



# Incorporating drought risk modelling as a planning tool for climate change adaptation measures

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# Project objectives

## Objective

- ❑ To incorporate drought risks modelling as a planning tool for climate change adaptation measures in Saint Kitts and Nevis

## Main outputs

- ❑ Implementation of a drought forecasting system
  - Stakeholder working group
  - Capacity building

## Outcome

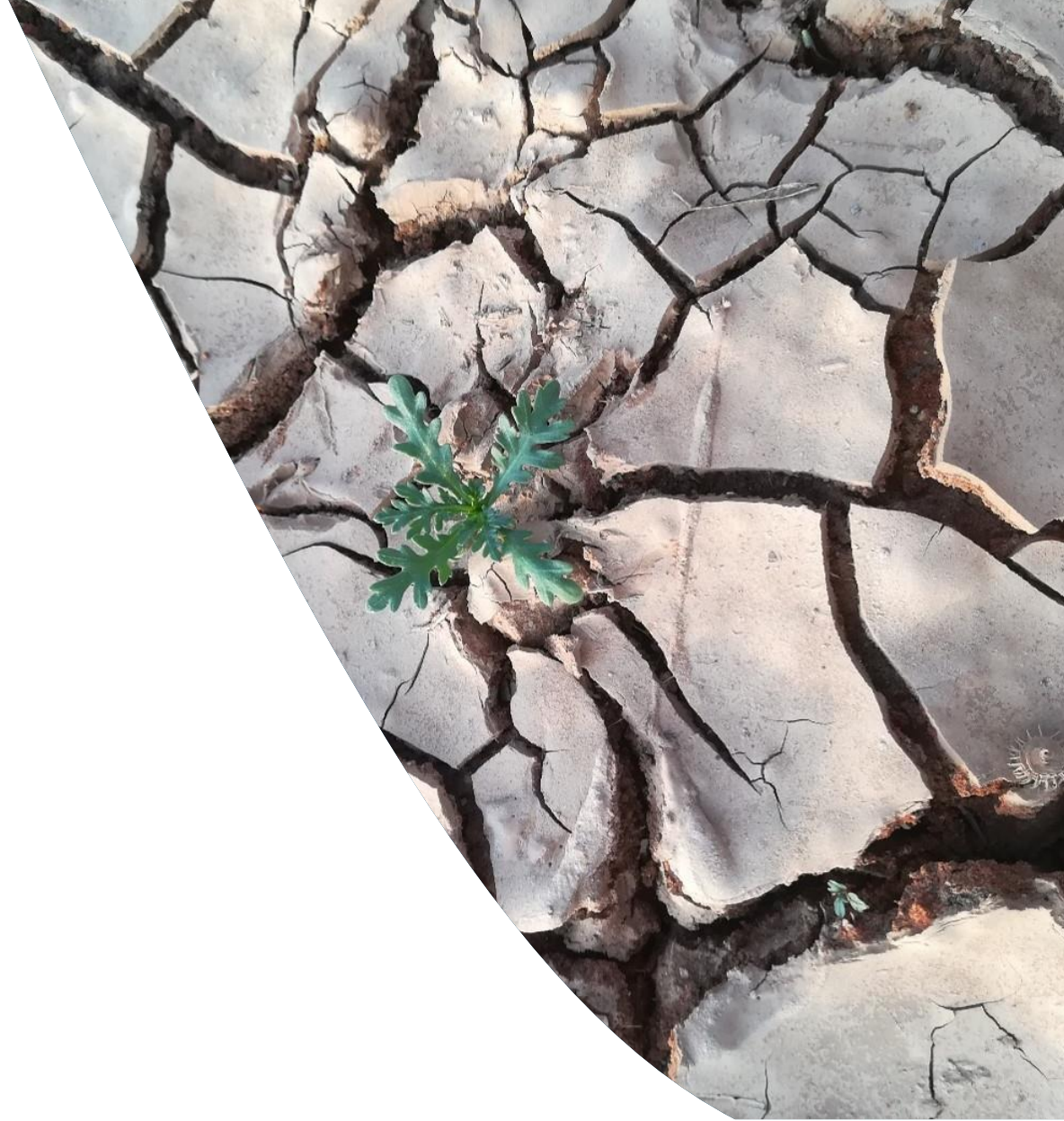
- ❑ Increased resilience in the water sector, improved use of water resources, water and food security





# Drought and climate change

- ❑ Increasing drought risk is projected for Caribbean SIDS, with **moderate to extreme drought conditions** projected if temperature increases by 1.5°C.
- ❑ Since 2015, St. Kitts and Nevis has been experiencing significant drought which **impacts water and food security**.
- ❑ Almost half of St. Kitts and Nevis receives **less than 50 inches** of rainfall per year.



