Effect of Drought Stress on Forest Evapotranspiration

A case study on Indian Forest

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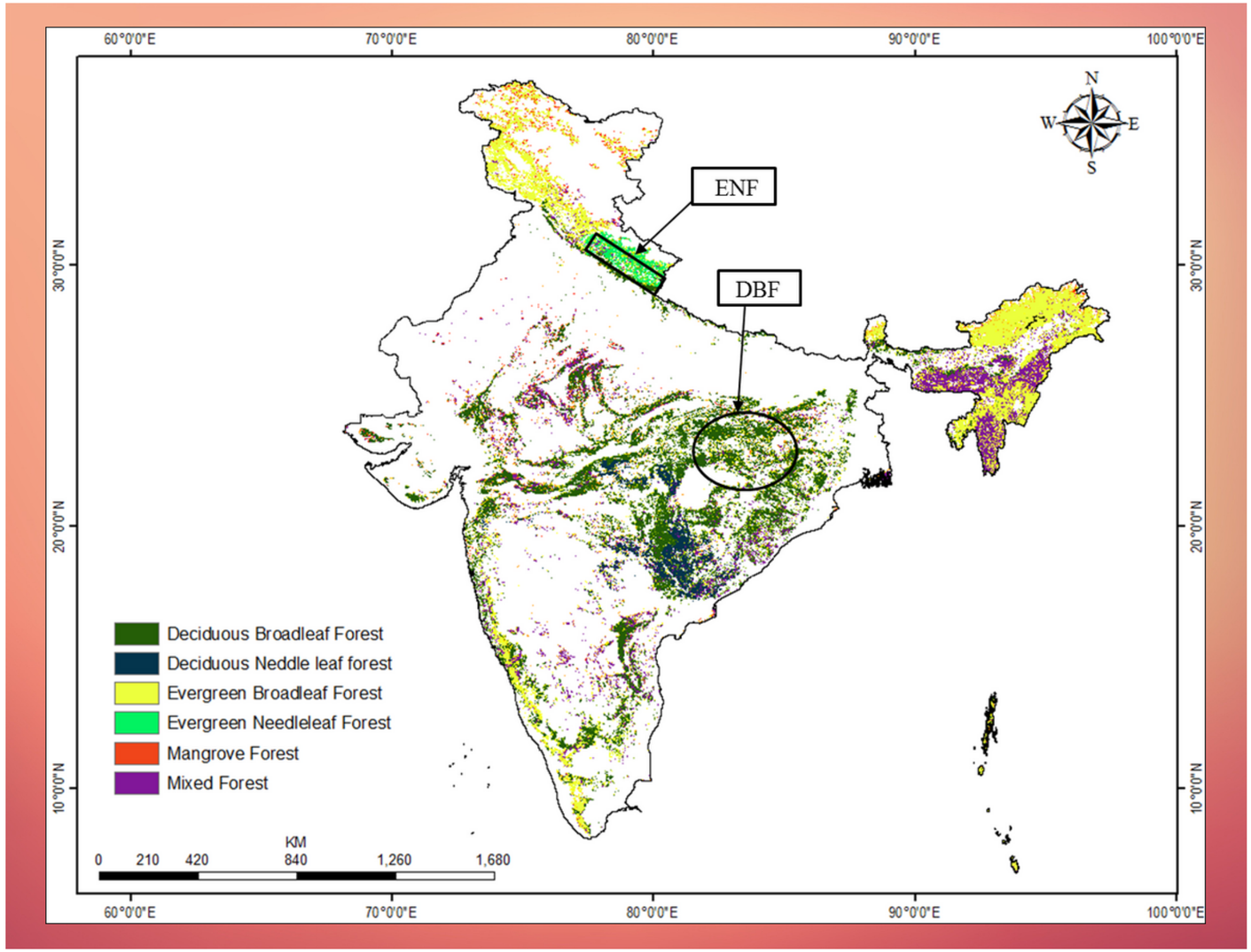
Study Area



Source: **Decadal Land Use and Land Cover Classifications by Roy et. al 2015 across India, 1985, 1995, 2005**

In India, there are six main classifications of forest types. These are

- Evergreen Needle-leaf Forest(ENF)
- Evergreen Broad-leaf Forest(EBF)
- Deciduous Needle-leaf Forest(DNF)
- Deciduous Broad-leaf Forest(DBF)
- Mixed Forest(MF)
- Mangrove Forest(Ma-F)

However, we only employ two of these in our research. ENF and DBF are used to compare these scenarios.

Major Goals

1. The trend of Standardized Precipitation Index (SPI) from 1981 to 2020 over DBF and ENF's location
2. Trends in Vegetation Condition Index (VCI), Temperature Condition Index (TCI), and Vegetation Health Index (VHI) from 2002 to 2020
3. What happens to VCI, TCI, and VHI during drought and non-drought years
4. How does evapotranspiration reacts during drought and non-drought years?

Data Used

1. **Standard Precipitation Index (SPI)**

   Climate Hazards Group Infrared Precipitation with Stations (CHIRPS) with 5 km resolution

2. **Vegetation Condition Index (VCI)**

   MOD09A1.006 Terra Surface Reflectance 8-Day Global with 500m resolution

3. **Temperature Condition Index (TCI)**

   MOD11A2.006 Terra Land Surface Temperature and Emissivity 8-Day Global with 1km resolution

