

In "*natura*" long-term experimental platforms

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In *natura* Long-term Experiments

Rothamsted



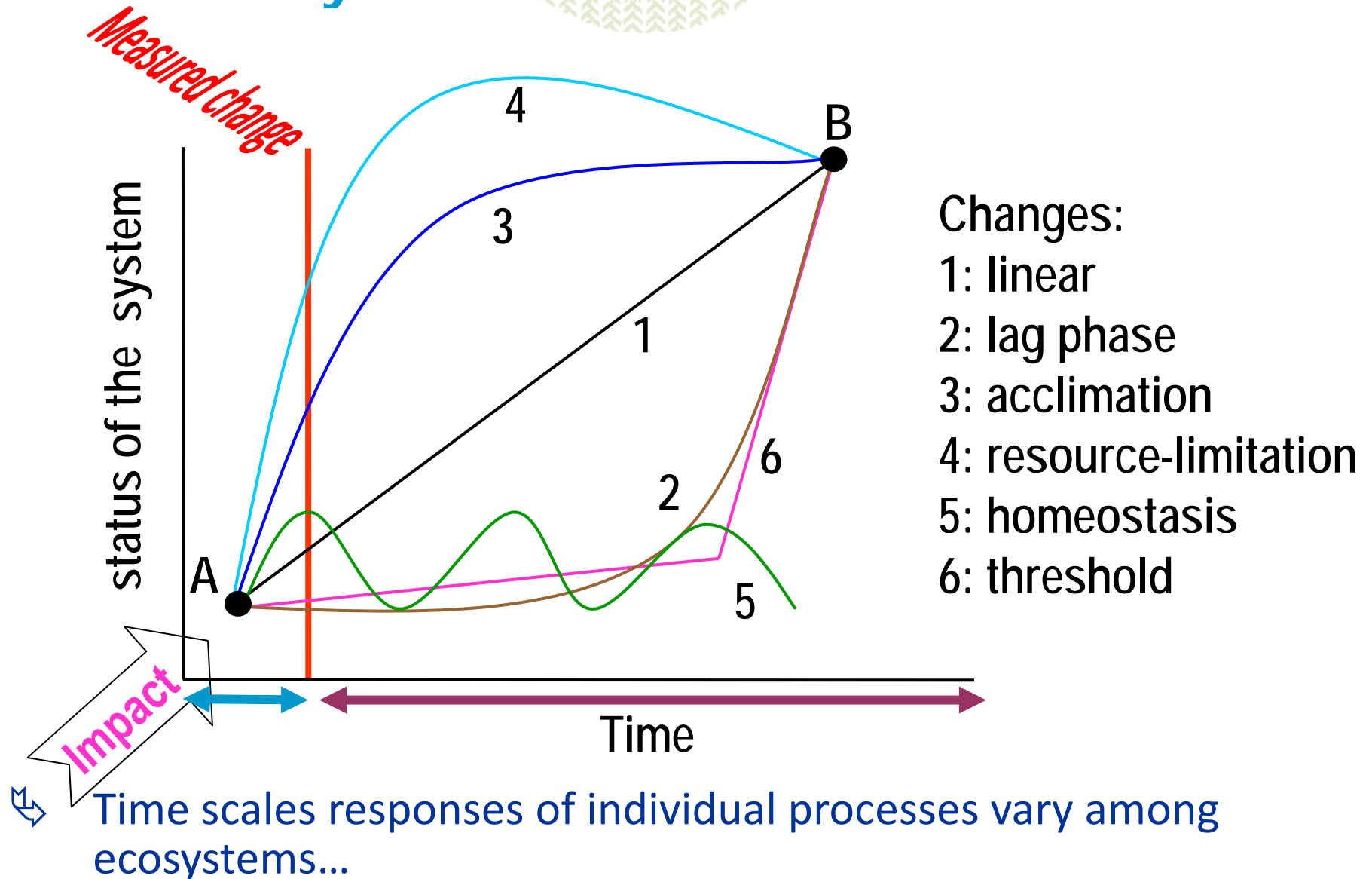


Major fields for research questions will remain:

- the mineralization and stabilization of soil organic matter, including changes in SOM composition,
- the impact of changing SOM levels and quality on the various soil functions (especially the production and ecological functions),
- the current status of understanding on the T°C dependence of decomposition of labile vs. recalcitrant SOM fraction,
- the impact of projected changes in the hydrological cycles, such as moisture impact on the decomposition,



Hypothetical trajectories for changes of a system from status A to B



Time scales responses of individual processes vary among ecosystems...