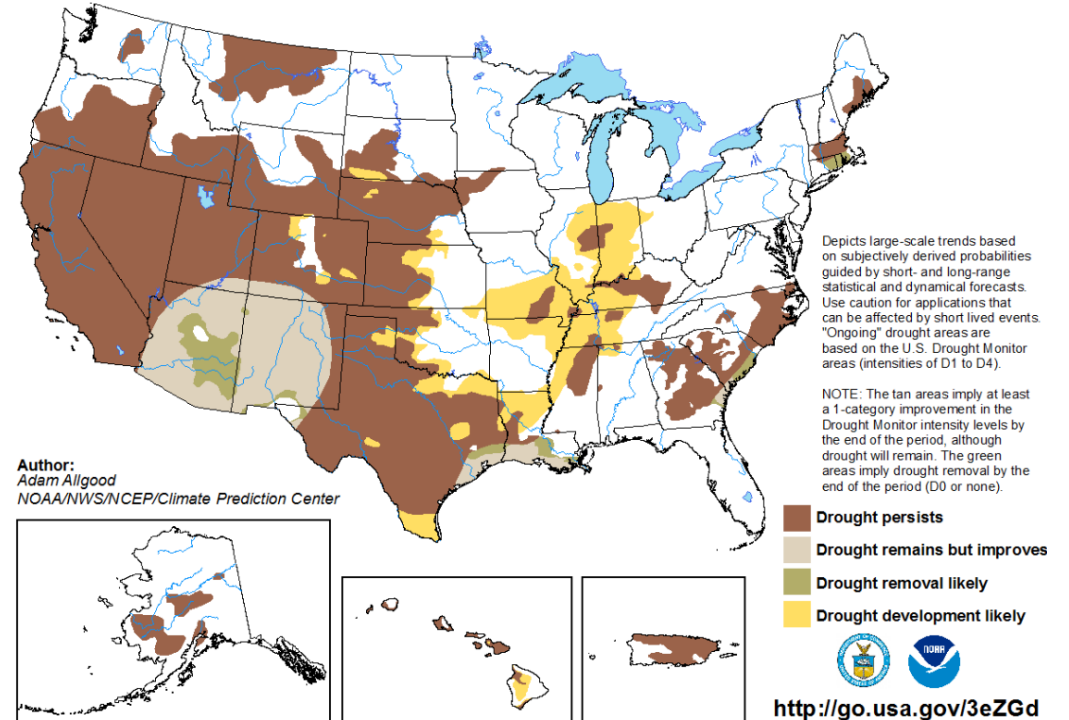
# Can droughts be predicted?

- ❑ Substantial advances in drought prediction
- ❑ Still challenges in predicting the full aspects of drought onset, severity, development, and recovery
- ❑ Occurrence at different temporal and spatial scales
- ❑ Efforts still needed in understanding drought mechanisms and predictability in different regions & seasons

Early warning systems can provide decision makers with timely and reliable access to information on which mitigation measures can be based.

## U.S. Monthly Drought Outlook Drought Tendency During the Valid Period

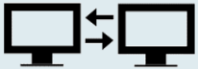
Valid for July 2022  
Released June 30, 2022



Monthly drought outlook published by the U.S. National Weather Service's Climate Prediction Center, which provides a drought forecast for the following month.

