# SEE A SUSTAINABLE

### FUTURE

How geospatial data can help you protect people, planet, and prosperity

1 Sarres



SEE ➤ BETTER PLACE

### Contents

Ι.	Introduction	3
	See a sustainable future	4
	Climate change in Africa	6
	What is geospatial information?	8
2.	Part one: Adapting to climate change	9
	Food security	10
	Disaster preparedness	14
	Environmental degradation	18
3.	Part two: Building a sustainable future	23
	Sustainable development	24
	Investing in your nation's geospatial maturity	25
	Reducing emissions	30
4.	Gain an advantage	33
	Build sustainable societies with geospatial information	35

This report is part of a series from Ordnance Survey to help you apply geospatial information to realise your nation's potential.

Read more at: os.uk/theysee

SEE YOUR NATION'S POTENTIAL

## INTRODUCTION



# See a sustainable future

Climate change is the greatest challenge that humanity will face in the 21st century. More extreme weather has the potential to impact every aspect of human life, and can exacerbate existing problems, increasing the chance of conflict and the pace of migration<sup>1</sup>.

Reducing greenhouse gas emissions, chiefly in the form of CO2, has become a focus for the international community, in the hope of keeping the global average temperature rise below 2 degrees above pre-industrial levels. Temperature rises above this are thought to trigger climate tipping points, causing irreversible and devastating change<sup>2</sup>.

The international community came together in 2016 to sign the Paris Agreement, which included emission reduction commitments referred to as Nationally Determined Contributions (NDCs). These are likely to be evaluated and renewed at COP26, the yearly UN climate change conference, hosted by the UK government in Scotland in 2021.

Climate change is a geographic problem, and solving it takes a geographic solution<sup>3</sup>, which is why geospatial technologies are an important tool, providing us with the ability to monitor and manage environmental changes, and implement more sustainable industry and agriculture.

Thanks to the advancement of geospatial technologies, it is now faster, easier, and more cost effective than ever before to

harness location data in the fight against climate change, and build your nation's geospatial capabilities.

Investing in your nation's geospatial capabilities enables you to:

- Understand how climate change impacts different sectors and regions in your country and make informed decisions to mitigate the impacts
- Make smart investments that maximise environmental benefit
- Demonstrate the results of those decisions to citizens and investors

These powerful technological interventions, when grounded in good governance and collaboration, can protect people, planet and prosperity, building a sustainable world for future generations.



I https://www.undp.org/2030-agenda-for-sustainable-development/peace/conflict-prevention/climate-security



<sup>2.</sup> https://climate.nasa.gov/news/2865/a-degree-of-concern-why-global-temperatures-matter/

 $<sup>\</sup>label{eq:linear} 3. https://www.esri.com/content/dam/esrisites/sitecore-archive/Files/Pdfs/library/bestpractices/climate-change.pdf \label{eq:linear}$ 

Working with an established mapping agency like Ordnance Survey to invest in your nation's geospatial capabilities can give your nation the edge in reducing emissions and making progress in sustainable development, while building sovereign geospatial data expertise.

Consider a geospatial maturity assessment provided by Ordnance Survey to identify how you can upgrade your geospatial ecosystem, boost sustainable development, manage climate-related risks and lower emissions.





# Climate change in Africa

African countries face unique challenges when it comes to climate change. While African nations are responsible for only 4% of global carbon emissions<sup>4</sup>, the continent is experiencing the worst impacts of climate change<sup>5</sup>. Climate change also acts as a risk multiplier, increasing the chance of local and regional conflict by putting pressure on resources, land use, and job security<sup>6</sup>,<sup>7</sup>.

Extreme weather events, drought and famine, deforestation and desertification are all pressing climate issues that impact African nations in unique ways. Extreme weather and flooding is likely to become more common as the 21st century progresses – 2019's Cyclone Idai displaced thousands, put pressure on food security, and caused death and destruction across southern Africa.

Addressing the climate emergency will involve both adaptation and mitigation. While South Africa is the only African country to have committed a 'Net Zero' pledge to law, many African countries have ambitious NDCs which include substantial emissions reductions by 2030. For example, Zambia has committed to reduce emissions by 25%<sup>8</sup>, Ghana has committed to reduce emissions by I5%<sup>9</sup>, and Ethiopia has agreed to reduce emissions by up to 53%<sup>10</sup>. Building

- 4. https://www.sipri.org/sites/default/files/2020-05/pb\_2005\_au\_climate.pdf 5. https://www.bbc.co.uk/news/world-africa-50726701
- 6. https://dppa.un.org/en/addressing-impact-of-climate-change-peace-and-security
- 7. https://www.sipri.org/sites/default/files/2020-05/pb\_2005\_au\_climate.pdf
- 8. https://www.climatewatchdata.org/countries/ZMB
- 9. https://www.climatewatchdata.org/countries/GHA
- 10. https://www.climatewatchdata.org/countries/ETH



a climate-resilient green economy is also a strategic pillar of Ethiopia's Pathway to Prosperity economic blueprint<sup>II</sup>.

While many countries in the world are experiencing population decline, many African nations are seeing some of the fastest population growth in the world as their development and urbanisation gathers pace<sup>12</sup>. This presents particular challenges for African countries for honoring NDCs and lowering emissions, as they must attempt to decrease emissions while their demands for resources increase.

This means that instead of treading the same technological path as the biggest carbon emitting countries, African countries have the opportunity to develop more sustainably, a process described as 'leapfrogging'<sup>13</sup>. The UN's 2030 Agenda including the Sustainable Development Goals (SDGs) provide a framework for development that takes into account environmental and sustainability issues, providing African countries with a viable route to a sustainable future. Geospatial data plays a particularly important role in implementing the SDGs and measuring progress against them<sup>14</sup>, helping to model the environmental impact of infrastructure projects and inform decision making<sup>15</sup>.

Environmental degradation, including desertification and deforestation, is happening at a startling pace in Africa, and geospatial data is a vital tool for monitoring, predicting, and preventing it. The Department of Rural Economy and Agriculture (DREA) of the African Union has identified enhancing access to environmental information, including Earth observation data, as a priority in its environmental agenda<sup>16</sup>. The need for accurate and up-to-data data in addressing climate change in Africa is also acknowledged by the UN<sup>17</sup> and the World Meteorological Association<sup>18</sup>.

Due to technological innovation, it is easier than ever before to maximise the value of location data and build your geospatial capabilities. Geospatial innovation is accelerating at great speed, and it is now possible to build a digital base map in a fraction of the time and for a fraction of the cost of mapping efforts in the 20th century.

Part one of this report looks at how geospatial information can help you adapt to the impacts of a changing climate. We'll explore how tools can help you predict the impact of climate change on specific regions, sectors and resources, prepare for and mitigate disasters, as well as respond and recover quickly. Part one will also show you how technology can improve your view of desertification and deforestation, and inform decisions to protect natural habitats and ecosystems.

