AOMSUC-15 2025 FYSUC

THE 15TH ASIA-OCEANIA METEOROLOGICAL SATELLITE USERS' CONFERENCE (AOMSUC-15)
2025 FENGYUN SATELLITE USER CONFERENCE (2025 FYSUC)

ASI+: Enhancing FAO's Agricultural Stress Index with Soil Moisture for Improved Drought Early Warning in Iran

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Why Monitor Agricultural Stress?

Food Security Threat

Drought and agricultural stress pose critical risks to global food systems and farmer livelihoods.

Early Warning Essential

Monitoring tools provide crucial early warnings that enable proactive response and risk mitigation.

Insurance Support

Agricultural insurance schemes rely on accurate stress monitoring to assess claims and manage risk.

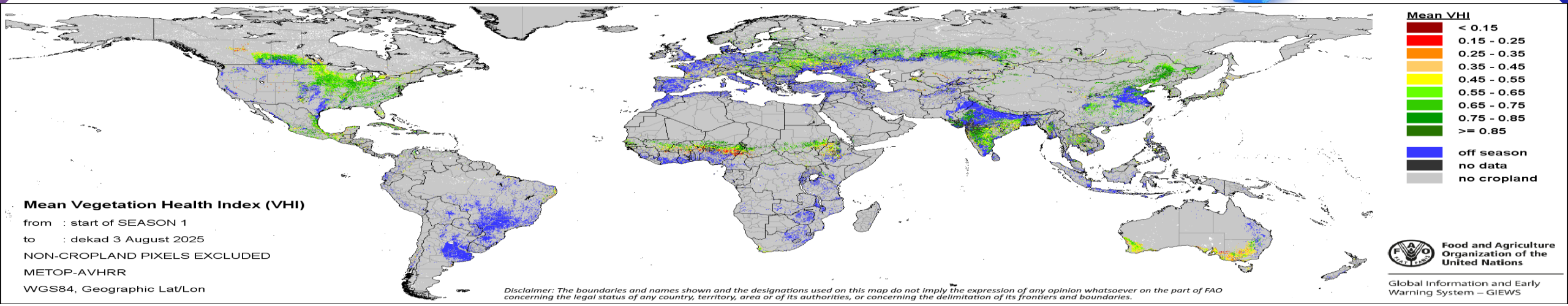
The **Agricultural Stress Index (ASI)** was developed by FAO to address these critical monitoring needs with a standardized global approach.

What is the Agricultural Stress Index?

Core Features

- Developed by FAO/GIEWS for comprehensive global agricultural drought monitoring
- Built on the Vegetation Health Index (VHI) combined with precise cropland mapping
- Identifies regions where significant portions of cropland experience stress conditions
- Provides continuous global coverage from 1984 to present with regular updates

FAO ASIS
Agriculture Stress Index System



Global Applications

AMIS Integration

Agricultural Market Information System uses ASI for global crop monitoring and market intelligence.

GIEWS Early Warning

Global Information and Early Warning System leverages ASI for timely food security alerts worldwide.

Open Access Platform

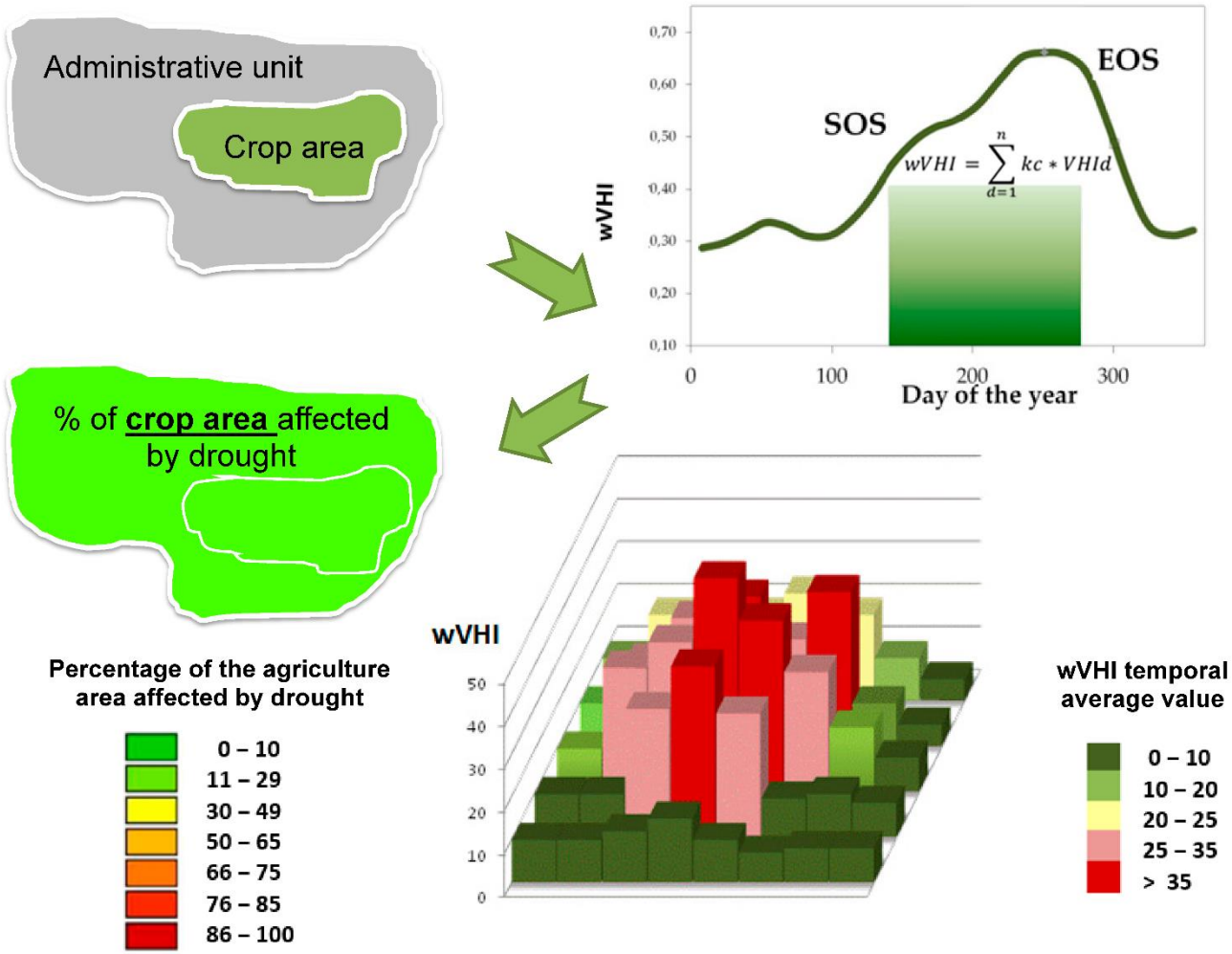
Freely accessible maps and historical time series data support researchers, policymakers, and practitioners.

