UNIVERSITY OF Southampton
School of Geography

Regional integration of past records for management of modern resources and landscapes: introduction

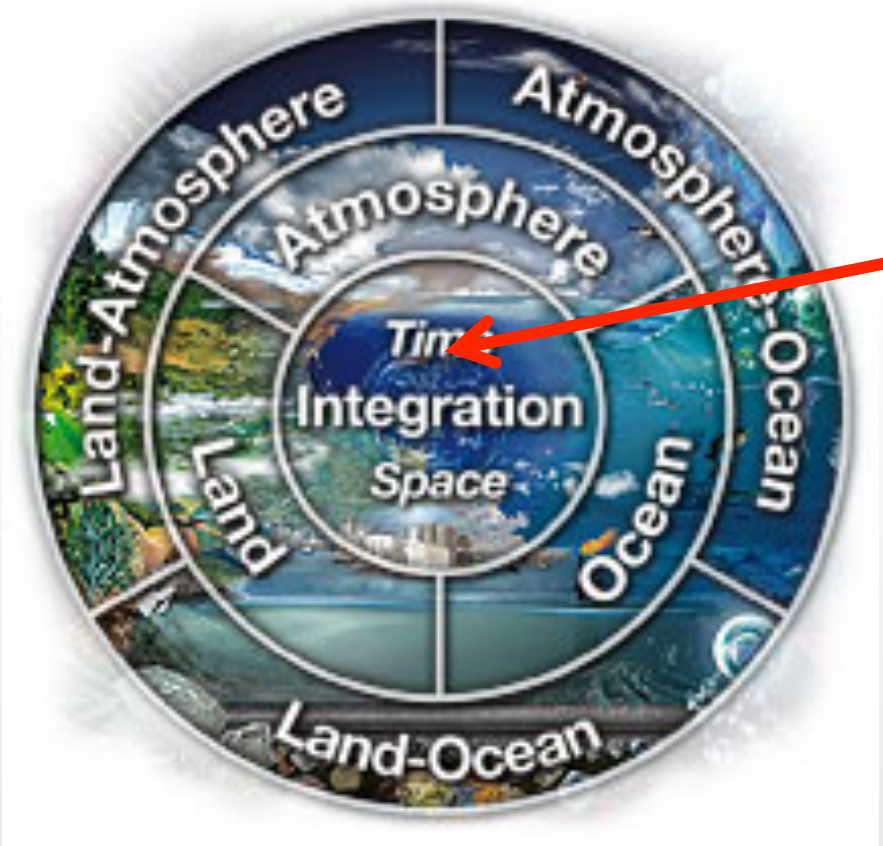
John Dearing

22 September 2010

PAGES Focus 4/USRG LWEC Workshop, Southampton

1. International organisation….

International Geosphere-Biosphere Programme (IGBP)



Past Global Changes (PAGES)

http://www.igbp.net/page.php?pid=113

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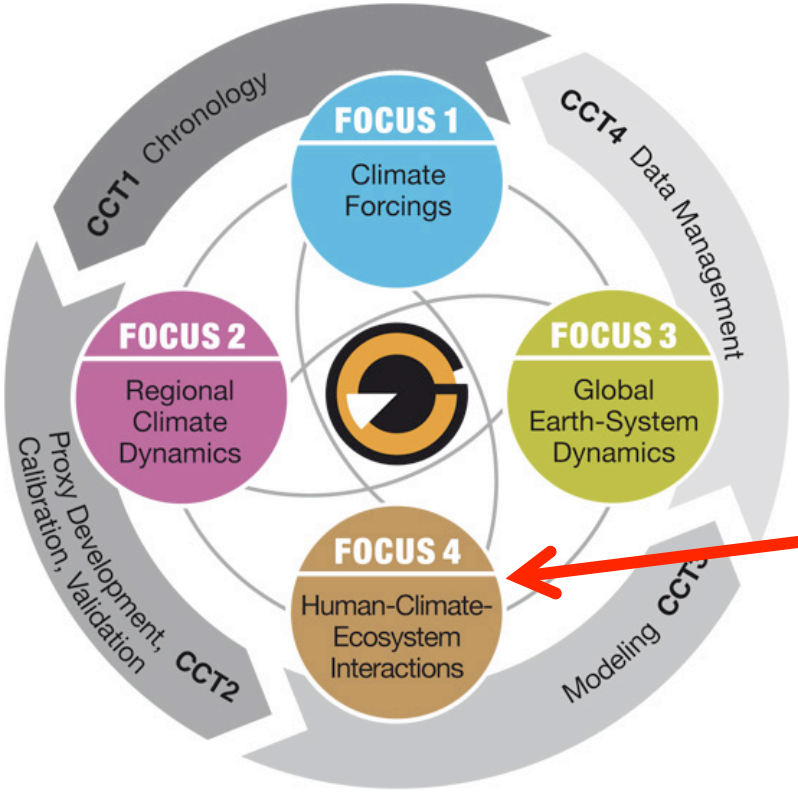

Fig. 1. PAGES scientific structure: Four thematic Foci (colored circles) are complemented by four circling Cross-Cutting Themes that are of relevance to all Foci.