In part two of this report, we focus on the opportunities for African nations to build a sustainable future. From cutting air pollution to decarbonising transport, we will show you how geospatial tools can be applied to reducing emissions, and building a green economy. We will also look at how geospatial tools underpin the delivery of the SDGs, crucial in directing resources to address the world's greatest challenges.



II. https://europa.eu/capacity4dev/file/109230/download?token=rxippQKh

<sup>12.</sup> https://www.cfr.org/blog/africa-fastest-urbanizing-place-planet

<sup>13.</sup> https://openknowledge.worldbank.org/handle/10986/34098

<sup>14.</sup> https://sustainabledevelopment.un.org/topics/informationforintegrateddecision-making/geospatialinformation

<sup>15.</sup> https://www.costain.com/news/comment-and-opinion/how-can-infrastructure-do-more-to-boost-biodiversity/

<sup>16.</sup> https://au.int/en/directorates/sustainable-environment

<sup>17.</sup> https://unfccc.int/news/climate-change-is-an-increasing-threat-to-africa

<sup>18.</sup> https://library.wmo.int/doc\_num.php?explnum\_id=10421

# What is geospatial information?

'Geospatial information', also referred to as 'geospatial data', or 'location data', is information about location. Geographers and cartographers have worked with geospatial information for centuries, plotting maps and charts to represent the world around us.

In the 21<sup>st</sup> century, digital geospatial information is generated constantly, from locations derived from our mobile phones, to remote sensing of the Earth's surface from space, to global navigation satellite systems (GNSS) like GPS.

Geospatial information serves an important role in linking different data sets that would be otherwise unconnected, through their shared location and place. A Spatially Enabled Society is one that benefits from a wide array of spatial data and services<sup>19</sup>. Enhancing and linking other data-driven initiatives, geospatial information is a critical enabler for nations seeking to grow their economies, drive sustainable development, support evidence-based decision making and policy setting, and enable new and innovative uses of government data to solve problems and provide new services.

Every country is at a different stage of their approach to managing geospatial information. 'Geospatial maturity' is a term used to describe the level of sophistication that a country has in its ability to collect, manage, and exploit geospatial information for the benefit of the nation. A geospatial maturity assessment is a tool that can help organisations objectively understand how mature their geospatial capabilities are.

19. https://www.fig.net/resources/publications/figpub/pub58/figpub58.pdf



The global market in geospatial information is measured in billions of US Dollars, and is set to increase.





### PART ONE: ADAPTING TO CLIMATE CHANGE



### What is food security?

'Food security exists when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life.' – Food and Agriculture Agency of the United Nations (FAO)<sup>20</sup>

### Food security

One of the biggest challenges that climate change poses is its potential to disrupt agriculture and threaten food security. This is especially true in sub-Saharan Africa, where smallholder farmers account for 60% of the population, and almost a quarter of GDP comes from agriculture<sup>21</sup>. With 96% of African agriculture dependent on rainfall and 50% of fisheries related jobs estimated to be lost by 2050, climate change poses a very serious threat to livelihoods in Africa<sup>22</sup>.

At the same time as the climate emergency, Africa is experiencing a population explosion. Sub-Saharan Africa's population is growing at 2.7% a year, which is more than twice as fast as South Asia and Latin America<sup>23</sup>. Given current rates, Africa's population is set to double by 2050<sup>24</sup>, and the population of sub-Saharan Africa in particular is expected to triple in size to more than three billion people by 2100<sup>25</sup>.

- 20. http://www.fao.org/fileadmin/templates/faoitaly/documents/pdf/pdf\_Food\_Security\_Cocept\_Note.pdf
- 21. https://www.mckinsey.com/industries/agriculture/our-insights/winning-in-africas-agricultural-market
- 22. https://www.nepad.org/news/africa-presents-common-position-climate-change-negotiations
- 23. https://www.economist.com/special-report/2020/03/26/africas-population-will-double-by-2050
- 24. https://www.economist.com/special-report/2020/03/26/africas-population-will-double-by-2050
- 25. https://www.bbc.co.uk/news/world-53424726





This means food production in Africa needs to dramatically increase while the conditions for growing that food are becoming more unpredictable. Geospatial data, tools, and techniques have an important role to play in ensuring food security. Geographic Information Systems (GIS) in agriculture can help farmers to achieve increased production and reduced costs by enabling better management of land resources<sup>26</sup>.

New technology is helping to usher in a new era of farming known as precision agriculture. Geospatial data and software underpins precision agriculture, which is highly dependent on digital maps and Global Navigation Satellite Systems (GNSS) like GPS.

GIS software can help you visualise and understand how different variables, like soil type, wind direction, and rainfall are affecting your yield, and provide analysis on how to increase it. Using sensors, drones, and software analysis, farmers are increasing their yields by harnessing highly accurate geospatial data to be more precise with their interventions. Precision agriculture, underpinned by GIS, can help you to:

- Increase crop yield by 11%
- Reduce herbicide by 15%
- Reduce fossil fuel usage by 16%
- Reduce water usage by 21%<sup>27</sup>

Climate-related risks, including increased extreme weather events, are also a great threat to food security as they can increase the risk of crop failure. Extreme weather events like heat waves, floods, and intense rain are increasing in intensity, frequency and severity across many parts of Africa due to climate change<sup>28</sup>.

Geospatial tools can help your nation to manage this increased risk and predict crop failure and drought. Digital basemaps can now be built quickly and cheaply using automation and satellite imagery, with Earth observation data collected over many years providing information on land use, water availability, and soil type to give you analytic and predictive power to boost your food security.

28. https://www.downtoearth.org.in/news/africa/extreme-weather-events-increasing-in-intensity-in-africa-greenpeace-report-74184



<sup>26.</sup> https://www.geospatialworld.net/blogs/gis-in-agriculture/

 $<sup>27. \</sup> https://www.croplife.com/precision/study-shows-precision-agriculture-improves-environmental-stewardship-while-increasing-yields/states$ 

#### The Africa Regional Data Cube

The Africa Regional Data Cube (ARDC) is a tool harnessing the latest Earth observation data and satellite technology to help Ghana, Kenya, Sierra Leone, Senegal, and Tanzania address various issues relating to agriculture, food security, deforestation, urbanisation, water access, and more.

Earth observation data and satellite imagery can promote food security to help end hunger. Data cubes such as the ARDC can also play a critical role in supporting refugees, internally displaced peoples, and people living in fragile or conflict-affected states.<sup>29</sup>

In Senegal, where large pastoralist communities rely on agricultural production and crop yields for survival, climate change and other external forces are threatening their livelihoods. The ARDC can improve monitoring of vegetation cover, and can also detect change, comparing vegetation over time while balancing for seasonal variation.<sup>30</sup> The ARDC is an illustration of what is possible when partnerships, data, and innovation are leveraged to power progress toward the SDGs. It was developed by the Committee on Earth Observation Satellites (CEOS) in partnership with the Group on Earth Observations, Amazon Web Services, Office of the Deputy President – Kenya, Strathmore University, and the Global Partnership for Sustainable Development Data<sup>31</sup>.

