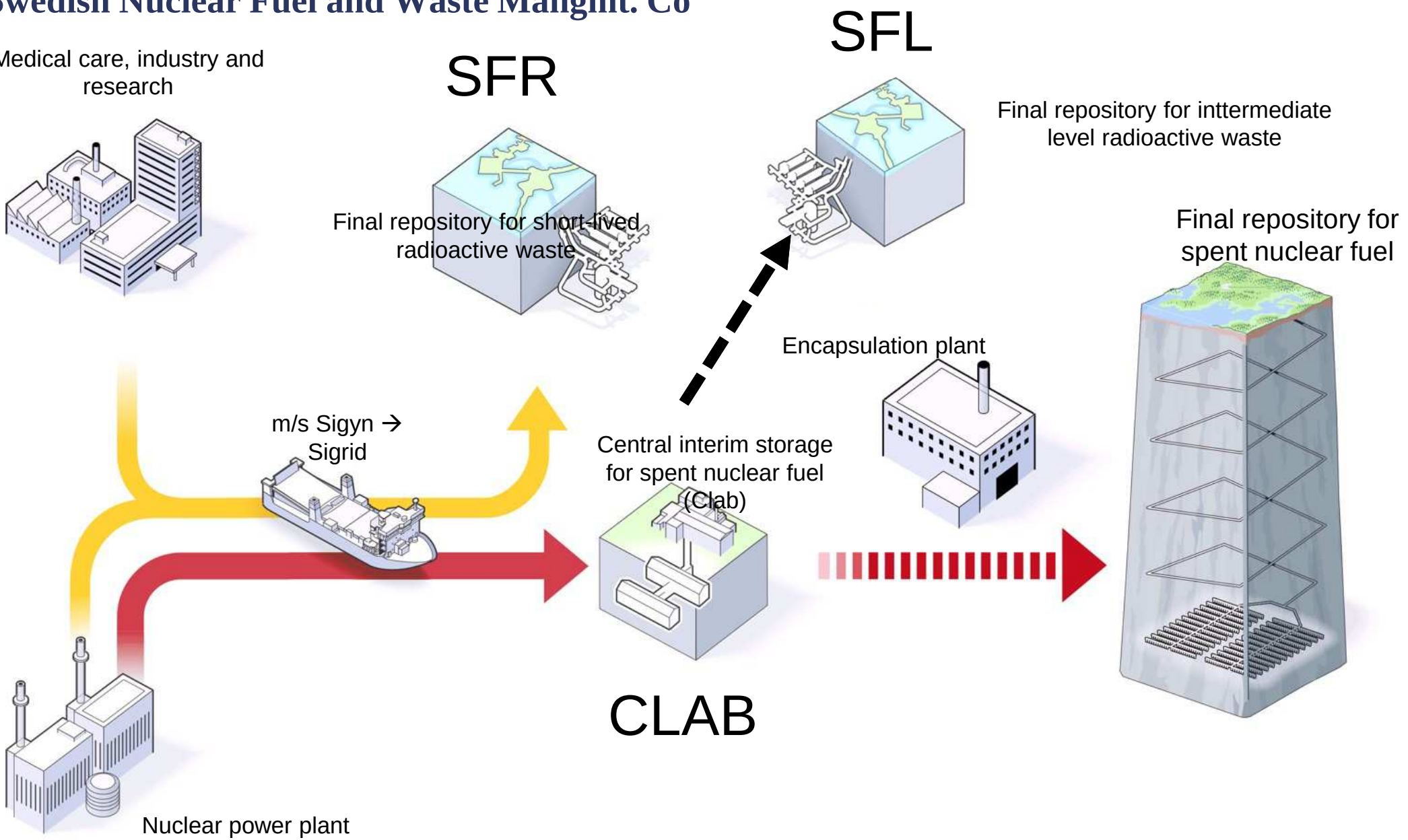
Really long term radiological assessment of ecosystems and humans

