GEOSPATIAL FOR HUMANITY

Prevention, Response and Recovery of the World
from the COVID-19 Pandemic

UN GEOSPATIAL NETWORK

UNITED NATIONS COMMITTEE OF EXPERTS ON
GLOBAL GEOSPATIAL INFORMATION MANAGEMENT

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FOREWORD

Chair of the UN Geospatial Network

This is a time of change. This is the change of times. Humanity is facing one of its most significant societal challenges as the spur towards globalisation has been itself the genesis of a global pandemic, the first of our modern times in this third millennia.

This decade has started with instability, uncertainty, and complexity, originating from the global COVID-19 pandemic which is affecting all societies to an unprecedented extent. This humanitarian crisis is expected to disproportionately impact the most fragile populations from developing countries – poorer social classes, women and children, older generations, and those affected by conflict, or living in fragile settlements or poorly-equipped medical areas.

More importantly, this pandemic has reminded all of us of our interconnectedness—our global societies, economies, and environments—and that a local phenomenon can rapidly impact the whole of humankind. More than ever, we must act as One Planet to address global challenges using a coherent and collaborative approach, and becoming more resilient in the process.

We must be better prepared for our future response to emergencies with more effectiveness and recover from humanitarian disasters, building back better. We are all in this together and we need to find innovative ways to fight this COVID-19 and ensure that we "Leave No One Behind".

Geospatial information and its enabling technologies, data and information, tools and services, knowledge and skills, can play a critical role in leveraging our understanding of mega-trends and global phenomena through innovative technology and analysis. Geospatial approaches provide insights, models and knowledge to understand patterns, trends and events as well as build scenarios, and act upon them - the "Data for Action" approach. The integration of geographic location contributes to data-driven and evidence-based decision making to support local, national, regional, and global development and emergency priorities and agendas.

The United Nations is using geospatial information for the delivery of its mandates in the Peace, Development and Humanitarian nexus, and must work to create synergies with all governments, academia, private sector, societies, innovators, and civil society at large. This will be of fundamental importance in building a "Geospatial way for a better world", transforming the lives of People, Places and our Planet.

In the execution of its mandate within the framework of the Committee of Experts on Global Geospatial Information Management (UN-GGIM), this publication of the United Nations Geospatial Network, "Geospatial for Humanity: Prevention, Response and Recovery of the World from the Pandemic COVID-19." aims to provide a selective analysis across the United Nations system of actions to fight for humanity. Our vibrant geospatial community stands ready to act. It is our responsibility to further raise awareness of these activities in our drive to prepare humanity for a better future. For our Common Future.

ALEXANDRE CALDAS

United Nations Environment Programme

EXECUTIVE SUMMARY

The emergence of COVID-19 has shaken the very foundations of globalization and humanity's optimism and challenged us to reflect on the true nature of our safety and well-being, as human beings.

At this eleventh session of the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM), this publication has the horrid opportunity to reflect on how the members of the United Nations Geospatial Network have assisted Member States with responding to COVID-19, supported prevention and recovery efforts, and highlights the future actions that its members will undertake to help quicken our road to the "new normal".

It should be underlined that COVID-19 has already disproportionately impacted the most fragile populations from developing countries – poorer social classes, women and children, older generations, and those affected by conflict, or living in fragile settlements or poorly-equipped medical areas. Moreover, this impact is still being felt in some areas, with the strong possibility that the coming years will lead to progressively more negative outcomes for many. The 2021 Sustainable Development Goals Report provides a stark snapshot of how unequal and severe the ongoing impact of COVID-19 is on our global society. The inequalities in our global society have simply been deepened by COVID-19 and we must use the transformational ability of geospatial information to support better preparedness for our future, enable a faster response to emergencies, and foster a more inclusive and equitable recovery.

The art and science of geographic location is unlocked through the use of geospatial information and its enabling technologies. It is an enabling craft. With a clear potential to transform the lives of People, Places and Planet. Here, we consider the wider approach to "geospatial": the set of data, information and knowledge which supports decision making. The tools and services which drive action on the ground at regional, country and local levels. The personnel, skills and competencies which on a day to day basis save lives from one corner of the world, to the other side of the world, by providing logistics and support to peace, development or humanitarian actions. Geospatial drives action to prevent, respond and recover from this global pandemic.

As the COVID-19 pandemic unfolded, governments around the world relied on digital solutions and many countries put in place Geospatial Information Systems (GIS) for hotspot mapping, contact tracing, and early warning systems open to public, to strengthen COVID-19 preparedness and prevention, as well as other disasters. Public and private sectors collaborated to develop platforms and publish information products, such as web maps of confirmed infections and deaths, maps of critical infrastructure and supplies, and available routes for medical staff, interactive maps for global monitoring of school closures caused by COVID-19, among other forms of response. Geospatial analysis made it possible to design new rural development projects in a time when it was not possible to visit the countries due to COVID-19 and security issues. Different geospatial datasets were combined to determine the social, environmental and climate vulnerabilities of 4,000 villages. Geospatial is thus supporting recovery.

As a coalition of 37 entities within the United Nations system that engages in geospatial information management, the UN Geospatial Network's direct mission is to strengthen the coordination and coherence of geospatial information management within the United Nations system, including its overarching trends, technology, practices, data, needs, capacity building, and partnerships. Ultimately, to promote synergies and enable the United Nations system to "Deliver as One and Leaving no One behind". And to act, to use Geospatial for Humanity.

INTRODUCTION

We are living through a seminal moment in human history. In the United Nations' 75th year, a period which started with immense global instability, we are now in the midst of the novel Coronavirus (COVID-19) pandemic. It was not meant to be this way. 2020 began with a wave of optimism; it was this optimism that noted that while the progress towards the 2030 Agenda for Sustainable Development remained unequal, we could in the next decade overcome the barriers in front of us and reach those that are currently being left behind. Together, in solidarity, notwithstanding the immense challenges in front of us, we were to strive to meet the ambitious needs of the 2030 Agenda, face the coming challenges of climate change, and ultimately pave the way for a better, more inclusive, prosperous, safer, secure, and sustainable world.

However, the emergence of COVID-19 has shaken the very foundations of this optimism and challenged us to reflect on the state of our global collective and the true nature of our humanity. At this eleventh session of the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM), this paper has the daunting opportunity to reflect on how the members of the United Nations Geospatial Network have assisted Member States with responding to COVID-19, supported prevention and recovery efforts; and highlights future actions that its members can undertake to help quicken our road to the new normal.

Globally, as of July 2021 we are still inside the crisis: emerging variants and 3rd and 4th waves of the virus are hitting countries around the world. While vaccination rates in developed countries provide a significant cause for hope, the rate of the vaccine rollout, disparity of its application, and emergence of new variants provide a complicated picture and one that is indicative of the vast inequalities among and within countries. However, as demonstrated within the case studies provided by UN Geospatial Network's members, there is still an opportunity to craft an equitable pathway out of the pandemic.

It was predicted that COVID-19 would disproportionately impact the most fragile populations from developing countries – poorer social classes, women and children, older generations, and those affected by conflict, or living in fragile settlements or poorly-equipped medical areas. The 2021 Sustainable Development Goals Report provides a stark snapshot of how unequal and severe the ongoing impact of COVID-19 is on our global society.

The Committee of Expert's decision 10/101 provided comprehensive guidance on the steps forward for the global geospatial information community regarding the value of geospatial information for the response to COVID-19 and suggested that experiences gained and lessons learned are shared. In cognizance of this decision, the UN Geospatial Network canvased its members to collect their experiences of using geospatial information in their response to COVID-19.

As a coalition of entities within the United Nations (UN) System that engages in geospatial information management, the UN Geospatial Network is one of four thematic networks of UN-GGIM, whose direct mission is to strengthen the coordination and coherence of geospatial information management within the UN system, including its overarching trends, technology, practices, data, needs, capacity building, and partnerships, ultimately to promote synergies and enable the UN system to "Deliver as One." Represented by the senior most professionals working in the field of geospatial information management, led by a Chair, two Vice-Chairs and a Steering Group, the UN Geospatial Network's members have had an unparalleled opportunity to observe prevention, response and recovery efforts to

COVID-19. This publication includes contributions from the Regions, the Secretariat and Funds, Programmes, Specialized Agencies and others.

Each of these contributions highlights the crucial role of, and need for, geospatial information in the prevention, response and recovery to COVID-19. It highlights the urgent need for the wide adoption of geospatial technologies and tools. It also provides a reflection on the similarities of needs in the missed opportunities of lessons learned from the response to Ebola and underscores the fact that the need of geospatial information in the prevention, response and recovery to COVID-19, is broadly the same need as the 2030 Agenda, and that capacities built to respond to COVID-19 can be subsequently leveraged by the 2030 Agenda, and vice-versa. This interconnectivity only serves to highlight the importance of UN-GGIM's substantive programme, with its emanating work proving transformational in assisting the prevention, response and recovery to COVID-19.

THE WORLD HEALTH ORGANIZATION (WHO)

WHO utilises geospatial technology and data mapping for the betterment of both the response and recovery phases of COVID-19, including enabling routine health systems to catch up from disruptions brought on by the pandemic. The power of geospatial information and its enabling technologies to visually present data in a way that can communicate quick and effective messages has enabled tools such as the COVID-19 Dashboard to deliver timely and accurate data, information, analysis, and visualization as well as support key public health decision-making for preparedness and response activities, together with regional, country offices, and external organizations and institutions. In the context

of recovery to COVID-19, geospatially integrated information allows for answering questions around equity and resource allocation, as the equitable distribution of COVID-19 vaccines can only be ensured with accurate geospatial data about populations, health catchment areas, and supply chains.

FROM THE REGIONS

The UN Regional Commissions for Asia and the Pacific (UNESCAP), Americas (ECLAC) and Africa (ECA) provided their perspectives of how they have responded since the beginning of the COVID-19 pandemic, from ECLAC tracking the public policies of its 33 constituent countries have implemented to limit the impact of the COVID-19 pandemic, to ECA tracking the impact of the pandemic on the operations of its constituent countries' National Geospatial Information Agencies and National Mapping Agencies. Regardless of the region, it is clear that countries have undertaken an increasing number of actions supported by regional stakeholders, whether supporting vaccination efforts, implementing movement restrictions, or monitoring the sectors of national health, labor, economy, education, gender, social protection.

FROM THE SECRETARIAT

The various constituent members of the UN Secretariat, including its funds, programmes and specialized agencies provide a colourful and broad perspective of how it has specifically, and collectively, responded to COVID-19. Highlights include the UN Office of Drugs and Crime (UNODC) discussing how it has developed an initial assessment report of the scale of COVID-19 facilitated criminality and shifts in criminal behaviour. The

conclusions of the report suggest that crime targeting COVID-19 medical products will become more focused with significantly greater risks to public health as the containment phase of the pandemic passes to the treatment and prevention stages. Another case details how OICT, through its Geospatial Information Section has stood up dashboards and other interactive tools to measure and monitor COVID-19, whether in prevention, response, or recovery.

Regardless of the diversity of voice and the messages discussed in this paper, it is clear that there is still a significant task ahead of us. The discussion paper 'COVID-19: Ready to Respond - The Role of the Geospatial Community in Responding to COVID-19', presented at the tenth session of UN-GGIM stressed:

"There is still a critical and urgent need for countries and the multilateral system to mobilize resources to ensure the availability and accessibility of geospatial information, not just for COVID-19 in both the short- and long-term, but for the SDGs as well. The IGIF has provided an anchor for the national response for countries, a first step for many has been to develop dashboards to communicate and visualise the spread of COVID-19".

Through this paper a year on from the tenth session, the UN Geospatial Network echoes this statement and endorses the notion that its findings and call for action are as relevant in 2021, as they were in 2020, if not more urgent. The inequalities in our global society have simply been deepened by COVID-19. We must use the transformational ability of geospatial information to support better preparedness for our future, enable a faster response to emergencies, and fight for an inclusive and equitable recovery.

In their contributions, the members of the UN Geospatial Network highlight how geospatial information is informing their response, stressing the need for solidarity in the response to COVID-19, and the need for integrated geospatial information to make informed decisions in global, national, and local prevention, response and recovery to COVID-19; as we are all in this together to find and adopt innovative ways to fight COVID-19 and leave no one behind.

CALL TO ACTION

OBSTACLES

More than ever, we must act as 'One Planet' to address global challenges using a coherent and collaborative approach, becoming more resilient in the process. Wars and conflicts, disasters, water scarcity, climate change and pollution, diseases and poverty, crimes and inequalities all have global consequences and spillover effects that affect all regions of the world, impacting us all. We must be better prepared for our future, respond to emergencies with more effectiveness, and recover from disasters building back better. We are all in this together and need to find innovative ways to fight this complex phenomenon and Leave No One Behind.