The ARDC is based on the Open Data Cube (ODC) infrastructure, which has been successfully demonstrated in Australia, Switzerland, and Colombia and is under development or evaluation by more than 35 other countries<sup>32</sup>.

 $29. \ https://www.data4sdgs.org/initiatives/africa-regional-data-cube$ 

- 30. https://www.data4sdgs.org/news/africa-regional-data-cube-harnessing-satellites-sdg-progress
- 31. https://unfoundation.org/blog/post/the-africa-regional-data-cube-harnessing-satellites-for-sdg-progress/
- 32. https://opendatacube.org/







CASE STUDY

#### Anticipating food shortages

Political instability, conflict, droughts, and disasters can threaten food security in any country at any time.

Monitoring conditions and distributing aid in the Horn of Africa presents a huge logistical challenge. Crop analysis and early warning tools developed by the Group on Earth Observations<sup>33</sup> uses remote sensing and geolocation information to offer predictive solutions. The Group on Earth Observations Global Agricultural Monitoring Initiative (GEOGLAM)<sup>34</sup> uses satellite observation to produce warnings that indicate regions that could face food shortages.

They also allowed for these countries to plan food provision during Cyclone Idai in 2019<sup>35</sup>. GEOGLAM is an example of how geospatial information can be harnessed to improve food security, and predict and plan for food shortages when they occur.<sup>36</sup>

- 33. https://www.earthobservations.org/index.php
- 34. https://cropmonitor.org/
- 35. https://earthobservatory.nasa.gov/images/89735/food-shortages-in-the-greater-horn-of-africa
- 36. http://earthobservations.org/geoglam.php



# Disaster preparedness

FEMA saw \$1.3 billion\* in benefits from modernising its flood mapping programme

Managing crises – from pandemics to armed conflict to disasters – requires a rapid, efficient, and coordinated response. Geospatial information is vital for informing effective disaster planning, improving early detection and responding quickly to crises. Investing in creating a digital base map builds a powerful foundation for managing risk in your nation.

According to the World Bank, while Africa has contributed the least to climate change, the continent may well bear the brunt of its most devastating impacts<sup>37</sup>. There is a growing body of evidence that climate change is causing more frequent and more extreme weather events. Floods, hurricanes and drought are expected to become more frequent and more extreme as we progress through the 21st century, and there is evidence that this has already begun<sup>38</sup>. Planning for extreme weather events and other disasters like tsunamis, volcanic eruptions, and landslides has never been more important.

The disaster management cycle is the process by which governments, businesses, and civil society plan for and reduce the impact of disasters, react during and immediately following a disaster, and take steps to recover after a disaster has occurred<sup>39</sup>. The four recurrent steps in the disaster cycle are prevention, preparedness, response, and recovery. Geospatial tools are used extensively in every step of the disaster cycle<sup>40</sup>.

For example, GIS software helps forecast the impact of imminent disasters, and the World Food Programme (WFP) uses GIS to understand vulnerabilities among populations living in areas prone to disasters<sup>41</sup>.



<sup>37.</sup> https://openknowledge.worldbank.org/bitstream/handle/10986/34098/34098.pdf?sequence=25&isAllowed=y

<sup>38.</sup> https://www.carbonbrief.org/mapped-how-climate-change-affects-extreme-weather-around-the-world

<sup>39.</sup> https://www.gdrc.org/uem/disasters/I-dm\_cycle.html

<sup>40.</sup> https://www.esri.com/about/newsroom/arcnews/gis-supports-wfps-food-security-program/

<sup>41.</sup> https://www.esri.com/about/newsroom/arcnews/gis-supports-wfps-food-security-program/

<sup>\* \$</sup> references throughout this report are USD.

Geospatial tools, powered by Earth observation data, are very effective in managing disaster risk in Africa. Rapid urbanisation, informal settlements that are unmapped, and land degradation create a situation where human populations are at great risk of flooding and other disasters in many African nations.

The Africa Regional Data Cube (ARDC) is helping countries better prepare for flooding by providing high-resolution, a real time bird's eye view of informal settlements as they build and grow. The data provided by the ARDC means policymakers can work to map and register settlements to improve planning and resource distribution, allowing these nations to effectively plan for crises. Governments use the ARDC to monitor land degradation over time as a preventative measure, and eventually develop stronger early warning systems for flooding<sup>42</sup>. Investing in the creation of a digital basemap can help your country build its sovereign data capabilities, giving your nation greater resilience and independence.

Nations around the world rely on geospatial data to bolster their disaster preparedness. The US Federal Emergency Management Agency (FEMA) saw \$1.3 billion in benefits from modernising its flood mapping programme<sup>43</sup>, a cost benefit ratio of 1.7. In the UK, police, fire and ambulance services, local authorities, government agencies, and armed forces rely on Ordnance Survey Mapping for Emergencies data for disaster preparedness<sup>44</sup>. Ordnance Survey data is also the basis of a specialised app built by Esri, an international supplier of GIS software, that helps to protect the city of York from flooding<sup>45</sup>.

Geospatial data in the form of cadastral base maps and addressing are vital when it comes to rebuilding after hurricanes and floods<sup>46</sup>.

Geospatial data is a powerful tool for tracking infectious disease, and data dashboards built using GIS are essential for nations to manage their Covid-19 response<sup>47</sup>. Disease mapping helped turn the tide on the Ebola outbreak of the 2010s<sup>48</sup>, and helped Nigeria eradicate polio in 2020<sup>49</sup>, <sup>50</sup>.

Investing in the creation of a digital base map can help you make the right investments to reduce the risks of disaster, protect your citizens, and improve the resilience of your nation.



- 42. https://www.data4sdgs.org/news/africa-regional-data-cube-harnessing-satellites-sdg-progress
- 43. https://www.nap.edu/read/I2573/chapter/8#82
- 44. https://www.ordnancesurvey.co.uk/contact-us/mapping-for-emergencies
- 45. https://www.ordnancesurvey.co.uk/business-government/products/case-studies/york-flooding
- 46. https://www.esri.com/news/arcwatch/0310/feature.html
- 47. https://coronavirus.jhu.edu/map.html
- 48. https://www.who.int/csr/disease/ebola/maps/en/
- 49. https://www.gavi.org/vaccineswork/how-geospatial-technology-helping-nigerias-covid-19-vaccine-roll-out
- 50. https://www.bbc.co.uk/news/world-africa-53887947



#### SERVIR flood modelling

Floods pose a major threat to life, property and food security in Africa. To mitigate this problem, development organisation SERVIR has provided a flood modeling tool called CREST to several eastern African countries

CREST integrates satellite rainfall information with geospatial data about land shape, elevation, soil characteristics, and other variables to model evaporation, transpiration, soil moisture, and streamflow – factors that influence likelihood of flooding in specific basins in Eastern Africa. This enables endusers to visualise the modeled information in the form of graphs and high-resolution maps. Using this tool, end-users can readily assess imminent and near-term likelihood of flooding at selected locations.<sup>51</sup>

SERVIR is a joint development initiative of NASA and USAID that works in partnership with leading regional organisations worldwide to help countries use information provided by Earth observing satellites and geospatial technologies for managing climate risks and land use.<sup>52</sup>

51. https://servirglobal.net/Global/Articles/Article/1473/servir-expands-flood-modeling-tools-to-more-african-countries

52. https://servirglobal.net/about-servir





#### CASE STUDY

#### Landslide prediction

In 2019, during the monsoon season in Bangladesh, 26 landslides in Rohingya refugee camps killed one person and left more than 4,500 without shelter.