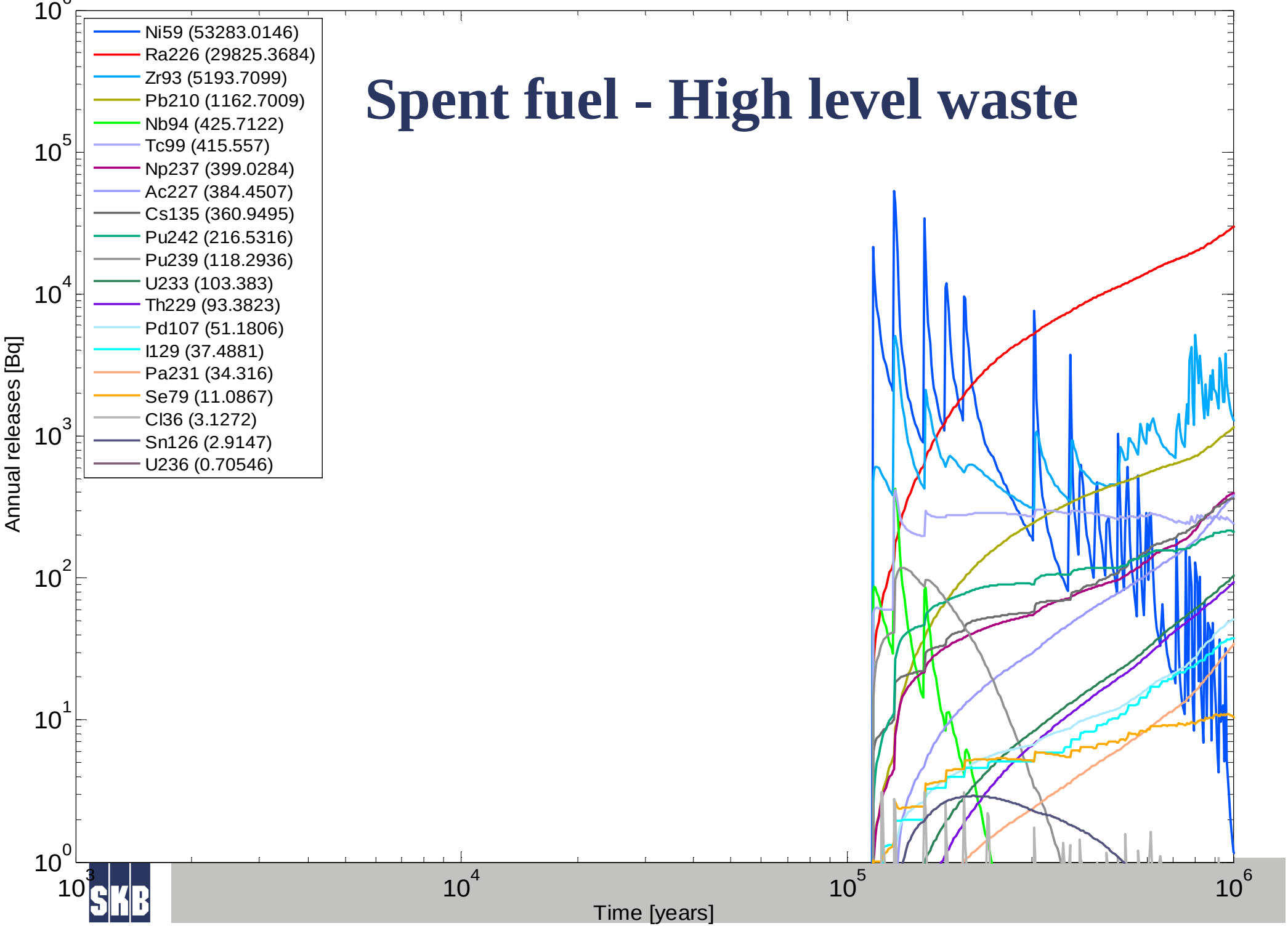
Ulrik Kautsky

SKB's system

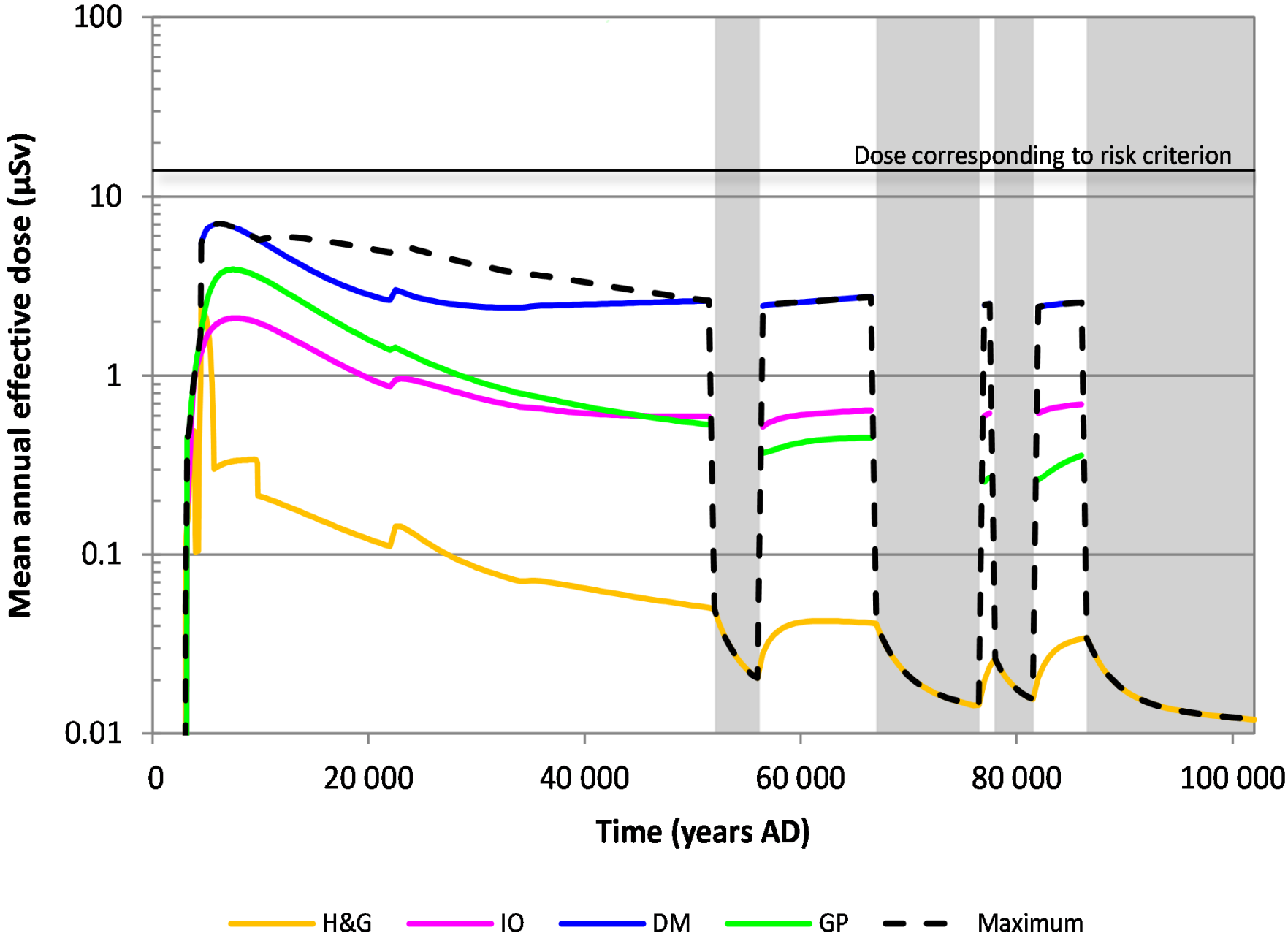