OPPORTUNITIES

The global geospatial community plays a critical role in leveraging our understanding of mega-trends and global phenomena through innovative technology, data and analysis. Geospatial information provides insights, models and knowledge to understand patterns, trends and events as well as build scenarios, and act upon them - the "Data for Action" approach. Geospatial information contributes to data-driven and evidence-based decision making to support local, national, regional, and global development and emergency priorities and agendas. The UN is using geospatial information for the delivery of its mandates in the Peace, Development and Humanitarian nexus, and must work to create synergies with all governments, academia, private sector, societies, innovators and civil society at large. This will be of fundamental importance in building a "geospatial way for a better world", impacting People, Places and our Planet.

FUTURES APPROACH

The UN Geospatial Network's Work Plan for 2019–2021 fostered the development of the "*Blueprint*" and its companion document the "*Blueprint: Geospatial Landscape of the United Nations system*" which aims to be respectively a strategy document and a concise and dynamic resource of current geospatial mandates, activities, personnel, data usage, infrastructure and resources across the whole UN system. Even with the challenges imposed by COVID-19, the Blueprint offers a sustainable way forward with which to strengthen the geospatial activities of the UN system.

Through the realization of its Blueprint activities, the United Nations Geospatial Network will also further contribute to increase readiness and strengthen capacities, strategies and activities of Member States on geospatial information including on Health or for crisis response. The UN Geospatial Network must foster, with and for Member States, partnerships with academia, the private sector, societies, innovators and the civil society to further strengthen geospatial information management in a global partnership for people, planet, peace, and prosperity.

PERSPECTIVES OF THE UNITED NATIONS GEOSPATIAL NETWORK

THE REGIONAL PERSPECTIVE

ECONOMIC COMMISSION FOR AFRICA (ECA)

Impact of COVID-19 Mobility Restrictions on Human Mobility

Community Mobility Patterns in Africa: A Geospatial Insights into Changes in Population Movements as a response to Policies aimed at Combating COVID-19

ECA conducted a study in 2021 which assesses Community Mobility Patterns in Africa using Geospatial insights, into changes in population movements as a response to policies aimed at Combating COVID-19. Furthermore, this study evaluated mobility pattern changes at the continental level as a response to policies aimed at Combating COVID-19. It equally assessed mobility pattern changes at the national and sub-national levels as a response to policies aimed at Combating COVID-19. The study proposes policy options that guides decision makers on responding to the emerging challenges aimed at combating COVID-19.

The study uses the Google Mobility, Demographic and Health Survey and other datasets provided for 28 African countries that depicts mobility trends for places like public transport hubs such as subway, bus, and train stations, restaurants, cafes, shopping centers, theme parks, museums, libraries, and movie theaters, grocery markets, food warehouses, farmers markets, specialty food shops, drug stores, and pharmacies, national parks, public beaches, marinas, dog parks, plazas, and public gardens. The study helps track both governments' stringency of response and citizens' compliance to the measures recommended during the COVID-19 pandemic.

Population Movements as a response to Policies aimed at Combating COVID-19 (02-15-2020 to 02-15-2021)
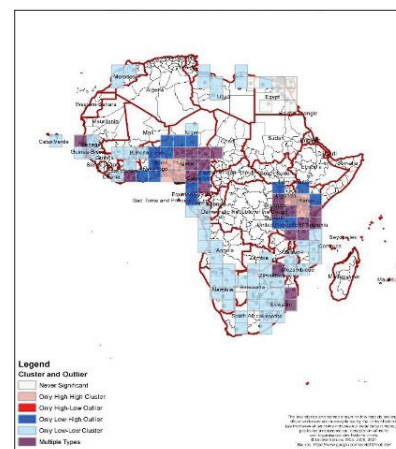

Changes in Population Movements as a response to Policies aimed at Combating COVID-19 Clusters and Outliers in both Space and Time (02-15-2020 to 02-15-2021)

Assessing the Preparedness, Impact and Readiness to Respond to COVID-19 in the Geospatial Activities of Africa's National Mapping Agencies (NMAs)

ECA efforts of taking stock of the impact of COVID-19 on business continuity of 54 National Mapping Agencies (NMA's) in the continent and identifies the challenges faced and responses to COVID-19 by NMA's. The survey was jointly developed and carried out by the African Centre for Statistics (ACS), Geospatial Information Management Section (GiMS) of the United Nations Economic Commission for Africa (ECA) and National Mapping Agencies. The results are based on tallied 431 responses from 17 fully completed questionnaires, with each respondent representing a National Mapping Agency that operates in one of the 54 African countries. The analysis was based on 31% of respondents as only 17 out of 54 countries responded to the questionnaire. It is the intention of ECA to further collect data from the remaining 70% of countries to have a complete picture of the impact COVID-19 crisis on NMA's in the continent.
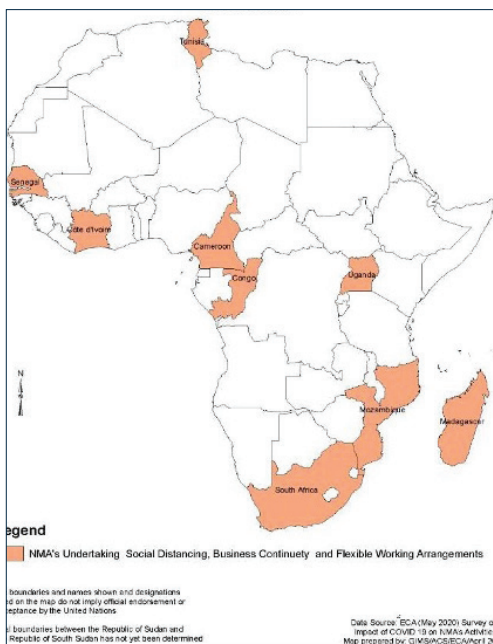
Severe Impact of COVID-19 Pandemic on National Mapping Agencies (NMA's) Activities in Africa
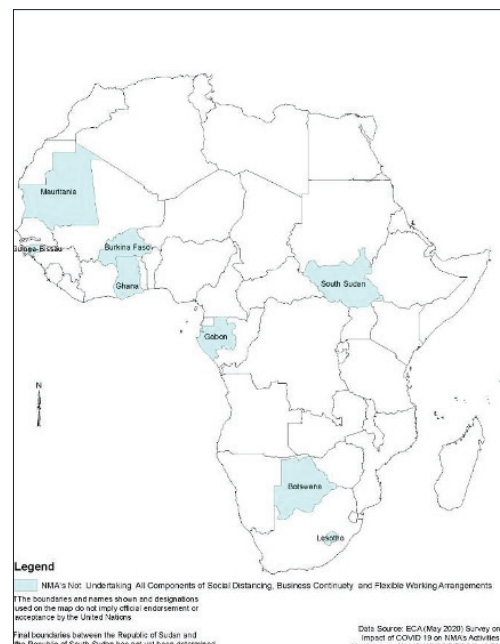
Less Severe Impact of COVID-19 Pandemic on National Mapping Agencies (NMA's) Activities in Africa

ECONOMIC COMMISSION FOR LATIN AMERICAS AND THE CARIBBEAN (ECLAC)

From the beginning of the COVID-19 pandemic, the Economic Commission for Latin America and the Caribbean (ECLAC) has been tracking the public policies that the 33 countries of the Latin America and Caribbean region (LAC region) have implemented to limit the impact of the COVID-19 pandemic, as input to the analysis of the economic and social impacts that these policies will have at the national and sectoral levels. One relevant work line in this regard is to monitor the actions taken by the governments on a daily basis and provide access to this information by means of technological tools that facilitate the dissemination and exchange of practices within the region. This work is being conducted with the support of the United Nations Country Resident Coordinators, UN

Women and ECLAC, who have been reporting on the actions taken by the countries. As a result of this work, it is observed that the countries of the LAC region have been taking an increasing number of actions, categorized in measure types such as vaccination, movement restrictions, health, labor, economy, education, gender, social protection.

In order to provide access to detailed information about these actions, ECLAC has created a COVID-19 Observatory *https://www.cepal.org/en/topics/covid-19*, which contains geospatial viewer where, by clicking a country in the map, it is possible to know details on the date in which the action(s) was/were taken, the governmental organization in charge and a comprehensive explanation.

Measures and actions at the national level

ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC (ESCAP)

Health management: Monitoring, responding to, and preparing for COVID-19

Before the COVID-19 pandemic hit, during the formulation of the Asia-Pacific Plan of Action on Space Applications for Sustainable Development (2018-2030), member States in Asia and the Pacific had the foresight to highlight the importance of strengthening the ability of countries in the Asia-Pacific region to leverage geospatial information for monitoring, responding to and preparing for pandemics. The Plan of Action requests the Secretariat and its member States to research on how GIS, GNSS, Big Data analytics and mapping of health risk hotspots can contain the present and future spread of disease and pandemics, monitor health impacts, and promote cooperation to address transboundary health risks. The Plan of Action also identifies the need for research on telehealth solutions using space technology to improve emergency health capacities.

As the COVID-19 pandemic progresses, Governments around the world rely on measures, such as contact tracing, quarantining, and social distancing. All of these are spatial in nature and rely on geospatial information, digital solutions, and AI-driven risk analytics to enhance community resilience. Many countries have put in place geospatial information systems and have shown that hotspot mapping, contact tracing, and early warning systems open to the public are all capable of strengthening the preparedness for COVID-19, as well as other disasters. These applications can also help in the recovery phase to build back better, by providing an evidence base for decisions on the easing of lockdown and the resumption of economic and social activities.

The pandemic has accelerated the research and capacity development on how geospatial information and

Big Data can be used to map health risk hotspots and minimize the spread of health epidemics, which are action items set forth in the Plan of Action. For example, Governments are using geospatial data and space applications to support monitoring, response, and preparation for the COVID-19 pandemic. Public and private sectors have collaborated to develop platforms and publish information products, such as web maps of confirmed infections and deaths, maps of critical infrastructure and supplies, and available routes for medical staff, among others.

In support of these endeavours, ESCAP has prepared a guidebook on risk analytics and organized regional initiatives to advance the usage of geospatial applications for identifying vulnerable communities under the Asia-Pacific Disaster Resilience Network (APDRN). However, while measures involving geospatial information and Big Data have proven effective, it should be noted that the pandemic risks normalizing government use of invasive monitoring and surveillance systems with implications for the right to privacy.

The following include an introduction to only a few of the many innovative examples of how space technology applications contribute to combatting the COVID-19 pandemic in the Asia-Pacific region[1].

a. Thailand: Lockdown measure impacts and COVID-19 iMAP dashboard

b. Indonesia: Heatmaps of vulnerability levels

c. India: Bhuvan-COVID-19

d. Fiji: Dashboard and managing disasters during COVID-19

e. Malaysia: WebGIS dashboard

f. China: Health QR codes

g. Philippines: Campaign supports innovative apps

h. The Republic of Korea: Private sector's role in developing vital platformsGeospatial risk analytics solutions for humanitarian actions: case studies from South Asia

Figure 6.3 Reduced night light image of Thailand before and during the COVID-19 pandemic lockdown
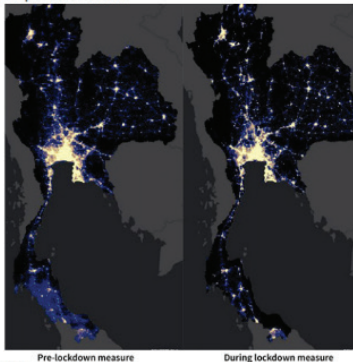
Pre-lockdown measure | During lockdown measure

