

Fixed and flexible

– lessons learned from two decades of monitoring at Zackenberg

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Back in 1991...

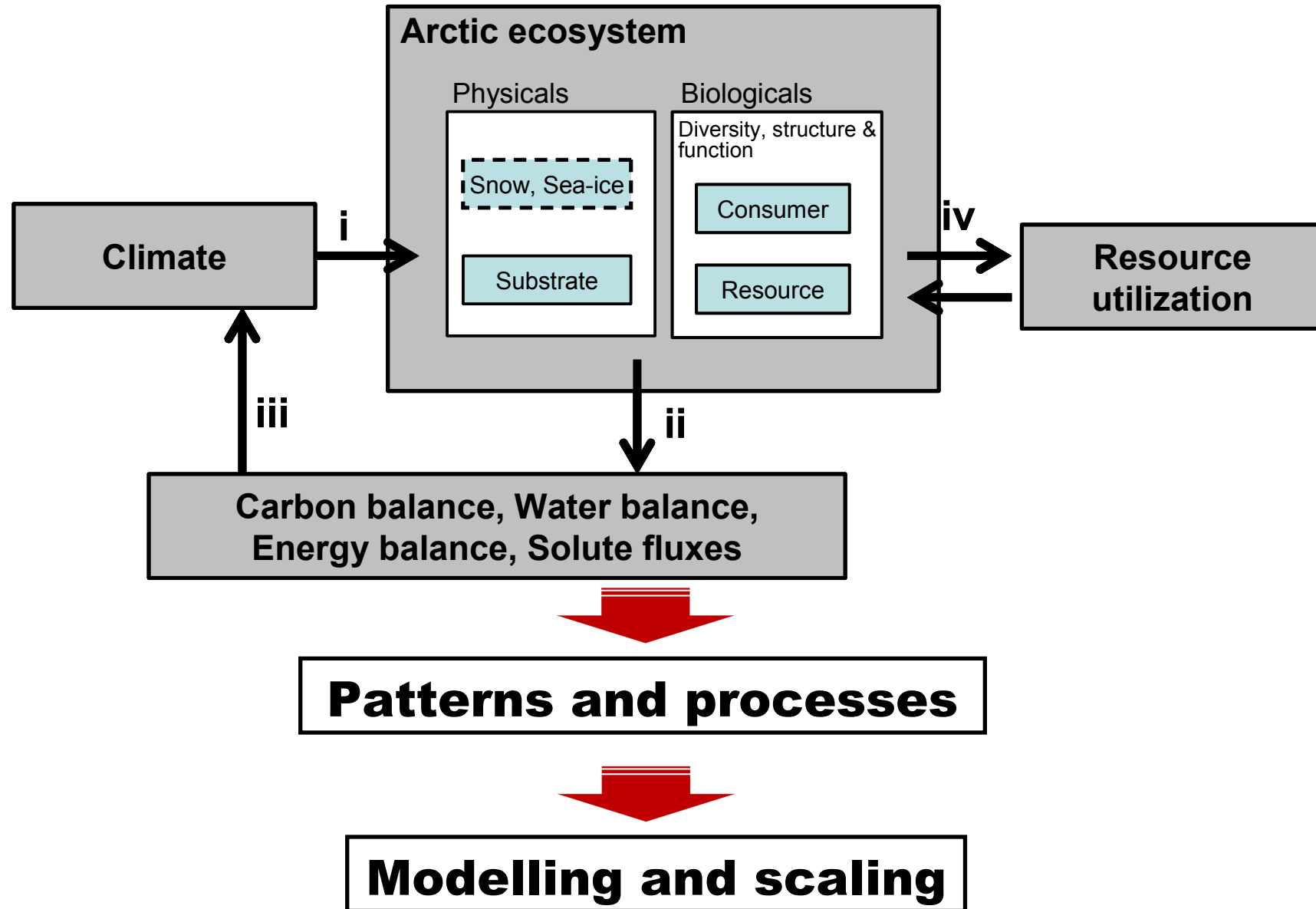
'For the next fifty years we will measure the effects of climate variability on arctic ecosystems. These measurements will be used as a reference, or a ZERO-line, when climate starts to change.'

