Metodologia Integrada para Avaliação dos Estoques de Carbono do Solo e suas Mudanças em Escala Regional/Nacional

Carlos Eduardo P. Cerri
M. Bernoux, Carlos C. Cerri, E. Milne, K. Paustian, K. Coleman

GEF

cena

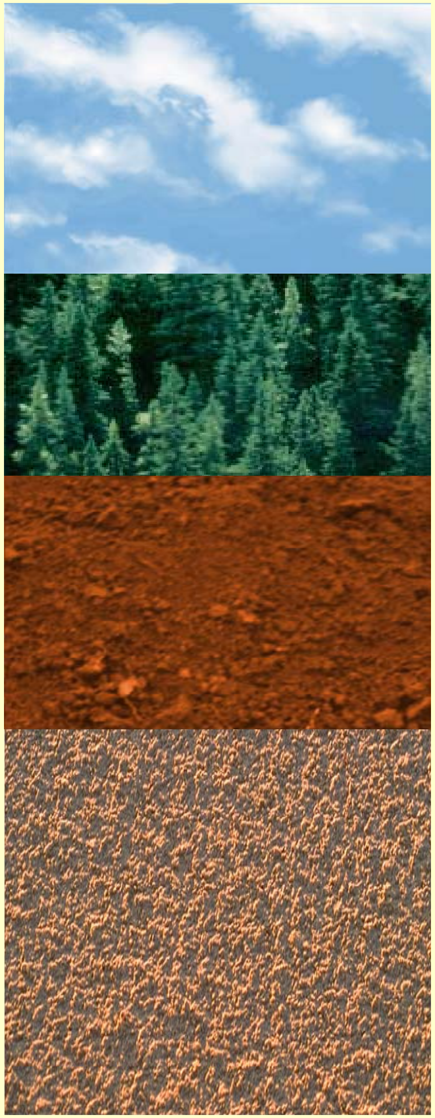
IRD

UNEP

Metodologia Integrada para Avaliação dos **Estoques de Carbono do Solo** e suas Mudanças em **Escala Regional/Nacional**

Metodologia Integrada para Avaliação dos **Estoques de Carbono do Solo** e suas Mudanças em Escala Regional/Nacional

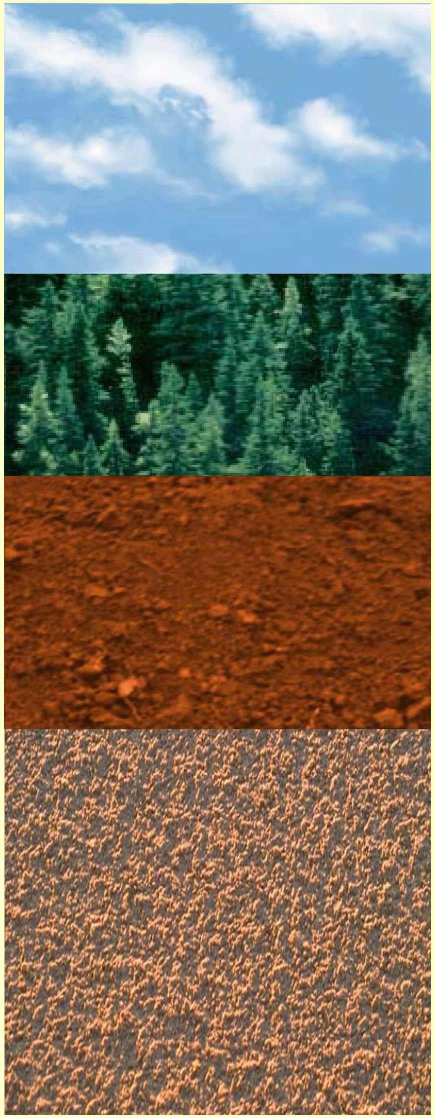
Importância dos solos no ciclo de carbono

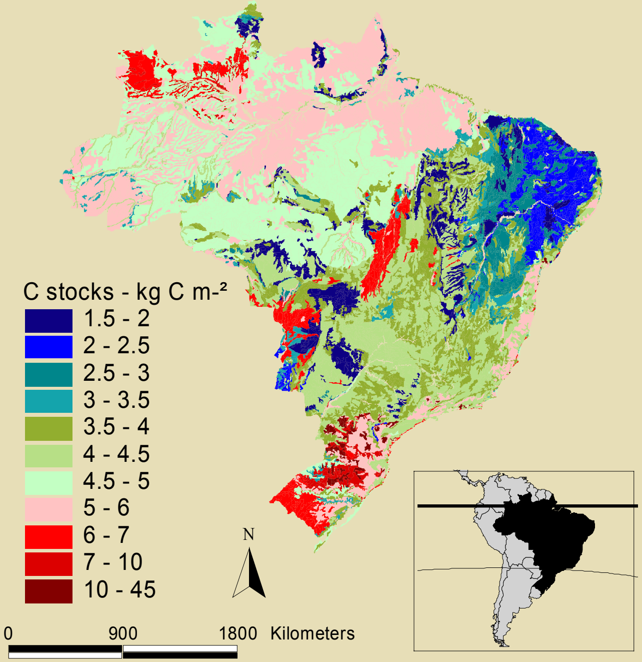


	Pg
Atmosfera	730
Vegetação	470-655
Solo (0-30cm)	~800
Solos (1m)	1500-1600

Valores em Gt de C ; 1Gt = 10^9 t = 1 Pg

Importância dos solos no ciclo de carbono




C stocks - kg C m-²
1.5 - 2
2 - 2.5
2.5 - 3
3 - 3.5
3.5 - 4
4 - 4.5
4.5 - 5
5 - 6
6 - 7
7 - 10
10 - 45
N
0
900
1800 Kilometers

From Bernoux et al. 2002. SSSAJ

36.4 ± 3.4 Pg C

Brasil
~5% do Globo

~800 nos primeiros 30 cm

Valores em Gt de C ; 1Gt = 109 t = 1 Pg

Metodologia Integrada para Avaliação dos Estoques de Carbono do Solo e suas Mudanças em **Escala Regional/Nacional**

Escala Regional/Nacional

Escala de trabalho

Escala da parcela	Maioria dos estudos
Escala regional	Poucos estudos
Escala Nacional	Pouquíssimos estudos

UNFCCC

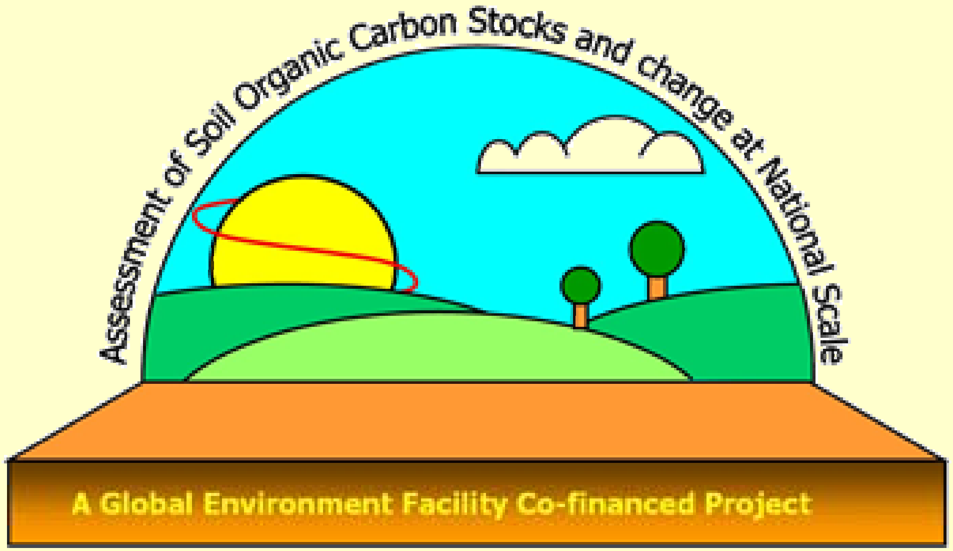
Metodologia Integrada para Avaliação dos Estoques de Carbono do Solo e suas Mudanças em Escala Regional/Nacional

Metodologia Integrada

Metodologias utilizadas para estimar as mudanças nos estoques de C do solo incluem basicamente:

1. Metodologias baseadas em regressões
2. Regressões baseadas em dados espaciais
3. Modelos de simulação da dinâmica do carbono no solo acoplados a base de dados espaciais

ASSESSMENT OF SOIL ORGANIC CARBON STOCKS AND CHANGE AT NATIONAL SCALE


Assessment of Soil Organic Carbon Stocks and change at National Scale
A Global Environment Facility Co-financed Project

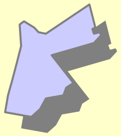
GEF-SOC project

ASSESSMENT OF SOIL ORGANIC CARBON STOCKS AND CHANGE AT NATIONAL SCALE

Assessment of Soil Organic Carbon Stocks and change at National Scale

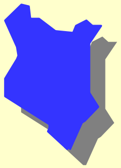
A Global Environment Facility Co-financed Project

GEF-SOC project



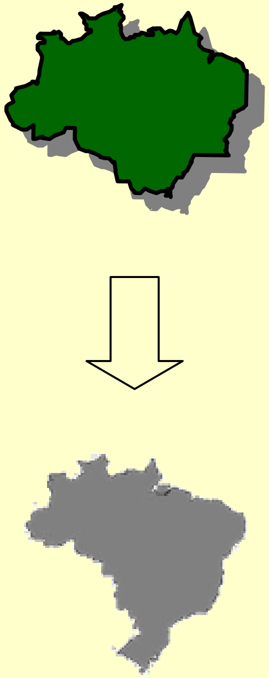
Jordânia

IGP, Índia



Quênia

ASSESSMENT OF SOIL ORGANIC CARBON STOCKS AND CHANGE AT NATIONAL SCALE



Assessment of Soil Organic Carbon Stocks and change at National Scale
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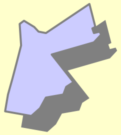
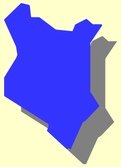
GEF-SOC project