Source: GISTDA
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

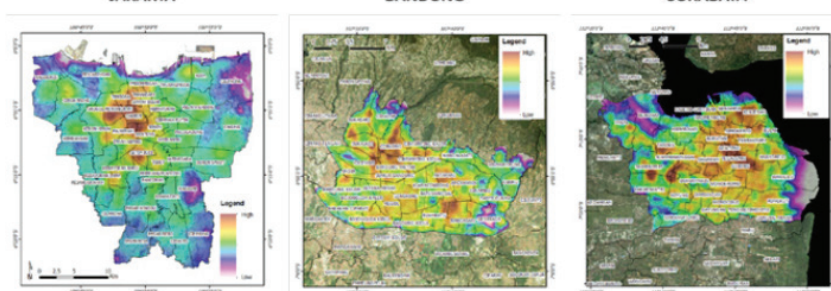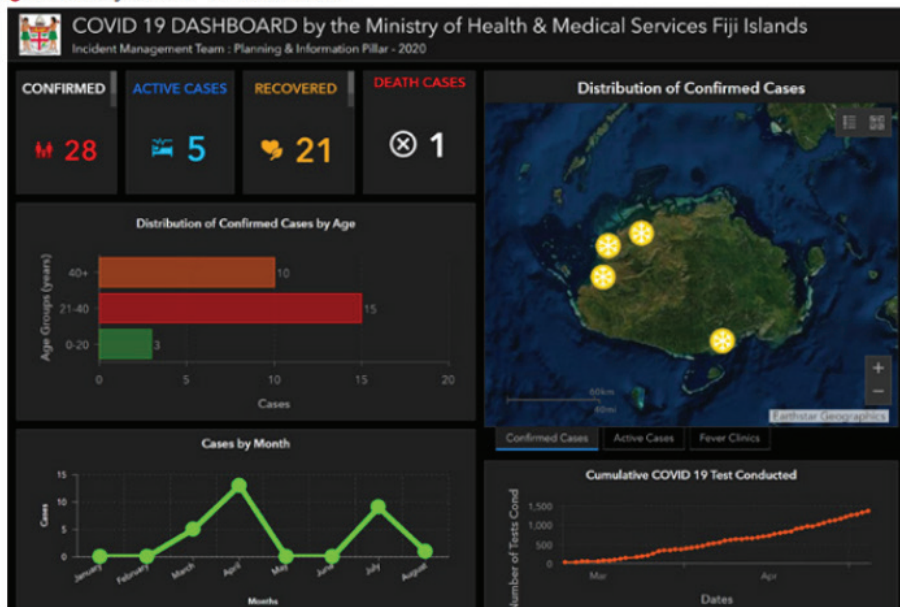**Figure 6.4** COVID-19 iMAP dashboard, developed in Thailand

Source: GISTDA
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 6.5 COVID-19 vulnerability levels of major cities in Indonesia

JAKARTA | BANDUNG | SURABAYA

Source: National Institute of Aeronautics and Space of Indonesia (LAPAN)
Note: Vulnerability levels are calculated using the Zone of Population Density and Settlement, the Zone of Density of Road Access Conditions and the Zone of Strategic Locations against COVID-19 spread.
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

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1   ESCAP (2020) Geospatial Practices for Sustainable Development in Asia and the Pacific 2020: A Compendium (*https://www.ESCAP.org/publications/geospatial-practices-sustainable-development-asia-and-pacific-2020-compendium#*)

Figure 6.6 Fiji COVID-19 Dashboard

Source: Ministry of Health & Medical Services Fiji. Available at http://fijigeospatial.maps.arcgis.com/apps/opsdashboard/index.html#/
a099962e2cae4e15b8127d044753723d
Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Geospatial risk analytics solutions for humanitarian actions: case studies from South Asia

The ESCAP's Asia-Pacific Disaster Resilience Network (APDRN)[2] has been providing geospatial risk analytics solutions for managing the cascading risks – intersection of COVID-19 with extreme climate events. Derived from predictive (forecasting, early warning), descriptive (situation analysis/disaster impacts), prescriptive (policy options under different risk scenarios) and discursive analytics (risk communication, engaging community interactive response), these solutions help to support a range of risk informed decisions under the uncertainties.

Predictive analytics

In South Asia, the most immediate concern was the monsoon season of June to September 2020 when the spread of the COVID-19 was rapidly growing. The APDRN translated seasonal outlook of South Asia monsoon to impact forecasting to visualize the potential impacts of cascading risks[3].

The cascading risk hotspots were indicated for taking preparedness measures and policy interventions to reduce the impacts of floods and drought while managing the risks of COVID-19 transmission simultaneously (Figure 1). Climate related disasters have different risk pathways from COVID-19, but they can intersect and converge with the pandemic in complex and destructive ways. Consequently, many communities are exposed to both, and the long-term consequences can be similar – damage to people's health and livelihoods and their prospects of escaping poverty. The predictive analytics help in managing the cascading risks scenarios.

2   ESCAP (2019a). Operationalizing Asia-Pacific Disaster Resilience Network (APDRN), ESCAP Committee on Disaster Risk Reduction, 6th Session, August 2019. **https://www. unescap.org/sites/default/files/Operationalizing%20the%20 Asia-Pacific%20Disaster%20Resilience%20Network_En**

3   ESCAP (2020g). Seasonal outlook to socio-economic impact forecasting, APDRN Manual and Training Guidebook, December 2020. **https://www.unescap.org/kp/2020/seasonal-outlook-socio-economic-impact-based-forecasting**
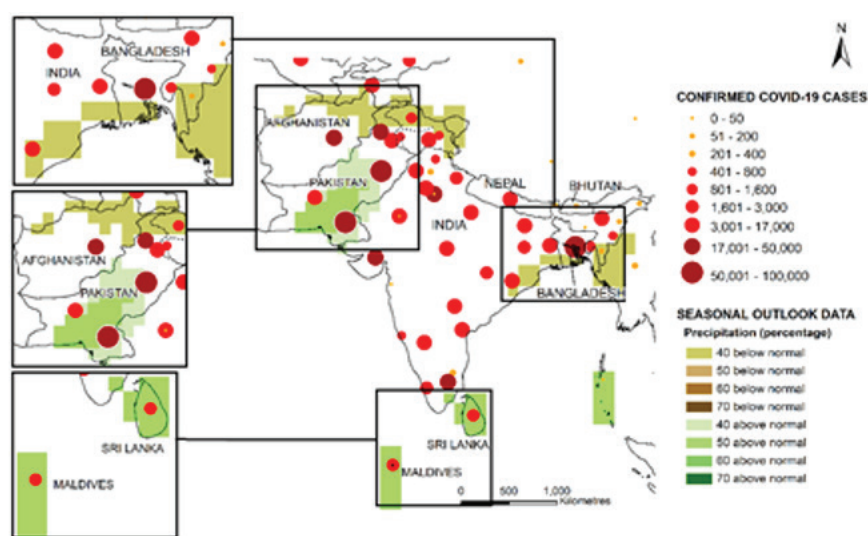
Source: *Protecting the most vulnerable to cascading risks from climate extremes and the COVID-19 in South Asia, Policy study series, Asia-Pacific Disaster Resilience Network (APDRN)*[4]

Descriptive risk analytics

The new demands for responding to the cascading risks of COVID-19 and cyclone/floods were evident in May 2020 when cyclone Amphan hit densely populated low-lying coastal areas of Odisha, West Bengal in India, and adjoining Bangladesh. The large-scale evacuations in the path of the cyclone relied on precise early-warning systems that saved thousands of lives[5]. Unavoidably, these measures also increased the risk of infection. In India it was reported that 59 members of the National Disaster Response Force and 170 personnel who fought against cyclone Amphan tested positive for COVID-19. Similar challenges were faced in June when cyclone Nisarga struck densely populated areas on the west coast of India – where COVID-19 was already spreading fast. Here too, precise early warning followed by large-scale evacuations undoubtedly saved lives. However, COVID-19 infections accelerated: between May and June 2020 the number of confirmed cases in India rose from 100,000 to 440,000 (Figure 2). There is no scientific evidence that disaster-related disruptions in social distancing increased the number of infections, but they would certainly have played a part. For such complexities, scenario based and data intensive risk analytics that enable impact-based and risk-informed early warning systems can play an important role in saving lives and reducing transmission of diseases[6].

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4   ESCAP (2020b). *Protecting the most vulnerable to cascading risks from climate extremes and the COVID-19 in South Asia, APDRN Policy Brief, 14 August 2020.* **https://www.unescap.org/resources/protecting-most-vulnerable-cascading-risks-climate-extremes-and-covid-19-south-asia**

5   ESCAP (2020c). *When crises converge: responding to natural disasters in South Asia during the COVID-19, APDRN Policy Brief, 14 August 2020.* **https://www.unescap.org/resources/when-crises-converge-responding-natural-disasters-south-asia-during-covid-19-0**

6   ESCAP (2020f). *Scenario-based risk analytics for managing cascading risks, APDRN Manuals and Training Materials, November 2020.* **https://www.unescap.org/resources/scenario-based-risk-analytics-managing-cascading-disasters**
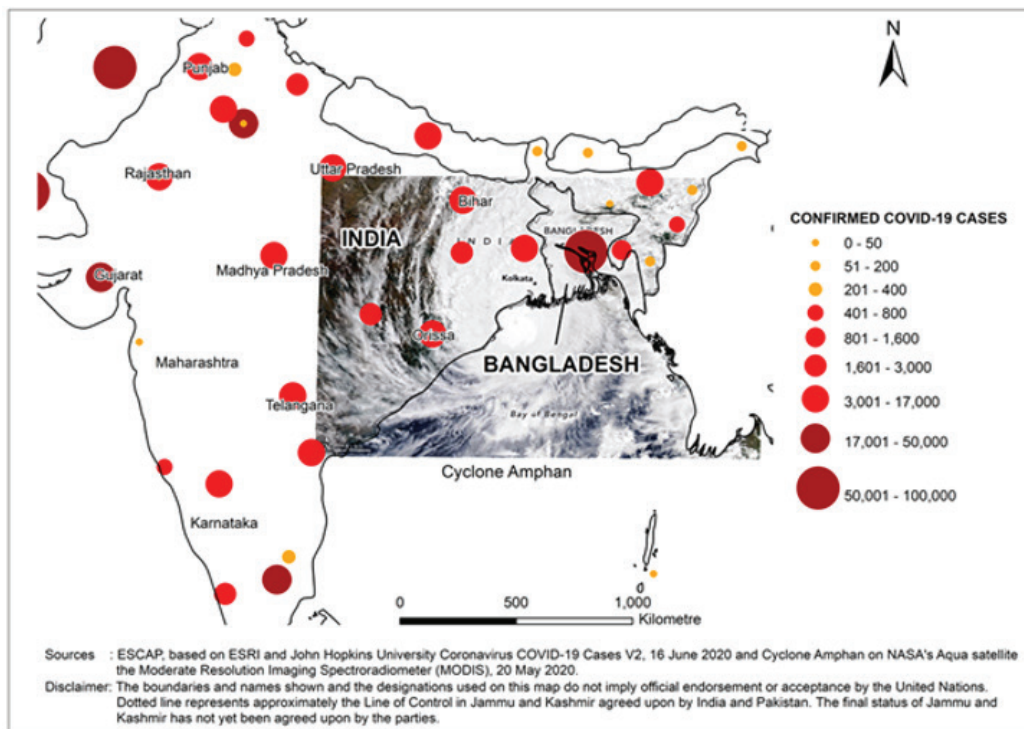
Source: *Protecting the most vulnerable to cascading risks from climate extremes and the COVID-19 in South Asia, Policy study series, APDRN[7]*

The COVID-19 pandemic, a stark reminder of the systemic and cascading nature of risk, highlights the need for a whole-of-government and an all-of-society approach. The key challenge is building back better with resilience at the core of recovery. ESCAP's High-level Panel meeting on disaster and climate resilience in South Asia, on 4th December 2020, presented pathways based on the scientific understanding of disaster-pandemic and health nexus, that harness frontier technology-based solutions for comprehensive preparedness systems to tackle cascading disasters. These pathways must be supported by an innovation framework of diverse stakeholders, including regional and sub-regional organizations[8]. Ultimately this aims to strengthen the capacity of all countries in the region to address systemic risks for a more resilient future.

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7   ESCAP (2020b). *Protecting the most vulnerable to cascading risks from climate extremes and the COVID-19 in South Asia, APDRN Policy Brief, 14 August 2020.* ***https://www.unescap.org/resources/protecting-most-vulnerable-cascading-risks-climate-extremes-and-covid-19-south-asia***

8   ESCAP (2021). *Weaving a stronger fabric: Managing cascading risks for climate resilience, APDRN Policy Review, 26 January 2021.* ***https://www.unescap.org/kp/2021/weaving-stronger-fabric-managing-cascading-risks-climate-resilience***

SECRETARIAT PERSPECTIVES

UNITED NATIONS OFFICE ON DRUGS AND CRIME (UNODC)

Strengthen national capacities to counter the trafficking of substandard and falsified medical products stemming from COVID-19

The COVID-19 pandemic gave rise to specific forms of crimes that pose a direct and indirect threat to public health, particularly for the most vulnerable sectors of society and those without adequate access to public health systems. The pandemic has highlighted vulnerabilities in health and criminal justice systems, particularly the need for real-time monitoring to produce rapid pictures of threats and enhance capacities to combat the multiple and related forms of trafficking of substandard and falsified medical products.

