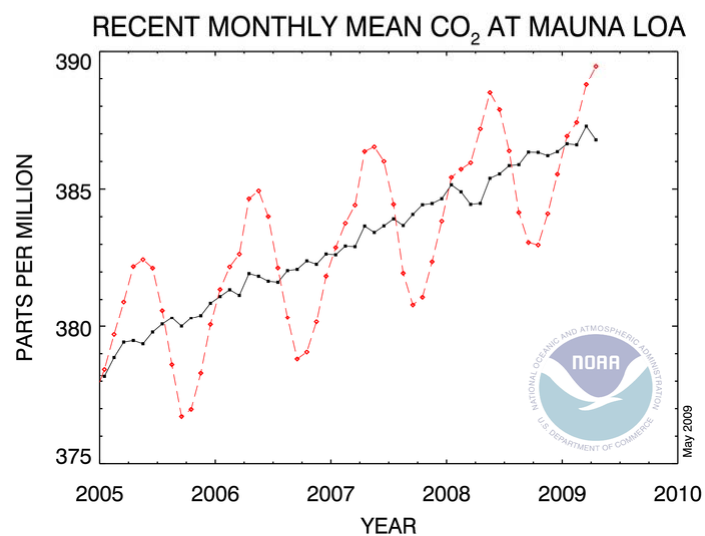


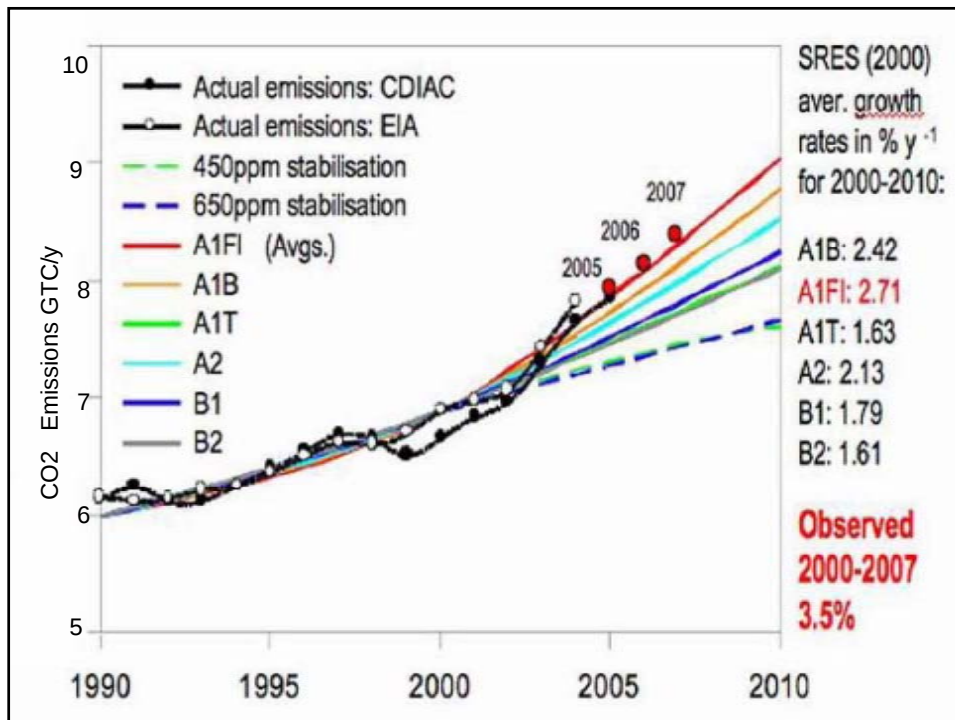
World Coffee Conference 2010
Guatemala City 26-28 February