Past Human-Climate-Ecosystem Interactions (PHAROS)

http://www.pages-igbp.org/science/index.html

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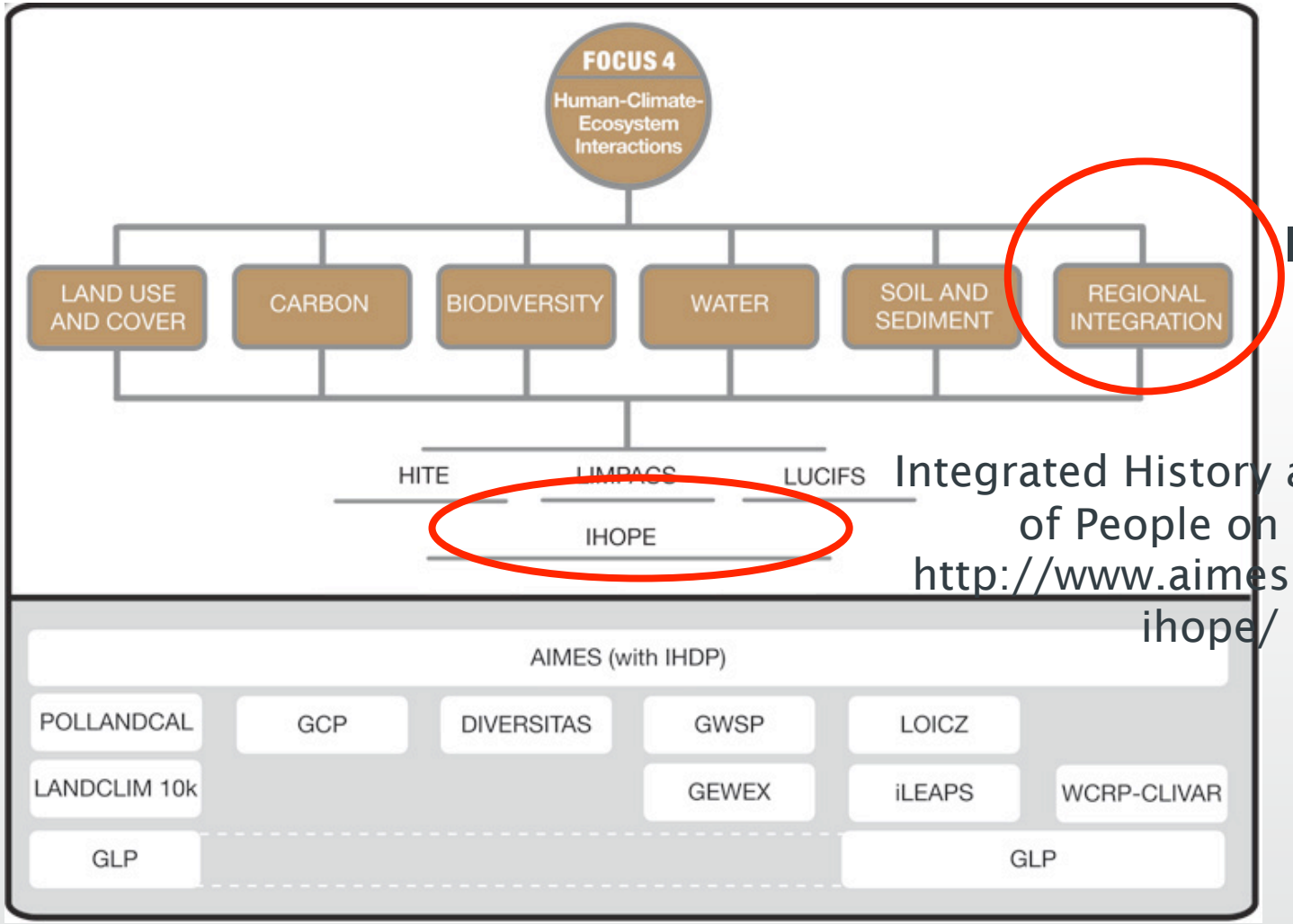