Now camp managers have access to maps and a daily-updated website that provides near real-time data on land use, rainfall and elevation, using data provided by NASA and Columbia University's International Research Institute for Climate and Society (IRI)<sup>53</sup>.

The maps allow them to make better predictions about where landslides might occur, allowing them to take preventative measures.



53. https://blogs.ei.columbia.edu/2019/11/22/landslide-risk-rohingya-refugee-camps/





### Environmental degradation

Geospatial tools are essential for measuring and tracking degradation to the natural environment. Satellite imagery from Earth observation, combined with GIS are powerful tools for monitoring biodiversity, deforestation, desertification, and pollution build up over time<sup>55</sup>. This information can be used to inform policy to reverse environmental destruction, safeguard resources, and protect ecosystems. Since 1993, an international agreement on biodiversity, known as the UN's Convention on Biological Diversity (UN CBD), has been a policy driver behind tackling biodiversity loss.<sup>56</sup>

Forests sequester carbon by capturing carbon dioxide from the atmosphere and

transforming it into biomass through photosynthesis. The total amount of carbon that is stored in Europe's forests is thought to be several times higher than its yearly emissions, highlighting forests' vital role in controlling atmospheric carbon<sup>57</sup>.

Africa's rainforests are also more resilient as carbon sinks than those elsewhere, even when exposed to high temperatures. African forests continue to remove carbon dioxide from the atmosphere, despite experiencing drought and a warming of 0.92 degrees Celsius. Similar conditions in rainforests in the Amazon and Southeast Asia have led to a temporary halting or reversal of carbon dioxide absorption <sup>58</sup>.

57. https://unece.org/forests/carbon-sinks-and-sequestration



<sup>54.</sup> https://environmentalassessmentandgis.wordpress.com/2012/05/12/the-use-of-gis-technology-to-prevent-deforestation-2/

<sup>55.</sup> https://www.ordnancesurvey.co.uk/newsroom/insights/major-brands-using-eyes-in-the-sky-to-combat-deforestation-ne

<sup>56.</sup> https://www.cbd.int/convention/

<sup>58.</sup> https://www.weforum.org/agenda/2021/05/african-rainforests-slow-climate-change-el-nino-asia-amazon-research/

Deforestation is a major threat to the environment – 25% of all global greenhouse gas emissions come from deforestation and other land-use changes<sup>59</sup>. Emissions from tropical deforestation are equal to the emissions from the whole of the EU, and monitoring and preventing deforestation is one of the most effective ways to cut carbon emissions and mitigate climate change<sup>60</sup>. GIS monitoring can reduce deforestation by II%.<sup>61</sup>

According to the UN Food and Agriculture Organisation (FAO), indigenous (also known as 'old-growth') forests in Africa are being cut down at a rate of more than 4 million hectares per year — twice the world's deforestation average. According to the FAO, losses totalled more than 10% of the continent's total forest cover between 1980 and 1995 alone<sup>62</sup>.

Earth observation is vital for monitoring and preventing deforestation. In 2020, a satellite dataset on the world's tropical forests was made available, enabling users to track deforestation over time for free<sup>63</sup>. The Norwegian government is funding the project through its International Climate and Forests Initiative (NICFI)<sup>64</sup>, with the data being provided by US firm Planet.

With global industries like palm oil production incentivising deforestation, geospatial data and tools can help commercial organisations to show that they are taking steps to ensure that their supply chains are not contributing to the problem<sup>65</sup>.

Community land rights are essential to both slowing deforestation and capturing carbon. Developing basic geospatial tools, including cadastral base maps that define property boundaries, is the first step towards provision of land rights and establishing tenure for your citizens, which can help protect your nation's forests and their valuable role in carbon capture and storage.

- 59. https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data
- 60. http://mudancasclimaticas.cptec.inpe.br/~rmclima/pdfs/destaques/sternreview\_report\_complete.pdf
- 61. https://environmentalassessmentandgis.wordpress.com/2012/05/12/the-use-of-gis-technology-to-prevent-deforestation-2/
- 62. https://www.un.org/africarenewal/magazine/january-2008/saving-africaE28099s-forests-E28098lungs-worldE28099
- 63. https://www.planet.com/nicfi/
- 64. https://www.nicfi.no/





In Latin America, converting forests to farmland and other uses accounts for almost half of total emissions<sup>66</sup>. Studies have shown that tenure-secure community land yields positive environmental outcomes: the average annual deforestation rates in tenure-secure indigenous forestlands in Bolivia, Brazil, and Colombia are two to three times lower than in similar land not managed by indigenous people<sup>67</sup>. In Peru, titling of indigenous lands reduced forest clearing by more than threequarters and forest disturbance by roughly two-thirds in two years. Long-term leases can also encourage sustainable land use, as shown by a study in Guatemala<sup>68</sup>. Another study that looked at deforestation in Africa has shown that land tenure security reduces deforestation, and consequently mitigates the cost of land degradation. 69

Land security for indigenous communities not only helps to fight climate change, but also promotes sustainable development. Establishing digital base maps is key to enabling accurate land registries necessary for providing tenure and land security for forest communities and indigenous peoples.

Other carbon capture and storage approaches are more expensive than securing community land rights. A 2016 report revealed that carbon capture and storage at power plants is up to 29 times more expensive than the costs of securing indigenous lands<sup>70</sup>. For natural gas-fired power plants, the average cost of carbon capture and storage is up to 42 times more expensive than securing indigenous lands. Desertification is sometimes described as the greatest environmental challenge of our time<sup>71</sup>, and it is important for governments to understand the link between climate change and this type of environmental degradation. Desertification reaches far beyond those living in and around the world's deserts, as it threatens the food security and livelihoods of more than two billion people<sup>72</sup>.

The combined impact of climate change, land mismanagement and unsustainable freshwater use has seen the world's water-scarce regions increasingly degraded. This leaves their soils less able to support crops, livestock, and wildlife. Earth observation combined with GIS are powerful tools for measuring this process, and provide a vital first step in turning the tide on one of the most serious environmental challenges of our time. Geospatial tools are also vital for initiatives aimed at reversing desertification, including management of tree planting drives, like the Great Green Wall in Africa<sup>73</sup>, and rewilding<sup>74</sup>. Geospatial software underpins It.org<sup>75</sup>, the drive to plant one trillion trees to capture carbon<sup>76</sup>.

