FAPESP
FAPESP Research Program on Global Climate Change Workshop
2011 May 11, 12 - Espaço APAS - São Paulo

Generation of Alcohol Production Scenarios as Support for the Formulation of Public Policies Applied to the Adaptation of the National Sugar and Alcohol Industry to Climate Changes

Process: 2008/58160-5 - Political Science (07090000)
Period: Dec/01/2010 - Nov/30/2014

Scenarios

- Scenarios can be described as instruments which aid decision-makers by providing a context for planning and programming, lowering the level of uncertainty and raising the level of knowledge. (Eleonora Masini, 1993).
- Scenarios are not forecasts. They focus on relevant aspects and are challenging and meaningful images about the future.

Scenario Working – Morphological Futures Studies

Anita Rubin – Finland Futures Research Center, University of Turku

http://www.cost.eu/download/Thinking%20in%20Scenarios_Anita%20Rubin

Why Study the Sugar Cane and Alcohol Sector ? (1/4)

- High possibility that the Climate is changing and in the most drastic way (Scenario);
- Long time to develop techniques for mitigation and adaptation for Climate Change;
- Alternative for mitigation of GHGs and adaptation for Climate Change;
- Importance of agribusiness for Brazilian society and economy;
- Importance of sugar cane for São Paulo and Brazil;
- Traditional agricultural crop (~500 years of history);
- Adaptation is possible and desirable;
- Knowledge acquired and available in São Paulo;
- Costs and impacts of inaction can be very high (need of planning);

Why Study the Sugar Cane and Alcohol Sector ? (2/4)

- Different regional developments – Southeast, Northeast and Central West;
- Great interest in the expansion of its production;
- Production of food, energy, fuel and chemistry;
- Can supply domestic and foreign markets, simultaneously;
- Constraints against expansion – environmental sectors;
- Competition with oil sector and other types of energy;
- Typical factors of an agricultural production (seasonality, inelasticity, dependence of uncontrollable factors, such as the climate) - Stock;
- Increasing use of technology;

Why Study the Sugar Cane and Alcohol Sector ? (3/4)

- Use of large areas;
- Competition with other agricultural crops;
- Existence of different interests - e.g. population (fuel, food and environment);
- Development linked to several sectors (agriculture, industry, energy, environment, foreign trade, infrastructure, demography, food security, national and international policies);
- Risk of being a temporary solution for the climate change;
- Starting point of methodology well-defined, consolidated and used for several years in the definition of public policies in the agricultural sector;
- Great opportunity for business and development X Impacts (social, economical and environmental)

Why Study the Sugar Cane and Alcohol Sector ? (4/4)

Expansion

X

Constraints & Impacts

Potential, Pressure, Demand,
Economical Interest, Land, Technology

Environment, Food Security, Tax Burden
Demographic Dynamics, Infrastructure
Human Health, Harvest Forecast

