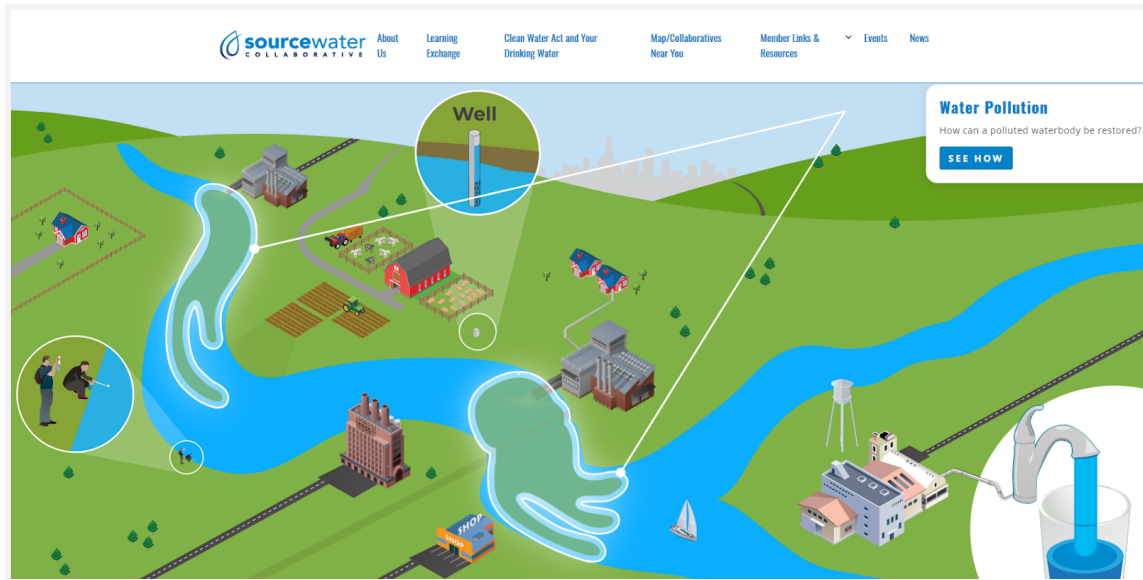
- Geographic infographics:** These infographics use maps and other geographic data to visualise information about a particular place or region. They can be used to show population density, to track the spread of disease, or to highlight environmental issues. The map included in the infographic below shows how different Pakistani districts were affected by flood events.



Source: <https://floodlist.com/asia/pakistan-2010-graphic>



- **Interactive infographics:** These infographics allow users to interact with the data in some way. This may involve hovering over elements of the infographic to reveal more information, clicking on elements to filter the data, or dragging and dropping elements to create their own visualisations. The example below allows users to click on particular areas of the illustration to receive more information.



Source: <https://www.sourcewatercollaborative.org/infographic/>

As you can see, there are many types of infographics. They vary in the type of data they use, the target audience they aim at, the style of illustrations, the level of detail, and many other aspects. What they have in common is this balance between written and visual content, in a way that highlights certain aspects of the information we want to communicate, making a hierarchization of the contents.

WHO MAKES INFOGRAPHICS?

The main objective of this section is to:

- Discuss the range of individuals involved in creating infographics, including designers, educators, students, and community members. By doing this, we want to highlight the importance of incorporating diverse perspectives in infographic creation, searching for this balance between content and form.

The art of crafting infographics is a collaborative effort that spans a diverse spectrum of individuals, ranging from designers and science communicators to educators and community advocates. These professionals come together to distil complex ideas into visually engaging narratives, bridging the gap between intricate information and broader audiences. Anyone can partake in crafting infographics in this era of digital empowerment, but to master this art, a delicate balance between interpretation, summarising skills, and aesthetic sensibilities is essential.

In today's landscape, the increasing **democratisation of digital tools and platforms** has opened the door for virtually **anyone to delve into infographic creation**. However, transforming this endeavour into a compelling and impactful practice requires more than just access to software. It calls for the ability to decipher intricate concepts, pinpoint crucial information, and artistically arrange these elements into a coherent visual story. Just as a skilled mapmaker layers information to guide and inform its audience, a proficient infographic creator highlights key aspects of complex topics, creating a compelling point of view.