4. **Vegetation Health Index (VHI)**

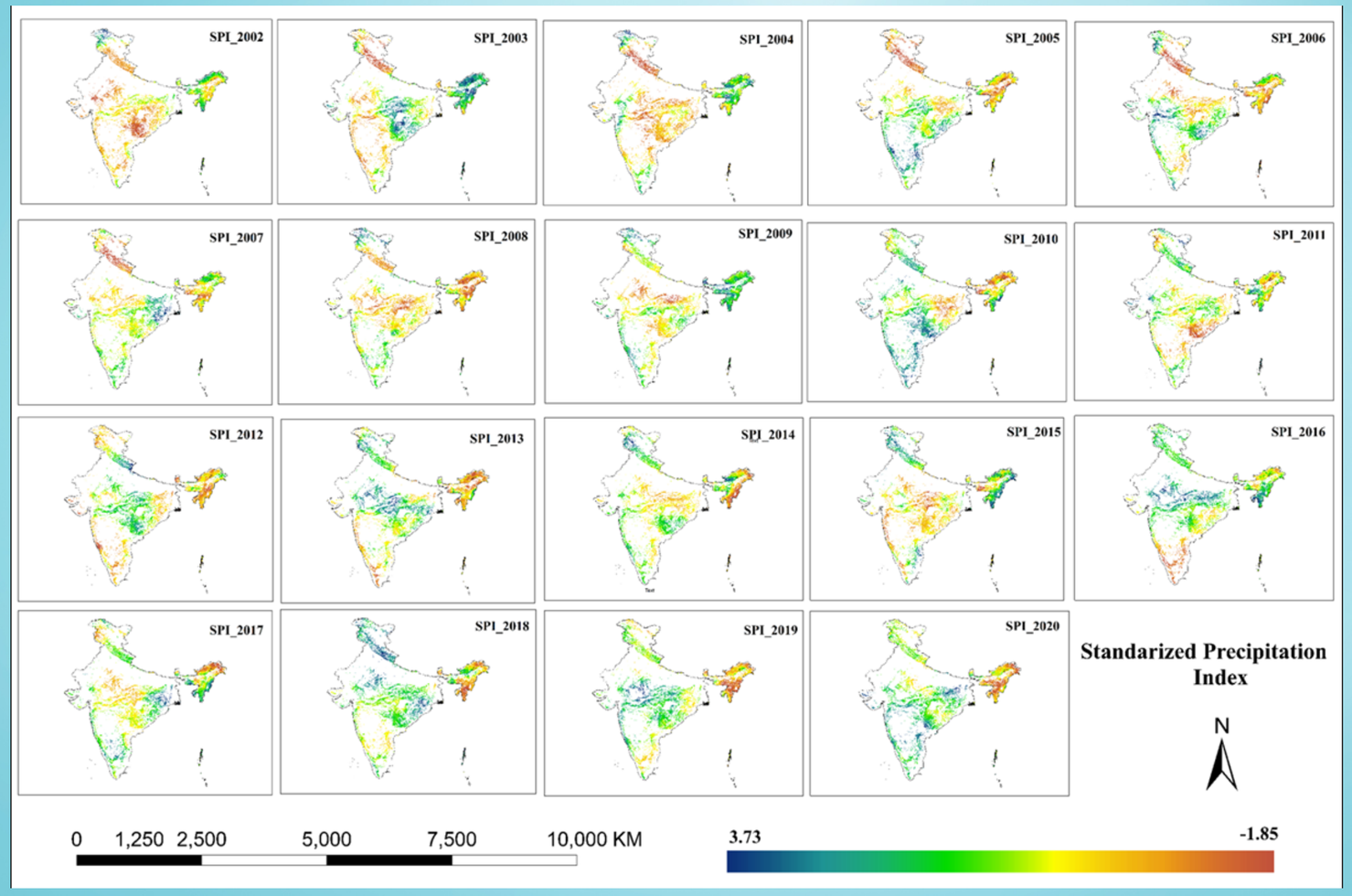
   both VCI and TCI data are used and resampled to 5 km

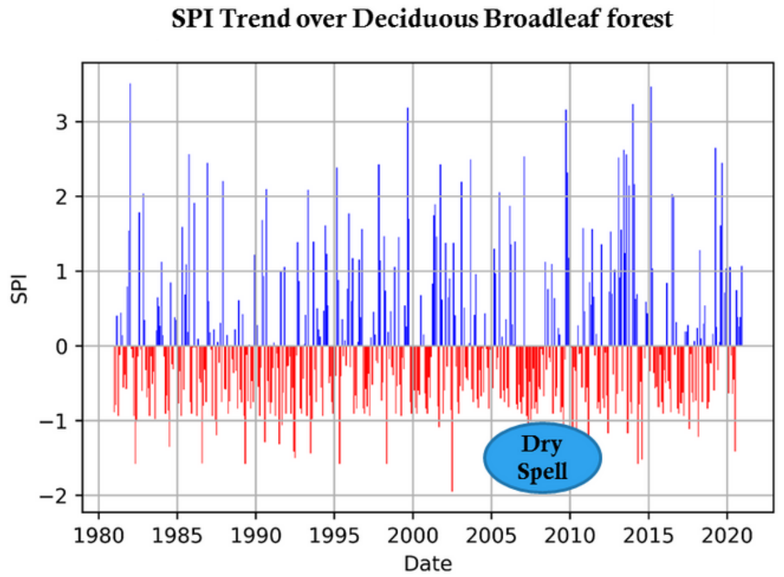
5. **Evapotranspiration (ET)**

   Mapping Evapotranspiration with Internalized Calibration(METRIC) with 30 m resolution

Results

Trends in SPI over major forest types of India (2002 to 2020)





