



Wheat rust advisory - risk assessment from surveys and forecasts in Bhutan

Summary period: 07 Apr - 13 Apr 2025

Overall risk level:

Caution

Key messages

Surveys have been undertaken in the southwest of Bhutan, Trongsa, Punakha / Wangdue and are on-going in the east. Leaf and stripe rust are present, with high incidence/ severity of stripe rust in some fields in Punakha valley. Low levels of disease are being detected in the east. Crops are at a range of growth stages, most at flowering to maturity in survey areas, but earlier growth stages will exist in other areas. Given increasing suitability and presence of susceptible cultivars, stripe rust is likely to increase.

Increasing disease is starting to be detected in neighboring countries (Bangladesh (leaf rust) and Nepal Leaf and stripe rust)). Forecasts indicate continued possibility for spore dispersal into Bhutan, especially the western / southern (central) areas.

Suitability forecast (26 – 31 Mar) for leaf, stripe and stem rust indicates a marked increase in infection efficiency from the last advisory. High / moderate infection efficiency is forecast in southern areas and notably the main valleys. Light rain is forecast for Bhutan during the period 26 Mar – 3 Apr and this is likely to increase in most areas during 3 – 11 April. Temperatures are forecast to be notably warmer.

Given the short term forecasts with rain, conditions are likely to become increasingly suitable for continued disease development. Further development of stripe rust is considered likely. Monitoring for any appearance of stem rust is advised.

Recommendations

Very close monitoring of fields, particularly for susceptible varieties, is recommended. Forecast weather conditions, and increased potential for spore deposition, indicate that disease development is increasingly likely. Stripe rust may increase and care should be taken to monitor for any possible appearance of stem rust.

Scouting should be undertaken, especially in southern areas and main valleys, and farmers informed to be vigilant for the emergence of rust. Control of stripe rust may be needed on susceptible cultivars in the Punakha/Wangdue valley.

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- Awareness should be raised amongst stakeholders at all levels, including farmers, to be vigilant for early appearance of rusts. **Early control to stop increased spread and further build-up of disease is very important.**

Sampling should be undertaken to determine races of rust present.

Field surveys

Surveys undertaken Feb 10 2025 - Apr 04 2025. A total of 94 fields surveyed. No stem rust detected.

Legend for severity and incidence intensity: Low: less than 20%; moderate: 20-40%; high: more than 40%.

Leaf Rust reported from 14 out of 94 fields surveyed (15%). Moderate to high incidence of leaf rust has been seen in 5 fields (36% of infected fields). Moderate to high severity of leaf rust has been seen in 1 fields (7% of infected fields).

Stripe Rust reported from 40 out of 94 fields surveyed (43%). Moderate to high incidence of stripe rust has been seen in 22 fields (55% of infected fields). Moderate to high severity of stripe rust has been seen in 13 fields (32% of infected fields).

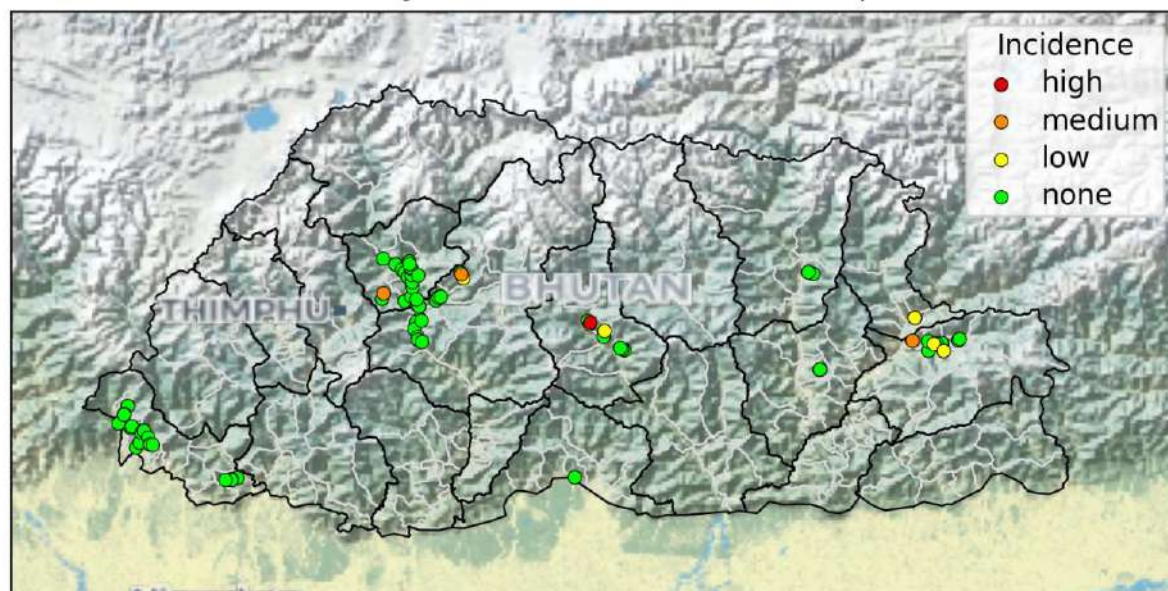
Table 1: Variety analysis of surveys.

Variety	Number of surveys	Number of surveys reporting infection of		
		stem rust	stripe rust	leaf rust
Guma Sokha	8	n/a	0	0
Indian Durum	2	n/a	2	0
Local	7	n/a	3	2
Local barley	1	n/a	0	0
Semolina	1	n/a	0	0
Unknown	75	n/a	35	12