# Challenges

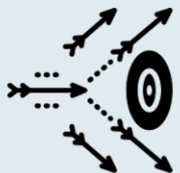
No data sharing




time needed to incorporate new technologies



Forecasts often unreliable



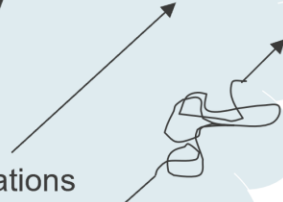
changes of political agendas



Information is too technical



Miss-match between user expectations and reality



expectations

reality


Insufficient data



data not relevant in local context

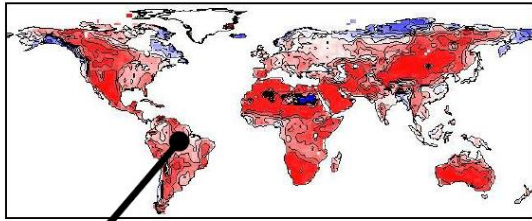


cost of new technology

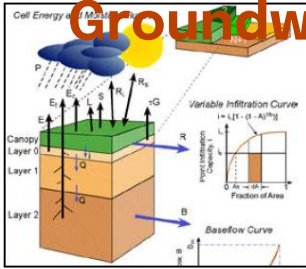




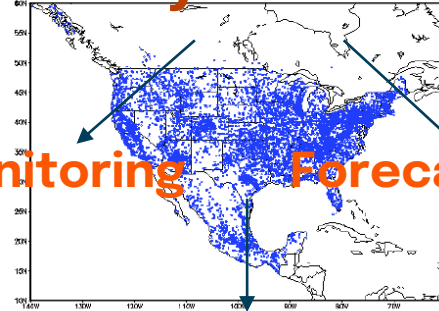
# Teck's data components



**Water balance**  
**Groundwater**



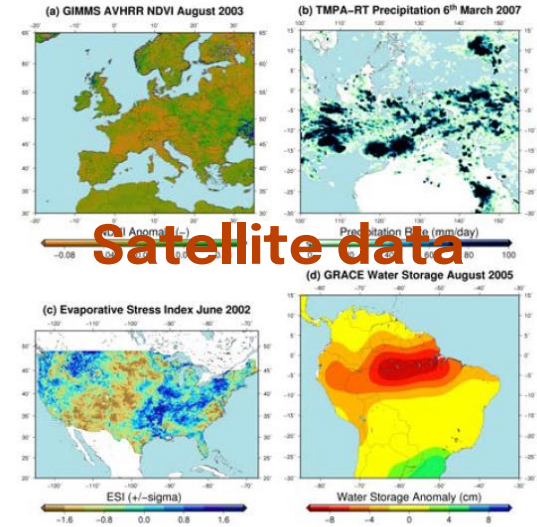
**Type of system**  
**Ground Observations**