(according to Rustad, 2006, modified)



Ecosystem responses to disturbance and initial conditions!

- ➔ **Need to predict which *kinds* of ecosystems are more or less responsive to disturbance and to identify the characteristics of ecosystems that cause them to be more or less responsive**
- ➔ Stocks and initial turnover rates of labile carbon in the soil,
- ➔ Stocks and initial turnover rates of labile nitrogen in the soil,
- ➔ Relative size of the carbon pools of plants and soil,
- ➔ Dominant form of available nitrogen in the soil, (e.g., organic nitrogen, ammonium, nitrate),
- ➔ Soil water and precipitation regime,
- ➔ Chemical composition and turnover rates of live plant tissues and litter,



Need of perennial “master sites” across Europe

- ↪ from numerous temporary experimental sites funded by short term programs devoted to a single process or forcing variable,
- ↪ to a lower number of perennial sites with national and European secured funding providing high standards of experimentation and measurements for the analysis of the coupling between processes and of the interactions between forcing variables,



Research services and goals

↪ *Forecasting the impacts of **climate change**, **land use change** and **biodiversity** on *continental ecosystem**

- **Intensive measurements of ecosystem processes**

(biogeochemical cycles, biodiversity, soil functioning)

- **Experimental manipulation of at least one forcing variable**

(climate, chemistry, biodiversity, land use)



In situ plot level

infrastructures

In vitro large mesocosms

infrastructures

complemented by **analytical and modeling tools**



To achieve these overarching objectives

- ↪ In ***situ* experimental platforms** which meet specific research questions on the processes and their coupling,
- ↪ Develop a true experimental approach and studied the cascade of reactions and feedbacks that determine the dynamic responses of the system and their consequences on ecosystem services.