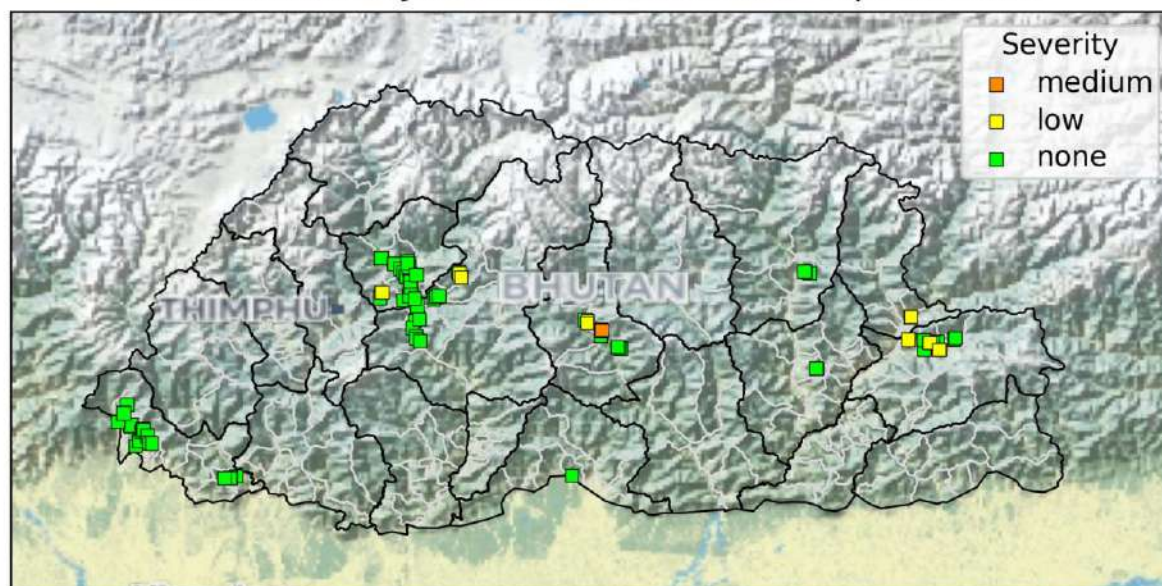
Table 2: Growth stage analysis of surveys conducted in the last week (since Mar 31 2025).

Country	Number of surveys in the last week that observed wheat growth stage:									
	tillering	boot	heading	flowering	milk	dough	maturity	NA	na	n/a
Bhutan	0	2	1	6	0	6	5	0	0	0

Leaf rust surveys Bhutan Feb 10 2025 - Apr 06 2025

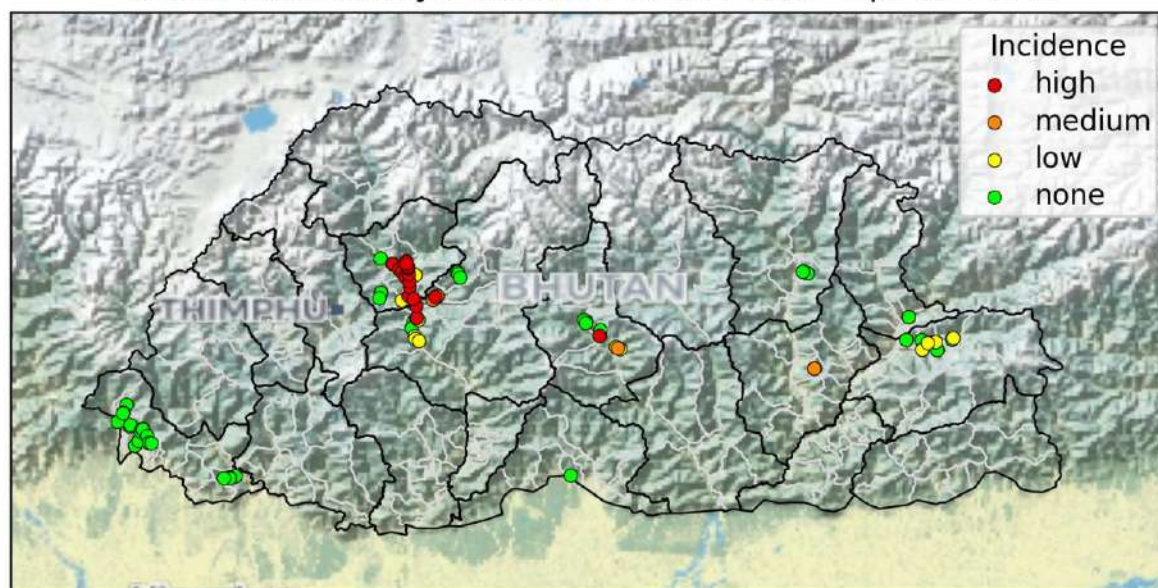


Leaf rust surveys Bhutan Feb 10 2025 - Apr 06 2025

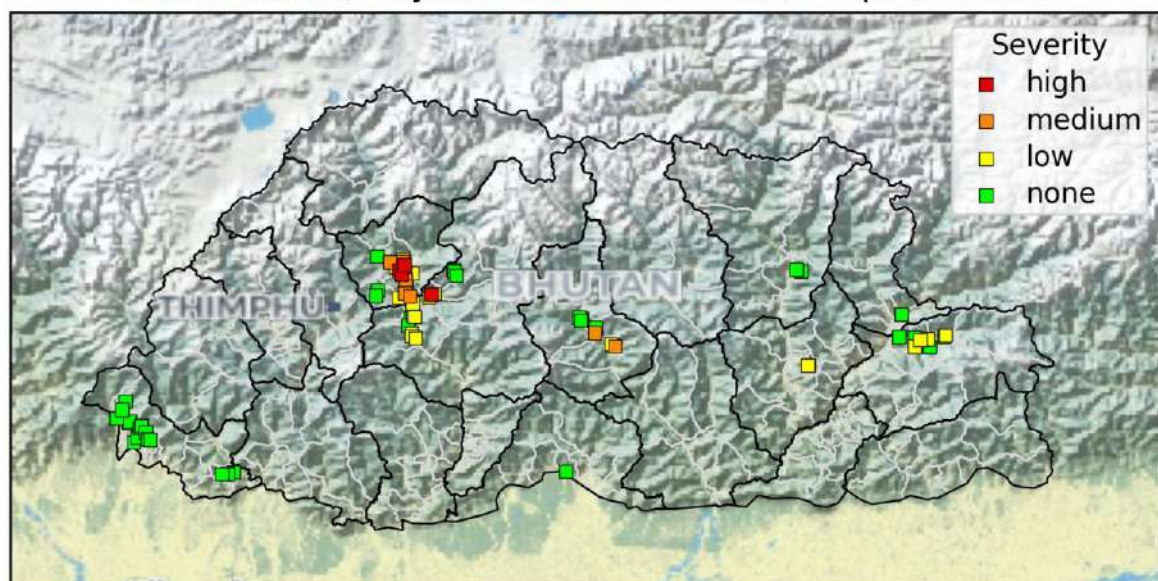


Map 1: Leaf Rust incidence (top) and severity (bottom) in Bhutan field surveys Feb 10 2025 - Apr 06 2025

