

A map perspective on the sustainable development goals



Let's make the world a better place with maps



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WE MAPS
INTERNATIONAL MAP YEAR 2015-2016

International Cartographic Association
Association Cartographique Internationale





As soon as location is involved maps will come into action. Maps allow us to compare tangible physical phenomena such as hours of sunshine, or intangible human phenomena such as level of education amongst different locations. They allow us to see geographical processes evolving over time such as land use changes. The map is no longer the static window to the world, it is now an interactive, mobile, dynamic and collaborative interface between humans and the dynamically evolving environment.

We only can comprehend the mapped data effectively if the maps are attractive, and well designed. In other words, maps that matter should raise interest, be engaging, instantly understandable, and relevant to society. It is the discipline of Cartography that aims to realize and facilitate this.

The International Cartographic Association (ICA), founded in 1959, has as its aim is to promote the discipline of Cartography internationally. It offers its expertise and knowledge of technological developments to other organizations via events, meetings, workshops, and publications. Its activities happen through the work of its Commissions and Working Groups, that deal with a wide range of topics that cover nearly the whole discipline.

How can ICA help realize United Nations' 2030 agenda for sustainable development. The 17 sustainable development goals and their targets should improve economic, social and environmental aspects of humanity and our planet. The targets are judged based on over 300 indicators. For instance, for the education development goal one of the targets is to ensure that all children have free and good primary and secondary education. Its success is measured by two indicators 'Percentage of children proficiency in reading and mathematics' and the 'Completion rate (primary, lower secondary, upper secondary)'.

How can we cartographers be relevant to society in helping to reach these targets? First, well-crafted maps can effectively visualize currently known facts, and online mapping technology can disseminate these facts globally to increase awareness of the current state of affairs. Interactive map dashboards connected to geographic databases at multiple scales and equipped with space-time analytical functions will allow decision makers on various decision levels to monitor and compare indicators for policy development and action at various geographical scales.

This booklet acts a kind of exhibition catalogue to a set of posters, one for each sustainable development goal. They do not map the goals and their target based on indicators as such. The poster series tells the story of cartographic diversity, of mapping options, and of multiple map perspectives. Each of the goals has been mapped from a particular perspective by different ICA Commissions. All posters have a short take-home-message that should make one aware of particular strengths of the map.

The posters, and this booklet can be downloaded from <http://icaci.org/maps-and-sustainable-development-goals/>

Menno-Jan Kraak
ICA President

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A map perspective on the sustainable development goals

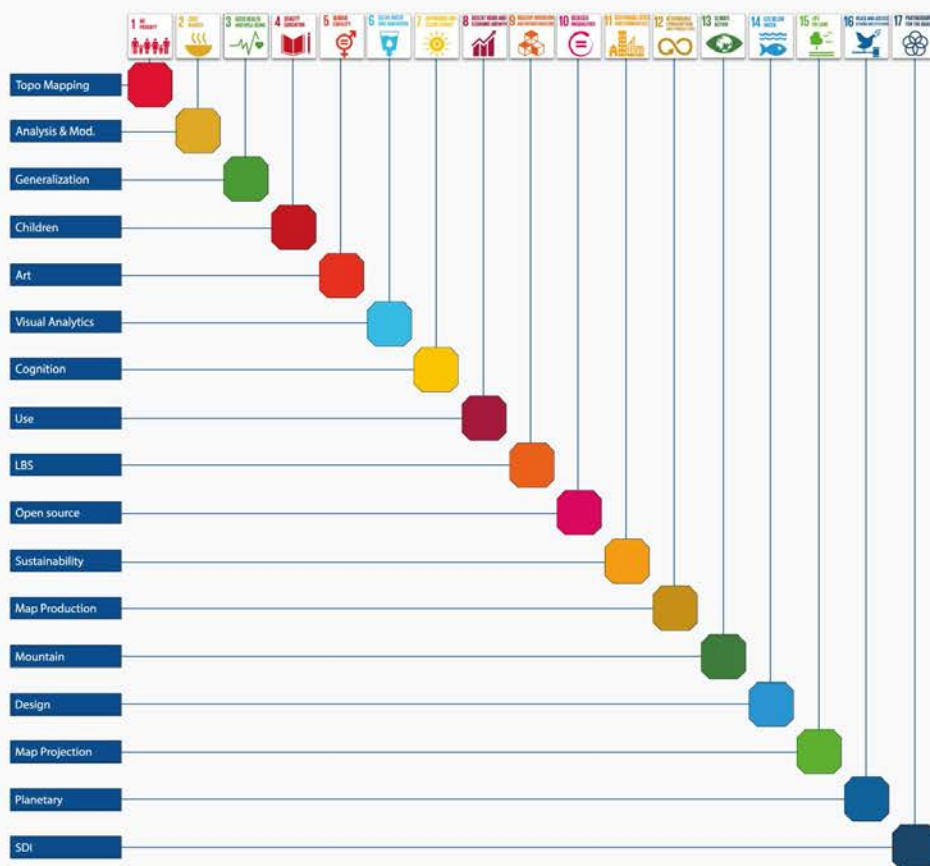


The aim of the International Cartographic Association is to promote the discipline of cartography internationally. It offers its expertise and knowledge of technological developments to other organizations via events, meetings, workshops and publications.

Its activities happen through the work of its Commissions and Working Groups which deal with a wide range of topics that cover nearly the whole discipline. Since being founded in 1959, ICA has worked with national and international governmental and commercial bodies, and with other international sister societies to achieve its aims.



The sustainable development goals and their targets can be mapped based on the indicators. ICA's Commissions have mapped each of the goals from their particular perspective. The resulting poster collection gives an overview of the strength of cartography. It is telling the story of cartographic diversity, of mapping options and of multiple map perspectives.



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Ending Poverty in all its forms everywhere

THE GLOBAL GOALS For Sustainable Development

Target

By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than \$1.25 a day

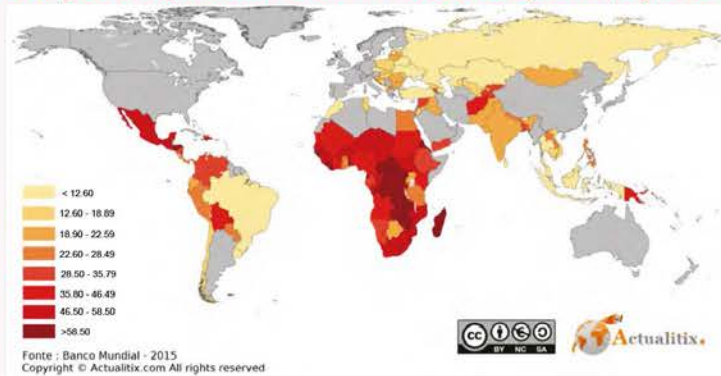
Indicator

Percentage of population below \$1.25 (PPP) per day

1 NO POVERTY



Percentage of Population below the Poverty Line, by Country



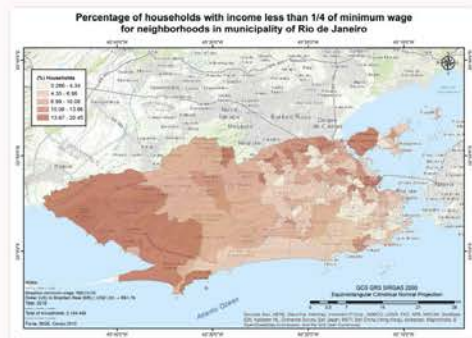
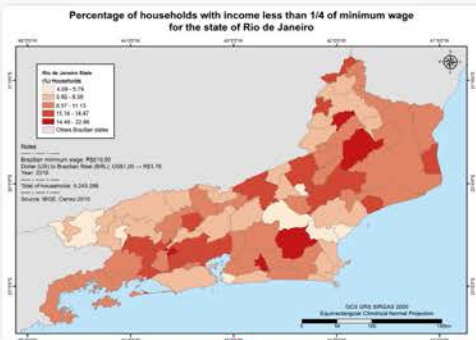
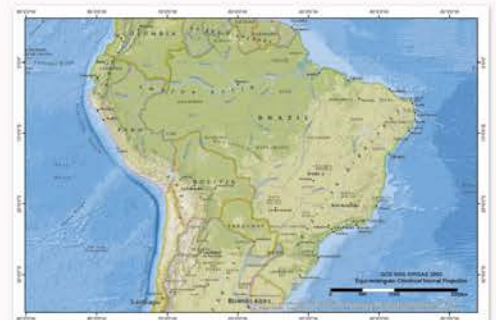
Names identify topographic elements which localize the map theme



The maps in this poster illustrate geographical patterns of poverty around the world and focus on the city of Rio de Janeiro, Brazil. Left a sequence of choropleth maps showing percentage of households with an income less than 1/4 of the minimum wage in Brazil (R\$10), at regional and local levels.

Right topographic and toponymic information, that is, more details about the landscape and the place names of the areas covered in the thematic maps at the same scales. Comparing the maps allows observations to be made about the patterns of poverty and its relationship with space and place. We can identify general trends, such as the low levels of income in regions within the Amazon basin and identify specific regions within the city of Rio de Janeiro which experience greater levels of poverty.

Below the combination of the thematic data with topographic data to allow efficient understanding of the relationship between poverty and place. However, poverty is an organic phenomenon and choropleth maps such as these are limited in how they present these data; they impose artificial boundaries that rarely coincide with fluid concepts and realities.



Toponymy allows us to analyze the relations between and among people, history, geography and culture, space and time. Toponymy, place names or geographical names are one of the most commonly and widely used way of geoinformation, consisting of official and local names of administrative, cultural and geographic features, including streets and roads.

Topographic Mapping helps us to gain a better insight into and understanding of the causes of poverty by supporting decision-making by the state (e.g. national surveys) and the empowerment of local people (e.g. community mapping). As a resource for planning, topographic maps can present the landscape as a shared resource for the benefit of all and help to conserve natural and built environments for future generations.

The ICA Commission on Topographic Mapping provides a forum for those whose primary focus is the design, production and use of topographic mapping and related geospatial data products.

The ICA Commission on Toponymy disseminates scientific knowledge on the processing and use of toponyms within geography and cartography and supports the publication of gazetteers, toponymic data files and toponymic reference systems.

Data and Information Source:

Actualitix.com
Banco Mundial, 2015
IBGE, Censo 2010
National Geographic
Open Street Map, created by people like you and free to use.

