IMPACT OF CLIMATE CHANGE ON RUBBER CULTIVATION IN INDIA

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Session outline

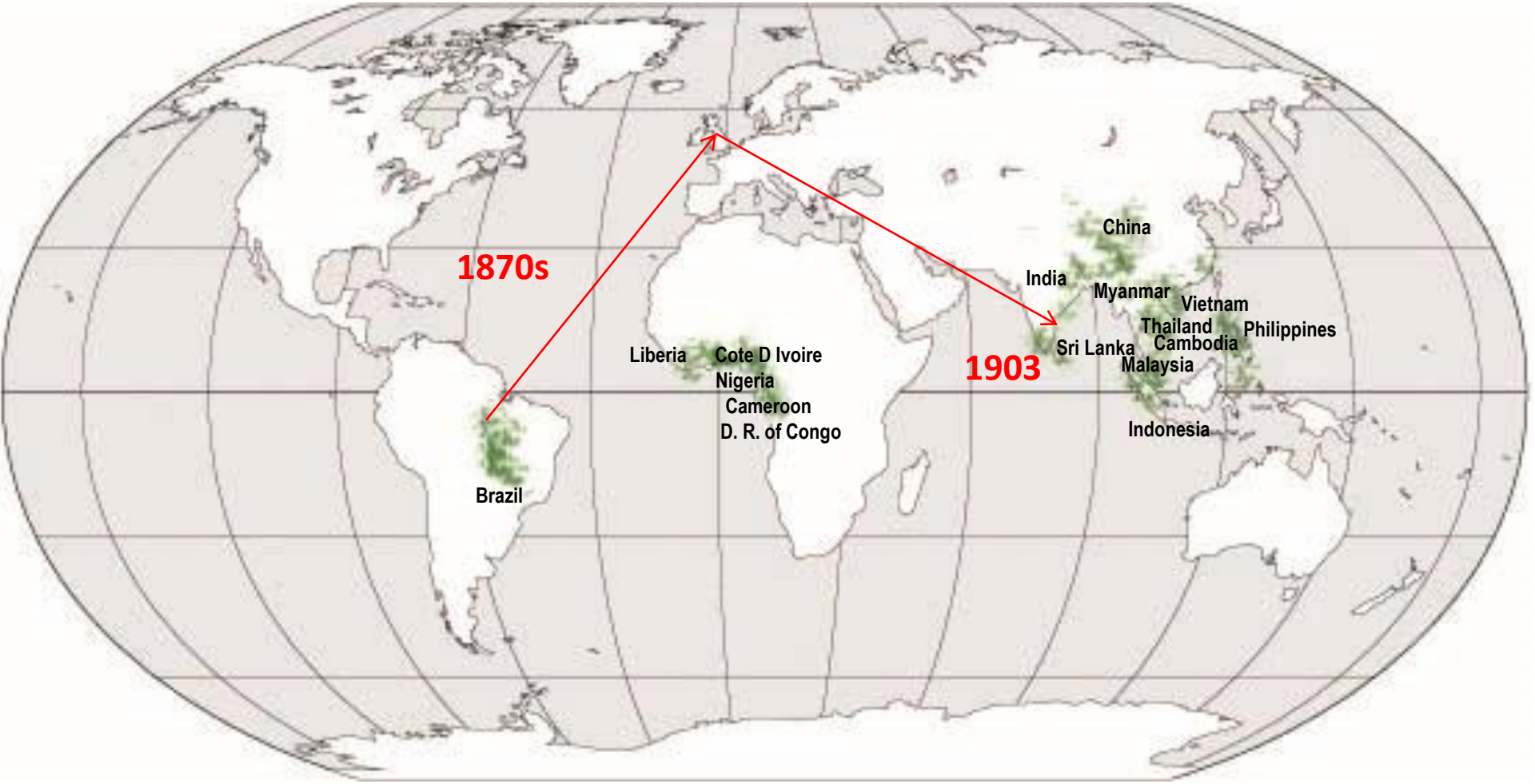
i. Climate change in rubber growing regions over the decades

ii. Impact on natural rubber cultivation

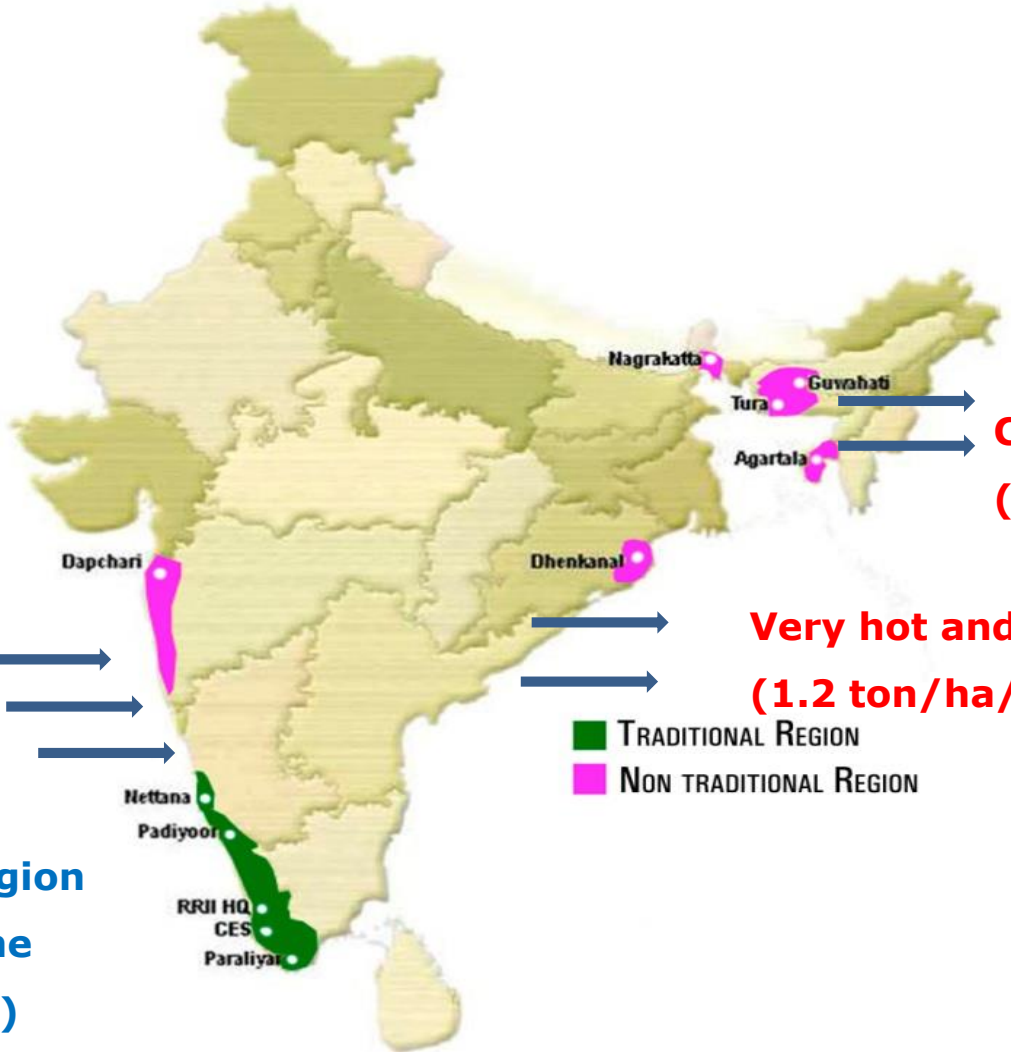
iii. Strategies for adaptation to climate change