Improved knowledge and monitoring of the transnational nature, routes and modus operandi used in the trafficking of falsified medical products and their link to other forms of organized crime is critical to inform policy and operational responses fundamental for both COVID-19 and a post-COVID-19 eras. In 2020, a real-time monitoring system was established to detect illicit events involving falsified medical products associated with COVID-19. A rapid collection of data from Member States and open sources coupled with the development of typologies of available information by crime was used to develop the dataset, while GIS tools were used to conduct quantitative analyses and visualize the data. (See figures 1 & 2).

This information enabled the development of an initial assessment report of the scale of COVID-19 facilitated criminality and shifts in criminal behaviour. The conclusions of the report (UNODC, July 2020) suggest that crime targeting COVID-19 medical products will become more focused with significantly greater risks to public health as the containment phase of the pandemic passes to the treatment and prevention stages.

At the time of publication, regional trends indicated that significant seizures of protective equipment (PPE), mostly substandard and falsified face masks and In-Vitro Diagnostics (IVD) test kits for COVID-19, occurred in regions where the highest number of deaths and infections were first recorded: Asia, Europe and the Americas. Substandard and falsified medicines were identified in several regions, including Africa.

The gap in recognizing the seriousness of such crimes has provided an additional opportunity for organized criminal groups during COVID-19, as evidenced by the large quantities of PPE seized or rejected by countries as substandard. Evidence of seizures was more striking in Europe, North America and Asia, although limited data on Africa also indicates the interception of PPE and COVID-19-related medicines (See Figures 1 & 2).
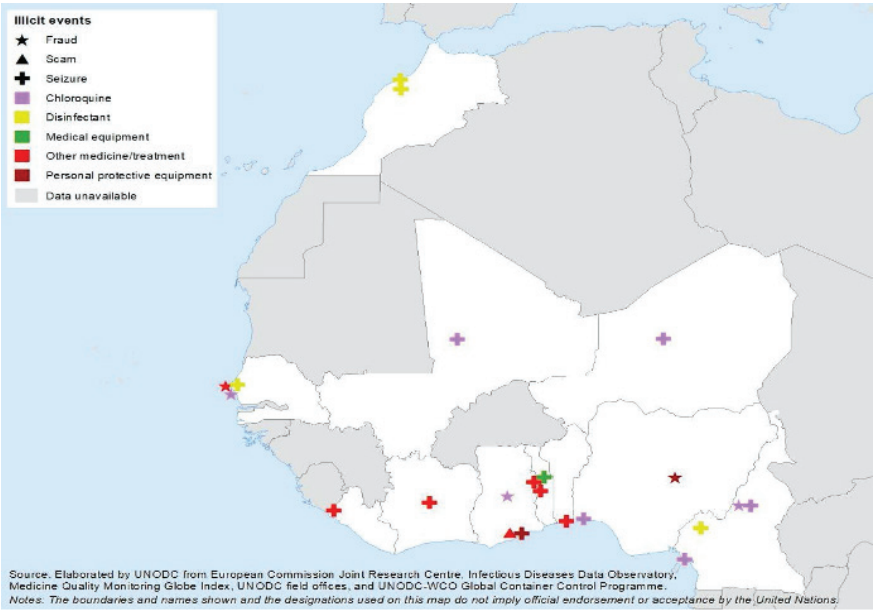
Figure 1: *Illicit events involving COVID-19 -related substandard and falsified medicine and medical equipment in Western Africa*
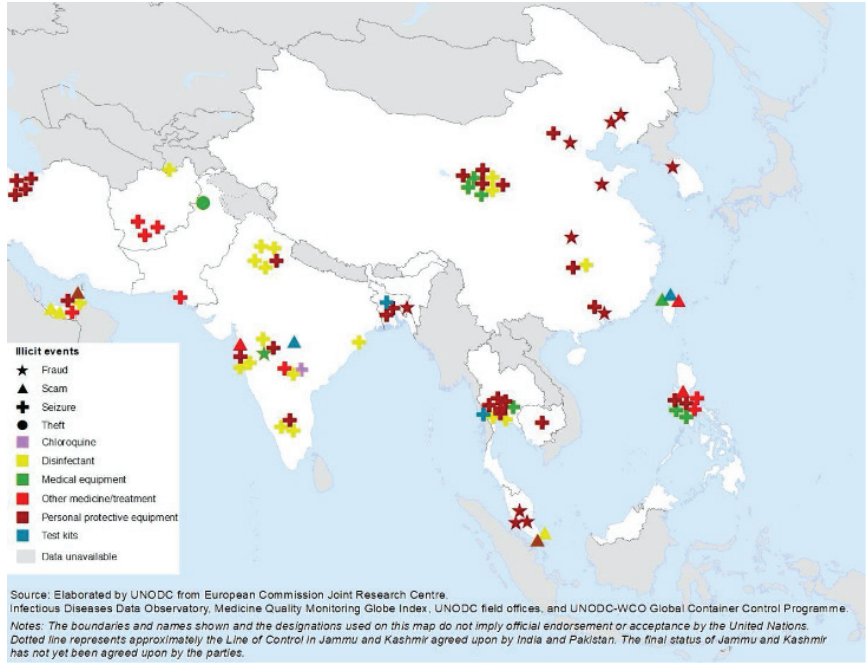

Figure 2: *Illicit events involving COVID-19 -related substandard and falsified medicine and medical equipment in selected countries in Asia*

UNITED NATIONS GEOSPATIAL (OICT)

The United Nations Geospatial (UN Geospatial) team from the Geospatial Information Section, Office of Information Communications Technology in New York, (USA), Global Service Centre, Department of Operational Support in Brindisi, (Italy) and field missions in peacekeeping and special political missions provided coordinated input to this call for interest. One of the responsibilities the UN Geospatial team has is to provide geospatial strategic guidance but in parallel, to provide tactical operational requirements to the UN Secretariat.

During the initial period of the global pandemic, UN Geospatial provided a general clearing house role in sharing the geospatial policy and practices when

preparing geospatial services through a guideline dissemination. At the operational level, the UN Geospatial team were involved in mapping the latest evolving situation of the global pandemic with inter-related data using UN sourced data (FAO, IOM, OCHA, OHCHR, UNCTAD, UNESCO, UNICEF, UNHCR, WHO, etc.) or non-UN sourced dataset (e.g. latest COVID-19 statistics from national authorities) for the UN senior management team through the United Nations Operations & Crisis Centre (UNOCC). In the early stages of the global pandemic, the UN Geospatial team engaged with the Field Support Group (FSG-COVID-19) of the Department of Operational Support (DOS) to offer tactical operational support such as the area of medical evacuation planning.
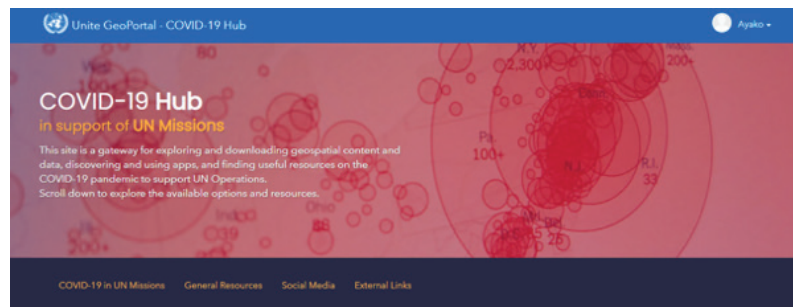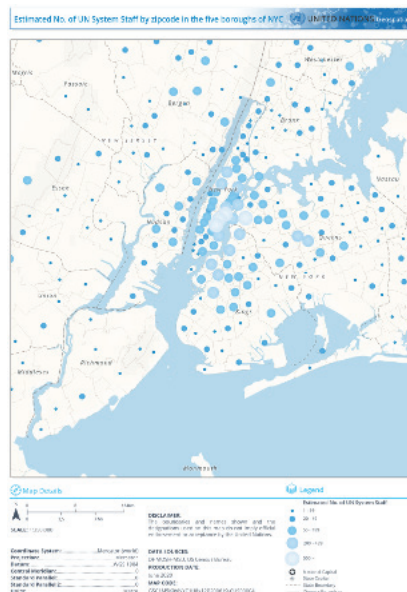
UN staff estimation map in New York metropolitan area and COVID-19 Hub by UN Geospatial: As part of preparedness, the geospatial and medical team collaborated in preparing for a possible mobile vaccination response during the early phases of the global pandemic. A dashboard to provide a comprehensive overview of the COVID-19 situation and an application for possible medical evacuation for the UN personnel in UN peace operations was also developed as a prototype for the medical team for them to consider to be integrated into their medical strategic decision-making and tactical logistical support.
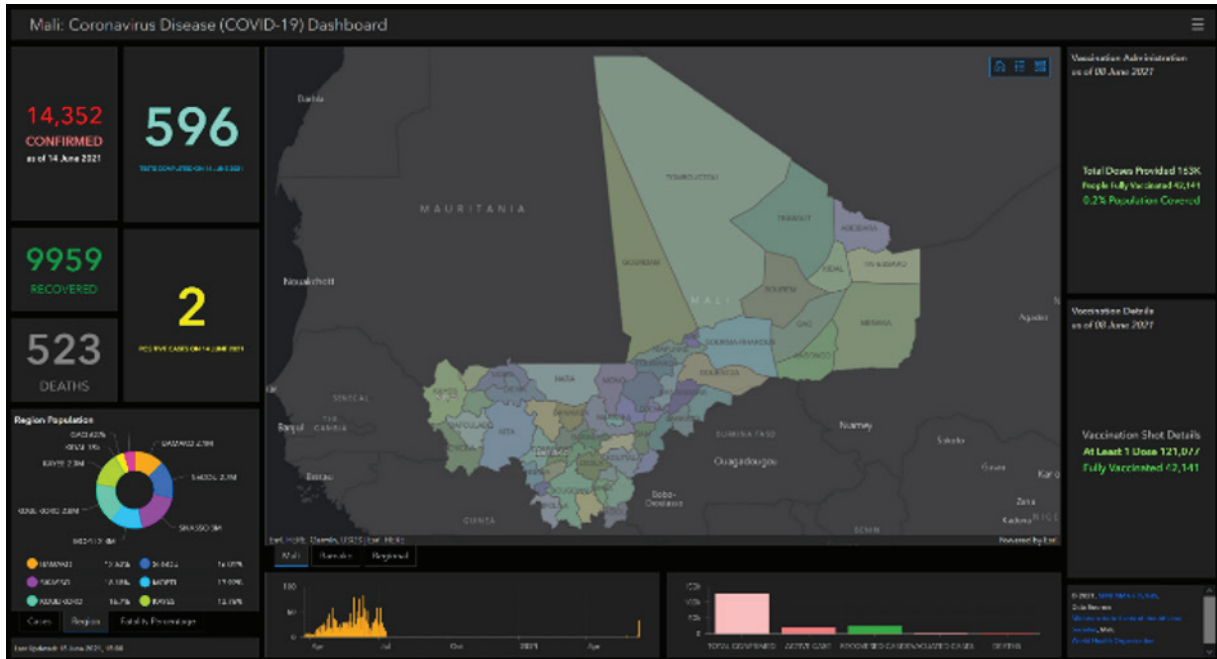
COVID-19 Dashboard by UN Geospatial MINUSMA: Integrating the latest daily authoritative data from the Ministry of Health and Social Affairs of Mali, this COVID-19 dashboard offered multiple interactive data visualizations, offering a comprehensive key insight for at-a-glance overview of the situation to the mission senior leadership and relevant government stakeholders.

Additionally, in the field, United Nations Multidimensional Integrated Stabilization Mission in Mali (MINUSMA), a COVID-19 dashboard was deployed to the mission and the relevant government stakeholders at the peak of the pandemic in March 2020 to provide a comprehensive view, trend and better insight into the impacts of the COVID-19 pandemic in Mali.

Some of the lessons learned at the strategic level was the greater need for communication and awareness raising on the broader geospatial services that can be provided by the UN Geospatial Network community, whilst at the tactical level, the need for harmonized or standardized data models that allow easier integration of geospatial and other types of data in a seamless way in times of emergencies.

UNITED NATIONS OFFICE FOR OUTER SPACE AFFAIRS (UNOOSA)

Geospatial for Humanity: Prevention, Response and Recovery of the World from the Pandemic COVID19

The year 2020 was a challenging time for the world since intersection climate extremes, disasters and Covid-19 pandemic caused complex risks and cascading effects for which the world is not prepared. This is crucial when extreme weather events are increasing the frequency of floods, droughts, and cyclones as experienced in many parts of Asia. The impact of climate change is also changing ocean currents, the frequency and intensity of forest fires and possibly act as a stimulant for outbreaks of pandemics like Covid-19[1]. This all has a significant impact on the economy, food security, health, education systems and ecosystems and is a significant setback to the world in achieving sustainable development goals (SDGs), especially its principle of 'leaving no one behind'.