Great challenge to adapt a complex productive system for climate change

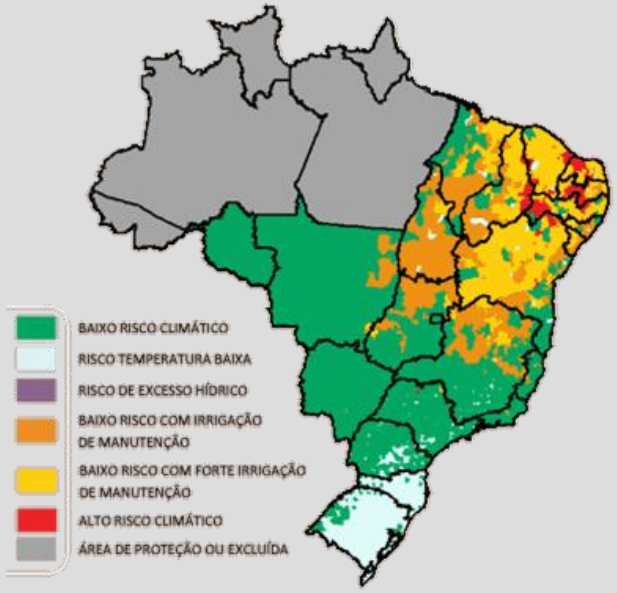
↓

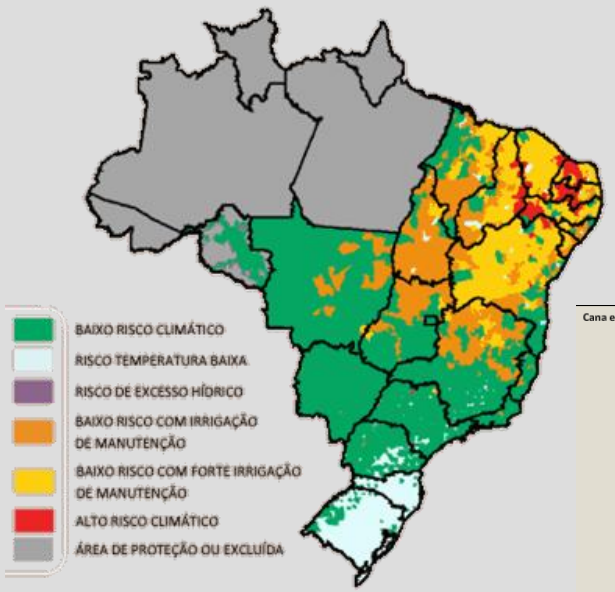
Public Policies

↓

Production Scenarios

Future Scenarios for 2020, 2050 and 2070 – Sugar Cane - Brazil





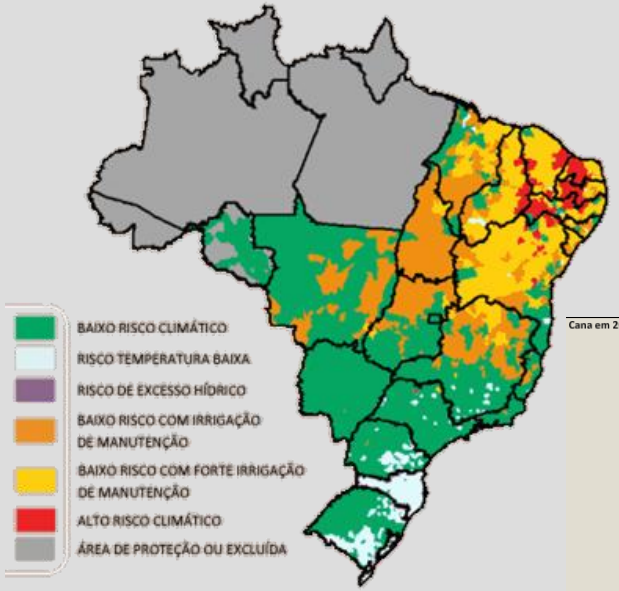
Cana em 2020

170,9%

aumento na área de baixo risco

ganhos em bilhões

R$ **29**



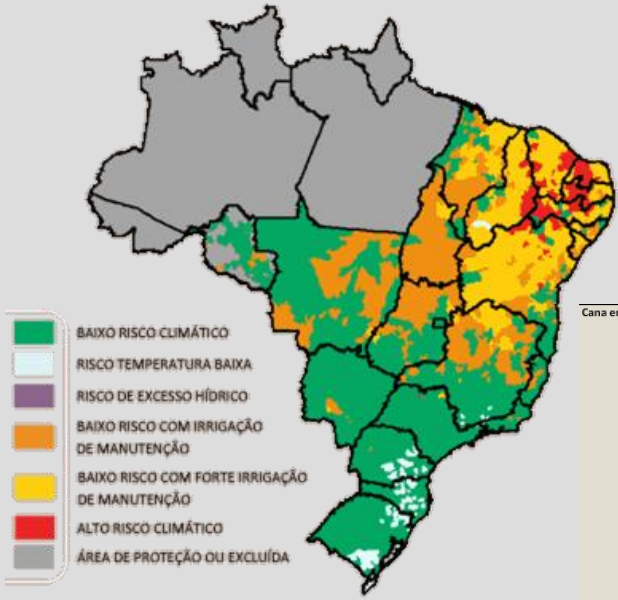
Cana em 2050

146,8%

aumento na área de baixo risco

ganhos em bilhões

R$ **24,9**



Cana em 2070

143,4%

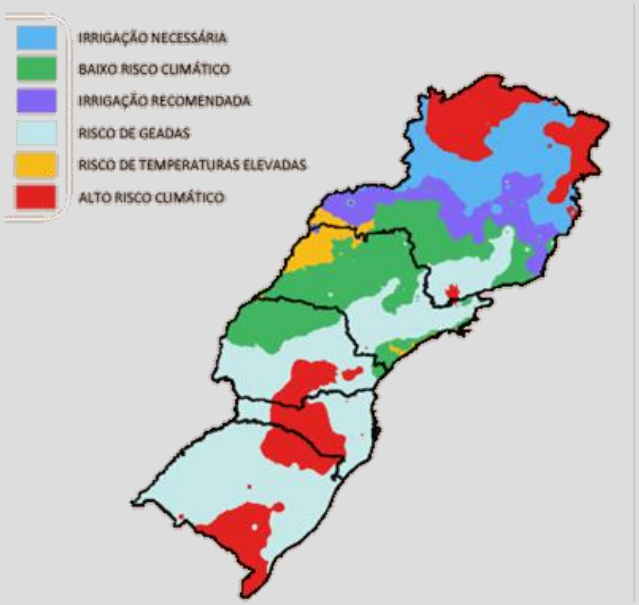
aumento na área de baixo risco

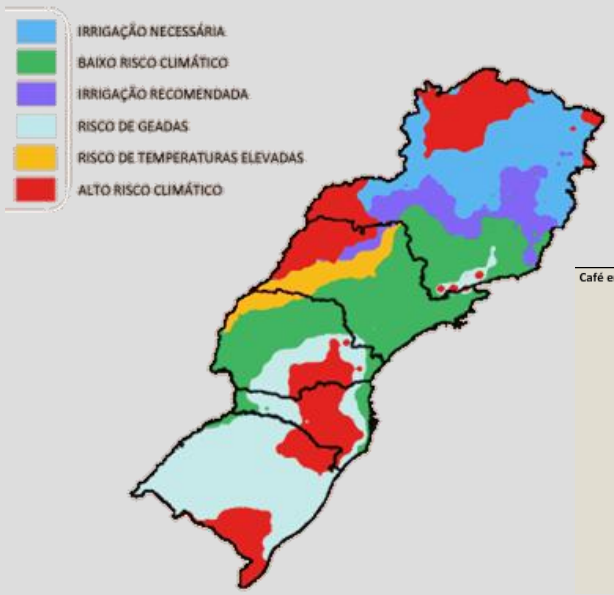
ganhos em bilhões

R$ **24,3**

Source: http://www.agritempo.gov.br/climaeagricultura/cana.html

Future Scenarios for 2020, 2050 and 2070 – Arabica Coffee – Center South Brazil





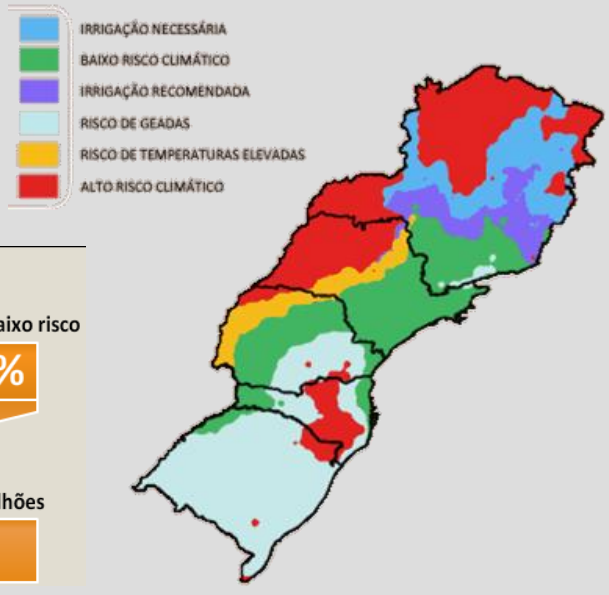
Café em 2020

queda na área de baixo risco

6,75%

prejuizo em milhões

R$ **628,5**



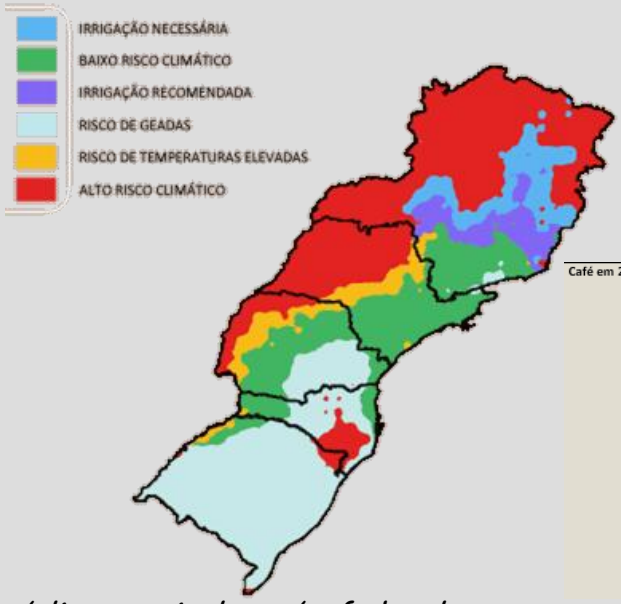
Café em 2050

queda na área de baixo risco

18,32%

prejuizo em milhões

R$ **1,7**



Café em 2070

queda na área de baixo risco

27,60%

prejuizo em milhões

R$ **2,57**

Source: http://www.agritempo.gov.br/climaeagricultura/cafe.html

Variation in production value in A2 scenario, compared to current IBGE values for 2006

CROPS	CURRENT PRODUCTION (TONNES)	PRODUCTION VALUE (R$ 1,000)	IMPACT ON PRODUCTION VALUE BASED ON PRECIS A2 MODEL, 2020 (R$ 1,000)	IMPACT ON PRODUCTION VALUE BASED ON PRECIS A2 MODEL, 2050 (R$ 1,000)	IMPACT ON PRODUCTION VALUE BASED ON PRECIS A2 MODEL, 2070 (R$ 1,000)
Cotton	2.898.721	2.831.274	-313.422	-407.730	-456.401
Rice	11.526.685	4.305.559	-417.639	-530.445	-610.959
Coffee	2.573.368	9.310.493	-882.635	-1.596.750	-3.073.394
Sugarcane	457.245.516	16.969.188	27.109.975	23.515.901	20.054.186
Beans	3.457.744	3.557.632	-155.113	-363.234	-473.165
Sunflower	—	—	—	—	—
Cassava	26.639.013	4.373.156	-137.754	589.501	929.733
Maize	42.661.677	9.955.266	-1.192.641	-1.511.209	-1.720.270
Soybean	52.454.640	18.470.711	-4.357.241	-6.307.748	-7.645.027

Reference: Pinto, H.S. & Assad, E.D. Global Warming and the New Geography of Agricultural Production in Brazil. British Embassy, 2008.

temperatura_CBA.pdf - Adobe Reader

Arquivo Editar Visualizar Documento Ferramentas Janela Ajuda

2 / 2 73,6% Localizar

Impacto do aumento da temperatura no zoneamento climático do café nos Estados de São Paulo e Goiás. Avaliação dos cenários do IPCC

Hilton S. **Pinto**[1], Eduardo D. **Assad** [2] ,Jurandir **Zullo Jr.** [1], Orivaldo Brunini[1], Balbino A.**Evangelista** [2]

1-INTRODUÇÃO

O recente relatório do Intergovermmental Panel on Climate Change - IPCC (2001), de fevereiro de 2001, indica uma situação inquietante quanto ao aumento de temperatura no planeta. Nos modelos adotados, a temperatura deve aumentar nos próximos 100 anos, entre 1,4 °C à 5,8°C, considerando o ano de 1990 como referência. Esse cenário complementa os estudos feitos também pelo IPCC (1997), quando foi avaliado que houvera um incremento de temperatura de 0,15°C com variação de 0,05°C por década, desde 1950, quando medições mais confiáveis começaram a ser feitas. Verificou-se também que a precipitação havia aumentado de 0,5% à 1,0% por década, até o final do século vinte, principalmente no hemisfério norte. Na região tropical, compreendida entre 10° de latitude norte até 10° de latitude sul, esse incremento na precipitação foi de 0,2% à 0,3%. Até a elaboração do último relatório IPCC(2001), havia uma discordância razoável entre as medições e os modelos adotados, no que diz respeito aos incrementos de temperatura por ações naturais (variação de radiação solar e atividades vulcânicas) e ações antropogênicas (efeito estufa, estimativa de aerossois na atmosfera). Ao considerar os dois efeitos simultaneamente, os modelos apresentam maior concordância, indicando um aumento de temperatura de 0,5°C na superfície da terra, no período compreendido entre 1850 e 2000. IPCC(1997).

Considerando esses cenários, o objetivo deste trabalho foi verificar o efeito que o incremento futuro de temperatura terá sobre a cafeicultura brasileira, notadamente nos estados de São Paulo e de Goiás.

2- MATERIAL E MÉTODO

Tanto para o Estado de São Paulo, quanto para o Estado de Goiás, o processo cartográfico para espacialização da temperatura foi baseado nos dados altimétricos fornecidos pelo United States Geological Survey (USGS) no arquivo GTOPO30 em forma de uma grade regular com espaçamento de 30 s x 30 s de grau [1]nas coordenadas geográficas A temperatura média anual e a probabilidade de geadas foram calculados para cada ponto da grade, utilizando equações de regressão, considerando a latitude, longitude e altitude de cada ponto, PINTO et al (1972), SILVA et al (2000). O cálculo da deficiência hídrica anual foi feito a partir da estimativa do Balanço Hídrico Climático utilizando o método de Thornthwaite & Mather (1955) considerando um armazenamento de água no solo correspondente a 125mm. Os valores de deficiência hídrica anual foram espacializados considerando a mesma grade regular utilizada no cálculo da probabilidade de geadas e temperatura média anual, ou seja, 30 s x 30 s. A aptidão climática para a cafeicultura dos dois estados foi definida à partir dos valores de deficiência hídrica anual, temperatura média anual e probabilidade de geadas para cada ponto da grade regular. Esse procedimento gerou o zoneamento de riscos utilizado atualmente. Para efeito de simulação, foram confeccionados novos mapas de temperaturas com valores incrementados de 1°C, 3°C e 5°C, procurando assim acompanhar os cenários futuros de acordo com IPCC. Esses valores foram novamente associados aos valores do balanço hídrico e espacializadas as áreas aptas para café segundo os seguintes critérios adotados:

- risco de geada superior à 25% de probabilidade (temperatura inferior à 1°C)
- temperatura média anual entre 18°C e 22° graus. Com irrigação é possível atingir 23°C.
- Deficiência hídrica anual inferior à 150 mm/ano.