Yellow rust surveys Bhutan Feb 10 2025 - Apr 06 2025

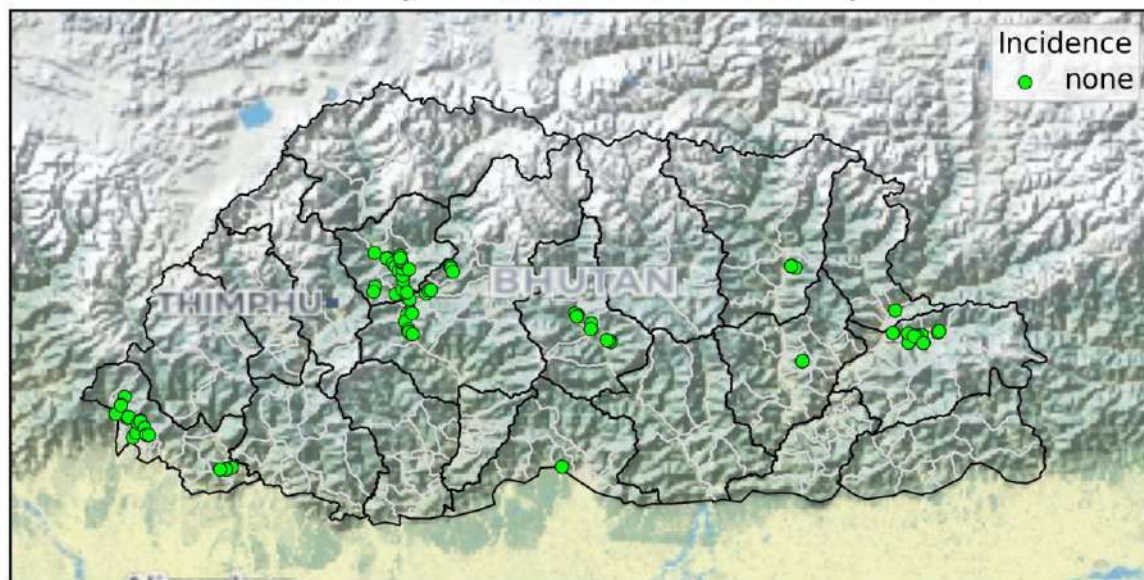


Yellow rust surveys Bhutan Feb 10 2025 - Apr 06 2025

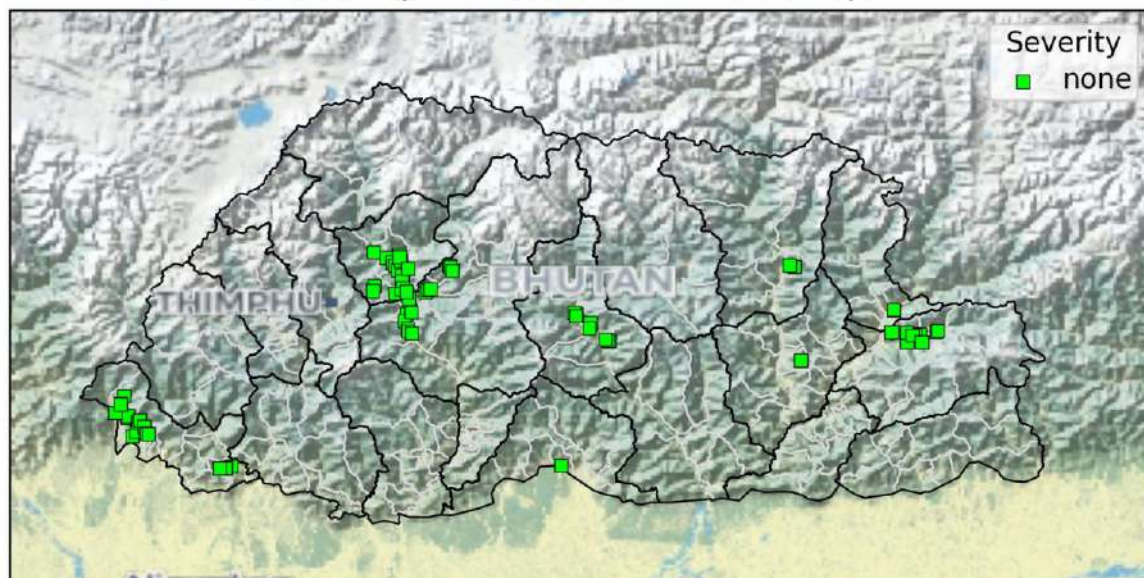


Map 2: Stripe Rust incidence (top) and severity (bottom) in Bhutan field surveys Feb 10 2025 - Apr 06 2025

Stem rust surveys Bhutan Feb 10 2025 - Apr 06 2025



Stem rust surveys Bhutan Feb 10 2025 - Apr 06 2025



Map 3: Stem Rust incidence (top) and severity (bottom) in Bhutan field surveys Feb 10 2025 - Apr 06 2025