ASI Methodology

Input Data Collection

Index Calculation

Cropland Application



ASI+ Derivation and Frequency Integration

1. NOATA AVHIR / Metop – VHI computation
2. ERA55-Land – SMCI (Soil Moisture Condition Index)

MODIS Time-Series – 10-day mean in active season)

→ Final ASI+

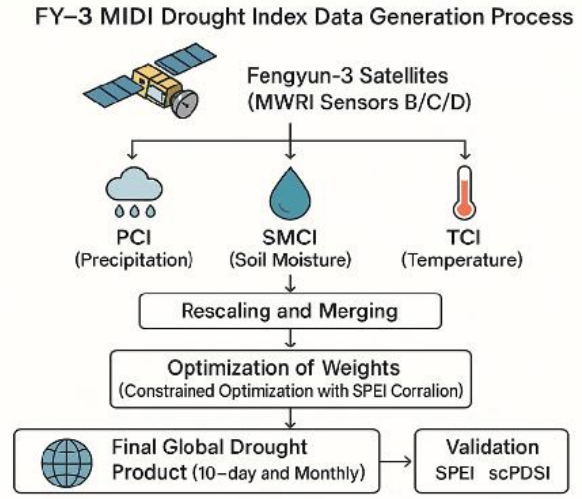
FY-3 MIDI index

Drought classification logic

10+day analysis: (WATCH → 1–2 spare stress

WARNING → ≥3 consecutive stress periods; ALERT → ≥5 consecutive stress periods.

