EMRAS II, IAEA,Vienna, 25 - 29 January 2010

BIOCLIM, a reminder and BIOPROTA
Update on Application and New Output

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BIOCLIM

•A 3-year European project under the 5th Framework Program

• October 2000 - December 2003

• Coordinator : ANDRA

• 12 participants (UK, B, D, CZ, SP, FR)

• 5 Work Packages

• 13 deliverables - 1 web site, **http://www.andra.fr/bioclim**

Bioclim

BIOCLIM : Objectives

To provide a scientific basis and practical methodology

for assessing

the potential impacts of long-term climate change

on Biosphere characteristics

in the context of radiological Performance Assessments (PAs)

⇨ For 5 regions of interest in Europe

⇨ Over the next 1 million years

⇨ Quantitative scenarios of climate changes numerically produced

⇨ Narrative descriptions of future Biosphere changes (states + transitions)

BIOCLIM : Region of interest

Central England
(51.6°-54.8°N; 0-2.8°W)

Bure
(48.6°N; 5.7°E)

Toledo Area
(38°-41°51’ N; 1°30’-6°30’ W)

Padul Peat Bog
(37°N; 3°40 ’W)
Cullar-Baza Basin
(37°20 ’-37°55 ’; 2°20 ’-2°50 ’W)

Czech Republic
(48°55’N-49°28’N;
15°E-15°35’E)

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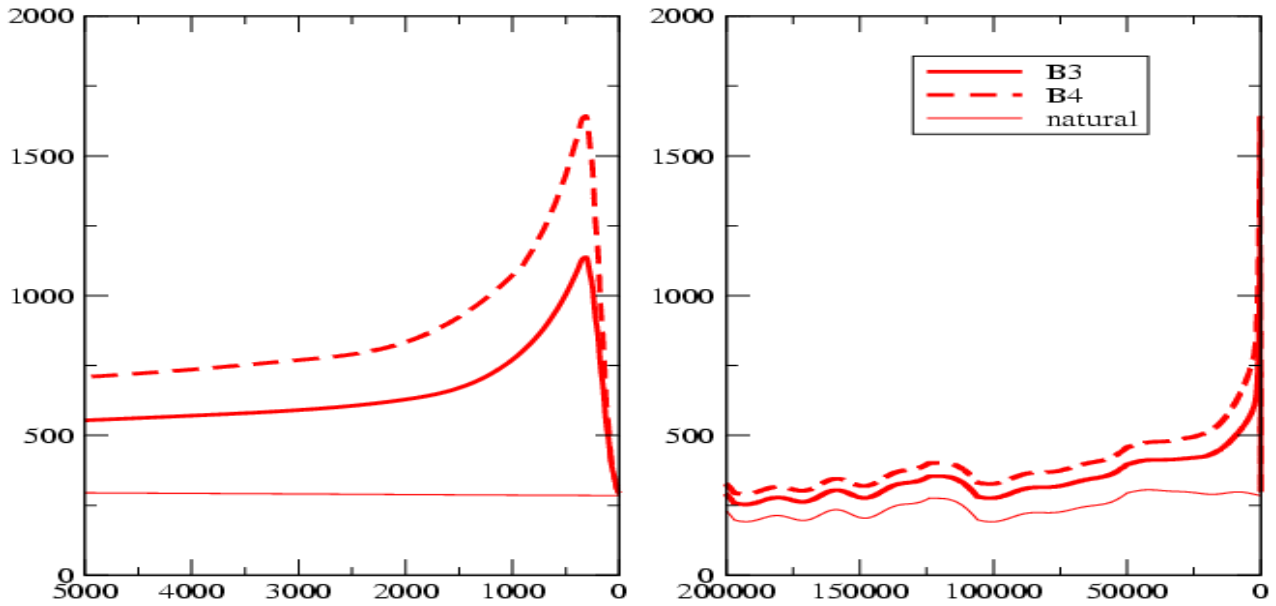
BIOCLIM :

3 scenarios of climate evolution



A natural scenario : > 290ppmv during next 50kyr then decreases towards 190ppmv

Two perturbated scenarios : B3 = natural + 850ppmv at 325yr AP - still +50ppmv at 200ky
B4 = natural + 1350ppmv at 325yr AP - still + 85ppmv at 200ky

BIOCLIM :

Climate Numerical Experiments

Transient sequences of future climate & vegetation patterns (WP3)

The next 1000kyr (with zoom on +200kyr) under 3 different CO_2 scenarios :