Spore dispersal forecasts

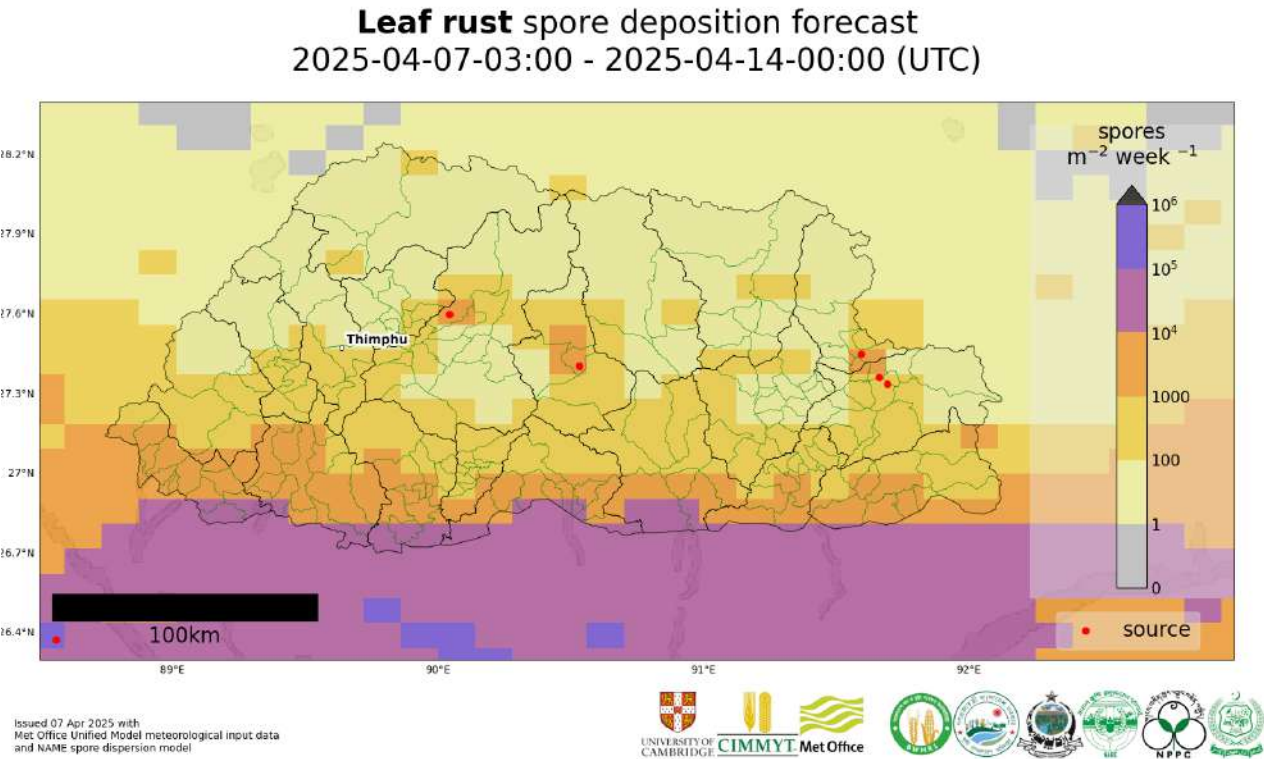
Spore dispersal forecasts run by the UK Met Office and Cambridge University are displayed for stem, stripe and leaf rusts for the forecasted period. Surveys in each district are gathered to provide a single source per administrative area for dispersal forecasts (red dots in figure).

Environmental / climatic suitability for infection forecasts

These forecasts give the probability of wheat rust infection occurring based on meteorological factors. The maximum infection efficiency that can occur is 100%. This means that 100% of the spores deposited on susceptible wheat plants could complete the infection process. Therefore, a forecast Infection Efficiency of 100% indicates the highest risk of wheat rust infection occurring in susceptible wheat varieties.

Leaf rust

Dispersal: Current forecast (07 Apr - 13 Apr) indicates dispersal in an easterly direction from infected sites in Bangladesh / Nepal. Generally reduced spore deposition forecast, highest in southern areas.



Map 4: Leaf rust spore deposition forecast Bhutan 07 Apr - 13 Apr 2025

The 20 most impacted districts (spore deposition) per country are presented in the table below.

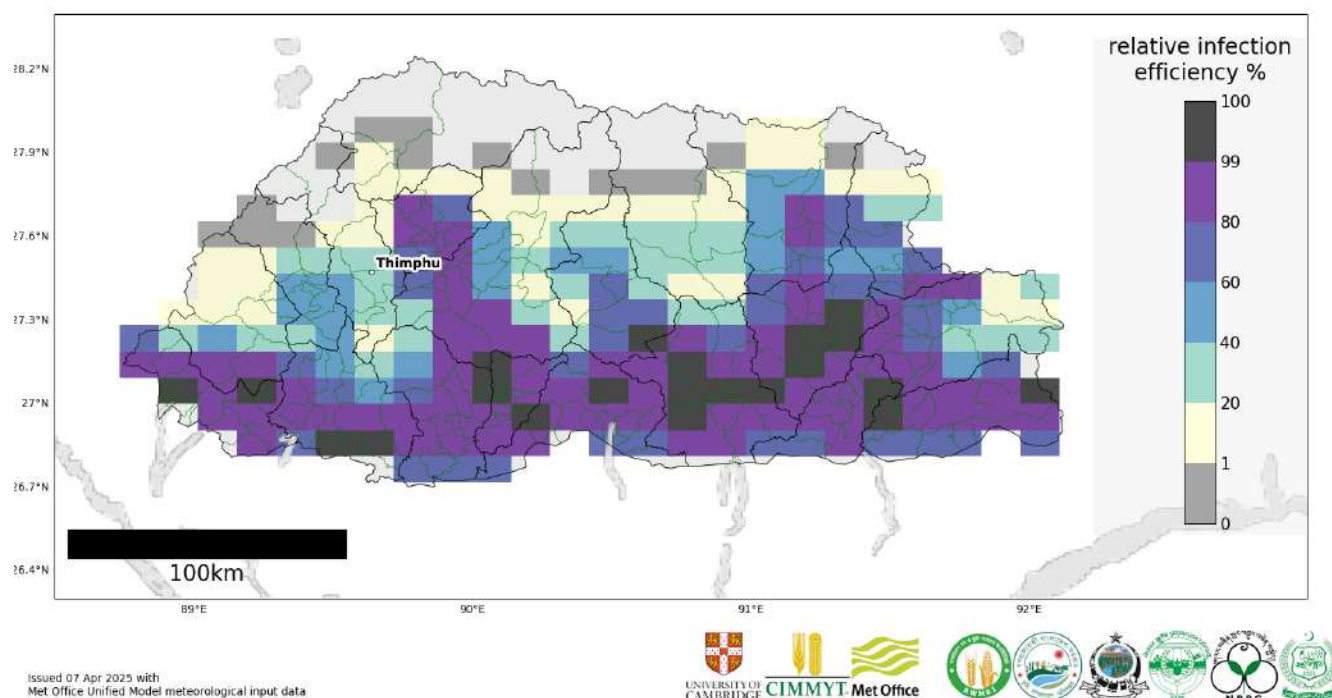
admin2Name	admin1Name	Leaf rust spores per m ² per week
Taklai	Sarpang	19000
Pagli	Samtse	18000
Norbugang	Pemagatshel	15000
Lhamoizingkha	Dagana	14000
Ngangla	Zhemgang	14000
Pangkhar	Zhemgang	14000
Dala	Chhukha	13000
Samphelling	Chhukha	13000
Dewathang	Samdrupjongkhar	9200
Chokhorling	Pemagatshel	9100
Phuntsthothang	Samdrupjongkhar	8800
Tading	Samtse	8600
Senge	Sarpang	8200
Nichula	Dagana	7900
Shompangkha	Sarpang	7400
Logchina	Chhukha	7200
Samtse	Samtse	7100

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Deorali	Dagana	7100
Umling	Sarpang	7000
Phuentsholing	Chhukha	6900

Risk of infection: Current forecast (7 – 12 Apr) indicates increased suitability from the last advisory. High to infection efficiency forecast in southern areas and valleys of central-west and east.