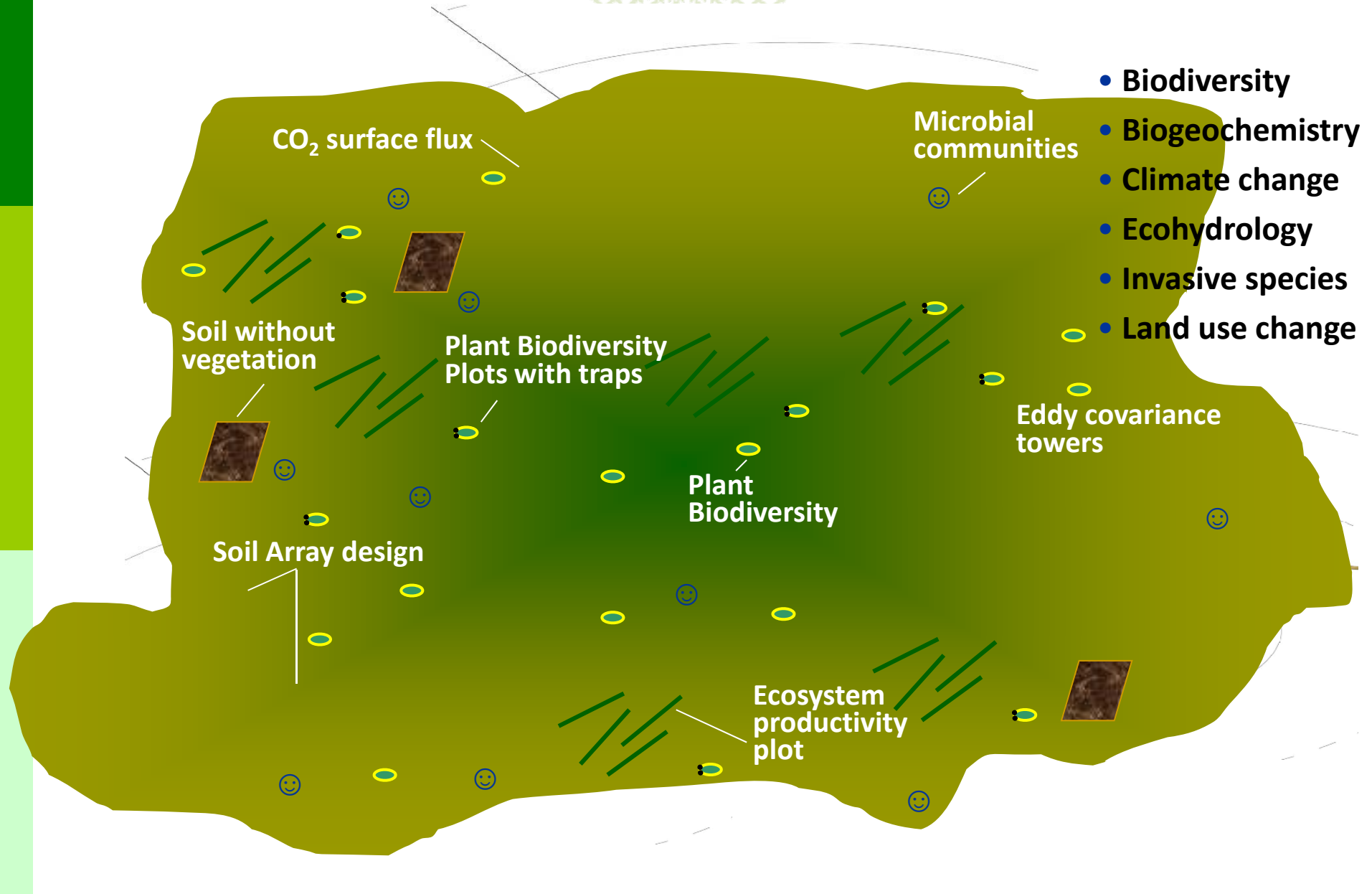
Monitoring vs experimentations

↪ “...existing monitoring networks, while useful for many purposes, are not optimized for detecting the *impacts* of climate and land use changes on ecosystems”

(Backlund et al., 2008).