- Scenario 1 : natural CO_2 variations only (A4)
- Scenarios 2 & 3 : natural CO_2 variations + Fossil Fuel Contribution (B3, B4)

Snapshots of future climate & vegetation patterns (WP2)

- A very near future : high atmospheric [CO_2] with or without ice sheets
- A super interglacial (67ky AP) : high insolation, high atmospheric [CO_2], no ice sheets
- A glacial maximum (178ky AP) : low [CO_2] , large ice sheets

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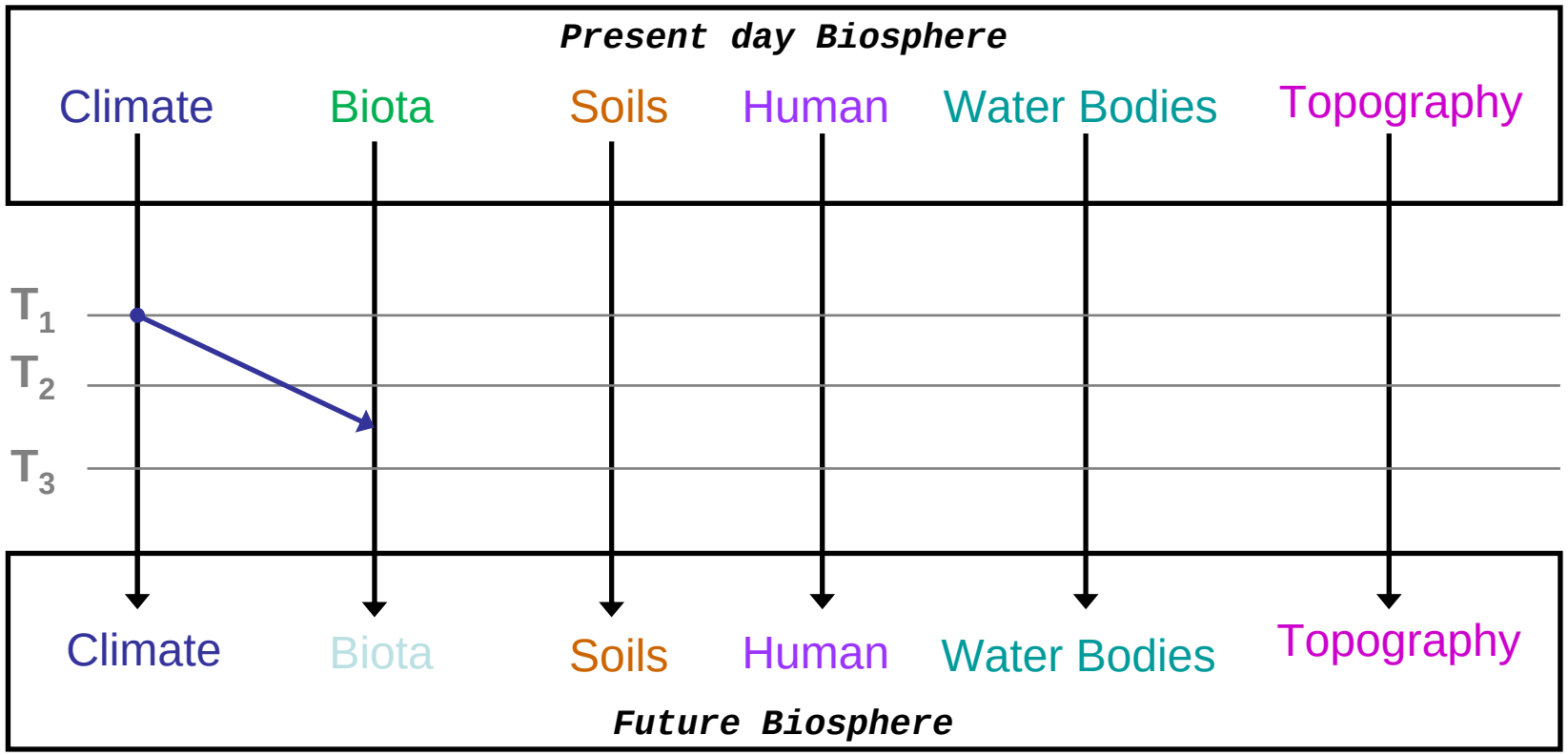
Biosphere Systems Changes :