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Commission on Topographic Mapping
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Vice-chair: Anja Hopfstock e-mail: anja.hopfstock@bkg.bund.de
Commission on Toponymy
Chair: Paulo Menezes e-mail: pmenezes@acd.uff.br
Vice-chair: Peter Jordan e-mail: peter.jordan@oeww.ac.at

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THE GLOBAL GOALS

For Sustainable Development

Target

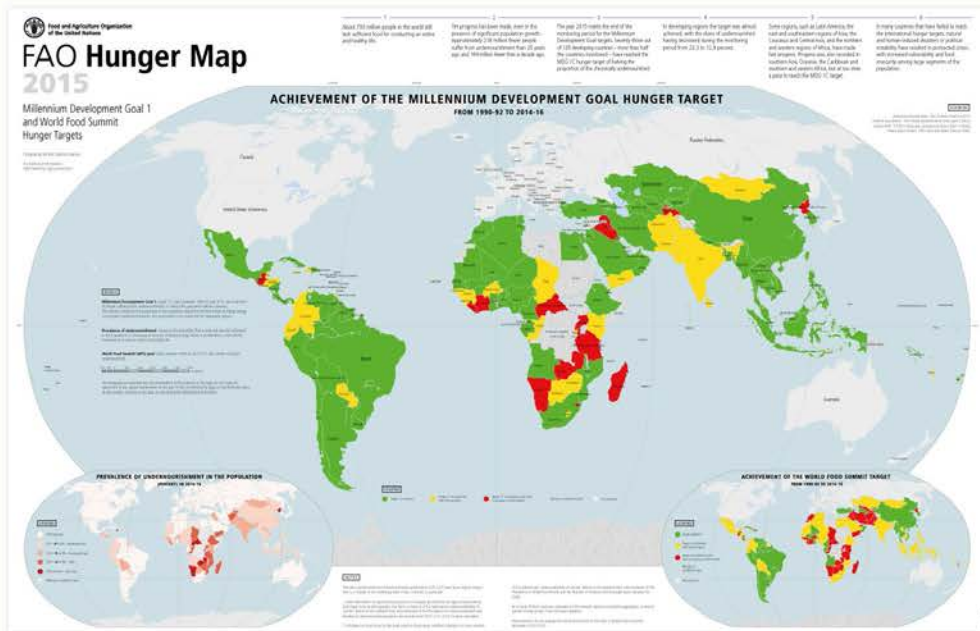
End hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants to safe, nutritious and sufficient food all year round. Ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production.

Indicator

Prevalence of Undernourishment (PoU)
Prevalence of population with moderate or severe food insecurity
Emissions of greenhouse gasses in agriculture (per hectare of land and per unit of output).



Maps communicate spatial patterns and spatio-temporal analysis results effectively



Mapping the reality of food insecurity in the World

The prevalence of undernourishment (PoU) is analyzed for each country and visualized in the world map. Changes of PoU have been monitored and visually presented in the map. It is shown that the progress of reduction in number of undernourished has been made in all world regions, but at different rates.

Between the monitoring period of 1990-2015, more than 50% of the developing countries have at least halved the proportion of the chronically undernourished. But the map also shows that many countries still have not reached the international hunger target, with increased vulnerability and food insecurity among large segments of the population.

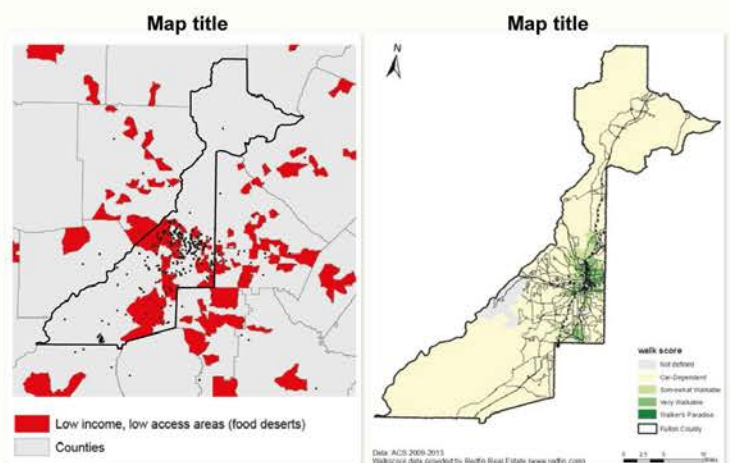
Sustainable agriculture

GIS and mapping have been used as enabling technology for sustainable agriculture and food production. The GIS and GPS-enabled mobile device technologies allow planners, agronomists and farmers to research and devise for resilient agricultural practices and better productivity. For example, emissions of greenhouse gasses per hectare of land and per unit of output can be accurately estimated based on precise geolocation, observation, and measurement.



Prevalence of population with moderate or severe food insecurity at fine urban and regional scales

The prevalence of food insecurity also needs to be studied at the local level. This is often done with special consideration of the income level and people's spatial accessibility to healthy food. The mapping of the analysis results helps to identify areas where improvements are urgently needed. The maps below show such areas in Atlanta, USA.



Contributors: Winston Cai, Angela Yan, Jerry Shannon in Geography Department at the University of Georgia

The ICA Commission on Geospatial Analysis and Modeling focuses on spatial analysis, modeling and data mining, often with links to the geovisualization and visual analytical approaches. The commission encourages concerted efforts on cutting-edge or emerging research directions related to geospatial data and problems.

Note: Some of the maps come from publications from official sources.

Data and Information Source info:
FAO, ESRI, researchers at the University of Georgia, USA

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Ensure healthy lives and promote well-being for all at all ages

3 GOOD HEALTH AND WELL-BEING

THE GLOBAL GOALS For Sustainable Development

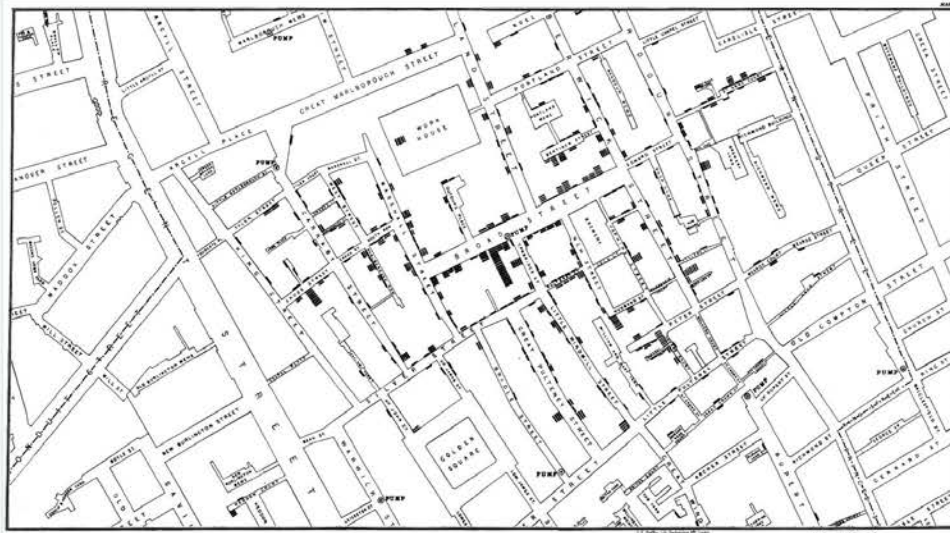
Targets

By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases.

Indicators

Malaria incident cases per 1,000 person years.
Malaria deaths per 100,000 population could be presented with the methods shown below. The bottom map show additionally an estimation of exposure risk to malaria.

The choice of the administrative unit will influence the patterns visible in the map



Health studies and cartography: an old story

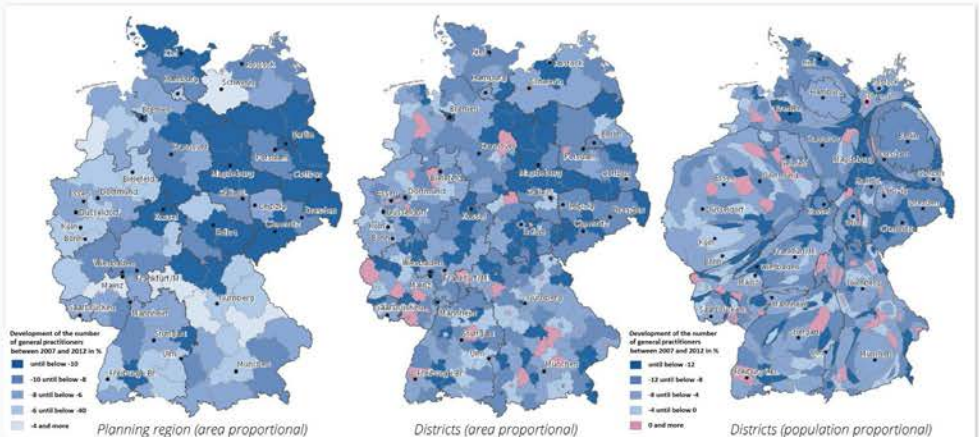
The map shown on the left is famous for being one of the first epidemiology maps. It was published in 1855 by Dr John Snow, a medical doctor working on the mode of propagation of the cholera. The map shows occurrences of death by cholera in an area of London during the severe outbreak of 1854. Each death is displayed as a black bar, deaths in the same house being piled up perpendicularly to the street in which the house is situated. Water pumps are also shown.

The map shows that a big number of deaths occurred close to the Broad Street water pump. This is because cholera is indeed transmitted by drinking water (which was not acknowledged at this time), and because the water of this pump had been contaminated by cholera at the beginning of the outbreak. [1] [2]

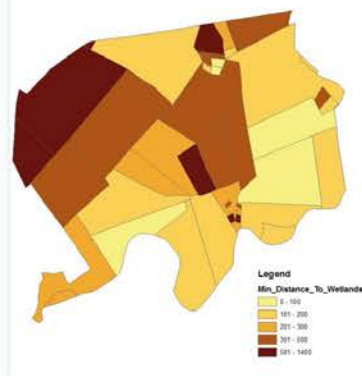
Level of detail matters – Two illustrative case studies

Medical care in Germany - change in number of doctors between 2007 and 2012 in %

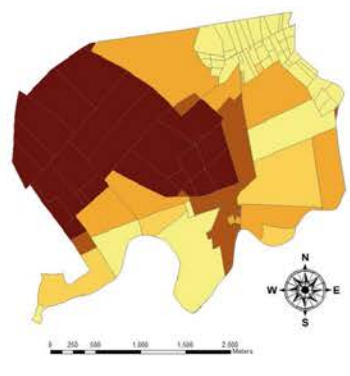
The three different maps show the development of the number of general practitioners between 2007 and 2012 in percent. All three maps are based on the same statistical data, but they look different since they are using different administrative units. The resulting patterns do not look the same, which might cause different interpretations and decisions. This effect is called the "modifiable areal unit problem" (MAUP). Only the map on the right uses areal units which are proportional to the number of population. [3]



Proximity to Wetlands from Address Units
in Kävlinge Parish, Scania County, Southern Sweden (1804 - 1914)



Proximity to Wetlands from Property Units
in Kävlinge Parish, Scania County, Southern Sweden (1804 - 1914)



Historical demography - investigating correlation between proximity to wetlands and child mortality

Studies in historical demography aim at finding relationships between living conditions and demographic variables (fertility, mortality, etc.). To include the geographic conditions into these studies it is required to geocode the population and quantify the geographic context. In an ongoing project at Lund University, Sweden 57,000 individuals from the Scanian Economic Demographic Database (SEDD) (during 1813-1914) have been geocoded. Studies using the geocoded SEDD database have revealed that the soil conditions (on micro-level) affected child mortality. Since malaria was a threat in Sweden during the 19th century it was investigated if closeness to wetlands affected child mortality. Such relationship was found when population is geocoded on property unit level, but not if it is geocoded on the coarser address level. The figure illustrates the variation of the geographic context variable on these two geographic levels. [4]

The ICA Commission on Generalisation and Multiple Representation works on the modelling and management of geographic information at different levels of details, and the automated transformation of the information from one level of details to coarser levels of details by means of simplification and caricature – an operation called generalisation.