One of the main drivers for deforestation, desertification<sup>77</sup>, and soil erosion is the mining industry. In Ghana, illegal mining is taking a huge toll on the environment and the economy, but the illegal mines have been difficult to identify. Geospatial data in the form of Earth observation, made accessible via the ARDC, is helping the country detect areas where illegal mining is taking place<sup>78</sup>.

- 67. https://www.sciencedirect.com/science/article/pii/S0921800917309746
- 68. https://www.wri.org/publication/economic-costs-and-benefits-securing-community-forest-tenure
- 69. https://d3pcsg2wjq9izr.cloudfront.net/files/6063/articles/4943/X04337I08P3HG08Q.pdf
- 70. https://www.wri.org/publication/climate-benefits-tenure-costs
- 71. https://www.theguardian.com/environment/2010/dec/16/desertification-climate-change and the second sec
- $72. \ https://www.carbonbrief.org/explainer-desertification-and-the-role-of-climate-change-$
- 73. https://www.greatgreenwall.org/about-great-green-wall
- 74. https://royalsocietypublishing.org/doi/10.1098/rspb.2019.3017
- 75. https://www.lt.org/
- 76. https://www.esri.com/about/newsroom/arcnews/rooting-for-our-planet/
- 77. https://link.springer.com/chapter/I0.1007/978-94-009-4648-4\_I5



<sup>66.</sup> http://siteresources.worldbank.org/INTLAC/Resources/I7619\_LowCarbonHighGrowth\_English\_PDF.pdf

<sup>78.</sup> https://unfoundation.org/blog/post/the-africa-regional-data-cube-harnessing-satellites-for-sdg-progress/



Environmental degradation, pollution, and heavy industry can all impact water quality, due to runoff and other types of contamination in rivers. Geospatial data is a vital tool for mapping rivers and identifying issues upstream that may be affecting your nation's water supply<sup>79</sup>.

Air pollution is an environmental issue of growing concern for national governments. With air pollution linked to an estimated 4.2 million deaths per year, it is vital for governments to make efforts to improve air quality to protect citizens' health as well as protect themselves from potential legal claims in the future<sup>80</sup>. Geospatial information is a valuable tool in assessing air pollution hotspots, and informing mitigation policies. Geospatial data can help citizens make better choices through hyper local air quality monitoring and real-time pollution maps<sup>81</sup>.

Accurate geospatial data and analysis platforms are essential to the burgeoning field of natural capital. Natural capital is defined as the world's stocks of natural assets which include geology, soil, air, water, and all living things<sup>82</sup>. Establishing natural capital can help your nation to evaluate the impact of policy decision on the environment in financial terms, as well as provide vital data for natural capital and carbon accounting<sup>83</sup>

82. https://naturalcapitalforum.com/about/

<sup>83.</sup> https://seea.un.org/sites/seea.un.org/files/documents/EEA/ruijs\_and\_graveland\_-\_nca\_for\_mainstreaming\_climate\_change\_forum\_draft\_nov\_2018.pdf



<sup>79.</sup> https://www.ordnancesurvey.co.uk/business-government/products/mastermap-water

<sup>80.</sup> https://www.who.int/teams/environment-climate-change-and-health/air-quality-and-health/ambient-air-pollution#--text=Ambient20air20pollution20accounts20for.qu ality20levels20exceed20WHO20limits.

 $<sup>{\</sup>tt 81.} \quad https://www.ordnancesurvey.co.uk/business-government/innovation/happens/articles-ehs/mapping-pollution-cleaner-aircondition/happens/articles-ehs/mapping-pollution-cleaner-air$ 



CASE STUDY

#### Building a Great Green Wall across Africa

The Great Green Wall or Great Green Wall of the Sahara and the Sahel, is a project led by the African Union designed to combat desertification in the Sahel region and hold back expansion of the Sahara, by planting a wall of trees stretching across the entire Sahel. The Great Green Wall involves tree planting in a 15 km wide band across 12 countries, stretching for 8,000 km across one of the most difficult places to measure on the planet<sup>84</sup>.

The Great Green Wall is designed to increase reforestation, reduce soil erosion, develop and diversify agriculture, and conserve plants and biodiversity. The Pan-African Agency of the Great Green Wall is responsible for planning, and The Sahara and Sahel Observatory (OSS), based in Tunisia, is responsible for monitoring the progress of the project using geospatial techniques.

OSS has developed an online portal to display geospatial data using trusted, standardised systems for monitoring and evaluation of progress<sup>85</sup>. National projects implementing the Great Green Wall are supported by the Sahel and West Africa Program (SAWAP) through the World Bank's Global Environment Facility (GEF). OSS has also developed geographic information systems for all SAWAP national programmes, consisting of a planning tool to help decision making.

OSS has produced a land use map with 30m resolution, covering all of the 12 countries in the SAWAP program.

Since the birth of the initiative in 2007, life has started coming back to the land, bringing improved food security, jobs, and stability to people's lives.

The project received a boost in January 2021 during the One Planet Summit for Biodiversity, where an additional \$14 billion was pledged by financiers including the Government of France, the World Bank, and the African Development Bank.<sup>86</sup>



<sup>84.</sup> https://www.greatgreenwall.org/about-great-green-wall

<sup>85.</sup> https://www.earthobservations.org/geo\_blog\_obs.php?id=194

<sup>86.</sup> https://www.unccd.int/news-events/great-green-wall-receives-over-14-billion-regreen-sahel-france-world-bank-listed-0

# PART TWO: BUILDING A SUSTAINABLE FUTURE



Investing in building a digital base map for your nation lays the foundation for progress in achieving the SDGs

# Sustainable development

Poverty can hamper the economic growth of your nation. In sub-Saharan Africa, poverty is a major problem, with half of the countries in the region having poverty rates higher than 35%<sup>87</sup>. By 2030, most of the world's poor will live in the region<sup>88</sup>. The highest population growth of anywhere in the world in sub-Saharan Africa is a contributing factor, with Africa's population set to double by 2050<sup>89</sup>.

Given the urgency of both poverty and the climate emergency, sustainable development is a top priority for African government ministers. The UN's 2030 Agenda for Sustainable Development is a useful blueprint for government officials who are interested in lifting their country's prospects while protecting the environment. Geospatial data is a key enabler for achieving the SDGs<sup>90</sup> and measuring your progress against them<sup>91</sup>. Investing in geospatial capabilities can therefore set your nation up for success in sustainable development.