Regional Integration theme

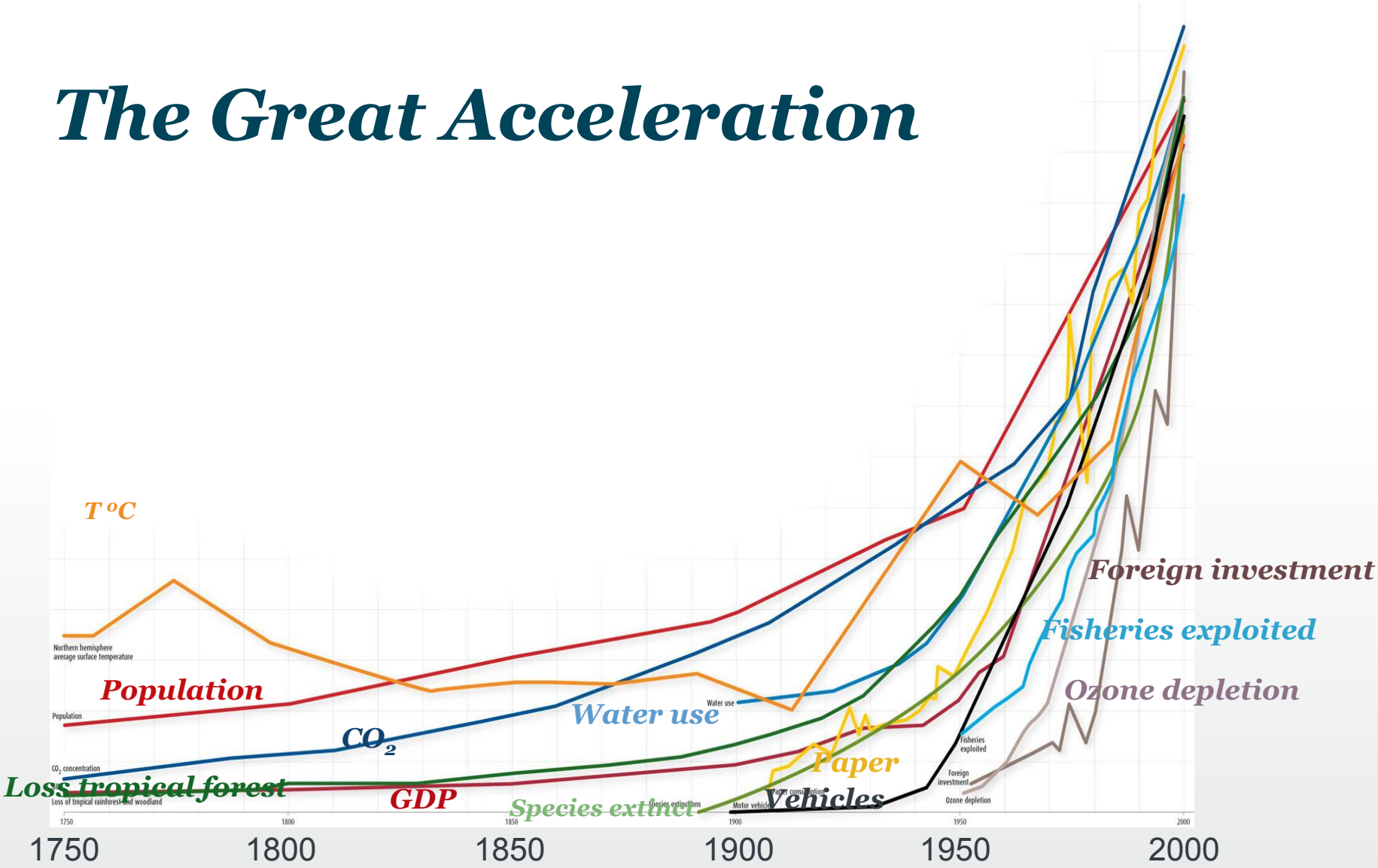
Integrated History and Future of People on Earth
http://www.aimes.ucar.edu/ihope/

http://www.pages-igbp.org/science/focus4.html

2. Background…..

…..the context of sustainable management of regional landscapes and adaptation to global environmental change

The Great Acceleration



Steffen et al 2004 Global Change and the Earth System: A Planet under Pressure, Springer.

http://rs.resalliance.org/2008/12/04/visualizing-the-great-acceleration-part-ii/

Stationarity is dead!

"Stationarity - the idea that natural systems fluctuate within unchanging envelop of variability - is a fundamental concept..in water-resources engineering."

"Stationarity is dead because ..change of the Earth's climate is altering the means and extremes…"

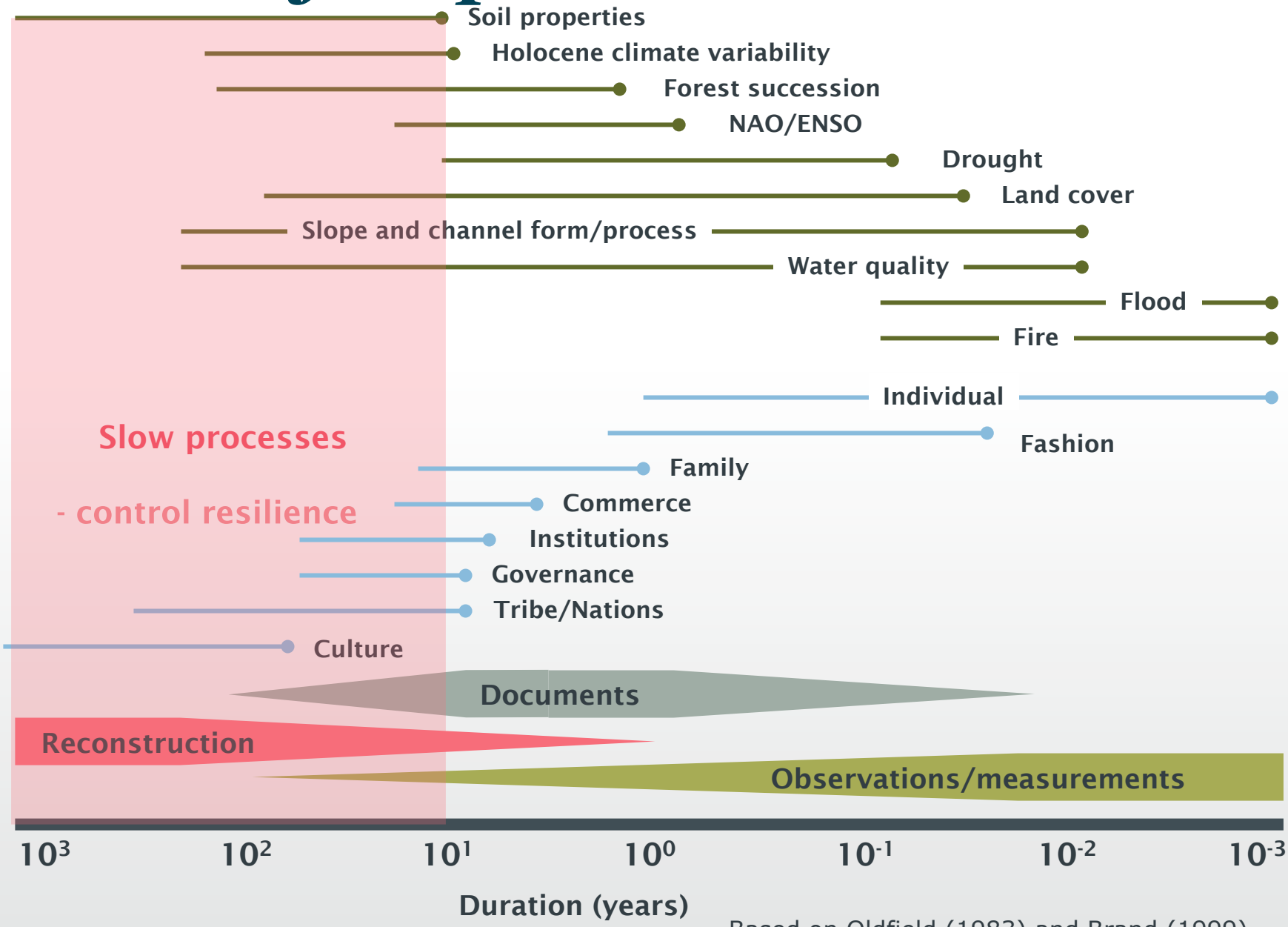
"… The challenge is daunting. Patterns of change are complex; uncertainties are large; and the knowledge base changes rapidly…."