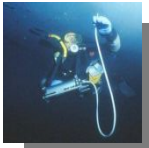
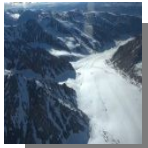
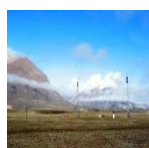
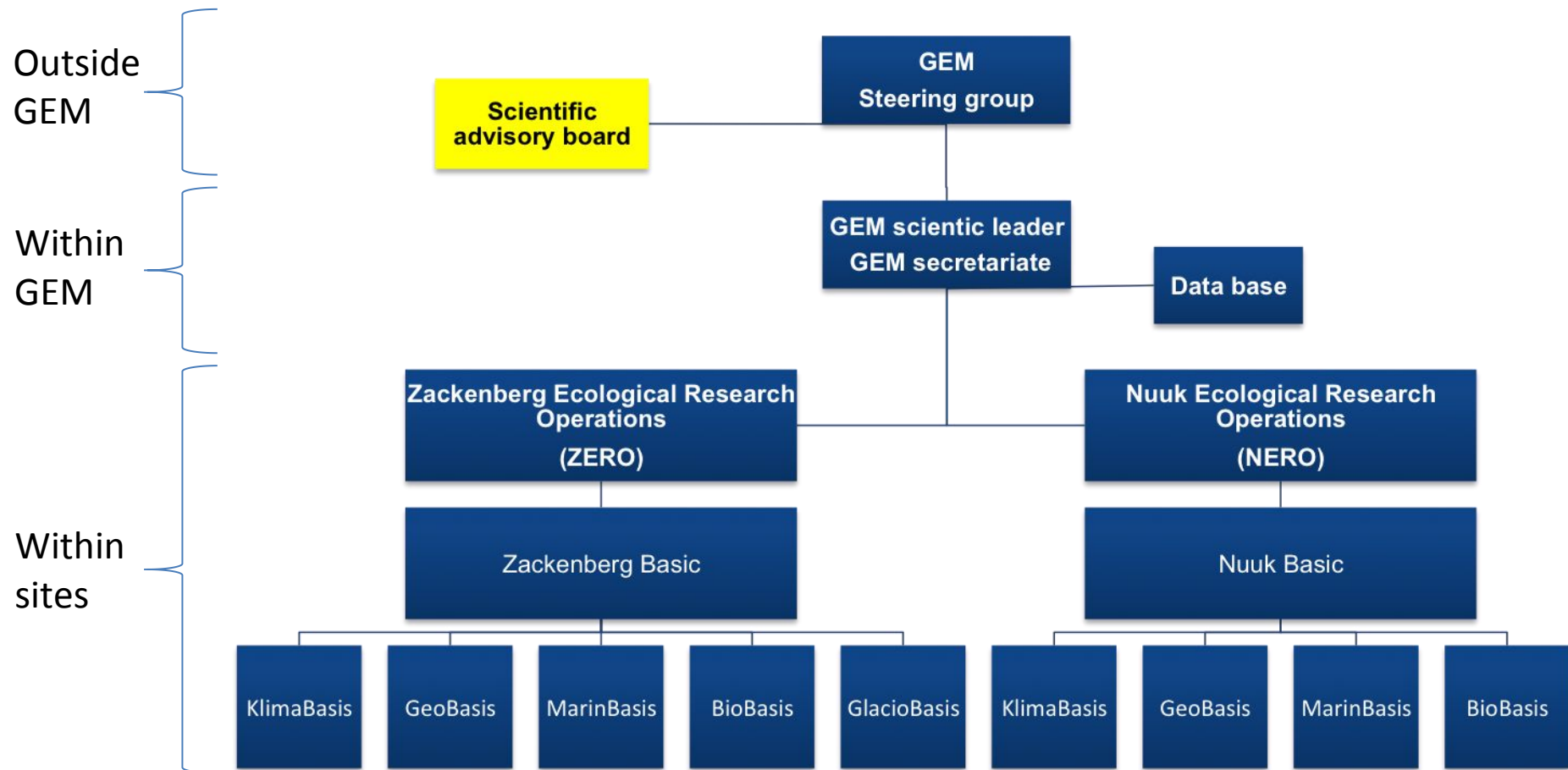