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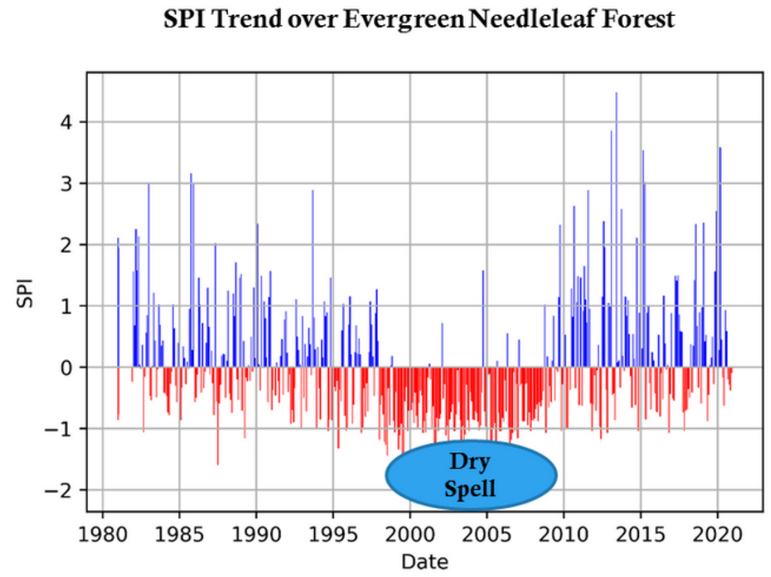
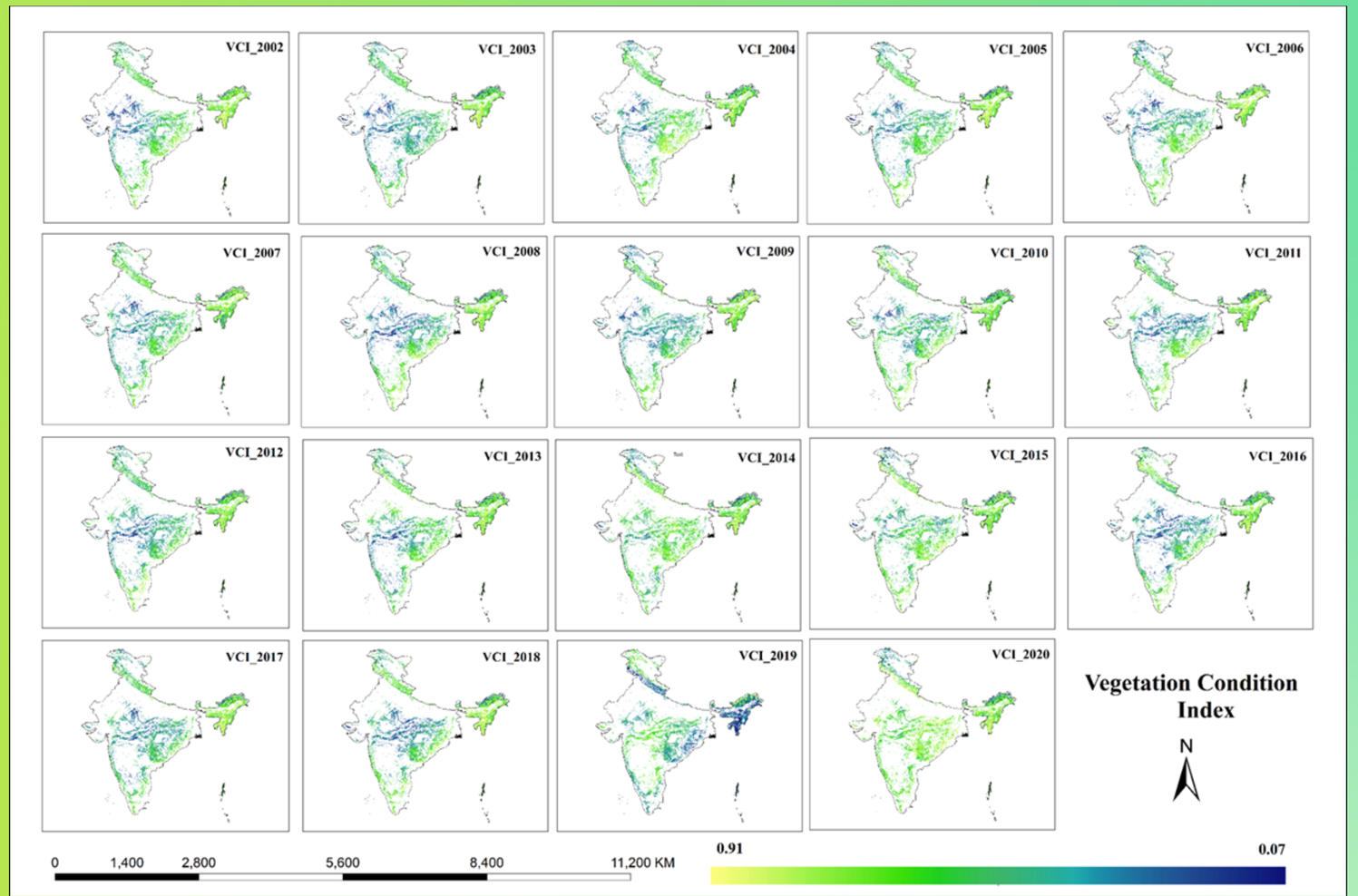