3- RESULTADOS E DISCUSSÃO

O aumento de temperatura de 1°C, 3°C e 5°C, promoveu uma mudança radical nas regiões consideradas aptas para o plantio de café nos Estados de São Paulo e Goiás. Na figura 1, onde está ilustrado o zoneamento atual do café em São Paulo, existem 5 níveis de condições climáticas: favorável, favorável com restrição térmica , favorável com irrigação, favorável sujeita as geadas e inapta. Considerando um aumento de 3 graus na temperatura média anual, três níveis aparecem (figura 2); favorável, favorável com restrição térmica e inapto, reduzindo a área apta em 75%. No caso do estado de Goiás, onde o café é recomendado somente com irrigação (figura 3), considerando um aumento de temperatura de 3°C, a área apta fica reduzida em 98%, em relação ao zoneamento atual (figura 4).

[1] Cepagri/Unicamp. CNPq. Cidade Universitária Zeferino Vaz. Campinas - SP.

[2] Embrapa Cerrados. CP 08223. Planaltina-DF. CEP 73301-970.

Conclusão

Se mantidos os cenários atuais preconizados pelos modelos do IPCC, o cultivo do café nos estados de Goiás e São Paulo será drasticamente reduzido nos próximos 100 anos. É importante avaliar corretamente as possibilidades de acréscimo de temperatura, com a magnitude em que é apresentada nos relatórios principalmente a partir de ações antropogênicas.

Bibliografia

PINTO, H. S.; ORTOLANI,A A ; ALFONSI, R.R 1972. Estimativa das temperaturas médias mensais do Estado de São Paulo em função da Altitude e Latitude. Caderno Ciências da Terra 23. Instituto de Geografia FFCL USP. 20p. São Paulo.

SILVA, F.A .M.; SANTOS, E.,R.A.; EVANGELISTA, B.; ASSAD, E.D.; PINTO, H.S.; ZULLO JR.,J.BRUNINI,O, CORAL, G.; 2000 Delimitação das áreas aptas do ponto de vista agroclimático para o Plantio da Cultura de Café no estado de Goiás. In: I simpósio de pesquisa dos Cafés do Brasil. Poços de Caldas, setembro de 2000. Resumo expandido, Anais. 123-126p

IPCC – 2001 Summary for Policymakers Climate Change 2001: Impacts, Adaptations and Vulnerability. http://www.meteo.gov.uk/sec5/CR_div/ipcc/wg/ipccfar.html

IPCC – 1997 Na introduction to simple climate models used in the IPCC Seconde Assessment Report. February 1997.
ISBN 92-9169-101-1. 47 pg. OMM/WMO – PNUE/UNEP

Figura 1. Zoneamento atual do Café no Estado de São Paulo

Figura 2. Zoneamento do café em S. Paulo com +3ºC na temperatura.

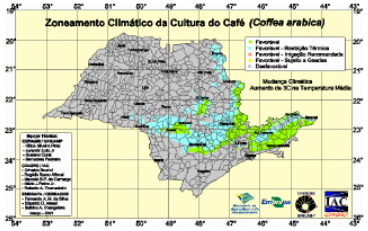


Figura 3. Zoneamento atual do café no Estado de Goias

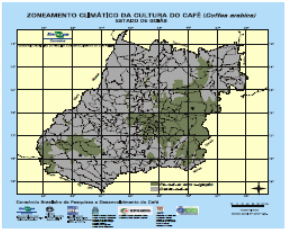


Figura 4. Zoneamento do Café em Goiás. Temperatura +3ºC

215,9 x 279,4 mm

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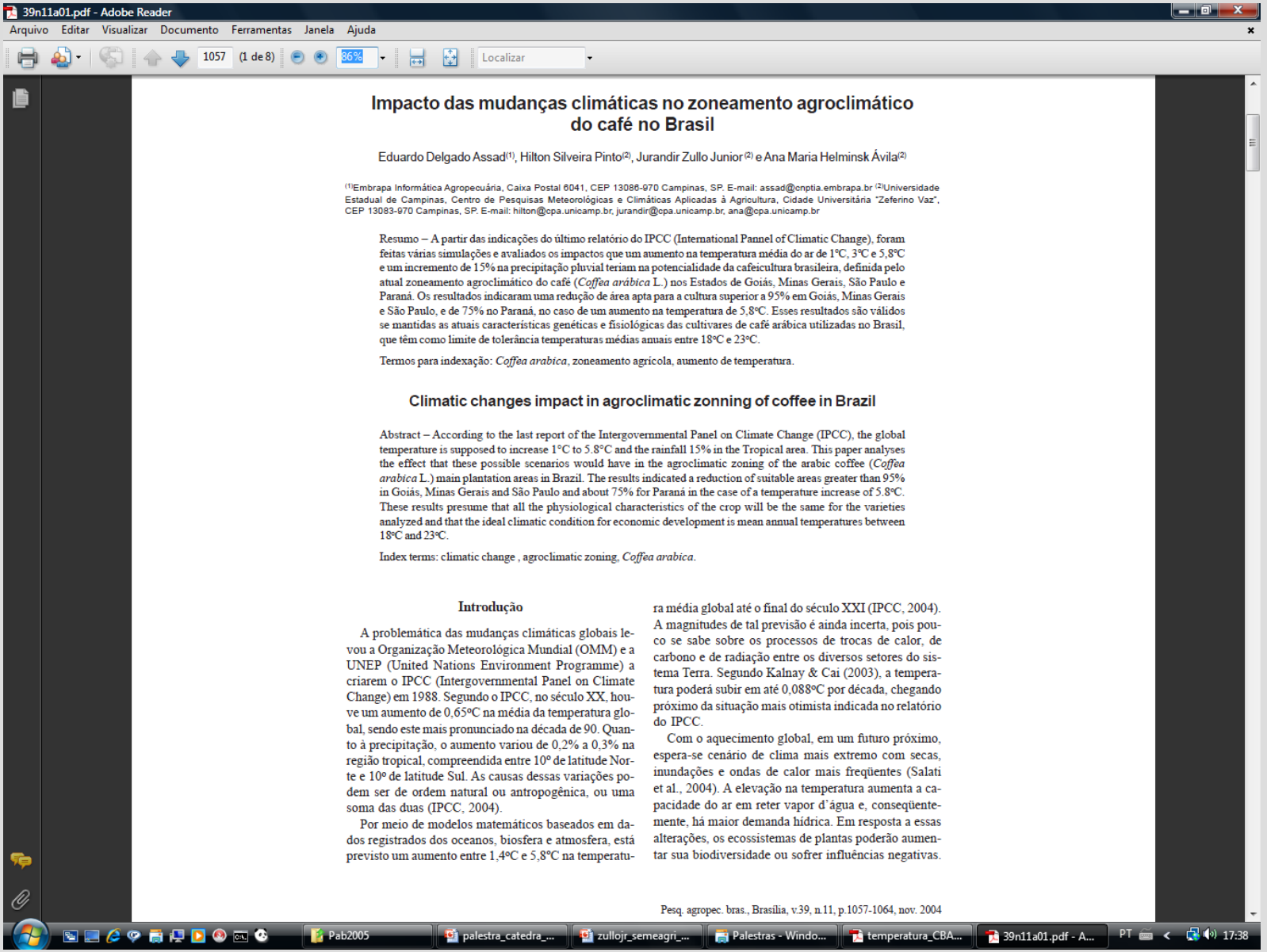

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Arquivo Editar Visualizar Documento Ferramentas Janela Ajuda

1057 (1 de 8) 86% Localizar

Impacto das mudanças climáticas no zoneamento agroclimático do café no Brasil

Eduardo Delgado Assad[1], Hilton Silveira Pinto[2], Jurandir Zullo Junior[2] e Ana Maria Helminsk Ávila[2]

[1]Embrapa Informática Agropecuária, Caixa Postal 6041, CEP 13086-970 Campinas, SP. E-mail: assad@cnptia.embrapa.br [2]Universidade Estadual de Campinas, Centro de Pesquisas Meteorológicas e Climáticas Aplicadas à Agricultura, Cidade Universitária "Zeferino Vaz", CEP 13083-970 Campinas, SP. E-mail: hilton@cpa.unicamp.br, jurandir@cpa.unicamp.br, ana@cpa.unicamp.br

Resumo – A partir das indicações do último relatório do IPCC (International Pannel of Climatic Change), foram feitas várias simulações e avaliados os impactos que um aumento na temperatura média do ar de 1°C, 3°C e 5,8°C e um incremento de 15% na precipitação pluvial teriam na potencialidade da cafeicultura brasileira, definida pelo atual zoneamento agroclimático do café (*Coffea arábica* L.) nos Estados de Goiás, Minas Gerais, São Paulo e Paraná. Os resultados indicaram uma redução de área apta para a cultura superior a 95% em Goiás, Minas Gerais e São Paulo, e de 75% no Paraná, no caso de um aumento na temperatura de 5,8°C. Esses resultados são válidos se mantidas as atuais características genéticas e fisiológicas das cultivares de café arábica utilizadas no Brasil, que têm como limite de tolerância temperaturas médias anuais entre 18°C e 23°C.