[1] Brody H., Russell Rip M., Vinten-Johansen P., Paneth N., Rachman S. (2000). Map-making and myth-making in Broad Street: the London cholera epidemic, 1854. The Lancet, Vol. 355, July 1, 2000, p. 84-88.
[2] Snow J. (1855). On the mode of communication of cholera. London: John Churchill, 1855 (2nd edn).
[3] Shode N., Shode S., Rod-Thatcher E., Rana S., Vinten-Johansen P. (2015). The mortality rates and the space-time patterns of John Snow's cholera epidemic map. International Journal of Health Geographics, 2015, 14:21. DOI: 1186/s12942-015-0011-y.

[4] Contributors of the study: Lund University, Department of Physical Geography and Ecosystem Science, (L.Harrie, F.Hedefalk, K.Pantazidou), Centre for Economic Demography and Department of Economic History (T.Bengtsson, L.Quaranta, P.Svensson)

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Commission on Generalisation and Multiple Representation
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Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

4 QUALITY EDUCATION

THE GLOBAL GOALS For Sustainable Development

Target

By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and Goal-4 effective learning outcomes. And eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations.

Indicator

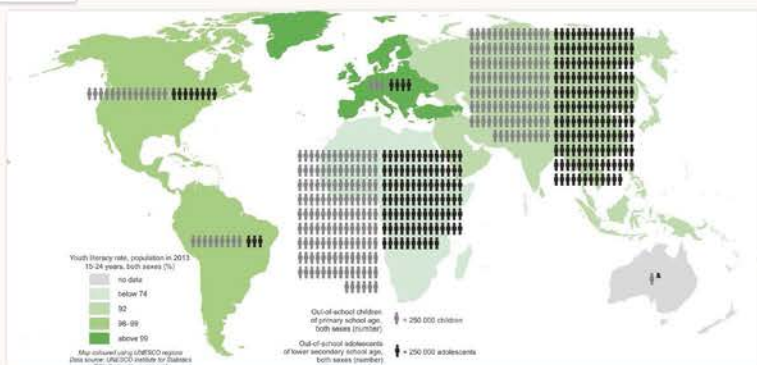
Completion rate primary and secondary / teachers in primary education, school life expectancy, out-of children of primary school age and out-of-school adolescents of lower secondary school age.

Maps help children understand our world

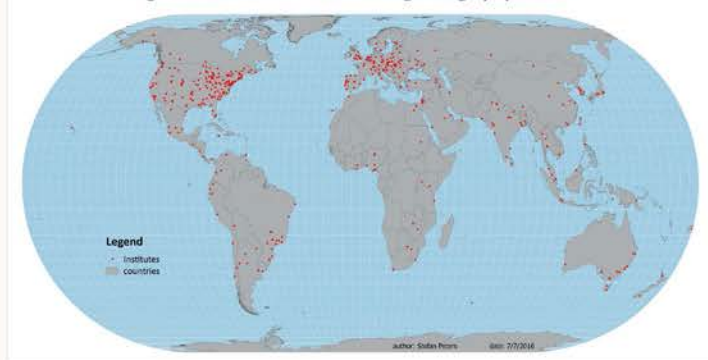


Every person - child, young or adult - should be able to benefit from educational opportunities designed to meet his/her basic learning needs.

These needs comprise both essential learning tools (such as literacy, oral expression, numeracy, and problem solving) and basic learning contents (knowledge, skills, values, and attitudes), indispensable to human beings to survive, allowing them to fully develop their capacities, living and working with dignity, improving life quality, making well-founded decisions, and continuing to learn.



Higher education institutes offering cartography courses



Cartography can play an important role in the goals proposed by the United Nations. Learning how to guide one's self into the geographic space, read maps and know how to use them as a spatial representation with a specific language is essential for the formation of autonomous citizens.

Children who draw maps nowadays will be more conscious adults about the geographic space!



The main goal of the ICA Commission on Cartography and Children is to promote the use and enjoyment of maps by children and young people.

The Commission on Maps and Graphics for Blind and Partially Sighted People exchanges and disseminates information on the design of and production technologies for maps and graphics for blind and visually impaired people.

The Commission on Education and Training acts as a forum to maintain an overview of cartographic education worldwide.

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Commission on Cartography and Children

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Commission on Maps and Graphics for Blind and Partially Sighted People

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Commission on Education and Training

Chair: David Fairbairn e-mail: david.fairbairn@newcastle.ac.uk

Vice-chair: Stefan Peters e-mail: stefan.peters@directbox.com

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Achieve gender equality and empower all women and girls

5 GENDER EQUALITY

THE GLOBAL GOALS
For Sustainable Development

Target

Adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels.

Indicator

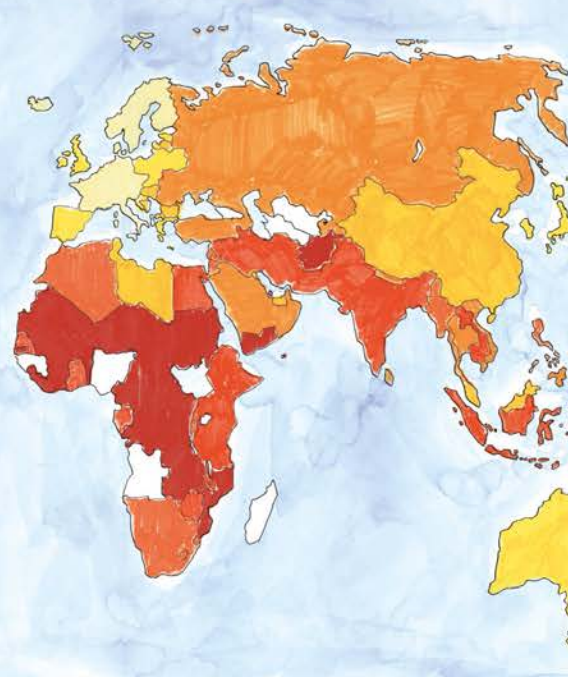
Monitor the existence and quality of policies to achieve gender equality

Art brings women to mapmaking & encourages the female way of cartographic expression & practices

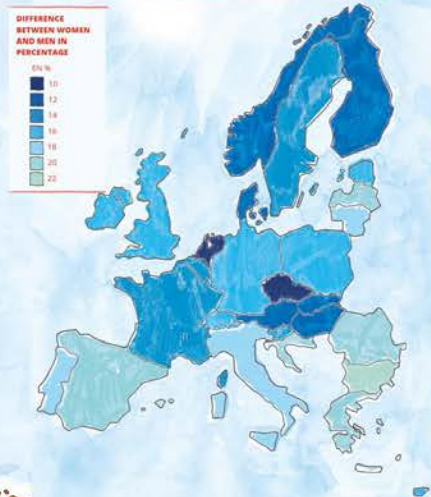


MAPPING GENDER ISSUES

MEASURING INEQUALITIES: THE INDEX OF GENDER INEQUALITY



POVERTY RATE OF WOMEN IN EUROPE



Source of information: Arnaud, J., Brogellier, C., Rault, W., Cartographie, C. Mami, 2015.
Atlas mondial des Femmes, Les paradoxes de l'émancipation, Autrement, ed. Institut National d'Études Démographiques (INED), Paris.

WOMEN ARTISTS AS MAPMAKERS

MADELEINE DE SCUDÉRY



CARTE DU PAYS DE TENDRE (1654)

La Carte du pays de Tendre is a map of an imaginary country called Tendre, imagined by Madeleine de Scudéry in her novel Clélie, histoire romaine, published in 10 volumes from 1654 to 1660. This work is an example of allegorical maps of love, this map opened new ways of using maps as a storytelling mechanism, since it graphically represents the different stage of relationships through a set of places names. It is a woman perspective on space (and cartography) that challenges the more conventional (military) type of approach of cartography.

http://fr.wikisource.org/wiki/Carre_de_Tendre

JANE HAMMOND



ALL SOULS (MAMINDE, 2009) (JOTRAX)

"In the midst of the Iraq war, Hammond dreamed of a map of the Middle East covered with butterflies and built a series around it. For her, painting is an entry point for accessing, and mapping, the unconscious. In the All Souls series, delicate butterflies float on softly rendered maps of South America, Africa, Asia, and the Middle East as tender evocations of the world's ephemeral nature" (Hammon, K., 2009. The Map as Art: Contemporary Artists Explore Cartography, 26.5 cm x 23.5 cm, ed. Princeton Architectural Press, p. 73)

MONA HATOUM



SILVER LINING, 2011

Silver Lining is a suspended map of the world that was inaugurated in January 2011 at the Hochschule der Künste in Bern. "The numerous outlines, suspended from the ceiling and corresponding to the 192 member states of the United Nations, present an astonishing, unexpected picture of our geopolitical world. Unraveled and all mixed up, the nations have become drawings of light afloat under the ceiling. Like pieces of a jigsaw puzzle or ice floes during breakup, they have been separated. In SILVER LINING they no longer share borders; they have become configurations of light whose contours enable us to identify the individual nations. Only the scale of the countries has been retained" (Burckhardt, Jacqueline "Mona Hatoum's Silver Lining," Parkett (no. 89 2011), p. 250).

ARIANE LITTMAN



JERUSALEM, MARCH 2006

"Performed at the Science Museum in Jerusalem this work relates to the erasure of territory and memory. A map of Jerusalem where the name of Esh Sheikh Badr appears was screened on the floor. The map was compiled, drawn and printed by the Survey of Palestine in 1947, later in 1955 instead the name Ramat Hakirya appears on the revised map by the Survey of Israel in 1955. Today, in the vicinity of that area are located all the major national institutions (...). Paradoxically, this act of erasing repeated during 7 hours became an existential act of exhuming forgotten names, forgotten memories, forgotten pains and reannouncing basic forgotten feminine gestures." (<http://ariane-littman.com/2006/02/erasure-mehka/?set-slides&cat=jerusalem>)

MAP MARY EDNA FRASER



VENICE (ITALY, 2000)

"Bakic artist Fraser took part in an unusual artistic/scientific collaboration to draw attention to the complexity and fragility of barrier islands around the world (...). "The batiks convey perspectives that the human eye, conventional maps, and cameras cannot reveal", she writes. "I hope the art will contribute to an appreciation of the dynamic nature of these moving strips of sand, and will act as a catalyst for the preservation of barriers islands for future generations" (Hammon, K., 2009. The Map as Art: Contemporary Artists Explore Cartography, 26.5 cm x 23.5 cm, ed. Princeton Architectural Press, p. 93)

The main goal of the ICA Commission on Art & Cartography is exploring the interaction at large between art and cartography which involves rethinking the way we approach spatial expressions.

commission on
ART & CARTOGRAPHY



Commission on Art & Cartography

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Vice-chair: Julia Mia Stirmemann e-mail: juliamia.stirmemann@hkb.bfh.ch

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Ensure access to water and sanitation for all

THE GLOBAL GOALS
For Sustainable Development

6 CLEAN WATER AND SANITATION

Target

By 2030, achieve universal and equitable access to safe and affordable drinking water.
By 2030, achieve access to adequate and equitable sanitation and hygiene for all.