Swedish Nuclear Fuel and Waste Mangmt. Co



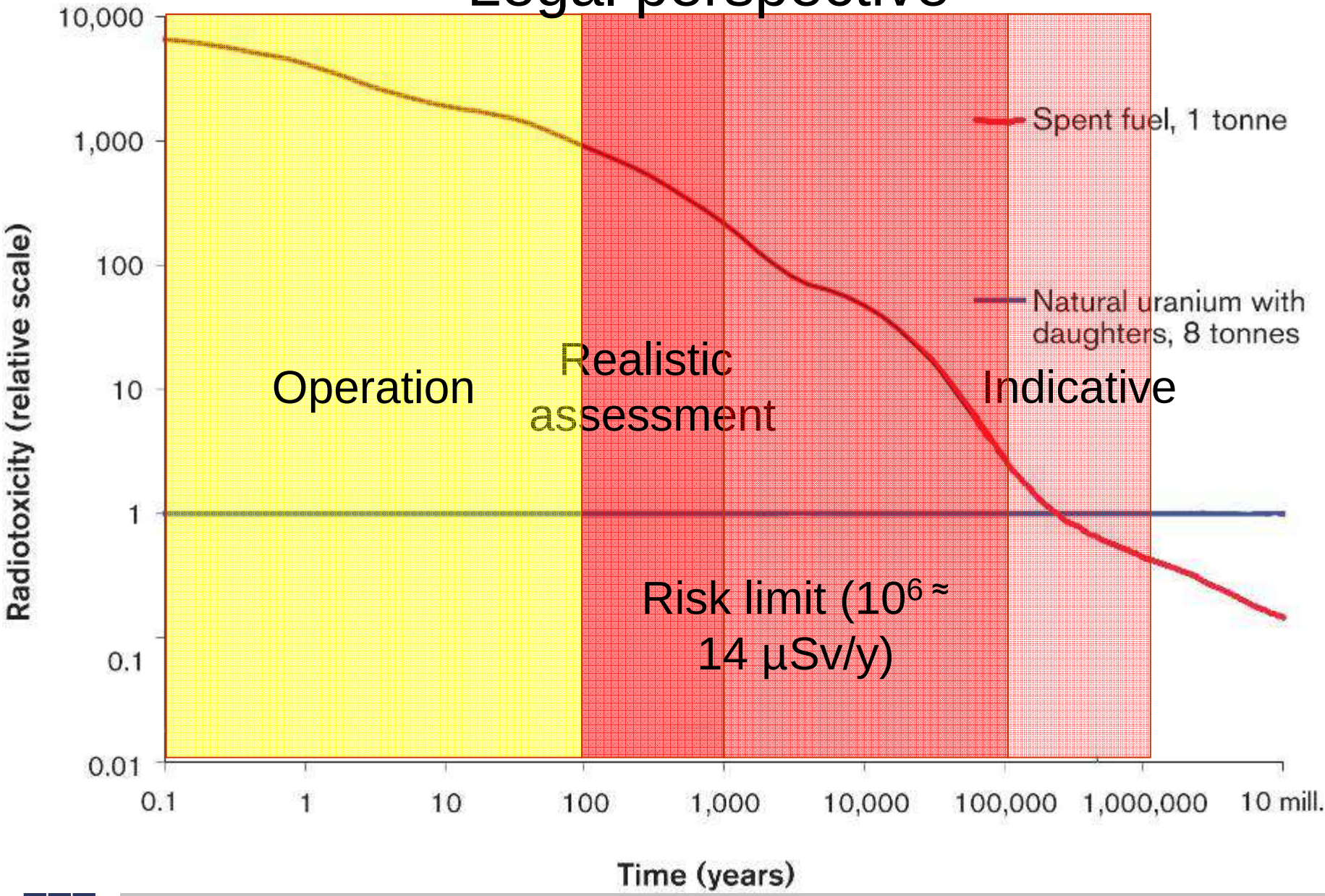
Spent fuel - High level waste