- Bottom-up
- Shaped by few, enthusiastic persons
- Ecosystem approach

Ecosystem-based monitoring

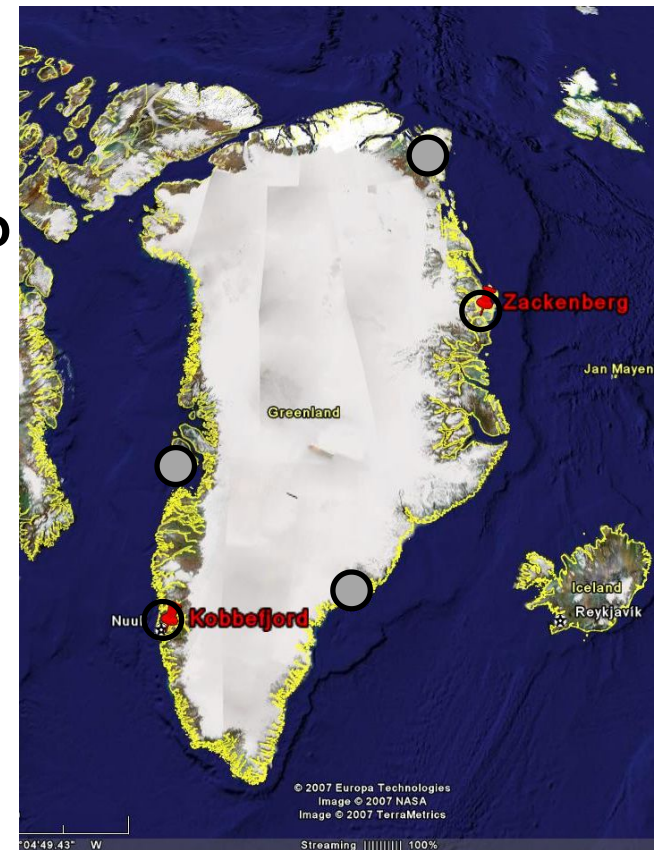
- Implement all AMAP recommendations
- Monitoring that incorporates major focal elements *and* their likely drivers (biotic and abiotic)
- Based on conceptual models
- + "things we measure because we are there anyway and the only ones who to do so in high arctic Greenland"
- Ambition: As many probes as possible
- Result: More than 3500 parameters annually





Original main questions

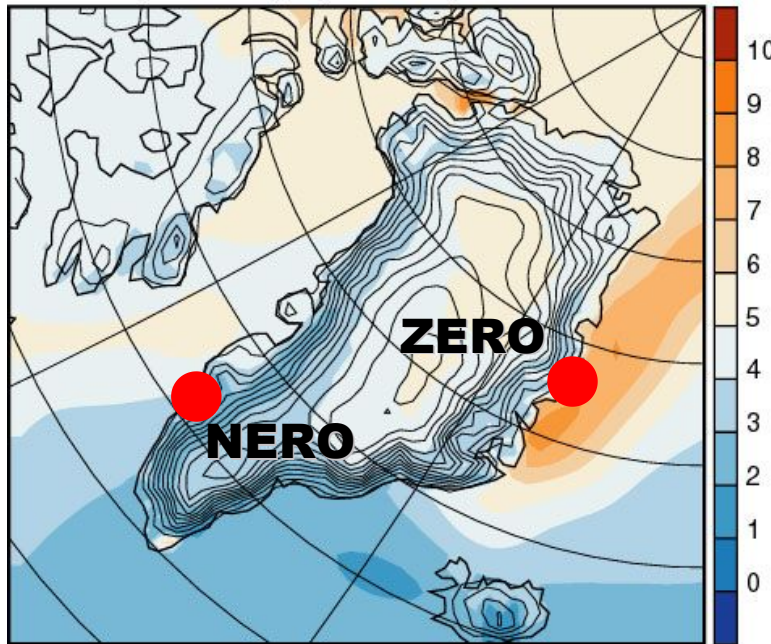
- How and why does climate variability influence the dynamics of arctic ecosystems?
- How do arctic ecosystems affect climate?