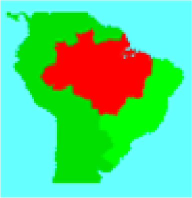


Jordânia

IGP, Índia

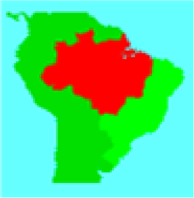


Quênia



Assessment of Soil Organic Carbon Stocks and change at National Scale

A Global Environment Facility Co-financed Project



Associação oficial

LBA

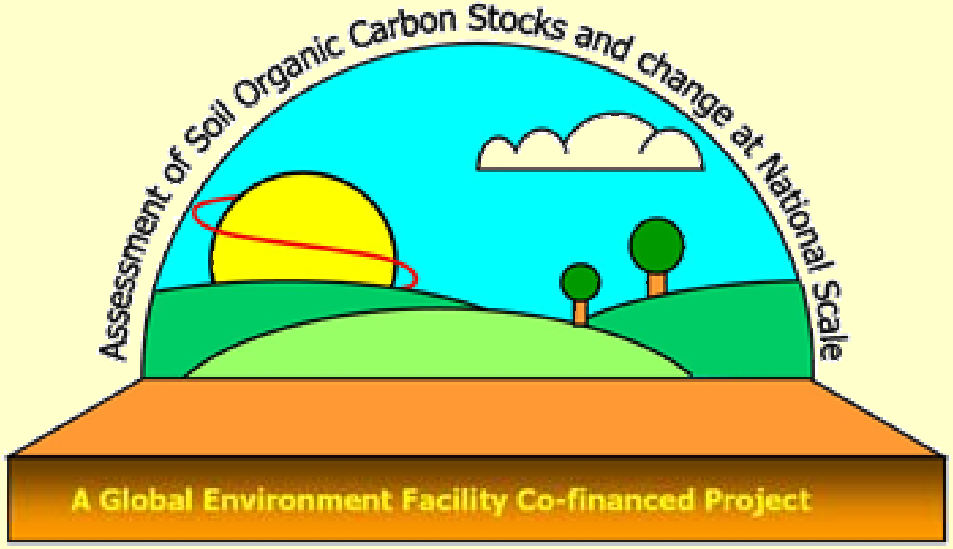
EXPERIMENTO DE GRANDE ESCALA DA BIOSFERA-ATMOSFERA NA AMAZÔNIA - LBA

GEF-SOC project: instituições participantes

- Universidade de Sao Paulo, Brazil
- Higher Council for Research and Technology / Badia Research and Development, Jordan
- Kenya Soil Survey
- National Bureau of Soil Survey and Landuse Planning, India
- International Institute for Applied Systems Analysis, Austria
- International Soil Reference and Information Centre, Netherlands
- Colorado State University, U.S.A.
- Institut de recherche pour le developpement, France
- Rothamsted Experimental Station, U.K.
- The University of Reading U.K. (Coordinating Institution)
- UNEP (GEF Implementing Agency)

GEF

ASSESSMENT OF SOIL ORGANIC CARBON STOCKS AND CHANGE AT NATIONAL SCALE


Assessment of Soil Organic Carbon Stocks and change at National Scale
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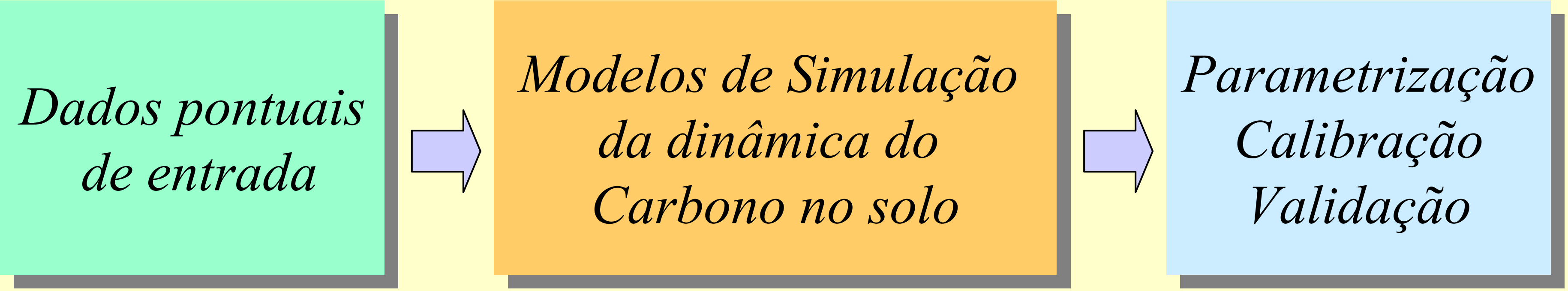
GEF-SOC project

