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ITHACA PREVENTION FORECAST USE CASE, SUMMER 2022

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Prometheus Space Technologies: Pioneering Wildfire Prevention on Ithaca Island

Introduction

Prometheus Space Technologies is at the forefront of environmental safety, dedicated to preventing disasters through innovative solutions. The Prometheus Fire Guardian platform, a pivotal tool in wildfire risk management, was deployed on Ithaca Island to evaluate its capabilities in delivering early and accurate wildfire prevention forecasts. This project marks the initial large-scale test of the Minimum Viable Product (MVP) for Prometheus Technology, setting the stage for comprehensive Wildfire Risk Management. The monitoring of this MVP took place from May 1st, 2022, to October 30th, 2022. The outcomes of this test are detailed in this Use Case Document.

Background

Ithaca Island's diverse topography and dense vegetation make it susceptible to wildfires, posing significant risks to both the environment and local communities. Recognizing the need for an advanced solution, Prometheus Space Technologies implemented its MVP prevention forecast to deliver precise, actionable insights for wildfire management.

Objectives

- To provide a 10-day wildfire prevention forecast with a spatial resolution of 10 meters.
- To integrate and analyze data from multiple sources, including satellites and IoT sensors, for comprehensive risk assessment.
- To enhance the efficiency of resource allocation and preventive measures through precise risk mapping.

Methodology

Given the unique characteristics of each study area, forecasts were conducted individually. Data sources included high-resolution satellite imagery and nanosatellite data, encompassing information such as slope, vegetation, meteorological data, and human-centric factors.

Variables were divided into static and dynamic categories. Static variables, like slope and orientation, showed little or no variation over time but had a significant impact on fire spread. Dynamic variables required continuous monitoring due to their susceptibility to meteorological changes and human impact, affecting fuel availability and vegetation conditions.

The prediction was achieved by gathering and evaluating variables, each assigned a specific importance. Quiron Digital's software and algorithms produced the forecasting results, while Prometheus's GIS experts mapped these predictions to maximize their value to end-users. Human factors, such as proximity to cities and recreational areas, and historical fire incidents, were used to calibrate the prediction model. Machine learning was employed for evaluation and forecasting.

The prediction model included meteorological risk forecasts covering the next 10 days, utilizing the maximum risk during this period in the final outcome. Each variable's weight was calibrated based on historical burn data and critical analysis of its influence on ignition, spread, and fuel load potential.

Depending on the data collected for each variable throughout the algorithm construction process, wildfire risk predictions are classified according to the following fire risk categories:

- Null (water body)
- Low
- Medium
- High
- Very High
- Extreme
- Black Dot (areas where we indicate more attention is needed)

Tools Used for Forecast Creation

To achieve the accuracy of the 10-day Fire Forecast with high-resolution analysis, the following tools were used:

- Satellite data from the Sentinel system of the ESA's Copernicus Program.
- Satellite data from NASA's Landsat system.
- High-precision and high-resolution satellite data from Spire Global.
- High-resolution and high-precision satellite data from Airbus Defence.
- Very high-resolution satellite data from the Pleiades satellite constellation.
- Utilization, processing, and analysis of data with the European Forest Fire Information System (EFFIS).
- Utilization, processing, and analysis of data with NASA's MODIS (Moderate Resolution Imaging Spectroradiometer).
- Utilization, processing, and analysis of data with NASA's Visible Infrared Imaging Radiometer Suite (VIIRS).
- Highly detailed meteorological forecasts from the National Oceanic and Atmospheric Administration (NOAA) of the USA.
- Highly detailed meteorological forecasts from SPIRE GLOBAL.