Yet, the essence of excellent infographic craftsmanship goes beyond mere technical proficiency. Effective infographics are not just data dumps—they are a thoughtful interplay of interpretation and aesthetics. They weave together key insights, draw connections, and present them in an aesthetically pleasing manner. In a world **where information is abundant and attention spans are limited, the ability to summarise and synthesise complex concepts into a concise, engaging format is a precious skill**. Like skilled cartographers who choose what features to highlight on a map, adept infographic makers decide what information to spotlight, ensuring that the essence of the story is preserved.

Given the central importance of the balance between aesthetics and content, creating effective infographics typically involves the use of complementary skills, such as critical thinking and design competencies. So individuals involved in the process of

infographic making come from a diverse set of backgrounds. The types of professionals commonly involved in infographic making include:

- **Graphic designers:** These professionals are experts in creating visually appealing layouts, selecting appropriate colours, and designing typography that enhances the visual appeal of infographics.
- **Data analysts, researchers, and journalists:** Data analysts play a crucial role in gathering and analysing the data that serves as the foundation of infographics. They ensure data accuracy and relevance.
- **Content writers or copywriters:** Skilled in crafting clear and concise text, copywriters structure the narrative within an infographic and help convey the intended message effectively.
- **Illustrators or visual artists:** Illustrators contribute custom graphics and visuals to infographics, making complex concepts more understandable and engaging.
- **User experience (UX) designers:** UX designers ensure that infographics are user-friendly, responsive, and well-designed for effective interaction.

Interactive Developers: Infographics with interactive elements require developers with programming skills to create animations and interactivity.

- **Researchers and subject matter experts:** They provide accurate, credible information and domain-specific knowledge that is crucial for informative and reliable infographics.
- **Data visualisation specialists:** These experts specialise in transforming complex data into visually comprehensible graphics and charts, ensuring data clarity and accuracy.

Here are some examples of exceptional infographic designers (and a company that combines infographics and map making):

- **Alberto Lucas Lopez:** Lopez is a Spanish infographic designer who creates visually stunning infographics on a variety of topics, including science, technology, and social issues. His work has been featured by publications such as The New York Times, National Geographic, and The Guardian. <https://www.lucasinfolgrafia.com/>
- **David McCandless:** McCandless is a British data journalist and information designer. He is the author of several books on data visualisation and infographics, including "Information is Beautiful" and "The Visual Miscellaneum."

He also creates infographics for his website, Information is Beautiful. <https://davidmccandless.com/> + <https://informationisbeautiful.net/>

- **Giorgia Lupi:** Lupi is an Italian information designer and data visualisation researcher. She is the author of the book "Dear Data", which is a collection of handwritten data visualisations that Lupi exchanged with her friend and collaborator, Stefanie Posavec. She also creates infographics for her website, Dear Data. <https://giorgialupi.com/>
- **Nadieh Bremer:** Bremer is a Dutch data visualisation designer and artist. She is the author of the book "Data Sketches: Visualizing Information with Pen and Paper." She also creates infographics for her website, Nadieh Bremer. <https://www.visualcinnamon.com/>
- **Stamen Design:** Stamen Design is a design and technology studio that specialises in information design and data visualisation. The studio has created infographics for a variety of clients, including Google, NASA, and The New York Times. <https://stamen.com/>

Given the amount of resources available to create infographics, maybe the most important characteristics one must have to make them are: **to be curious, to be rigorous in the research process, to have an interest in communication in general and in visual communication in particular.** In this sense, while many tools are available so that virtually anyone can make infographics, here is our list of relevant skills of those who make infographics (or that want to start and get better at making them):

- **Graphic design and illustration:** Proficiency in graphic design is essential for creating aesthetically pleasing infographics. Layout design skills help arrange content for maximum impact. Knowledge of colour theory is crucial to select visually appealing colour schemes that enhance the infographic's readability. Understanding typography aids in choosing the right fonts and text arrangements, contributing to visual aesthetics. These elements collectively enable the effective visualisation of data and information in an engaging manner.
- **Data skills:** Competency in data-related tasks, such as gathering, analysis, interpretation, and visualisation, forms the backbone of infographics. Data is often the foundational content of an infographic. Skills in data analysis and interpretation ensure that information presented is accurate and contextually relevant. Data visualisation abilities help transform complex data into clear, meaningful graphics that enhance audience comprehension.