3 fases

Fase I



Dados pontuais de entrada

Modelos de Simulação da dinâmica do Carbono no solo

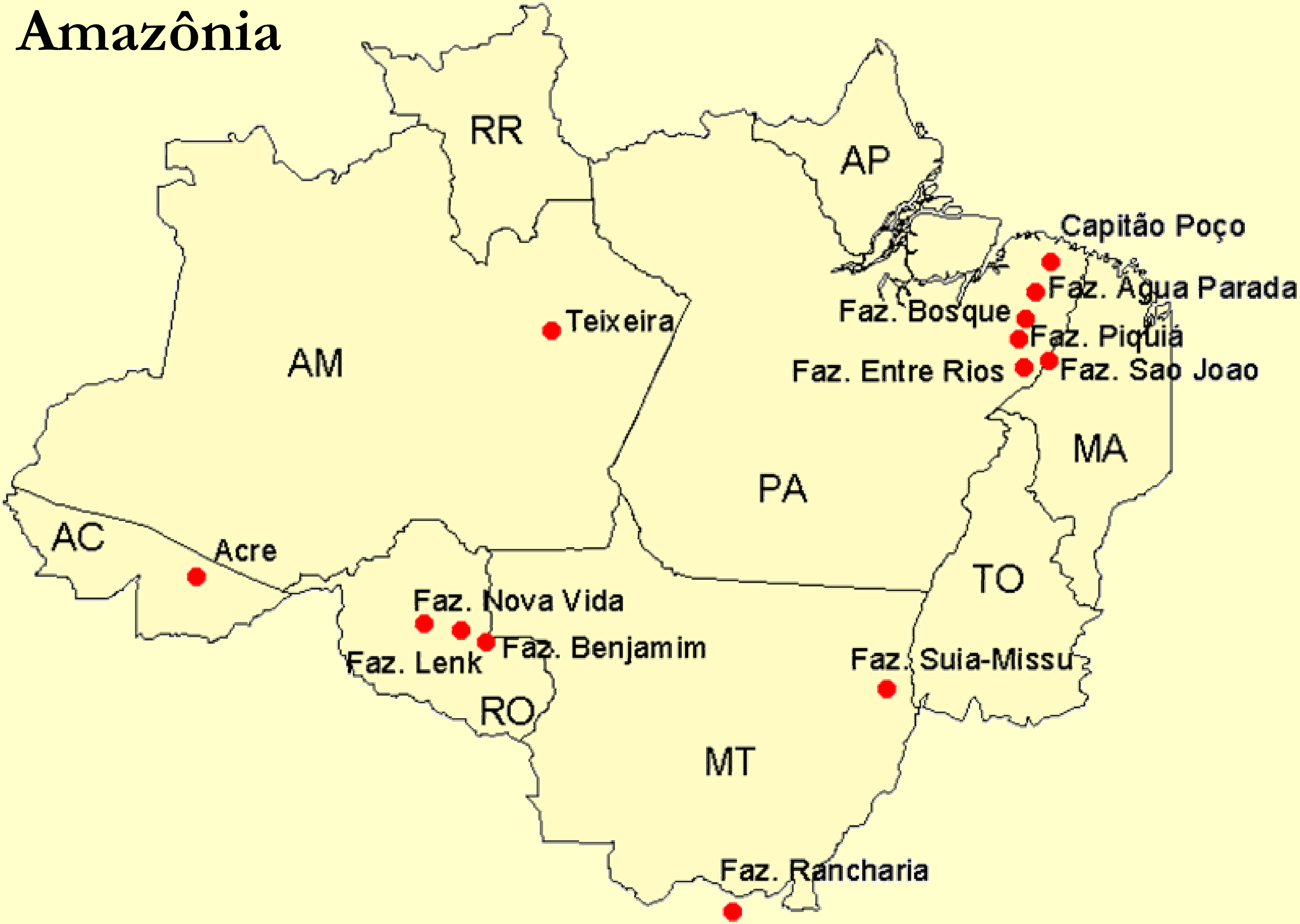
Parametrização Calibração Validação

- *Clima*
- *Solo*
- *Vegetação*
- *Manejo*

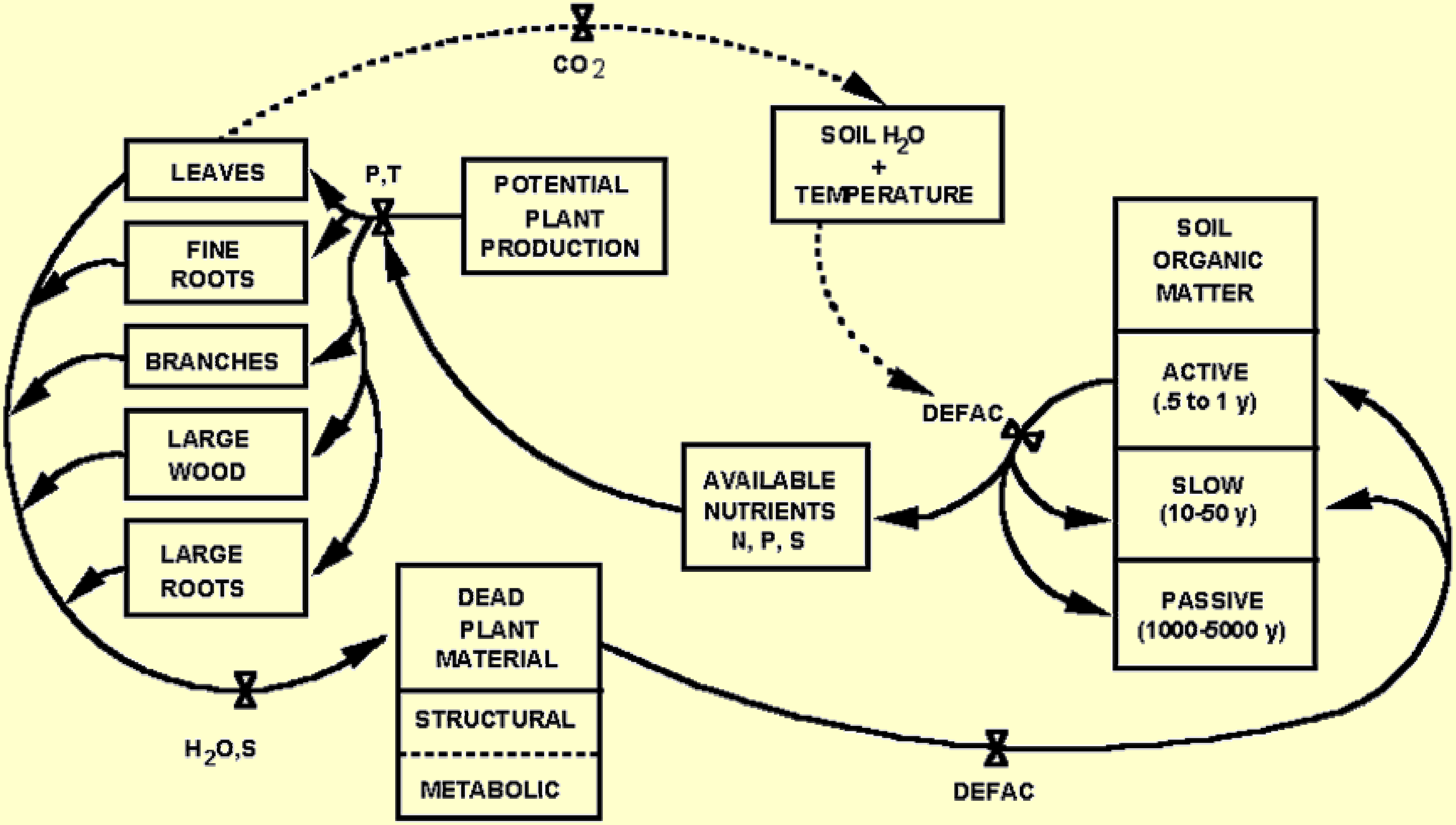
- *Century*
- *RothC*
- *TEM*
- *DNDC*

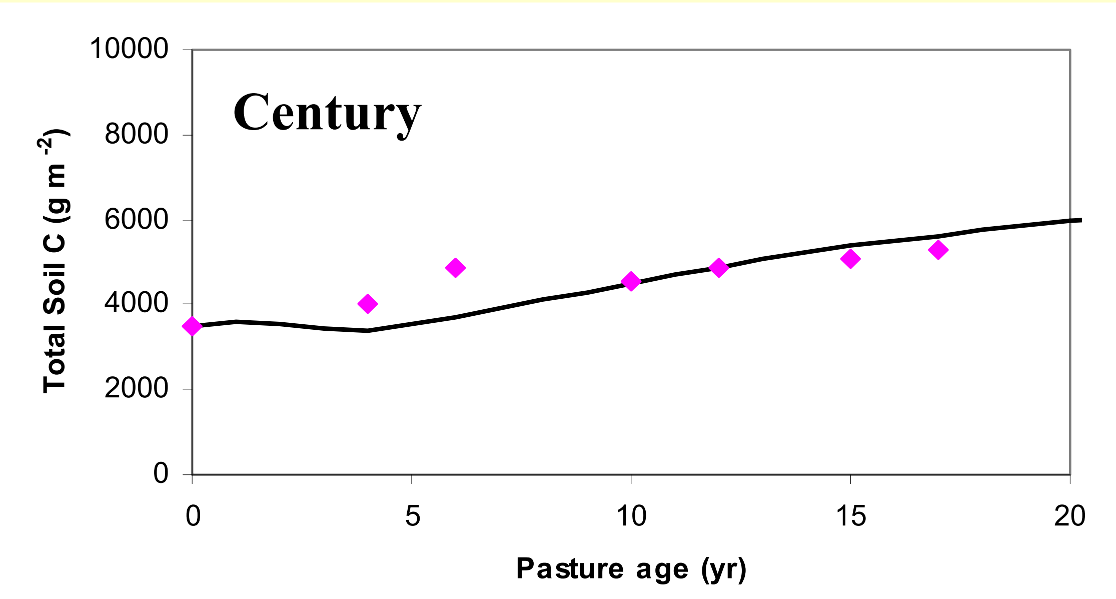
Adaptação dos modelos para condições de clima tropical

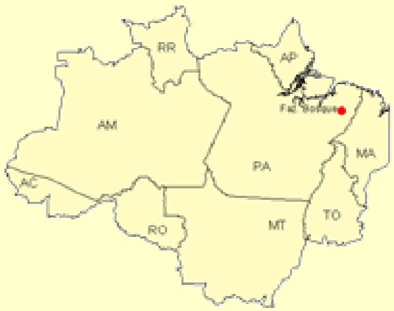
Amazônia


RR
AP
Capitão Poço
Faz. Água Parada
Faz. Bosque
Faz. Piquiá
Faz. Entre Rios
Faz. Sao Joao
Teixeira
AM
MA
PA
AC
Acre
TO
Faz. Nova Vida
Faz. Benjamim
Faz. Lenk
Faz. Suia-Missu
RO
MT
Faz. Rancharia

Century Ecosystem Model (Century)

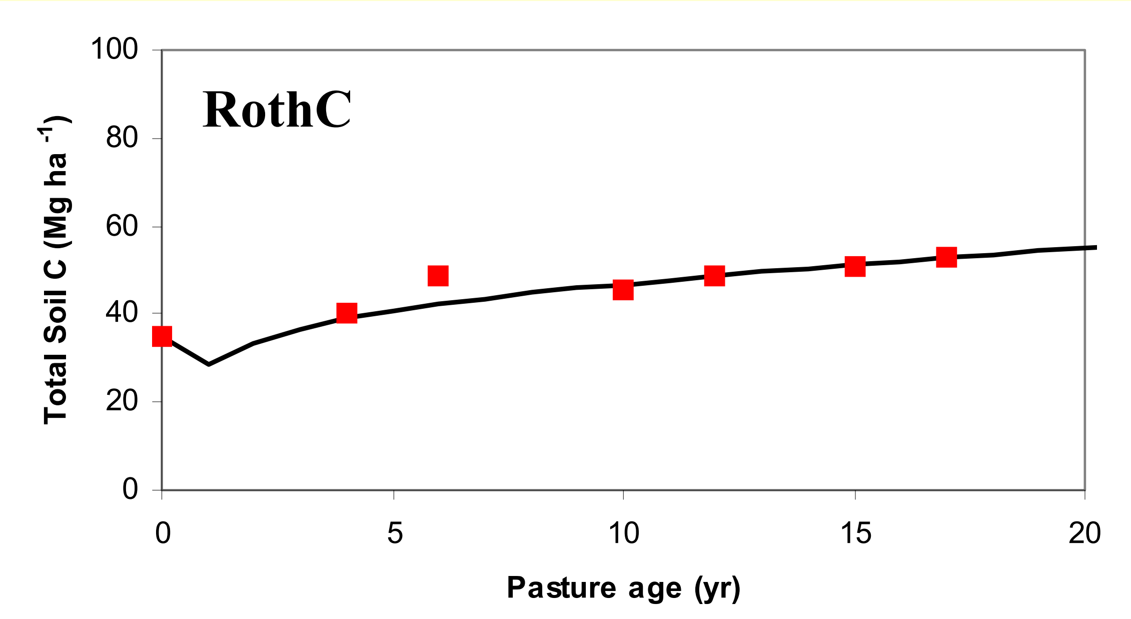

CO2
LEAVES
FINE ROOTS
BRANCHES
LARGE WOOD
LARGE ROOTS
P,T
POTENTIAL PLANT PRODUCTION
SOIL H2O + TEMPERATURE
SOIL ORGANIC MATTER
ACTIVE (.5 to 1 y)
SLOW (10-50 y)
PASSIVE (1000-5000 y)
DEFAC
AVAILABLE NUTRIENTS N, P, S
DEAD PLANT MATERIAL
STRUCTURAL
METABOLIC
H2O,S
DEFAC