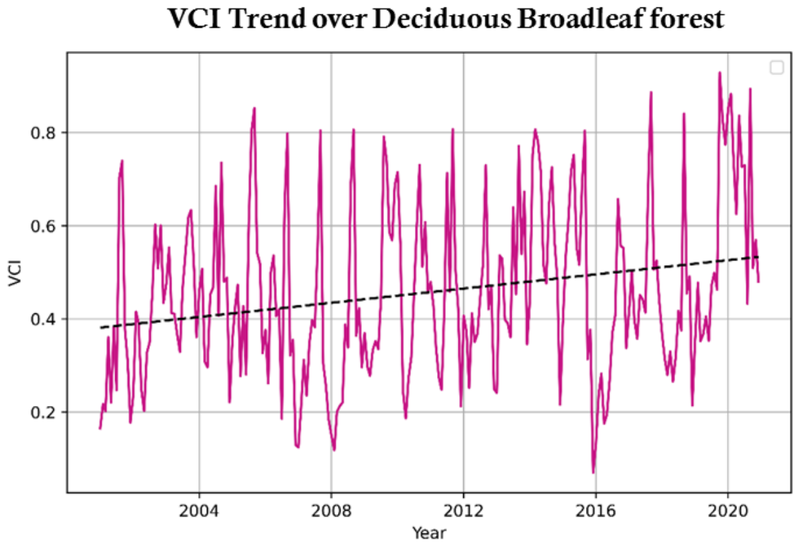
B

A. The lowest SPI value for DBF was -2.03 in 2002, while the highest value was 3.46 in 2015.

B. ENF had a low SPI of -2.28 in 2002 and a high SPI of 3.94 in 2015

Trends in VCI over major forest types of India (2002 to 2020)





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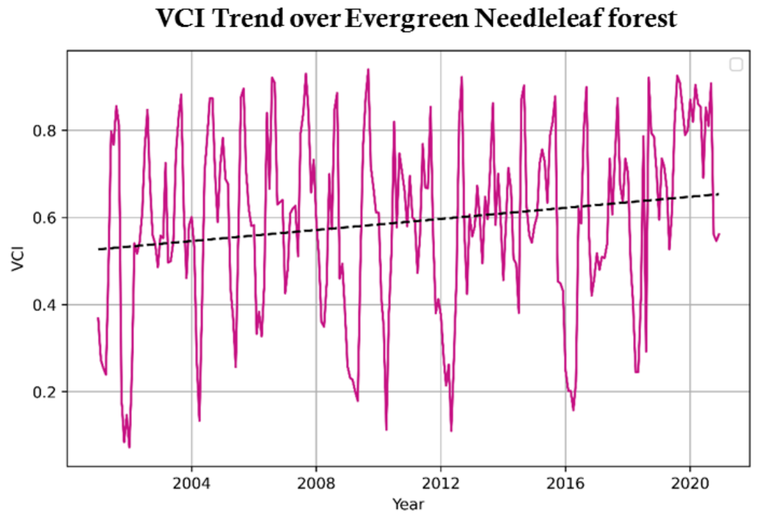

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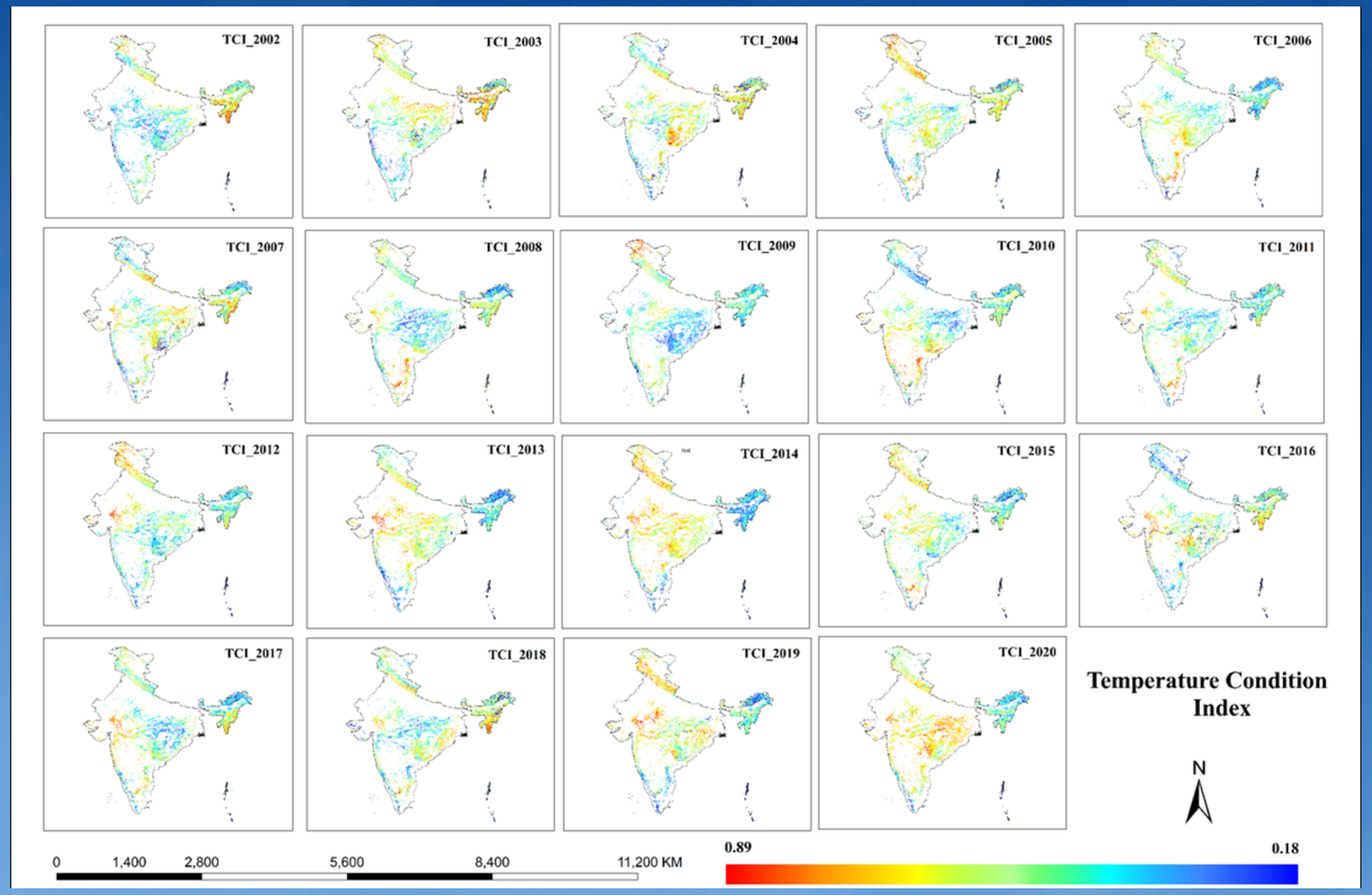
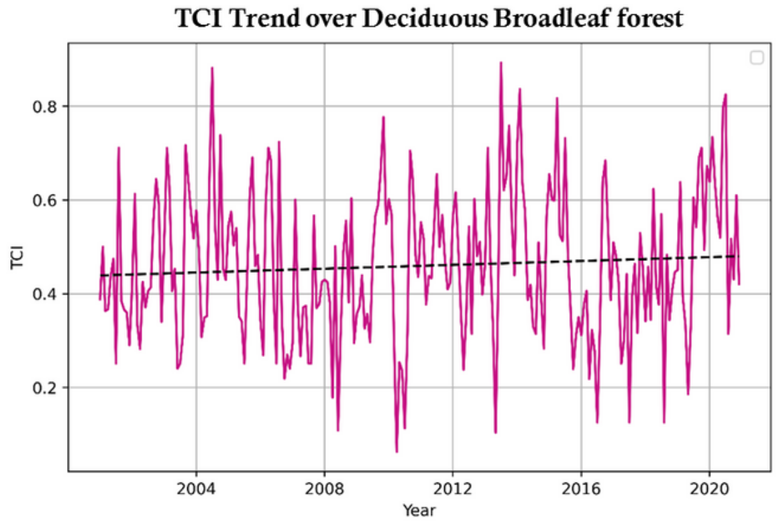
A. In DBF, the lowest VCI was 0.069 in 2016, while the highest VCI was 0.928 in 2019