Milly et al 2008 Stationarity is dead! Whither water management. Science 319, 573-574

Socio-ecological systems as complex adaptive systems

Self-organisation
Feedbacks
Paths, Trajectories and Traps
Emergence
Networks
Thresholds
Adaptive Cycle
Collapse
Resilience

Slow and fast processes



Based on Oldfield (1983) and Brand (1999)

Regional syndromes

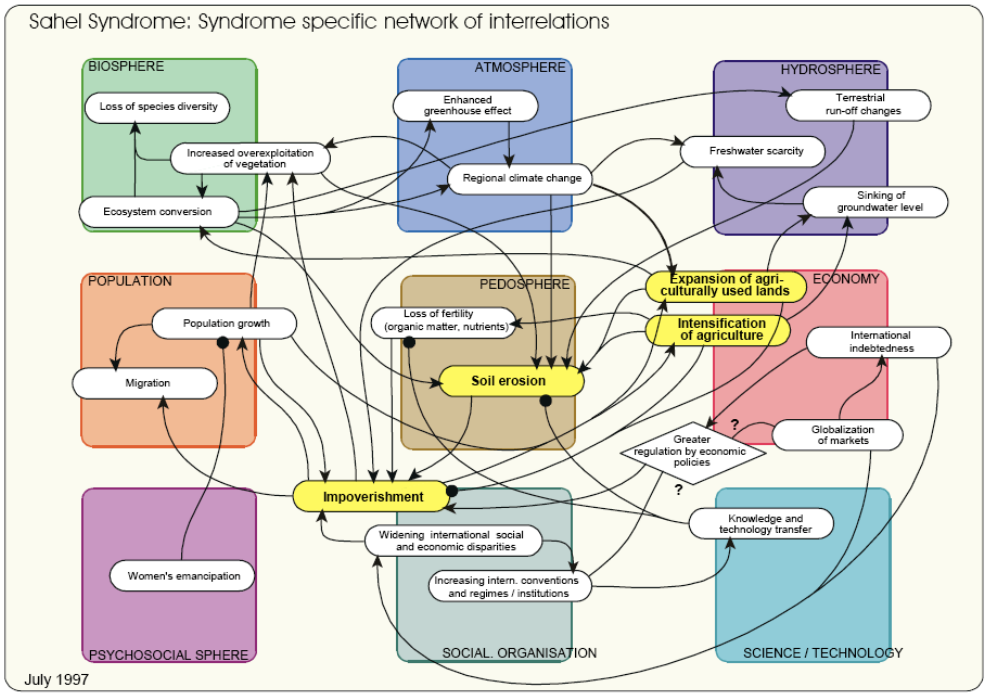
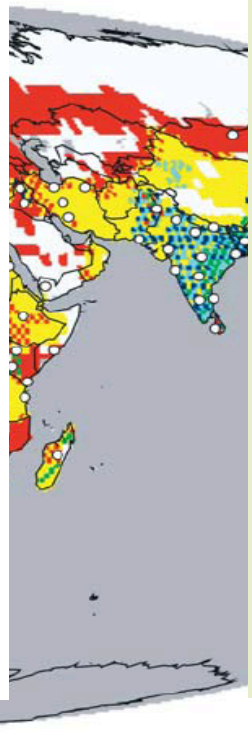


Figure 3: Network of interrelations for the Sahel-Syndrome-generating functional pattern (Sahel HFP).