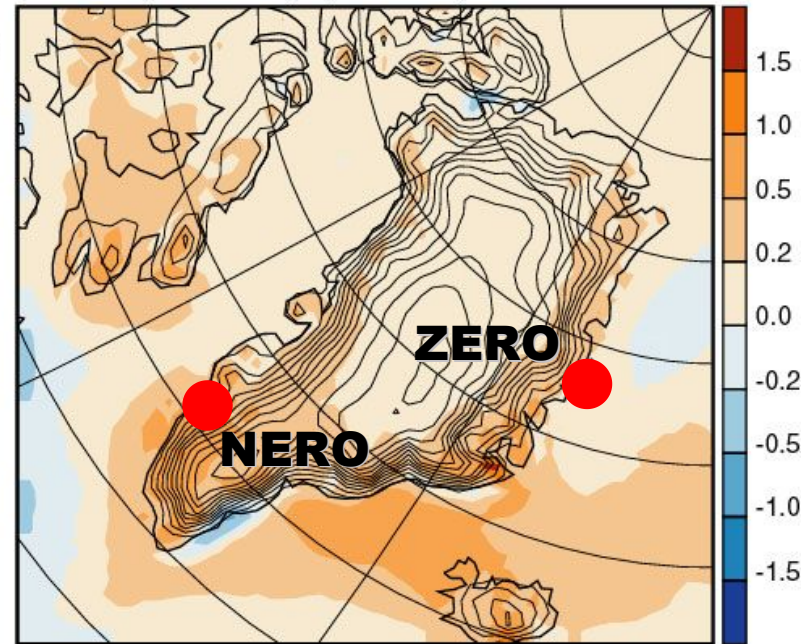
Representativeness



HIRHAM4 (2071-2100) – (1961-1990) scB2



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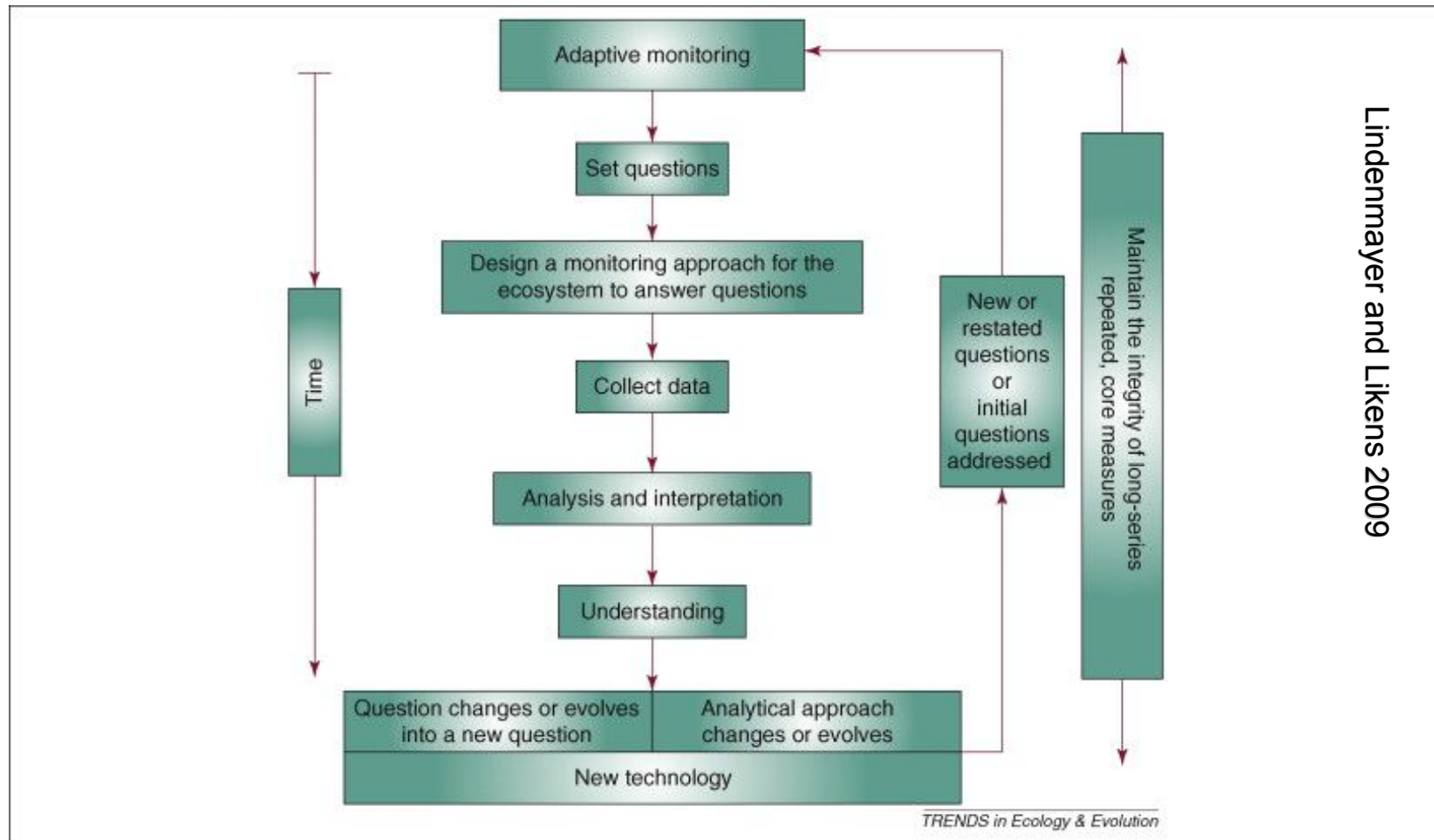
Representativeness

- What does Zackenberg represent?
 - Logistical and scientific compromise
 - High arctic Greenland
 - Relatively diverse
 - Relatively productive
 - Knowing everything about nothing (and *vice versa*)
 - Identification of central ecosystem parameters og processes