Termos para indexação: *Coffea arabica*, zoneamento agrícola, aumento de temperatura.

Climatic changes impact in agroclimatic zonning of coffee in Brazil

Abstract – According to the last report of the Intergovernmental Panel on Climate Change (IPCC), the global temperature is supposed to increase 1°C to 5.8°C and the rainfall 15% in the Tropical area. This paper analyses the effect that these possible scenarios would have in the agroclimatic zoning of the arabic coffee (*Coffea arabica* L.) main plantation areas in Brazil. The results indicated a reduction of suitable areas greater than 95% in Goiás, Minas Gerais and São Paulo and about 75% for Paraná in the case of a temperature increase of 5.8°C. These results presume that all the physiological characteristics of the crop will be the same for the varieties analyzed and that the ideal climatic condition for economic development is mean annual temperatures between 18°C and 23°C.

Index terms: climatic change , agroclimatic zoning, *Coffea arabica*.

Introdução

A problemática das mudanças climáticas globais levou a Organização Meteorológica Mundial (OMM) e a UNEP (United Nations Environment Programme) a criarem o IPCC (Intergovernmental Panel on Climate Change) em 1988. Segundo o IPCC, no século XX, houve um aumento de 0,65°C na média da temperatura global, sendo este mais pronunciado na década de 90. Quanto à precipitação, o aumento variou de 0,2% a 0,3% na região tropical, compreendida entre 10° de latitude Norte e 10° de latitude Sul. As causas dessas variações podem ser de ordem natural ou antropogênica, ou uma soma das duas (IPCC, 2004).

Por meio de modelos matemáticos baseados em dados registrados dos oceanos, biosfera e atmosfera, está previsto um aumento entre 1,4°C e 5,8°C na temperatura média global até o final do século XXI (IPCC, 2004). A magnitudes de tal previsão é ainda incerta, pois pouco se sabe sobre os processos de trocas de calor, de carbono e de radiação entre os diversos setores do sistema Terra. Segundo Kalnay & Cai (2003), a temperatura poderá subir em até 0,088°C por década, chegando próximo da situação mais otimista indicada no relatório do IPCC.

Com o aquecimento global, em um futuro próximo, espera-se cenário de clima mais extremo com secas, inundações e ondas de calor mais freqüentes (Salati et al., 2004). A elevação na temperatura aumenta a capacidade do ar em reter vapor d'água e, conseqüentemente, há maior demanda hídrica. Em resposta a essas alterações, os ecossistemas de plantas poderão aumentar sua biodiversidade ou sofrer influências negativas.

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Reference: PAB, v.39, n.11, p.1057-1064, nov., 2004

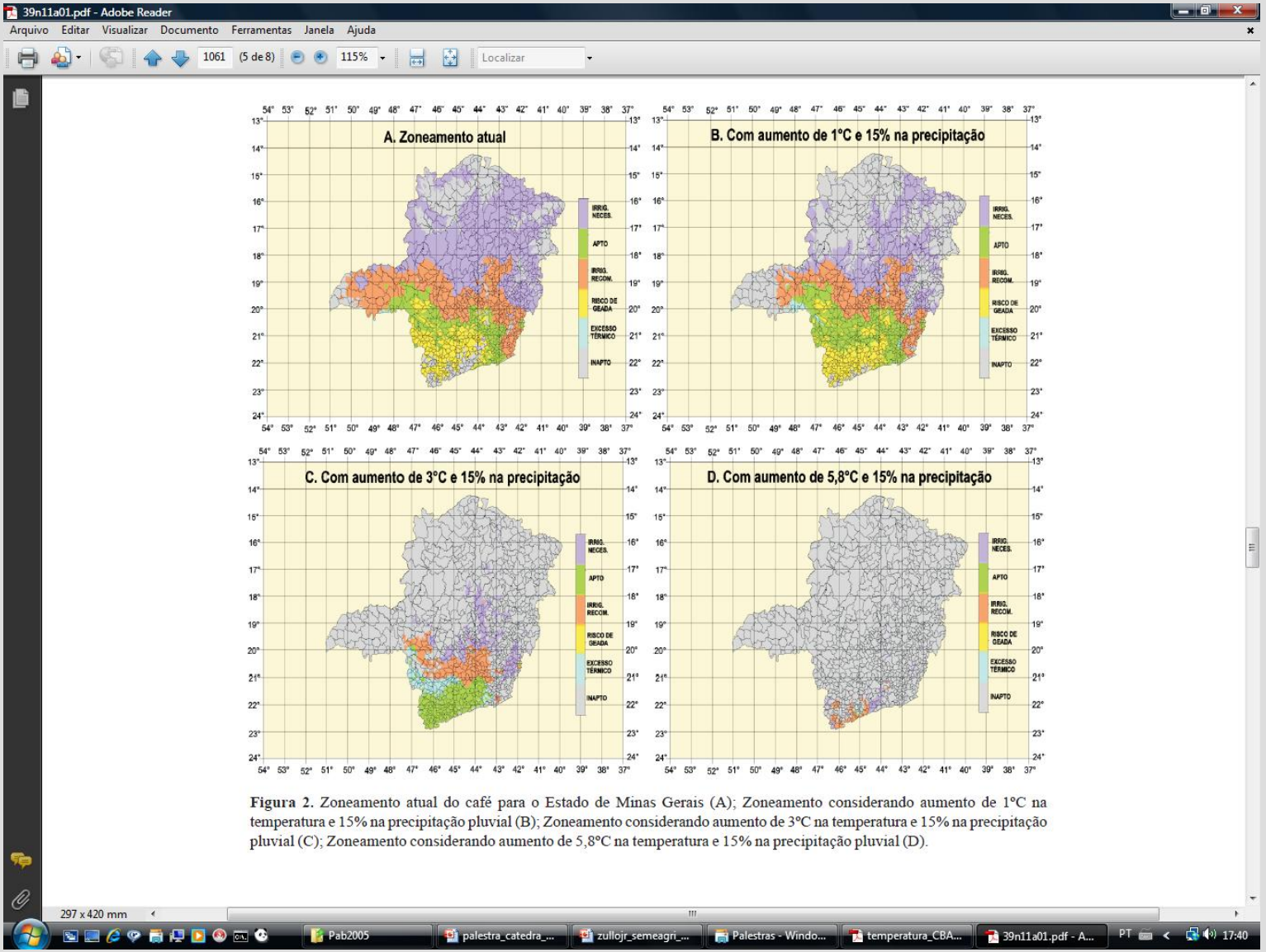
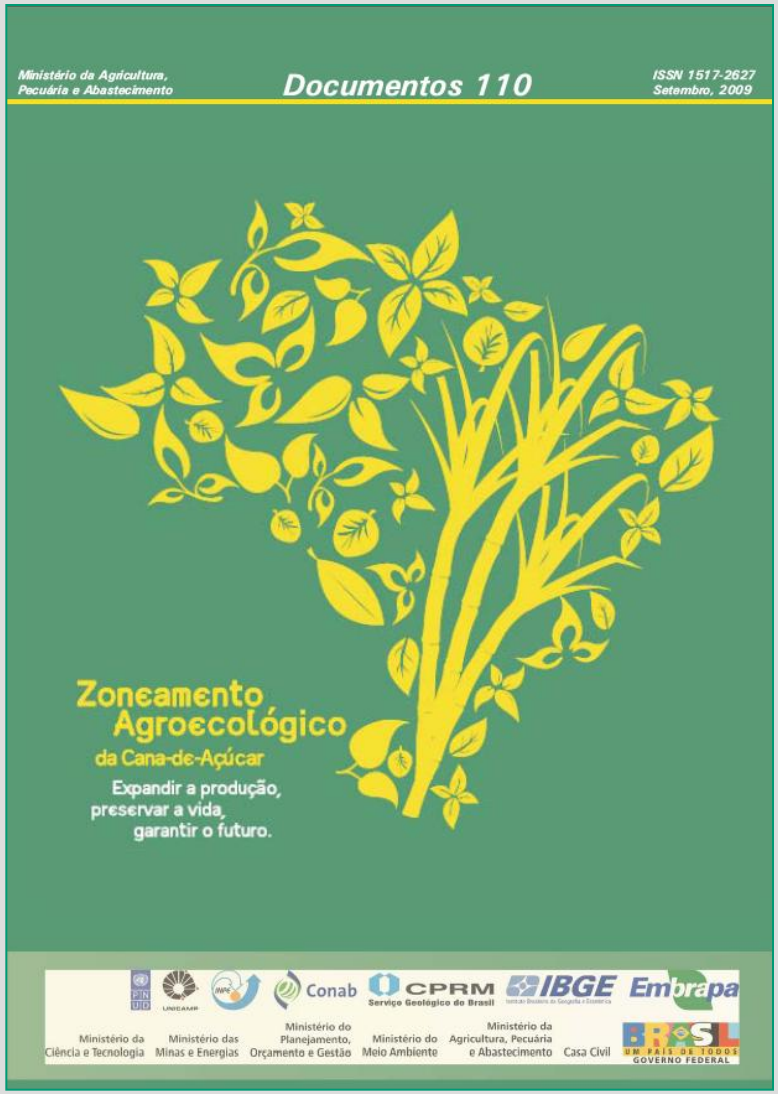
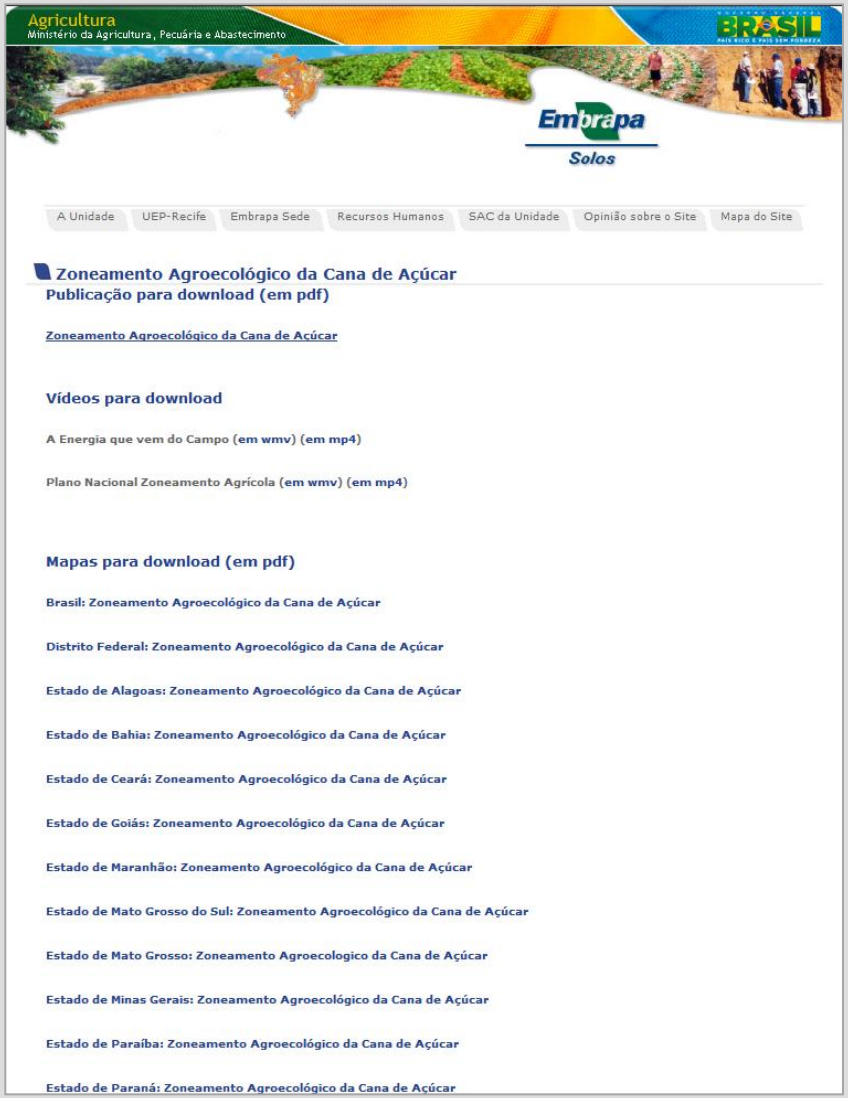