But lacks a long time perspective… limited sense of evolving trajectories, thresholds, alternate steady states etc

DUST BOWL

OVEREXPLOITATION

GREEN REVOLUTION

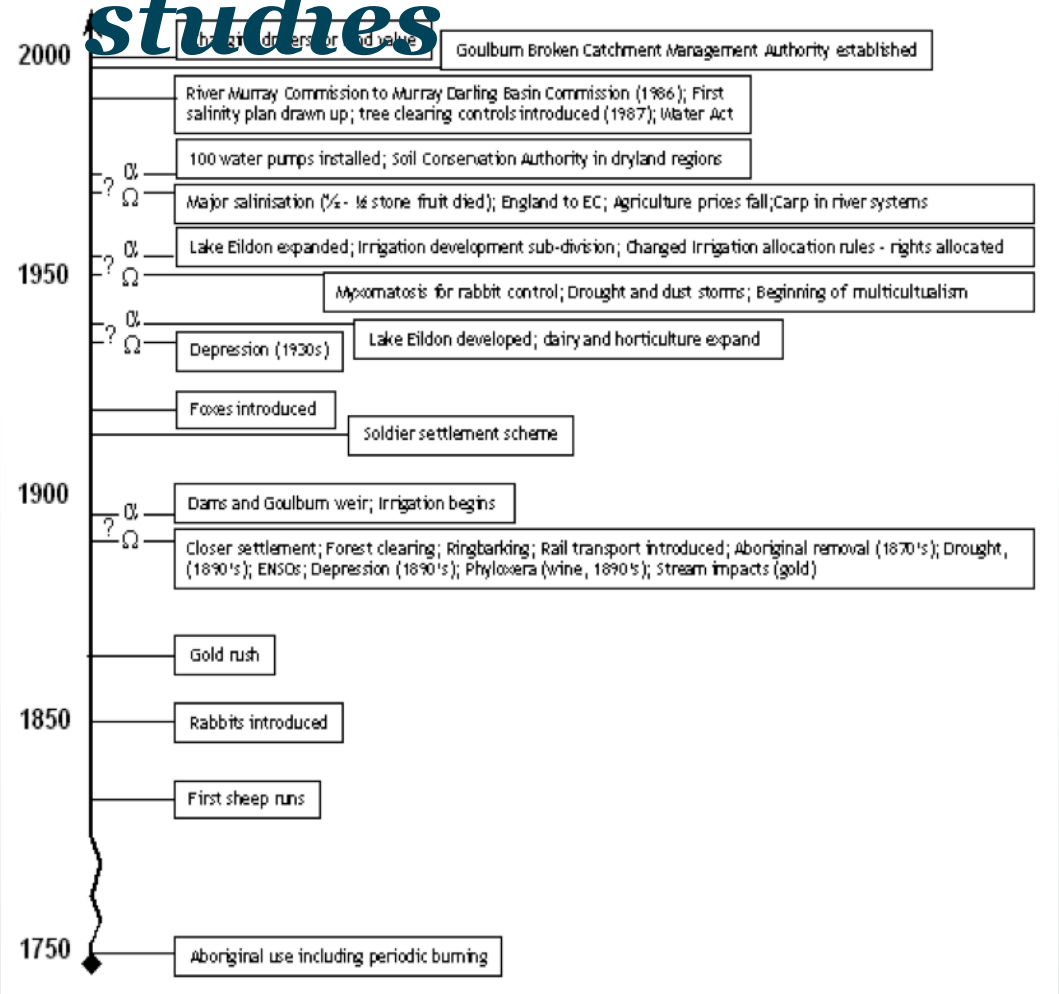
ARAL SEA

ASIAN TIGER

Figure 2. Global distribution of seven syndromes. Syndrome names are given in the legend. Simultaneous occurrence of more than one syndrome in a spatial map unit (2 degrees of latitude by 2 degrees of longitude) is symbolised by a chequered pattern combining the colours of the syndromes involved (the finest original resolution for a single syndrome is 0.5 by 0.5 degrees). The light grey land areas are either syndrome-free with respect to the seven investigated syndromes, or potential syndromes could not be identified because of significant gaps in data availability. While the indication of the *Dust Bowl*, the *Green Revolution* and the *Asian Tiger Syndromes* has global coverage, some gaps exist for the other four syndromes due to absence of or unreliable data. This refers, for example, to all four syndromes with respect to Russia, to the *Aral Sea* and *Sahel Syndromes* in some regions of Africa and the *Overexploitation Syndrome* in parts of Central America.