 $<sup>87. \</sup> https://blogs.worldbank.org/opendata/african-countries-show-mixed-progress-towards-poverty-reduction-and-half-them-have-extreme and the state of the stat$ 

<sup>88.</sup> https://blogs.worldbank.org/opendata/projecting-global-extreme-poverty-2030-how-close-are-we-world-banks-3-goal

<sup>89.</sup> https://www.economist.com/special-report/2020/03/26/africas-population-will-double-by-2050

<sup>90.</sup> https://sustainabledevelopment.un.org/topics/informationforintegrateddecision-making/geospatialinformation

<sup>91.</sup> https://www.iges.or.jp/en/publication\_documents/pub/peer/en/10430/10.1007\_s10661-019-7996-9.pdf

Investing in your nation's geospatial maturity and building a digital base map for your nation lays the foundation for progress in achieving the SDGs:

#### Goal I: No poverty



Geospatial capabilities can help countries reduce poverty through effective land administration, establishing addressing, and tenure. Secure land tenure supports an effective mortgage sector which unlocks the hidden capital in property<sup>92</sup>. Mapping informal settlements is the first step towards turning the tide on urban poverty.

#### Goal 2: Zero Hunger



Geospatial tools are essential to increasing crop yields through precision agriculture<sup>93</sup>. Food security is safeguarded through disaster management , with GIS software playing a strategic role throughout the entire disaster cycle<sup>94</sup>.

#### Goal 3: Good health and wellbeing



Geospatial data is a powerful tool for tracking infectious disease, and data dashboards built using GIS are essential in managing nations' Covid-19 response<sup>95</sup>. Mapping was also a powerful tool during the Ebola outbreak of the 2010s<sup>96</sup>.

#### Goal 4: Quality education



Geospatial tools can help nations plan their education provision. Accurate census data underpins planning and public service provision, and geospatial capabilities provide the basis upon which decisions about where to build new schools and universities can be made<sup>97</sup>. GIS can help ensure equity of provision<sup>98</sup>.

- 92. https://www.goodreads.com/en/book/show/86154.The\_Mystery\_of\_Capital
- 93. https://www.croplife.com/precision/study-shows-precision-agriculture-improves-environmental-stewardship-while-increasing-yields/
- 94. https://www.esri.com/about/newsroom/arcnews/gis-supports-wfps-food-security-program/
- 95. https://coronavirus.jhu.edu/map.html
- 96. https://www.who.int/csr/disease/ebola/maps/en/
- 97. https://www.researchgate.net/publication/275209527\_Planning\_and\_Analysis\_of\_Educational\_Facilities\_using\_GIS\_A\_Case\_Study\_of\_Busia\_County\_ Kenya
- 98. https://journals.sagepub.com/doi/abs/10.1068/c140301

Find out about the SDG goals here: https://www.un.org/sustainabledevelopment/

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#### Goal 5: Gender equality



GIS can be used to analyse gender-based inequalities, including determining access to education, healthcare, economic opportunity, and political empowerment, and can help to prevent gender-based violence<sup>99</sup>.

#### Goal 6: Clean water and sanitation



Geospatial data and tools have been used in the application of water, sanitation, and hygiene (WASH) programmes administered by Water & Sanitation For The Urban Poor (WSUP) in Mali<sup>100</sup>, and GIS tools have been used to monitor water, sanitation and hygiene facilities for refugees in Tanzania<sup>101</sup>.

#### Goal 7: Affordable and clean energy



GIS technology and mapping allow policymakers to determine the right location for renewable energy, by providing a platform for the analysis of wind potential, solar potential, population size, and type of land cover<sup>102</sup>. Geospatial expertise can help you to build an energy systems maps, to support a more efficient path to net-zero<sup>103</sup>.

#### Goal 8: Decent work and economic growth



Maps can be a valuable tool for combating unemployment. GIS can help analyse the effectiveness of interventions, such as locations of career centres, and to determine access to these facilities, including how accessibility varies by demographic categories like age, gender, and ethnicity<sup>104</sup>.



- 99. https://www.routledge.com/Gender-Inequalities-GIS-Approaches-to-Gender-Analysis/Ozdenerol/p/book/9780367184735
- 100. https://www.ircwash.org/sites/default/files/Hayward-2011-GIS.pdf
- https://oxfamilibrary.openrepository.com/bitstream/handle/10546/620338/cs-mapping-wash-tanzania-gis-120917-en. pdf;jsessionid=5C25DF30F45118025482F3321919A7FC?sequence=1
- 102. https://mapline.com/role-gis-renewable-energy/
- 103. https://www.ordnancesurvey.co.uk/newsroom/news/energy-networks-and-ordnance-survey-to-harness-the-power-of-data-to-deliver-net-zero
- 104. https://www.researchgate.net/publication/5153655\_Does\_local\_access\_to\_employment\_services\_reduce\_unemployment\_A\_GIS\_analysis\_of\_One-Stop\_ Career\_Centers



#### Goal 9: Industry innovation and infrastructure



Geospatial tools are essential for planning, building, and maintaining infrastructure assets, improving efficiency and cutting costs for assets maintenance<sup>105</sup>. Geospatial data makes it possible to plan and manage multiple roadworks simultaneously, minimising disruptions to road users and reducing costly mistakes<sup>106</sup>.

#### Goal 10: Reduced inequalities



GIS is being used to give a voice to the underrepresented. Esri's StoryMaps – an online storytelling tool based on GIS functionality – is being harnessed to tell powerful stories about societal inequality. Will.i.am put this to great effect as part of his #WhereIsTheLove campaign, to show that the US is spending more on prisons than education, entrenching inequality<sup>107</sup>. 'Policy maps' showcase the opportunity to intervene and overcome social inequalities<sup>108</sup>.

#### Goal II: Sustainable cities and communities



Earth observation and artificial intelligence are being used to make our cities greener. Ordnance Survey worked with Dubai municipality to improve environmental monitoring of urban palm trees and mangroves, using satellite Earth observation data and machine learning algorithms<sup>109</sup>.

#### Goal 12: Responsible production and consumption



GIS has the capabilities to collect, manage, analyse, report, and share vast amounts of agricultural data to aid in discovering and establishing sustainable agriculture practices. This includes implementing organic farming methods, finding the most profitable and healthy places to plant new crops, or allotting farmland for preservation to secure future food production<sup>110</sup>.



- 105. https://www.ordnancesurvey.co.uk/business-government/products/case-studies/sse-imagery
- 106. https://www.ordnancesurvey.co.uk/business-government/products/case-studies/london-traffic-data
- 107. https://www.arcgis.com/apps/Cascade/index.html?appid=65eaa5f39d9f498d8fd500504c102bae
- 108. https://www.esri.com/about/newsroom/arcuser/can-a-map-speak-for-those-who-cannot-speak-for-themselves/
- ${\small 109. https://www.ordnancesurvey.co.uk/business-government/products/case-studies/auto-change-dubai}$
- $II0. \ https://www.esri.com/content/dam/esrisites/sitecore-archive/Files/Pdfs/library/bestpractices/sustainable-agriculture.pdf$



#### Goal 13: Climate action



ArcGIS underpins It.org<sup>III</sup>, the drive to plant one trillion trees to capture carbon<sup>112</sup>. GIS is an important tool for the emerging field of carbon capture technologies<sup>113</sup>. These are technologies and techniques for capturing and storing carbon either directly from the atmosphere, using a dedicated carbon capture plant<sup>114</sup>, or at the emissions' source<sup>115</sup>.