- **Writing and storytelling abilities:** Crafting an engaging narrative within an infographic requires strong writing and storytelling skills. These skills are particularly vital as infographics demand concise and compelling text. Writers must present information clearly and concisely to capture the audience's attention. The text's brevity is crucial for maintaining the infographic's engagement while conveying essential information.
- **User experience (UX) design and programming skills:** For interactive infographics, the expertise of User Experience (UX) designers is invaluable. UX designers ensure the infographic is user-friendly and responsive, providing a seamless interactive experience. In the case of interactive elements, programming skills are necessary for creating animations and interactivity. These elements engage the audience and enable them to interact with the content, leading to a deeper understanding of the topic.
- **Software and Tools know-how:** Competence in using graphic design software and data visualisation tools is pivotal in the infographic creation process. These tools empower designers to bring their creative visions to life and make data visualisation more effective. Given the vast amount of data available, the ability to utilise the appropriate software tools streamlines the design process and enhances the quality of infographics.
- **Critical thinking:** Infographic creators employ critical thinking to identify key messages and distil complex information into digestible visual content. This skill ensures that the infographic effectively conveys its intended message and that the most pertinent information is presented.

The combination of these skills and competencies allows those engaged in infographic making to effectively balance aesthetics and content, engaging and informing audiences. Are you up for the challenge? Are you interested in helping your students gain and strengthen these skills?

WHEN TO USE INFOGRAPHICS?

In this section we will focus on the decisions related to when to use infographics. So our main focus will be to:

- Explain the versatility of infographics for various purposes, such as pre-flood preparedness, emergency response, and post-flood recovery.

INFOGRAPHICS FOR PREPAREDNESS

Infographics can play a crucial role in flood preparedness, serving as a versatile tool to educate communities about flood risks and measures to mitigate them. These graphics can be used to illustrate the various types of floods and identify high-risk areas. Moreover, infographics can guide people on the steps to prepare for potential flooding, such as emergency kits, evacuation plans, and flood insurance. Their visual appeal makes complex information accessible, ensuring that communities are well-informed and equipped to face impending flood events. Furthermore, infographics help develop and communicate emergency plans, mapping evacuation routes, identifying safe havens, and providing step-by-step guidance during flood scenarios.

INFOGRAPHICS FOR EMERGENCY RESPONSE

During a flood emergency, infographics can be valuable tools for timely and effective communication. They provide concise and visually appealing formats to relay critical information, catering to various audiences' information needs.

News services frequently use infographics to inform the general public about unfolding flood emergencies. These graphics present real-time flood warnings, pinpoint areas under evacuation orders, and offer essential safety instructions. News outlets understand the power of infographics in breaking down complex information into easily digestible visuals, ensuring that the broader public, regardless of their familiarity with flood terminology, can comprehend the gravity of the situation. These infographics offer a quick overview of the flood's current status, allowing for immediate and informed decision-making, particularly when time is of the essence. Moreover, infographics are adaptable to various communication platforms. News services can disseminate them through television, websites, social media, and printed materials, ensuring that the information reaches the widest audience possible. Their versatile nature allows for comprehensive outreach, which is essential during a crisis.



INFOGRAPHICS FOR POST-FLOOD RECOVERY

After a flood event, infographics can continue to serve a vital role in conveying information on the recovery process. They can be instrumental in extending assistance to flood victims, offering guidance on how to navigate the complexities of recovery, providing, for example, insights into filing flood insurance claims, accessing available resources, and tips for reconstructing homes damaged by floods.

Furthermore, infographics act as powerful advocates for flood resilience measures. They can clearly outline the economic costs of flooding, emphasise the advantages of flood resilience, and urge action to reduce flood risk. In this post-flood phase, infographics play a dual role: they inform flood-affected communities and engage the broader public in supporting recovery and resilience efforts. In this sense, the post-flood infographics also become preparedness infographics.

Beyond these specific use cases, infographics offer a wide array of applications within flood preparedness, emergency response, and post-flood recovery. In this sense, they can be used when it is important to raise awareness with the public and promote resilience. Infographics can explain the causes and impacts of floods, enhancing public understanding. If the level of risk awareness is low, infographics can be a good communication tool with the general public. In conclusion, infographics emerge as a versatile and highly effective medium to convey critical information regarding floods. Their utilisation in flood preparedness, emergency response, and post-flood recovery can be highly instrumental in keeping communities informed and resilient in the face of flood events.

HOW TO MAKE INFOGRAPHICS?

We have finally arrived at the operation section of the module on how to make infographics. Here we will address the following specific objectives:

- Provide step-by-step guidance on creating infographics with digital resources.
- Introduce user-friendly infographic design tools and software suitable for students and teachers.
- Encourage creativity and experimentation with infographic styles and formats.