Infection efficiency of Wheat **Leaf rust** spores 2025-04-07-00:00 - 2025-04-13-00:00 (UTC)



Map 5: Leaf rust suitability for infection forecast Bhutan 07 Apr - 12 Apr 2025

The 20 most impacted districts (infection efficiency)per country are presented in the table below.

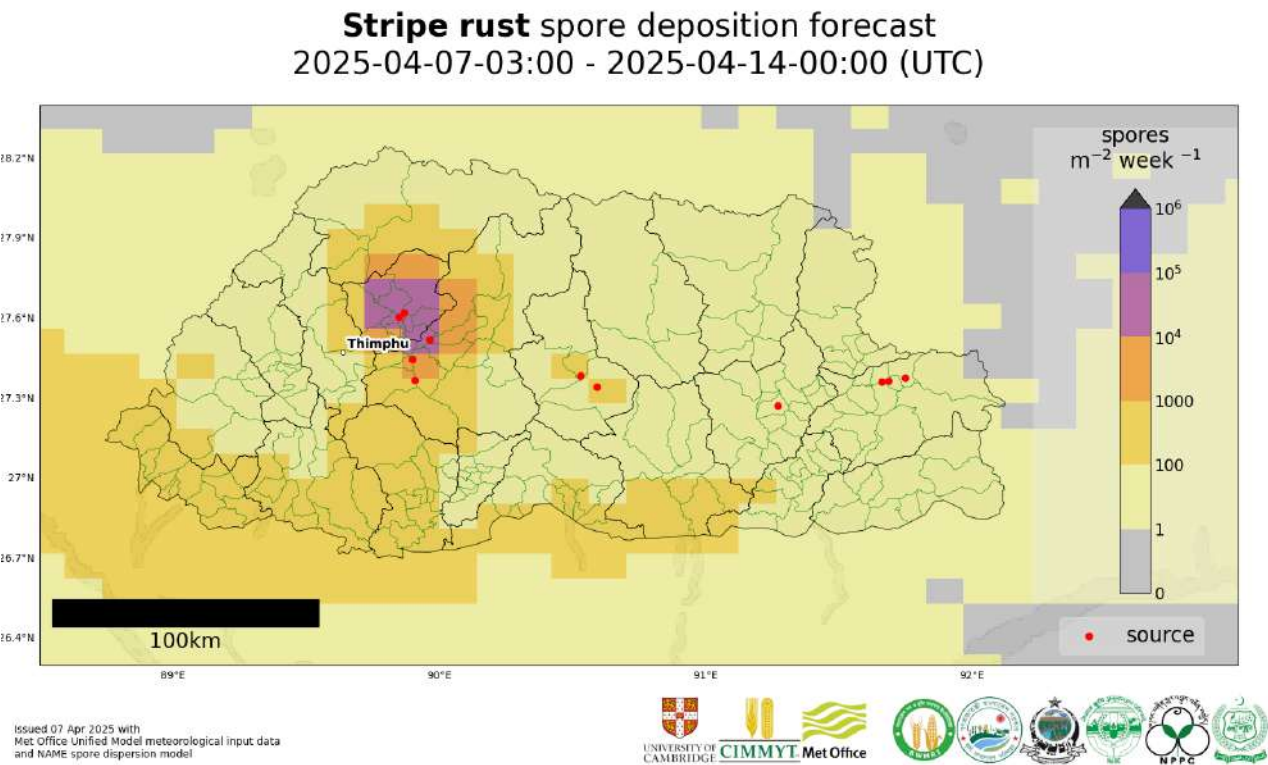
admin2Name	admin1Name	RIE_leaf_rust_%
Sipsu	Samtse	100
Biru	Samtse	99
Dunglegang	Tsirang	99
Thangrong	Monggar	99
Kengkhar	Monggar	99
Mongar	Monggar	99
Drepung	Monggar	99
Gosarling	Tsirang	99
Gomdar	Samdrupjongkhar	99
Chhali	Monggar	99
Shemjong	Tsirang	99
Tsirangtoe	Tsirang	99
Yurung	Pemagatshel	98

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Patakla	Tsirang	98
Rangthangling	Tsirang	98
Drugyelgang	Dagana	97
Dungtoe	Samtse	97
Jurmey	Monggar	97
Kikorthang	Tsirang	97
Chongshing	Pemagatshel	97

Stripe rust

Dispersal: Current forecast (07 Apr - 13 Apr) indicates dispersal in a generally easterly direction. High spore deposition forecast in Punakha / Wangdue. Potential for spore deposition from infected sites in Nepal, especially in West/ South.