To this cause, UNOOSA undertook several initiatives that are presented as follows:

» The Working Group on Space and Global Health[2] established through the Committee on the Peaceful Uses of Outer Space held a virtual meeting on Space and Global Health to discuss lessons learned from the COVID-19 pandemic that could be useful for the work of the Working Group.

» To help bridge the information crisis, the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER), the programme of the United Nations Office for Outer Space Affairs, UN-SPIDER compiled examples of contributions and best practices using space in addressing COVID-19[3].

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1   *McNeely, J.A. Nature and COVID-19: The pandemic, the environment, and the way ahead. Ambio 50, 767–781 (2021).* ***https://doi.org/10.1007/s13280-020-01447-0***

2   ***https://www.unoosa.org/oosa/en/ourwork/copuos/stsc/gh/index.html***

3   ***https://www.un-spider.org/advisory-support/emergency-support/covid-19***

UN-SPIDER organised a special conference in 2020 to reflect on the lessons learned from the Covid-19 pandemic and how space contributed during such a situation. These lessons will allow the disaster management community to develop scenarios of cascading risks that coincide during such a pandemic and use them for preparedness and response in future. The lessons can be summarized as follows:

» Information at various scales is needed to capture the systemic risk scenarios and do predictive risk analysis that can help in decision-making processes. For example, amid the Covid-19 outbreak, the Cyclone Amphan (May 2020) in India and the record-breaking torrential heavy rains in the southern Japanese island of Kyushu (July 2020) that triggered floods and landslides posed contrasting requirements to evacuation measures and social distancing. In such cases, risk scenarios can be successfully applied to identify the requirements well before the crisis.

» EO technologies provided great service during disasters that overlapped with the Covid-19 pandemic by narrowing down the possible affected places and generating precise damage maps to assist local authorities in establishing evacuation plans. These damage maps, in conjunction with the data on the pandemic situation, provided valuable information needed for planning response efforts. Such information reduced the lead time to respond to possible disasters which are particularly crucial under the COVID-19 pandemic. The role of the International Charter Space and Major Disasters, Sentinel Asia and Copernicus EMS to share disaster information in near-real-time was crucial during the natural disasters that occurred during the pandemic time. For example, during the flood and cyclone disasters in 2020, the additional challenge to the disaster managers and emergency responders was to follow social distancing norms during response efforts and avoid a spread of the virus by accommodating a lower number of persons in evacuation shelters. This means evacuations needed even more attention and planning time and required more shelters and the need of frequent sanitization.

» It is difficult to model and hard to monitor Covid-19 spread as it is influenced by decisions made by governments and the behavior of people, however EO provided the information on cascading risks caused by the pandemic and natural disasters. Power space technologies (earth observation and location-based services), big data, analytics and models can be very useful in building scenario-based approaches. These technologies allow efficient integration of field-based geospatial information with Earth observation data and predict systemic risks that are transboundary, stochastic, non-linear and uncertain.

» The magnitude of such a crisis goes beyond a local humanitarian crisis but awakens a notion of building a resilient society through sustainable development. The disaster management community is uniquely positioned to contribute to those challenges, particularly in building disaster risk reduction programmes.

The concern is that there are loads of technologies but these need to be put to use. This is where the role of a platform like UN-SPIDER is crucial as such platforms bring together all stakeholders including technical community, government officials, NGOs, industries and people to learn from each other and help establish nexus from policy design to capacity building and institutional strengthening. Indigenous communities should be central to these efforts to ensure that no one is left behind, and this has become possible due to the revolution in social media.

PERSPECTIVES FROM UNITED NATIONS FUNDS, PROGRAMMES, SPECIALIZED AGENCIES AND OTHERS

WORLD HEALTH ORGANIZATION (WHO)

WHO uitilises geospatial technology and data mapping for the betterment of both the response and recovery phases pf COVID-19, including enabling routine health systems to catch up from distruptions brought on by the pandemic.

A.   Response to COVID-19

WHO Health Emergencies Programme: Global COVID-19 situation dashboard and geospatial information products

During the early stage of the SARS-CoV-2 outbreak when cases were localized in certain countries and subnational regions, multiple geospatial products were developed to visualize the latest epidemic situations at the subnational level, and also to understand how the cross-border transmissions in different countries had occurred. This was done by analyzing detailed case narratives and their travel histories through International Air Transport Association (IATA) flight and passenger volume data that were incorporated to approximate the general population movements in and out from the affected areas. Collaborating with WHO regional and country offices, alerts were raised for a potential spread of the virus to other areas that are highly connected to each other. Tremendous efforts were made to disseminate accurate and timely information about the outbreak as quickly as possible. Leveraging the global network of disease surveillance and reporting in our regional and country offices as well as the

governments' public health authorities, case reporting systems were rapidly established to consolidate the global daily case and death counts. As a result, the WHO Coronavirus (COVID-19) Dashboard (https://covid19.who.int/) - supported by efforts from various departments and units across the organization and funded by generous contributions from our Member States and donors, was developed and shared publicly shortly after the detection of the COVID-19 outbreak in January 2020.

The WHO Coronavirus (COVID-19) Dashboard was developed to summarize and communicate the latest situation of the pandemic including various geospatial visualizations for different indicators that could help us understand the extent and the evolution of the pandemic to guide preparedness and response activities. The main objective of this dashboard was to utilize geospatial technologies to deliver timely and

accurate data, information, analysis, and visualization of COVID-19 and to support key public health decision-making for preparedness and response activities, together with regional, country offices, and external organizations and institutions.

Since the initial launch of the dashboard, the contents have been tailored according to the phases of the outbreak by adding more timely and relevant information such as vaccination status and the situation of the public health and social measures. Transparency and data sharing are also important to respond to this global pandemic with our internal and external partners. All of the indicators included on the dashboard are available for download.

To date, the Dashboard has been visited by over 45 million users with approximately 100 000 daily visitors globally.
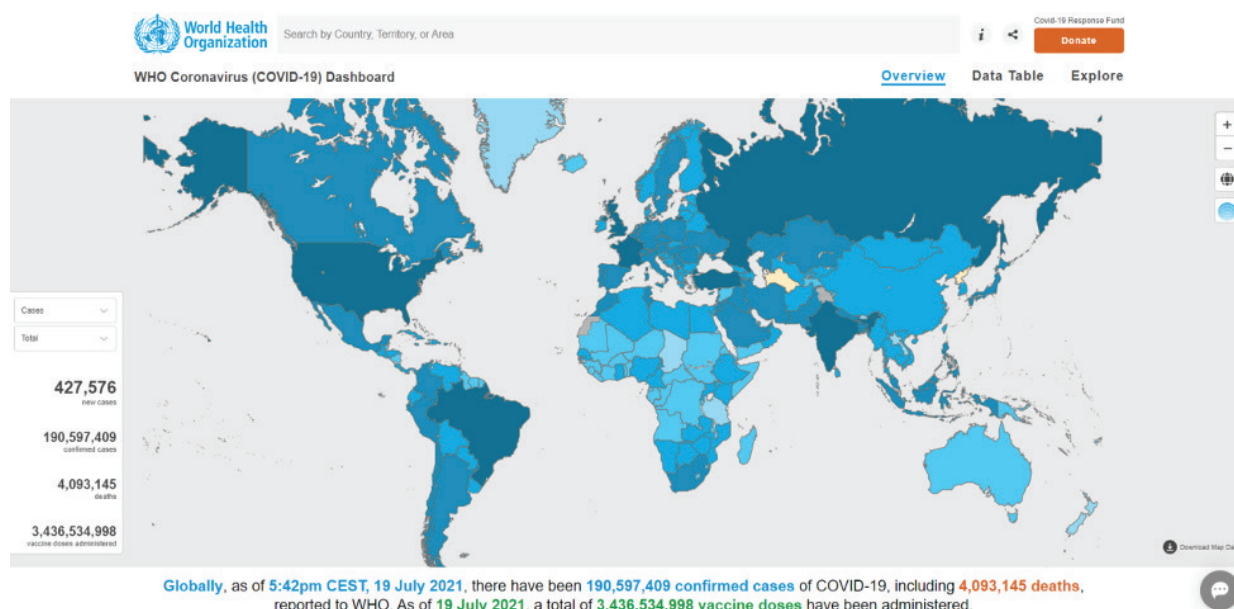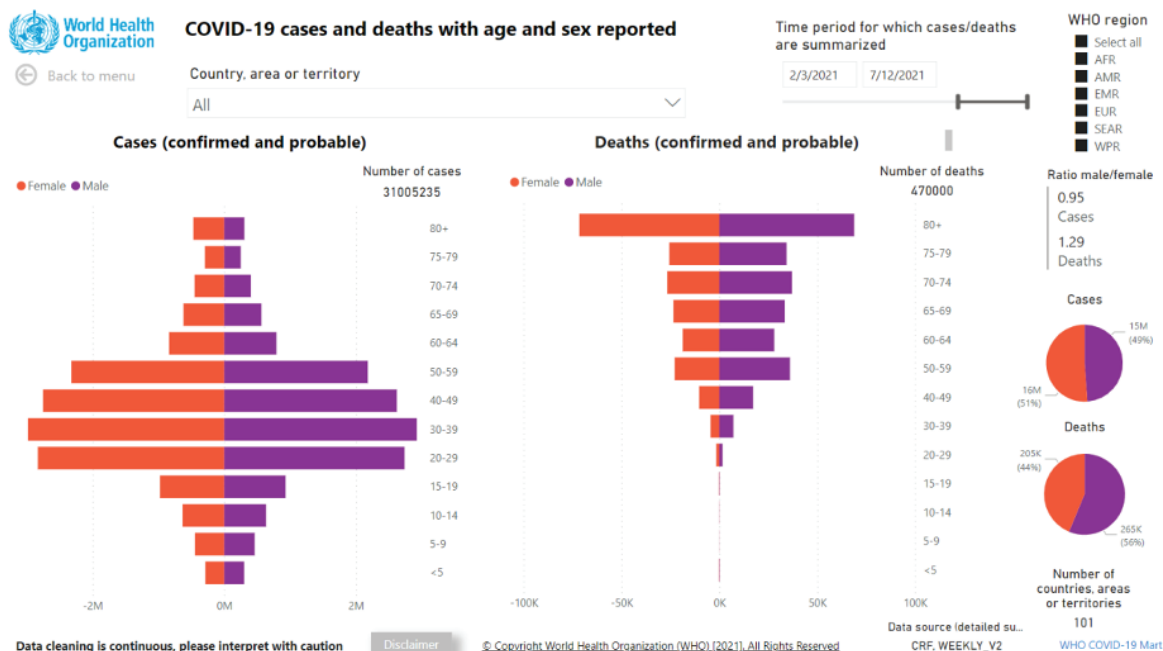
EVOLUTION

In addition to the daily epidemic situation update with the number of daily cases and deaths, the dashboard has evolved according to the progress and the phases of the outbreak, reflecting the most relevant information for our internal and external audiences, including the latest vaccination status, detailed surveillance data, the public health and social measures in place, and analytic tools for data interpretation.

Besides the Dashboard, countries are implementing a package of measures, calibrated to the local context and epidemiology of the disease. These include individual, environmental, social and physical distancing, surveillance and response, movement and travel measures. For more information, WHO has produced the following *Overview of Public Health and Social Measures in the context of COVID-19*.

REPORTING

Global COVID-19 case and death data are compiled through WHO regional offices' daily reporting. The counts are primarily based upon the WHO case definitions. Beside the daily count of confirmed cases and deaths of COVID-19, WHO requested all Members States to report a minimal set of information on the cases and deaths reported: age, sex, hospitalization, testing data and cases and deaths among health and care workers. Further, vaccination data are pooled from numerous sources, including direct reports from Member States, WHO review of publicly available official data, or data collated and published by third-party sites such as Our World in Data.

OTHER DASHBOARDS

Other dashboards were also available with more specific and detailed information on different subjects including, but not limited to:

WHO COVID-19 Data Explorer with a focus on the dynamics of the epidemiological situation with analyzing indicators such as the reproduction number, laboratory testing, growth rates and trends in the infections.

WHO COVID-19 Detailed Surveillance Data dashboard provides insights into the more detailed epidemiological situation of COVID-19. Features include stratification by age and sex, trends over time, case fatality ratios by age, testing, hospitalization, and data on health workers both at the country and the regional levels. The dashboard allows users to conduct further analyses with a downloadable data set.

WHO EIOS News Map and Global COVID-19 Signal Dashboard aim to summarize and visualize relevant "signals" identified through event-based surveillance media monitoring activities to provide key context to interpret epidemiological trends.