Indicator

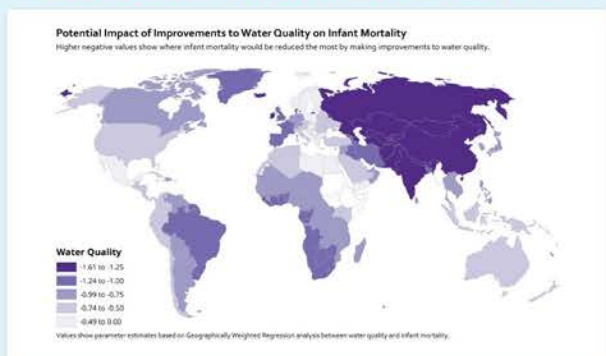
Percentage of population using safely managed drinking water services.
Population with a hand washing facility with soap and water in the household.
We describe geographic relationships of these two indicators to rates of maternal and infant mortality.

Combining spatial analysis with mapping reveals geographic patterns that statistics alone cannot identify

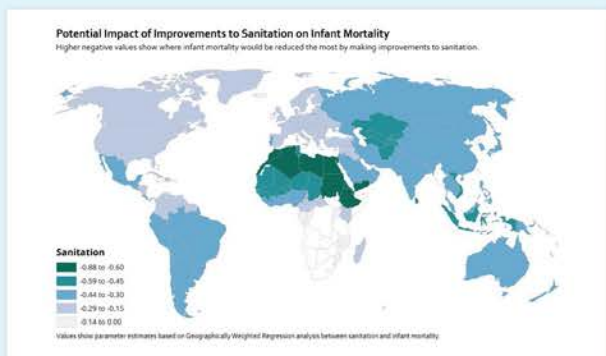
This example highlights the utility of exploring the geographic perspective in global problems to reveal patterns and suggest new locations for intervention – something that a purely statistical study (such as [1]) cannot do. The combined approach of geographic analysis and visualisation using

methods from [2,3] helps us understand **where in the world the improvements to water and sanitation could have the most impact**, as well as in where we would not expect it to make a larger difference.

Geographic analysis of infant mortality rates

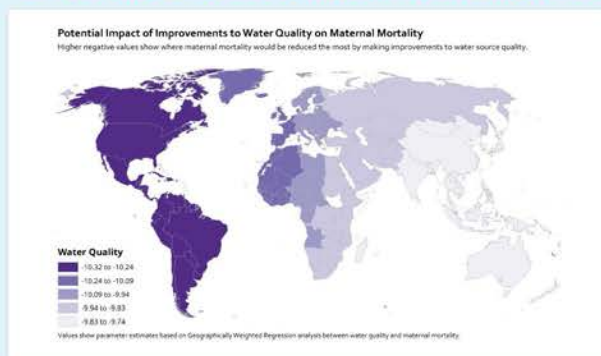


Asia and parts of South America and Sub-Saharan Africa are potential targets where better access to water would lower infant mortality.

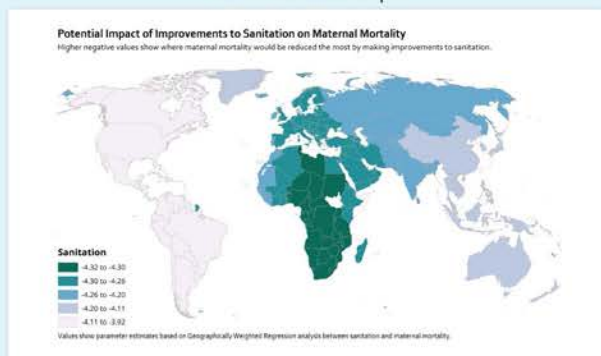


Better access to sanitation would lower infant mortality rates in Northern Africa and parts of Southeast Asia.

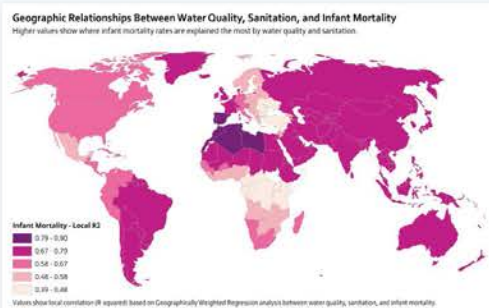
Geographic analysis of maternal mortality rates



Better access to water would lower maternal mortality rates across both Northern and Southern America, western and central Africa and in Europe.

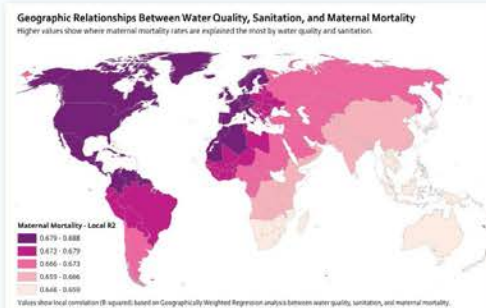


In Africa, Middle East and Eurasia the maternal mortality would decrease the most with **improved access to sanitation**.



Reliability of geographic analysis:

These two maps help us understand how well our spatial statistical models represent the relationships between infant and maternal mortality and rates of access to water and sanitation. The darker the purple, the more representative our models are. **The lighter the colour**, the less we managed to explain – in these areas, there may be other factors beyond access to sanitation and clean water that can better explain the rates of infant and maternal mortality.



The ICA Commission on Visual Analytics seeks to advance the state of the art in analytical reasoning supported by visual interfaces to geographic information. Through the coupling of computational analysis and interactive visualizations of geospatial data, the Commission encourages new research to solve major human and environmental problems.

Data and information sources:

- We used data from 2010 [1], sourced from WHO (<http://www.who.int/>), World Bank (<http://data.worldbank.org/>) and Natural Earth (<http://www.naturalearthdata.com/>). The data were analysed and visualised using Geographically Weighted Regression [2, 3].
- Cheng JJ & al. 2012, An ecological quantification of the relationships between water, sanitation and infant, child and maternal mortality. Environmental Health, 2012, 11:4
 - Fotheringham AS et al., 2002, Geographically Weighted Regression. Chichester, England: Hoboken, NJ, USA: Wiley
 - Demšar U & al., 2008, Combining Geovisual Analytics with Spatial Statistics: the example of GWR. The Cartographic Journal, 45(3):182–192.

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Commission on Visual Analytics
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WE MAPS
INTERNATIONAL MAP YEAR 2015–2016

International Cartographic Association
Association Cartographique Internationale





Ensure access to affordable, reliable, sustainable and modern energy for all

THE GLOBAL GOALS For Sustainable Development

7 AFFORDABLE AND CLEAN ENERGY

Target

By 2030, increase substantially the share of renewable energy in the global energy mix.

Indicator

Renewable energy share in the total energy final energy consumption (%).

Renewable sources of electricity

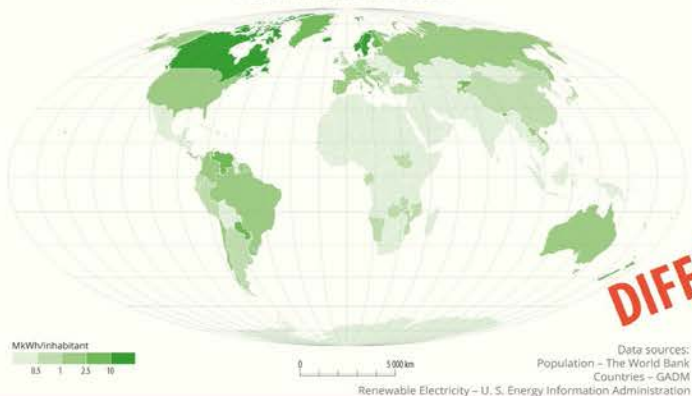
have grown significantly within the global power sector during the past decade. Total installed renewable electricity capacity increased from 800 Gigawatts (GW) in 2004 to 1,560 GW by the end of 2013, and renewable energy sources now supply 22.1% of global electricity demand of which 5.8% is from sources other than large hydro.

Renewable energy market growth has been driven by a combination of factors, including government policy, rising energy prices, and rapidly declining renewable energy costs. By 2013, 144 countries around the world had adopted specific targets for renewable energy development, up from only 48 countries in 2004.

Map design
is influenced by
the map's
target groups
and use
circumstances



RENEWABLE ELECTRICITY NET GENERATION
PER INHABITANT IN 2012



TOTAL RENEWABLE ELECTRICITY NET GENERATION
IN 2012



DIFFERENCE?



*The answer is to end our reliance on carbon-based fuels...
If we succeed, we create booming new industries, wealth,
clean secure energy and maybe we prevent the greatest disaster
so far in human history, saving millions of lives while improving
billions more. If we fail, basically it's business as usual
while things slowly get worse all around us...*

Al Gore



SUITABILITY OF VISUALIZATION METHODS



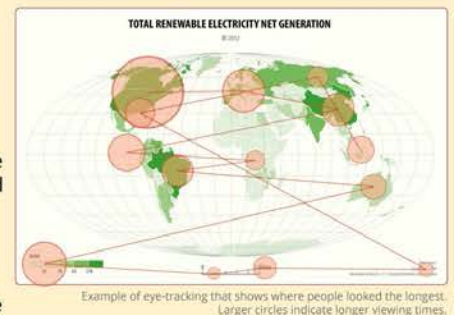
To express spatial information there are lots of cartographic visualization methods. The choice of which type of map to use depends mainly on the map maker's purpose and objectives. There are fundamental **rules for cartographic design**. Compare the maps above. Do you see the difference? The situation for the map on the right looks much better, doesn't it? But your perception is influenced by the map maker choosing an inappropriate method of cartographic visualization. The data in the map on the right map are **NOT normalized** to the population of the different countries. In the map on the left the data are normalized per capita - and the situation now is not so rosy...

To select appropriate methods of cartographic visualization and appropriate parameters for each method, it is necessary to know the basics of cartographic design. Also it is important to perform **user testing**. Statistical evaluation of correctness and time performance can help us find efficient and effective designs.

USER TESTING

Maps are an important medium to communicate information with a spatial dimension. It is essential that this information is transferred as efficiently and effectively as possible. Therefore, the end products (maps) should be evaluated by the actual target users in order to verify whether an optimal communication has been achieved. The best results can be obtained if the users are already involved in early stages of the product's design so problems can be detected early on and corrected without too much cost. This is called the User-Centred-Design life cycle or approach.

Individual experiments are focused on specific aspects of cartographic visualization - the use of text labels and fonts, use of colours, the map content (information vs. graphic), various methods of cartographic visualization, etc.



Photographs from eye-tracking experiment, software (left) and hardware (right).