Validation



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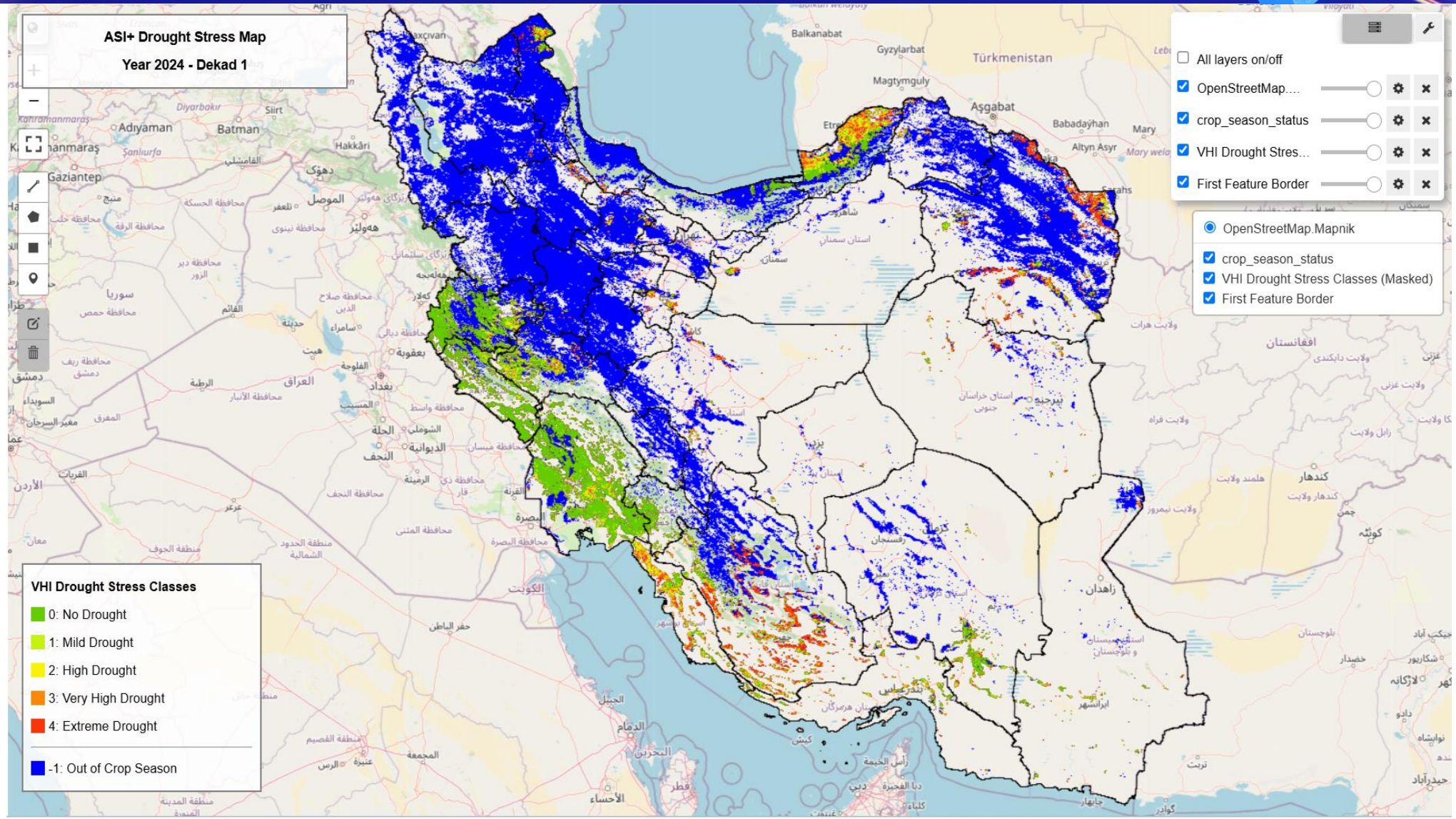
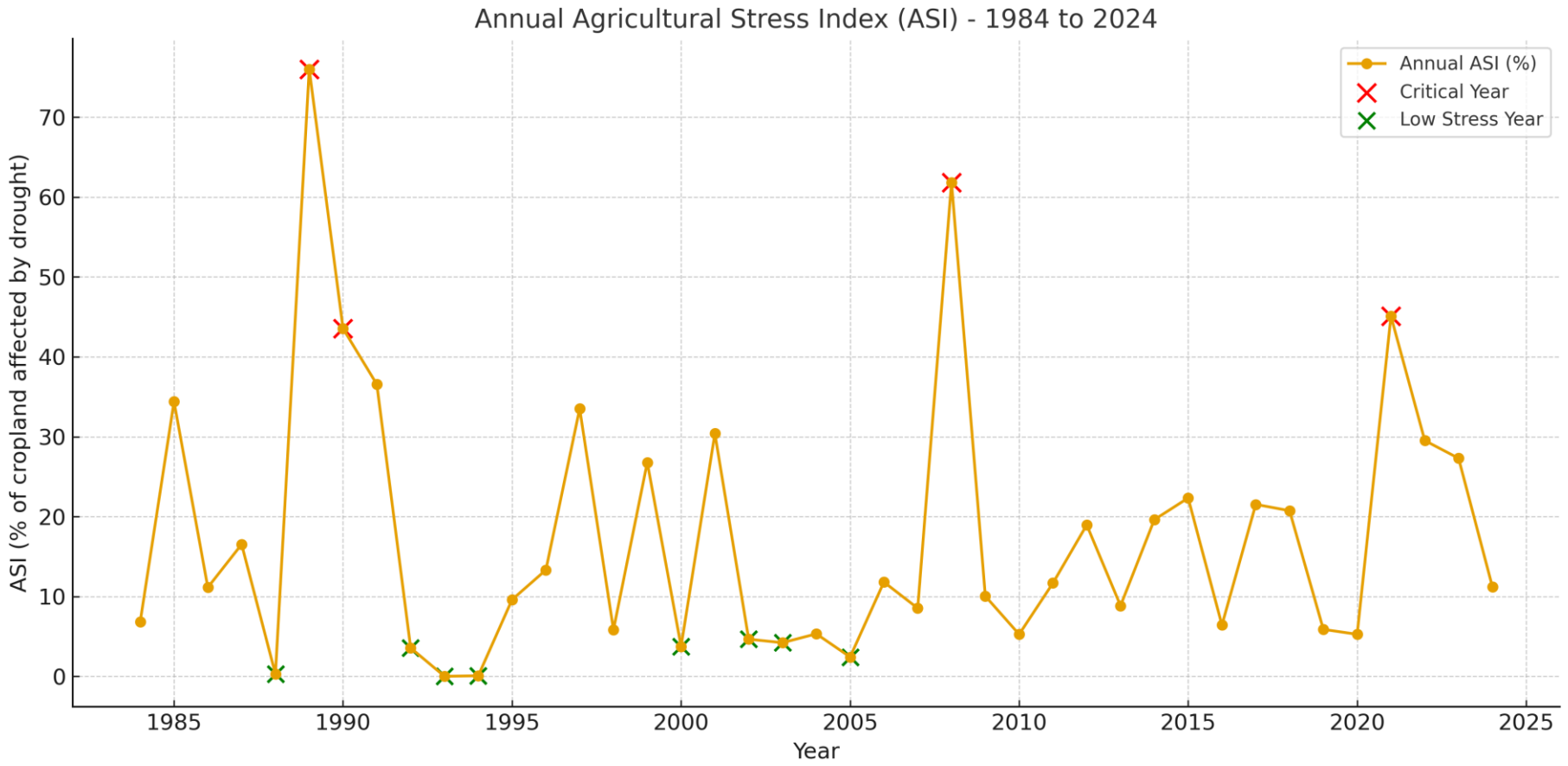