B.   Recovery of COVID-19

WHO GIS Centre for Health: World Health Organization's advocacy for equitable and efficient distribution of COVID-19 vaccines through GIS digital microplanning

World Health Organization regional centers have been leveraging geospatial technologies for years. Since the onset of the pandemic in January of 2020, WHO regional offices have been deploying geo-enabled programs to ensure equitable access to COVID-19 responses, which has revolutionized vaccine distribution planning, monitoring, and evaluation as it provides a common operating framework to answer questions around equity, resource allocation and coverage.

Equitable distribution of COVID-19 vaccines can only be ensured with accurate geospatial data about populations, health catchment areas, and supply chains. There are many questions that can be answered with geospatial data and technologies, ranging from how many vaccines are needed to finding optimal routes for cold chain, to evaluating coverage. Without such data, we cannot ensure universal health coverage for the COVID-19 treatment or vaccine distribution. These data and digital tools also enable improved collaboration among stakeholders from community health workers to ministries of health to international organizations. To address the urgent need for improved stakeholder coordination, WHO has been working closely with countries to understand their information needs and ensure they have access to the right partners and technologies to equitably distribute vaccines.

Specifically, GIS digital microplanning is a health information system strengthening approach to better plan, target, monitor, and evaluate public health interventions. A digital microplan is a data-driven environment, based on spatial population, satellite imagery, and travel time estimation, to assess whether the given health care facilities and their associated catchments can serve the population and their sub-groups equitably. It gathers and utilizes layers of geospatial data to precisely locate health system capacities, populations in need, and how to connect the two, enabling equitable and efficient allocation of scarce resources. Digital microplanning can facilitate a wide range of activities such as vaccination campaigns, health facility stocking, public health distributions, and targeted communications. Such microplans are mission critical to ensuring the timely and equitable distribution of the COVID-19 vaccination for demarcating catchment areas that would be covered by each Covid-19 vaccination center.
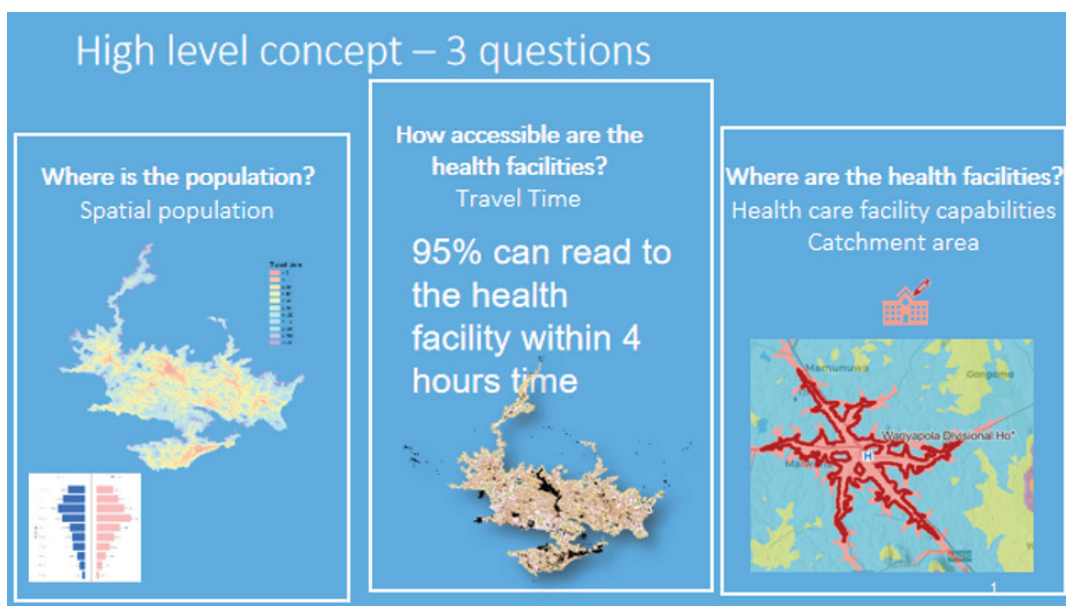
Once the vaccination arrives in a country, it needs to be stored and distributed to the vaccination centers. At this moment, it is crucial to quickly distribute the

Satellite imagery

Travel time

Spatial population

Health facilities

Catchment areas

vaccination to the right locations to effectively reach people in need. Each vaccination center has a catchment, an area, a region, or list of towns and villages that it serves. No one should be left out and placing vaccination centers where they are most effective ensures reasonable travel times to vaccination centers, essential for equitable access. This not only applies to existing facilities but will influence the planning of temporary and mobile vaccination centers as well.

As more vaccines become available, digital microplanning meets the dual goals of maximizing population coverage and allowing officials to prioritize high-needs groups and plan the subsequent distribution. Prioritized groups can be health care workers, an age group, people with preexisting conditions, essential workers, or other demographic groups. Public health officials can prioritize based on the specific context at the time and place, then use the platform to plan the rollout and monitor the progress. GIS and a data driven approach can help with the identification of the groups, but also with the equitable distribution of the vaccine through digital microplans.

High level concept – 3 questions

Where is the population?
Spatial population

How accessible are the health facilities?
Travel Time

95% can read to the health facility within 4 hours time

Where are the health facilities?
Health care facility capabilities
Catchment area

Why use digital microplanning?

» This approach identifies all settlements in each catchment area, ensuring that work plans for service delivery are based on accurate maps and account for all people.

» Using timely and comprehensive data sources like high resolution satellite imagery means that even the most remote or vulnerable populations are mapped.

» While most census data is outdated or incomplete, microplanning with satellite imagery is a more comprehensive planning tool and such imagery layers can be incorporated alongside other data to provide important context for delivery teams.

» Health system mapping reveals service coverage gaps and which communities and how many people are lacking access. In many cases, these maps also support more efficient resource distribution, including deploying mobile clinics where facilities are unavailable.

» Deploying these teams based on digital microplanning also fosters accountability and reduces risk of vulnerable populations being overlooked.

## WHO/UNICEF -led GIS working group

The WHO/UNICEF -led GIS working group has been established under the COVAX innovation working group, under the Access to COVID-19 Tools (ACT) Accelerator.

The GIS working group is a time-limited group of technical experts working at the intersection of geospatial data for vaccine delivery. The group works collectively on specific programmatic and technical deliverables that reflect a bottom-up approach, focusing on country needs to guide the community of geospatial partners. The GIS working group streamlines and coordinates geospatial service and data offerings for countries seeking such resources, for COVAX and their wider public health needs in the future, in order to reduce transaction costs of leveraging these technologies and enable equitable vaccine distribution.
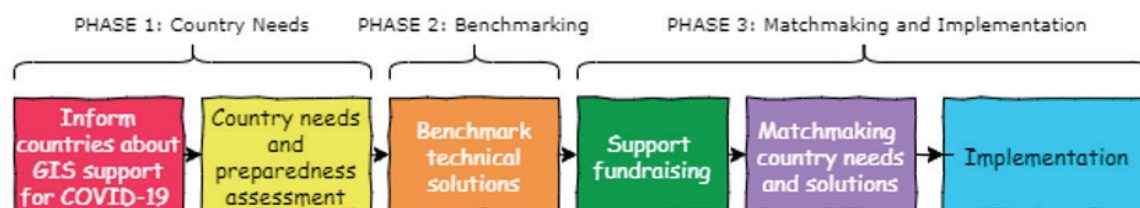
The working group is supporting countries in incorporating geospatial data and technology into their COVID-19 response and COVAX planning. Areas of support include:

» Answering questions on how to leverage existing funding mechanisms to jumpstart use of GIS

» Providing access to budget tools and guidance to include relevant geospatial data, solutions, and services in funding requests

» Offering consultations with technical experts to provide more information on the value of GIS for country needs and what things should be considered when deciding which data and technologies to use (e.g. relevant use cases, budget, licensing, scalability of these solutions, time to deliver, capacity development needs, etc.)

» Providing overviews of relevant technical partners and their offerings (data, tools, services, etc.), plus how to build out technical partnerships to maximize value from them.
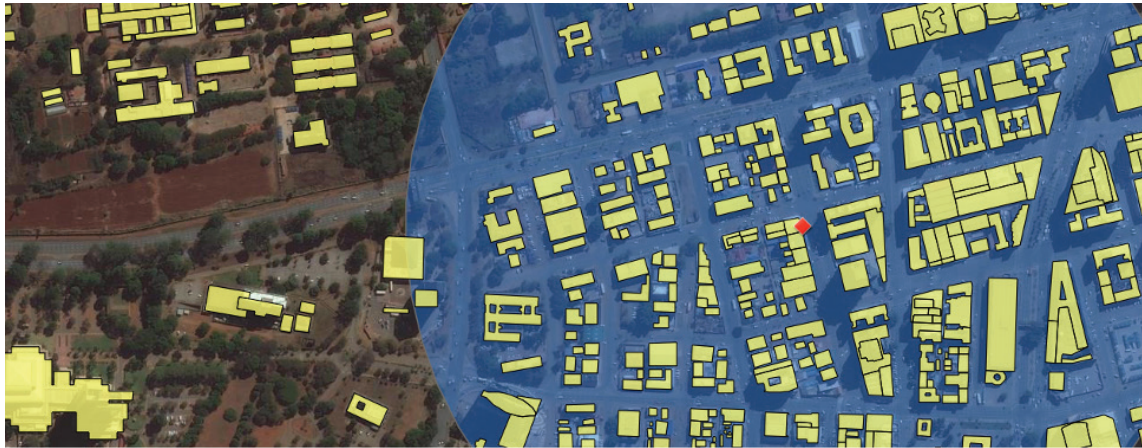
Case Study Digital Microplanning for COVID-19

The Rapid Response Team (RRT) in Zimbabwe first developed a web-based application and geotagged all positive cases, probable cases, and contacts using *Open Data Kit* linkage to the AFRO-GIS center based in Brazzaville.

The RRT then analyzed these points by drawing a 500-meter buffer around each positive case. This method would tell the team which households needed COVID-19 surveillance. Using building footprints with high resolution satellite imagery, the team was able to identify, visit, and screen every household within a 500-meter buffer around each positive case of COVID-19.

People in households with COVID-19 symptoms were then swabbed for coronavirus. These data were reported to AFRO and used for epidemiological analysis.

Ready to learn how you can work with WHO to accelerate your vaccine program and ensure no one is left behind?

Reach out to *gissupport@who.int* to learn more about the cutting-edge geospatial technologies enabling the digital microplan era.

UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION (UNESCO)

Interactive map for global monitoring of school closures caused by COVID

Since the outbreak of the global COVID-19 pandemic, UNESCO has been collecting and disseminating information on school closures and vaccination of teachers at the national and sub-national levels, to track the number of learners that were affected by the COVID-19 crisis. Through this dynamic dashboard, the global educational community and its partners are able to follow live the impact of the pandemic on learners.

UNESCO and its partner CSF have developed a "vaccination module" for its education management information system, OpenEMIS. The module allows for spatialized analysis of the vaccination coverage amongst educational staff and learners.

Furthermore, UNESCO has created spatialized school-age population estimates at the micro level to better assess the location of children and youth (in school and out of school) that were affected by school-closures.

Application

Education is a fundamental human right. The interactive map's main purpose is to quantify the scale of the unprecedented disruption in education caused by COVID-19, which has impacted more than 90% of the student population.The data have been used by UNESCO and partners in their response to the COVID-19 crisis. For example, the World Food Programme was able to quickly estimate the number of children for which their school feeding programmes were impacted by the crisis. The data has also encouraged partners to come together through the UNESCO-led Global Education Coalition for COVID-19 and collaborate on a range of activities, including advocating for the safe reopening of schools. The data allow for a better estimate of potential learning loss caused by lengthy school closures. The data have been widely cited in the media, and provide the most up to date and timely information on the status of schools.