States and Transitions



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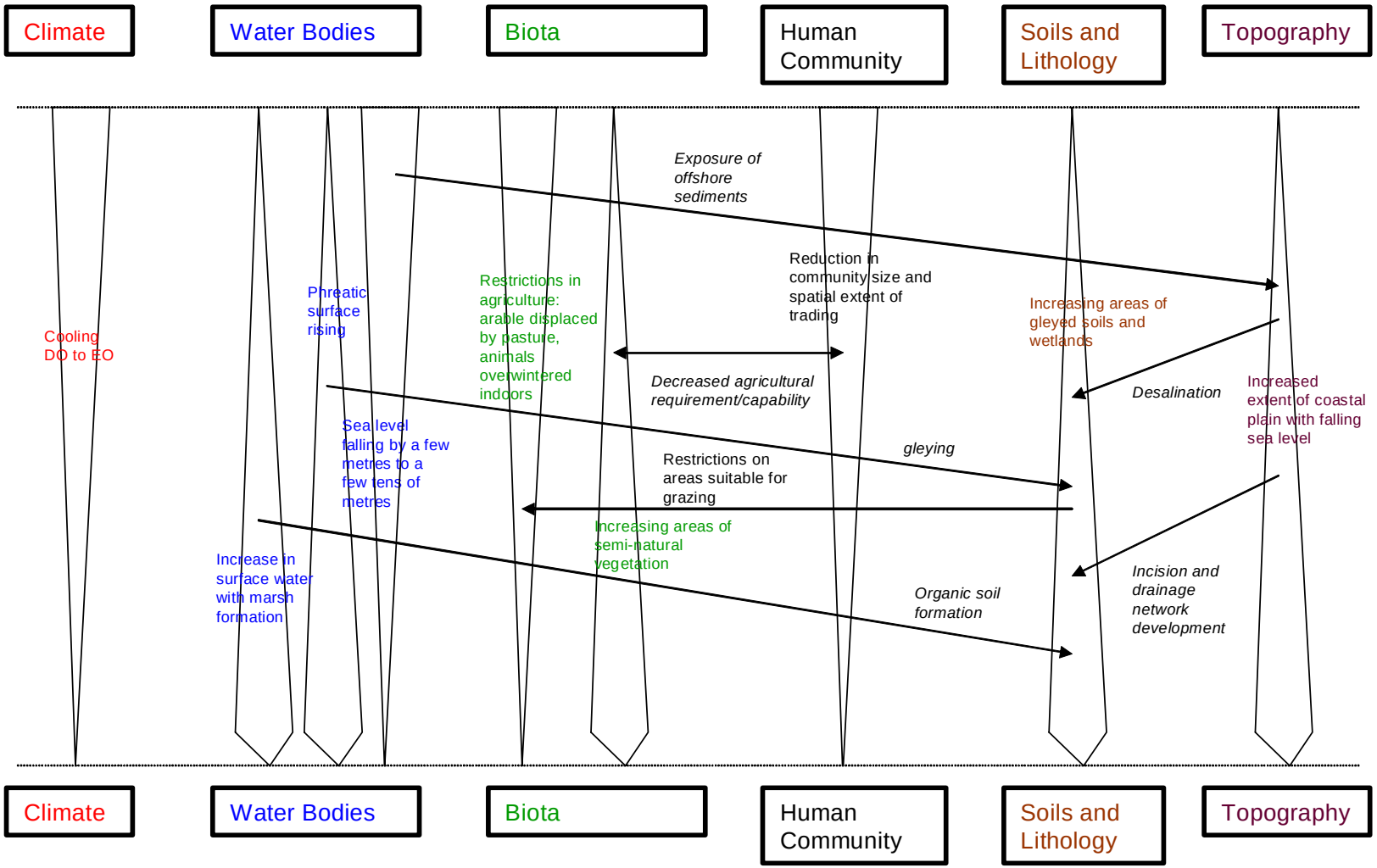

Transition from State 1 to State 3 over a Few Thousand Years

BIOCLIM main output document

- A substantial body of climatic modelling results for Europe –a potential resource for organisations wanting to include future climate change in performance assessments
- These organisations might complement these results with their own climatic modelling studies
- In particular, it would be useful to explore the diversity of results produced from an ensemble of different models, as has been done in palaeoenvironmental reconstructions, for various forcing scenarios, and to compare downscaling experience
- It seems likely that the associated diversity of climate projections could be mapped to a limited number of states and transitions of interest at any particular site

See "**Development and Application of a Methodology for Taking Climate-Driven Environmental Change into Account in Performance Assessments"** BIOCLIM deliverable D10-12 available from ANDRA and at **http://www.andra.fr/bioclim**

BIOCLIM/BIOMOSA
‘Matters Arising!’