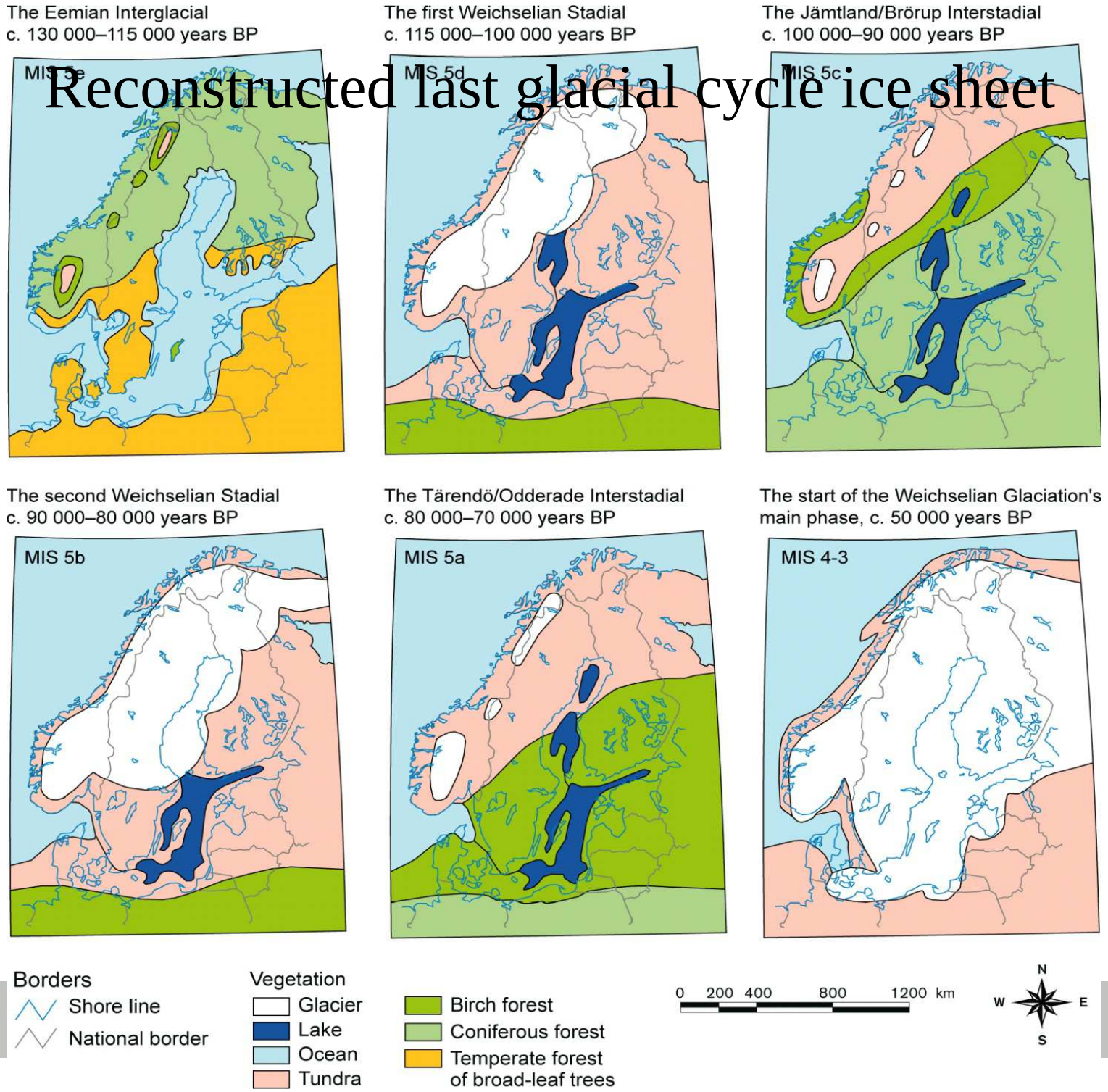
SFR - low level waste



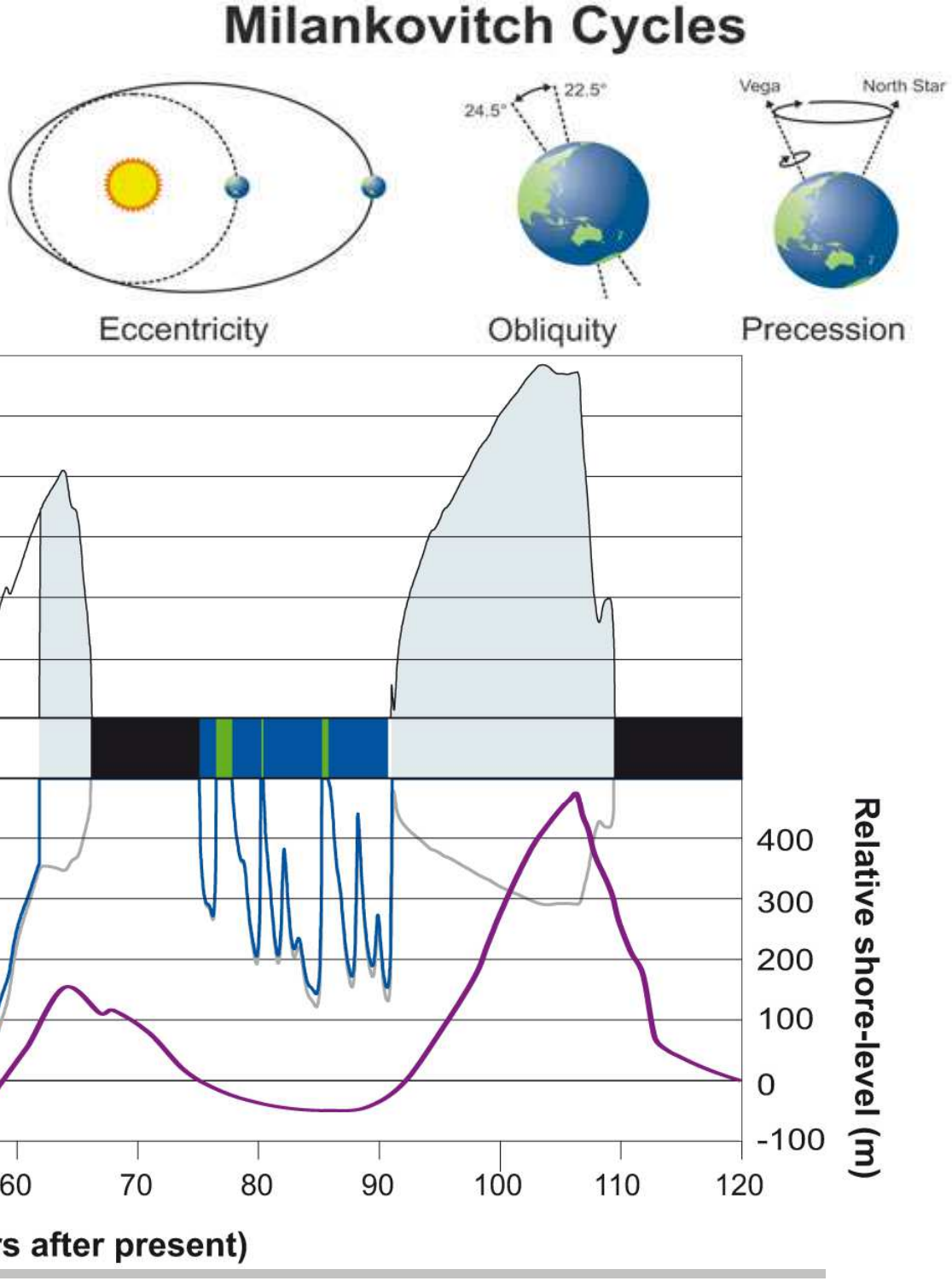
Legal perspective