Eye-tracking is one of the methods applied in usability studies and is considered to be an objective method because it is not influenced by the opinion of respondents like other methods (e.g. questionnaire).

The objective of the ICA Commission on Cognitive Issues in Geographic Information Visualization is to promote the awareness of cognitive issues in cartography and geovisualization, developing human-centered cartographic theory and practice based on sound empirical findings on the use of cartographic displays for spatiotemporal inference and decision-making.

The objective of the ICA Commission on Use, User, and Usability Issues is to stress the importance of the map user and promotes their involvement in the evaluation of cartographic products to improve their usability.

Graphic elements designed by Freepik.com. Source of photographs: Department of Geoinformatics, Palacký University Olomouc.

Map Data Source:
See maps for information.

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ICACI



Commission on Cognitive Issues in Geographic Information Visualization

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WE MAPS
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International Cartographic Association
Association Cartographique Internationale





Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

8 DECENT WORK AND ECONOMIC GROWTH

THE GLOBAL GOALS For Sustainable Development

Target

By 2030, sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries.

Indicator

Gross Domestic Product (GDP) per capita.

Map design
is critical to allow
the user perceive
the correct message



Green is a positive and calming colour. And green is everywhere! Most of the world appears in more saturated colours. So probably there is not a big problem with the economy...



Red usually means there is a problem. And red is everywhere! Most of the world appears in saturated colours. So probably there is a huge problem with the economy globally...

WHERE IS THE TRUTH?

Variability in the world

This map presents values of exports minus values of imports. Both are represented as a percentage of annual GDP. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services and exclude compensation of employees and investment income (formerly called factor services) and transfer payments.

Negative values (red colour) mean more imports than exports, positive values (green colour) mean more exports than imports and values near zero (yellow colour) are in balance. However the combination red-green might cause problems for some. Southeast Asia and Oceania are in balance, Russia and Asia are mostly positive, Europe is mainly positive, Africa and the Indian subcontinent are mainly negative and North and South America are a mixture near balance.

GDP growth is the annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2005 U.S. dollars. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources.

A map is not just a picture

A map is a representation of the world; maps can **visualize a lot of data quickly and efficiently**. But they can also visualize a lot of data **innaccurately and misleadingly**. The methodology that was used to collect and parse that data is important, as is what methodology was used to make the map. In some ways, maps must always be a little inaccurate because they make generalizations. As Mark Monmonier writes in the fantastic book **How to Lie With Maps**, it is important to understand the meaning and manipulation of data presentation. People often assume maps are accurate. In the last 30 years, the use of **geographic information systems (GIS)** has exploded, and almost **everybody can make a map**. It is a good thing, but it means that many maps are made by people without any cartographic

education. It results in **many inaccurate and incorrect maps**, because the creators don't fully understand what they are doing. Don't trust everything. There are a few things you can keep in mind to avoid being fooled by a map. The **source of the data** is the most important thing you should look for — Is it relevant? Is it recent? Can you find original data? Who is the **author**? Is it somebody with cartographic education? Can you find references? What is the **main aim** of the map? Certain things have to be **highlighted** and less important things removed. Is there some relevant information hidden? Is there **other information** in the form of graphs, tables, etc.? **Maps are an excellent way to present spatial data** — just think about them and be aware because maps can also manipulate.

The objective of the ICA Commission on Cognitive Issues in Geographic Information Visualization is to promote the awareness of cognitive issues in cartography and geovisualization, developing human-centered cartographic theory and practice based on sound empirical findings on the use of cartographic displays for spatiotemporal inference and decision-making.

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Graphic elements designed by Freepik.com.

Data and Information Source:
The World Bank Group
GDP growth (annual %) Cited on-line 2016-01-31. Available from:
<http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=SD>
Imports of goods and services (% of GDP). Cited on-line 2016-01-31.
Available from:
<http://data.worldbank.org/indicator/NE.EXP.GNFS.ZS?display=default>

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Commission on Cognitive Issues in Geographic Information Visualization

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Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

THE GLOBAL GOALS
For Sustainable Development

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

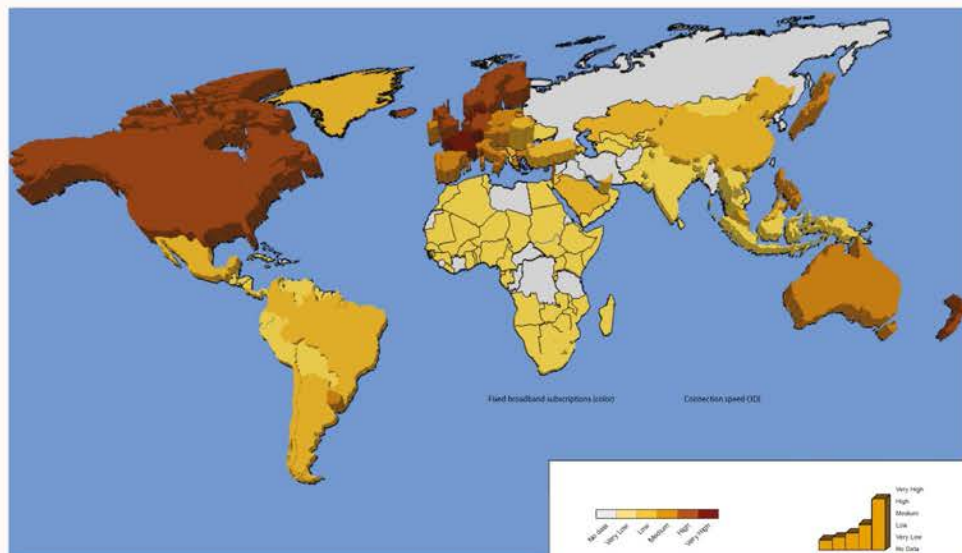
Target

Significantly increase access to information and communications technology and strive to provide universal and affordable access to the internet in least developed countries by 2020.

Indicator

Fixed broadband quality measured by mean download speed.
Subscription fixed broadband internet (per 100 people).

Mobile communication technology enables "anywhere, anytime, for anyone and anything" map services



Visualization of broadband & subscriptions

3D Extrusion - representing the fixed broadband quality measure by the mean download speed. This variable is visualized via a 3D extrusion in the map. The higher the extrusion, the faster is broadband connection speed.

Color - The numbers of subscription for fixed broadband internet (per 100 people) is visualized by color in the map. Darker color represents a higher number of subscriptions.

The map shows relations of subscriptions and download speed in different countries. In France for example there seems to be a high number of subscriptions for fixed broadband internet. The download speed seems slightly lower than in some neighboring countries.



Mobile broadband

With mobile broadband users can access maps on their mobile device. As many devices have built-in Global Navigation Satellite System (GNSS) receivers, it is possible to display the current position of the user. A mobile broadband connection enables the user to utilize Location-Based Services (LBS), for example for navigation or local information, entertainment, or social networking.

Mobile broadband enables public to access (spatial) information anywhere and anytime. This trend together with the development of information and communications technology (ICT) foster many innovative applications, such as smart cities, intelligent transportation services and urban planning. These innovative applications play a key role in developing a sustainable future.



New devices

All countries have increasing access to the internet, mobile & fixed. Emerging mobile devices (e.g., smart watches and digital glasses) are increasingly considered for visualizing maps. It is expected to have an increasing diversity of technical systems (including data formats) and an increasing diversity of devices.

Concerning the cartographic presentation of content we may see different "specialized platform specific systems" vs "more universal or web-based systems", as the different media can handle content and interactivity in various ways. For example the map has to scale according to the size of the display in a smart watch.

The main goal of the ICA Commission on Location Based Services (LBS) is to advance the research on LBS in all its interdisciplinary fields, with the aims to enable "anywhere, anytime, for anyone and anything" 4A services.

Data and Information Source:
ITU, global ICT statistics, 2014, Subscription to fixed broadband internet (per 100 people)
<https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx>
Akamai, State of the Internet, 2014,
<https://www.akamai.com/us/en/our-thinking/state-of-the-internet-report/>
Authors: Jukka M. Krisp, Haosheng Huang, Andreas Keler, Julian Bischoff

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ICA Commission on Location Based Services (LBS)
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WE MAPS
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Reduce inequality within and among countries

THE GLOBAL GOALS For Sustainable Development

10 REDUCED INEQUALITIES

Target

This goal calls for action to reduce inequalities within and among countries. Inequalities can have a strong geographic component and maps are a powerful tool to understand factors and plan measures to address such issues.

Indicator

A variation on the measure of income inequality by offering open data, open source software, open standards and open education.

Maps
should be
accessible
for all



GEOlab IN ACTION



GEOlab is actively collaborating with the Humanitarian OpenStreetMap Team (HOT) and the Missing Maps project to organize and run humanitarian mapathons, such as the mapathon after Nepal's earthquake in April 2015. A world record mapathon with more than two hundred 10 year old children was held in March 2016.



A Volunteered Geographic Information (VGI) collaborative platform named PoliCrowd has been developed since 2013. Based on NASA World Wind virtual globe, it is a multidimensional and multithematic platform to organize, visualize and collaboratively enrich VGI collected through mobile devices.



GEOlab is also involved in teaching and research using Open Source platforms, and organizing FOSS4G events.

GEOlab - Geomatics and Earth Observation laboratory, Politecnico di Milano, Italy

VIVA GIS! EMPOWERMENT THROUGH MAPPING

In 2015, the University of Pretoria partnered with the Viva Foundation, in the Alaska informal settlement in the City of Tshwane, to start a project that aimed to ultimately empower the settlement. The project was driven by the final year geoinformatics students in the CGIS.



The first phase was the mapping of the settlement. Data such as dwelling numbers, location of taps and point of interest and footpaths were captured.

Four projects were identified to implement a web GIS solution: Fire safety and Management, Health Care, Service Delivery and Security and Surface Runoff Risk Zones.

Centre for Geoinformation Science (CGIS), University of Pretoria, South Africa

LABGEOLIVRE - MAPPING INEQUALITY IN BRAZIL



Source: Bem Paraná e Gazeta do Povo



Brazil is one of the countries with the highest economic and social inequality levels.

Labgeolivre has been promoting mapathons to improve the use of VGI to supply data where it is not available. Additionally, the group develops Open Source solutions, conducts research and creates applications such as the study: Mapping Inequality in Curitiba, Brazil.

The maps show the spatial distribution of income, race and homeless population in Curitiba.

This is an example of mapping the SDG indicator: 10.2 By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status

Laboratório Geoespacial Livre - UFPR, Brazil

- Open data contribute to transparency by making available to the public relevant data to analyse current situation and propose new public policies.
- Open source software is a vital tool to democratize access to mapping platforms, making these technologies available for organizations such as NGOs and developing countries institutions.
- Open standards are key to integrate organizations, including local and international levels, and allow the coordination of efforts from several groups.
- Finally, Open Education enables the users to use these tools and include the diversity of each reality on the map.