Before we start, it is important to highlight that our approach here will be mainly focused on digital approaches to making infographics. Of course, some aspects can be made by hand, but we want to foster digital skills and we recognise that digital tools often facilitate collaborative creative processes. In the box below, we have an extensive - but by no means comprehensive - list of some great resources you can use to create infographics using digital tools.

Some great resources to produce infographics digitally




There are several options to create infographics online. Most of them come accompanied by templates that can help to make the creative process more effective.

- **Canva:** is a popular online design platform that offers a variety of templates and tools for creating infographics. It is free to use, with paid plans available for additional features. www.canva.com
- **Piktochart:** is another popular online infographic maker with a wide range of templates and tools to choose from. It also offers a free plan, with paid plans available for additional features. piktochart.com
- **Visme:** is an all-in-one content creation platform that includes a powerful infographic maker. It offers a free plan, with paid plans available for additional features. www.pcmag.com



- **Venngage:** is a user-friendly infographic maker with a variety of templates and tools to choose from. It offers a free plan, with paid plans available for additional features.  www.g2.com
- **Snappa:** is a simple and easy-to-use infographic maker with a library of templates and graphics. It offers a free plan, with paid plans available for additional features.  snappa.com
- **Easel.ly:** is a free online infographic maker with a variety of templates and tools to choose from. It is easy to use and does not require any design experience.  www.easel.ly
- **Infogram:** Infogram is a powerful infographic maker with a wide range of features and tools. It offers a free plan, with paid plans available for additional features.  infogram.com
- **Adobe Express:** is a web-based and mobile app that allows users to create a variety of content, including infographics. It offers a variety of templates, fonts, and images that users can use to create their infographics.  www.adobe.com

These are just a few of the many online resources available for creating infographics. However, if you are interested in more visualisations that are more data intensive, here are other web-based tools that you might want to check out:

- **Datawrapper:** is a free and easy-to-use data visualisation tool. It offers a variety of charts and graphs, as well as the ability to create interactive and embeddable visualisations. It does not require any coding knowledge to use.  www.datawrapper.de
- **Chartblocks:** is a data visualisation tool that offers a variety of charts and graphs, as well as the ability to create interactive and embeddable visualisations. It requires some coding knowledge to use.  www.chartblocks.io
- **Tableau Public:** is a free data visualisation tool that allows users to create and share interactive data visualisations. It is easy to use and does not require any coding knowledge.  www.tableau.com



- **Flourish:** is a data visualisation tool that offers a variety of templates and tools for creating interactive and embeddable data visualisations. It does not require any coding knowledge to use. ✨ <https://flourish.studio/>.

Each of these resources will offer different options and functionalities. The one you chose to use, will depend on your objectives and preferences. Most of them have blog posts and specific tutorials, so you can browse their main characteristics before choosing one.

Remember, while creating infographics and visualisations, it's crucial to consider digital **accessibility**. Pay attention to aspects like contrast and descriptive text to ensure that your content is accessible to all. You can use tools like the ones listed in the [W3C Web Accessibility Initiative \(WAI\) Evaluation and Repair Tools](#) to check your designs for digital accessibility.

MAIN STEPS TO CREATE YOUR INFOGRAPHIC

We are presenting a simple, straightforward structure to create an infographic. However, it is important to highlight that, as in any creative process, these steps might not be as clean-cut in reality as they are here. A lot of muddling through might emerge in the process, like revisiting who is the target audience after not finding supporting data for your initial idea or approach. Similarly, you might get inspired to create an infographic after exploring a data set, or reading a report that caught your attention. So have these steps as general references for your creative process.

1. **Select your topic and audience.** What do you want to learn about and create an infographic on? Who is your target audience? What do you want them to learn from your infographic?
2. **Identify your learning goals.** What do you want to learn about floods by creating this infographic?
3. **Gather information.** Once you have chosen a topic and identified your learning goals, gather information from reliable sources. This could include books, articles, websites, or even experts in the field.