i. Climate change in rubber growing regions over the decades

Domestication led to 56% loss of alleles in the last 120 years, resulting in loss of genetic diversity in Asian rubber clones



NR Growing regions of India



Cold-prone NE

(2 ton/ha/yr)

Very hot and dry

(1.2 ton/ha/yr)

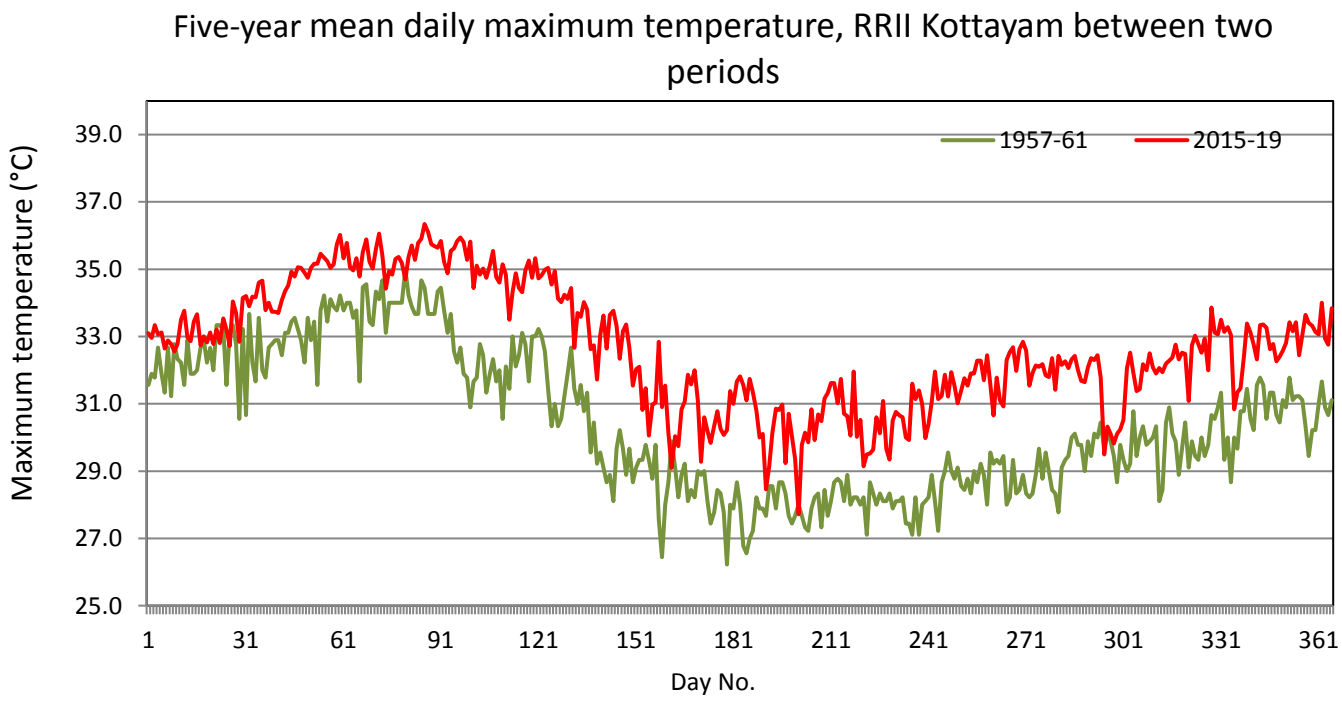
Very hot and dry
North Konkan

(1.4 ton/ha/yr)