Lüdeke et al 2004. Gaia 13, 42-49. Schellnhuber et al 1997 Gaia 6, 19-34

Historical profiling-resilience studies



Goulbern-Broken catchment, Australia

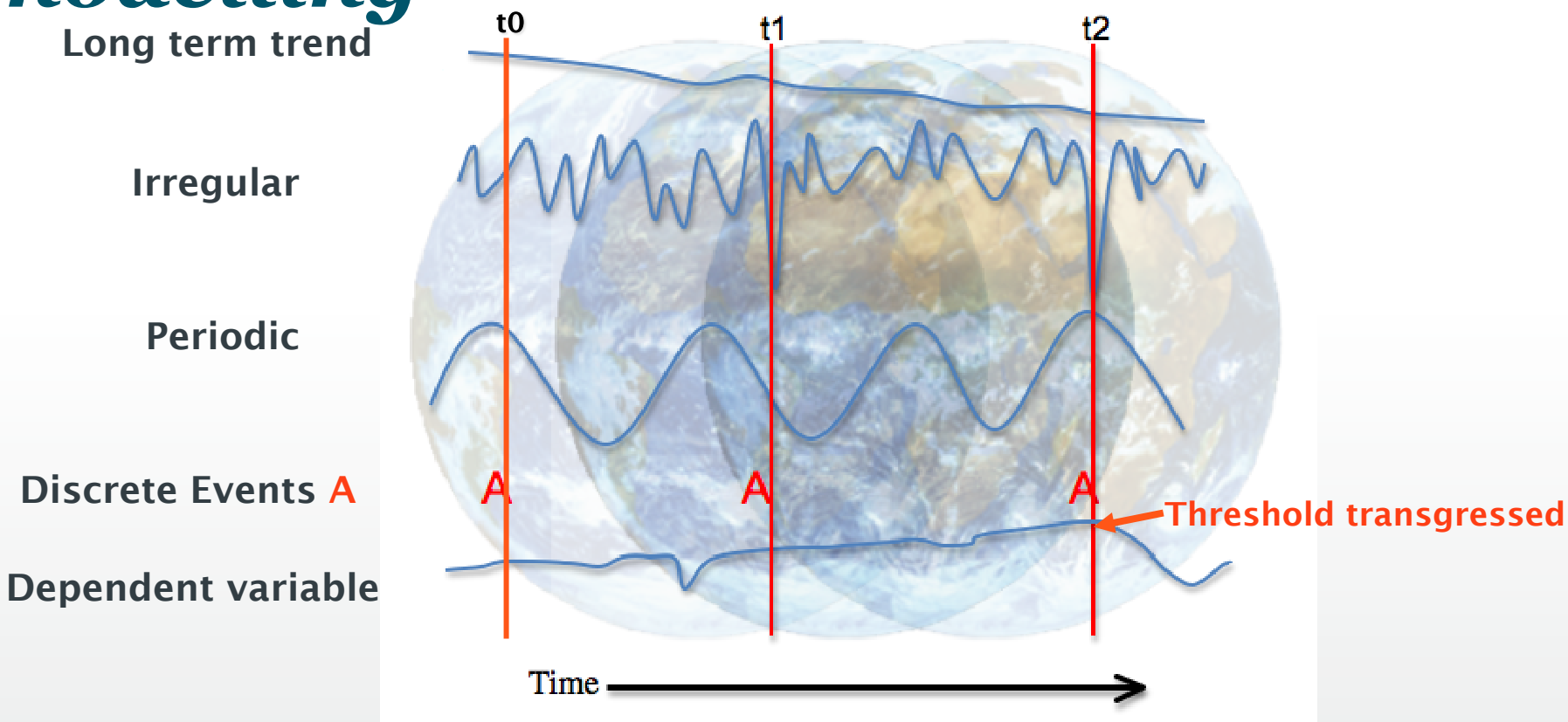
Provides a 'historical profile' of modern system and asks questions about drivers etc

But more a sequence of historical events that 'contextualises' the present

Fails to capture the 'evolutionary' nature of change that has led to the modern system.

Walker et al 2002 Conservation Ecology 6, 14

‘Perfect storm’ evolutionary modelling



Deforestation, fertilizer use, climate, soil erosion event – clear water/eutrophication
Sub-prime debt, bank stocks, economic cycle, major bank failure – growth/depression

Costanza and Dearing (unpublished)

Converging view....

IGBP (2008) defines urgent needs in terms of identifying thresholds/ tipping points, regional information on past climate, regions where society is vulnerable to climate (climate hotspots), ... land use feedbacks at regional-global scales, and 'climate information systems' for adaptation .....

"there are critical gaps in our knowledge of the social, biological, biogeochemical and physical foundations needed to make decisions for a sustainable future." (review of MEA 2009)

Impact assessment models that do not consider feedbacks have the potential to produce "dangerous policy recommendations" (UK review 2009)

"modeling to understand the evolution of natural capital, ecosystem services and human wellbeing will play a key role." (PECS 2010)

International Geosphere-Biosphere Programme 2008 p4; Carpenter et al 2009 Proc. Nat. Acad. Sci. **106**, 1305-1312; Nicholson et al 2009 J. Appl. Ecol. doi: 10.1111/j.1365-2664.2009.01716.x; http://www.icsu.org/1_icsuinscience/ENVI_PECS_1.html (ICSU Programme on Ecosystem, Change and Society)

3. Theme Aims.....

..... the changes we hope to achieve as a result of Regional Integration

Focus 4 Regional Integration

Promote and provide new integrations of historical information at regional scales in order to provide a stronger basis for developing strategies for sustainable management and adaptation to global environmental change.