4. **Organise your information.** Once you have gathered information, organise it in a way that makes sense. This could involve creating an outline, a storyboard, or mind map. This will depend on the previous steps and decisions you have made.
5. **Choose a visual style.** Decide what kind of visual style you want your infographic to have. This could involve choosing colours, fonts, and graphics. If you are using a design platform such as Canvas, you could start with a template. Many digital resources offer a variety of templates for infographics, and you can choose one that is appropriate for your topic and audience, as well as for the medium you will share it.
6. **Create your infographic.** Add your text and visuals to your infographic. Don't be afraid to experiment with different resources and to explore different options.
7. **Get feedback.** Once you have a draft of your infographic, get feedback from others. This could involve asking friends, family, or teachers for their opinion.
8. **Revise and finalise your infographic.** Make any necessary revisions to your infographic and finalise it.
9. **Share your infographic.** Once you are happy with your infographic, share it with your audience. This could involve posting it on social media, emailing it to your classmates, or printing it out and displaying it in your school.

Here are some tips for making your infographic a learning process:

- Choose a topic that you are interested in learning more about.
- Gather information from a variety of sources.
- Organise your information in a way that makes sense to you.
- Choose a visual style that you are comfortable with.
- Get feedback from others throughout the process if you can.
- Reflect on what you have learned and how you can improve your infographic making skills in the future.



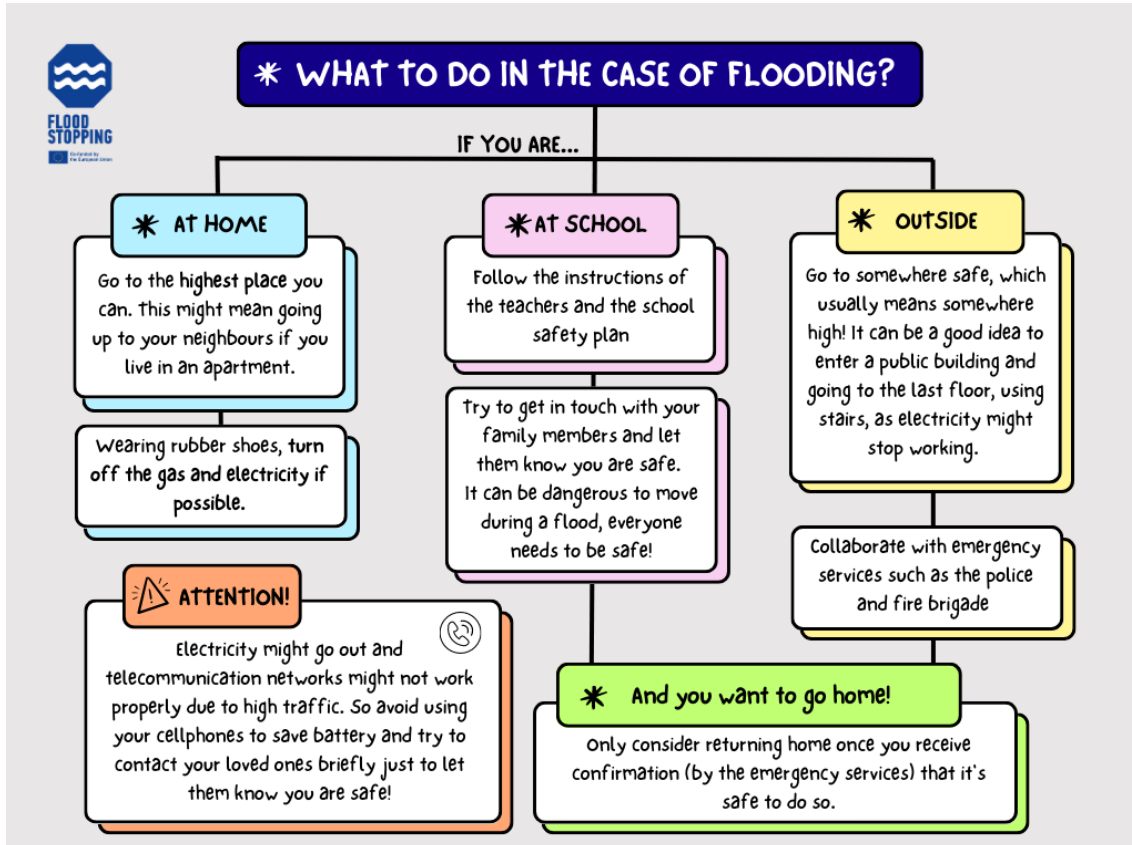
Some great resources for the aesthetics and visual components of your infographic

There are many resources online related to digital design. We have listed a few here that might be of value to create infographics and will probably spark interest among those who are eager to explore the visual aspects more in depth.