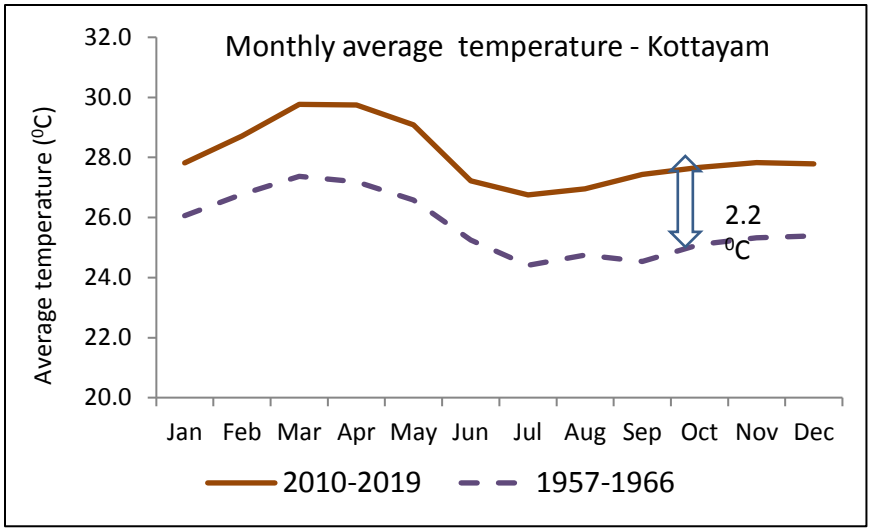
Traditional region

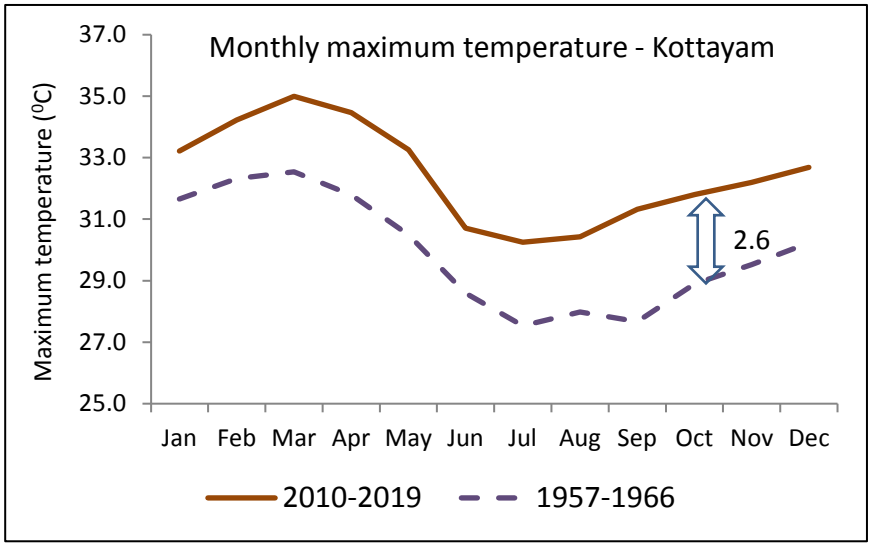
Moderate clime

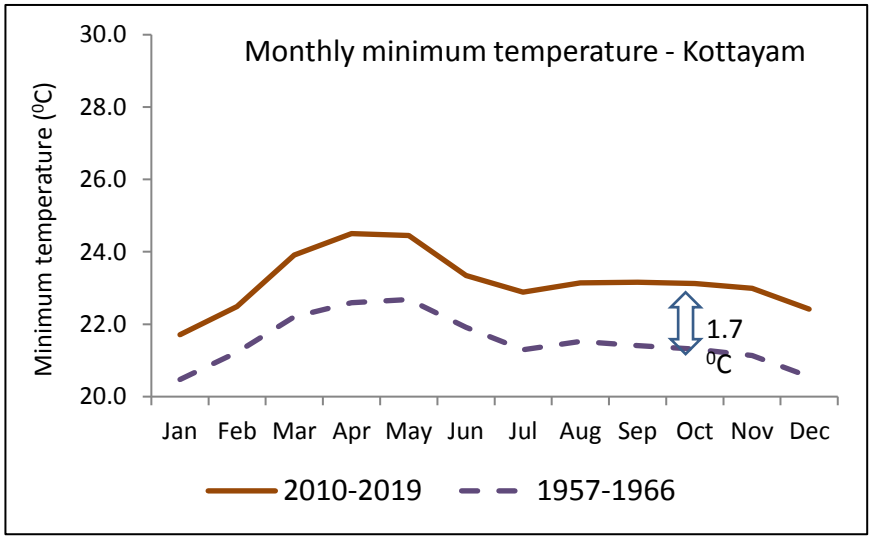
(.2 ton/ha/yr)


Five-year mean daily maximum temperature, RRII Kottayam between two periods
Maximum temperature (°C)
39.0
37.0
35.0
33.0
31.0
29.0
27.0
25.0
1957-61
2015-19
1
31
61
91
121
151
181
211
241
271
301
331
361
Day No.