The main goal of the ICA Commission on **Open Source Geospatial Technologies** aims to promote multi-national holistic research in free and open source geospatial technologies in order to make accessible the latest developments in open source tools to the wider cartographic community



GVSIG BATOVÍ

gvSIG Batoví is an open Geographic Information System (GIS) software tool applied to educational environments through which Primary and Secondary students can acquire knowledge of geography using laptops through didactic and interactive information. Source: Bem

Primary and Secondary students can make their own thematic maps

Knowledge of geography in an attractive, motivating and interactive environment

The tool, after its launch, became the first Uruguayan distribution that gives rise to gvSIG Educa, which aims to be a tool for educators to provide students a better analysis and understanding of the territory, as well as collaborate with the assimilation of special concepts using visual tools.



Dirección Nacional de Topografía - MTOP, Uruguay



Data and Information Source:
See also: <http://www.geo4all.org>

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Commission on Open Source Geospatial Technologies
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WE MAPS
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Make cities and human settlements inclusive, safe, resilient and sustainable

THE GLOBAL GOALS
For Sustainable Development

11 SUSTAINABLE CITIES AND COMMUNITIES

Target

By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.

Indicator

Km of high capacity (BRT, light rail, metro) public transport per person for cities with more than 500,000 inhabitants.
Proportion of residents within 0.5 km of accessible green and public space.

Integration of multi scale geodata in maps is a key factor of sustainable developments



Planet



Earth

City



Protvino, Russia

Community



Green environment

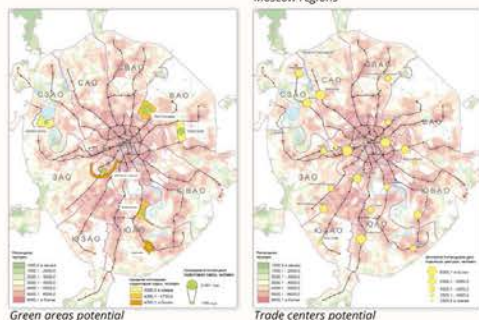
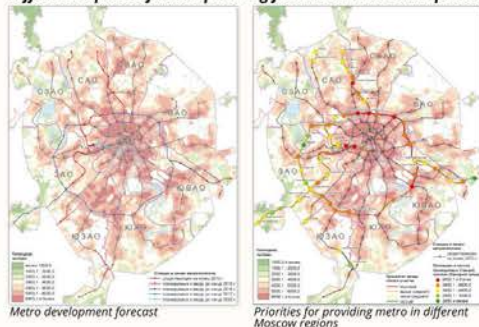
Sustainable Development for all scales

Scale

GIS modelling

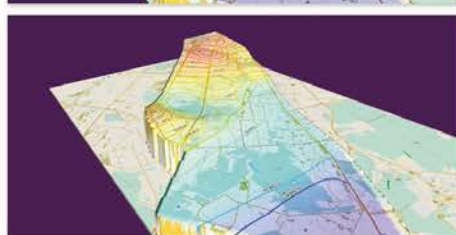
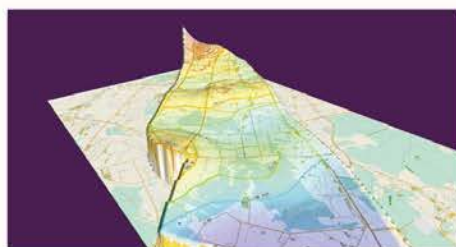
GIS modelling of the integrated accessibilities for assuring sustainable development of Cities and urban territories.

Different aspects of urban planning for sustainable development

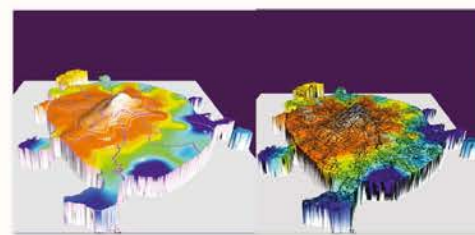
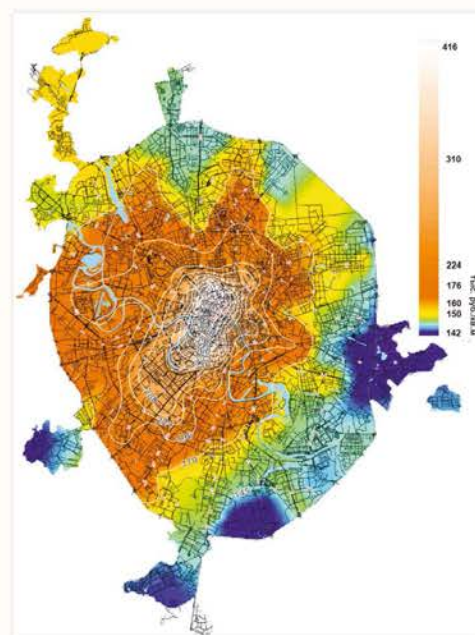


Sustainable development

Assuring sustainable development of Cities in the fluid environment demands consolidation of different data within common volume of time and space. Representation of spatial distribution of scalar parameters as a geolocated thematic 3D-shape helps to add useful indicator of healthness of the town.



3D representation of land cost



The main goal of the ICA Commission on GI for Sustainability aims to produce a methodological structure for GIS and cartographic basis of sustainable development.

Data and Information Source:
Lomonosov Moscow State University, Faculty of Geography (Russia)
Deakin University (Australia)
Neogeography Group, Technopark Protvino (Russia)

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Ensure sustainable consumption and production patterns

THE GLOBAL GOALS For Sustainable Development

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Target

Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainable information into their reporting cycle.

Indicator

Number of companies in each country that have sustainable practices as part of their company profile.

*Making maps
goes beyond
map production*

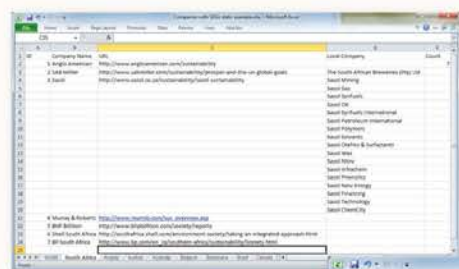
- Company websites
- SDG organisations websites
- Spatial data - world map



- Other sources:
- Spatial Data Infrastructures,
 - Open Government Portals,
 - Open Data Access

1. Source

Collect company name and URL into a spreadsheet. If local names differ from parent company, include the local name. Create a counter to count number of companies. Do this for each country.

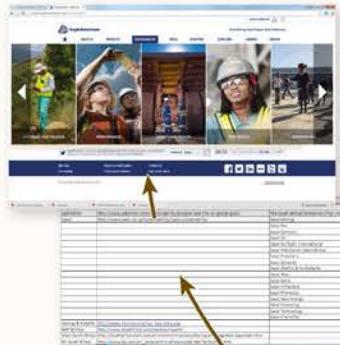


2. Make

Use country counter to create a spreadsheet for the world indicating the number of companies per country.

Country	Number of Companies
1. Angola	1
2. Australia	35
3. Austria	20
4. Belgium	13
5. Benelux	3
6. Brazil	11
7. Canada	2
8. Canary Islands	5
9. Chile	14
10. Colombia	2
11. Czech Republic	1
12. Ecuador	1
13. Egypt	1
14. El Salvador	1
15. France	41
16. Gabon	2
17. Germany	1
18. Ghana	1
19. Honduras	1
20. Hungary	1
21. India	2
22. Ireland	1
23. Isle of Man	50
24. Italy	2
25. World	2

3. Deliver



WMS Internet etc.



Static maps
for reports, etc.

Dynamic maps for querying country data and links to company websites. Dynamic maps can be delivered also:

- as spatial data servers
- in spatial data infrastructures for explaining complex sources
- report automatization/delivering to open data portals.



Link the spreadsheet to a GIS to create a thematic map of the world to indicate the number of companies. Alternatively use the Table Joining Service (TJS*) to link attribute data to spatial (framework) data.

* <http://geoprocessing.info/tjsdoc/> for more information on TJS

The main goal of the ICA Commission on Map Production and Geoinformation management is enhance the study on map production- and process management, geoinformation logistics and geobusiness

Please note:
Data shown is illustrative and not actual.

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WE MAPS
INTERNATIONAL MAP YEAR 2015-2016

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Take urgent action to combat climate change and its impacts

13 CLIMATE ACTION

THE GLOBAL GOALS

For Sustainable Development

Target

Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.

Indicator

From 1880 to 2012, average global temperature increased by 0.85 degree Celsius. Oceans have warmed, the amounts of snow and ice have diminished and sea level has risen.

3D maps
change your
perspective on
the (mountainous)
world



Proposal for solving the problems of global climate change with a focus on finding solutions through the mountains areas.

COP 21 Paris

The Paris UN climate conference in December 2015 delivered a new universal climate change agreement. The new agreement is aimed at putting the world firmly on track to a low-carbon sustainable future that keeps a global temperature rise under 2 degrees C.



Action to adapt

Building resilient societies and economies is key to coping with climate change. Many nations and communities are already doing this, but far greater action and commitment is needed to cost effectively manage the risks and impacts of extreme weather events now and into the future.

Green Urban and global climate.

Cities will be key to a low carbon, resilient global economy that can address and adapt to climate change. Many are emerging as leaders cutting emissions and greening infrastructure.

Wind Power is a vast, but largely untapped source of potential sustainable energy in mountains.



Solar Energy can be efficiently produced in mountains and other cold regions.

Hydropower is one of the main sources of sustainable energy in mountain regions.

Sustainable energy brings benefits to human health, the mountain environment and global climate.



Mountains provide sustainable energy for both regional cities and remote mountain communities.

Solar Energy

Hydropower

Wind Power

The main goal of the ICA Commission on Mountain Cartography is to discuss different issues about mountain cartography and map related representations in large scale topographic mapping (symbolization and map design, technological issues, maps use).

Data and Information Source:
Atlas of Switzerland

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WE MAPS
INTERNATIONAL MAP YEAR 2015-2016

International Cartographic Association
Association Cartographique Internationale





Conserve and sustainably use the oceans, seas and marine resources for sustainable development

THE GLOBAL GOALS For Sustainable Development

14 LIFE BELOW WATER



Target

Goal 14 targets include reducing marine pollution, strengthening ecosystem resilience, restoring habitats, reducing acidification, ending overfishing, conservation and improving research.

Indicator

Numerous indicators provide a way of assessing the extent to which targets are met. This poster illustrates a range of indicators and how different designs can support understanding and the overall goal.

Map design makes a difference because it is key to effective communication



Traditional mapping

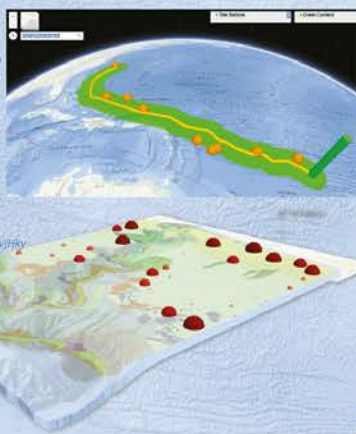
When we think about mapping the oceans we think of nautical charts. They contain a wealth of detail and remain important in both paper and digital form. Mapping the oceans for sustainability requires different products, new products, immersive and interactive products as well as maps of new data and models.