Figura 2. Zoneamento atual do café para o Estado de Minas Gerais (A); Zoneamento considerando aumento de 1°C na temperatura e 15% na precipitação pluvial (B); Zoneamento considerando aumento de 3°C na temperatura e 15% na precipitação pluvial (C); Zoneamento considerando aumento de 5,8°C na temperatura e 15% na precipitação pluvial (D).

Reference: PAB, v.39, n.11, p.1057-1064, nov., 2004

Agro-Ecological Zoning of Sugar Cane - 2009



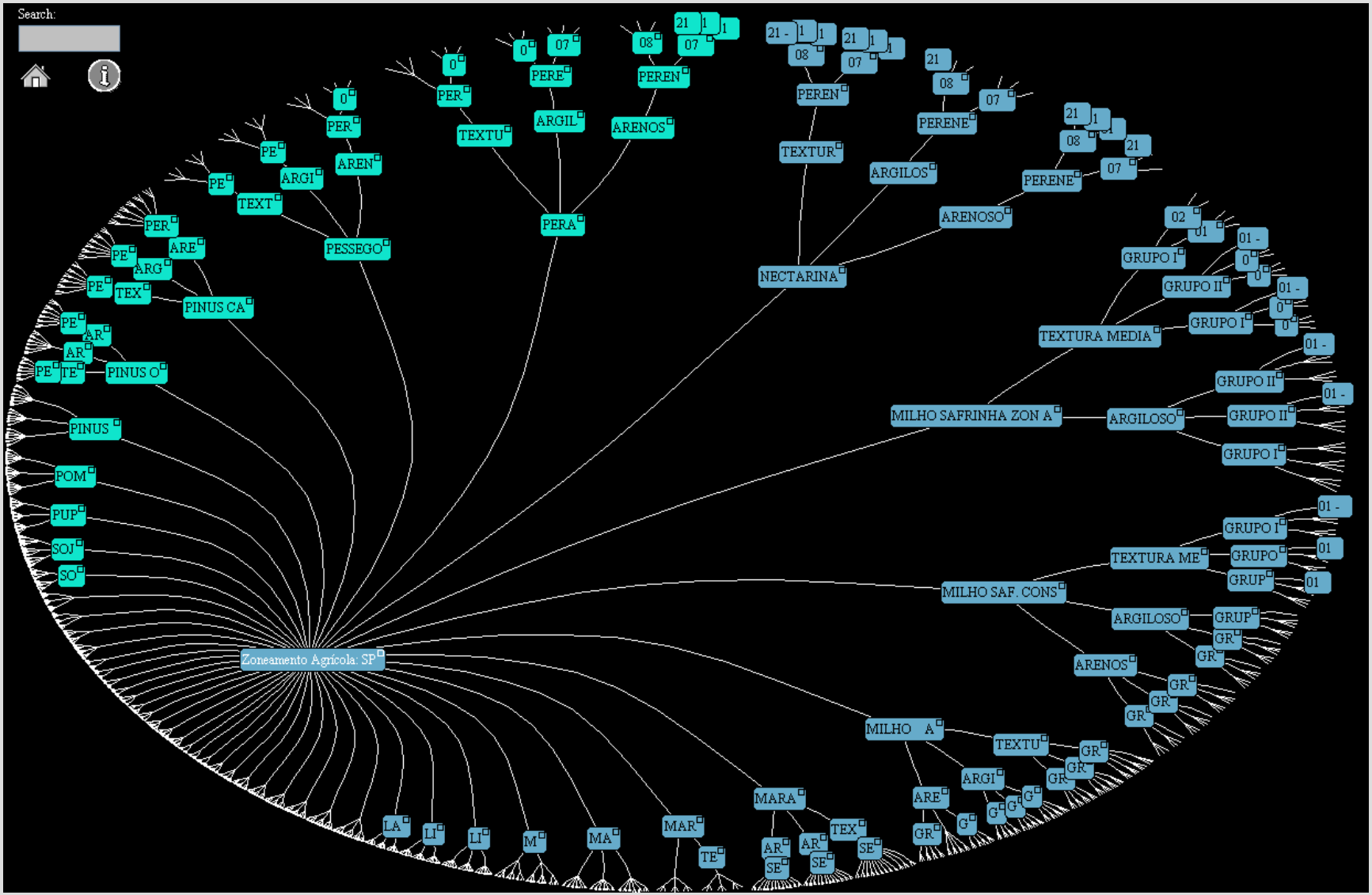


http://www.itamaraty.gov.br/videos/documentary-sugarcane-agroecological-zoning-in-brazil

http://www.cnps.embrapa.br/zoneamento_cana_de_acucar/

Agricultural Zoning – Ministry of Agriculture

http://www.agricultura.gov.br/politica-agricola/zoneamento-agricola/portarias-segmentadas-por-uf