B. The lowest VCI, 0.072, was recorded in 2002, and the highest VCI, 0.939, was recorded in 2009 in ENF

Trends in TCI over major forest types of India (2002 to 2020)





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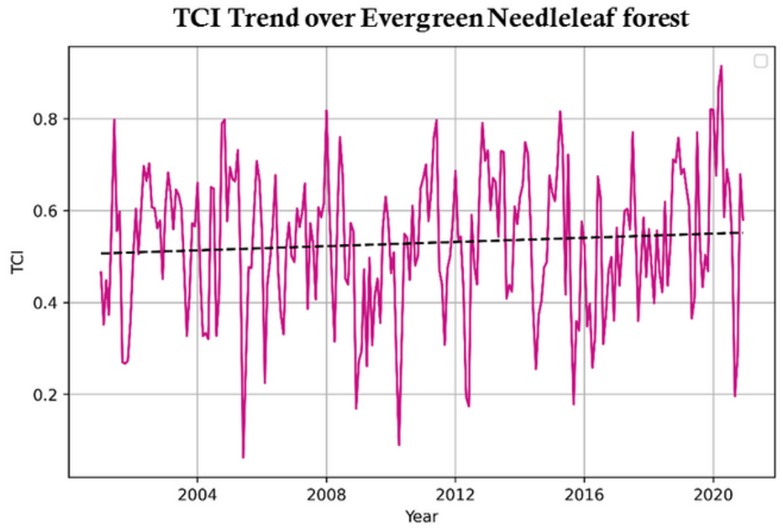