Climate warming in traditional rubber growing region

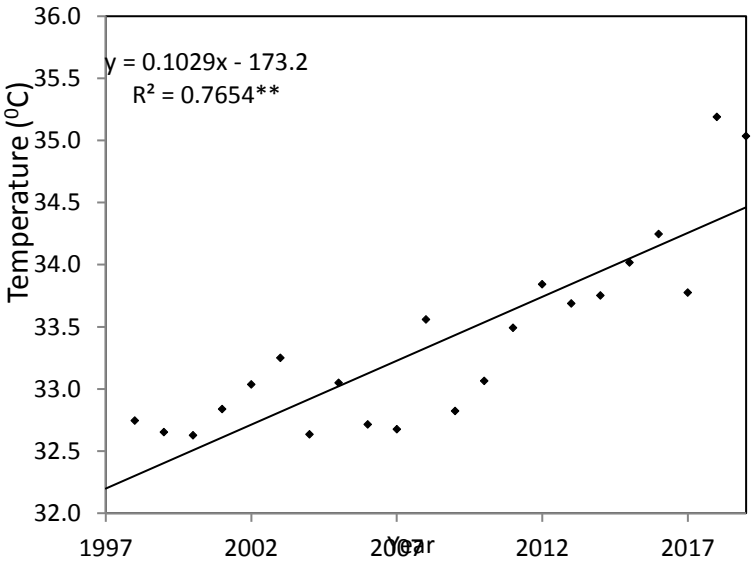




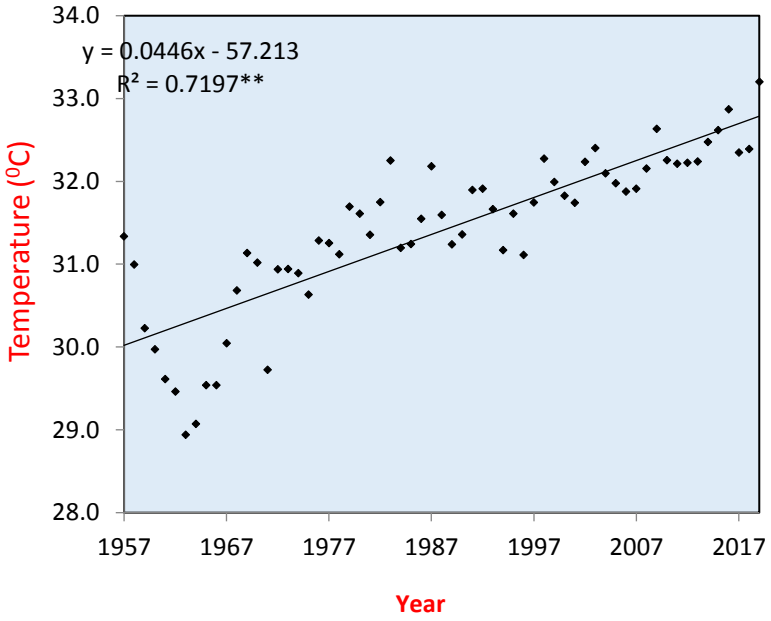


Climate warming in traditional region

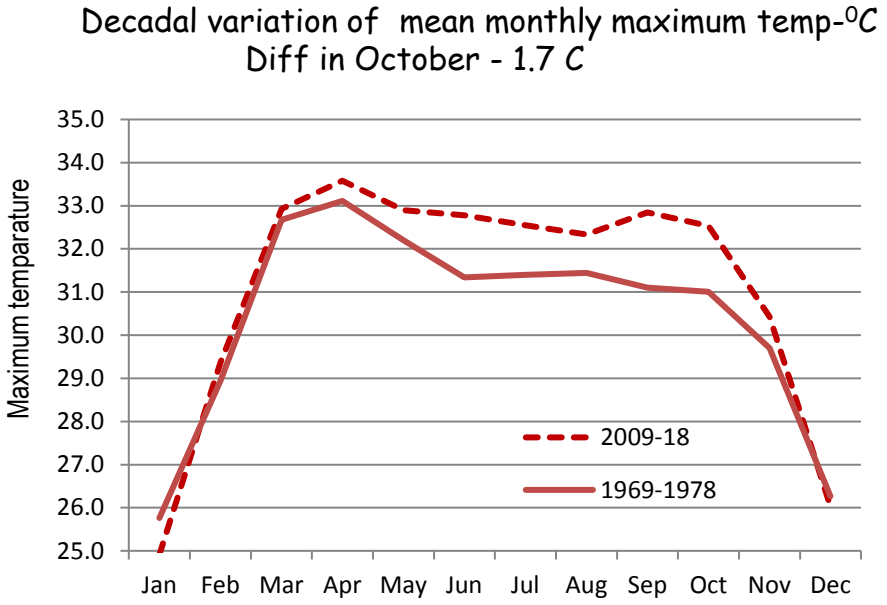
Mean annual maximum temperature trend for RRS,Padiyoor(1997-2019)

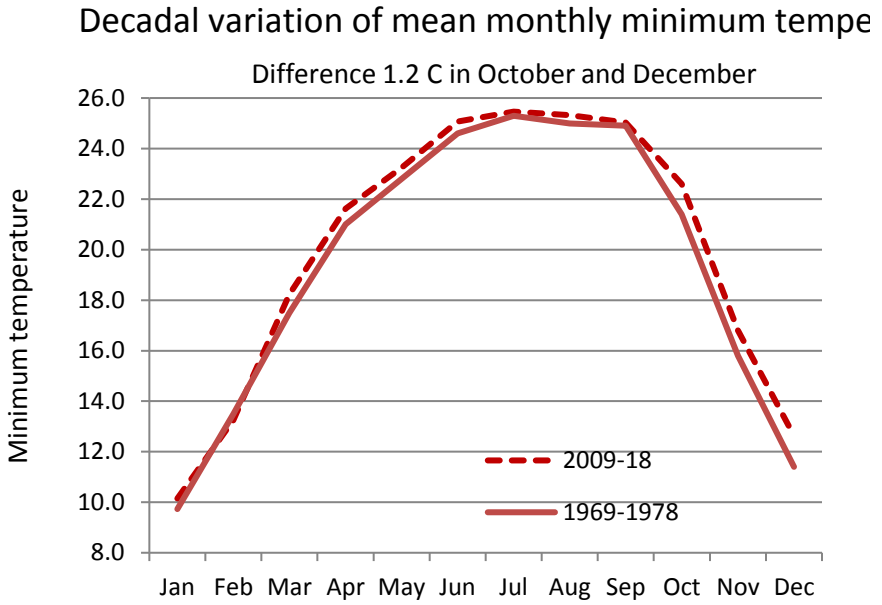


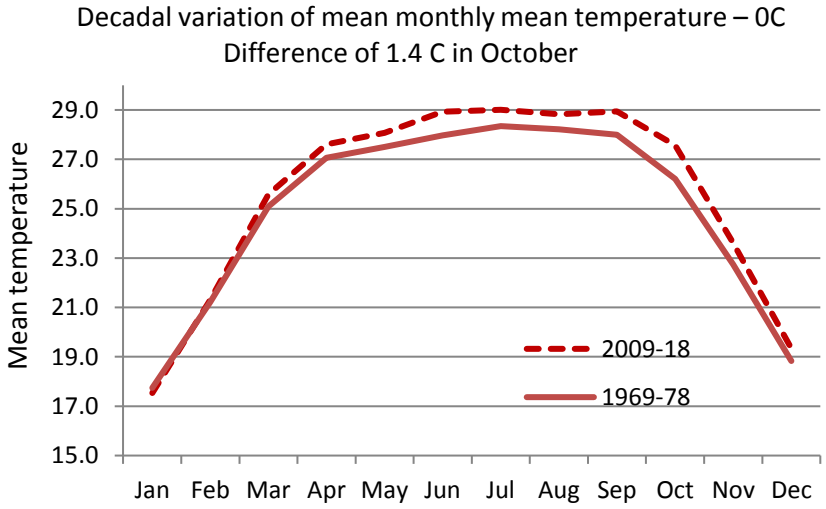
Mean annual maximum temperature trend for RRII, Kottayam (1957-2019)



Warming in non traditional region - Agartala







1. Both Tmax and Tmin have increased.

2. Number of hot days and warm nights every month have gone up in Kottayam.

3. Number of bright sunshine hours per day showed a decreasing trend.

4. Mean annual rainfall did not show a clear trend, but rainfall distribution has become more unpredictable.

5. Number of extreme weather events and their severity on the rise. (Heavy rainfall, droughts, heat waves, break in monsoon, cyclonic storms etc.)