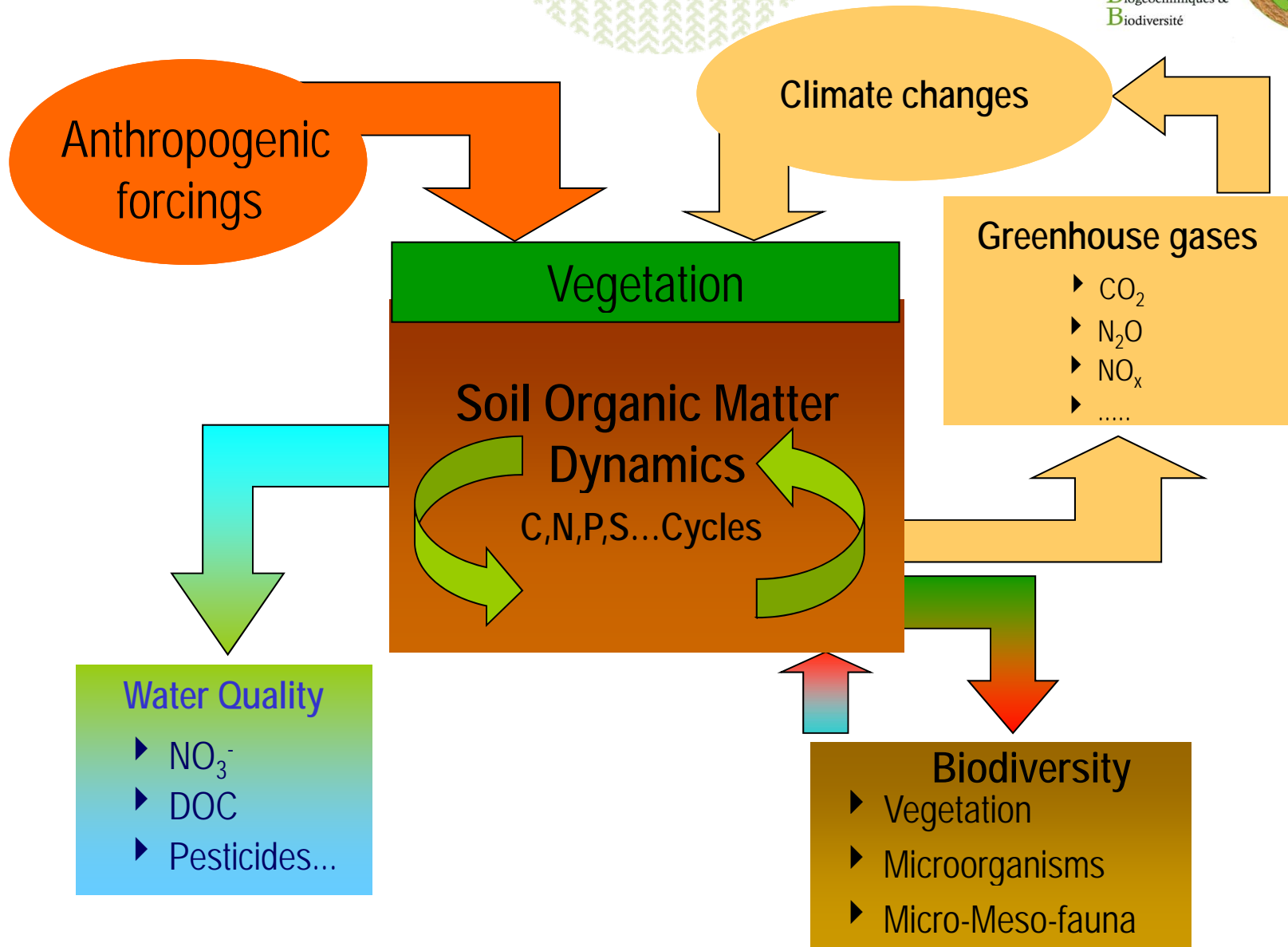


“Master sites” with well defined initial conditions



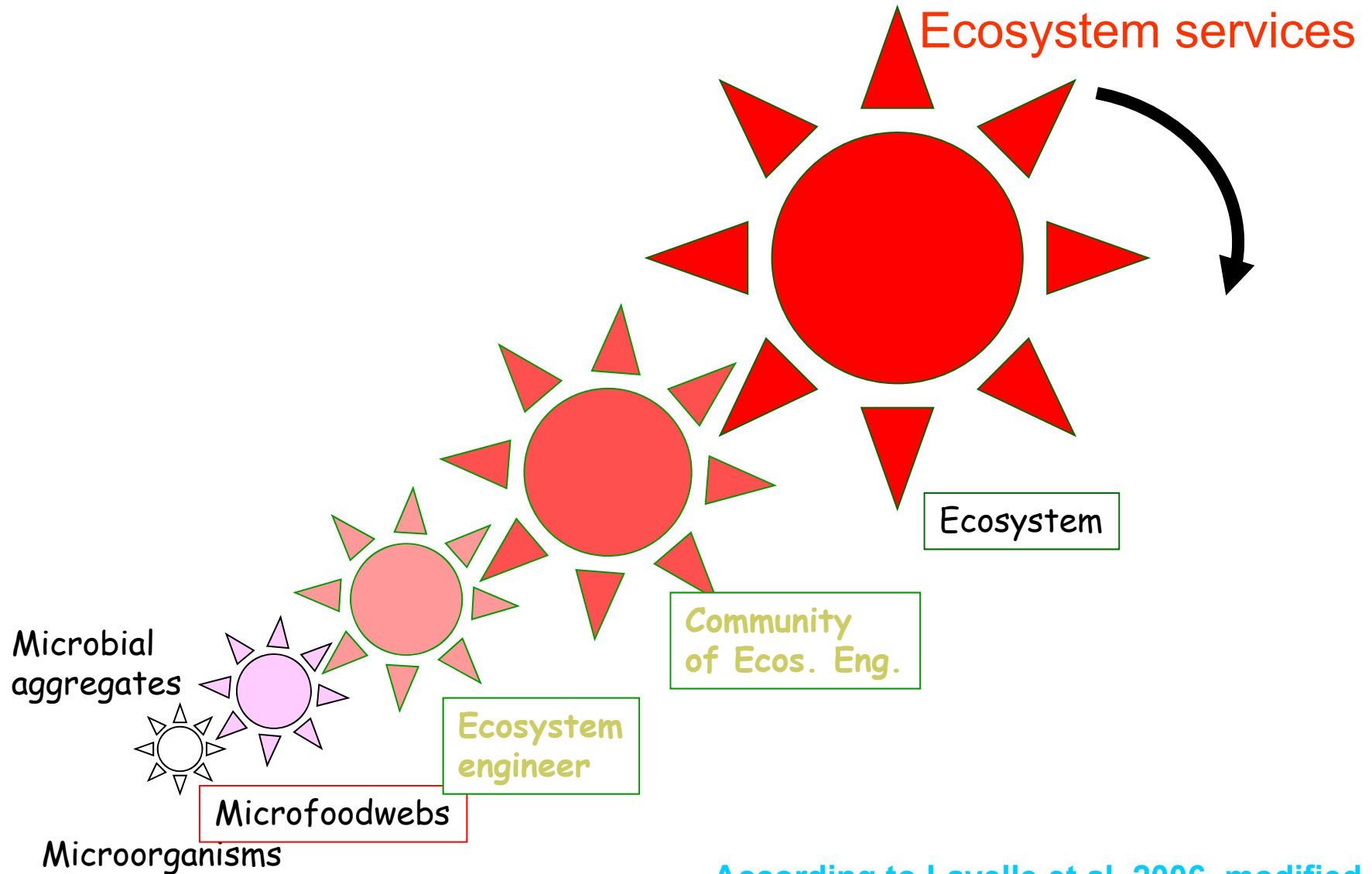


Grand Challenges





Self organizing systems and vulnerability of ecosystem services at different scales



According to Lavelle et al. 2006, modified



In “natura” platforms should allow

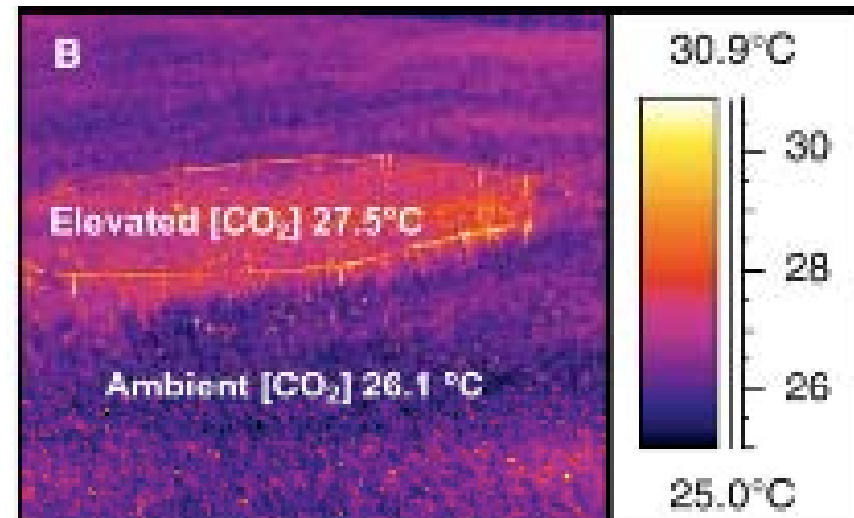
- ↪ Experimental manipulations on the long-term forcing variables based on a rigorous experimental design for a geostatistical analysis;
- ↪ Recording the trajectories of evolution of different state variables for the different experimental treatments as well defined;
- ↪ Direct or indirect measurement of the main fluxes to the atmosphere and hydrosphere;
- ↪ Analysis of SOM component, plant and soil fauna biodiversity;
- ↪ Collection and archiving samples of soil, vegetation, and living organisms;
- ↪ support experiments that accelerate changes towards anticipated future conditions (*enable ... forecasting*).