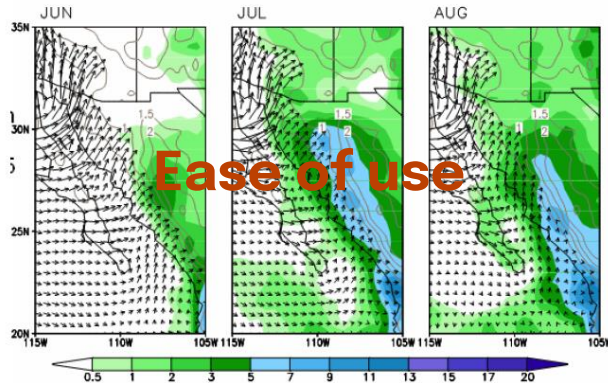
**Monitoring**      **Forecasting**

**Operational**

## Satellite Remote Sensing

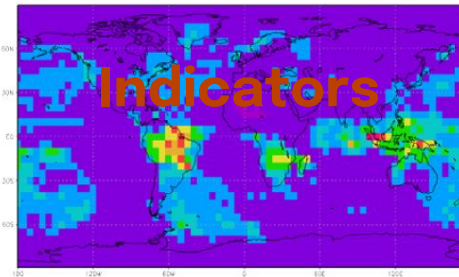


## Reanalysis



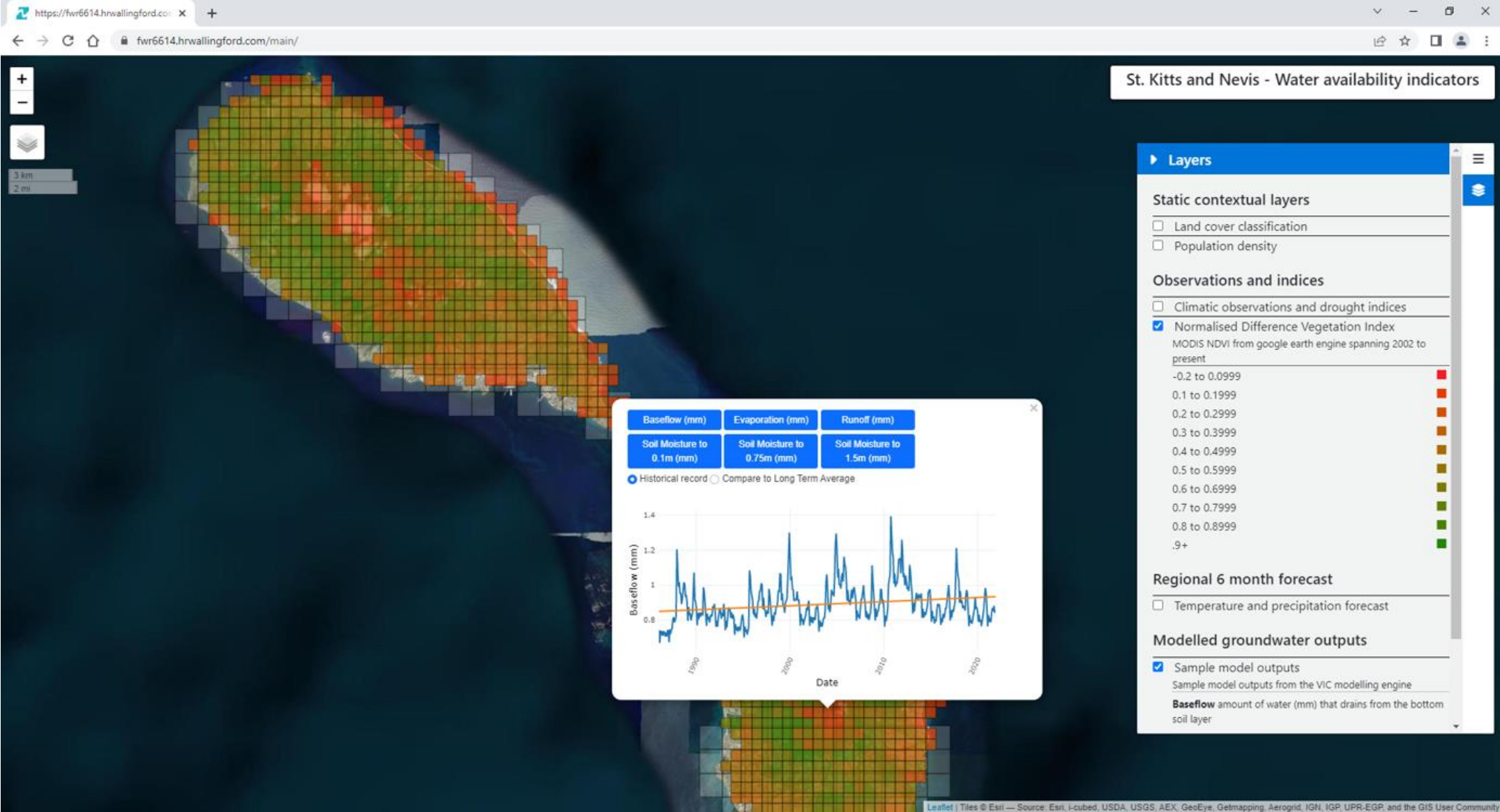
**Ease of use**

## Regional/Global Climate Models, Statistical Prediction



**Indicators**

# The web-based system



St. Kitts and Nevis - Water availability indicators

Layers

Static contextual layers

- Land cover classification
- Population density

Observations and indices

- Climatic observations and drought indices
- Normalised Difference Vegetation Index  
MODIS NDVI from google earth engine spanning 2002 to present

-0.2 to 0.0999  
0.1 to 0.1999  
0.2 to 0.2999  
0.3 to 0.3999  
0.4 to 0.4999  
0.5 to 0.5999  
0.6 to 0.6999  
0.7 to 0.7999  
0.8 to 0.8999  
.9+

Regional 6 month forecast

- Temperature and precipitation forecast

Modelled groundwater outputs

- Sample model outputs  
Sample model outputs from the VIC modelling engine

**Baseflow** amount of water (mm) that drains from the bottom soil layer

Baseflow (mm) | Evaporation (mm) | Runoff (mm)  
Soil Moisture to 0.1m (mm) | Soil Moisture to 0.75m (mm) | Soil Moisture to 1.5m (mm)