Findings and Results

Risk Assessment and Alerts

: The platform successfully identified areas of extreme and very high fire risk, issuing "Black Dot" alerts for locations requiring immediate attention.
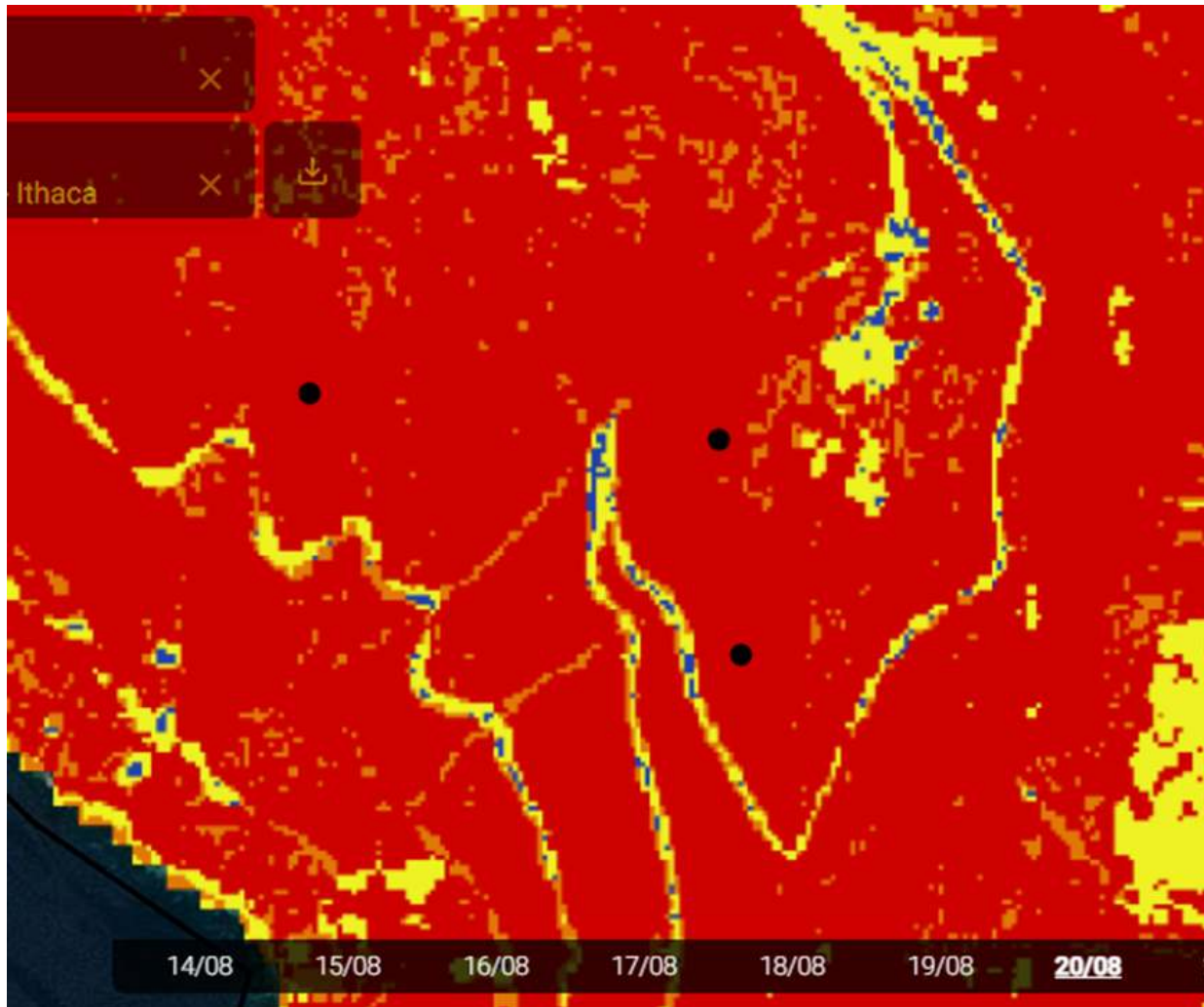
Thermal imagery pointing to the three black dots was extremely likely points to ignite.