Main objective

The interactive map monitors the status of educational institutions around the world on a daily basis since the beginning of the COVID-19 pandemic in February 2020. It estimates the number of students who have been impacted by these closures
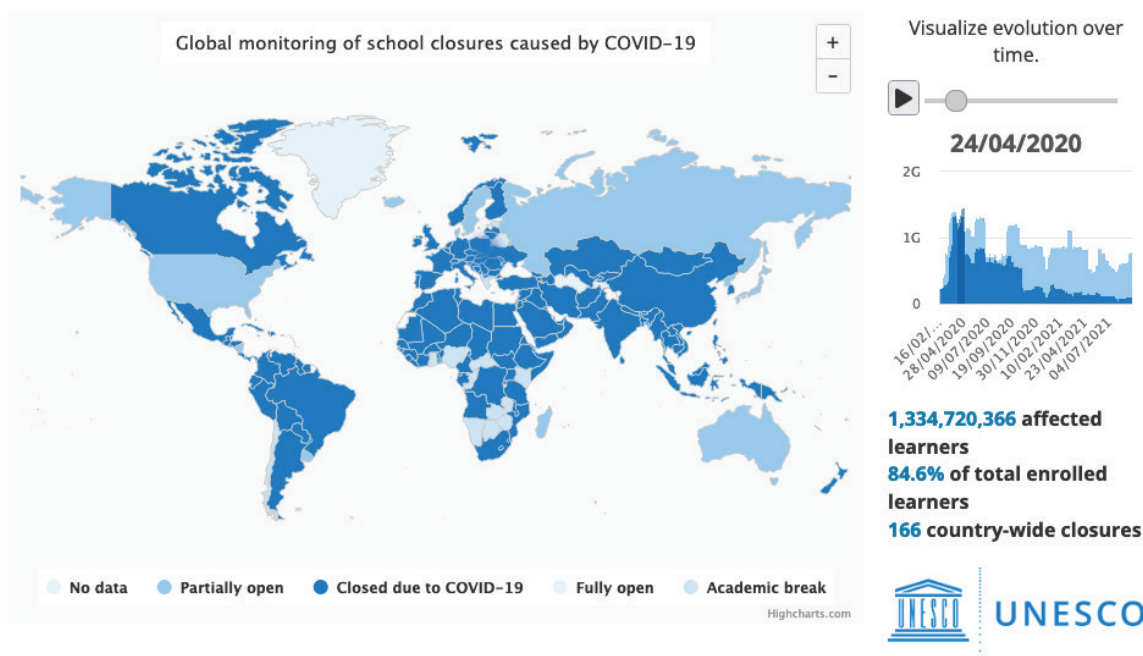
Partners

United Nations Educational, Scientific and Cultural Organization (UNESCO).

Sustainability

The map is updated on a weekly basis. A working group across UNESCO entities at Headquarters and in the Field Offices work together to update the data based on the most recent available information. Through this network, UNESCO is better able to monitor government responses to school closures.

Data

The interactive map was developed by colleagues across UNESCO entities using information provided by its wide network, its Permanent Delegations and National Commissions, as well as official sources such as Ministry of Education websites. Estimates are based on the enrollment data from the UNESCO Institute for Statistics database. The data is available publically, and estimates for number of students impacted is available by level of education and by sex. *https://en.unesco.org/covid19/educationresponse*

Global monitoring of school closures caused by COVID-19

Visualize evolution over time.

24/04/2020

1,334,720,366 **affected learners**
84.6% **of total enrolled learners**
166 **country-wide closures**

No data   Partially open   Closed due to COVID-19   Fully open   Academic break

Highcharts.com

UNESCO

UNITED NATIONS INSTITUTE FOR TRAINING AND RESEARCH (UNITAR)

United Nations Satellite Centre (UNOSAT) supporting COVID-19 preparedness work using geospatial information technology.

Application

Geospatial information technology (GIT) including satellite imagery analysis and data visualization plays a vital role in understanding the geographic extent and severity of disaster events. The ability of national and regional authorities as well as disaster management experts to seamlessly collect, integrate, analyze geospatial information in a comprehensible and easy to use format is key to effectively prepare for, respond to and recover from any disaster, including pandemics.

The provision of technical backstopping activities to the national and regional authorities helps strengthen an evidence-based decision-making process. In the Solomon Islands, the local authorities needed support to monitor the quarantine stations over the archipelago in October 2020. The geospatial dashboard produced by United Nations Satellite Centre (UNOSAT) allowed the visualization of the different stations on satellite imagery, and also integrated the provided data on the occupancy such as the number of active cases, nationality, gender, etc. per station. This interactive tool allowed the authorities in charge to have a daily-updated comprehensive view of the situation, at both the national and local levels.

More recently, the Ministry of Environment, Climate Change, Disaster Management and Meteorology also requested support for their COVID-19 preparedness work. The satellite imagery provided helped anticipate and monitor transmission scenarios in the urban centers with daily boat commutes. These technical backstopping activities have been a much-lauded service that stakeholders have considered key in their daily activities. The provided data, tools, and information were used to support decision-making processes on numerous programmes and policies, including for COVID-19 monitoring and measure implementation.

Objective

Technical backstopping activities provided through the IPP CommonSensing aim to support the country authorities and regional stakeholders in strengthening their disaster management capacities and climate resilience. From simple maps, to modern web-maps, story maps, 3D visualisations, and Operations Dashboards, various products are made available to support informed decision making in partner countries.

Partners

UNOSAT, IPP CommonSensing consortium partners

INTERNATIONAL FUND FOR AGRICULTURAL DEVELOPMENT (IFAD), WORLD FOOD PROGRAMME (WFP) AND FOOD AND AGRICULTURE ORGANIZATION (FAO)

Overcoming COVID-19 and Conflict Constraints using GIS: Design of a Rural Development Project in Yemen

National partners: Government of Yemen, Yemen's Social Fund for Development (SFD) Co-funding: Least Developed Countries Fund (LDCF) of the Global Environment Facility (GEF)

Geospatial analysis made it possible to design a new rural development project in Yemen in a time when it was not possible to visit the country due to COVID-19 and security issues. Different geospatial datasets were combined to determine the social, environmental and climate vulnerabilities of 4,000 villages. This assessment identified intervention areas and preliminary intervention options of the Rural Livelihood Development Project (RLDP), an IFAD and GEF-funded project of USD 20 million aiming to improve the livelihoods of 26,000 poor households through increasing agricultural production and building resilience to climate change.

Yemen, one of the Arab world's poorest countries, has been devastated by a civil war since 2014. The conflict in Yemen had tremendous effects on the rural population who face destitution, acute food insecurity and extreme poverty. Due to the critical situation and in response to repeated government requests, IFAD agreed to provide USD 10 million to support poor rural households in Yemen. The Rural Livelihood Development Project (RLDP) aims to support 26,000 households or 175,000 people by strengthening communities, increasing agricultural production and building resilience to climate risks. The project is co-financed by the Global

Environment Facility (GEF) with an additional USD 10 million. The design of the project took place in March and April 2020, at the height of COVID-19. No travel could take place. International staff and experts had to design the project without visiting the field or meeting beneficiaries. The project design heavily relied on spatial data and earth observation analysis to identify the most vulnerable districts and villages for the project to intervene in and to come up with a prioritization of intervention options. The IFAD design team was supported by the FAO Country Office, Yemen's Social Fund for Development (SFD) and an experienced national consultant who had "ears on the ground". Geospatial analysis expertise was provided by WFP through the IFAD-WFP Joint Climate Analysis Partnership that has been supporting IFAD operations since 2014. The project aimed to operate in 15 to 20 districts. Three risk indices were calculated to help with their selection using the following spatial datasets:

»   Climate risk (rainfall variability and trend, dry-spell trend, max and min temperature trend);

»   Environmental risk (erosion, flooding and landslides);

»   Nutrition vulnerability (IPC Phase classification and Global Acute Malnutrition-GAM).

The risk indices were combined into a map showing priority districts (Figure 1). The selection of districts also considered population density, previous investments of IFAD, the current security situation, and the presence of other agency programmes. Having a long list of districts gives the project flexibility in case the security

situation changes and the focus has to be set on other districts. The final selection of districts was undertaken by the IFAD design team and the FAO country office. Geospatial analysis was also used to identify the appropriate climate resilient measures for over 4,000 villages. These were grouped into village units of around four villages or around 100,000 habitants. GIS analysis and maps (Figure 2) suggested where to promote small-scale irrigation schemes and flood-based agriculture in order to mitigate flash floods, and where the project should focus on soil and water conservation measures

to prevent soil erosion and landslides. The design of RLDP is an example for the collaboration between the Rome-based UN agencies to support member states: Finance and leadership came from IFAD, GIS and modelling expertise from WFP, and field knowledge and socio-economic datasets from FAO.
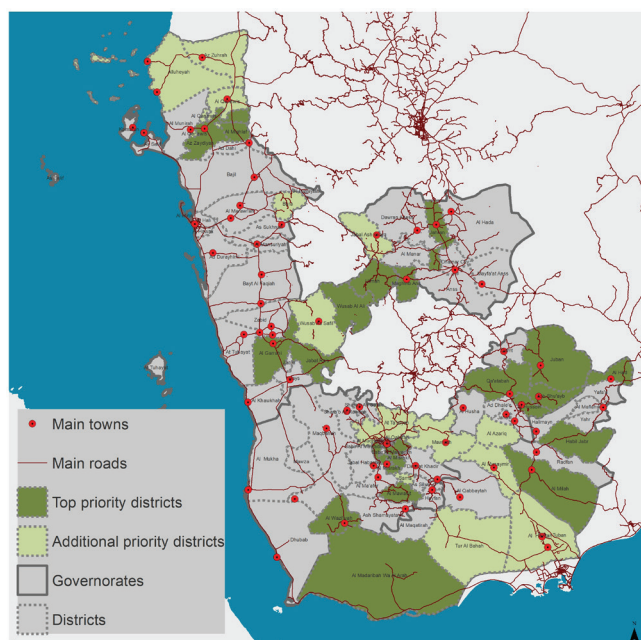

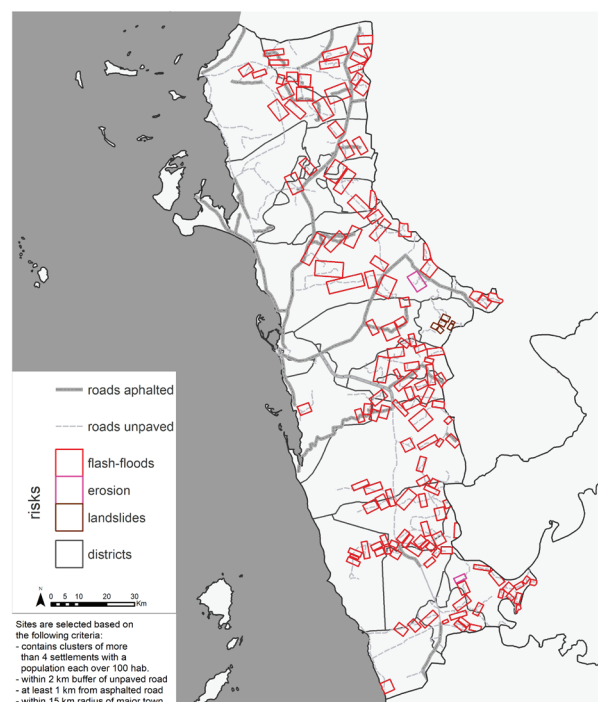**Figure 1:** *Priority districts of the Rural Livelihood Development Project (RLDP)*

Figure 2: *Response analysis for climate-resilient interventions*

INTERNATIONAL ORGANIZATION FOR MIGRATION (IOM)

Impact of COVID19 Mobility Restrictions on Human Mobility

Main objective

Inform decision makers and relevant actors on COVID-19 related mobility restrictions and its impact on migrants, Internally Displaced Persons (IDPs) and other mobile population to support addressing new and emerging challenges amid the pandemic. In particular, the data is critical in providing targeted response to address specific needs of vulnerable population who may have become stranded or whose challenging situation have been exacerbated due to COVID-19 travel restrictions and border closures.

Application

Utilize data from various primary and secondary sources to map and provide regular, up-to-date and comprehensive information on COVID-19 related mobility restrictions at different Points of Entry (POEs), including blue border crossing, land border crossing and airports. This consolidated database and its geospatial component supports the United Nations, governments, regional bodies and other relevant stakeholders to provide better understanding of the impacts of COVID-19 pandemic on human mobility.

More information on the application: *https://migration.iom.int*

Partners

United Nations agencies, organizations, and private sectors.

Sustainability

IOM's COVID-19 Mobility Impact work is supported by IOM's inter-departmental team working on COVID-19 response workstreams resourced through projects funded by various donors.

Data

» **IOM's information network at national, regional, and global levels;** provide direct account and information on COVID-19 impacts including on Points of Entry (POEs) data and up to date mobility restrictions information.

» **International Air Transport Association (IATA);** air travel restrictions data.

» **World Health Organization (WHO);** number of COVID-19 confirmed cases globally.

The current outbreak of COVID-19 has affected global mobility in complex and unprecedented ways in the form of various travel restrictions, suspension of air travel and border closures. To better understand this, the International Organization for Migration (IOM) has developed a global mobility spatial database to map these impacts on human mobility, across global, regional, and country levels. Furthermore, COVID-19 has had a disproportionate impact on vulnerable populations in camps and camp-like settings while also exacerbating the vulnerabilities of mobile populations who may become stranded due to COVID-19 related mobility restrictions. This data is particularly important in understanding the challenges migrants and mobile populations face which in turn can ensure targeted response when addressing their specific needs.