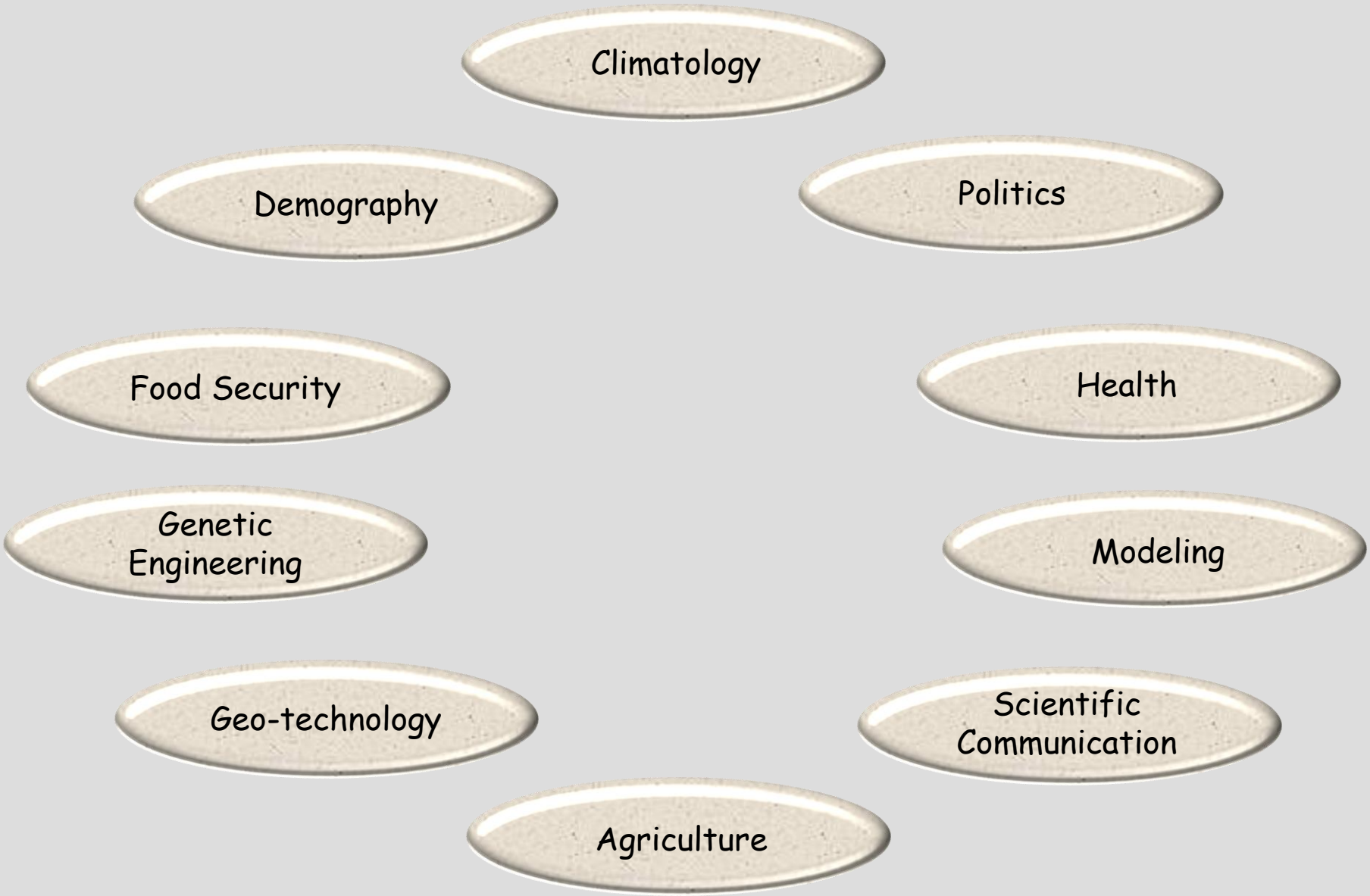
http://www.agritempo.gov.br/publish/zoneamento/SP.html

Scientific Problem

"Elaboration of ethanol production sceneries and the impacts associated, in the coming decades, in order to establish public policies that can promote the adaptation of the sugar and alcohol sector to the climate changes, considering their great social, economic and environmental responsibilities in the coming years."

Challenge

"Consider, together, several factors directly related to the cultivation of sugar cane, to the production technologies of its main products (sugar and alcohol) and the impacts directly related to their performance (in the environment, in the food and nutritional security, in the demographic dynamics and in the human health)."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Health
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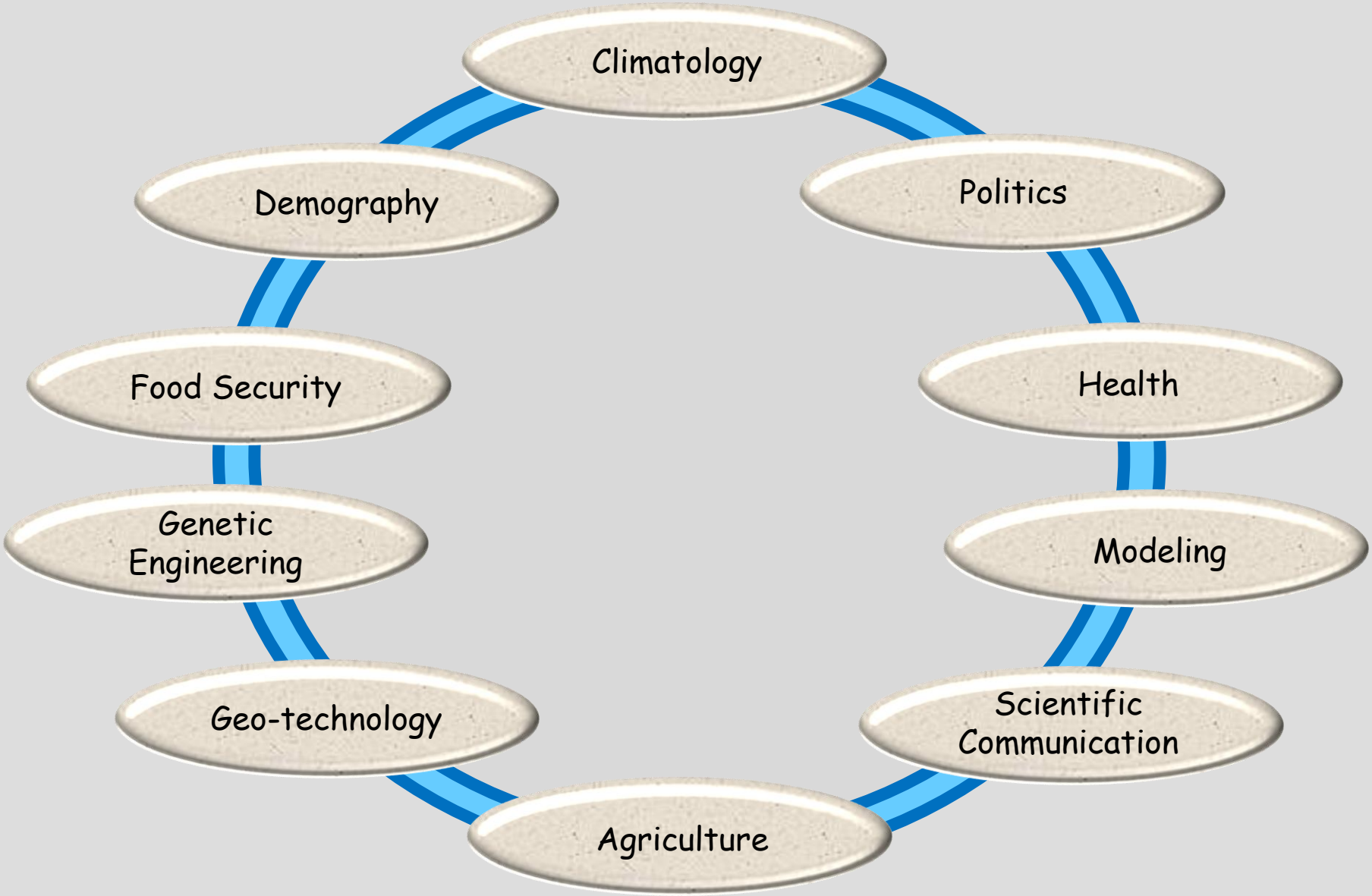
Modeling
Geo-technology
Scientific Communication
Agriculture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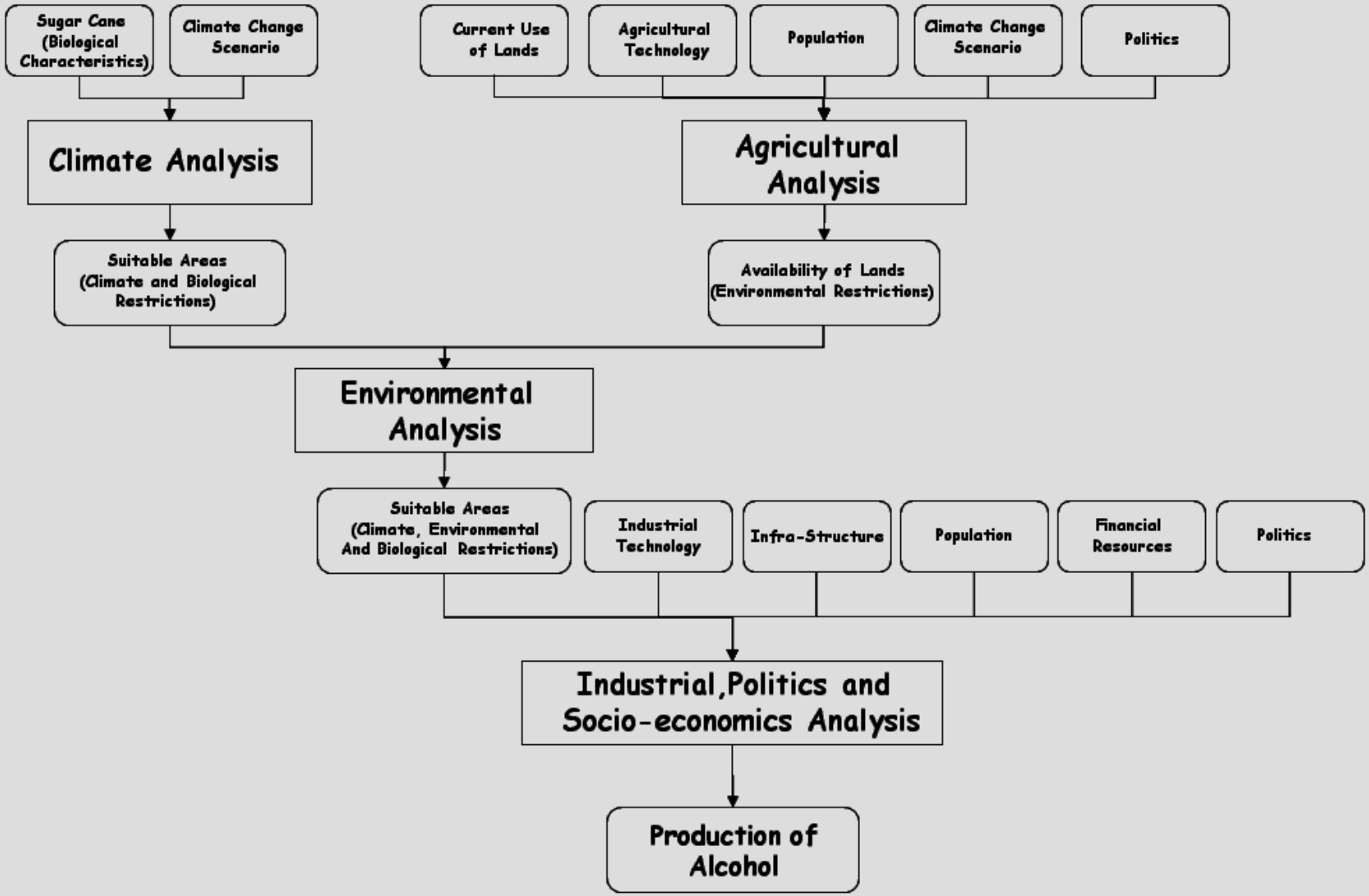
Agriculture
Geo-technology
Genetic Engineering
Food Security
Demography