This poster explores some of these cartographies of the oceans and their utility in support of the UN-GGM Sustainability Goal for Life Below Water.

Interactive cartography

Oceans are inherently three-dimensional with much of it yet to be fully explored. By creating interactive 3D cartographic representations, such as this model of sediment and geological analysis for Monterey Bay Canyon or the interactive map of ocean currents, we offer a unique, immersive and fascinating insight into the world below water.

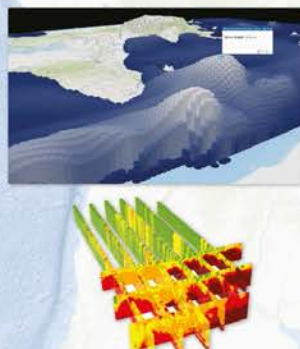
Find out more here: <http://arccg.is/1UQZqKk> and here <http://arccg.is/1Pvjfky>



Classic cartographic design

Beautiful design marries form and function which draws people's attention. Communicating the urgent objectives of this sustainability goal will need to draw upon a vast wealth of cartographic design experience. We've been mapping the oceans for hundreds of years from Marshall Island Stick charts to Heinrich Berann's beautiful maps of the Atlantic Ocean to Esri's new global ocean basemap (the background image to this poster).

Find out more here: <http://arccg.is/1RBH3Jf>

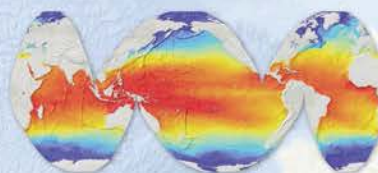


Innovative cartography

Mapping the oceans in different ways reveals new ways of seeing. This 3D view of wave height uses extruded columns of water on an isometric map to illustrate amplitude differences.

Alternatively, we can use 3D analysis to create vertical fences as a way of interpolating the water column. Here, exploring the measurement of oil in sea water after an oil spill.

Find out more here: <http://arccg.is/1S1MnFr>



Mapping measurements

Sea Surface Temperature is a key climate and weather measurement used for weather prediction, ocean forecasts, tropical cyclone forecasts, and in coastal applications such as fisheries, pollution monitoring and tourism. El Niño and La Niña are two examples of climate events which are forecast through the use of sea surface temperature maps.

Find out more here: <http://arccg.is/1Anqk>

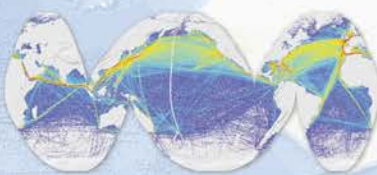
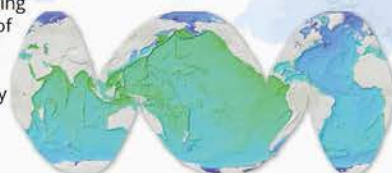
Mapping the science

The concentration of dissolved gases in water is of prime importance in considering the quality of water. Sufficient amounts of dissolved oxygen are required for marine-life survival.

Dissolved oxygen levels are influenced by temperature and salinity. The ability for oxygen to dissolve in water (solubility) decreases as temperature and salinity increase.

Poorly oxygenated areas are considered dead zones or hypoxic zones.

Find out more here: <http://arccg.is/15btaqk>



Mapping the human impact

Commercial shipping activity can lead to ship strikes of large animals, noise pollution, and a risk of ship groundings or sinkings. Ships from many countries voluntarily participate in collecting meteorological data globally, and therefore also report the location of the ship.

Find out more here: <http://arccg.is/15bUdu>

Our impact on the oceans is not restricted to the surface. While Submarine cables criss-cross the depths and there exist many underwater structures.

Find out more here: <http://arccg.is/1pC4kg>

Re-freshing cartography

Many maps of how we use the oceans have become regarded as classics such as Charles Minard's map of the export of British coal in 1864 but this doesn't mean we can't bring the cartography up-to-date for modern audiences and technology. Here, the same data Minard used has been woven onto a 3D globe replete with 3D symbology.

Find out more here: <http://arccg.is/1LWkUW>



New mapping

A large collaborative effort is underway to build a new cartography of the oceans and develop a standardised, robust, and practical global ecosystem classification and map for the planet's terrestrial, freshwater and marine ecosystems. The intent is to catalyze science; support planning; and underpin management and provide globally comparable understanding of change, impact and resilience.

Find out more here: <http://arccg.is/21LOLP>

The ICA Commission on Map Design acts as a forum for discussion, exchange of ideas and the development and spread of the principles and practice of high quality, effective cartographic design. Good design and better mapping are core to effective cartography. Information in a well-designed map will be rapidly recovered, unambiguous, easily recalled and ultimately inspire

confidence in both the product and the action that results from the map's use.

The examples presented here exhibit high quality design, innovation and expression that support the effective analysis and illustration of data and themes for Life Below Water.

Boundaries on maps may seem definitive, but there are often different perspectives on their status and position. This poster series is compiled from many sources by cartographers from different countries. The ICA tries to be neutral in such matters and boundaries shown reflect those found on the ground, in existing maps, or recognized by the United Nations. The ICA acknowledges that there may be different opinions and interpretations.



Commission on Map design
Chair: Kenneth Field e-mail: kfield@icaci.org
Vice-chair: Ian Muehlenhaus e-mail: muehlenhaus@icaci.org

WE MAPS
INTERNATIONAL MAP YEAR 2015-2016

International Cartographic Association
Association Cartographique Internationale





Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

THE GLOBAL GOALS
For Sustainable Development

15 LIFE ON LAND



Target

By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements.

Indicator

Coverage of protected areas broken down by ecosystem type, including total area of forests in protected area (thousands of hectares).

A correct map projection is the map's first perceptual signal

Terrestrial Ecoregions of the World: A map of Life on Earth



Mercator projection

The Mercator projection is conformal and is a most significant projection for navigational use since a straight line maintains accurate angles or bearing. However, the projection is unsuited for depiction of polar regions because of its cylindrical structure that increasingly distorts shape as the poles are approached, but are never reached. Consequently it should not be used for depicting general information or any area related subjects on the map of the world. Unfortunately, the projection continues to be used inappropriately as a world map in atlases, wall charts and mapping websites."



Winkel Tripel projection

The Winkel Tripel projection was designed of three projections, that is why it is called Tripel. It reduces three types of distortion: area, distance and direction. Therefore it is very well suited for mapping the entire world.

Either consciously or unconsciously, every map must start with the choice of map projection...

What does your choice of map projection say about

LIFE ON LAND?



Interrupted Goode Homolosine projection

The Goode Homolosine projection was designed to reduce scale and shape distortion by choosing several meridians to coincide with large land (or ocean) masses. This interrupted map projection of the world has regularly been discussed as a classic textbook projection. Unfortunately, it cannot be recommended for the world maps because the Earth obviously is not interrupted.

The Azimuthal Equidistant projection shows the Earth's oceans as a single water body and is therefore very well suited for the world ocean maps. This very old map projection, possibly developed in the polar aspect by Egyptians for star charts.



Azimuthal Equidistant projection

Marine Ecoregions of the World: A map of Life in the Sea

The main goal of the **ICA Commission on Map Projections** is to promote and foster research on map projections, coordinate systems, transformations and conversions, and disseminate the research outcomes.

The colours on these maps are intended to delineate ecoregion boundaries, they do not correspond with particular habitat types.

Map Data Source:
UNEP (2016): the UNEP environmental Data Explorer, as compiled from World Wildlife Fund, United Nations Environment Programme.
<http://ede.grid.unep.ch>

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Commission on Map Projections
Chair: Miljenko Lapaine e-mail: mlapaine@geod.hr
Vice-chair: Keith C. Clarke e-mail: kclarke@geog.ucsb.edu

WE MAPS
INTERNATIONAL MAP YEAR 2015-2016

International Cartographic Association
Association Cartographique Internationale





Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

THE GLOBAL GOALS For Sustainable Development

Target

Ensure responsive, inclusive, participatory and representative decision-making at all levels.

Indicators

Diversity in representation in key decision-making bodies (legislature, executive, and judiciary).

16 PEACE AND JUSTICE STRONG INSTITUTIONS

Names offer
universal access
to maps



The standardized international nomenclature of the surface features of planetary bodies.

The place-names of planetary surface features are approved by the International Astronomical Union; its Gazetteer is maintained by the United States Geological Survey and supported by NASA. These three organizations ensure that the names that appear on the maps of planets, moons and asteroids provide an equal representation of humanity for the foreseeable future. Today, names are taken from more than 355 nations and cultures from Algeria to the Virgin Islands.

However, when most planetary features on the near side of the Moon and on Mars got their names in the 17-19th centuries, they were named by individual astronomers in Europe. At that time the most universally accepted and neutral pool of

names was the ancient world and mythology. This tradition was continued by IAU, and many of these names are also used today. Astronomers also used the names of scientists, to commemorate their achievements, a tradition also kept today. Since the early 20th century this system is standardized: only one name is accepted officially and all names must be approved by IAU. There are few disputes, however, for example, the Russian names of catenae on the far side of the Moon, the name "Mount Sharp" NASA uses for "Aeolis Mons" at the landing site of the American Curiosity rover. Even the pronunciation can suggest meaningful differences: Charon may be pronounced as "Sharon", following its discoverer's intention, and

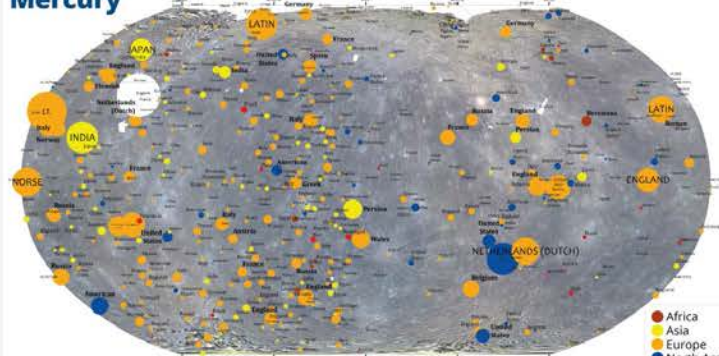
referring to his wife, Charlene; or as "Kharon", referring to the Greek mythological ferryman of the underworld, as preferred by IAU.

Although the names are taken from many nations, they have only one official form, using the latin alphabet. Our commission is working on collecting, providing access and helping standardize the names in other writing systems, from Cyrillic to Chinese to Arabic, to ensure that the names will be really felt to belong to all, regardless of which alphabet their language uses.

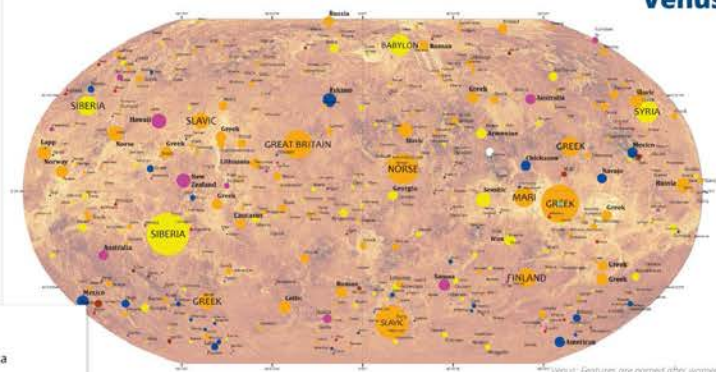
In the future, when planetary surfaces could be regarded as industrial resources, this peaceful and neutral situation may change.