Climate Change and Coffee Production: Vulnerability and possible adaptation

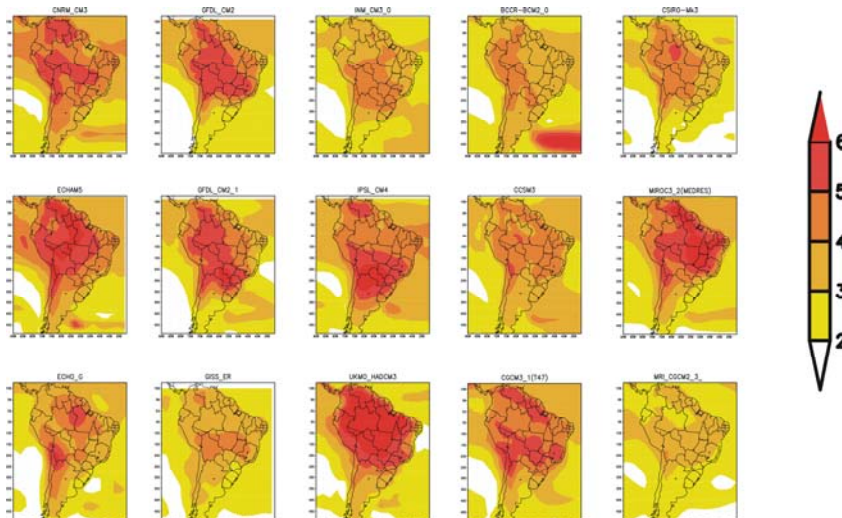
Eduardo Delgado Assad
Embrapa - Brazil

The growth rate of CO₂ is very high. There was no reduction in emissions in recent years as the skeptics predicted, in function on the economic crisis



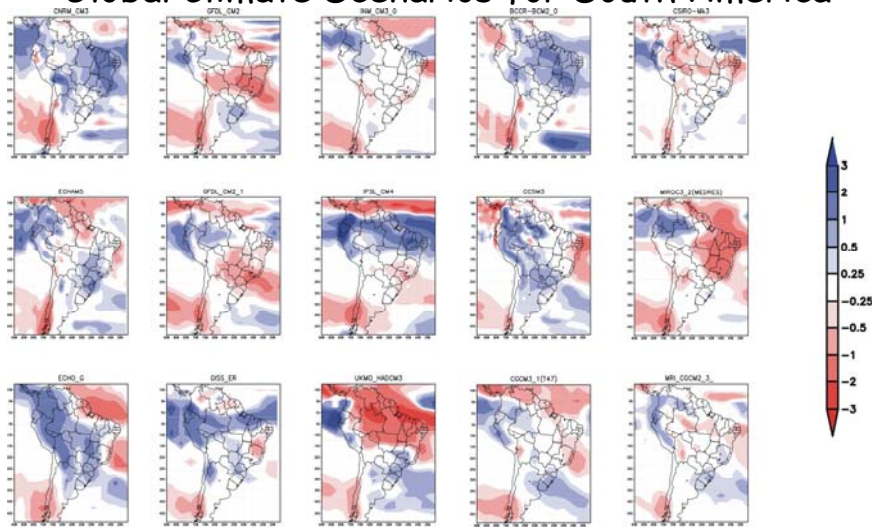


Global Climate Scenarios for South America



Projections of temperature anomalies (°C) to South America for the period 2090-2099 (scenario A2) over the base period 1961-1990 for 15 different global IPCC climate models.

Global Climate Scenarios for South America

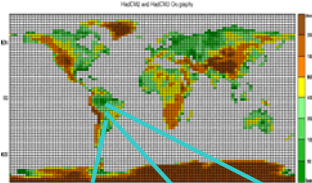


Projections of precipitation anomalies (mm/day) to South America for the period 2090-2099 (scenario A2) over the base period 1961-1990 for 15 different global IPCC climate models.

PROBIO-IPCC Global Models TAR (HadCM3)

Downscaling

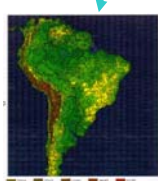
IPCC Model HadAMP3(Cox et al., 1999)



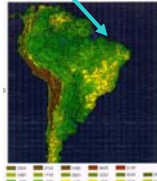
Climatology
1961-90

Senarios IPCC A2,
B2

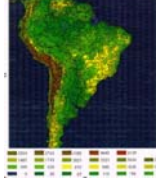
Regional Models



RegCM3



HadRM3



Eta CCS

Climatology regional
model 1961-90

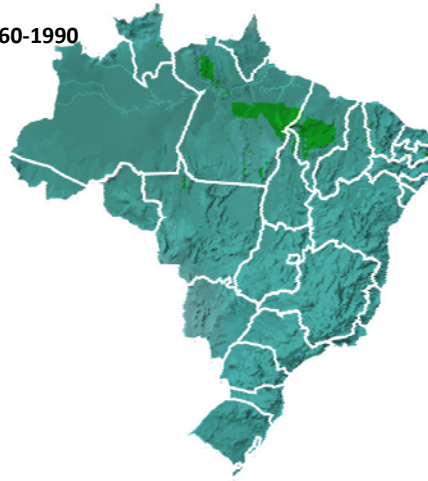
Scenarios of Climate
change Maps
(Regional
multimodel
ensemble)
2071-2100, A2, B2