Map 6: Stripe rust spore deposition forecast Bhutan 07 Apr - 13 Apr 2025

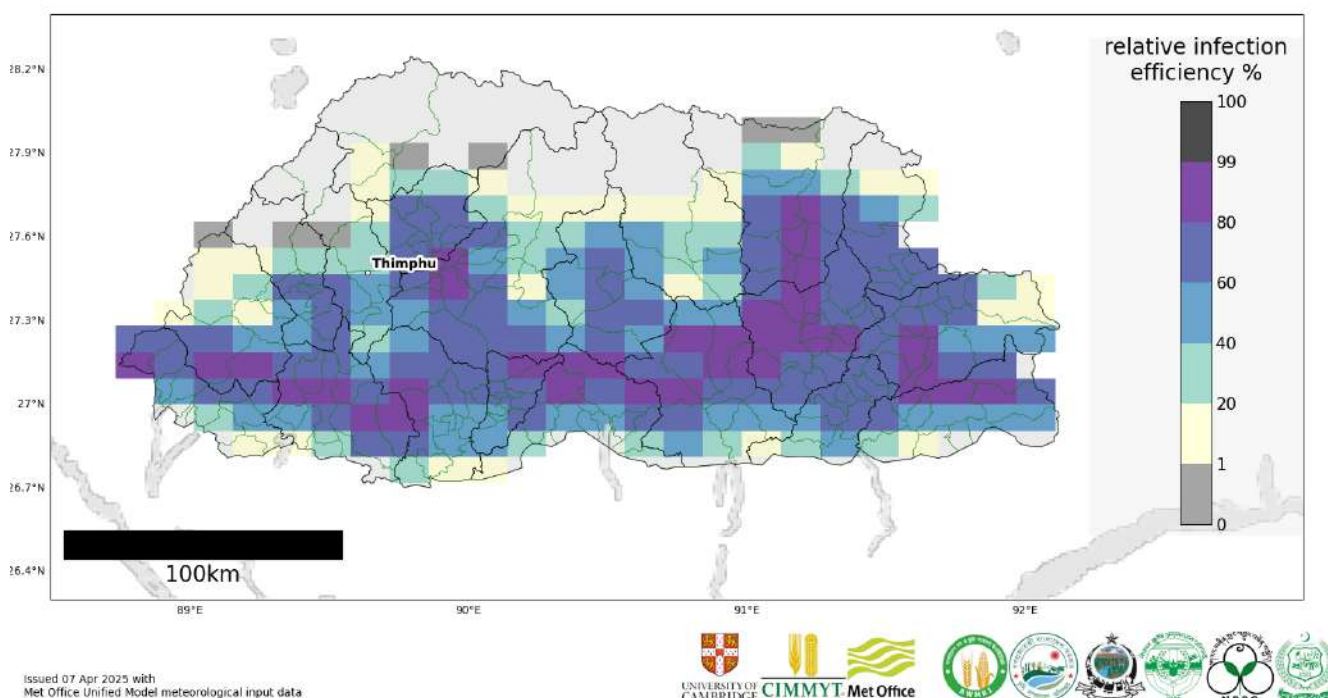
The 20 most impacted districts (spore deposition) per country are presented in the table below.

admin2Name	admin1Name	Stripe rust spores per m ² per week
Phangyuel	Wangduephodrang	43000
Dzoma	Punakha	43000
Lingmukha	Punakha	43000
Guma	Punakha	31000
Chhubu	Punakha	26000
Shengabjimi	Punakha	26000
Bapisa	Punakha	21000
Talo	Punakha	19000
Thedtsho	Wangduephodrang	14000
Nahi	Wangduephodrang	11000
Bjena	Wangduephodrang	11000
Toepisa	Punakha	9400
Nyisho	Wangduephodrang	9200
Kazhi	Wangduephodrang	9000
Ruepisa	Wangduephodrang	8500

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Kabjisa	Punakha	8300
Toewang	Punakha	8200
Goenshari	Punakha	4800
Goenkhome	Gasa	2200
Dangchhu	Wangduephodrang	1700

Risk of infection: Current forecast (7 – 12 Apr) indicates increased suitability since the last advisory. High to infection efficiency across most of the wheat growing areas.



Map 7: Stripe rust suitability for infection forecast Bhutan 07 Apr - 12 Apr 2025

The 20 most impacted districts (infection efficiency) per country are presented in the table below.

admin2Name	admin1Name	RIE_stripe_rust_%
Mongar	Monggar	86
Chhali	Monggar	86
Tsakaling	Monggar	84
Tsamang	Monggar	84
Bapisa	Punakha	83
Theedtsho	Wangduephodrang	83
Ngatshang	Monggar	83
Thrimshing	Trashigang	81
Dzoma	Punakha	80
Phangyuel	Wangduephodrang	80
Tsenkhar	Lhuentse	80

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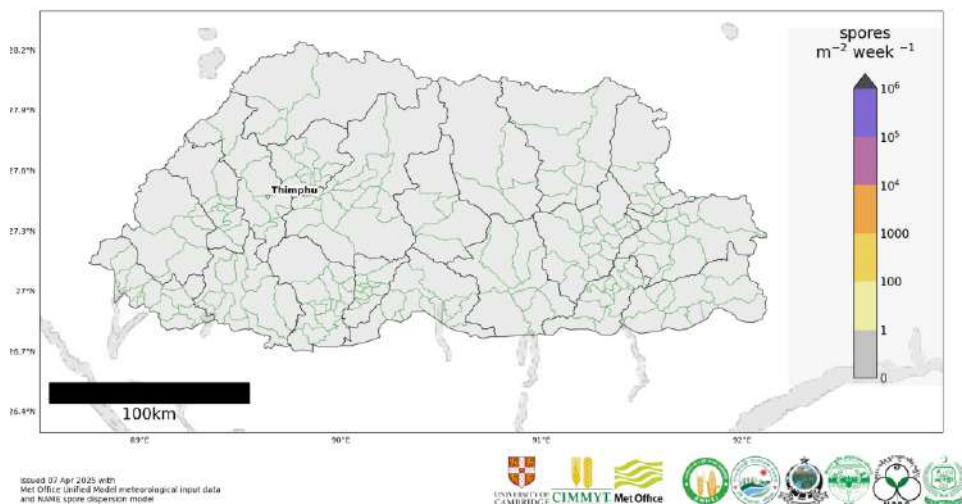
Lingmukha	Punakha	80
Minjay	Lhuentse	79
Phuentenchhu	Tsirang	79
Narang	Monggar	79
Thangrong	Monggar	79
Samkhar	Trashigang	79
Menbi	Lhuentse	79
Nahi	Wangduephodrang	79
Balam	Monggar	78

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Stem rust

Dispersal: Current forecast (07 Apr - 13 Apr) indicates no dispersal as no reports of stem rust.