Terrestrial Accelerator

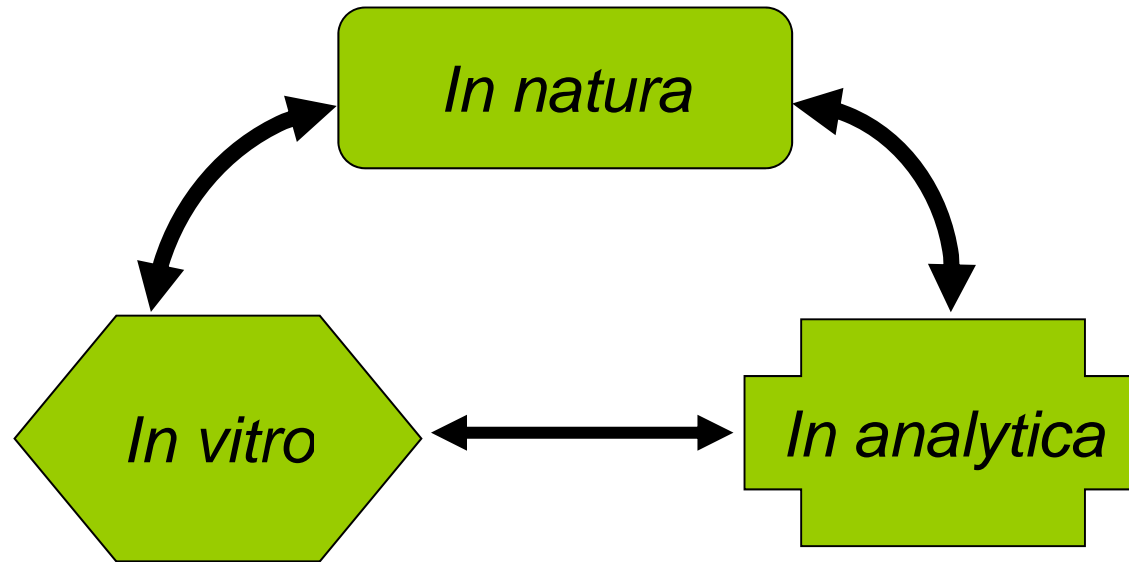
change conditions to those resembling forecast future conditions, for example, by artificially:

- **Warming temperatures,**
- **Global Change Experiment (GCE)**
 - stand level
 - 1 engineering prototype location in low stature vegetation
 - Options: CO₂ ambient, 750 ppm
 - Options: T (ambient, + 4°C)