Global Warming Scenarios in Brazil

Tmax (Precis-A2)
2010 – average 1960-1990

[°C]

- 8 a 6.5
- 6 a 5
- 4.5 a 3
- 2.5 a 1.5
- 1 a 0
- 0.5 a -2

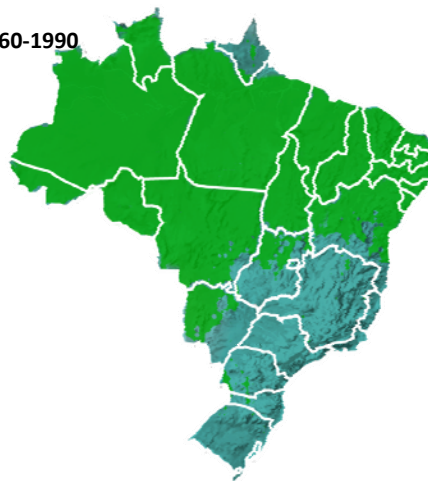


Global Warming Scenarios in Brazil

Tmax (Precis-A2)
2020 – average 1960-1990

[°C]

- 8 a 6.5
- 6 a 5
- 4.5 a 3
- 2.5 a 1.5
- 1 a 0
- 0.5 a -2

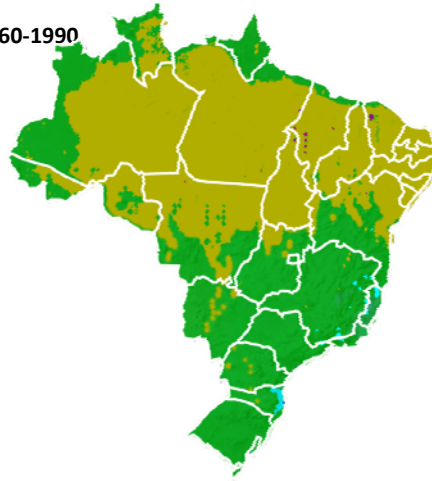


Global Warming Scenarios in Brazil

Tmax (Precis-A2)
2050 – average 1960-1990

[°C]

- 8 a 6.5
- 6 a 5
- 4.5 a 3
- 2.5 a 1.5
- 1 a 0
- 0.5 a -2

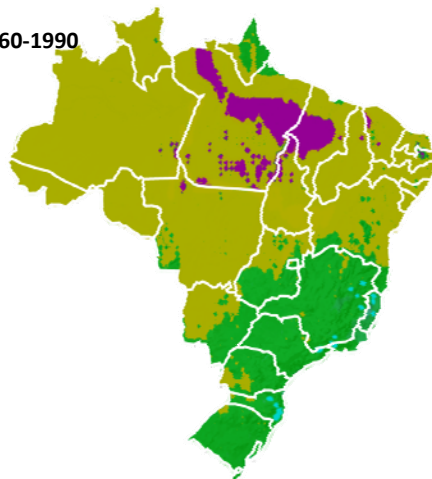


Global Warming Scenarios in Brazil

Tmax (Precis-A2)
2060 – average 1960-1990

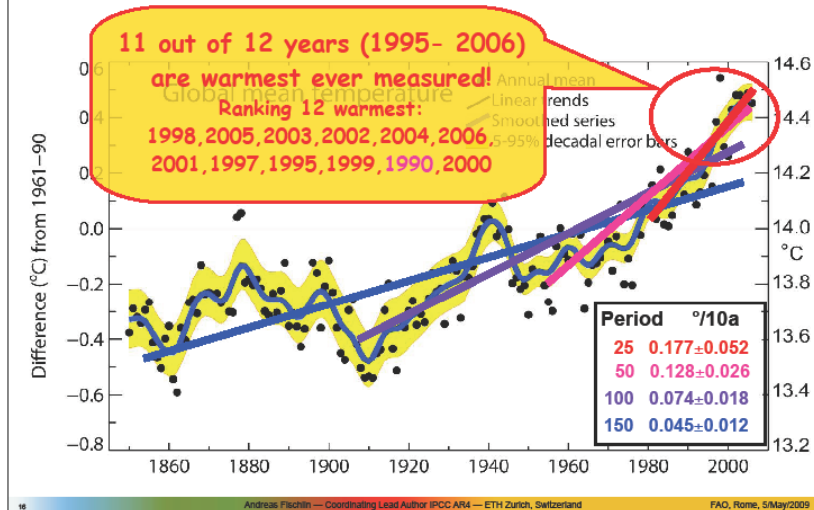
[°C]