Sugar Cane (Biological Characteristics)
Climate Change Scenario
Climate Analysis
Suitable Areas (Climate and Biological Restrictions)
Current Use of Lands
Agricultural Technology
Population
Climate Change Scenario
Politics
Agricultural Analysis
Availability of Lands (Environmental Restrictions)
Environmental Analysis
Suitable Areas (Climate, Environmental And Biological Restrictions)
Industrial Technology
Infra-Structure
Population
Financial Resources
Politics
Industrial,Politics and Socio-economics Analysis
Production of Alcohol

Production = f (Climate Model,

Availability of Lands,

Agricultural Technology,

Genetical Characteristics,

Population,

Financial Resources,

Politics,

Infra-structure,

Industrial Technology,

...)

Global Objectives

i. Generate scenarios for the production of alcohol obtained from a combination of the determinant factors of this production, for two representative regions in Brazil (one developed and another interested in expanding) in three different periods;

ii. Analysis of the adaptability of an important productive sector of the country to the climate changes;

iii. Assess the adaptation capacity of the society to the climate changes due to the complexity of the interrelations of the studied sector with political, economic, social and technical fields.

Specific Objectives (1/2)

i. Further the studies of impacts on climate change on agriculture – *Coordination: A.M.H.Ávila (Cepagri)*;

ii. Evaluate the level of Food and Nutritional Security associated to the expansion of the sugar cane crop – *Coordination: W.Belik (Nepa)*;

iii. Evaluate the impact of innovation policies to meet the future demands of ethanol and in the adaptation of Brazilian agriculture to climate changes – *Coordination: A.T.Furtado (IG)*;

iv. Improve the harvest forecast of sugar cane, making it more objective and accurate – *Coordination: J.Zullo Jr (Cepagri) – Link with AgrodataMine*;

v. Estimate the evolution of the applied genetic engineering, mainly, to the sugar cane growing and the potential for industrial production of cellulosic ethanol – *Coordination: A.P.de Souza (Cbmeg)*;

Specific Objectives (2/2)

vi. Evaluate the relationship between the expansion of the cultivation of sugar cane and the impact on urban and rural populations – *Coordination: T.Aidar and R.Baeninger (Nepo)*;

vii. Develop methods for generating scenarios of climate change impacts based on data and information from several sources and having different characteristics – *Coordination: J.Zullo Jr (Cepagri)*;

viii. Improve and deepen the scientific communication in the climate change area – *Coordination: V.R.T.Camargo (Labjor/Nudecri)*;

ix. Examine the circulation of the scientific communication through existing public policies – *Coordination: C.R.C.Pfeiffer (Nudecri)*;

x. Definition of public policies related to the expansion of the production of ethanol fuel in Brazil, due to the mitigation interest of the emissions of greenhouse gases, considering the need of adaptation of the national agriculture to the climate changes – *Coordination: P.A.B.Schulz (FCA)*.

Results and Products in 2 and 4 years (1/2)

i. Scenarios for the production of alcohol for two representative regions in Brazil (one developed and another interested in expanding) in three different periods;

ii. Identification of three to five models for forecasting climate changes that are best suitable to Brazil and to impacts and vulnerability evaluations of crops to climate change;

iii. Evaluations of the climate change impact in the chosen test-areas;

iv. Identification of the relation between the expansion of plantations of sugar cane and the food and nutritional security;

v. Determination of the relation between the expansion of planted areas with sugar cane and the demographic dynamics;

vi. Effects of the modification of the atmospheric composition due to the use of ethanol fuel on human health;

vii. Deepen communications, for several different public, on the issue of climate change in multiple media;

Results and Products in 2 and 4 years (2/2)

viii. Effects of the various technologies available in the adaptation to climate change;

ix. Suggestion for public policies to the adaptation of the production of ethanol fuel to the climate change;

x. Better knowledge of the relation between the climate and the production of sugar cane;

xi. Improve of the accuracy, objectivity and anticipation of the harvests of sugar cane forecast methods;

xii. Evaluation of the utilization of the agrometeorological products available on the Internet, especially on the pages of Cepagri and Agritempo, by the farmers, managers and technicians of the sugar and alcohol sector;

xiii. Methodology that allow to integrate the several different knowledge with the purpose to achieve the overall objective of the Project;

xiv. Training of qualified staff in the area of climate change.

http://gbdi.icmc.usp.br/agrodatamine/home

http://www.macroprograma1.cnptia.embrapa.br/scaf

Embrapa

SCAF – Macro 1

AlcScens

Brazilian Model of the Global Climate System

Embrapa Cerrados

Cluster 0	Cluster 1	Cluster 2
CNRM-CM3.0	CCSM3	INCM3
CSIRO	GISSEH	
ECHAM5	IPCM4	
ECHO-GFGOALS		
GFDL2		
HadCM3		
HadGem1		
MIROCmed		
MRICGCM		

M.Sc - Unicamp: C.Macedo Jr. – Fapesp 2009/07081-0

Technological Innovation and Organization in Agrometeorology: A study of the network system dynamics of "Agritempo".

M. D. Bambini (Embrapa Informática) – M.Sc – IG/Unicamp – March/22/2011 – A.T.Furtado

Use of agrometeorological models to estimate the production of sugarcane in Brazilian Savanna: Risks and Future Scenarios

B. A. Evangelista (Embrapa Cerrados) – PhD – Feagri/Unicamp – February/18/2011

- Three administrative meetings – December, February and March;
- Technical Meeting about Climate Modeling – Dr. Chou Sin Chan (Cptec/Inpe) – April/18/2011 – Nepo/Unicamp;

- Technical Meeting about Agricultural Zoning – J.Zullo Jr – May/26/2011 – 10h30 - Embrapa Informática;
- Technical Meeting about the Agrometeorological Service Agritempo – M.Bambino (IG/Unicamp and Embrapa Informática) - June;

Generation of Alcohol Production Scenarios as Support for the Formulation of Public Policies Applied to the Adaptation of the National Sugar and Alcohol Industry to the Climate Changes (AlcScens)

FAPESP Research Program on Global Climate Change - Process 08/58160-5

Contents

Navigation options

Summary

The theme of climate changes is no longer an issue restricted to academic area and became part of the everyday life of people and discussions subjects of national and international development policies, as the possibility of climate change is getting bigger in the most drastic way. Thus, the main approach recommended at this time is starting to develop ways, techniques and methods of adaptation of the human activities to these changes, because the costs and impacts of inaction can be very high.

The agriculture and the cattle raising, while activities that directly depend on environmental conditions for its performance, may be severely affected by the climate changes, mainly in tropical regions. This is worrying for Brazil because of the importance of agribusiness to the economy and to society as a whole. Among the agricultural crops of great importance for the country, the sugar cane has a special feature in the context of climate change due to the expansion of the use of alcohol fuel in Brazil and in the world, in the coming years, as a way of mitigating the emissions of greenhouse gases (GHGs).