Historical record  Compare to Long Term Average

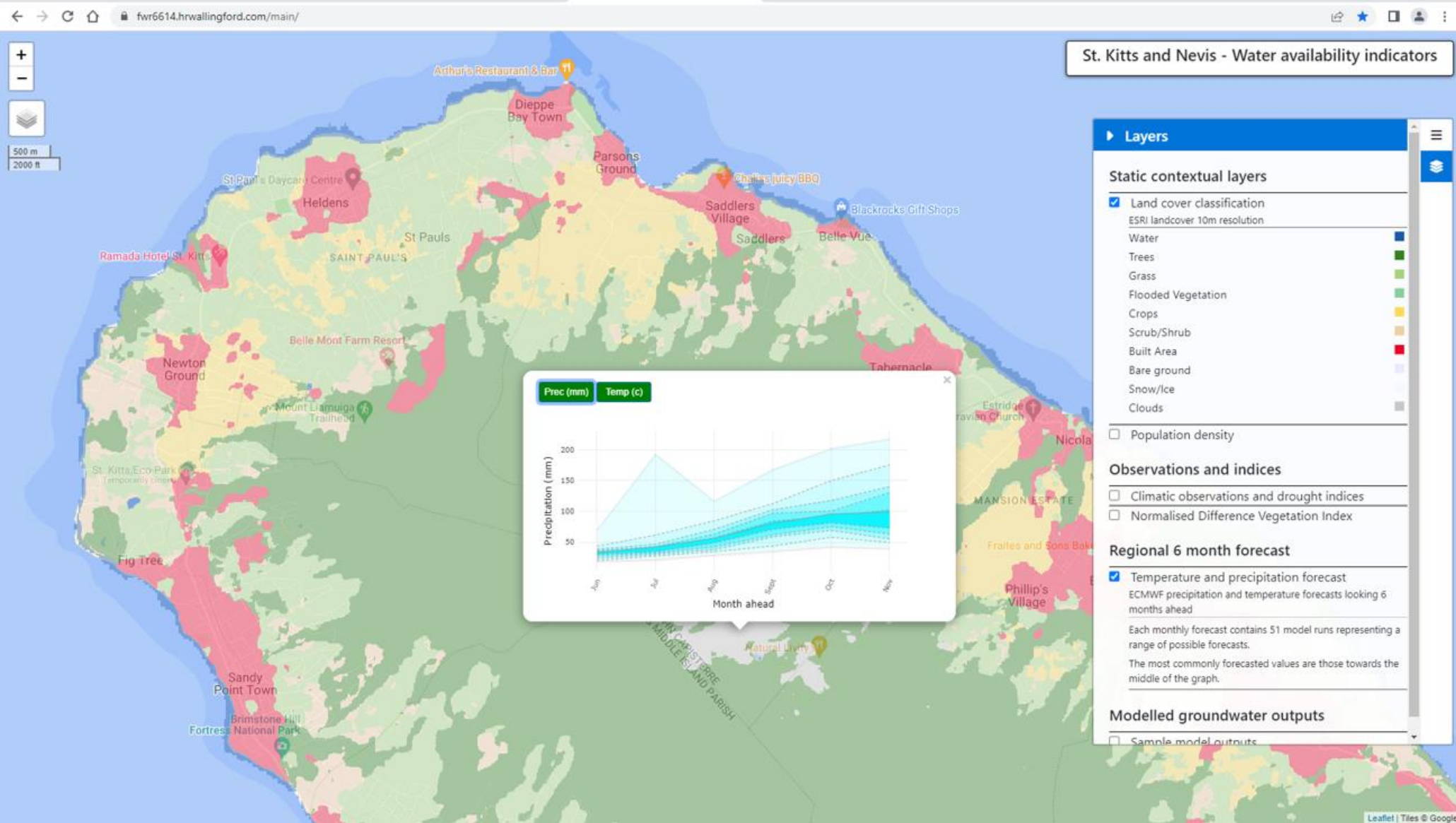
Baseflow (mm)

Date

Leaflet | Tiles © Esri — Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, UPR-EGP, and the GIS User Community




# The web-based system





# What needs to be done so that the full benefits of drought forecasting systems can be realized?



A photograph of a dry, cracked landscape. The foreground is filled with numerous irregular, raised blocks of dry earth, creating a textured, grid-like pattern. In the background, a long, low stone bridge with several arches spans across the horizon. The sky is a pale, clear blue, and the overall scene conveys a sense of extreme drought and aridity.

*There's no radar image for a water crisis. No storm surges, no debris fields - the Tap-Out is as silent as cancer. There's nothing to see, and so the news is treating it like a sidebar.*  
Jarrod Shusterman (from the book "Dry")





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Thank you!

# Sustainability

*Sustainability is resolved by addressing a problem in a way which is relevant to the local community*

- Ensure end-users are involved early in the process
- Focus on capacity building activities
- Co-designing of methods and tools
- Local partners play a key part
- Strong presence in the country