- 8 a 6.5
- 6 a 5
- 4.5 a 3
- 2.5 a 1.5
- 1 a 0
- 0.5 a -2

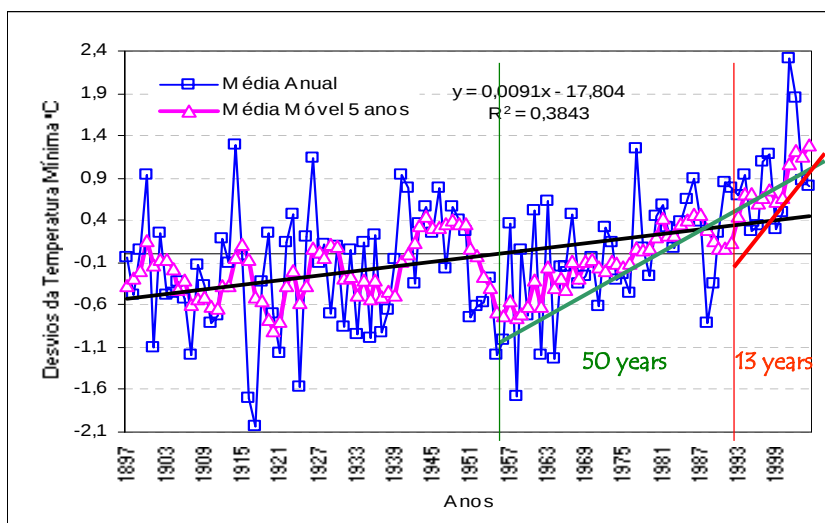


Observed Temperatures

After Figure TS.6 (IPCC, 2007b.
Technical Summary (TS) WGI)