Resource Allocation

: Precise risk mapping enabled efficient allocation of firefighting resources and implementation of preventive measures.
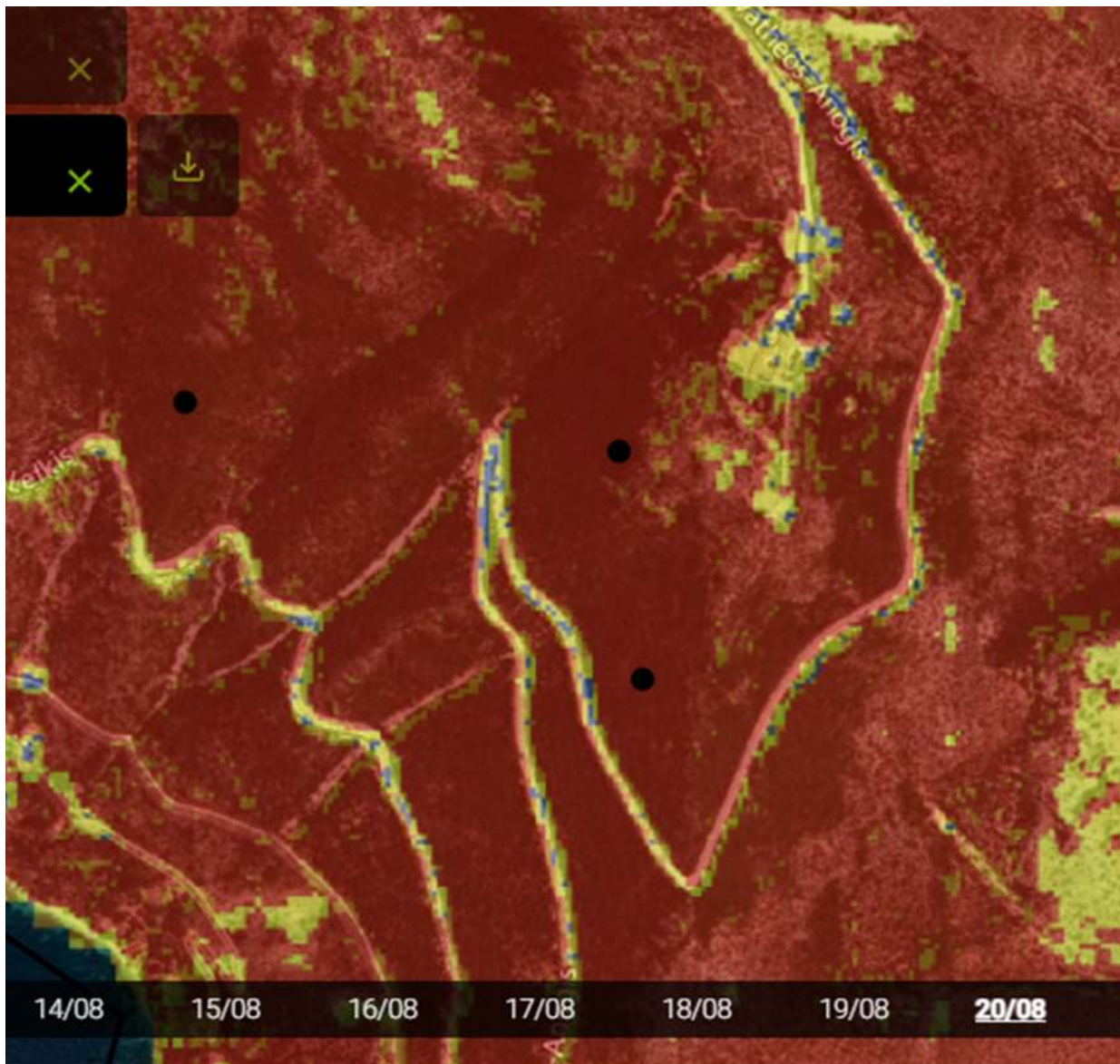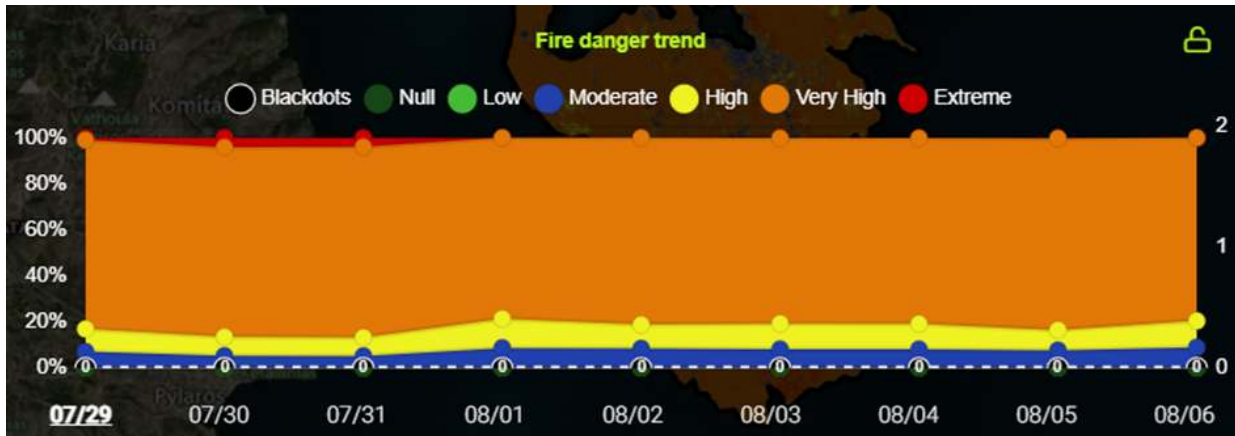
By the precise detection of this alert, there was a successful manpower and resource allocation and there are taken proactive actions that caused incident avoidance.