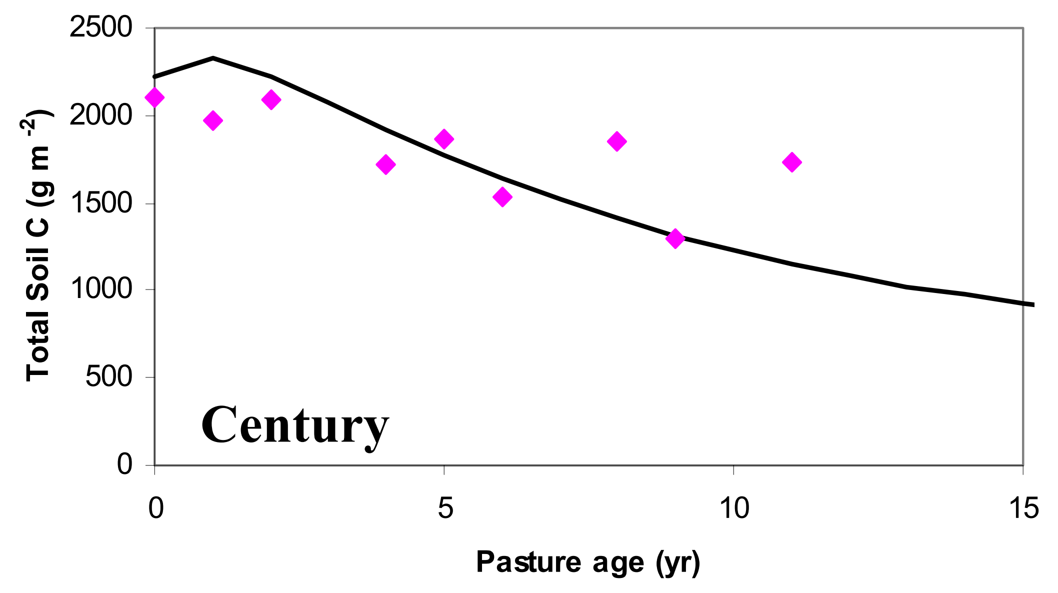


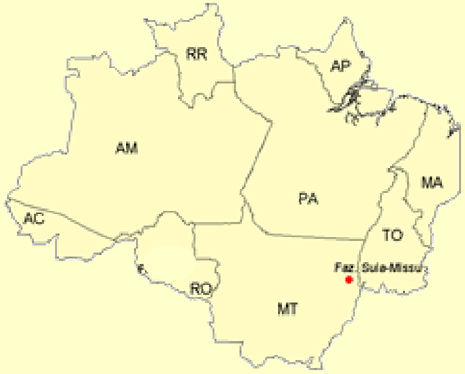

RR
AP
AM
Faz. Bosque
PA
MA
AC
RO
MT
TO

Faz. Bosque

Pastagem Bem Manejada

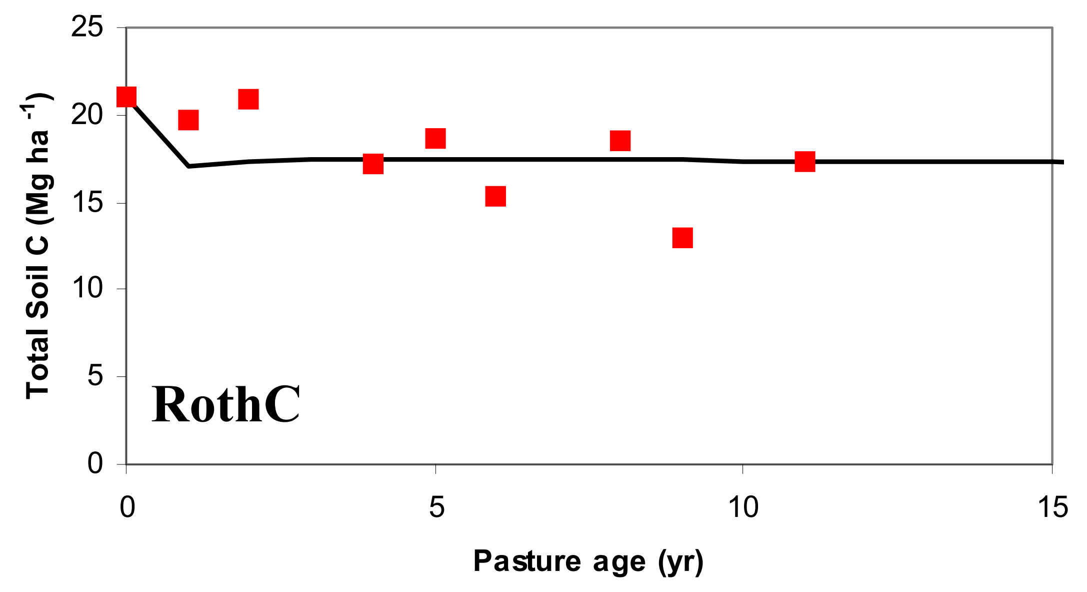





RR
AP
AM
PA
MA
AC
TO
Faz. Suia-Missu
RO
MT

Faz. Suia-Missu

Pastagem degradada

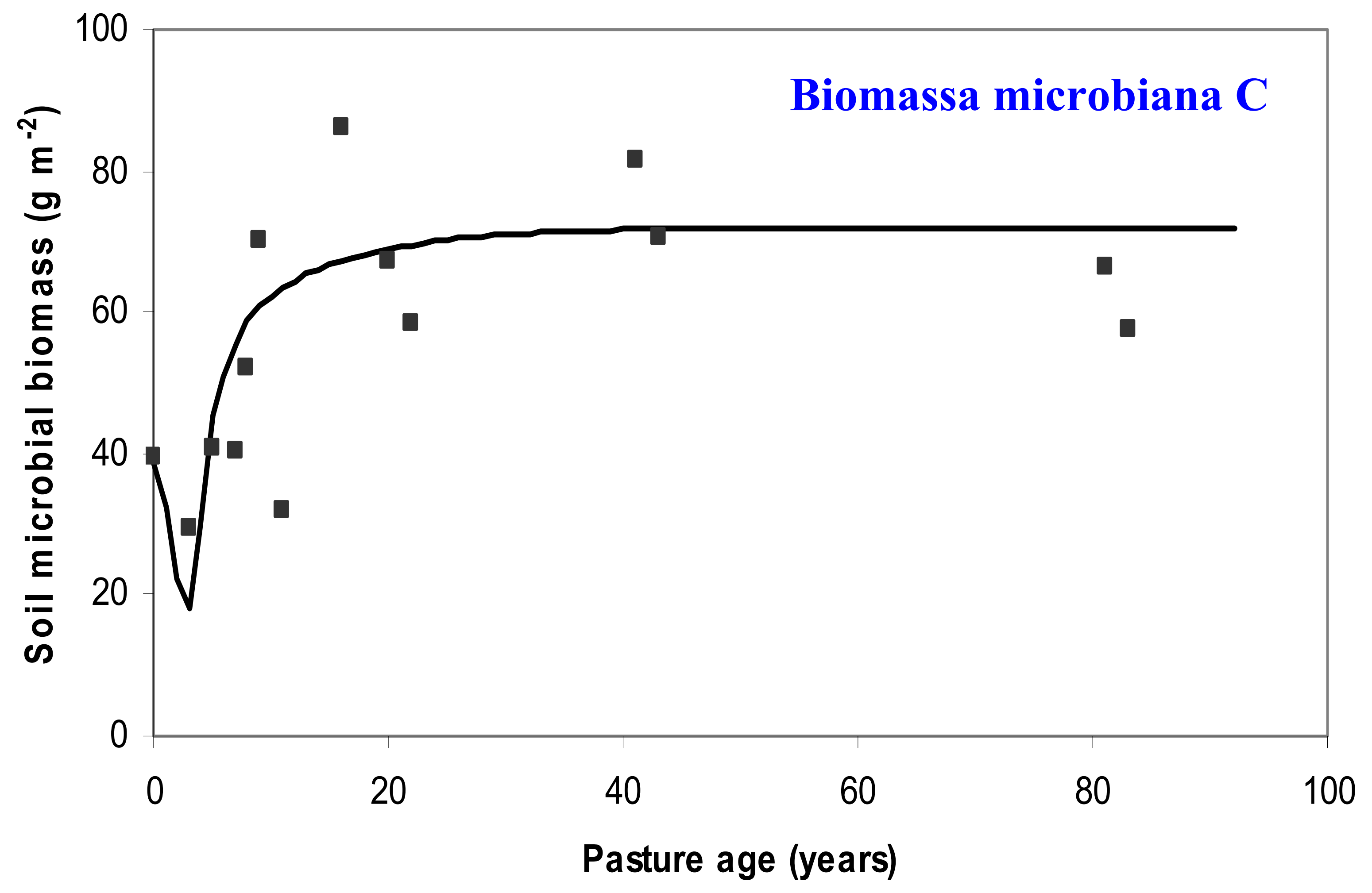


Avaliação Quantitativa

	Statistical tests					
Chronosequence	r	CD	CRM	RMSE	M	n
				%	g m-2	
Bosque (PA)	0.82	0.47	0.03	11.30	165.60	7
Água Parada (PA)	0.82	0.42	-0.16	21.68	-658.25	4
Piquiá (PA)	0.36	0.27	0.01	15.14	22.82	4
Entre Rios (PA)	0.52	0.50	0.06	12.94	106.54	7
Sao Joao (PA)	0.67	2.96	-0.09	23.70	-254.30	5
Teixeira (AM)	0.94	0.42	0.06	6.77	322.64	6
Nova Vida (RO)	0.55	0.86	0.04	17.58	144.81	21
Benjamim (RO)	0.38	0.14	0.17	21.51	529.26	4
Lenk (RO)	0.95	1.03	0.09	11.19	382.12	3
Rancharia (MT)	0.83	1.06	-0.01	10.70	-15.97	3
Suia-Missu (MT)	0.70	0.36	0.01	16.29	15.88	9
Perfect fit	1.00	1.00	0.00	0.00	0.00	

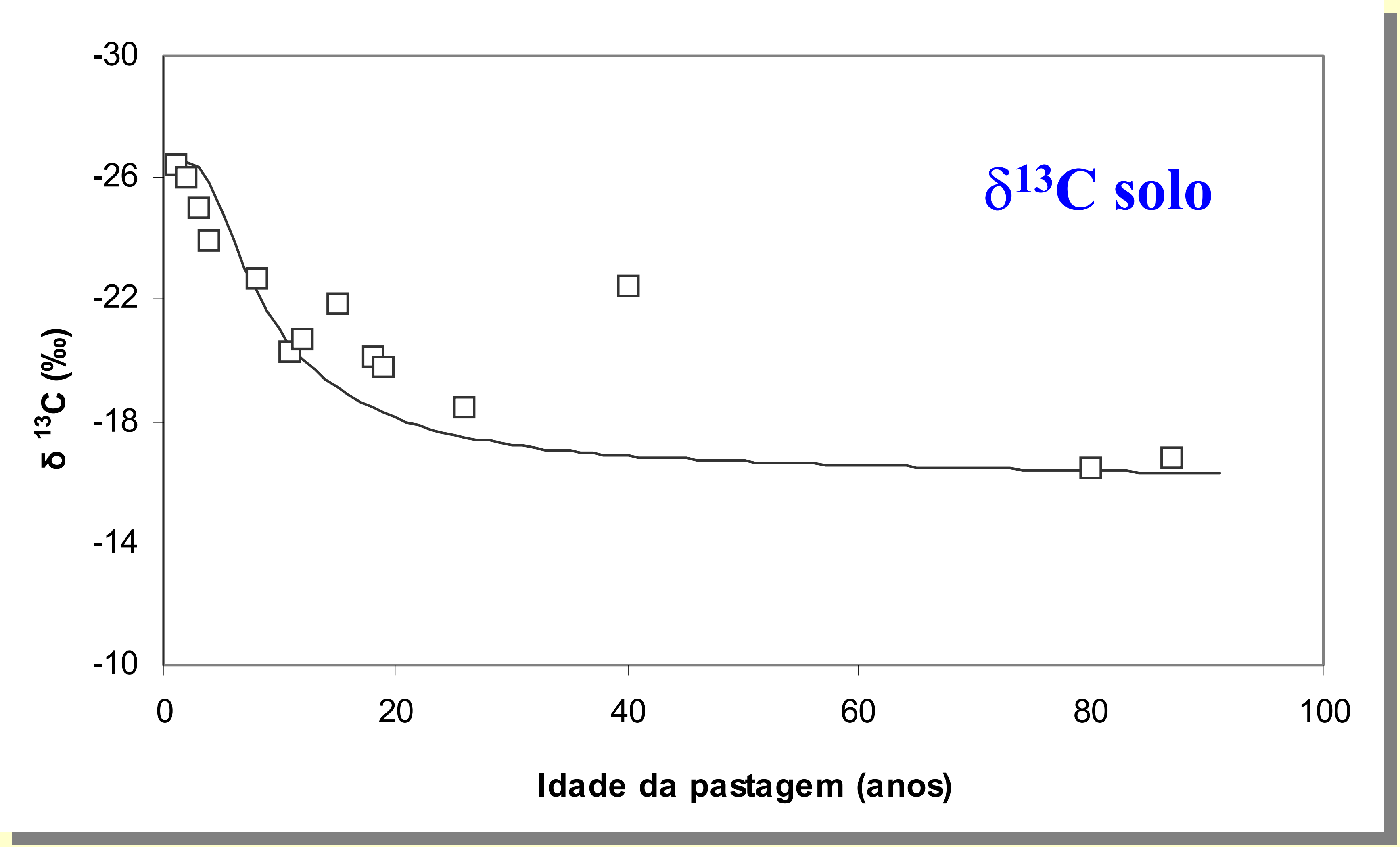
r: sample correlation coefficient, CD: coefficient of determination,
CRM: coefficient of residual mass; RMSE: root mean square error,
M: mean difference between observations and simulation.