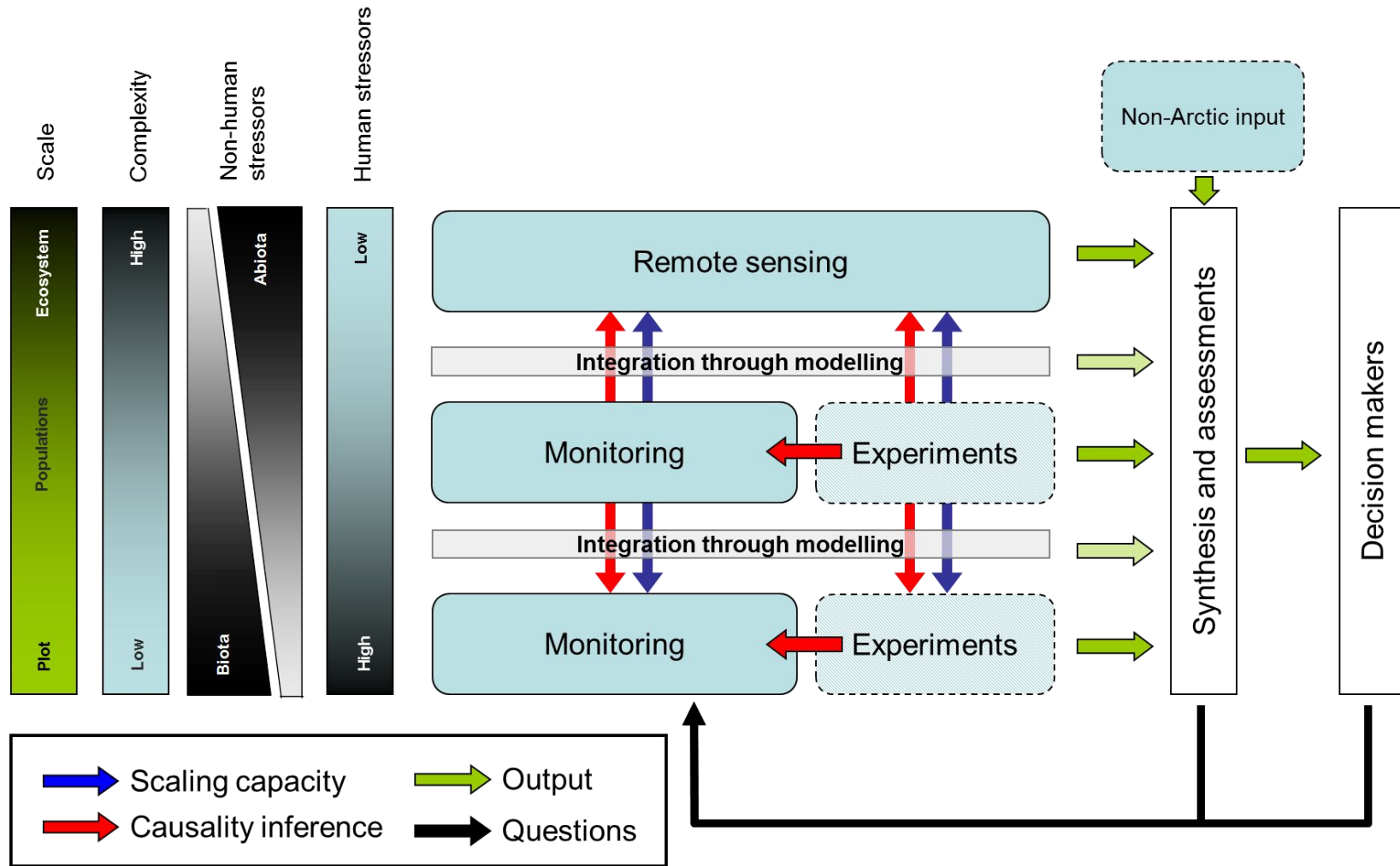
Representativeness

- How to increase spatial and temporal coverage?
 - Remote sensing
 - Modelling
 - Gradients
 - Establish (automatic) satellite stations
 - Collaborative studies (e.g. IPY, CBMP)
 - Be part of relevant international networks