Accuracy and Resolution

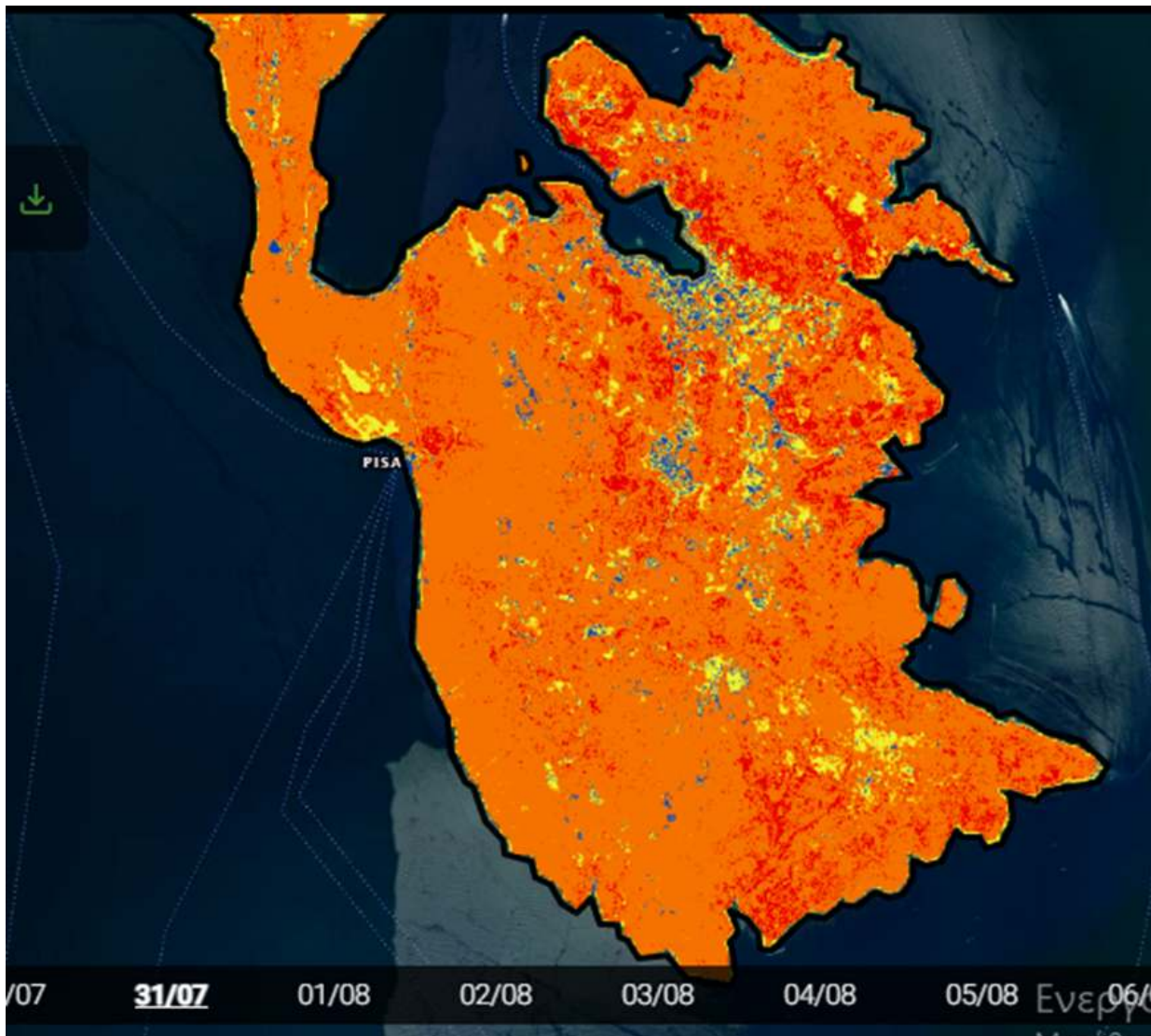: With a 10-meter resolution, the platform provided detailed insights, identifying at-risk areas down to individual trees or shrubs.