Biomassa microbiana C do solo em uma cronosseqüência floresta-pastagem



Valores simulados (linha) e observados (símbolos) para biomassa microbiana C 0-20 cm

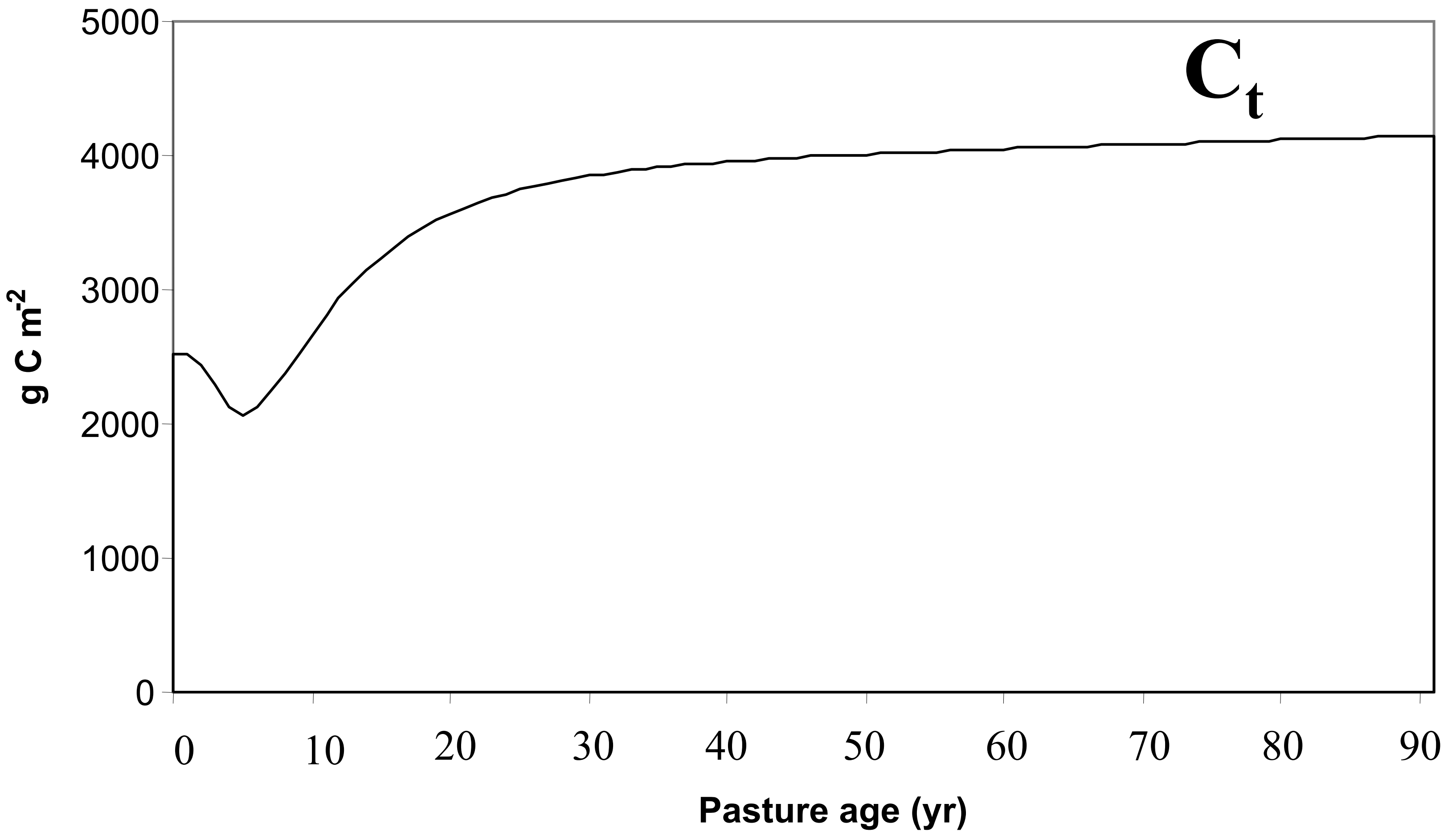
δ^{13}C do solo em uma cronosseqüência floresta-pastagem



Valores simulados (linha) e observados (símbolos) para δ^{13}C do solo 0-20 cm

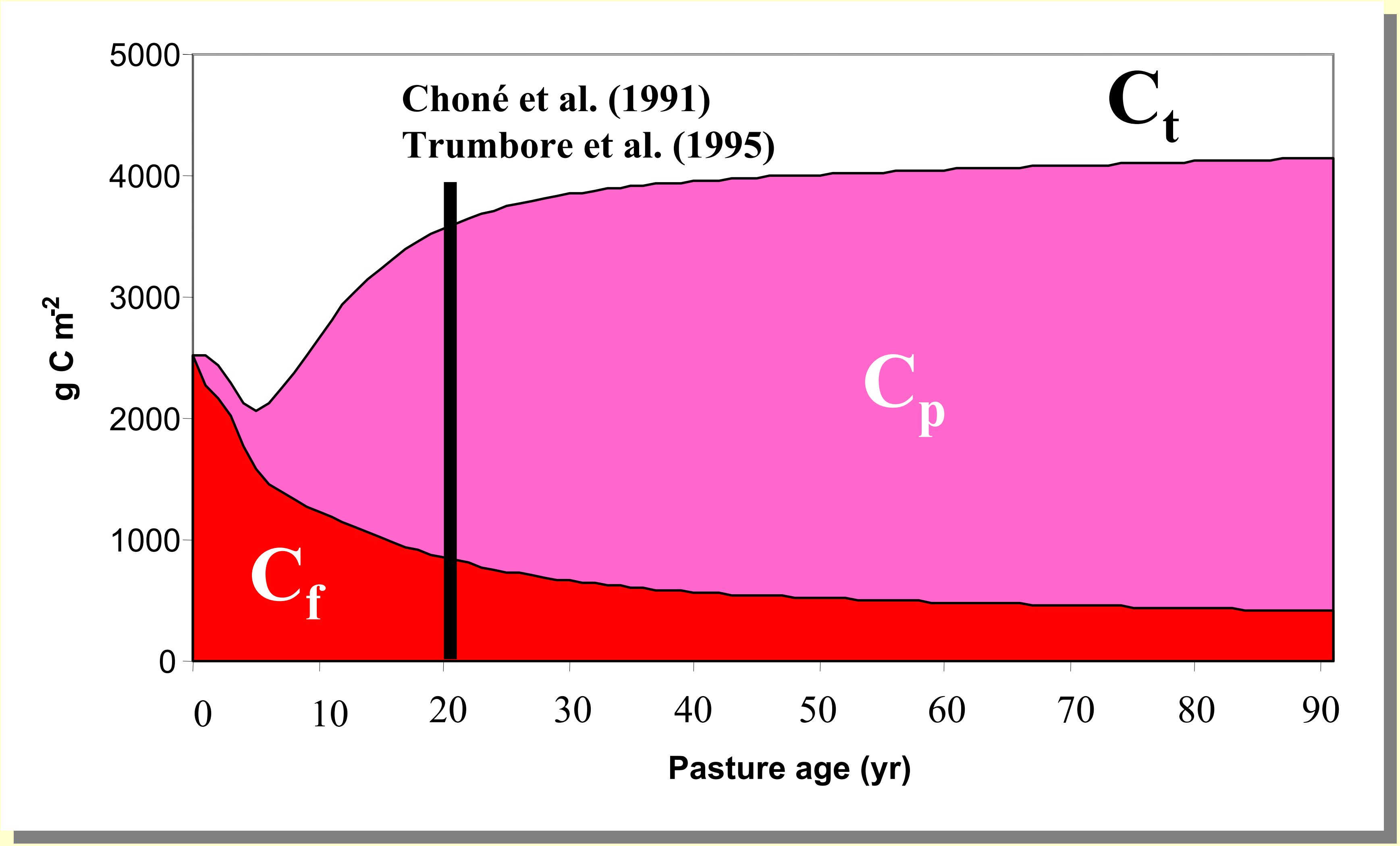
δ^{13}C do solo em uma cronosseqüência floresta-pastagem

Contribuição relativa do C remanescente da floresta (C_f) e introduzido pela pastagem (C_p)

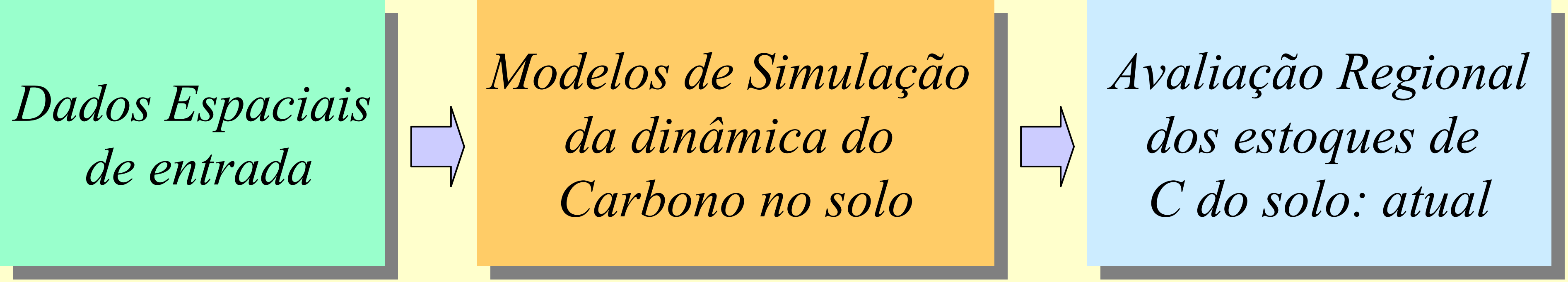


$\delta^{13}C$ do solo em uma cronosseqüência floresta-pastagem

Contribuição relativa do C remanescente da floresta (C_f) e introduzido pela pastagem (C_p)