#### Goal I4: Life below water



GIS software, like Esri's ArcGIS can show at-risk areas in danger of biodiversity loss, habitat degradation, and resource depletion. It also acts as an aid in monitoring and examining the effectiveness of conservation practices and protected areas to ensure the preservation of the earth's oceans<sup>116</sup>.

#### Goal 15: Life on land



Wildlife corridors that bridge highways to help animals cross roads that pass through their habitats can protect mammals from vehicles. GIS played a key part in a study to find the best approach to creating linkages between areas of the range of Black Bears where the Trans-Canada Highway passes through Banff National Park, Alberta, Canada<sup>117</sup>.

#### Goal 16: Peace, Justice and strong institutions



Crime mapping allows law enforcement and criminologists to analyse crime data to uncover hidden patterns and underlying causes. 'Environmental criminology' plays a vital role in understanding the drivers of crime and can uncover ways to reduce it<sup>118</sup>.

#### Goal I7: Partnerships for the goals



The 2030 Agenda for Sustainable Development promotes transparent and accountable scaling-up of appropriate public-private cooperation to exploit the contribution to be made by a wide range of data, including earth observation and geospatial information, while ensuring national ownership in supporting and tracking progress<sup>119</sup>.

III. https://www.lt.org/

- II2. https://www.esri.com/about/newsroom/arcnews/rooting-for-our-planet/
- II3. https://ec.europa.eu/clima/policies/innovation-fund/ccs\_en
- 114. https://www.bbc.com/future/article/20210310-the-trillion-dollar-plan-to-capture-co2
- II5. https://www.sciencedirect.com/science/article/pii/SI8766102I1003857
- ${\tt II6. https://www.esri.com/content/dam/esrisites/sitecore-archive/Files/Pdfs/library/bestpractices/ocean-conservation.pdf}$
- II7. https://www.gislounge.com/gis-used-conservation-biology/
- II8. https://www.crimeandjustice.org.uk/sites/crimeandjustice.org.uk/files/09627250708553264.pdf
- II9. https://sustainabledevelopment.un.org/topics/informationforintegrateddecision-making/geospatialinformation



#### Sustainable construction

Geospatial data tools are helping infrastructure organisations minimise their impact on the environment.

Technology-based construction company Costain has developed such a tool that calculates the costs associated with managing biodiversity on an infrastructure programme.

The tool provides a way to communicate the value of a habitat using biodiversity units developed by Defra. It also identifies risks to habitats as a whole, and risks to individual species, and flags regulatory constraints based on geography by identifying sites of special scientific Interest. By integrating geospatial data tools early in the planning process, Costain assesses the impact of infrastructure projects on the environment, with the goal of achieving biodiversity net gain. Costain also provides insights for improving the safety of construction projects by mapping accident data.

In 2020 Costain launched responsible business commitments to help create a greener future in line with the UN Sustainable Development Goals<sup>120</sup>.

120. https://www.costain.com/news/comment-and-opinion/how-can-infrastructure-do-more-to-boost-biodiversity/





Investing in a digital basemap will give your nation the edge in reducing your nation's emissions and documenting its progress

## **Reducing emissions**

The main driver of climate change is greenhouse gas emissions, with carbon emissions being the most abundant and therefore the focus of nations' environmental drives. Geospatial data is a vital tool in your nation's journey towards reducing greenhouse gas emissions.

A handful of countries have pledged to achieve a 'Net Zero' emissions profile by 2050, whereby carbon emissions are offset by sequestration to arrive at a carbon balance of zero emissions. Two small nations with low emissions and large forest coverage have already achieved this goal<sup>121</sup>.

While these ambitious legal pledges have been made mainly by high income countries

with above average emissions, many other nations have committed to climate action through NDCs which were secured after 196 signatories, i.e. nations and blocs, referred to as 'parties', came together under the Paris Agreement in 2015, with the goal of preventing warming exceeding 1.5 to 2 degrees C above pre-industrial levels<sup>122</sup>.

Each year a Conference of the Parties (COP) is held to evaluate and renew progress towards these commitments<sup>123</sup>. While South Africa is the only African country to have committed a 'Net Zero' pledge to law, many African countries have ambitious NDCs which include substantial reductions by 2030. For example, Zambia has committed to reduce emissions by 25%<sup>124</sup>, Ghana has

121. https://theconversation.com/5-years-after-paris-how-countries-climate-policies-match-up-to-their-promises-and-whos-aiming-for-net-zero-emissions-151722

123. https://ukcop26.org/



<sup>122.</sup> https://unfccc.int/process-and-meetings/the-paris-agreement/nationally-determined-contributions-ndcs/nationally-de

<sup>124.</sup> https://www.climatewatchdata.org/countries/ZMB

committed to reduce emissions by  $15\%^{125}$ , and Ethiopia has agreed to reduce emissions by up to  $53\%^{126}$ .

Geospatial data and tools like GIS are powerful enablers for reducing emissions. GIS is central to our ability to evaluate the carbon footprint of existing systems, and to evaluate the change in emissions for proposed solutions. It is also vital for calculating the carbon storage capacity of forests<sup>127</sup>, peat bogs<sup>128</sup>, and other natural carbon sinks. ArcGIS also underpins It.org<sup>129</sup>, the drive to plant one trillion trees to capture carbon<sup>130</sup>. GIS is an important tool for the emerging field of carbon capture technologies<sup>131</sup>. These are technologies and techniques for capturing and storing carbon either directly from the atmosphere, using a dedicated carbon capture plant<sup>132</sup>, or at the emissions source<sup>133</sup>.

Geospatial data is central to the roll out of renewable energy technologies like solar farms and wind parks<sup>134</sup>. GIS has become essential for identifying locations for these inherently geographic solutions for energy production<sup>135</sup>. Spatial analysis can reveal prime areas for renewable energy production by calculating the energy potential of a given location based on the landscape including average wind speed<sup>136</sup>, land use, population density, distance to roads, slope, and distance to transmission lines<sup>137</sup>. Solar panel placement strategies can be improved by solar illumination modelling using geospatial data to calculate how much sunlight particular faces of buildings receive<sup>138</sup>.



Geospatial data can also help to coordinate digitalisation and decentralisation of the energy grid. With solar panels becoming more common, energy consumers are also becoming energy providers. Energy grids of the future will reflect the diversification of supply, taking into account households that sell energy back to the grid. In the UK, Ordnance Survey is building an energy systems map, to support this process, building a more efficient path to net-zero<sup>139</sup>.