CLIMATE WARMING IN MAJOR NR GROWING REGIONS

- Temperature has been progressively warming (T_{max} by 0.04^{o} C/yr in traditional regions and 0.024^{o}C/yr in NE Indian region) and rainfall pattern changing in an unpredictable manner in the NR plantation belts of the country.

ii. Impact on natural rubber cultivation

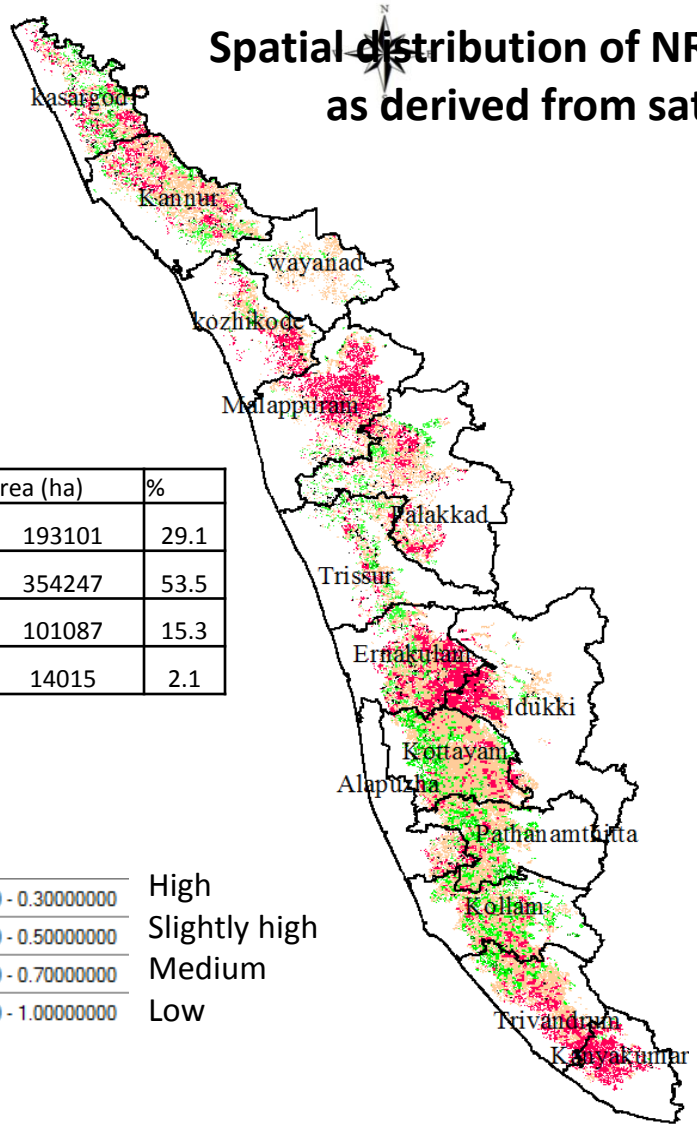
Future problems likely to affect NR cultivation :

- Decrease in field survival
- Slow growth
- Prolonged gestation period
- Yield depression
- Shift in climatically favourable areas of NR cultivation
- Increase in gestation period
- Increase in disease/pests with new disease/pests emerging?

Vegetation temperature condition index (VTCI) of rubber plantation in Kerala State and Kanyakumari district of Tamil Nadu (based on satellite data)

September 2016

Spatial distribution of NR areas in Kerala as derived from satellite data



VTCI class	Area (ha)	%
0.01-0.30	193101	29.1
0.31-0.50	354247	53.5
0.51-0.70	101087	15.3
0.71-100	14015	2.1

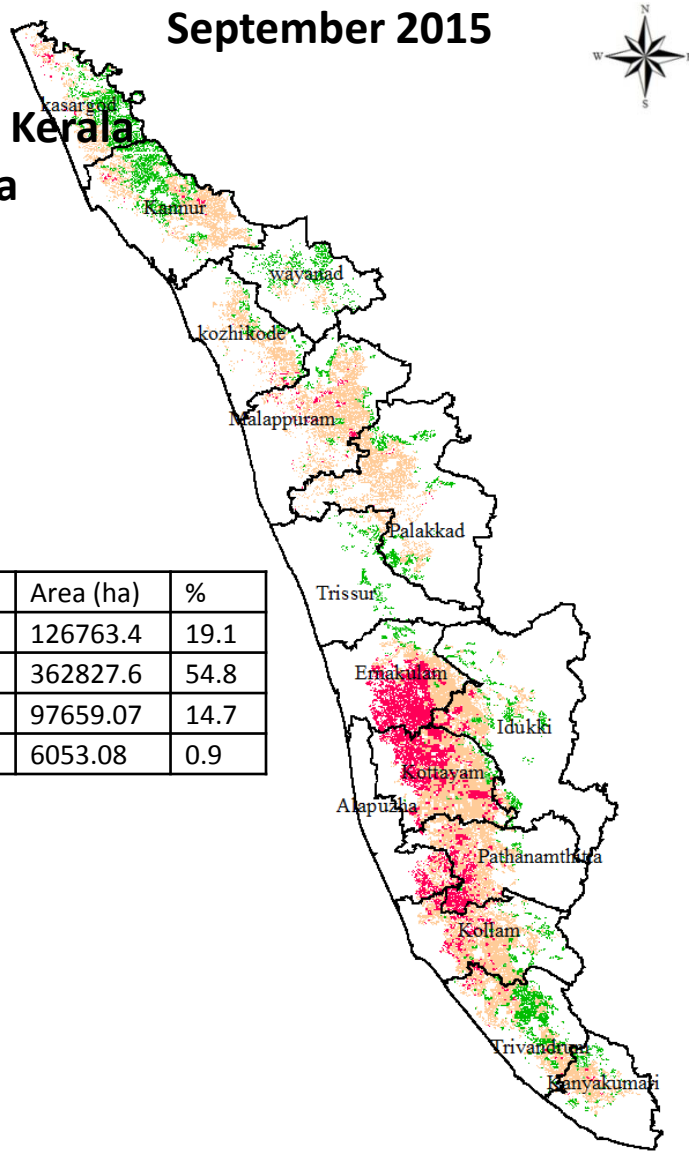
VTCI

0.01000000 - 0.30000000	High
0.31000000 - 0.50000000	Slightly high
0.51000000 - 0.70000000	Medium
0.71000000 - 1.00000000	Low

