GeoVRI: Geospatial Vegetation Recovery Index

Using Copernicus Data to analyze and predict vegetation recovery after ecological stressors

The problem

Climate Change & Global Warming:

- The growing frequency of droughts, wildfires, and floods is damaging ecosystems and affecting land use. Changes in precipitation patterns and extreme weather events make it difficult for industries to predict how the land will perform and recover over time.

Pressure on Land Resources:

- As demand for agricultural land, forestry, and urban expansion increases, understanding the resilience and recovery of land to stressors becomes crucial. Without proper planning and information, land-use decisions can lead to unsustainable practices and long-term degradation.

The solution

Geospatial Vegetation Recovery Index

GeoVRI is a tool designed to assess and monitor the ability of vegetation to recover after ecological stressors.

By providing the recovery time of vegetation after potential disturbances, the index can help stakeholders make informed decisions about where to use land and what types of crops or industries are most suitable for a given area

GeoVRI can adress important EU policies, such as

- Nature Restoration Law
- The Green Deal

Data

•Data :

•Copernicus Satellite Data aquired from the Sentinel-2 (most data from Statistical API)

•CDS Climate dataset

•How GeoVRI Uses These Data:

Tracks data relevant to observing the behaviour of vegetation (normalized difference vegetation index, moisture index, temperature and precipitation)

Based on gathered data it measures how well the ecosystem could recover.

Methodology

Scientific articles:

- Vegetation resistance and resilience to a decade-long dry period in the temperate grasslands in China - Link
- Fire Vulnerability, Resilience, and Recovery Rates of Mediterranean Pine Forests Using a 33-Year Time Series of Satellite Imagery - Link
- STAR - Global Vegetation Health Products : Background and Explanation - Link

Data that we used for analysis:

- Greece, Evia, 2021
- Italy, Sicily, 2021

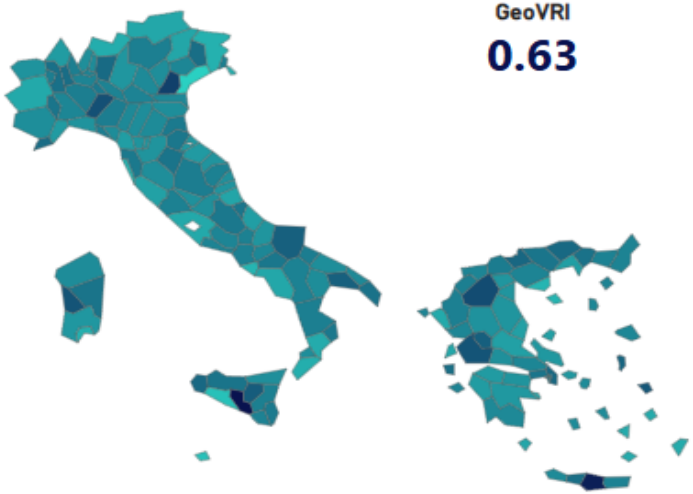
The formula:

$$\text{GeoVRI} = 0.5\,\frac{\text{NDVI}}{\text{NDVI}_{previous}} + 0.25\,\text{MOISI} + 0.2\,\text{PI} + 0.05\,\text{TEMP}$$

Country: All

NUTS 3 Region: All

GeoVRI: Geospatial Vegetation Recovery Index

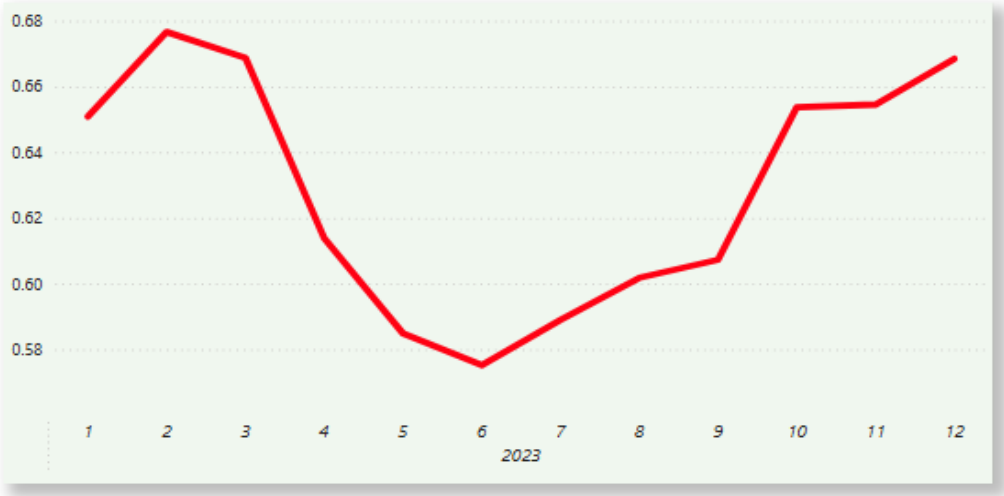


Regions with highest GeoVRI

NUTS 3 Region	GeoVRI
Caltanissetta	0.91
Ηράκλειο	0.88
Padova	0.80
Γρεβενά, Κοζάνη	0.77
Piacenza	0.76