- The past, palaeodata, was the key to the future, but anthropogenic inputs very important… *humans not very predictable…!*
- What site specific information will be needed?
- What are the most ‘realistic’ (relevant) biosphere system assumptions?
- Biosphere – Geosphere - Biosphere interactions noted as important

Matters Arising (2)

100,000 y of high CO^2! Long delay before next glaciation…

Timing of use of economic fossil reserve not critical.

Insolation affects the climate which drives the ice; *not insolation -> ice -> climate*

Technical uncertainties – still questions for climate modellers; but lots of data for different scenarios and models and downscaling available in BIOCLIM deliverables. ***Is this sufficient/necessary for repository PA?***

Matters Arising (3)

BIOCLIM approach to managing the assessment of climate change has been demonstrated.

Application of the BIOCLIM approach within real site and assessment context conditions.

Can we actually model the changes?

What answers will we get?

What will be the implications?

Matters Arising (4)

Comparing results for the Generic and each Site Specific Model; and results for different sites arising from the Site Specific models. Interesting and valuable, but caution:

- *Do all the modellers have the same approach to conservative v realistic assumptions?*
- *How does this affect design of model comparison exercises?*

Matters Arising (5)

The real issue is data interpretation at different sites, not different models.

Paradigm has been that the same biosphere system processes occur at all sites – but the significant ones will be identified only:

- according to the relative proportions of specific radionuclides in source term;
- how the source term is delivered to the biosphere, and
- the specific featires of the site under investigation.

Matters Arising (6)

- Checkout the data quality *(EMRAS, IUR Waste Task Force, BIOPROTA)*
- Determine adequacy of the data for systems of interest, allowing for time dependence *(BIOCLIM, and modelling exercises: BIOSCOMP, BIOMOSA, on-going BIOPROTA).*
- Can data deficiencies be resolved generically or only by (further) site specific consideration *(Hypothesis testing with additional modelling exercises,…*
- Develop guidance on site investigation requirements…

All the above projects imply further investigation of effects at Geosphere-Biosphere Interface Zone.

BIOPROTA Objectives

Building on IAEA-BIOMASS-6 (2003) "Reference Biospheres" for solid radioactive waste disposal,

BIOPROTA since 2002

providing a forum for exchange of information to support resolution of key issues in biosphere aspects of assessments of the long-term radiological impact of contaminant releases associated with radioactive waste and contaminated land management.

BIOPROTA Output - *see* *www.bioprota.com*

Technical reports,

- Long term models for dose assessment:
  - oSpray irrigation and direct uptake by crops
  - oAccumulation in soil and inhalation
  - oAccumulation in soil and uptake into the foodchain
- C-14 model review
- Cl-36 accumulation in soil and plant uptake
- Use of analogue data
- Site characterisation and data protocol

Workshop reports

- Se-79 behaviour in the environment
- Cl-36 behaviour in the environment
- Processes at the geosphere biosphere interface
- Long term dose assessment of non-human biota
- Evaluation of codes for transfer modelling
- Annual Forum reports

Database for special radionuclides, continuing dvpmt.

BIOPROTA new output in 2009

May 2009 Annual Forum hosted by CIEMAT

Paper on experimental work on sorption of I-129 in organic rich soils (lead by ANDRA)

Cl-36 dose assessment report including relative uncertainties in:

- estimating concentrations in food;
- “Representative Person” assumptions, and
- dose coefficients

C-14 dose assessment interim report

Se-79 in the soil-plant system report

BIOPROTA 2010 Projects

Addressing uncertainties in non-human biota dose assessments relevant to solid waste disposal, due for completion imminently...

Continuation of C-14 modelling studies, taking account of new research and wider participation. Kick-off 16 – 17 February 2010, Paris

Dose assessment for U-238 series radionuclides:

- U-Th-Ra disequilibrium in different conditions
- Rn-222 emanation and dose assessment
- Pb-Po disequilibrium

Kick-off 18 – 19 February 2010, Paris

Workshop on Ra-226 in the Environment, Paris, 4 – 5 May

Use of BIOPROTA Output...

Documentation to check if you have considered relevant processes in your own models

Documentation to understand implications of different assessment assumptions

Documentation allowing you to test and compare your own models with others

A forum to raise scientific issues and discuss with other experts outside the regulatory process:

- Data selection
- Site characterisation, etc.

Linked into IAEA programmes!