- 125. https://www.climatewatchdata.org/countries/GHA
- 126. https://www.climatewatchdata.org/countries/ETH
- 127. https://core.ac.uk/download/pdf/82288437.pdf
- 128. https://www.iucn.org/resources/issues-briefs/peatlands-and-climate-change
- 129. https://www.lt.org/
- 130. https://www.esri.com/about/newsroom/arcnews/rooting-for-our-planet/
- 131. https://ec.europa.eu/clima/policies/innovation-fund/ccs\_en
- 132. https://www.bbc.com/future/article/20210310-the-trillion-dollar-plan-to-capture-co2
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- 136. https://www.esri.com/content/dam/esrisites/sitecore-archive/Files/Pdfs/library/bestpractices/renewable-energy.pdf
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- 138. https://www.ordnancesurvey.co.uk/newsroom/insights/why-geospatial-helps-singapore-great-place
- 139. https://www.ordnancesurvey.co.uk/newsroom/news/energy-networks-and-ordnance-survey-to-harness-the-power-of-data-to-deliver-net-zero



GIS can also help nations to decarbonise transport. GIS technologies can provide a visual framework for conceptualising and understanding how transportation contributes to a region's emissions profile. This can help planners to develop more effective emissions reduction policies<sup>140</sup>.

Nations and even businesses are expected to have accurate records for their carbon emissions, and geospatial tools are essential for determining them<sup>141</sup>. This is valuable when it comes to carbon accounting, and trading carbon credits in carbon markets<sup>142</sup>. While controversial, some people see carbon markets as essential for nations to achieve 'Net Zero', by offsetting their emissions<sup>143</sup>.

Investing in a digital basemap will give your nation the edge in reducing your nation's emissions and documenting its progress.

- 140. https://www.gis.fhwa.dot.gov/documents/Climate\_Change\_Report\_Aug2011.htm
- 141. https://www.researchgate.net/publication/255968200\_Development\_of\_a\_greenhousegas\_accounting\_GIS-based\_tool\_to\_support\_local\_policy\_makingapplication\_to\_an\_Italian\_municipality
- 142. https://www.sdfinance.undp.org/content/sdfinance/en/home/solutions/carbon-markets.htm
- 143. https://www.politico.eu/article/fraud-puts-the-brake-on-the-emissions-market/

#### CASE STUDY

# The Renewable Energy Atlas of Vermont

A non profit organisation based in Vermont, United States built a tool to help make renewable energy viable in the state. The tool encourages people to get involved in localising energy production and provides justification for community projects that retain jobs and help stabilise the economy.

The Renewable Energy Atlas of Vermont is an interactive website that lets people identify, visualise, and analyse data about existing and promising renewable energy opportunities for any town or county in Vermont.

The atlas was initiated by Vermont Sustainable Jobs Fund (VSJF), a nonprofit organisation created by Vermont's legislature to accelerate the development of the state's



green economy. VSJF provides early stage grant funding and technical assistance to develop markets for sustainably produced goods and services (e.g., renewable energy, local food systems).

Built on Esri's ArcGIS technology, the atlas makes it possible for people to access data about biomass, geothermal, hydroelectric, solar, and wind resources and use GIS to view existing and potential projects by area<sup>144</sup>.



144. https://www.esri.com/news/arcuser/1010/files/renewable.pdf

## GAIN AN ADVANTAGE WITH A GEOSPATIAL MATURITY ASSESSMENT



'Climate change is a geographic problem, and solving it takes a geographic solution'

Jack Dangermond Co-founder, Environmental Systems Research Institute

# Build sustainable societies with geospatial information

Africa has contributed the least to climate change, and yet the continent may well experience its most devastating impacts<sup>145</sup>. This means that African nations must adapt quickly to a riskier world, with geospatial data and technology providing the intelligence to tackle challenges head on.

Using the power of geospatial data, African nations have the opportunity to become trailblazers in adapting to a changing climate, while prioritising sustainability and reducing emissions. Digital base maps can be thought of as a foundational technology that enables nations to launch a green economy.

COP26, the climate conference, hosted by the UK, and summits like it, provide opportunities for African nations to show ambition with bold climate policy and environmental commitments, while prioritising growth and prosperity by investing in powerful geospatial technology and building digital basemaps.

Good climate policy will underpin all aspects of governance in the coming years. Building your own location data capabilities enables you to model the effects of climate change on your nation and predict the impact of different solutions to inform investment.

Climate change is a geographic problem, and solving it takes a geographic solution<sup>146</sup>. It is now easier and quicker than ever to build your own geospatial data capabilities. By working with Ordnance Survey, you can combine 200 years of mapping expertise with the speed and usability of modern technological innovation, to deliver bespoke solutions to help your nation develop sustainably, reduce emissions, and manage risk associated with climate change.

Automated digital basemap generation underpins growth and empowers communities, and is quick and cost effective. Ordnance Survey can help you establish your own sovereign data capabilities to gain a strategic advantage.

Investing in geospatial can help your nation to:

- Increase crop yield by II%<sup>147</sup>
- Achieve a cost benefit ratio of I.7 in flood mapping<sup>148</sup>
- Reduce deforestation by II%<sup>149</sup>
- Boost progress towards all I7 SDGs<sup>150</sup>
- Reduce agricultural fossil fuel usage by 16%<sup>151</sup>

Consider a geospatial maturity assessment provided by Ordnance Survey to identify how you can upgrade your geospatial ecosystem, boost sustainable development, manage climate related risks, and lower emissions.

<sup>151.</sup> https://www.croplife.com/precision/study-shows-precision-agriculture-improves-environmental-stewardship-while-increasing-yields/



<sup>145.</sup> https://openknowledge.worldbank.org/bitstream/handle/10986/34098/34098.pdf?sequence=25

 $<sup>{\</sup>sf I46. https://www.esri.com/content/dam/esrisites/sitecore-archive/Files/Pdfs/library/bestpractices/climate-change.pdf}$ 

 $<sup>147. \</sup> https://www.croplife.com/precision/study-shows-precision-agriculture-improves-environmental-stewardship-while-increasing-yields/state$ 

<sup>148.</sup> https://www.nap.edu/read/12573/chapter/8#82

 $<sup>\</sup>label{eq:label_$ 

<sup>150.</sup> https://sustainabledevelopment.un.org/topics/informationforintegrateddecision-making/geospatialinformation

# Five steps towards a more sustainable society

Identify the unique challenges
facing your nation

Every country is unique. What are the problems you hope to solve with geospatial information?

### 02 Understand key policy drivers ata national and local level

What are the factors driving your decision making? For example, health, transport, disaster management.

#### 03 Identify key stakeholders and users of geospatial information

Who is working with geospatial data in your nation? Which industries stand to benefit?

#### 04 Work with them to understand their objectives and issues

What is keeping your stakeholders up at night? Establish how geospatial information can help.

### 05 Build services using data thathelp meet these challenges

What services would help to address your policy drivers and stakeholder requirements?

We're actively looking for cities to partner with us to demonstrate how detailed geospatial information can make city planning and development sustainable. Register your interest:

#### Internationalenquiries@os.uk



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Ordnance Survey provides funding, consultancy and technology services to governments helping to break down silos and improve policy decisions across urbanisation, environment and sustainability, land tenure, resilience and statistics collection.

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