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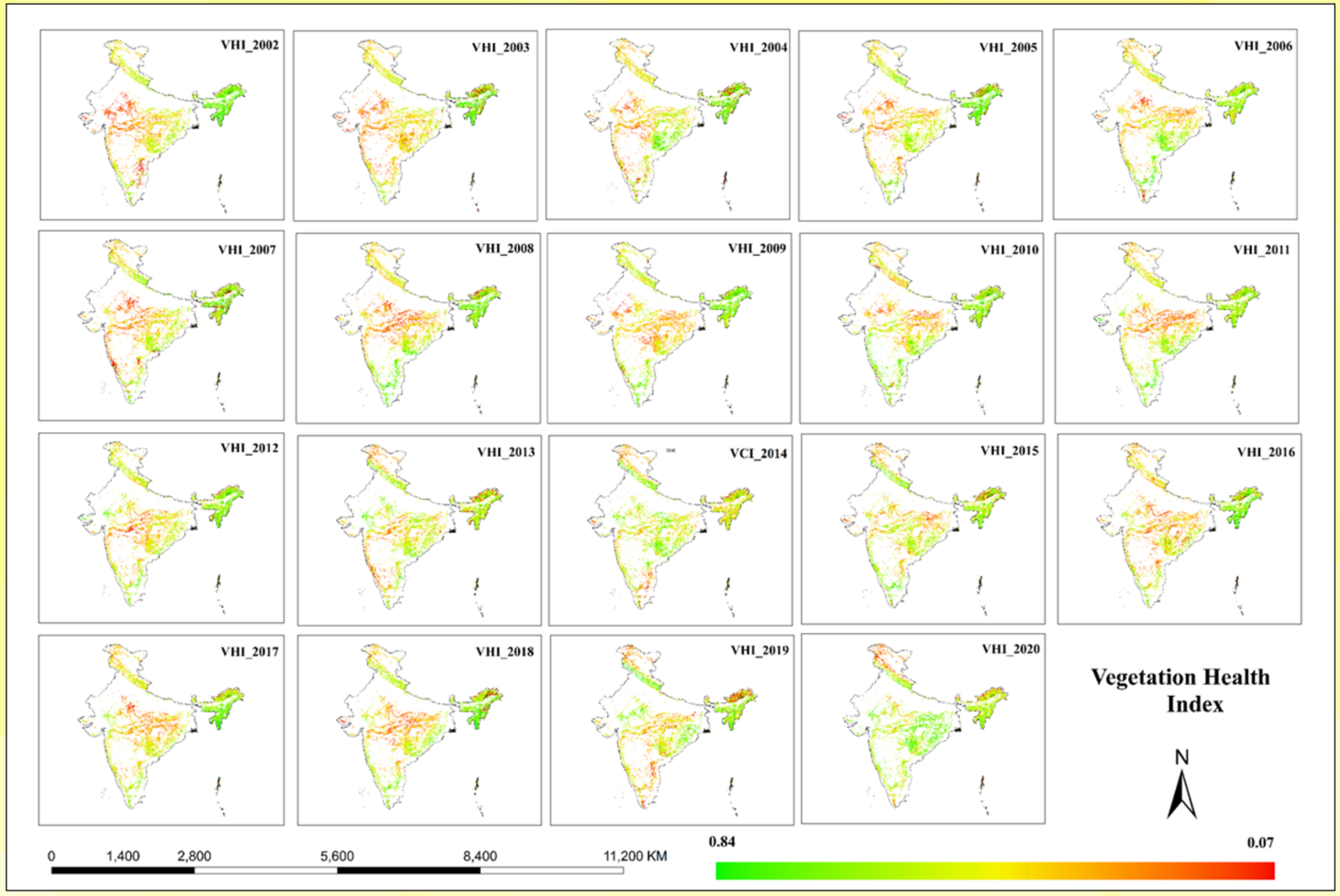
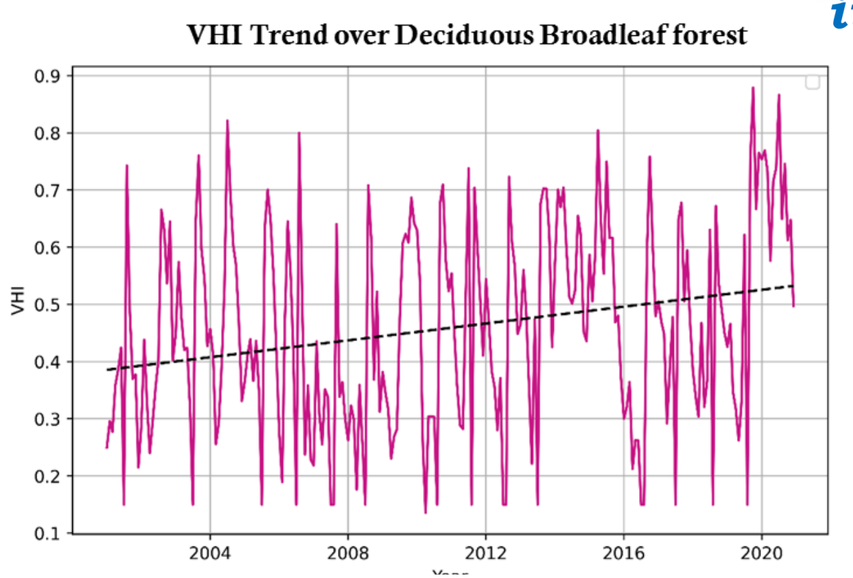
A. In 2010, the lowest TCI was 0.062, while in 2013, the highest TCI was 0.893 in DBF.

B. The lowest TCI was 0.052 in 2005, while the highest was 0.914 in 2020

Trends in VHI over major forest types of India (2002 to 2020)





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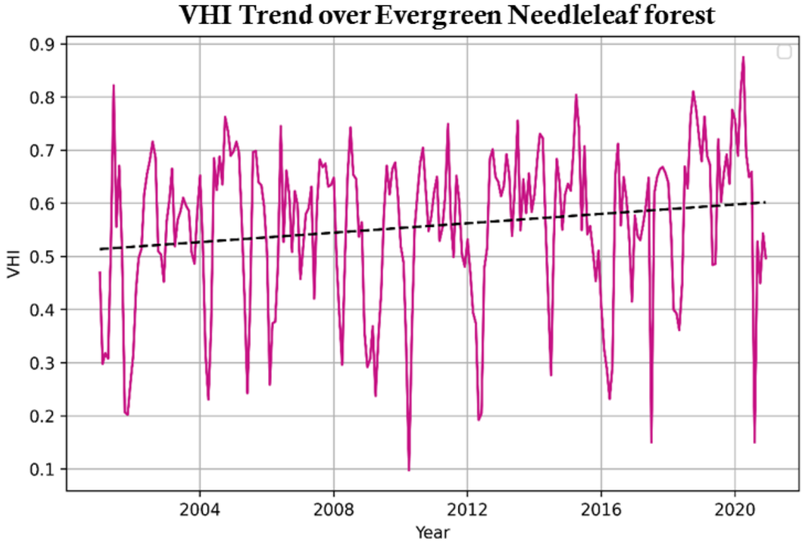