Fase II



Dados Espaciais de entrada

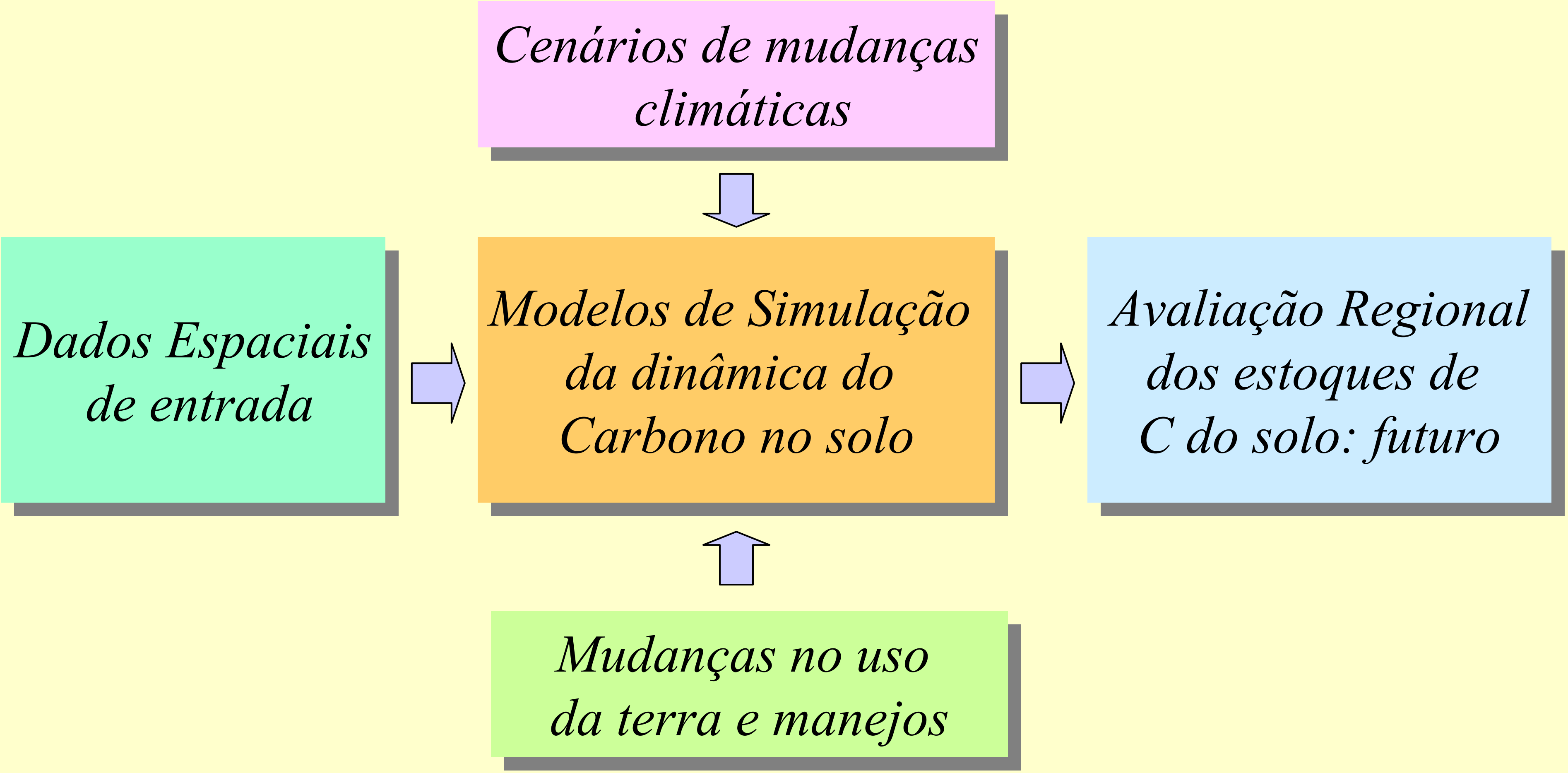
Modelos de Simulação da dinâmica do Carbono no solo

Avaliação Regional dos estoques de C do solo: atual

- *Clima*
- *Solo*
- *Vegetação*
- *Manejo*

- *Century*
- *RothC*
- *TEM*
- *DNDC*

Fase III



Cenários de mudanças climáticas

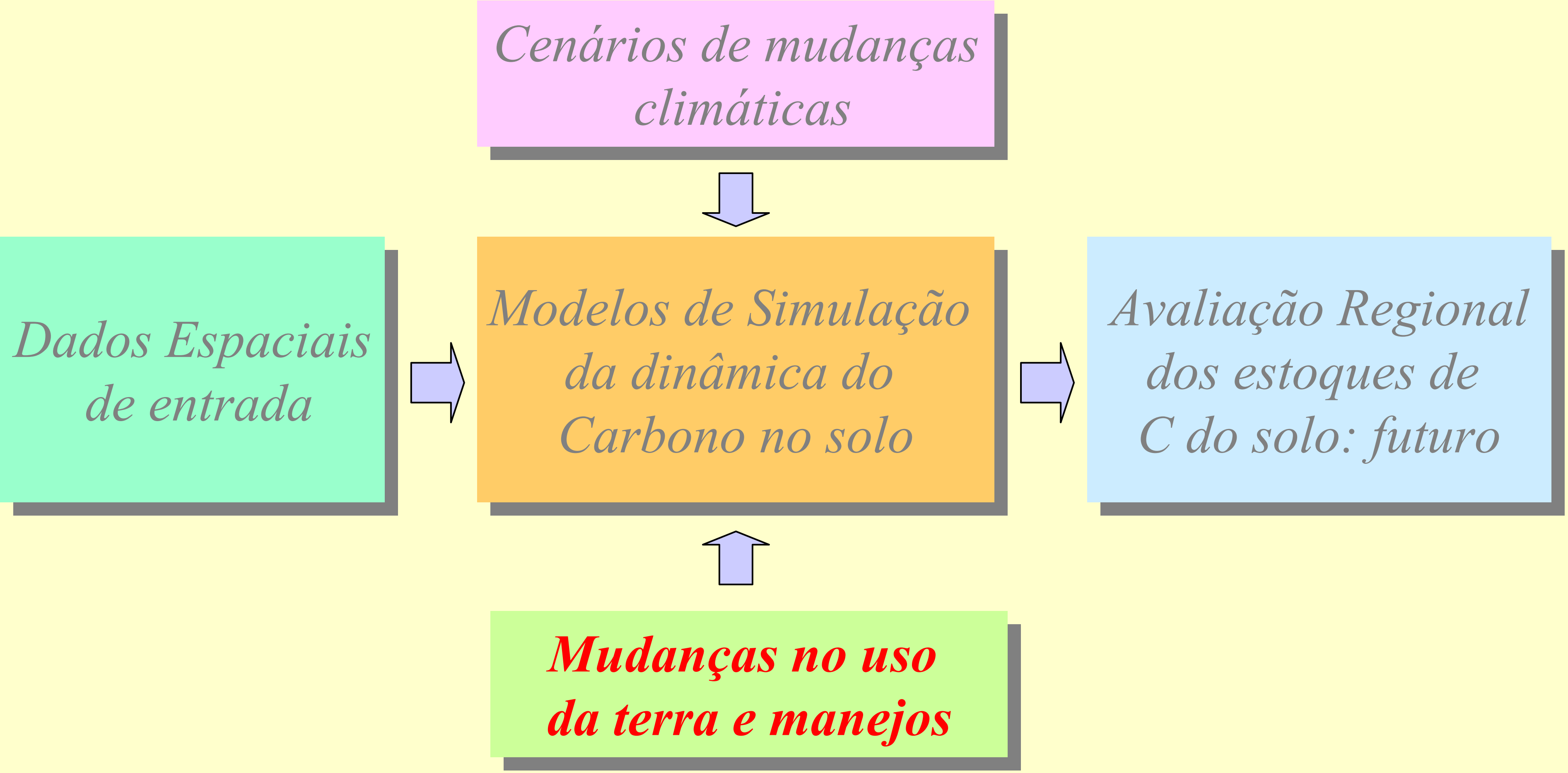
Dados Espaciais de entrada

Modelos de Simulação da dinâmica do Carbono no solo

Avaliação Regional dos estoques de C do solo: futuro

Mudanças no uso da terra e manejos

Fase III



Cenários de mudanças climáticas

Dados Espaciais de entrada

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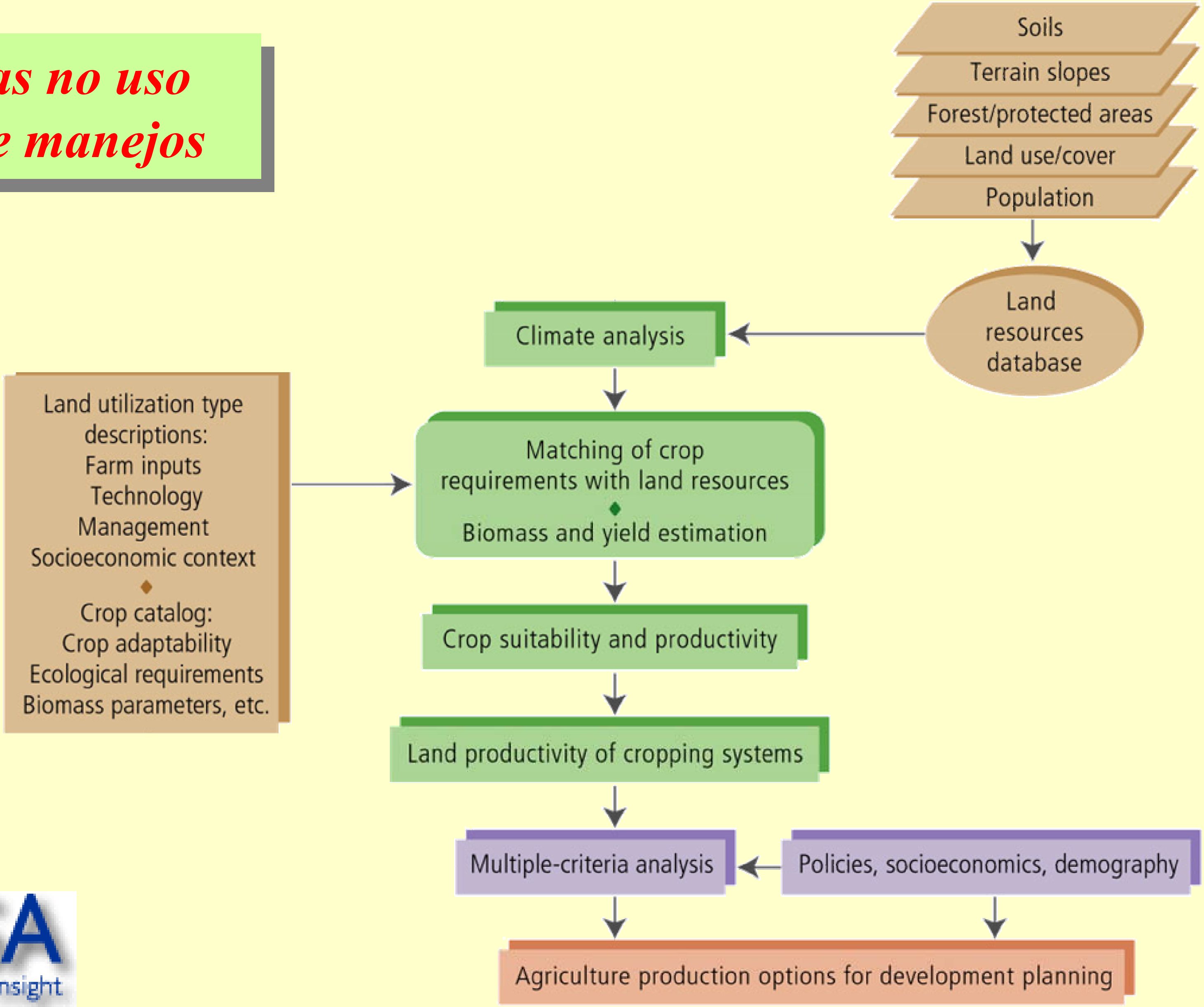
Avaliação Regional dos estoques de C do solo: futuro