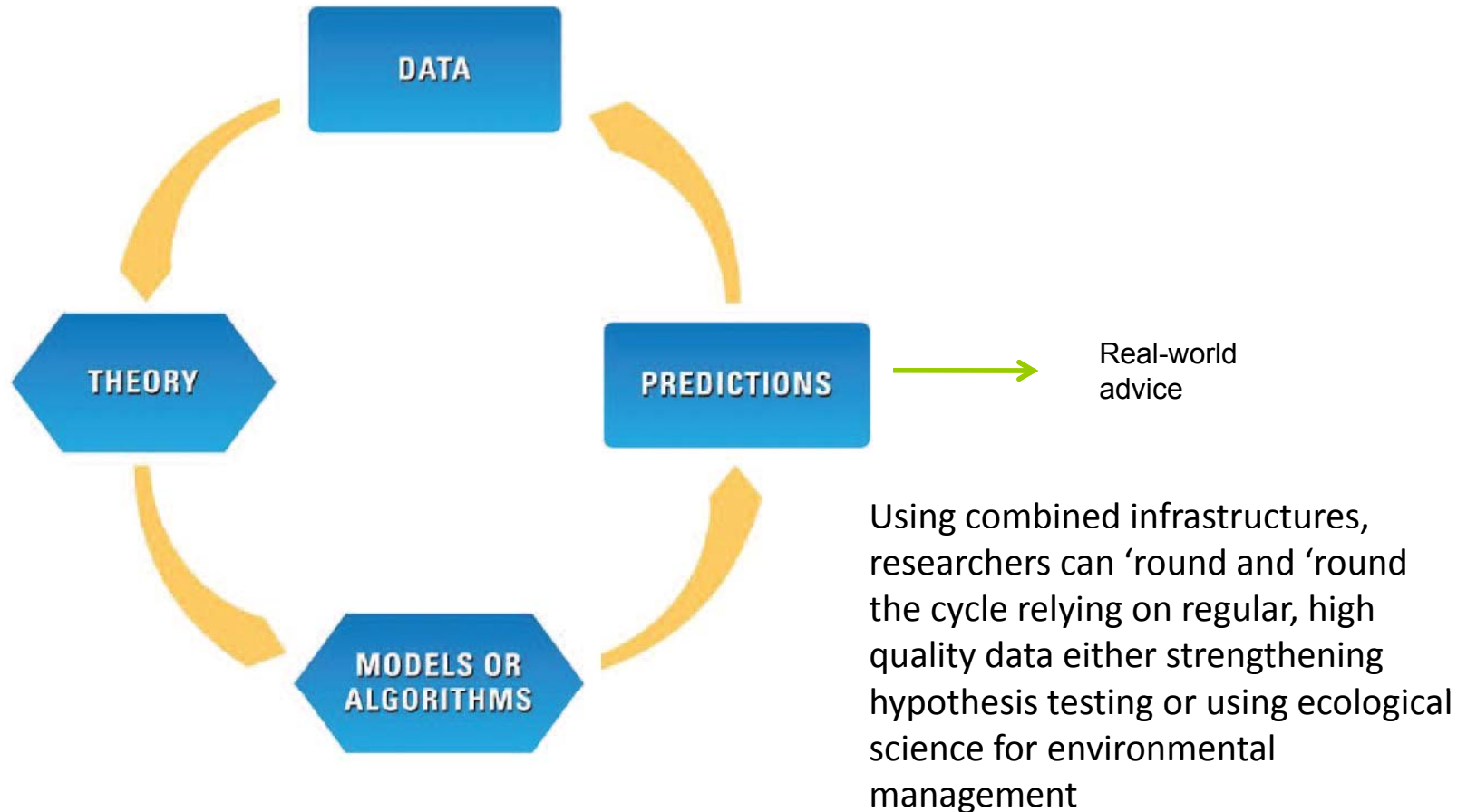


Approach and synergy





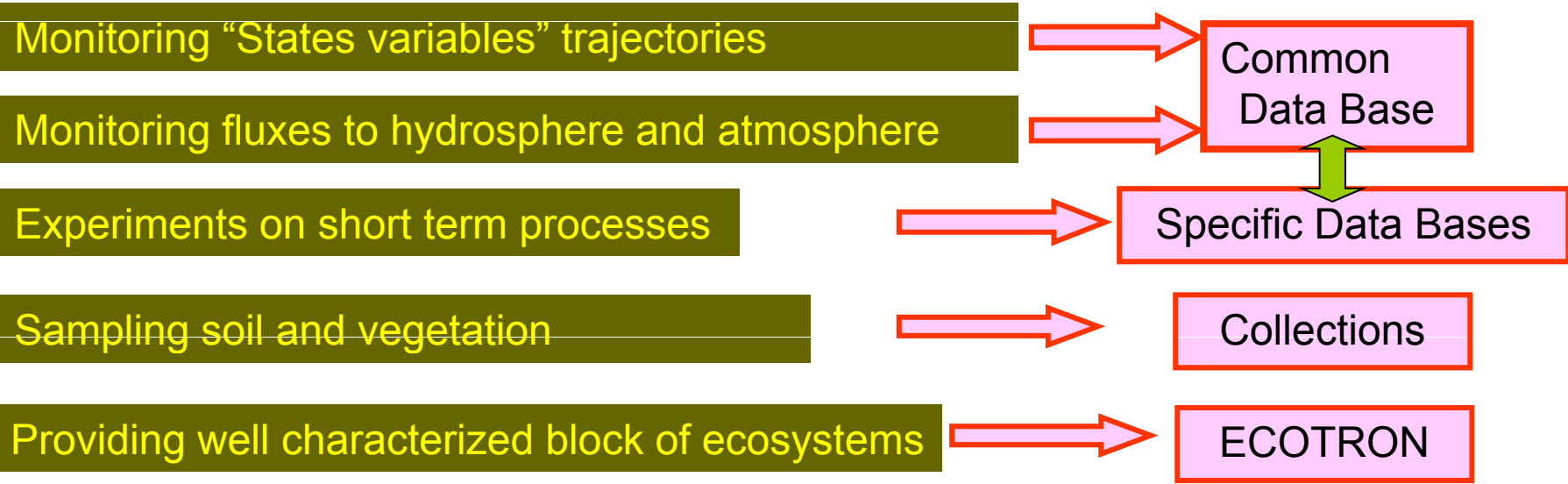
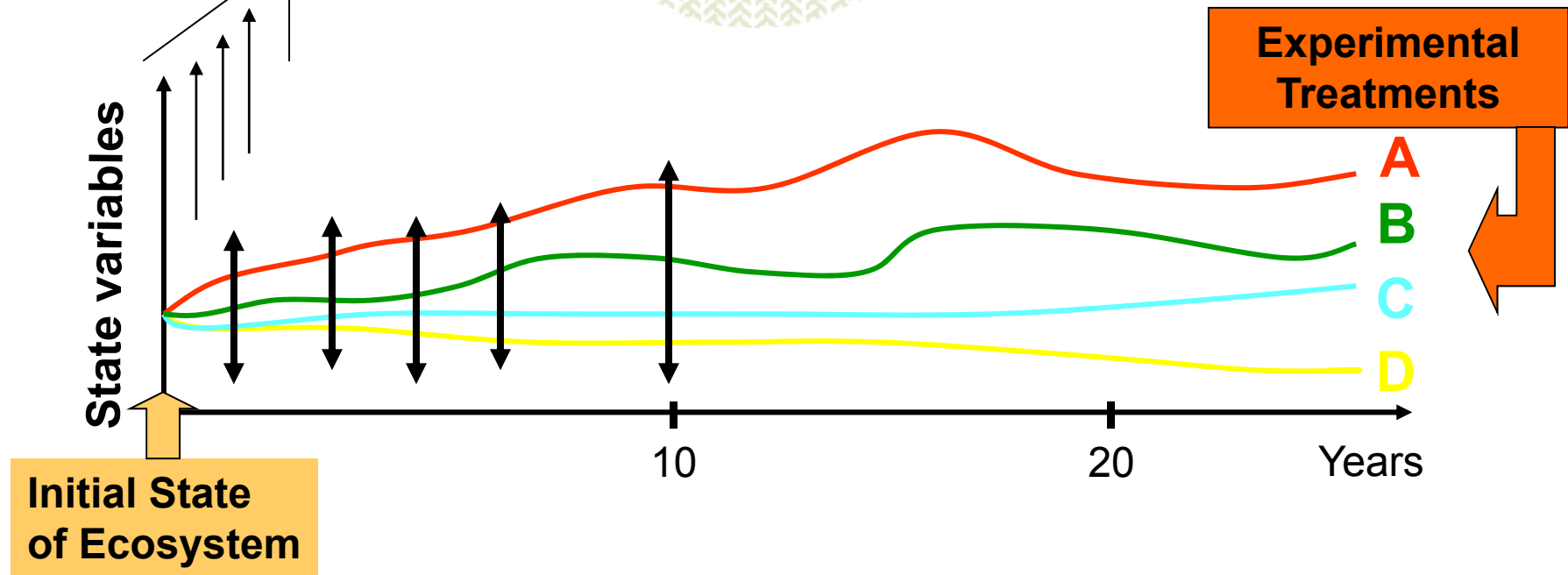
Forecasting and hypothesis testing using the in natura platforms



Courtesy: Dave Schimel, Boulder, USA



What in *natura* platforms have to produce and to offer ?





**Thank you
and keep coming together**