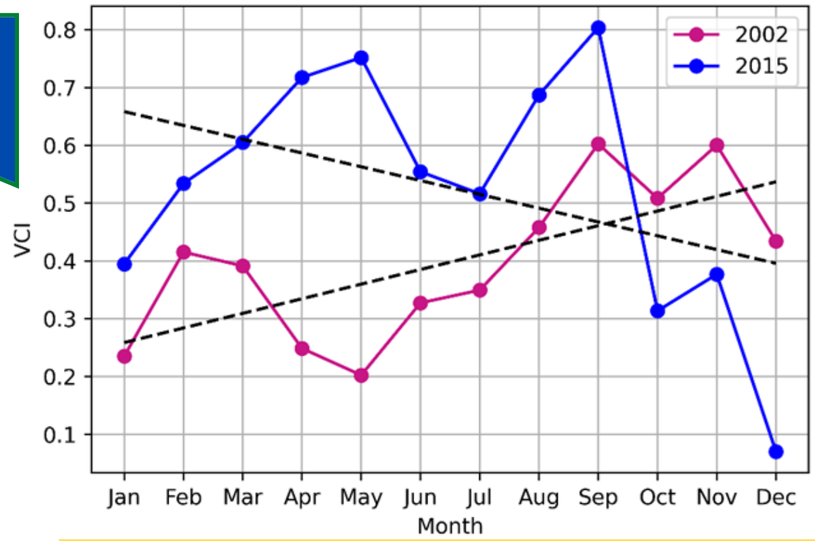
B

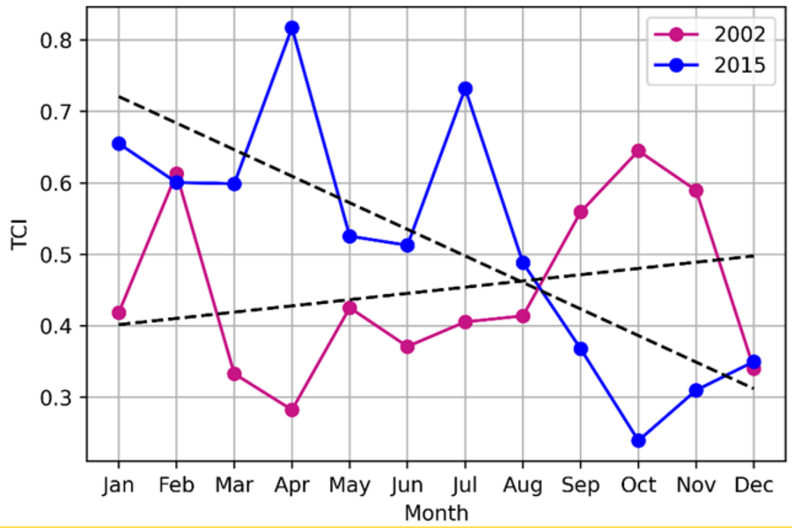
A. In 2019, the greatest VHI number was 0.879, while the lowest VHI was 0.135 in 2010 in DBF.

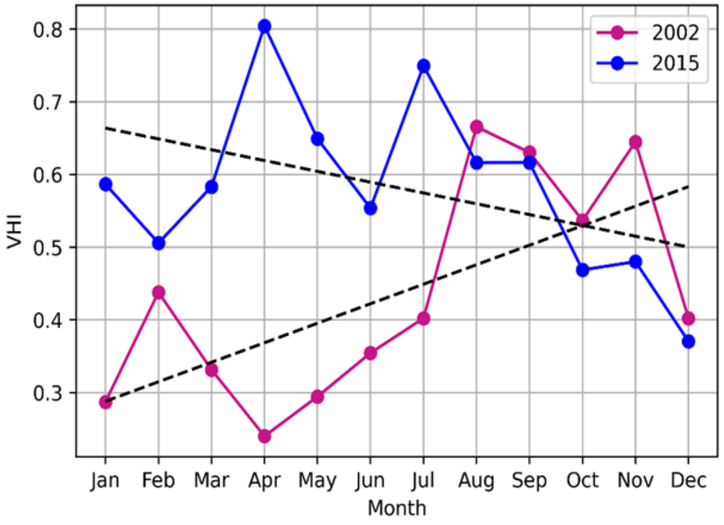
B. The lowest VHI value, 0.087, was recorded in 2010, while the highest, 0.875, was recorded in 2020 in ENF.

What happens to VCI, TCI & VHI during drought(2002) and non-drought years(2015)