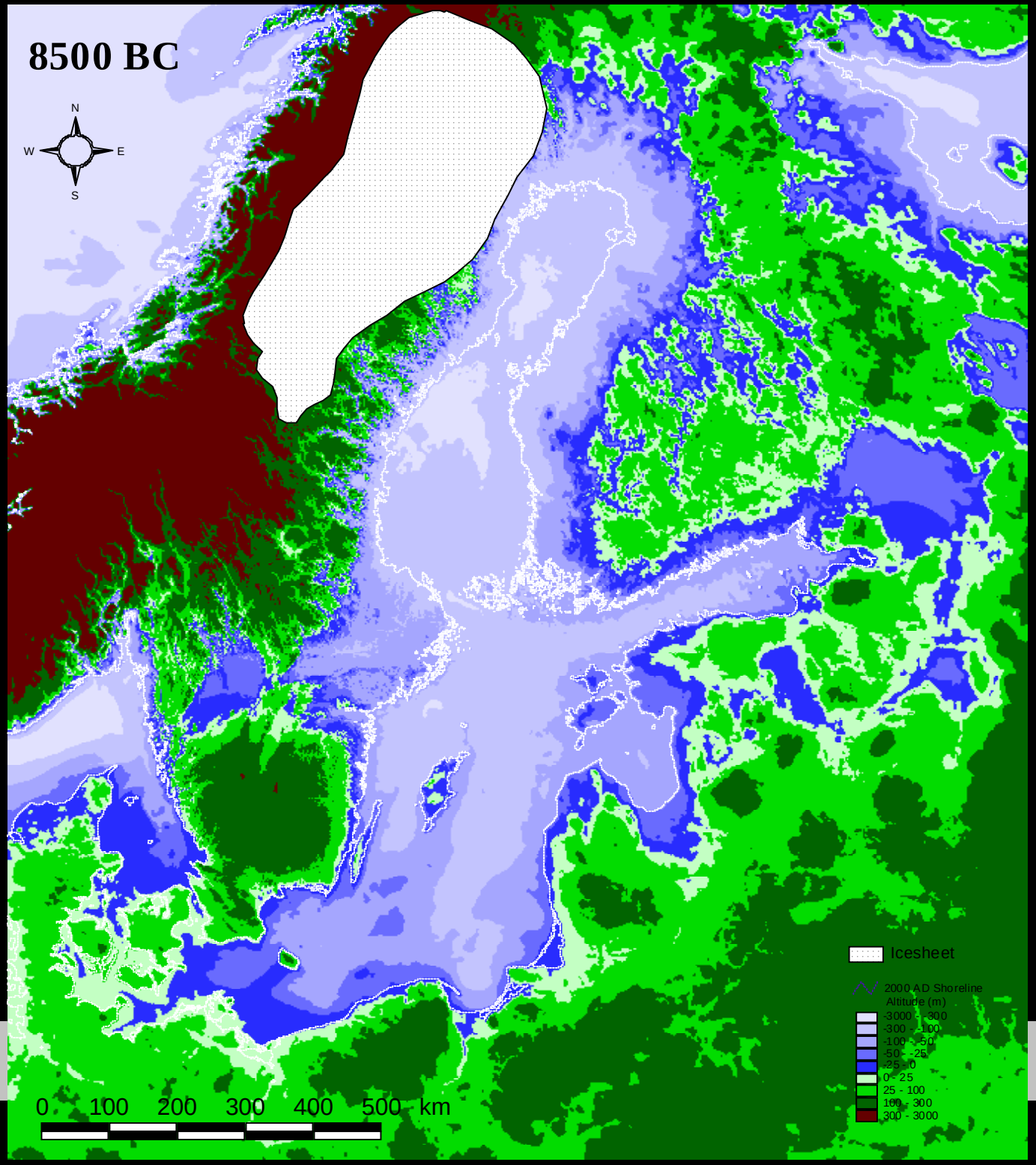


Reconstructed last glacial cycle ice sheet

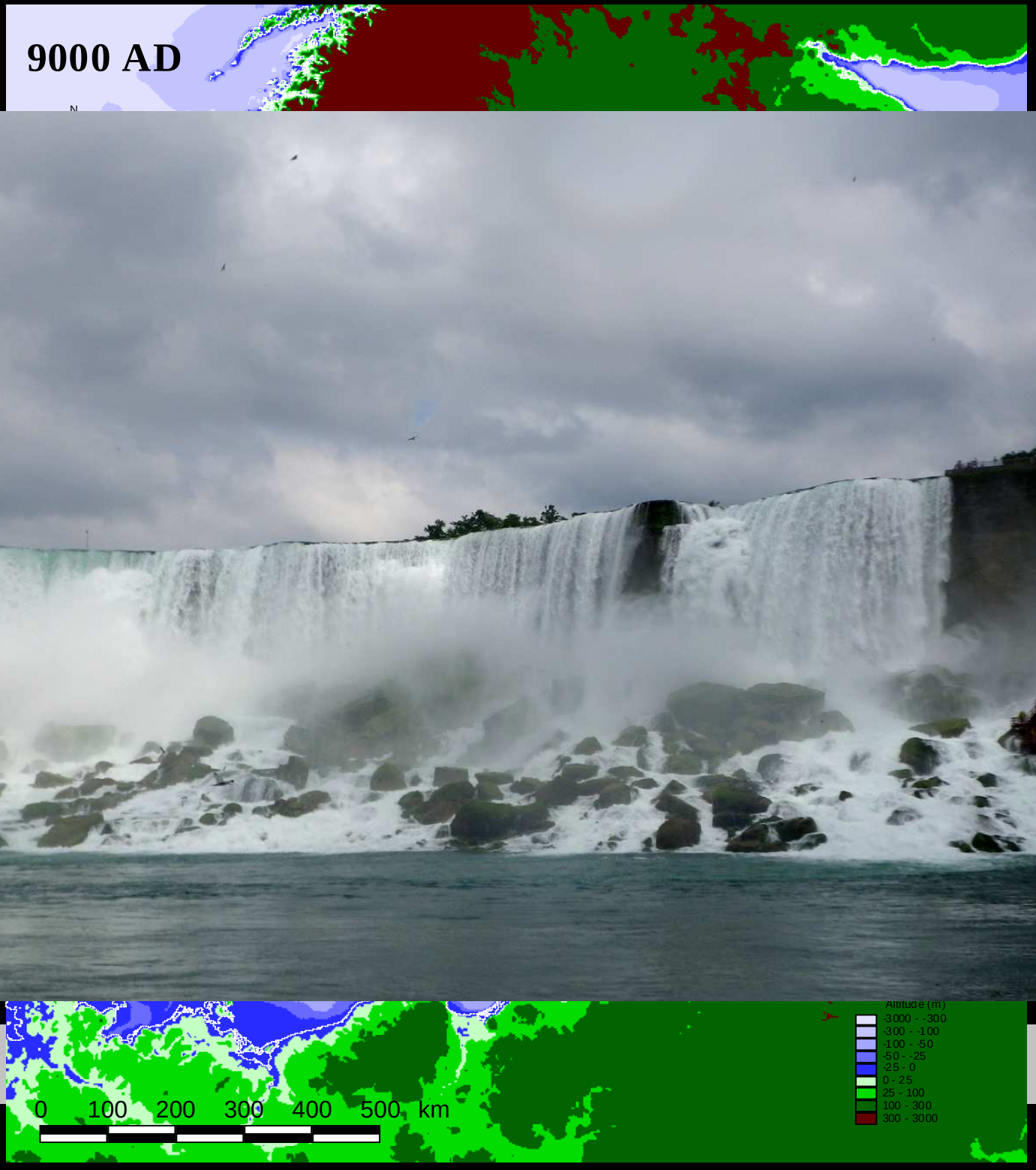