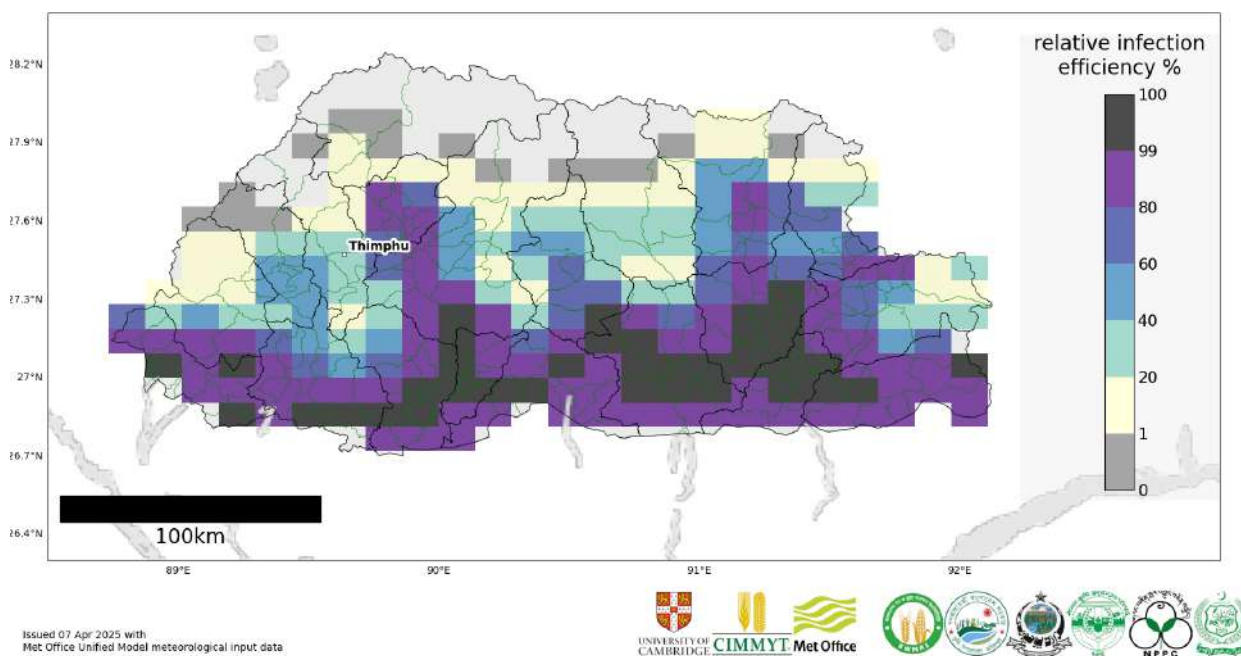
Stem rust spore deposition forecast 2025-04-07-03:00 - 2025-04-14-00:00 (UTC)



Map 8: Stem rust spore deposition forecast Bhutan 07 Apr - 13 Apr 2025

Risk of infection: Current forecast (7 - 12 Apr) indicates increased suitability since the last advisory. High infection efficiency across southern areas, and the main valleys.

Infection efficiency of Wheat **Stem rust** spores 2025-04-07-00:00 - 2025-04-13-00:00 (UTC)



Map 9: Stem rust suitability for infection forecast Bhutan 07 Apr - 12 Apr 2025

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The 20 most impacted districts (infection efficiency) per country are presented in the table below.

admin2Name	admin1Name	RIE_stem_rust_%
Chongshing	Pemagatshel	100
Sipsu	Samtse	100
Yurung	Pemagatshel	100
Gozhi	Dagana	100
Pagli	Samtse	100
Barzhong	Tsirang	100
Jurmey	Monggar	100
Tsholingkhon	Tsirang	100
Mendrelgang	Tsirang	100
Tsangkhah	Dagana	100
Rangthangling	Tsirang	100
Drepung	Monggar	100
Kengkhar	Monggar	100
Thangrong	Monggar	100
Chhali	Monggar	99
Mongar	Monggar	99
Drugyelgang	Dagana	99
Kikorthang	Tsirang	99
Biru	Samtse	99
Dunglegang	Tsirang	99