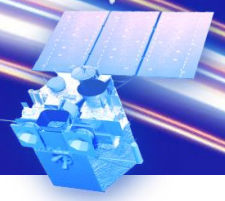
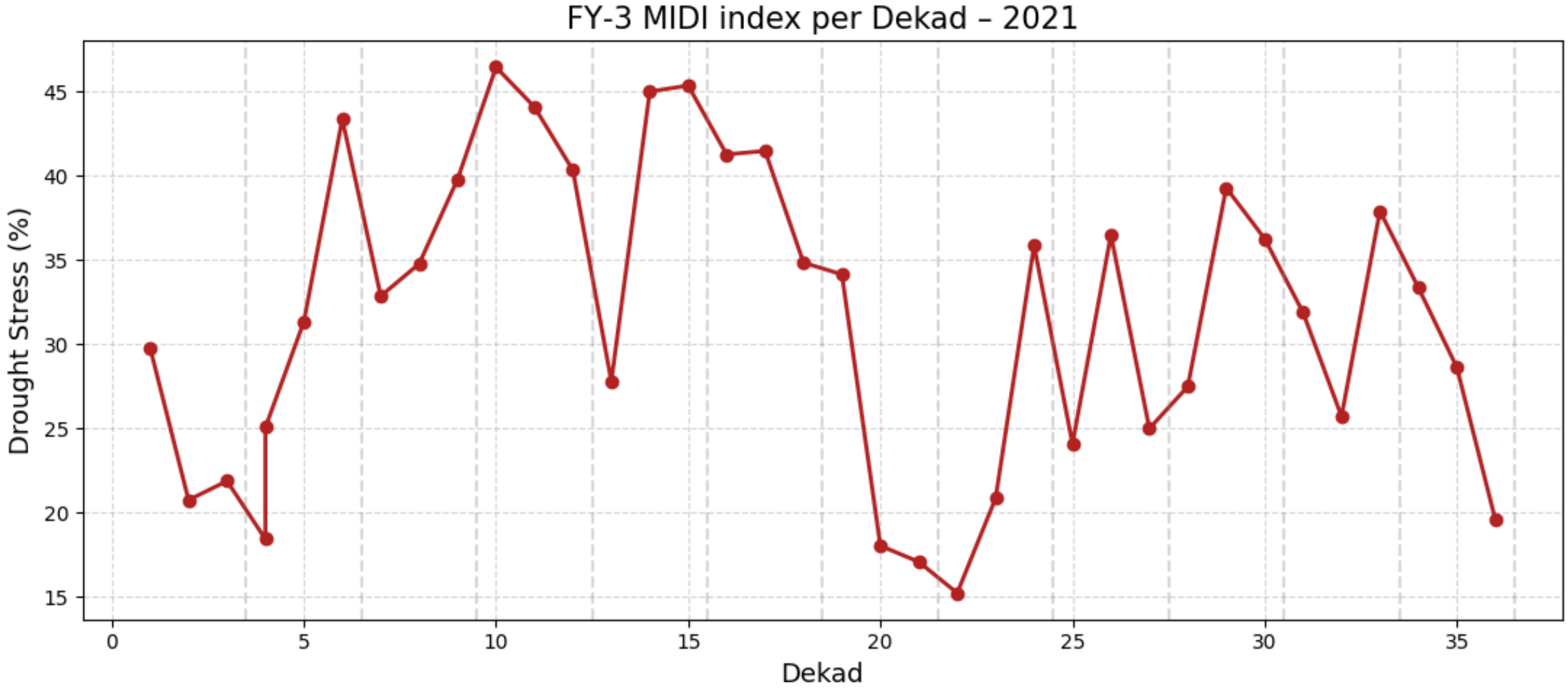
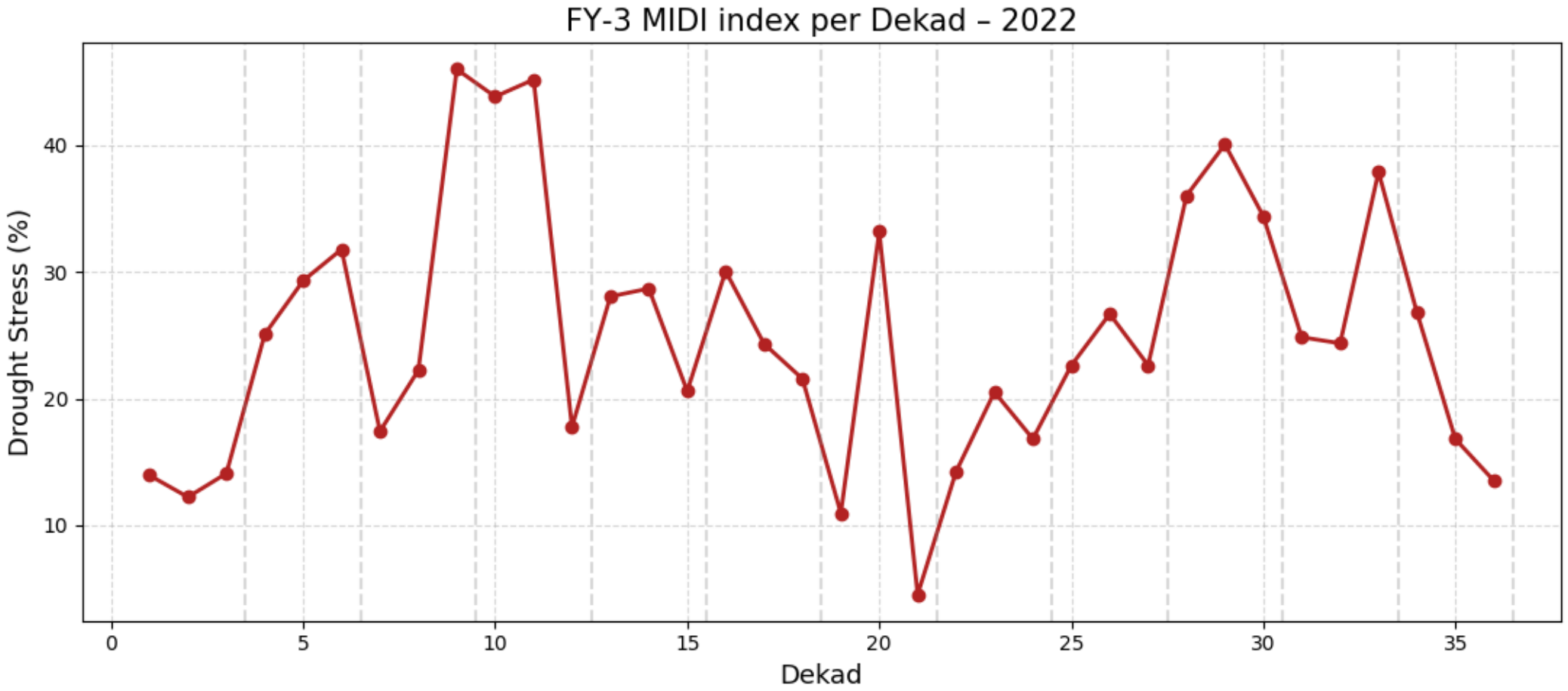