Future climate without green-house





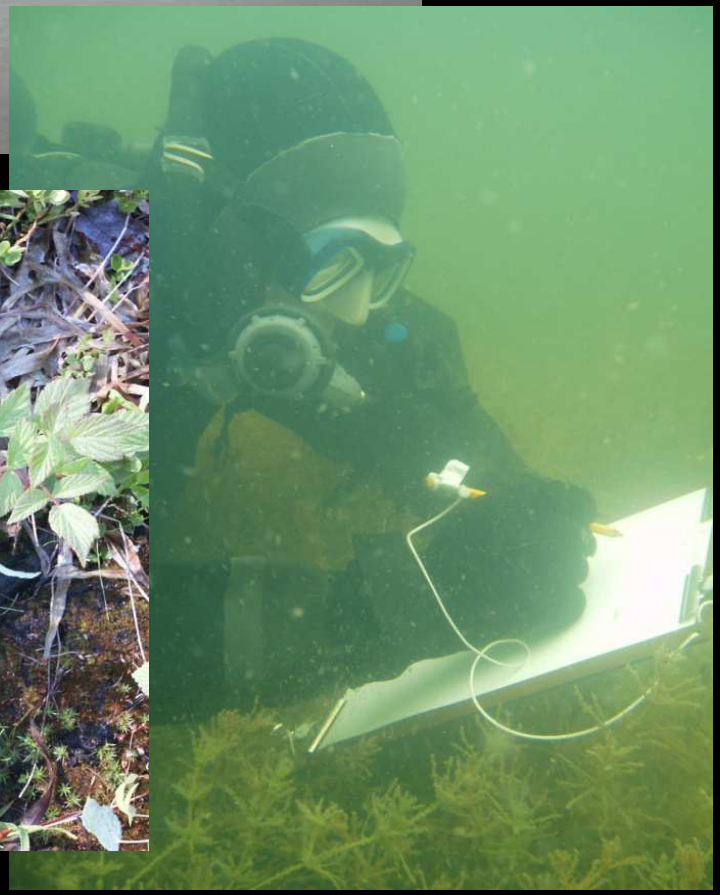
We learn from the past