DBF

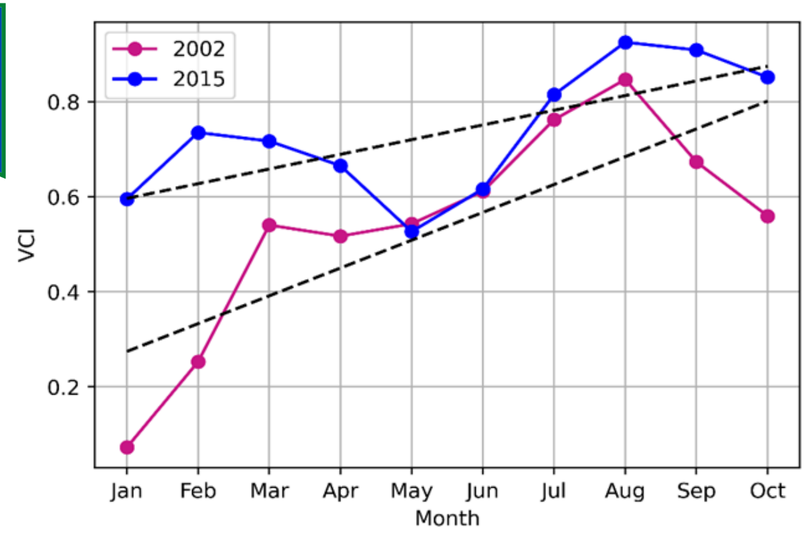


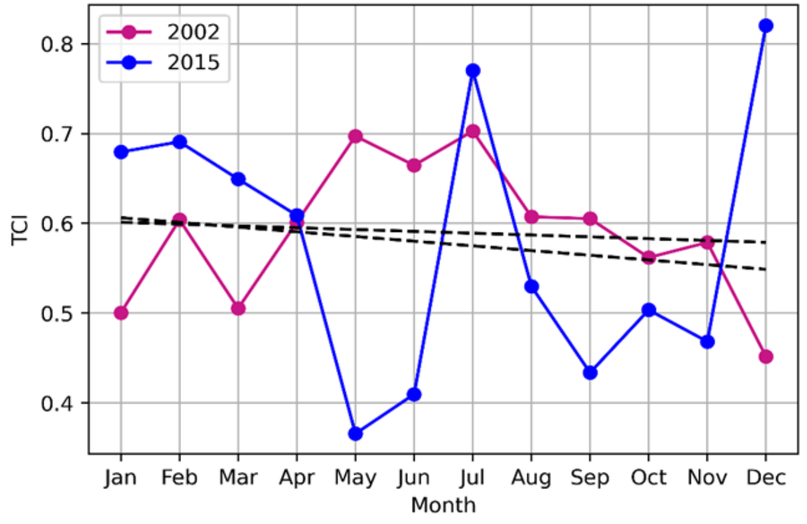


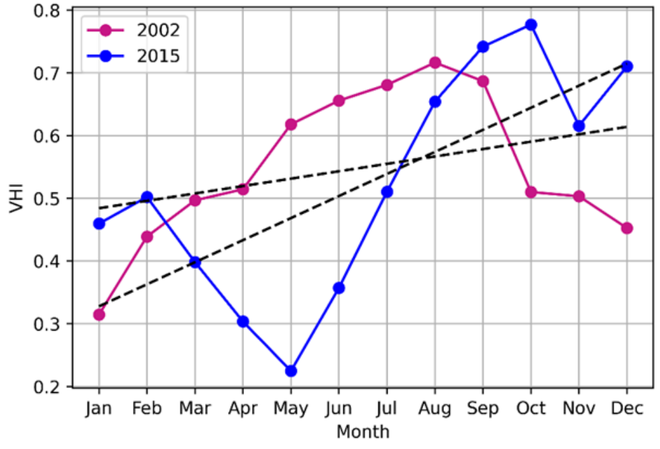


VCI **TCI** **VHI**

ENF

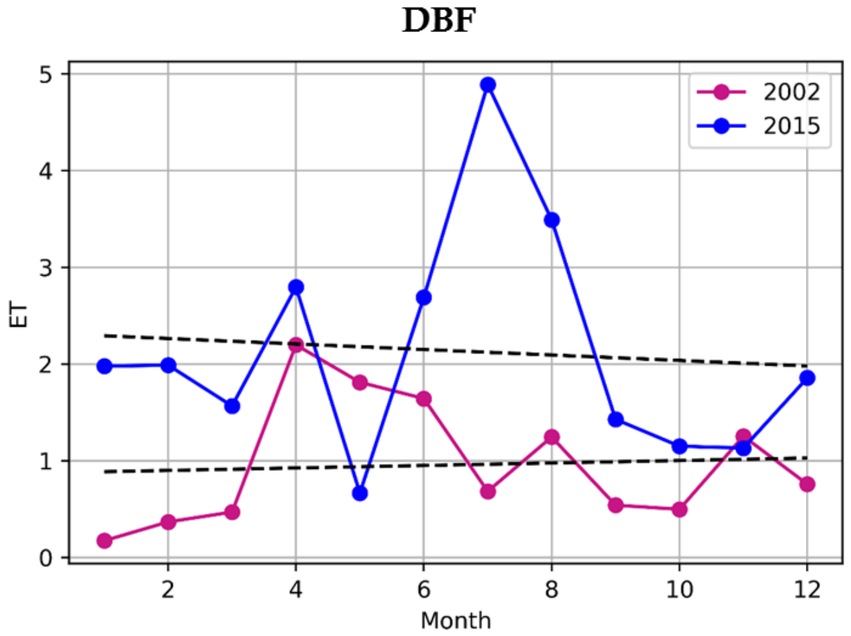


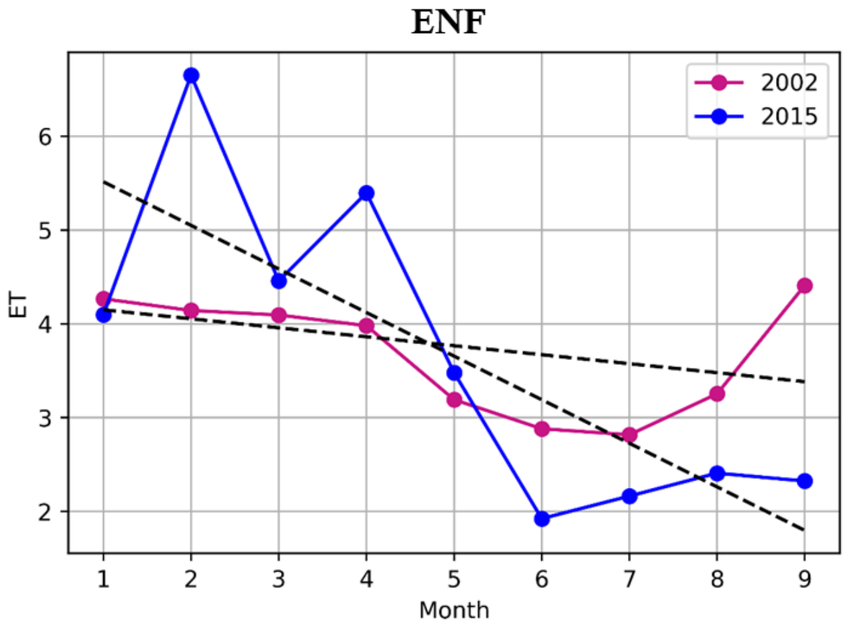




How does evapotranspiration react in drought and non-drought years?

A





B

A. DBF is more drought-stressed than ENF and its effect is seen in Evapotranspiration during 2002, the ET rate for DBF ranged from 0.17 mm/day to 2.19 mm/day and from 0.66 mm/day to 4.89 mm/day in 2015.

B. In 2002, the ET rate for ENF was 2.81 mm/day to 4.51 mm/day, it was 1.92 mm/day to 6.65 mm/day in 2015.

- Precipitation, temperature and plant's physiological and morphological difference between DBF and ENF are the main regulating factors for ET.


THANKS