Ethnicities, languages or geographic origin of the placenames of the major surface features of Mercury, Venus, the Moon, Mars.

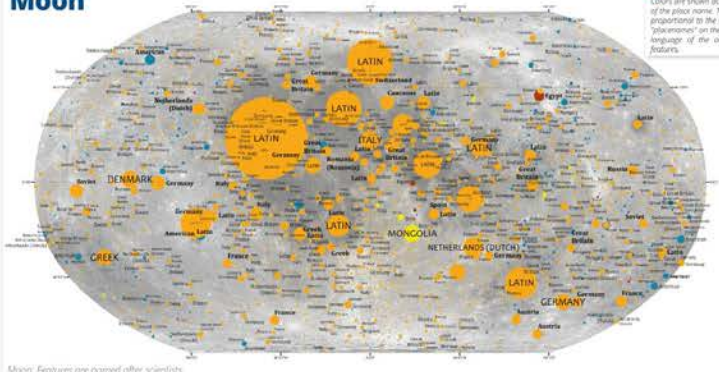
Mercury



Venus



Moon



Mars



From the UN Outer Space Treaty (1962):

Outer space is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.

From the IAU Gazetteer of Planetary Nomenclature Rules:

- Solar system nomenclature should be international in its choice of names.
- Recommendations submitted to the IAU national committees will be considered, but final selection of the names is the responsibility of the International Astronomical Union.

- Where appropriate, the WGPSN strongly supports an equitable selection of names from ethnic groups, countries, and gender on each map; however, a higher percentage of names from the country planning a landing is allowed on landing site maps.
- No names having political, military or religious significance may be used, except for names of political figures prior to the 19th century.

The main goal of the ICA Commission on Planetary

Cartography aims Strengthen Education and Public Outreach activities through the series of Multilingual Maps of Terrestrial Planets and their Moons and development of derived products.

Data and Information Sources:

Mercury: Messenger mosaic,
Venus: Magellan Radar,
Moon: Clementine albedo,
Mars: MOLA topography, NASA.
Data on nomenclature: IAU Working Group for Planetary System Nomenclature



Commission on Planetary Cartography

Chair: Henrik Hargitali e-mail: hargitali@gmail.com
Vice-Chair: Irina Petrovna Karachevtseva e-mail (official): i.karachevtseva@mxlab.ru or ica2003@mail.ru

WE MAPS
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Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development

17 PARTNERSHIPS FOR THE GOALS

THE GLOBAL GOALS For Sustainable Development

Targets

By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts.

Indicators

Proportion of sustainable development indicators produced at the national level with full disaggregation when relevant to the target, in accordance with the Fundamental Principles of Official Statistics.

SDIs and standards make data available for maps



Data collection



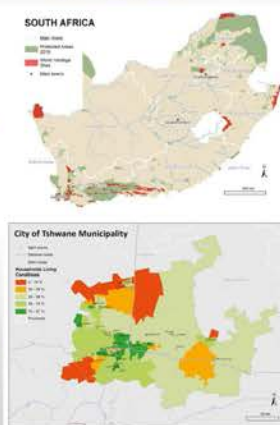
Geographic information is any information concerning phenomena implicitly or explicitly associated with a location relative to the Earth. Geographic information is required to monitor sustainable development goals. Multiple stakeholders are involved in data collection. Statistical agencies or departments typically collect demographic information. Other organizations collect of geographic information about the natural and built environments.

Data collection

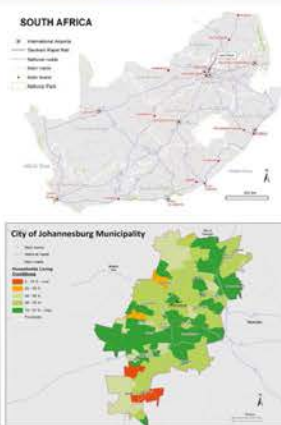


Vast amounts of geographic information are grouped by administrative areas for further analysis, comparison and aggregation.

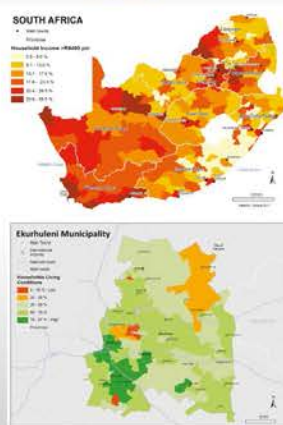
Environment



Infrastructure



Income



Satellite Image



A spatial data infrastructure (SDI) is an evolving concept about facilitating and coordinating the exchange and sharing of spatial data and services between stakeholders from different levels in the spatial data community. Many countries have SDIs to manage and use their geographic information assets better by taking a perspective that starts at the local level and proceeds up through state, national and regional levels to the global level.

SDIs facilitate sharing of geographic information and services, e.g. through geoportals. Sharing relies on standards for interoperability.



Geographic information and services available through SDIs facilitate map production, analysis, decision-making and planning of interventions for achieving the global goals for sustainable development.



ISO/TC 211, Geographic information/Geomatics, develops standards for geographic information and services within the International Organization for Standardisation (ISO). ISO membership allows countries to influence standards development and strategy by participating and voting in ISO technical and policy meetings.

OGC **The Open Geospatial Consortium (OGC)** is an industry consortium that develops and tests implementation standards for geospatial content and services. OGC membership is open to any organisation or individual.

The mission of the International Hydrographic Organization (IHO) is to create a global environment in which member states provide adequate and timely hydrographic data, products and services and ensure their widest possible use.

ISO/TC 211, OGC and IHO collaborate extensively on standardization.

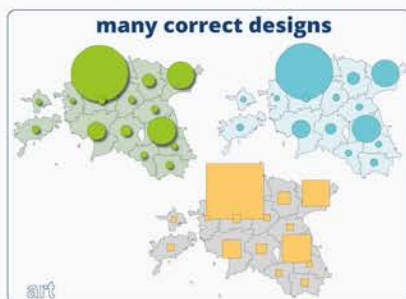
SDI stakeholder	Description
Policy maker	Sets the policy pursued by an SDI and all its stakeholders
Producer	Produces SDI data or services
Provider	Provides data or services to users throughout SDI
Broker	Brings users and providers together and assists in the negotiation of contracts between them
Value-added reseller	Adds some new feature to an existing product or group of products, and then makes it available as a new product
User	Uses the SDI for its intended purpose

SDI stakeholders according to the ICA's SDI model

The ICA Commission on Spatial data infrastructure (SDI) and Standards focuses on the role and impact of SDI and standards on cartography and mapping. It has developed a conceptual model of an SDI that contributes to understanding SDI stakeholders, their roles and activities, and processes in which

SDI stakeholders are involved. In support of world wide capacity building, a wiki site on guidelines and implementation benefits of geographic information standards is maintained at <http://wiki.icaci.org>.

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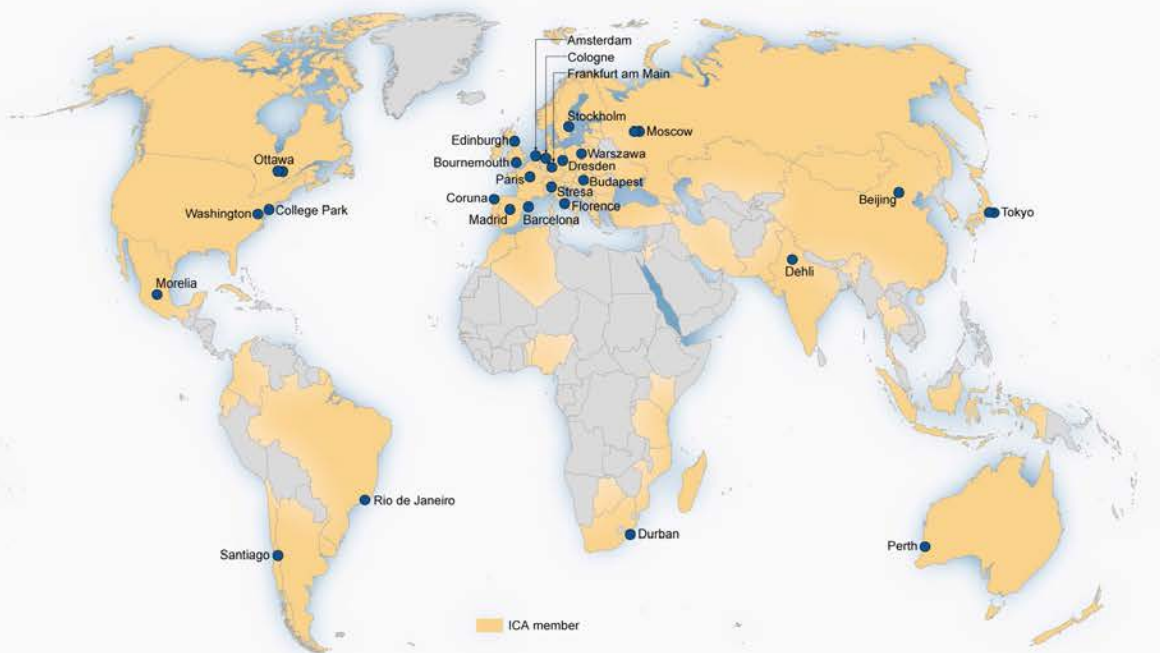
A map is a visual representation of an environment

MAPS matter because

maps tell stories
maps invite
maps show patterns
maps reveal relationships
maps explain
maps provide overview
maps deliver insight

maps ensure governance
maps provide well-being
maps instigate recreation
maps effect navigation
maps uphold order
maps achieve security
maps provoke humanity

Locations of International Cartographic Conferences



- 1962 Frankfurt am Main
- 1964 London/Edinburgh
- 1967 Amsterdam
- 1968 Delhi
- 1970 Stresa
- 1972 Ottawa
- 1974 Madrid
- 1976 Moscow
- 1978 College Park
- 1980 Tokyo
- 1982 Warszawa
- 1984 Perth
- 1987 Morelia
- 1989 Budapest
- 1991 Bournemouth
- 1993 Cologne
- 1995 Barcelona
- 1997 Stockholm
- 1999 Ottawa
- 2001 Beijing
- 2003 Durban
- 2005 Coruna
- 2007 Moscow
- 2009 Santiago
- 2011 Paris
- 2013 Dresden
- 2015 Rio de Janeiro
- 2017 Washington
- 2019 Tokyo
- 2021 Florence

Let's make the world a better place with maps

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ICA's Executive Committee members and Commission and Working Groups (vice)chairs at the start of the poster project, Vienna, November 2015

Poster design and production: Wim Feringa
Geodata Visualization and Usability lab.
ITC / University of Twente.