(lower the value of VTCI, higher the drought and *vice versa)*

0 25 50 100 Km

September 2015



VTCI class	Area (ha)	%
0.1-0.30	126763.4	19.1
0.31-0.50	362827.6	54.8
0.51-0.70	97659.07	14.7
0.71-1.0	6053.08	0.9

Source: Terra MODIS, 1Km

Young rubber plants drying in summer

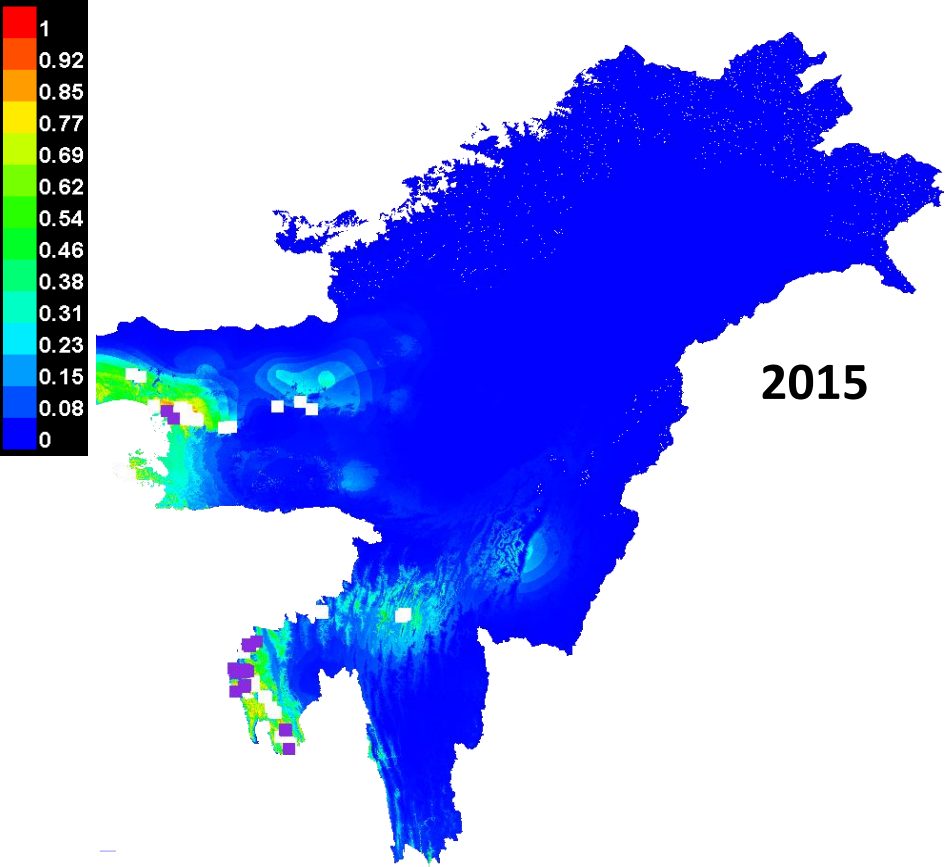
High temp. + drought + high light stress

Life saving irrigation, which was not a common practice earlier was practiced in 18% of the holdings in the traditional area during summer season in recent years.

IMPACT OF CLIMATE WARMING IS DIFFERENT IN DIFFERENT NR GROWING REGIONS

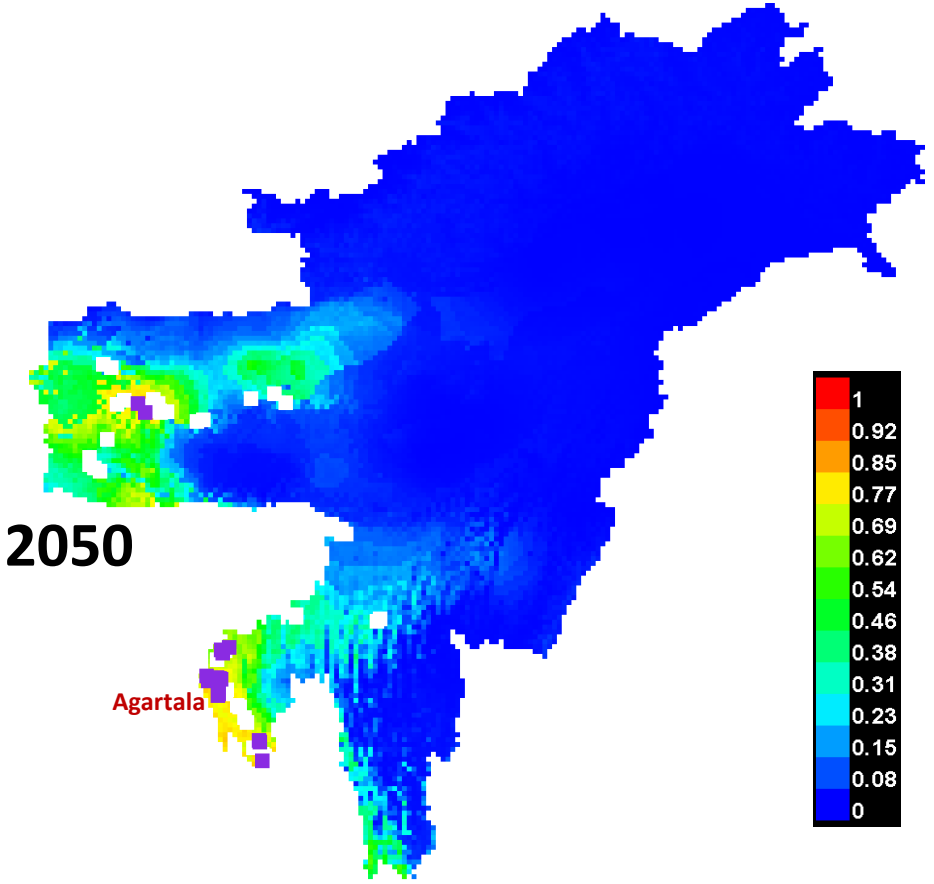
- As climate warming continues, more areas in North East India may become suitable for growing NR, but traditional areas may become less suitable. Non-traditional areas like north Konkan and central India are likely to become extremely difficult for cultivating this crop.