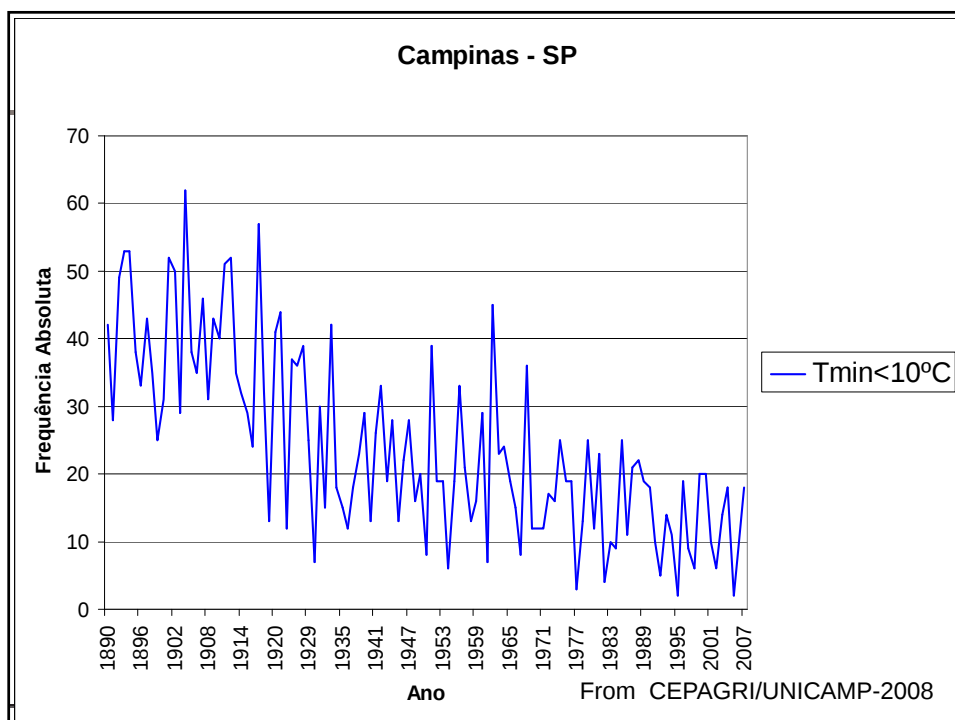
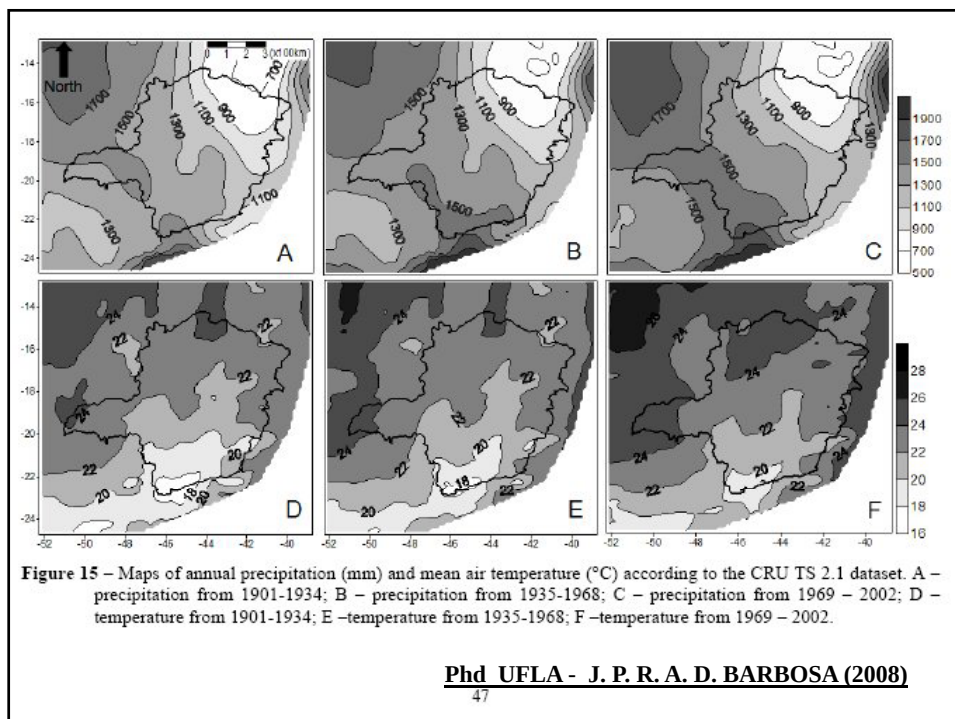


Temperature Variation Pelotas-RS



ΔT_{min}
= 1,6°C

From: Marcos S. Wrege & Flavio G. Herter – EMBRAPA Agroclimatology Lab. in Pelotas (2007)





CEPAGRI/UNICAMP-EMBRAPA CNPTIA

Conditions to simulations

- Air Temperature
- Average Annual:
 - 18°C and 22°C - Good
 - Greater than 23°C - Chance to floral abortion
 - Min. absolute annual:
 - Less than 1°C: Frost probability > 30%
 - Water deficit < 150 mm/y (80%)