Interdisciplinary activity
Multi-decadal timescales
Multiple archives and proxy records
Qualitative analysis
Systems modelling

Regional Integration – socio-ecological processes in landscapes

Water quality Technology Extreme weather

Population Air pollution Poverty Institutions

Settlement patterns Global economy

Flood regime Fire Climate Mining

Fertilizer Soil erosion Sewage Fishing

Land cover Crop yields Tectonics

Biodiversity Grazing Water use Governance

Disease Natural hazards Migration

Income Tourism Landslides Flood defences

Land use Subsistence Fuel Irrigation

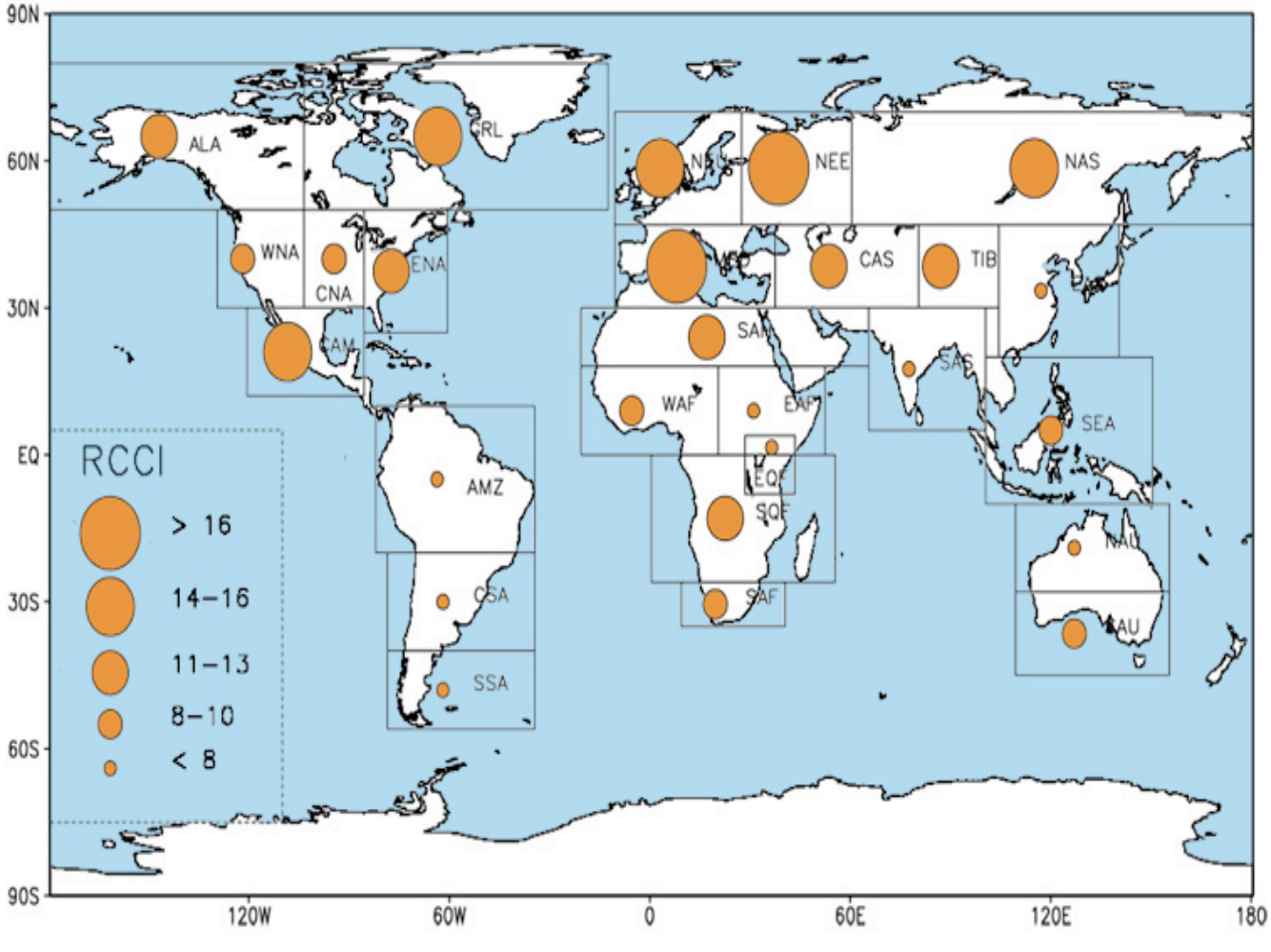
Local economy Subsidies Groundwater

How do these interact now?

How have these interactions changed through time?

How will they interact in the future?

Climate hotspots



Regional Climate Change Index (RCCI) over 26 land regions of the World calculated from 20 coupled Atmospheric-Ocean General Circulation Models and 3 IPCC emission scenarios (A1B, A2, B1). The RCCI is a comparative index that identifies the regions most responsive to climate change

Giorgi, F., 2006: Climate change hot-spots, Geophysical Research Letters, 33: L08707. Doi:10.1029/2006GL025734.