STATION	% Change (for 1^{0}C rise)
NE Region	-1.2 + 1.5
N. Kerala	-8.7
N. Konkan	-11.4
Central Kerala	-17.4



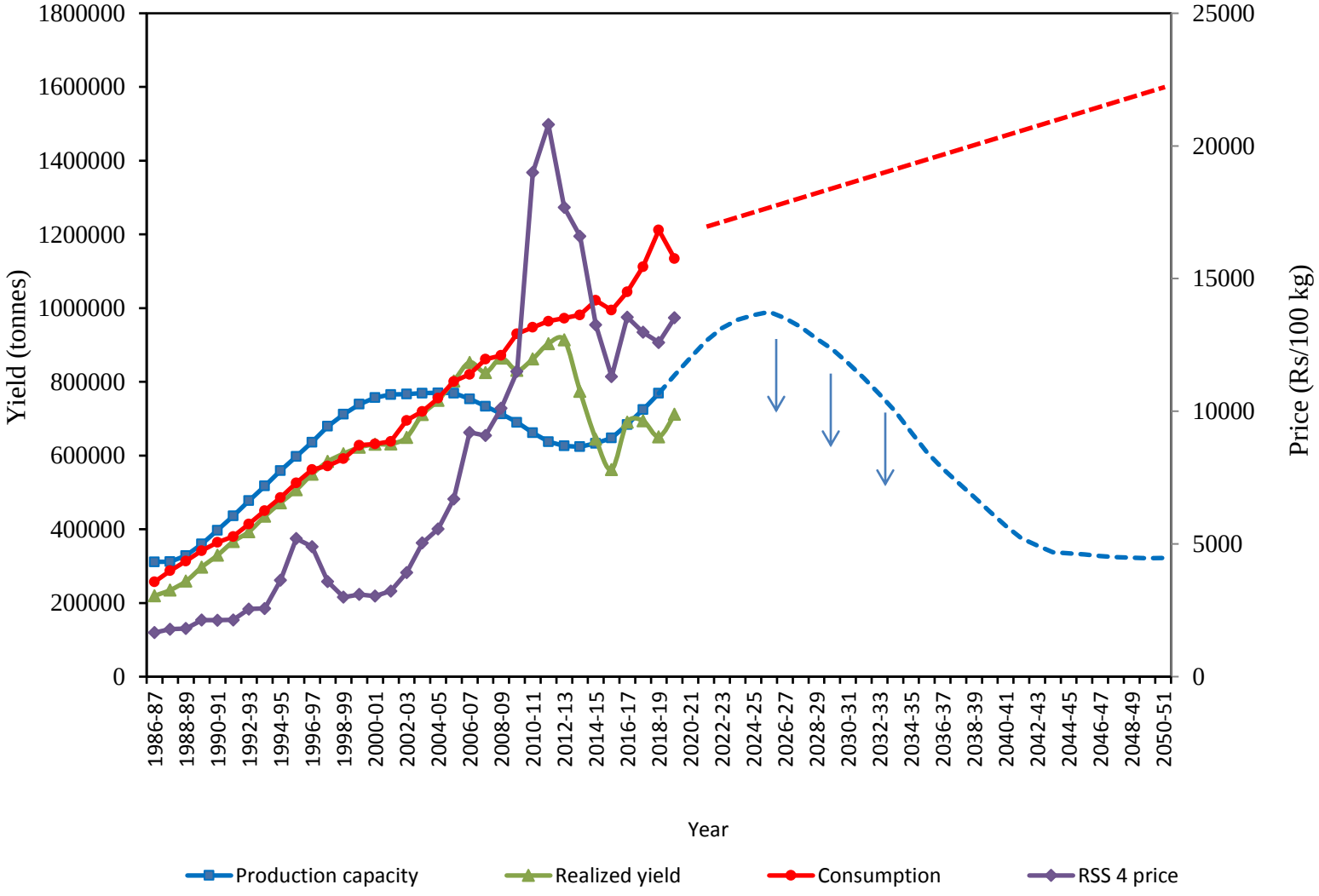
2015

Ecological Niche (Maximum Entropy) Modeling: More areas in NE (indicated in non-blue colors) will become suitable for NR cultivation in future.