Parâmetros: A. P.de Camargo-IAC



Candle Buds

T>34°C



Star Flowers



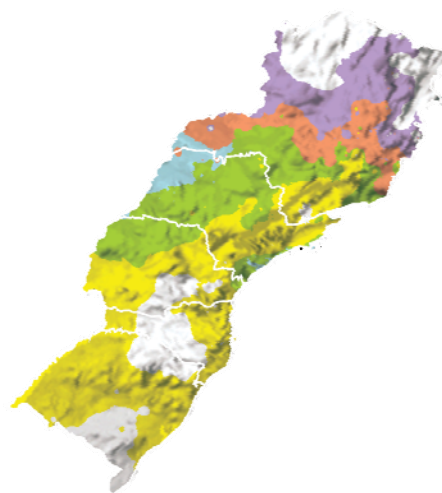
Day 29/09/2009 temperature 33°C

From: Embrapa Cerrados- Brasília-2009

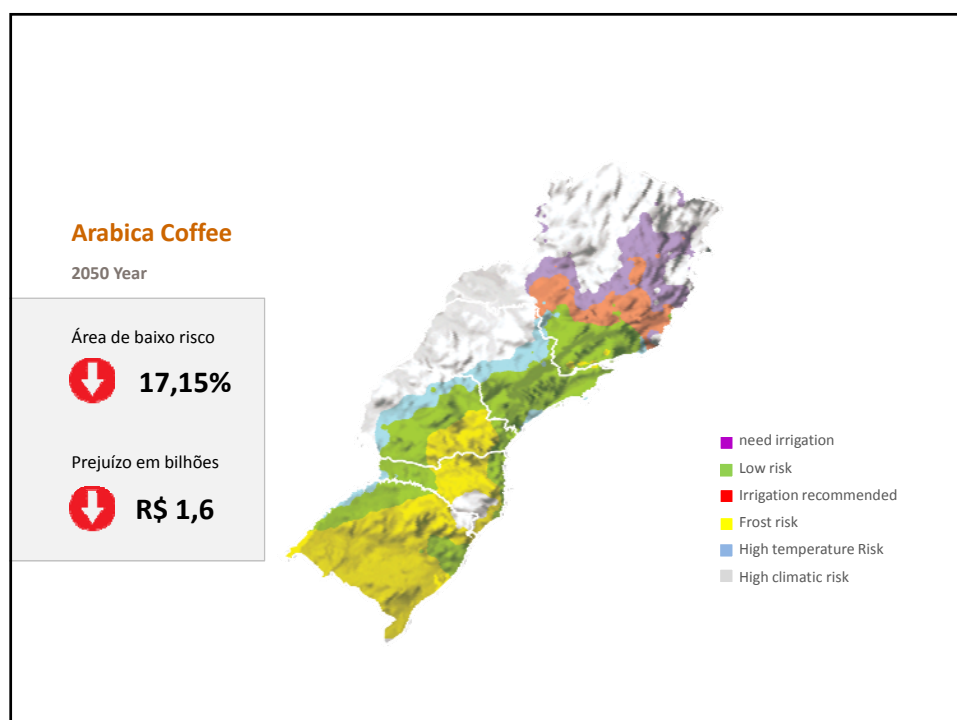
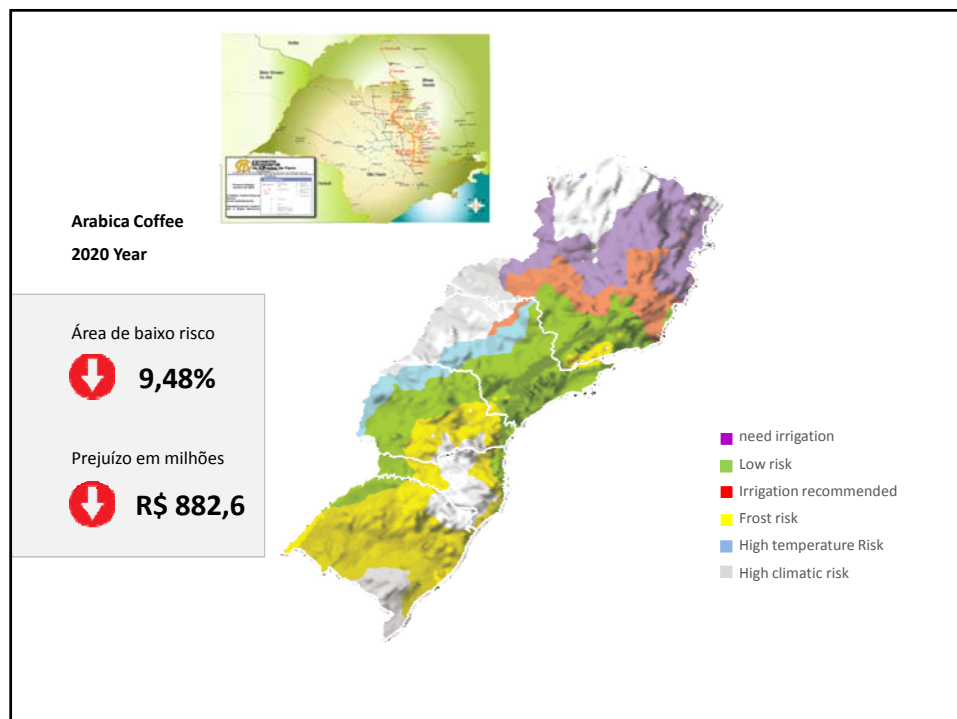