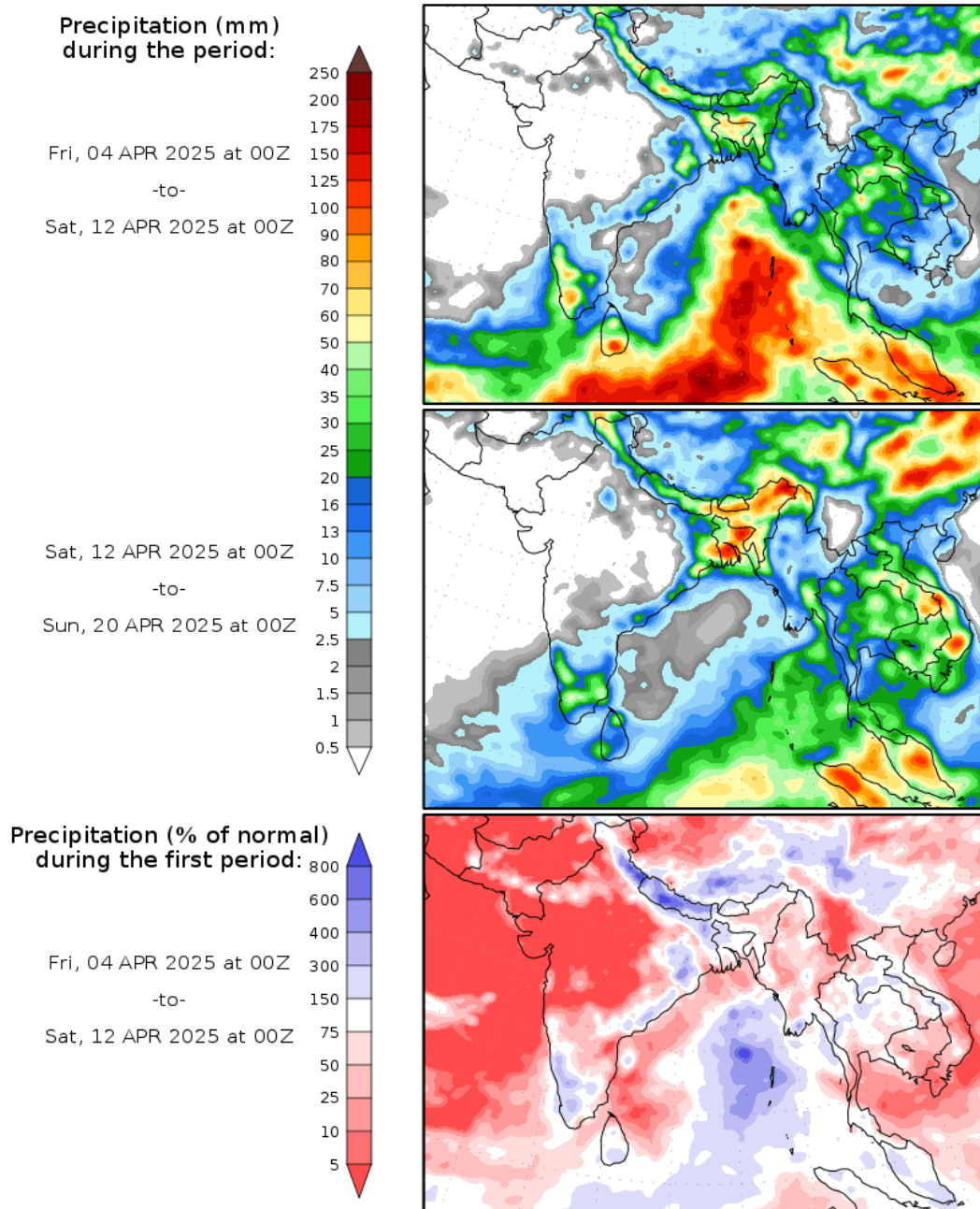
Region-wide Forecasts

Forecasts from the National Centers for Environmental Prediction NCEP <http://wxmaps.org/pix/clim>

These indicate possible general conditions across South Asia, with likely decreasing prediction accuracy in the second forecast period.

Precipitation: During the period 4 – 12 Apr, rain forecast across Bhutan, Bangladesh, Nepal, north west India, southern India and northern Pakistan. During 12 – 20 April, continued rain forecast for same areas (likely to be heavier in Bangladesh, Bhutan and eastern Nepal).

Precipitation Forecasts



Precipitation forecasts from the National Centers for Environmental Prediction.
Normal rainfall derived from Xie-Arkin (CMAP) Monthly Climatology for 1979-2003.
Forecast Initialization Time: 00Z04APR2025

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Temperature: During the period 4 – 12 Apr temperatures are warming considerably across the entire region (especially India and Pakistan). Warmer than normal across the region, except for northern Pakistan, north west India, high hills of Nepal, Bhutan.

Temperature Forecasts

Mean Surface Temperature (°C)
during the period:

Fri, 04 APR 2025 at 00Z

-to-

Sat, 12 APR 2025 at 00Z

Sat, 12 APR 2025 at 00Z

-to-

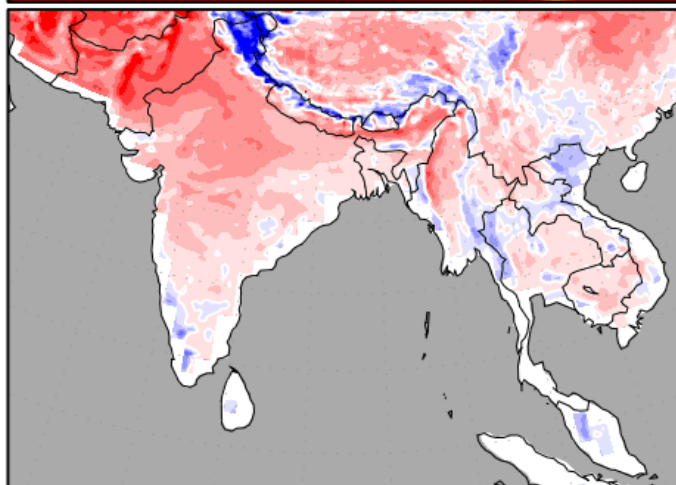
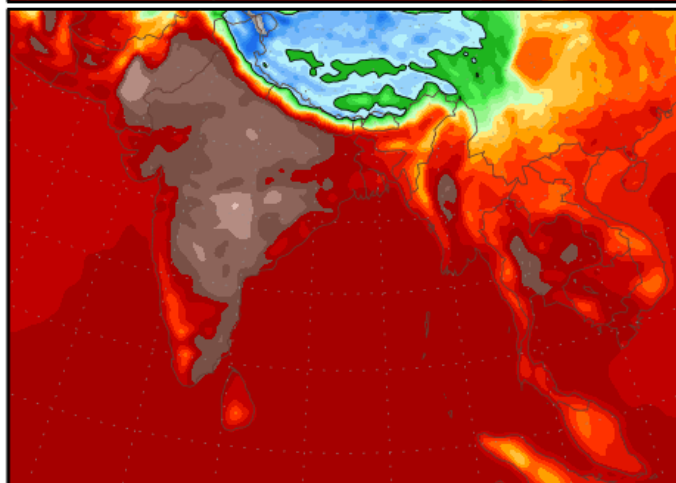
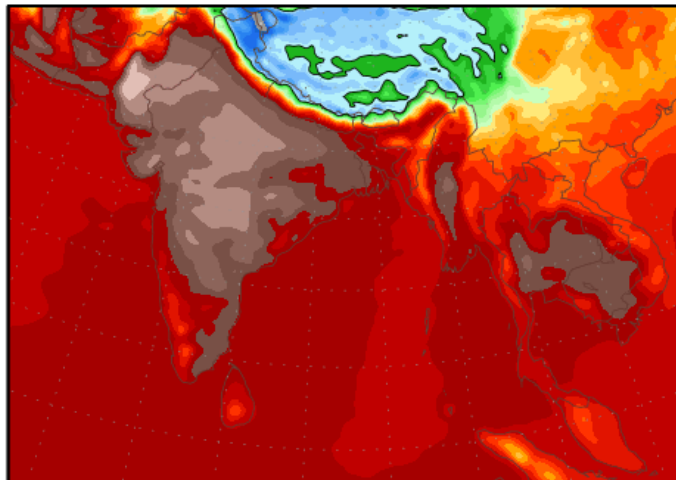
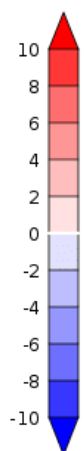
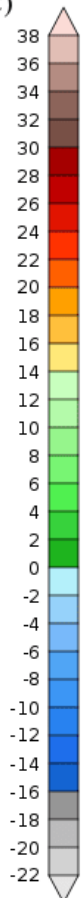
Sun, 20 APR 2025 at 00Z

Temperature Anomaly
during the first period:

Fri, 04 APR 2025 at 00Z

-to-

Sat, 12 APR 2025 at 00Z



Temperature forecasts from the National Centers for Environmental Prediction.
Normal Temperature derived from CRU monthly climatology for 1901-2000
Forecast Initialization Time: 00Z04APR2025