2050

Climate change will seriously dent NR supply in coming years

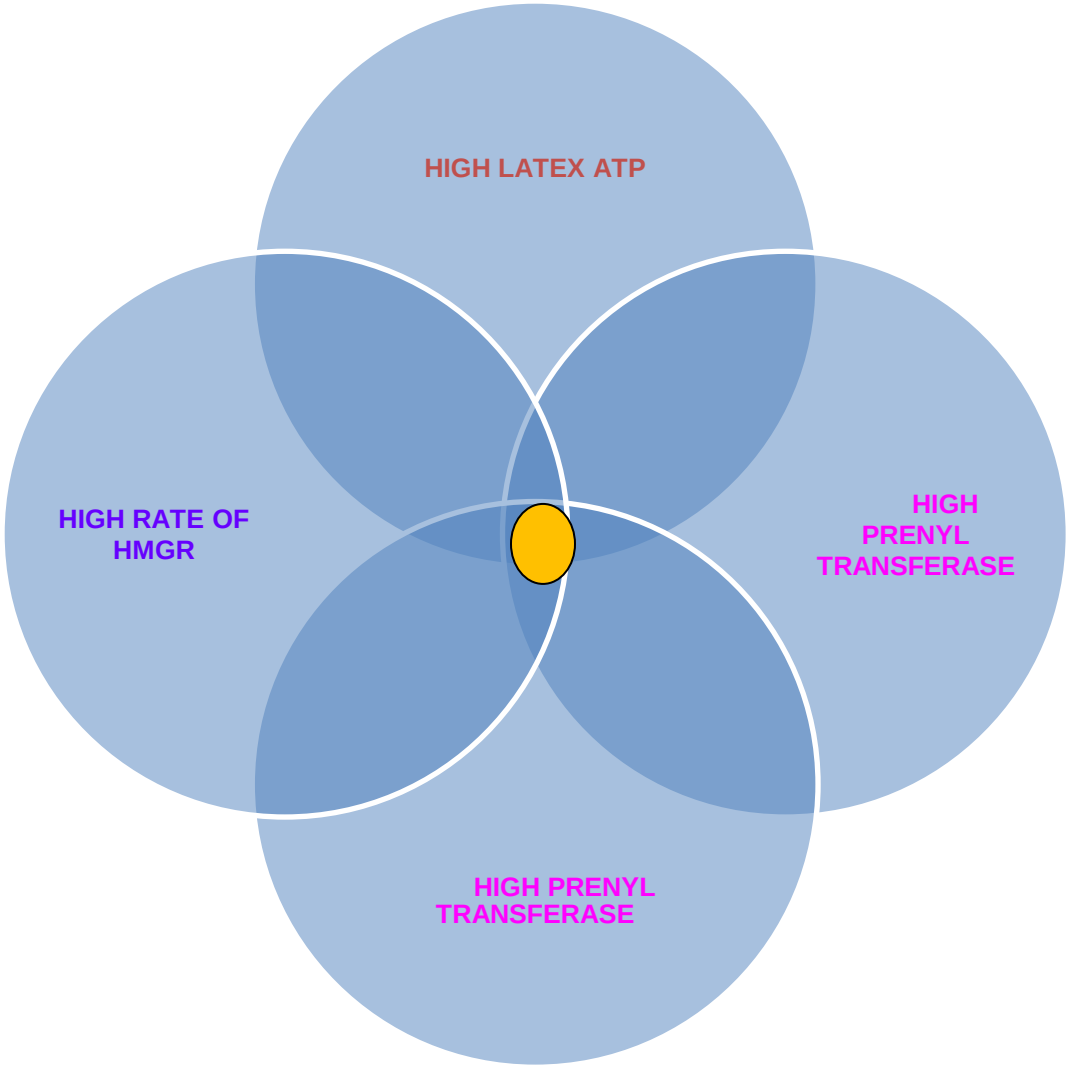


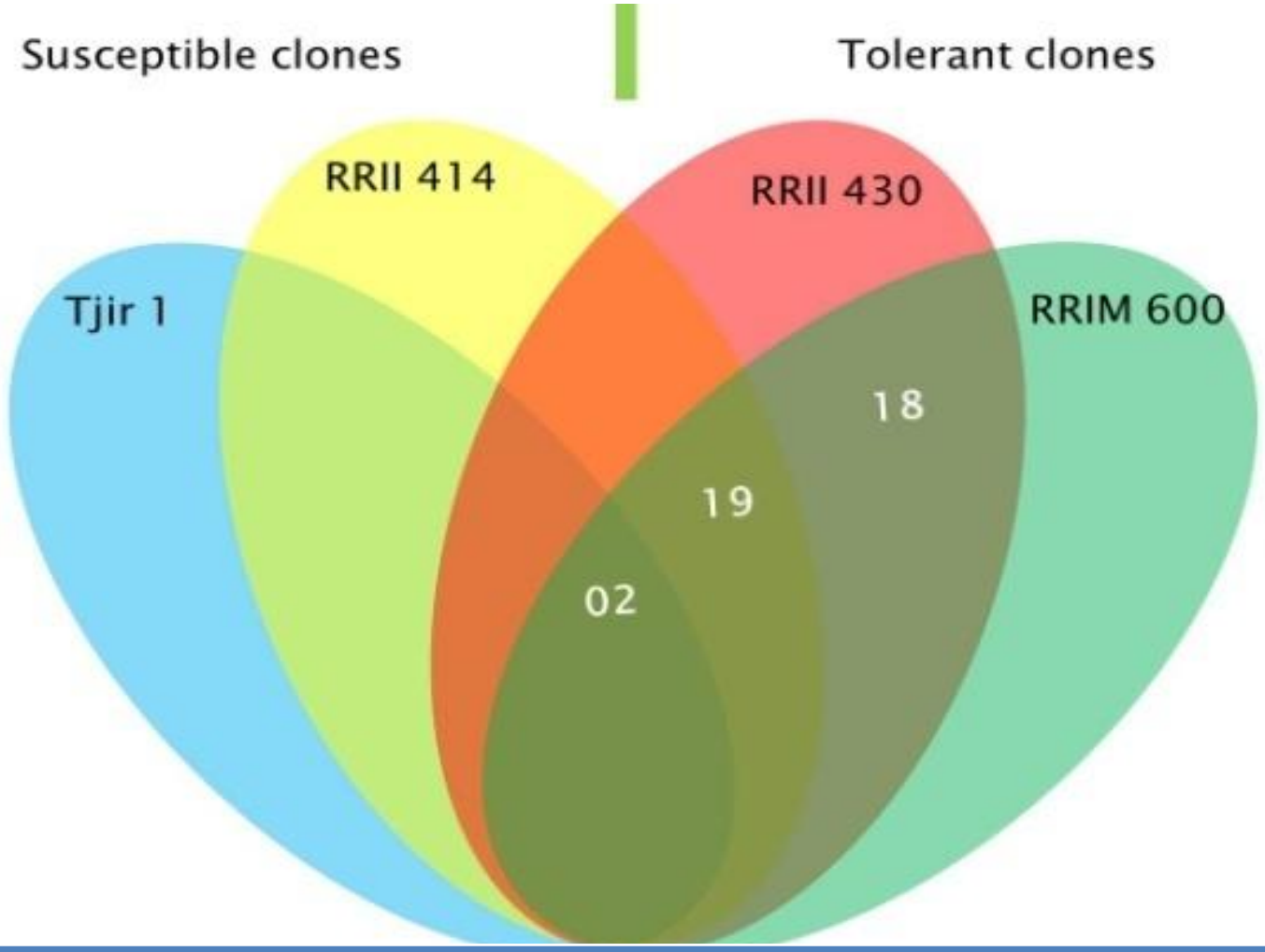
iii. Strategies for adaptation to climate change

Climate-resilient Agronomic practices

- To prevent excess light falling on leaves, partial shade is advised in nursery plants (30% shade)
- Mulching immature plants
- Allow natural weed flora (dicots) to co-exist with rubber
- Efficient nutrient management
- Life saving irrigation in non-traditional areas (150 litre water/tree/week during summer)
- Partial irrigation (0.5 or 0.25 ETc) in water deficit areas in mature plantation (North Konkan etc)

GENOMIC MARKER ASSISTED SELECTION FOR CLIMATE-RESILEINT HIGH YIELDING CLONES





Expression of stress proteins during drought stress

A 23 kDa chloroplast protein consistently over-expressed in drought tolerant clones

THANK YOU VERY MUCH

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