Impacts Simulation to *Coffea Arabica* Risks Zoning

Arabica Coffee
Actual Zonnig



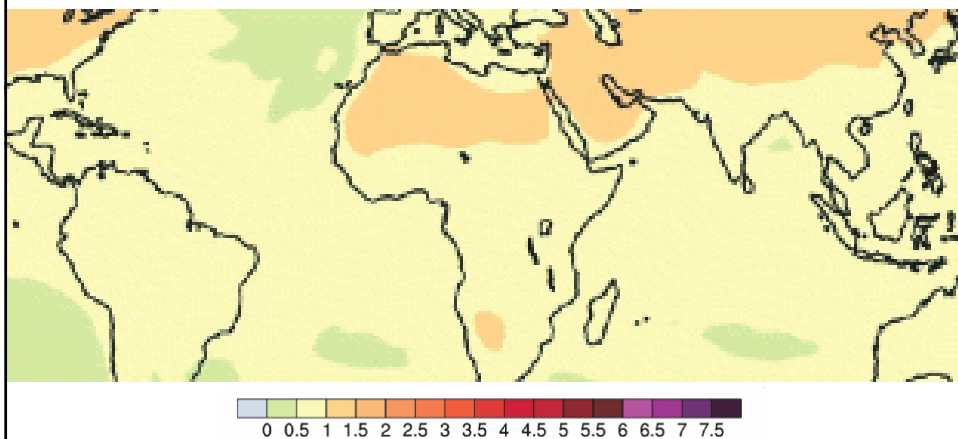
- need irrigation
- Low risk
- Irrigation recommended
- Frost risk
- High temperature Risk
- High climatic risk



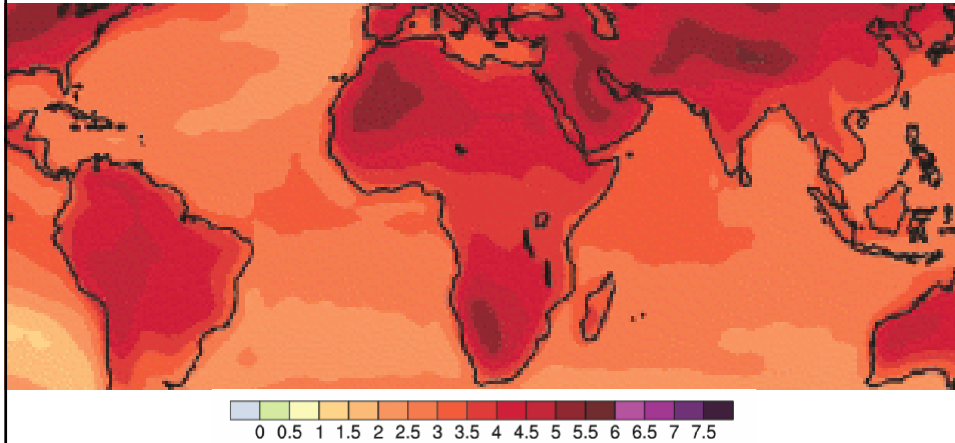


In the others Countries - Colombia and Vietnã

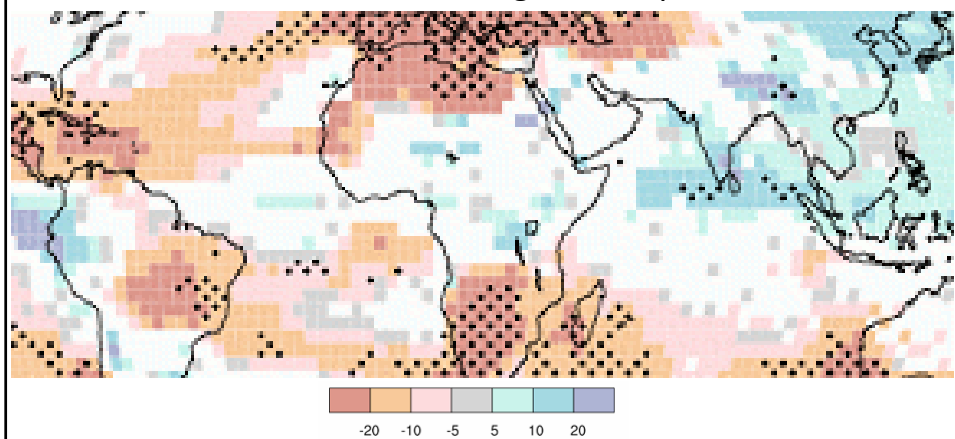
Scenarios to Climate Change
Temperature 2020-2029 Cenário A2