Adaptive monitoring



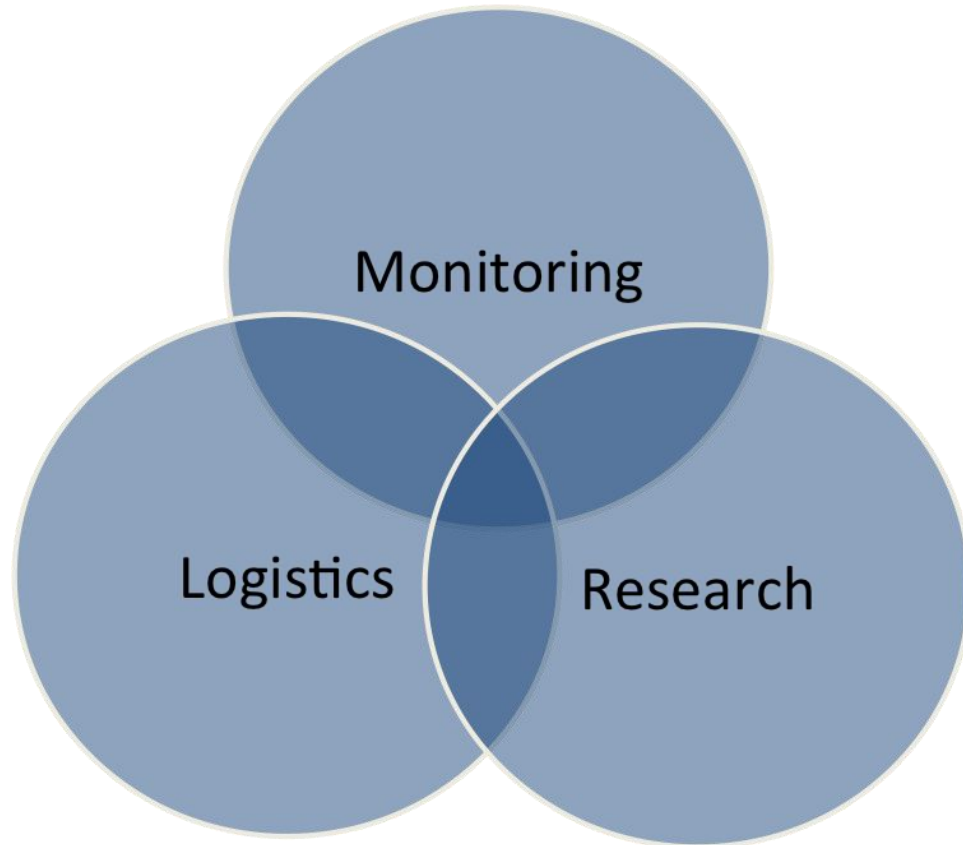
Adaptive approach



Adaptive monitoring at Zackenbergl

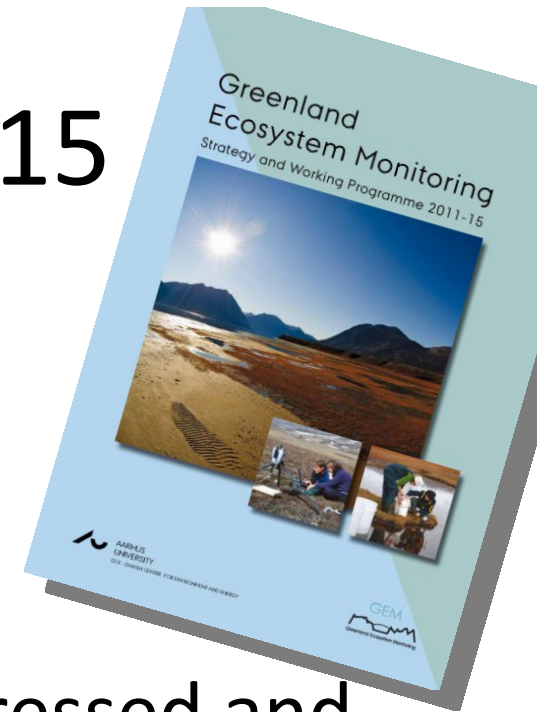
- Monitoring (pattens)
- Research projects (processes)
- Additional adaptations based on
 - Publications
 - Repeated evaluations
 - Internal
 - External
 - Development of working programs and strategies
 - External (incl. stake-holder) input

Adaptive approach



GEM strategy 2011-15

- Based on a system approach with clear definition of the system
- Question based (more narrow ;0)
- Evaluation of questions being addressed and parameters being measured at regular intervals
- Involvement of relevant stakeholders – together with the scientists - in definition of relevant questions to be addressed



Lessons learned

- Detailed knowledge of arctic ecosystem pattern and processes ;0)
- It takes time....
- Develop and maintain detailed protocols
- Secure proper structure
 - Scientific leadership and profile
 - Develop strategies (collaborative, adaptive effort)
 - Data management structure
- Secure subprogram integrity
- Ensure inter-disciplinary/subprogram collaboration
 - Relevant metrics

Lessons learned

- Communicate
 - scientific as well as public outreach
 - stake-holders
- Secure long-term funding
- Be fixed but flexible
 - Maintaining core time series while being adaptive
 - *Long* time series are highly needed and extremely valuable
 - Choose your adaptive approach - be prepared to quit, adjust or add things along the way

All successful collaboration starts with people enjoying each others company