- **Google Fonts:** is a library of over 1,400 open-source font families that you can use for free on your website or in your designs. <https://fonts.google.com/>
- **Adobe Color:** is a tool that allows you to create and explore colour schemes. It also includes a variety of resources on colour theory. <https://color.adobe.com/create/color-wheel>
- **Coolers:** is a tool that allows you to generate colour palettes quickly and easily. It also includes a variety of resources on colour theory. coolers.co
- **Paletton:** is a tool that allows you to create and explore colour schemes. It also includes a variety of resources on colour theory. <https://paletton.com/>
- **Freepik:** is a website that offers free and premium images, vectors, and icons. br.freepik.com
- **Pixabay:** is a website that offers free images, vectors, and videos pixabay.com
- **Pexels:** is a website that offers free stock photos and videos. www.pexels.com
- **Unsplash:** is a website that offers free high-resolution photos. unsplash.com
- **Flaticon:** is a website that offers free and premium icons. www.flaticon.com
- **TheNounProject:** is a website that offers icons and photos. <https://thenounproject.com/>



In the supporting material - [How to create an infographic in Canva: an introduction](#) - you can see a simple step-by-step introduction that we created when preparing the simple infographic below.



IDEAS FOR CLASSROOM ACTIVITIES AND EXERCISES

CREATING SIMPLE FLOOD AWARENESS INFOGRAPHICS - THE DO'S AND DON'TS

Objective: Using the infographic “what to do in the case of flooding”, invite your students to create a similar infographic, but pointing out what you should not do. You can use the same template on Canva that we used for the example on how to make an infographic.

You can access the [editable file](#) and start from there!

Materials:

- Computer with internet access
- List on what to do and not do in the case of floods.
- Reliable sources for information. Complementary to our project website, <https://floodstopping.eu/>, we also recommend the following
 - European Environment Agency (EEA) - <https://discomap.eea.europa.eu/climatechange/?page=Floods>
 - EU Science Hub - Joint Research Center - Floods https://joint-research-centre.ec.europa.eu/scientific-activities-z/natural-and-man-made-hazards-0/floods_en
 - Flood Resilience Portal <https://floodresilience.net/>

Step 1: Exploring the "Do's" Infographic (10 minutes)

Begin by examining the "What to Do in the Case of Flooding" infographic. Spend a few minutes discussing it as a class:

Is the information presented new to you?

Can you identify any missing information or areas that need further clarity?

What actions seem straightforward and obvious to you?

Step 2: Task Introduction and Group Formation (10 minutes)

Divide the class into small groups, each comprising creative minds eager to take on the challenge. Explain the main task: to create an "opposite" infographic that highlights what not to do during floods.



Provide students with reliable sources where they can find information about what not to do in the case of floods. Depending on the location and location you are in, it may be better to direct them towards fluvial floods, flash floods, and/or coastal floods events.

Share the [link](#) with them and provide them with the [basic tutorial](#)

Step 3: Infographic Creation (45 minutes)

Now it's time to bring your ideas to life using the provided Canva template:

Define the Message: Discuss within your group what key mistakes people often make during floods.

Visualise the Message: Utilise the Canva template to craft a clear and visually appealing infographic. Maintain a coherent design style to ensure effective communication.

Illustrate with Caution: Use icons, images, and captions to illustrate what not to do during floods. Keep the message straightforward and easy to understand.

Source and Cite: If you include specific data or information, make sure to source and cite the information appropriately.

Step 4: Sharing and Learning (15 minutes)

Gather back as a class and have each group present their "Don'ts" infographic. Pay attention to the design, clarity, and the impact of the message. After each presentation, open the floor for questions and discussions.

Step 5: Reflection and Impact (15 minutes)

Conclude the activity with a class reflection:

How did crafting the "Don'ts" infographic differ from the "Do's" version?
What did you learn about effective communication through infographics?
How can these infographics raise flood awareness and encourage responsible actions?

Variations: Following the same structure and logic, you can ask students to create:

- "what **to do before** a flooding"
- "what **NOT to do before** a flooding"
- "what **to do after** a flood"
- "what **NOT to do after** a flood"



You can divide the students into groups and assign different alternatives for each group. Afterwards, when they are presenting the do's and don'ts ask them to reflect on the differences and check if inconsistencies have emerged. These inconsistencies can be precisely the unclear points that can lead to riskier behaviour. This can be a good entry point to discuss ambiguities and foster student's agency and critical assessment skills.