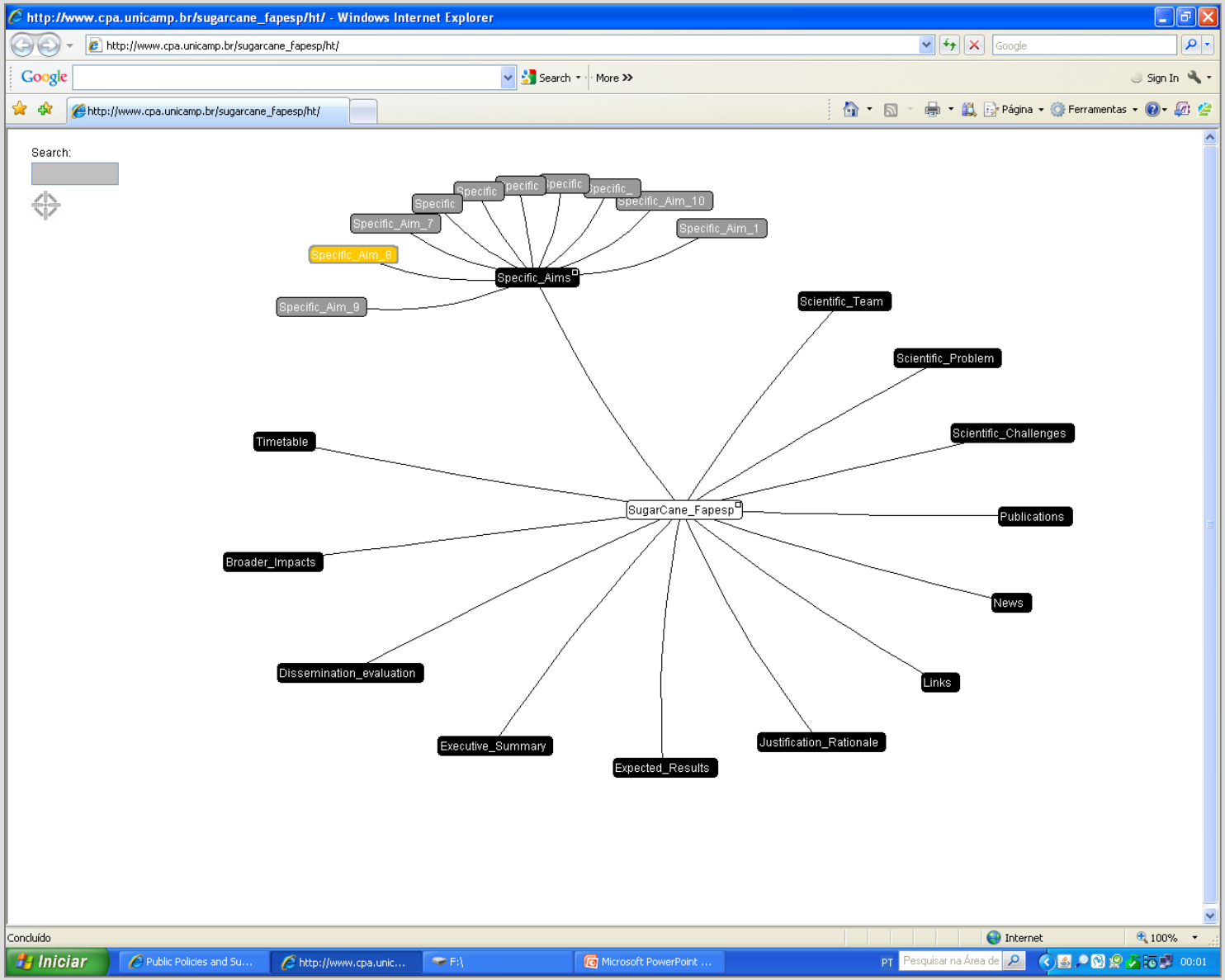
There is, first, a great interest in the expansion of areas for planting sugar cane aimed at meeting the growing demands of alcohol fuel, whereas, on the other hand, several justified restrictions by the potential impacts on the environment, in the food and nutritional security, in the demographic dynamics and in human health and, also, the concerns about the effects of climate change on agriculture. This expansion should be properly planned, also considering, the adaptation to the climate changes, so that Brazil does not miss a great opportunity for business and development, but also, does not have economic, social and environmental damages because of hasty decisions and without the necessary technical and scientific basis.

This case shows that the great challenge is to adapt a complex productive system, with several inter-relations, to the climate changes, and as such will be handled in the Project by experts from several knowledge areas, such as, climatology, demographic dynamics, food and nutritional security, scientific communication, public policy, geo-processing, environment, human health and scientific and technological development. The tool to be used in the analysis on the capacitation of adaptation of the sugar and alcohol sector to the climate change and, in general, to the adaptability of the agribusiness as a whole, will be the scenery of the production of ethanol fuel and associated impacts.

Internet 100%

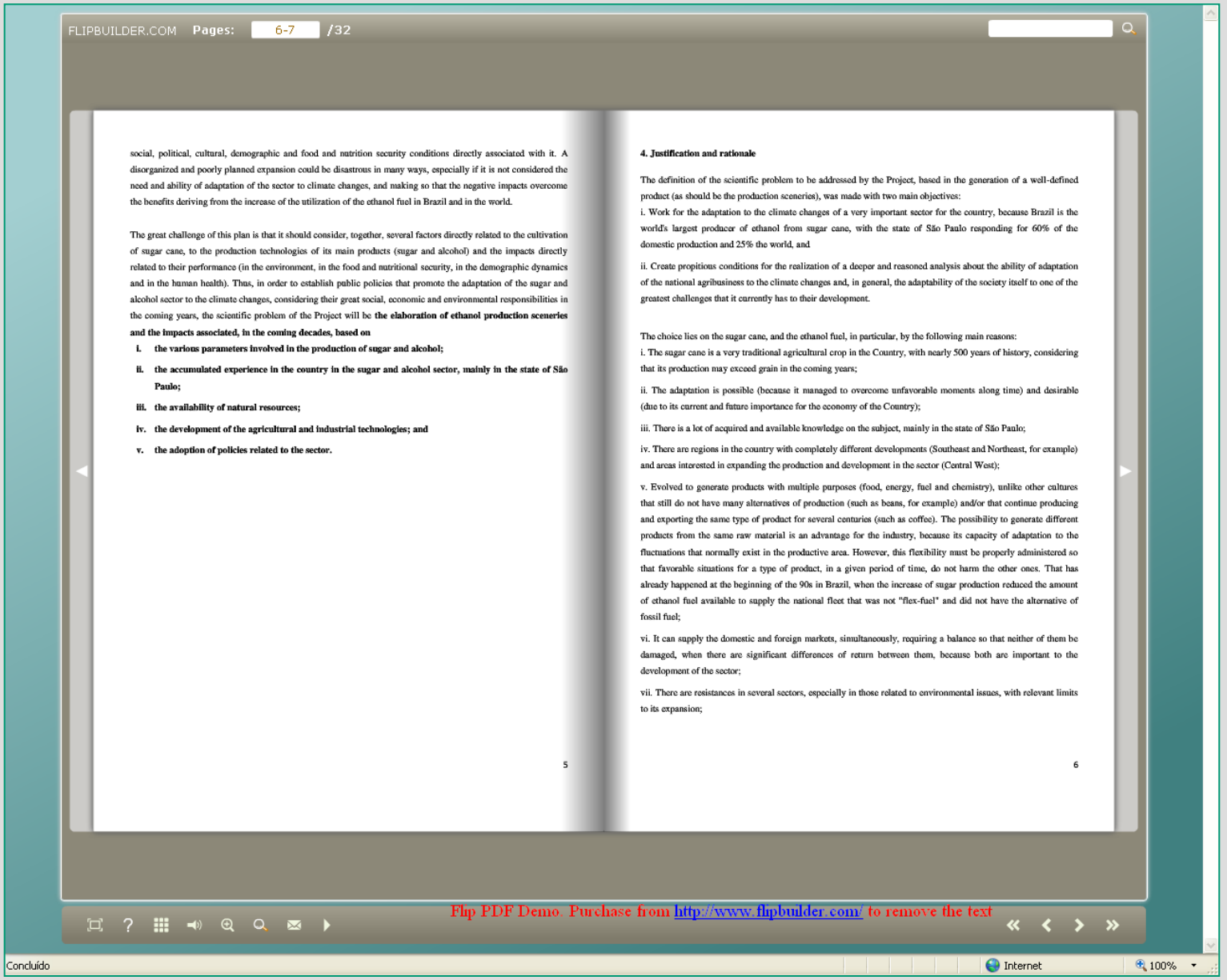
http://www.cpa.unicamp.br/sugarcane_fapesp

Webpage – Version 1 – Hyperbolic Tree



http://www.cpa.unicamp.br/sugarcane_fapesp/ht

Webpage – Version 1 – Flip Book



http://www.cpa.unicamp.br/sugarcane_fapesp/flip

Generation of Alcohol Production Scenarios as Support for the Formulation of Public Policies Applied to the Adaptation of the National Sugar and Alcohol Industry to Climate Changes

Process: 2008/58160-5 - Political Science (07090000)
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