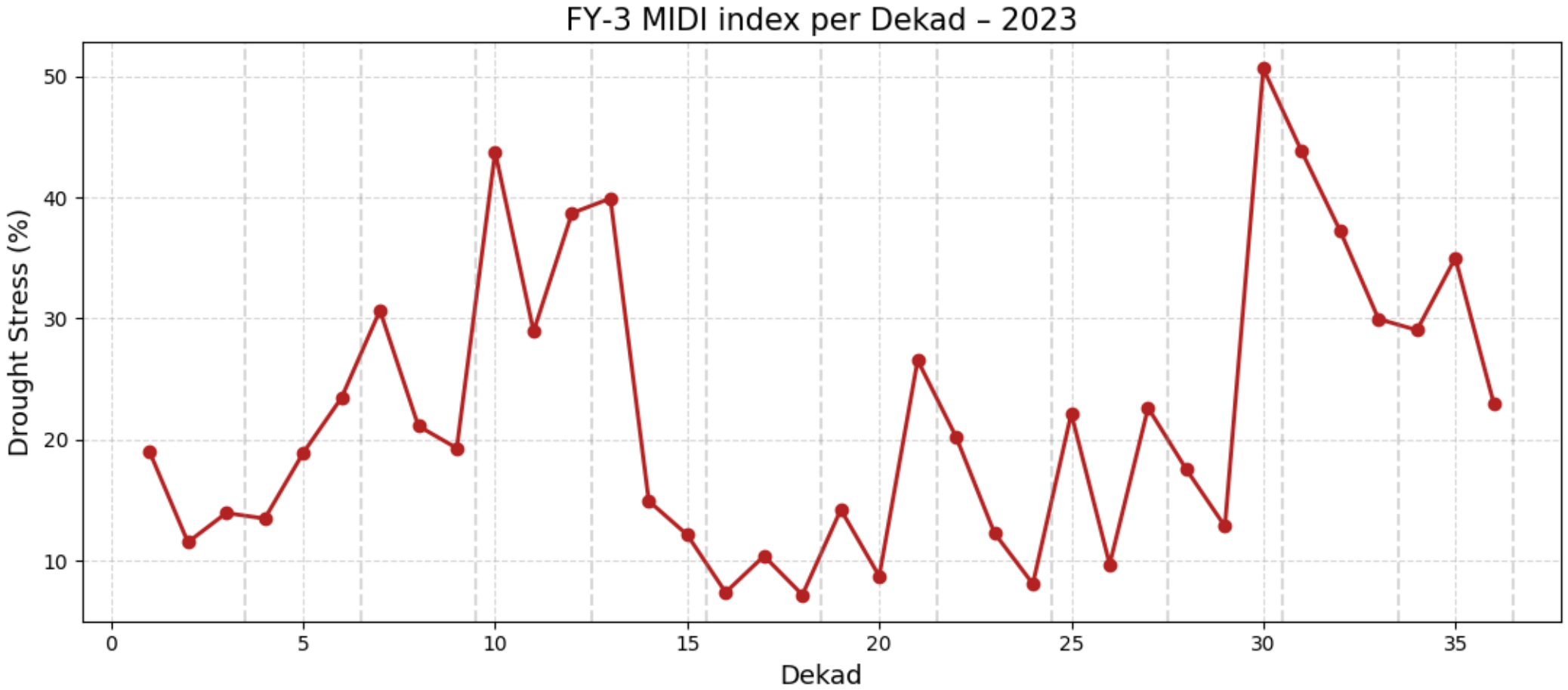

Annual Agricultural Stress Index (ASI) - 1984 to 2024
Annual ASI (%)
Critical Year
Low Stress Year
ASI (% of cropland affected by drought)
0
10
20
30
40
50
60
70
1985
1990
1995
2000
2005
2010
2015
2020
2025
Year