You can also propose the **infographic making as a home activity**, and afterwards they can share in class their impressions and lessons learned in the process.

UNRAVELLING THE MYSTERY OF CLOUDS IN THE CLIMATE SYSTEM

Objective: This activity is an invitation to explore systems thinking and climate awareness, inviting students to reflect on the variables that should be considered when gathering data, analysing it, and developing tools that help us to better understand the world around us and how to adapt to climate change events. In this activity, students will read an article titled "Why clouds hold the key to better climate models" and create an infographic to showcase their understanding of the intricate relationship between clouds, climate modelling, and floods.

Materials:

- Computer with internet access
- Reliable sources of information as a starting point.

Step 1: Reading the Article (home activity - preparation)

Share the article with students and invite them to read them before class.

"Why clouds hold the key to better climate models"

<https://www.carbonbrief.org/guest-post-why-clouds-hold-key-better-climate-models/>

Instruct the students to read the article carefully, taking note of key points related to clouds, climate modelling, and their connection to floods.

Step 2: After-Reading Discussion (15 minutes)

Begin the activity by engaging students in a short discussion about clouds, climate, and their potential impact on flooding.

Encourage students to share what they already know about clouds and their role in the climate system.

Discuss how rainfall from clouds can lead to flooding in certain areas.

Ask students to think about the challenges scientists face in accurately modelling clouds.

Step 3: Infographic Creation (30 minutes)

Divide the students into small groups.

Provide each group with a blank infographic template or guide them in creating their own on paper or digital platforms.

Instruct the students to use the information from the article and the brief provided to create an infographic that highlights the main concepts related to clouds, climate modelling, and floods.

Guidelines for the Infographic:

Include a catchy title related to the climate connection of clouds and floods.

Organise the infographic into sections, aligning with the outline provided in the brief.

Use visuals, symbols, and illustrations to represent clouds, rainfall, and climate processes.

Include simple and concise explanations for each section of the infographic.

Add arrows and connections to show the relationships between clouds, climate modelling, and floods.

Add at least one curiosity if possible or a lesson learned in the development process

Add references (regarding the sources of information you used)

Nota bene: highlight to the students that they will present their infographic to the class.

Step 4: Presentation (15 minutes)

Once the students have completed their infographics, have each group present their creations to the class.

Encourage the students to explain the main concepts they included in their infographics and how they visualised the connections between clouds, modelling, and floods.

Engage in a class discussion about the similarities and differences in the infographics, fostering an understanding of various perspectives on the topic.

Step 5: Reflection and Wrap-Up (10 minutes)

Conclude the activity by asking students to reflect on what they have learned about clouds, climate modelling, and floods through this interactive activity.

Emphasise the importance of clouds in the climate system and how they impact floods and weather patterns.

Encourage students to continue exploring climate science and its relevance in understanding the world around us.

CONCLUSION - WHAT IF... SO NOW WHAT?

We are glad that you have reached the end of our Flood Stopping manual on how to make maps and infographics! We hope that you have found the contents interesting, valuable and useful! And we would love to hear your feedback, so do get in touch with us if you have any questions, comments or suggestions. You can reach us on the project's webpage <https://floodstopping.eu/contact/> or get in touch with [Area Europa](#).

As we embark on this Flood Stopping journey, it is crucial to recognize the growing importance of flood education in the face of climate change. With the increasing frequency and intensity of extreme weather events, including floods, it is evident that our communities need to be prepared for the challenges ahead. Climate change has amplified the vulnerability of our territories to flooding, requiring us to have a proactive approach to education and risk management. In a world where floods challenge communities and the ever-growing tide of information can be overwhelming, both maps and infographics offer a way to navigate and understand. By embracing these tools, we equip ourselves to comprehend the complexities that surround us, making informed decisions and contributing to a more resilient and adaptable society.

It is important to highlight that this manual is just one of the results of the Flood Stopping project. We invite you to look at the other resources we have available, checking out the project's webpage: <https://floodstopping.eu/>

Keep in mind that floods are no longer isolated incidents but rather an impending reality that demands our attention and our well-informed response. Through the utilisation and creation of maps and infographics, we can effectively convey the impacts of climate change, visualise flood risks, and inspire action within our communities. By engaging students in understanding and addressing these challenges, we empower them to become agents of change, building resilient societies capable of adequately and safely responding to extreme weather events, such as future floods. Let's make maps and infographics in our journey for more resilience and sustainability!