Scenario to climate change
Temperature 2090-2099 Cenário A2



Scenario to climate change – Precipitation JJA



IPCC (AR4)- Report

IPCC AR4	Brasil	Colômbia	Vietnã
Prec DJF 2099	-05 a 10%	10 a 20%	05 a 20%
Prec JJA 2099	-30 a -10%	05 a 10%	05 a 10%
Temp B1 2029	0,5 a 1,0°C	0,5 a 1,0°C	0,5 a 1,0°C
Temp A1B 2029	0,5 a 1,0°C	0,5 a 1,0°C	0,5 a 1,0°C
Temp A2 2029	0,5 a 1,0°C	0,5 a 1,0°C	0,5 a 1,0°C
Temp B1 2099	2,0 a 2,5°C	2,0 a 2,5°C	1,5 a 2,0°C
Temp A1B 2099	2,5 a 4,0°C	3,0 a 3,5°C	2,5 a 3,0°C
Temp A2 2099	3,5 a 4,5°C	3,5 a 4,5°C	3,0 a 3,5°C

Adaptation actions

Tree in coffee production



Some producers in São Paulo and Minas Gerais have used mango trees, avocado trees rubber trees, banana trees and coconut trees. Not a high number of trees per hectare is needed, only enough to make the shade, with around 60 to 70 shaded plants per hectare.

Tree in Coffee
Production can
Increase the
Carbon absorption

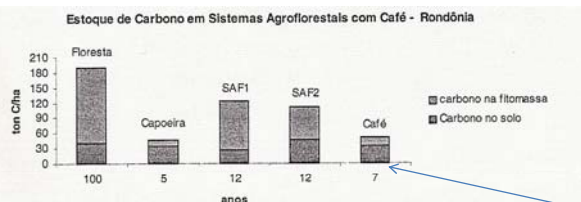


Figura 1. SAF1=café x seringueira (*Hevea brasiliensis*) SAF2=café x bandarra (*Schizolobium amazonicum*)

Sistema de uso da terra	Idade anos	C acima t/ha	I _c t/ha/ano	T _{max} anos	C _{max} t/ha	C _{max} /C _{floresta}
Floresta Primária	∞	148,0	-	-	148,0	1
Capoeira Natural	5	11,2	2,2 b	5	11,0	0,07
SAF1-Café x Seringueira	12	97,2	8,1 a	15	121,5	0,82
SAF2- Café x Bandarra	12	64,5	5,4 a	15	80,6	0,54
Monocultivo de Café	7	16,6	2,4 b	12	28,4	0,19

CV=18%. Médias seguidas da mesma letra nas colunas não diferem entre si pelo teste de Tukey a nível de 5%.

TABELA 2. Valores médios do Carbono acima do solo (C_{acima}), Taxa de acumulação de Carbono/ano (I_c), tempo para máxima de acumulação de Carbono (T_{max}), Carbono máximo acumulado em T_{max} (C_{max}) e relação do carbono nos sistemas de uso da terra com floresta primária. Rondônia. Brasil. 1997.

Vanda Gorete S. RODRIGUES, Eng. Agr. MSc. Embrapa - Rondônia. Caixa Postal 406. Porto Velho, RO. CEP 78900-970. vanda@cpsfro.embrapa.br; Carlos CASTILLA, Eng. Agr. DSc. ICRAF/ASB. PO Box 30677, Nairobi, Kenya; Rogério S. Corrêa da COSTA, Eng. Agr. MSc. Embrapa - Rondônia. Caixa Postal 406. Porto Velho, RO. CEP 78900-970; Cheryl PALM, Eng. Agr. DSc. TSBF, PO Box 30677. Nairobi, Kenya.

Carbon in
Soil Coffee
production

Adaptation and Mitigation Actions now and in the next years

- Mulching to reduce evaporation, avoid erosion and improve soil fertility.
Terracing/contouring, drainage and trapping/storing run-off rain water.
- Plating contours to mitigate wind and water damage;
- Improving access to climate data to monitoring coffee production
- Mapping potential climate change impact on coffee in local areas
- Improving soil fertility
- Examining different production models
- Developing planting disease resistance
- Developing drought resistant varieties
- Developing high temperature tolerance varieties

The challenge of global warming, brings a new dimension to future production of coffee. More technology, more and more professional organization. Not It will be the end of the coffee production, but the beginning of new times. We must be prepared.

Obrigado, Thanks, Gracias, Merci

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assad@cnptia.embrapa.br