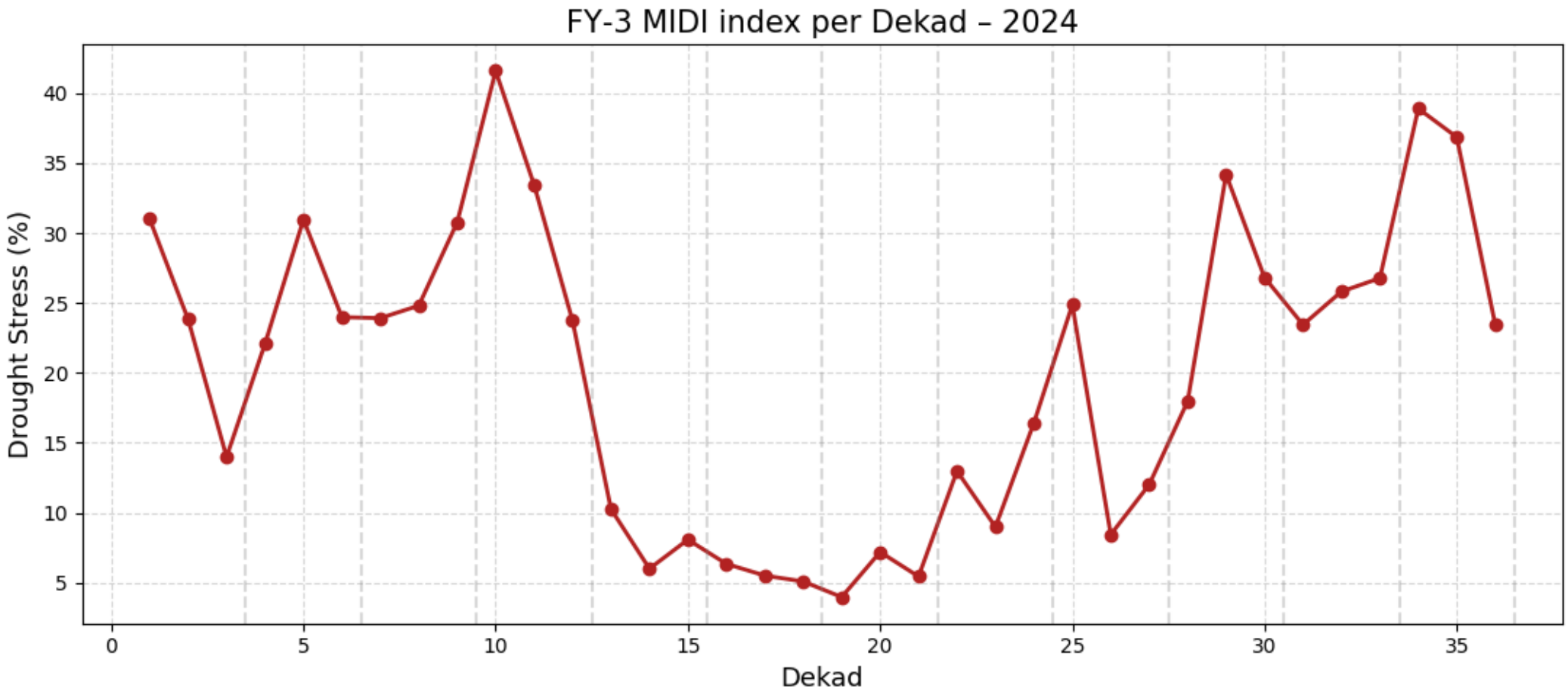


- 📈 **Maximum drought impact:** in **1989**, with **76%** of cropland affected.
- 📉 **Minimum drought impact:** in **1993**, with only **0.02%** affected.
- ⚖️ **Overall average ASI (1984–2024):** about **17.6%**.
- 🚨 **Critical drought years (above 40%):** 1989, 1990, 2008, 2021.
- 🌱 **Mild drought years (below 5%):** 1988, 1992, 1993, 1994, 2000, 2002, 2003, 2005.
- ⏳ **Recent 5-year average (2020–2024):** about **23.7%**, which is **higher than the long-term average**, indicating more recent stress.


FY-3 MIDI index per Dekad – 2021
Drought Stress (%)
45
40
35
30
25
20
15
0
5
10
15
20
25
30
35
Dekad


FY-3 MIDI index per Dekad – 2022
Drought Stress (%)
10
20
30
40
0
5
10
15
20
25
30
35
Dekad


FY-3 MIDI index per Dekad – 2023
Drought Stress (%)
Dekad
50
40
30
20
10
0
5
10
15
20
25
30
35


FY-3 MIDI index per Dekad – 2024
Drought Stress (%)
40
35
30
25
20
15
10
5
0
5
10
15
20
25
30
35
Dekad

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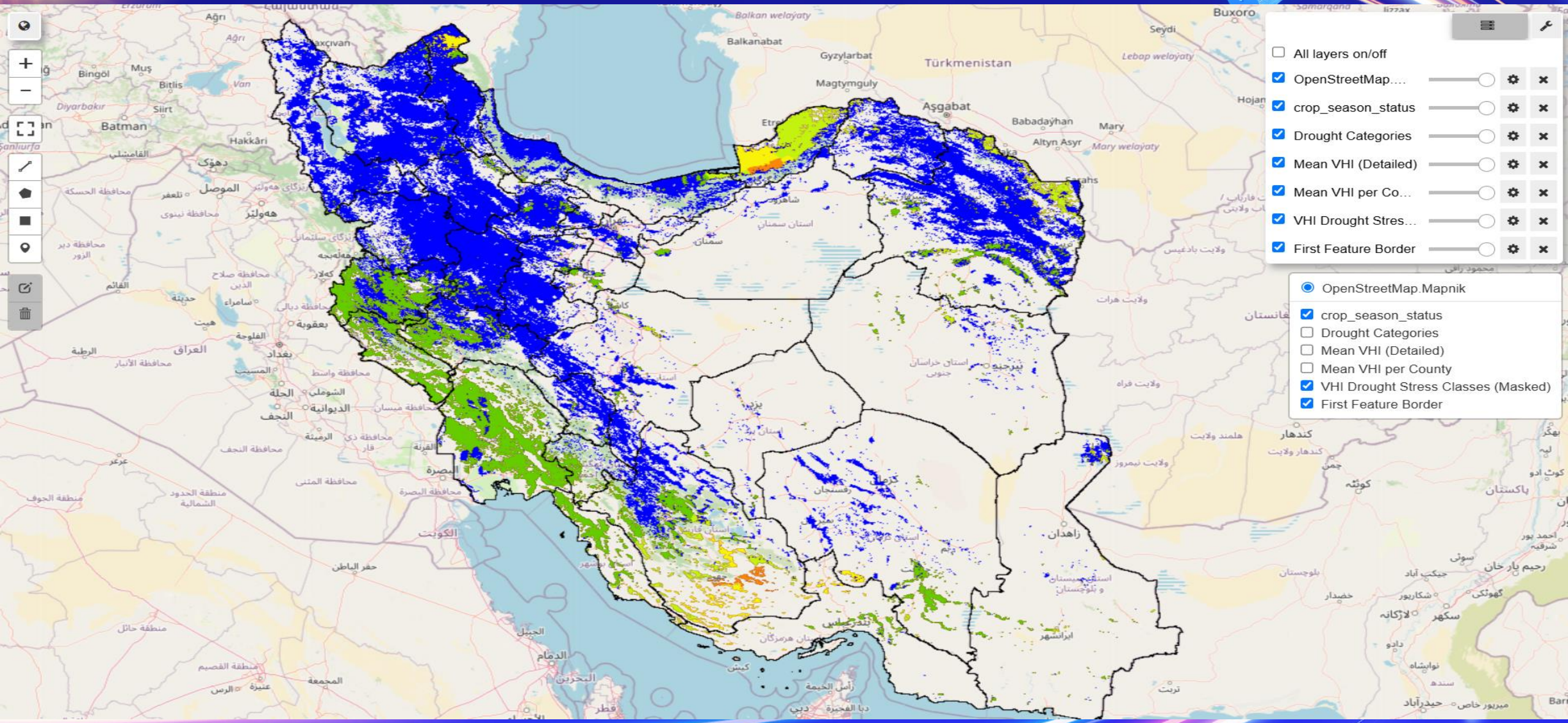