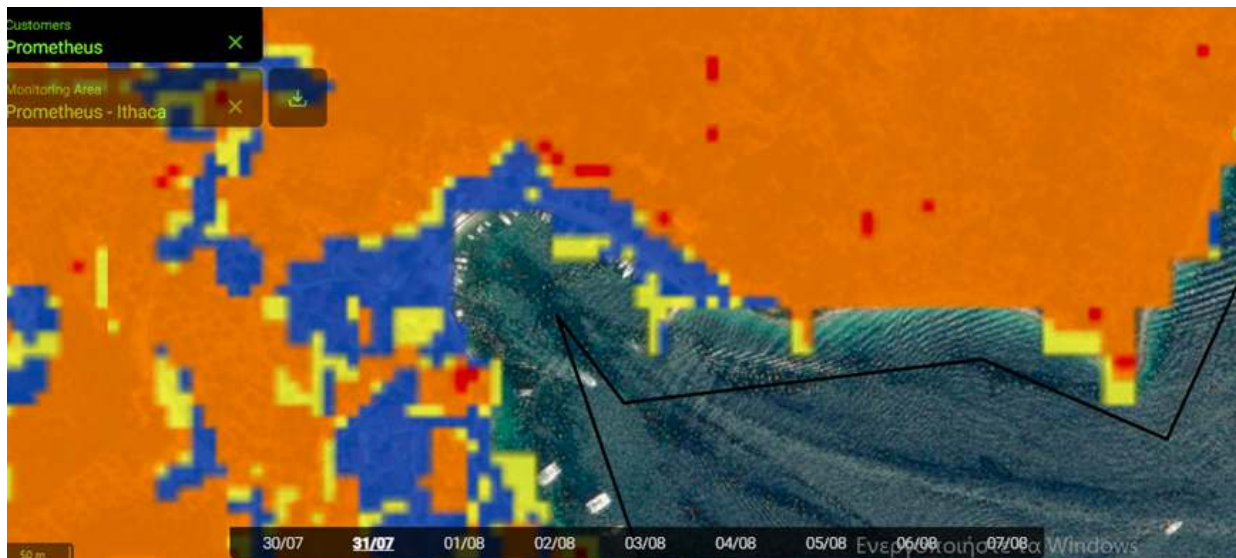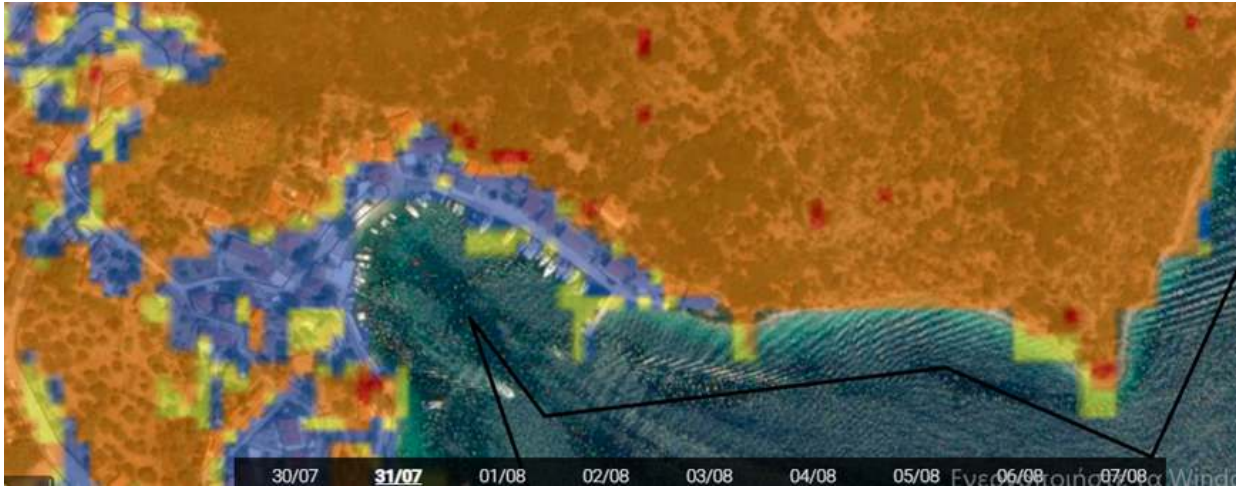Typical 10-day prevention forecast statistical analysis of the Ithaca Case study.