Regions with lowest GeoVRI

NUTS 3 Region	GeoVRI
Βόρειος Τομέας Αθηνών	0.52
Napoli	0.52
Χαλκιδική	0.52
Agrigento	0.49
Venezia	0.46



Country

All

NUTS 3 Region

Ancona

Search

- Agrigento
- Alessandria
- Ancona
- Arezzo
- Ascoli Piceno
- Asti

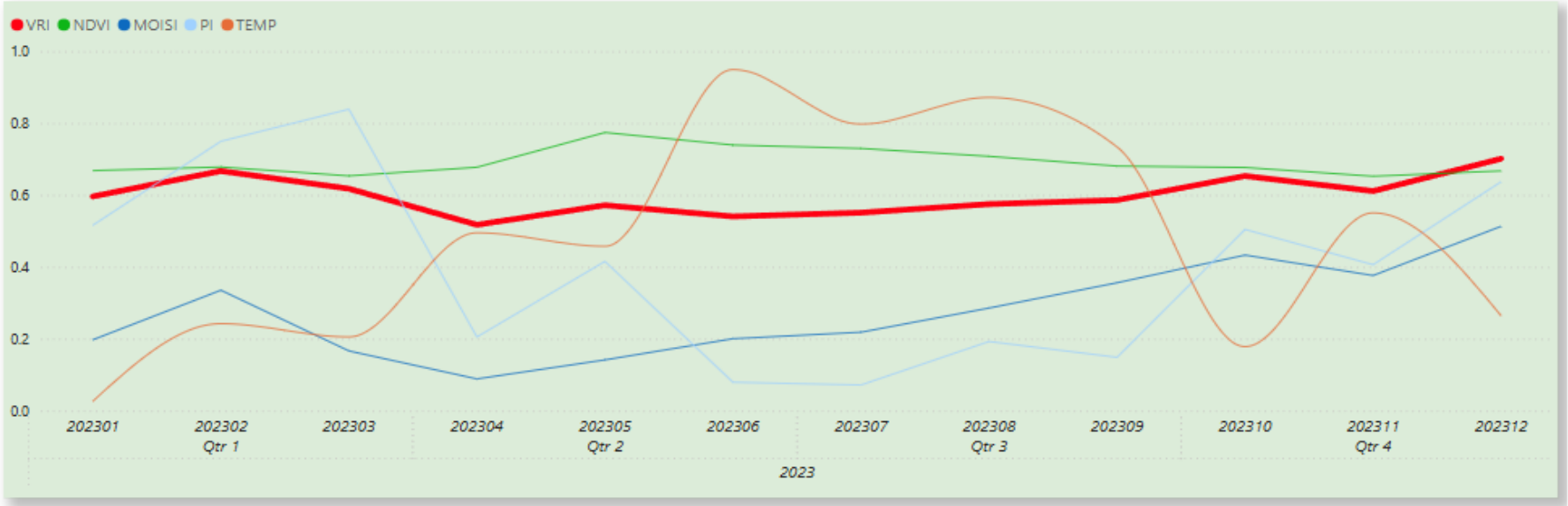
GeoVRI: Geospatial Vegetation Recovery Index

2019 2020 2023

1 2 6

7 8 12

Legend	
GeoVRI	Geospatial Vegetatiton Recovery Index
MOISI	Moisture index
NDVI	Normalized difference vegetation index
PI	Precipitation Index
TEMP	Temerature



Country: All

NUTS 3 Region: All

GeoVRI: Geospatial Vegetation Recovery Index

Year	Month	NUTS 3 Region	NDVI	MOISI	GeoVRI
2019	01	Agrigento	0.47	0.61	0.59
2019	01	Alessandria	0.72	0.68	0.76
2019	01	Ancona	0.65	0.45	0.68
2019	01	Arezzo	0.76	0.55	0.79
2019	01	Ascoli Piceno	0.70	0.32	0.67
2019	01	Asti	0.74	0.67	0.83
2019	01	Avellino	0.59	0.05	0.58
2019	01	Bari	0.67	0.16	0.60
2019	01	Barletta-Andria-Trani	0.66	0.19	0.63
2019	01	Belluno	0.61	0.14	0.54
2019	01	Benevento	0.57	0.03	0.48
2019	01	Bergamo	0.69	0.44	0.80
2019	01	Biella	0.69	0.68	0.81
2019	01	Bologna	0.72	0.64	0.76
2019	01	Bolzano-Bozen	0.57	0.05	0.53
2019	01	Brescia	0.70	0.36	0.70
2019	01	Brindisi	0.69	0.06	0.56

Limitations and further development

Prediction of the future: At the moment, GeoVRI calculates the vegetations' ability to recover in the moment of observation. The next step would be to apply machine learning algorithm so the index could predict future behavior in case of severe weather conditions.

Scale Optimization: Currently, the GeoVRI performs better on smaller scale, and a key area for improvement is optimizing the index to work effectively on larger regional scales.

Vegetation Type Inclusion: At present, the GeoVRI does not account for the specific type of vegetation or plant species in the region being analyzed. Incorporating vegetation type would significantly enhance the index's accuracy and improve predictions of recovery.

Thank you for your attention!

The dashboard:

NSI_RS

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