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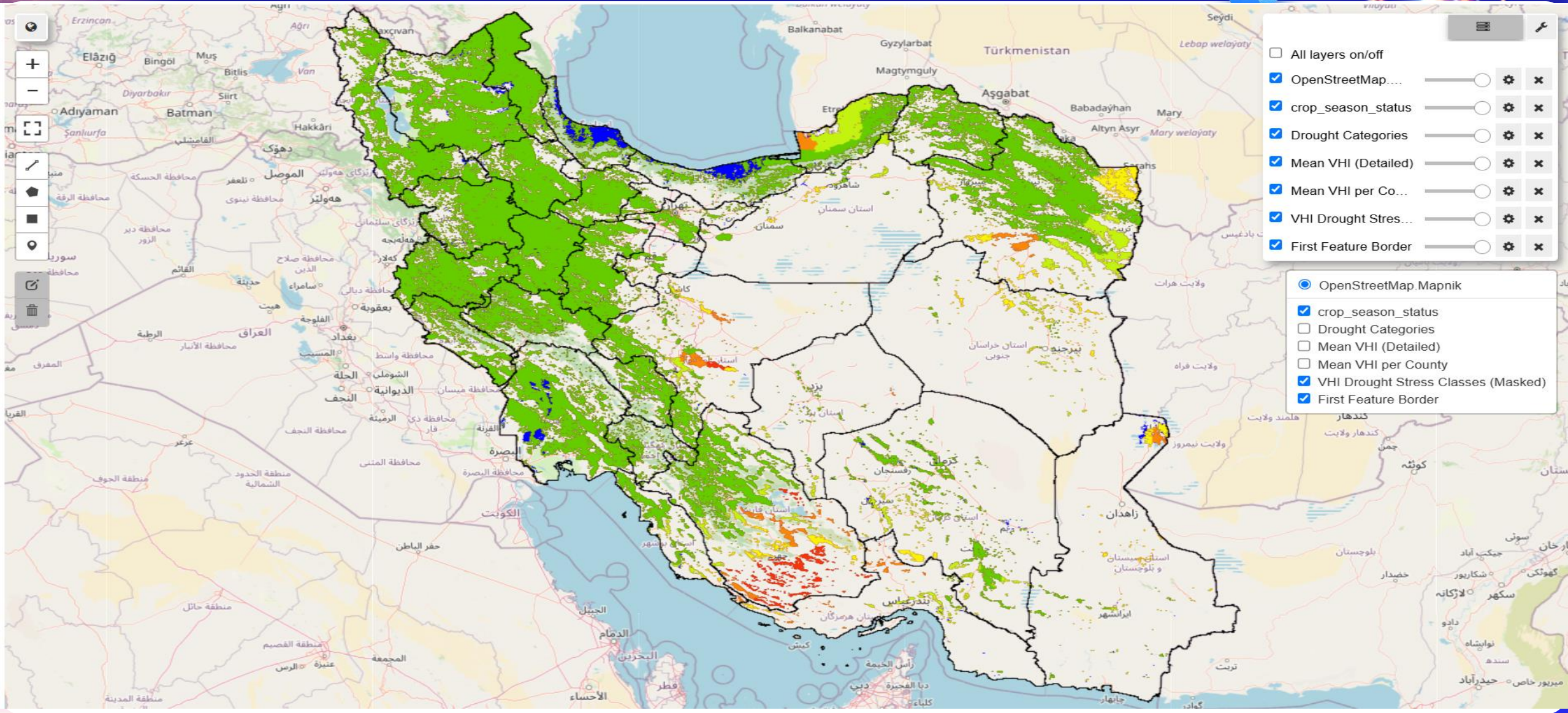

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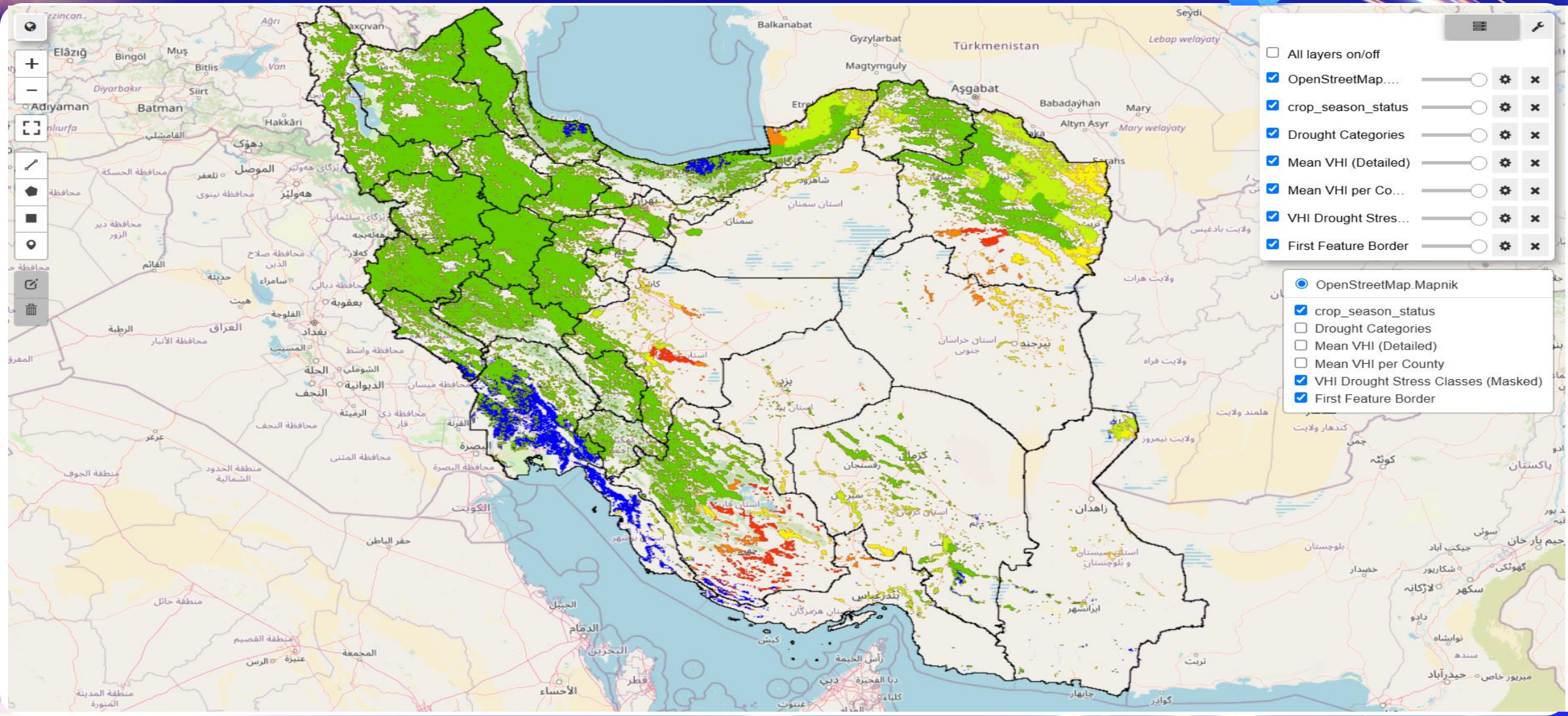