Mudanças no uso da terra e manejos

Mudanças no uso da terra e manejos



Soils

Terrain slopes

Forest/protected areas

Land use/cover

Population

Land resources database

Climate analysis

Land utilization type descriptions:
Farm inputs
Technology
Management
Socioeconomic context

◆

Crop catalog:
Crop adaptability
Ecological requirements
Biomass parameters, etc.

Matching of crop requirements with land resources

◆

Biomass and yield estimation

Crop suitability and productivity

Land productivity of cropping systems

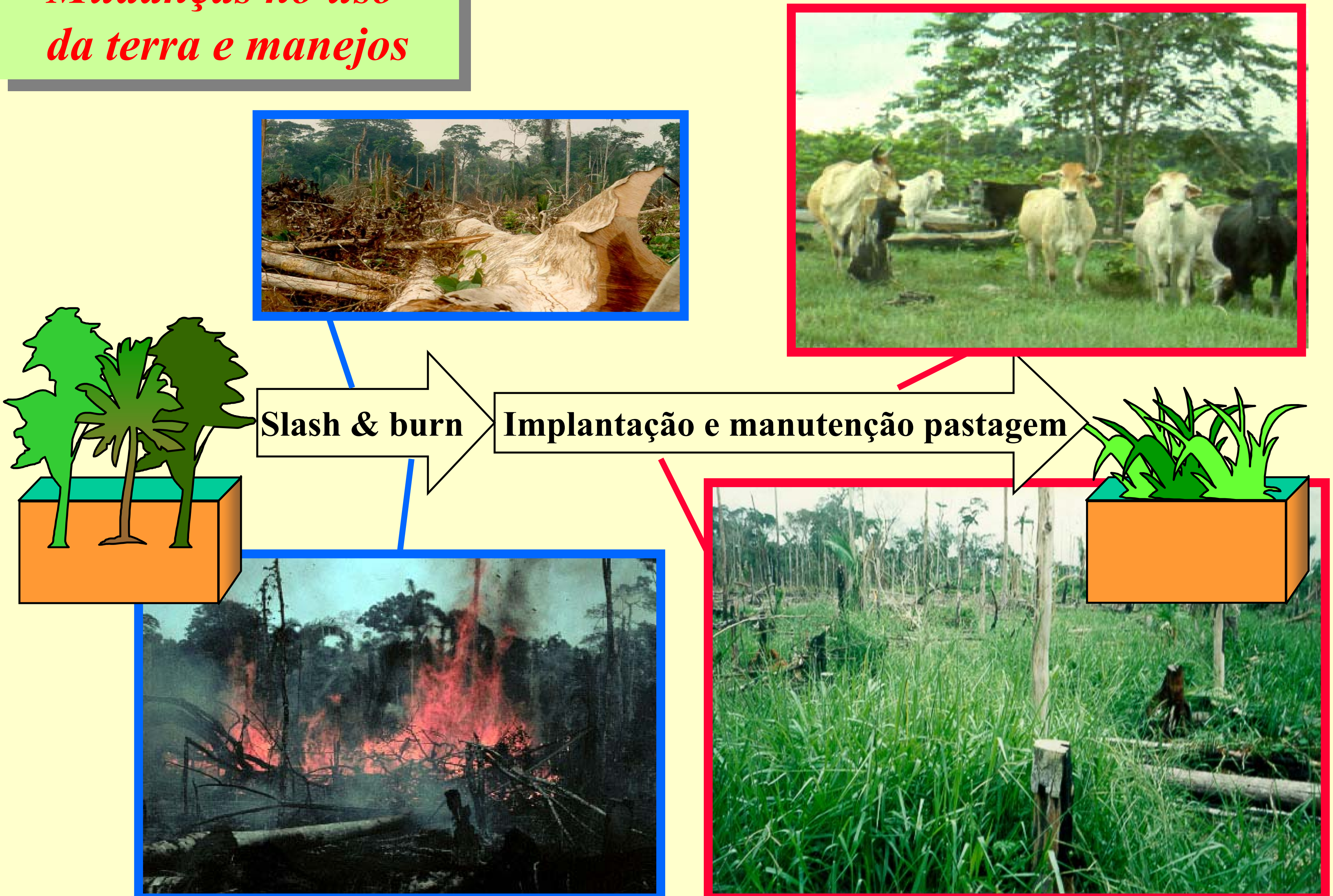
Multiple-criteria analysis

Policies, socioeconomics, demography

Agriculture production options for development planning

IIASA
Science for Global Insight

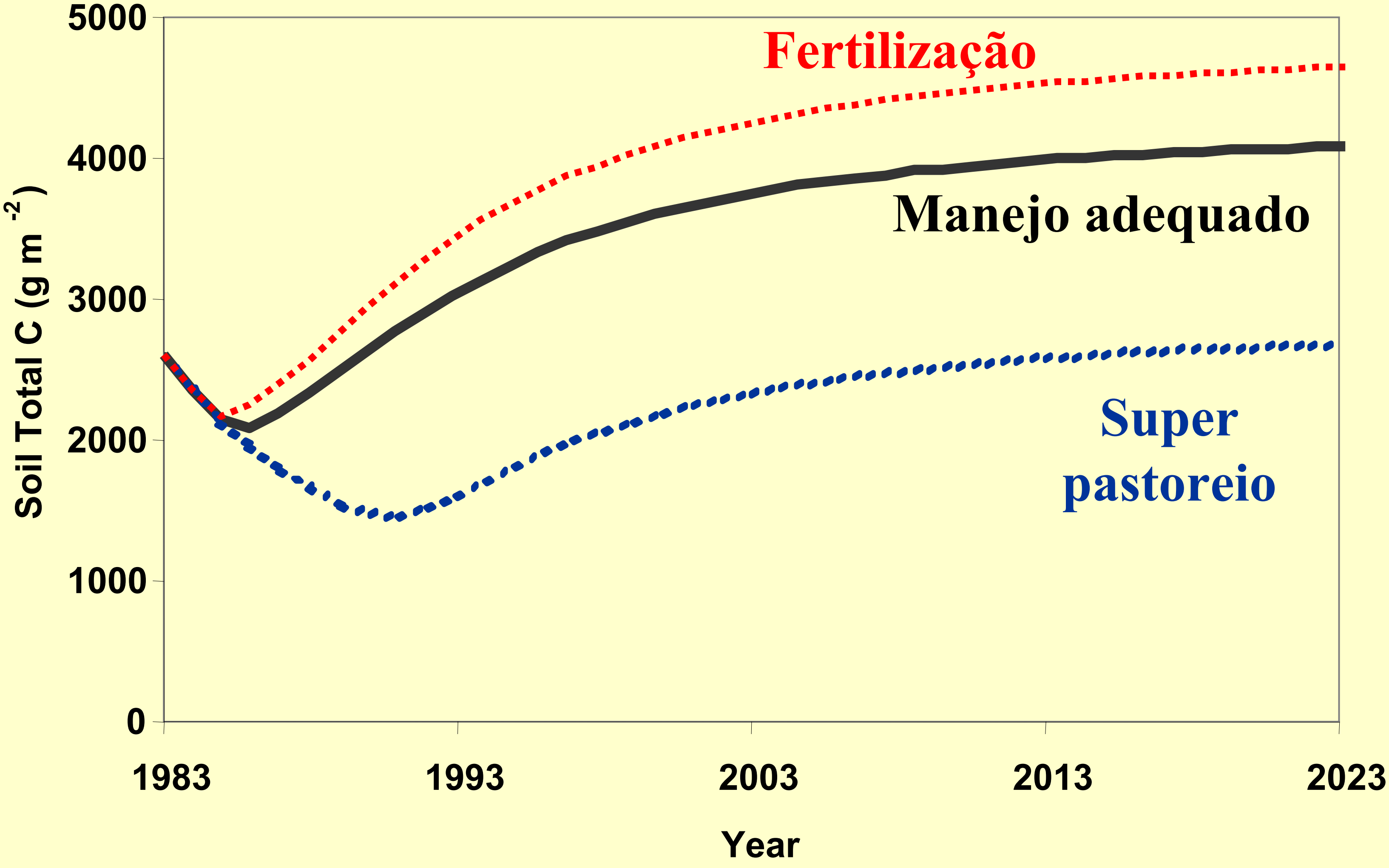
Mudanças no uso da terra e manejos



Slash & burn

Implantação e manutenção pastagem

CENÁRIOS


Fertilização
Manejo adequado
Super pastoreio
5000
4000
3000
2000
1000
0
Soil Total C (g m -2)
1983
1993
2003
2013
2023
Year