The high-risk areas spotted by the Prometheus Fire Guardian software

What the NOA's Beyond project demonstrates for next-day prevention forecast

The details are required from the local Firefighter Brigade as no evacuation plans are applied in this monitored area.

Case Highlights

- **August 20th Update**: Recalibration of the prediction model allowed for a more focused risk assessment, enhancing resource deployment and preventive strategies.
- **Continuous Monitoring**: Daily evaluations ensured the predictions remained accurate and responsive to environmental changes, bolstering the platform's reliability.

Impact

The deployment of the Prometheus Fire Guardian on Ithaca Island showcased the platform's effectiveness in wildfire risk management. By offering precise forecasts and enabling proactive measures, the platform significantly enhanced the ability to prevent and respond to wildfires, thus protecting communities and natural resources.

Conclusion

The successful implementation of the Prometheus Fire Guardian on Ithaca Island demonstrates its potential as a critical tool in wildfire management. The platform's ability to provide detailed, accurate forecasts supports effective prevention strategies and resource allocation, setting a benchmark for future deployments in other high-risk regions.

Future Outlook

Prometheus Space Technologies is committed to refining its platform, incorporating user feedback, and advancing its capabilities to offer even more comprehensive and precise wildfire management solutions. The success on Ithaca Island serves as a model for future applications across larger areas, showcasing the platform's scalability and efficiency. As the first line of firefighting defence, Prometheus plans to leverage its ground and air sensors, along with partner real-time multi-orbital satellite technology, to track and detect potential ignition points in real-time. By harnessing prevention technology and real-time detection capabilities, Prometheus aims to lead the wildfire risk management market, ensuring a safer future for vulnerable regions worldwide.