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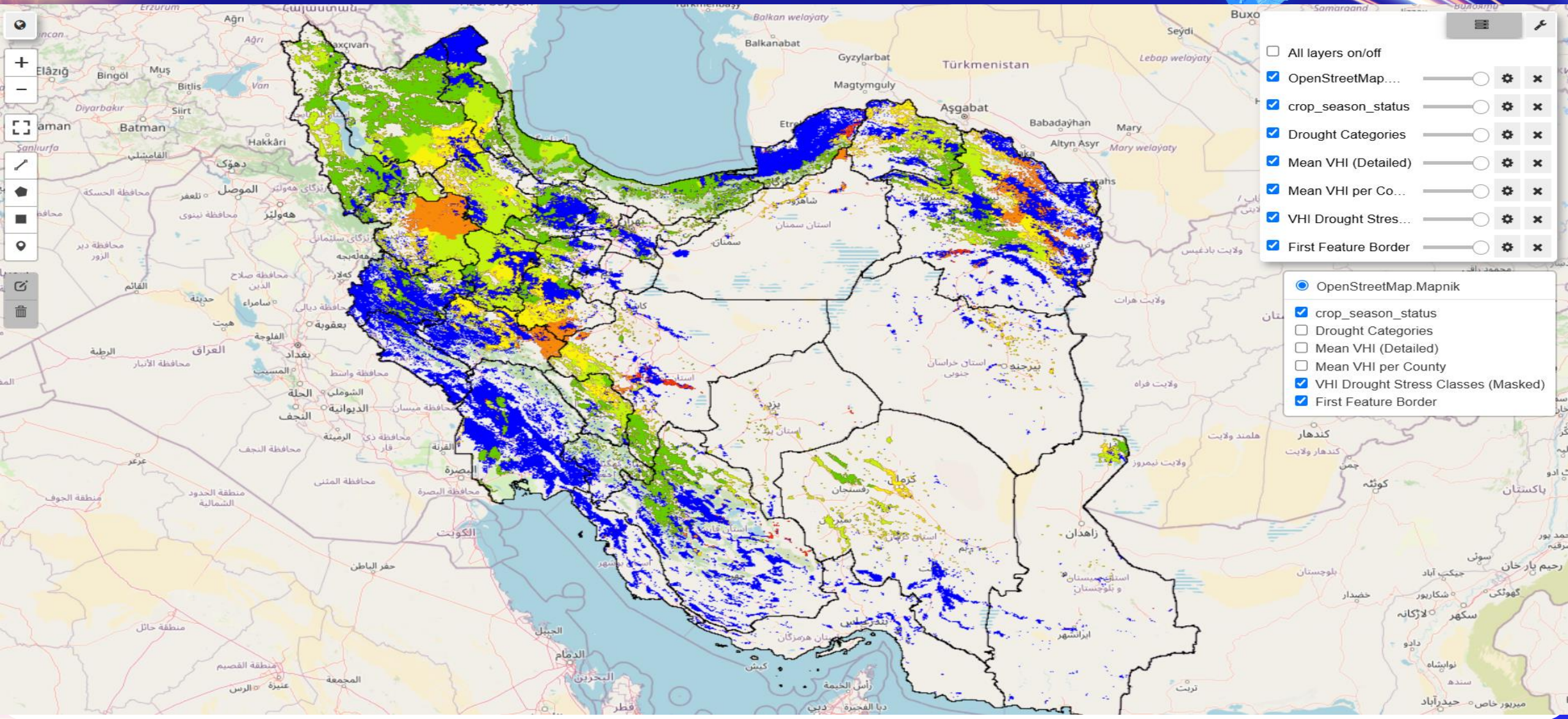
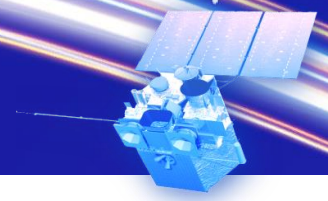




Comparative Analysis — ASI+ vs FY-3 MIDI (Year 2021)

The comparison between ASI+ and FY-3 MIDI indicates a **broad cross-sensor agreement** in detecting major agricultural droughts, despite differences in spatial coverage and retrieval mechanisms.

While ASI+ focuses on **cropland-specific optical and thermal anomalies** (NOAA/Metop with ERA5-Land), FY-3 MIDI provides **microwave-based soil-moisture and temperature insights** for the entire landscape.

Taken together, they offer **complementary perspectives**—ASI+ for area-based agricultural monitoring, and FY-3 MIDI for temporal dynamics and short-term drought evolution—highlighting the value of multi-sensor integration for regional early-warning systems.

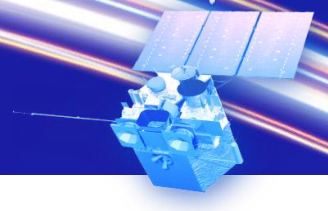
Conclusion & Outlook

The enhanced Agricultural Stress Index (ASI+) demonstrates high potential as a **decision-support tool** for monitoring and management of agricultural droughts.

By integrating vegetation health and soil-moisture anomalies under the phenological mask, ASI+ provides **consistent, cropland-focused assessments** with temporal continuity at the national scale.

Meanwhile, **dekadal hybrid indices such as FY-3 MIDI** offer valuable complementary insight into the **short-term evolution of drought**, enabling finer monitoring and early warnings.

Further research should focus on **regional downscaling** and **spatially explicit versions** of these combined indices to enhance operational use and policy support in agricultural drought resilience.



Thank you