Mudanças no uso da terra e manejos

Preparo Convencional x Plantio direto na palha

Mudanças no uso da terra e manejos

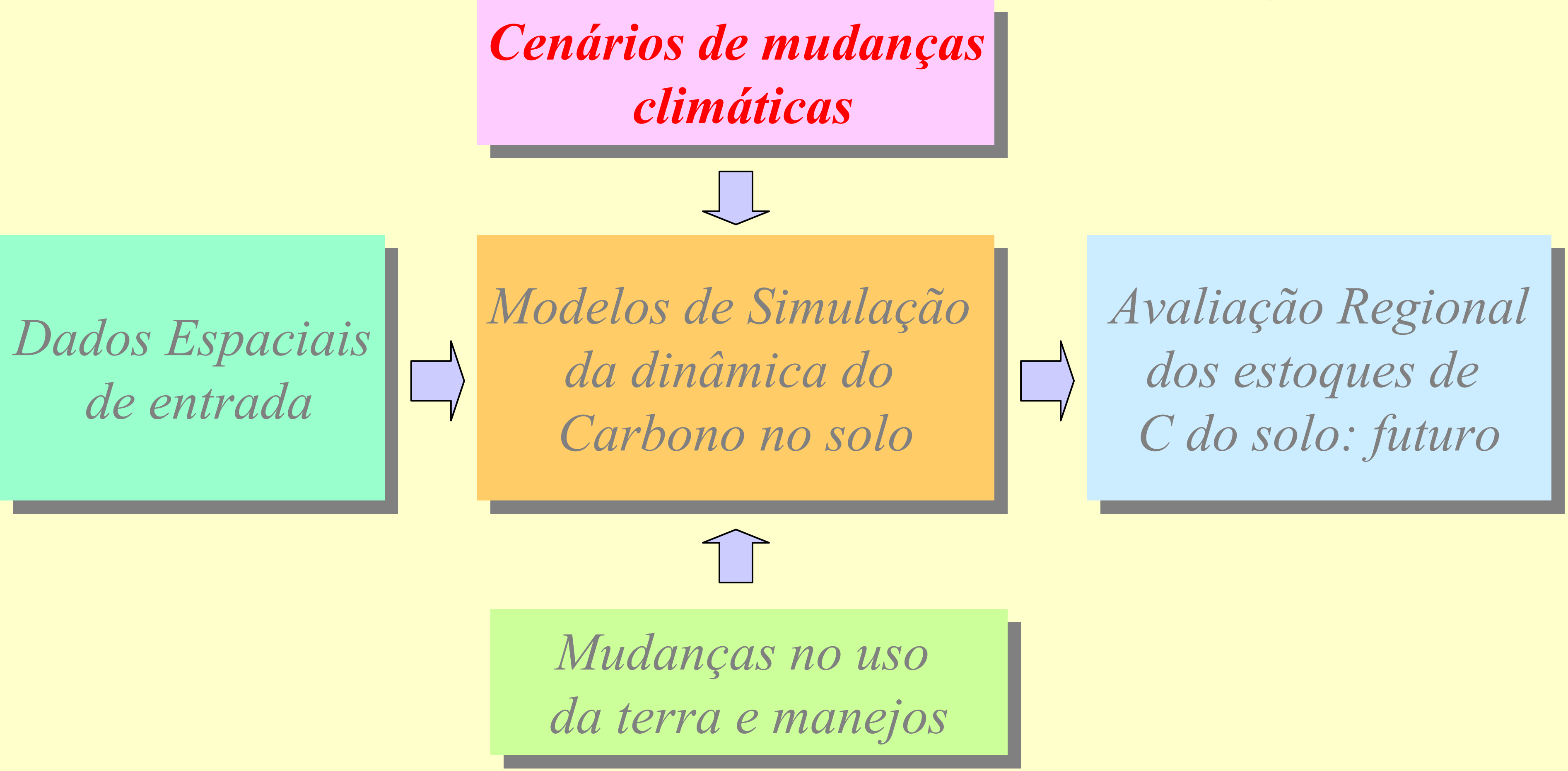
Cana-de-açúcar: colheita manual x mecanizada

Com Queima

Sem Queima

Fase III

CPTEC/INPE



Cenários de mudanças climáticas

Dados Espaciais de entrada

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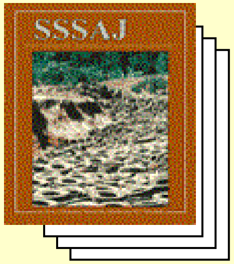
Avaliação Regional dos estoques de C do solo: futuro

Mudanças no uso da terra e manejos



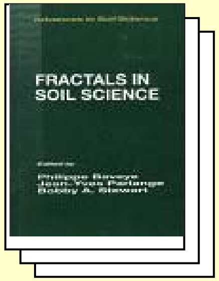
Modeling Soil Carbon from Forest and Pasture Ecosystems of Amazon, Brazil

Soil Science Society of America Journal - 2003

Global
Chan

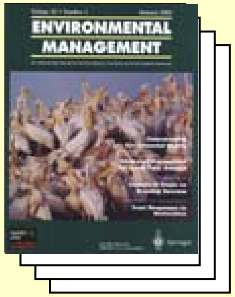
Modeling changes in soil organic matter in Amazon forest to pasture conversion with the Century model

Global Change Biology – 2004


FRACTALS IN
SOIL SCIENCE

Impact of Climate Change on SOM Status in Cattle Pasture in Western Brazilian Amazon

Advances in Soil Science - 2004


ENVIRONMENTAL
MANAGEMENT

Combining soil C and N spatial variability and modeling approaches for measuring and monitoring soil C sequestration

Journal of Environmental Management – 2003

Assessment of Soil Organic Carbon Stocks and Change at National Scale

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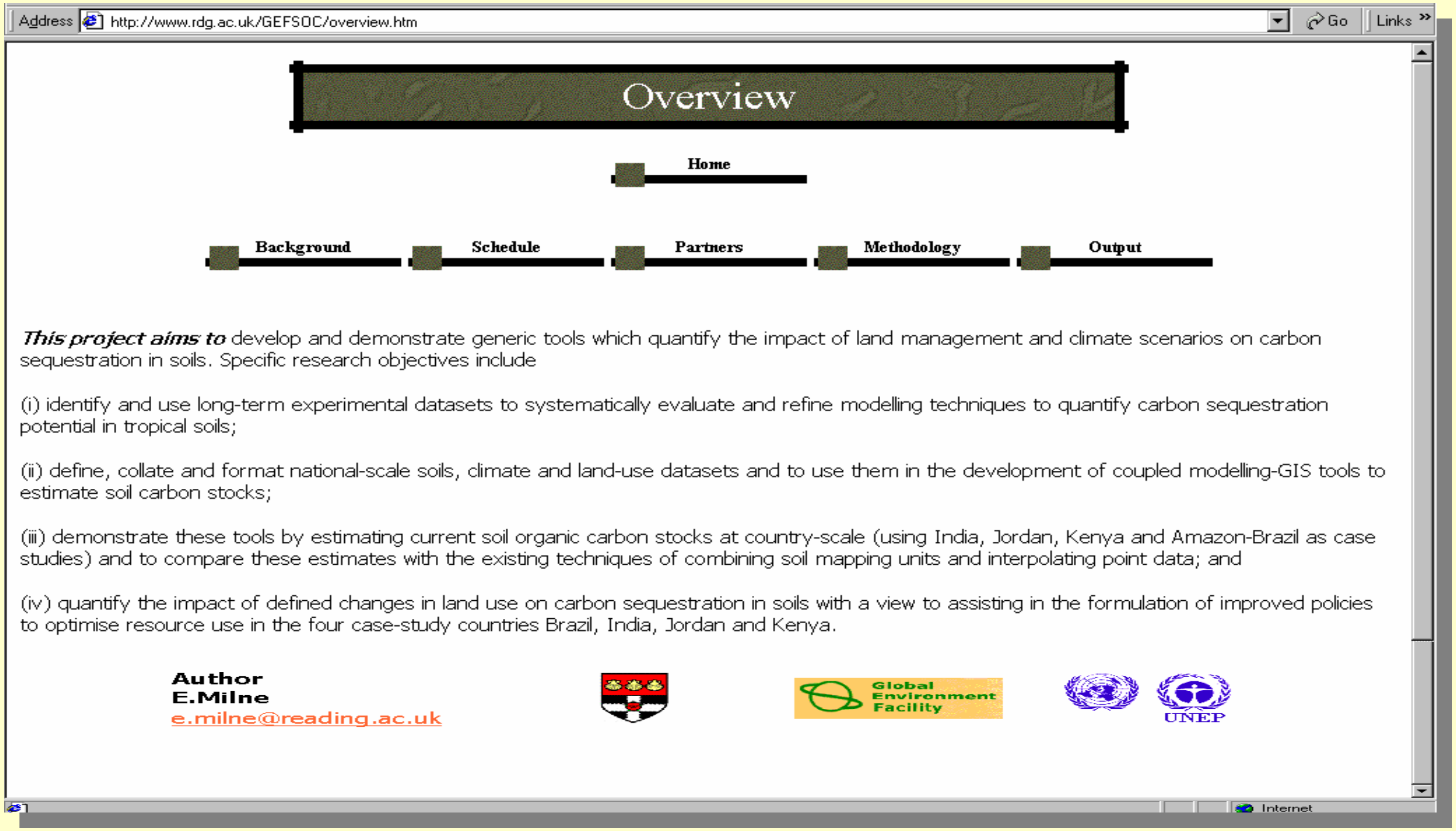
GEF-SOC project

Informações adicionais

www.rdg.ac.uk/GEFSOC


Address http://www.rdg.ac.uk/GEFSOC/overview.htm
Go
Links
Overview
Home
Background
Schedule
Partners
Methodology
Output
Global Environment Facility
UNEP
Internet

This project aims to develop and demonstrate generic tools which quantify the impact of land management and climate scenarios on carbon sequestration in soils. Specific research objectives include

(i) identify and use long-term experimental datasets to systematically evaluate and refine modelling techniques to quantify carbon sequestration potential in tropical soils;

(ii) define, collate and format national-scale soils, climate and land-use datasets and to use them in the development of coupled modelling-GIS tools to estimate soil carbon stocks;

(iii) demonstrate these tools by estimating current soil organic carbon stocks at country-scale (using India, Jordan, Kenya and Amazon-Brazil as case studies) and to compare these estimates with the existing techniques of combining soil mapping units and interpolating point data; and

(iv) quantify the impact of defined changes in land use on carbon sequestration in soils with a view to assisting in the formulation of improved policies to optimise resource use in the four case-study countries Brazil, India, Jordan and Kenya.

Author
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Seminário dos Usuários das Previsões Numéricas de Mudanças Climáticas e seus Impactos Regionais

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