Ystad Project – 1980s

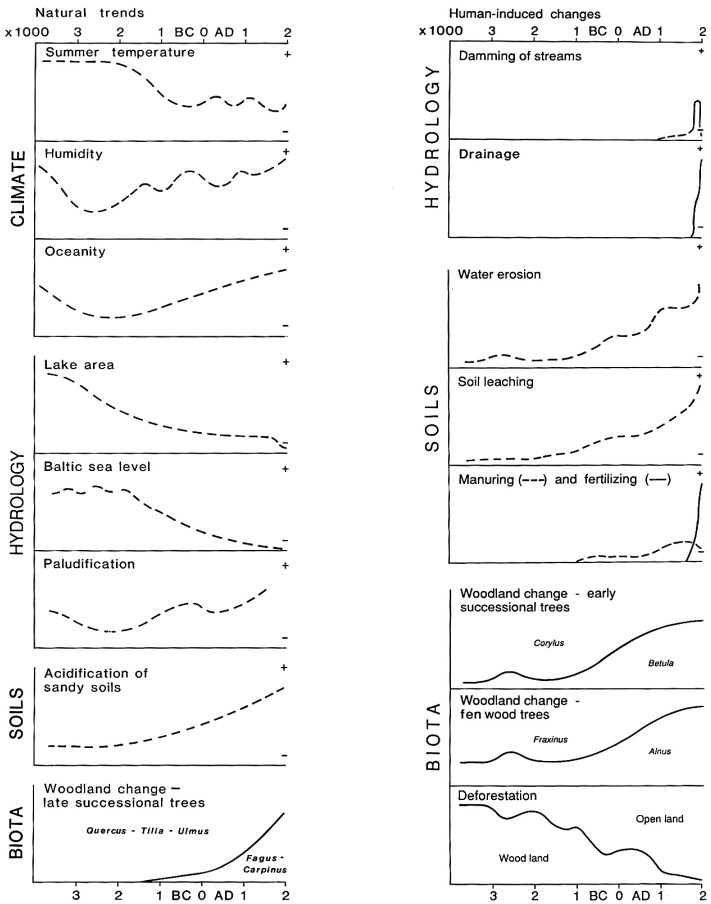


Fig. 6.2:2. Ecological factors related to society and landscape changes in a long-term perspective, illustrated by trend curves showing the relative changes through time. Higher precision in these curves indicated by continuous lines.

Large multidisciplinary project focusing on Scania in southern Sweden

Instrument, document, map, palaeoecological, archaeological records covering the last 6000 years

Not explicitly related to modern issues but probably the first major regional integration of archives

Berglund, B.E. 1991 Ecological Bulletins, 41, Wiley-Blackwell

Learning from the past

Extending timescales over past decades/centuries to create an **evolutionary** framework for understanding the present and future.

Focus 4 Regional Integration is about evolutionary frameworks - not analogues

Insi
peri
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tran
sense of an **analogue** for the present

4. Theme Objectives……

…..the activities we undertake to bring these changes about

Science outcomes

Develop methods and protocols for integrating and modelling multi-decadal biophysical and social records within sub-continental regions;

Create historical databases, integrative analyses, visualisations, models, future scenarios and interpretations for different regions worldwide;

Promote ‘long-termism’ in policy-making and landscape management;

Provide sufficient insight to influence policy for sustainable management of regional landscapes.

Strategic outcomes

Establish an international community around the Focus 4 'Regional Integration' with steering group/ regional representatives

Set international priorities/agenda for regions, hotspots, ecosystems, societies…….;

Facilitate grant submissions for national/ international funding, publications, regional workshops, etc;

From this meeting, outline a major multi-authored paper on the need and scope for regional integration of past records.

5. Workshop Schedule……

Wednesday 22nd September 2010

9.30 Registration and Coffee

Introduction

10.00-11.00 John Dearing (Southampton) Workshop – background, aims and objectives

Case-studies

12.00-13.00 Peter Gell (Ballarat, Victoria)- Lower Murray Darling Basin, Australia

13.00-14.00 Lunch

14.00-15.00 Mohammed Umer (Addis Ababa) - East Africa

15.00-16.00 Yang Xiangdong (CAS, Nanjing)/Zhang Weiguo (Shanghai) – Lower Yangtze Basin, China

16.00-17.00 Mary Edwards (Southampton) - New Forest National Park/Hampshire, England

Thursday 23rd September 2010

8.30 John Dearing – Introduction to Group Discussions

Key Questions and Answers

9.00-11.00 Groups A, B, C What are the key questions for contemporary socio-ecological systems that can be best addressed through historical perspectives? System behaviour, ecosystem services, thresholds etc.

12.00-13.00 Feedback and discussions

13.00-14.00 Lunch and Posters

Data, Methods and Techniques

14.00-15.00 Richard Treves (Southampton) Visualisations/Google databases

15.00-16.30 How should we source, organise and analyse interdisciplinary historical data? What are the barriers and challenges to progress? Group A Data sources Group B Dynamic Modelling Group C Databases

16.00-17.00 Feedback and discussions

Friday 24th September 2010

Forward planning

8.30 -1300 Groups A, B, C How to organise future Regional Integration activities? PAGES Focus 4 Regional Integration committee, National/International funding, IPCC/ME priority areas etc.

13.00-14.00 Lunch and Posters

1400 -1500 Groups A, B, C Producing a report and multi-authored paper

15.00-15.30 John Dearing and others - Workshop summary and conclusions

Getting involved....

Chair for breakout group
Rapporteur (note-taking/discussant) for breakout group
Poster presentation (5mins during lunch)
Offer alternative/additional breakout sessions
Drafting paper sections/grant applications
Focus 4 Regional Integration - Steering Group
Web-site design
Regional/National representative