The IOM's COVID-19 Mobility Database and its geospatial component provide valuable information to a number of stakeholders, including humanitarian actors, civil society organizations, as well as the general population by disseminating up-to-date information about COVID-19 related mobility restrictions, exceptions to restrictions and conditions for authorised entry. Regular updates on the global changes in mobility restrictions are also intended to support IOM missions, partners and member states in targeted response planning and advocacy for vulnerable populations who may be affected by changes in global mobility.

The IOM's COVID-19 Mobility Database is managed by the Displacement Tracking Matrix (DTM) team, in collaboration and coordination with various thematic programming areas within the organization, through the following main activities:

COVID-19 International Travel Restriction Monitoring

This database and its geospatial component provide weekly reporting on the rapidly changing travel restrictions being imposed in response to the COVID-19 pandemic. This platform maps and analyses the different countries, territories or areas (C/T/A) that are imposing and receiving restrictions, exceptions as well as conditions for authorised entry. This analysis is developed by categorizing the different types of restriction into 14 categories, including whether it is a total or partial restriction on entry. This workstream uses secondary data sources such as the International Air Transport Association (IATA), media reports and direct information from IOM country missions.

To effectively visualize this, drawing on the data from the COVID-19 Air Travel Restriction Monitoring database, the DTM team has also developed an interactive *travel restriction matrix* to spatially visualize the current status of travel related measures that are imposed and received by all the country, territory or area simultaneously.
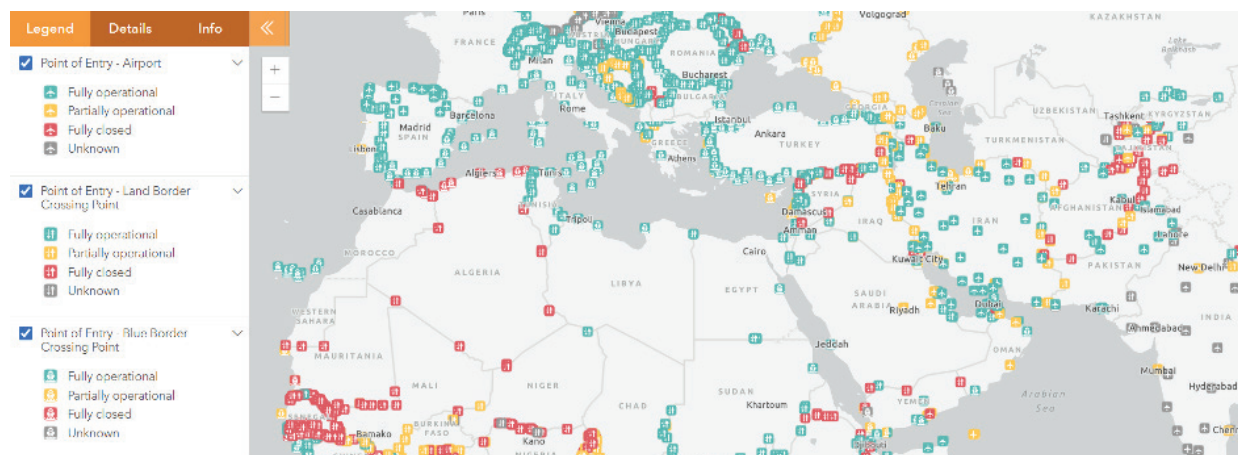
COVID-19 Mobility Restrictions Monitoring

IOM has developed a global mobility database mapping the locations and status of different *Points of Entry (PoE)*, globally. These include airports, land border crossing points (could be rail or road), blue border crossing points (sea, river or lake), internal transit points and areas of interest. For each point of entry, data is collected on the type of restriction, measures applied and the timeframe, as well as the population category that may be affected by the restrictive measures. This workstream uses direct input from IOM missions and this dashboard displays regularly updated mobility restrictions at location level.

Monitoring of Impact on IDPs, Migrants, and Migration Flows

To better understand how COVID-19 related mobility restrictions affect migrants and mobile populations, DTM is tracking information to provide a comprehensive overview of the different categories of mobile population groups in precarious situations through direct IOM country sources and extensive media searches.

UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP)

Technology / Prevention

The World Environment Situation Room (WESR) provides a *'Single-Entry Door to a UN Data and Knowledge Platform on Environment'* supporting data-driven analysis, decision making and policy development on environmental issues by UN actors, governments, academics, private sector, and the public actors. The WESR COVID-19 Dashboard was implemented as a *Rapid Response Function* for UNEP, to provide data, information, knowledge and rapid assessments on environmental and other priorities nexus (e.g. Coronavirus crisis), covering preparedness, response and recovery phases and towards *Building Back Better*. Relevant information is provided on the *Scientific assessment for policy-makers: Preventing the next pandemic* as well as the *Record global carbon dioxide concentrations despite COVID-19 crisis*, and further reports and booklets, policy information, fact sheets and infographics related to COVID-19 and building back better (*https://wesr.unep.org/*).

People

In West Asian countries, for example, lockdowns and mobility restrictions to curb the spread of the COVID-19 pandemic had both positive and negative impacts on the region's air and water quality and its natural environments. Containment measures to stem the spread of COVID-19 resulted in dramatic, albeit temporary, improvements in air quality, especially in the most polluted cities. However, poor and vulnerable populations sheltering at home have been increasingly exposed to indoor air pollution due to the increased burning of poor-quality fuels in homes.

A dramatic environmental impact of the COVID-19 pandemic has been the increase in the consumption and disposal of plastics, especially PPEs and single-use plastics. Until proven alternatives are found, plastics remain important in preventing the transmission of COVID-19, but their increased use, reduced recycling, and uncontrolled litter is undermining recent progress to sustainably manage plastics. The COVID-19 pandemic highlighted the importance of improving waste collection and management in West Asia.

The COVID-19 crisis offers countries in West Asia the opportunity to rebuild better during the post-pandemic period by embracing a green economic recovery with targeted stimulus packages to ensure nature-based solutions are implemented. The lessons learned about the benefits and risks of a global economic downturn will serve to inform leaders about how to reduce environmental degradation in a future crisis-free world and how to build back better.

Processes / Recovery

The COVID-19 pandemic has disrupted the global society in unprecedented ways and exposed many fragilities in our economies as well as deepened existing inequalities. Many governments and global governance institutions have responded to the reduction in global economic output with fiscal stimulus plans meant to mitigate the pandemic's economic and social impacts. While these short-term response strategies to peaks in infection and to control and mitigate the effects of future new infections are necessary and appropriate, the pandemic is also an opportunity to reimagine our socio-economic systems to strengthen resilience, innovation and cooperation – the mechanisms that are the foundation for building inclusive and equitable socio-economic systems resilient against future similar crises.

Given the multi-dimensional and complex effects of COVID-19, the development by UNEP with partners of comprehensive and integrated macroeconomic modeling frameworks that adequately represents the dynamics is essential for understanding the whole-of-society impacts of COVID-19 in the short and long term, and for designing coherent and cost efficient policy responses that mitigate the negative impacts increase resilience to future crises.

These data and systems modeling tools can examine whole-of-society impacts of the COVID-19 pandemic and allow policy makers and policy researchers to define and conduct foresight analysis and simulations of different future scenarios, assess their synergies, and find the best solutions within acceptable trade-offs. These models are particularly useful for testing the innovative policy proposals and can examine investments in climate adaptive infrastructure, renewable energy and energy efficiency, sustainable agriculture and food security, sustainable consumption and how these relate to human health and livelihoods, and post COVID-19 development.

UNITED NATIONS POPULATION FUND (UNFPA)

COVID-19 Population Vulnerability Dashboard

UNFPA, in collaboration with ESRI, developed the COVID-19 Population Vulnerability Dashboard (https://covid19-map.unfpa.org/). This interactive tool will provide public health workers, policy makers, and the general public with access to useful information on populations vulnerable to COVID-19 in order to target preparedness and response and to help save lives. The dashboard highlights vulnerable populations at the national and subnational levels, using data from the latest Integrated Public Use Microdata Series (IPUMS) census samples for 94 countries. It identifies populations at older ages, including those living alone, and includes risk factors for COVID-19 transmission such as residential density (household size and persons per room) and access to piped water and other amenities.

Daily updates on COVID-19 cases and deaths are embedded in the dashboard, as is global data on health sector readiness. This includes the density of available health care workers, hospital beds, and intensive care units (ICUs).

Mapping vulnerability for disaster preparedness and humanitarian response

Aligned with UNFPA's vision where countries are better prepared and more resilient to hazards and disasters and where people have their well-being, dignity, and safety ensured across development and humanitarian nexus. The UNFPA Country Office in Indonesia and Mozambique has been utilizing ArcGIS online as a key tool for advocacy purposes to address inequalities and vulnerabilities at subnational level through visualization. When two destructive cyclones hit Mozambique's Central and Northern provinces in March and April 2019, geospatial analysis of the 2017 Census data was used to provide figures of the number of people affected, infrastructures damaged and points of intervention. These estimates informed the UN Post-Disaster Needs Assessment (PDNA).

a. *Indonesia CO's work on mapping vulnerable population groups and programme updates*

b. *Mozambique CO's humanitarian dashboard*

Demographic Exploration for Climate Adaptation (DECA) tool

UNFPA worked together with Wolfram Solutions and developed an automated spatial analysis tool, named DECA - Demographic Exploration for Climate Adaptation. The tool can automatically integrate geospatial census, environmental data (e.g. flood risk, landslide, draught area, etc.), infrastructure data (e.g. schools, health facilities) and other spatial data. Results of the tool can identify the areas based on any two selected parameters, and show the priority areas for intervention/programme, for example, villages that have a high % of older people living in high risk of landslide zones. Along with the map results, statistical tables and figures will be generated. Examples of geospatial analytical functions embedded in the tool are, e.g. zonal statistics, vector-raster conversion, weighted average calculation, spatial autocorrelation and buffer zone generation. The purpose of the tool is for country governments who are not familiar with geospatial data and analysis to play with the data, and generate analytical results in a simpler and straightforward way. The tool is built for local climate change adaptation plans. The DECA tool can be online or offline. It received lots of demand from countries, however, one limitation of the tool is that it lacks the flexibility for users to upload their own data or revise the indicators. Any data or indicators updates need to be done by Wolfram, so it is not easy to scale up to more countries.

ACRONYMS

UNITED NATIONS ENTITIES

The term "entity" or "entities" refers to offices, departments, regional commissions, agencies, funds, programmes and related organizations of the United Nations system.

SECRETARIAT

DESA Department for Economic and Social Affairs

OCHA Office for the Coordination of Humanitarian Affairs

OICT Office of Information and Communications Technology

OLA Office of Legal Affairs

UNDRR United Nations Office for Disaster Risk Reduction

UNDSS United Nations Department of Safety and Security

UNODC United Nations Office on Drugs and Crime

UNOOSA United Nations Office for Outer Space Affairs

REGIONAL COMMISSIONS

ECA Economic Commission for Africa

ECE Economic Commission for Europe

ECLAC Economic Commission for Latin America & the Caribbean

ESCAP Economic & Social Commission for Asia and the Pacific

ESCWA Economic & Social Commission for Western Asia

FUNDS, PROGRAMMES & RESEARCH

UNDP United Nations Development Programme

UNEP United Nations Environment Programme

UNFPA United Nations Population Fund

UN Habitat United Nations Human Settlements Programme

UNICEF United Nations Children's Fund

WFP World Food Programme

UNITAR United Nations Institute for Training and Research

UNHCR United Nations High Commissioner for Refugees

UNOPS United Nations Office for Project Services

UN Women United Nations Entity for Gender Equality & the Empowerment of Women

SPECIALIZED AGENCIES

FAO Food and Agriculture Organization

ICAO International Civil Aviation Organization

IFAD International Fund for Agricultural Development

ILO International Labour Organization

ITU International Telecommunication Union

UNESCO United Nations Educational, Scientific and Cultural Organization

WHO World Health Organization

WMO World Meteorological Organization

World Bank World Bank Group

OTHER RELATED ORGANIZATIONS

IAEA International Atomic Energy Agency

IOM International Organization for Migration

ISA International Seabed Authority

UNCCD United Nations Convention to Combat Desertification

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UN GEOSPATIAL NETWORK

**UNITED NATIONS COMMITTEE OF EXPERTS ON
GLOBAL GEOSPATIAL INFORMATION MANAGEMENT**

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