9000 AD
N
0 100 200 300 400 500 km
Altitude (m)
-3000 - -300
-300 - -100
-100 - -50
-50 - -25
-25 - 0
0 - 25
25 - 100
100 - 300
300 - 3000

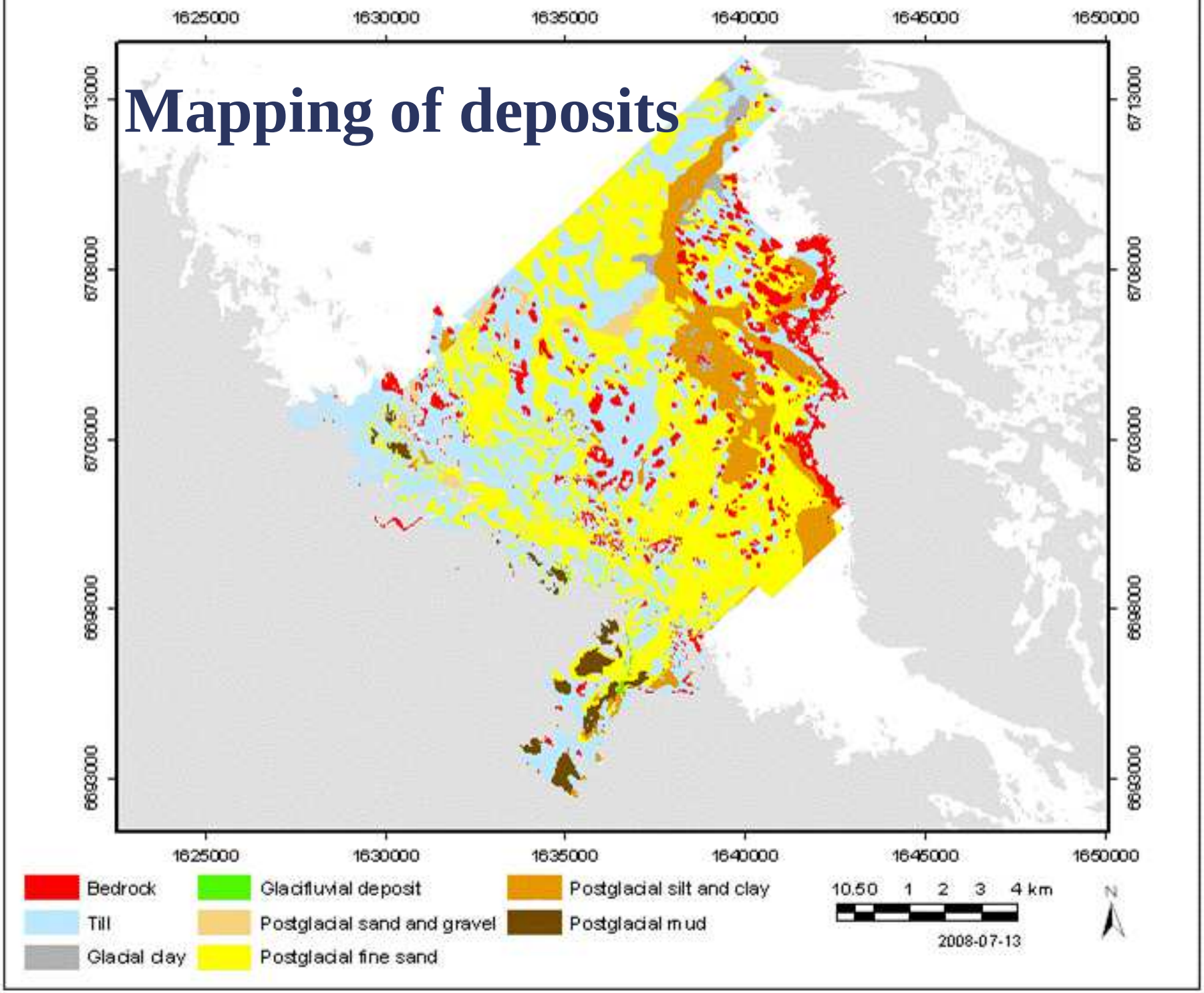
the
e

SFR facility, SR-PSU safety assessment

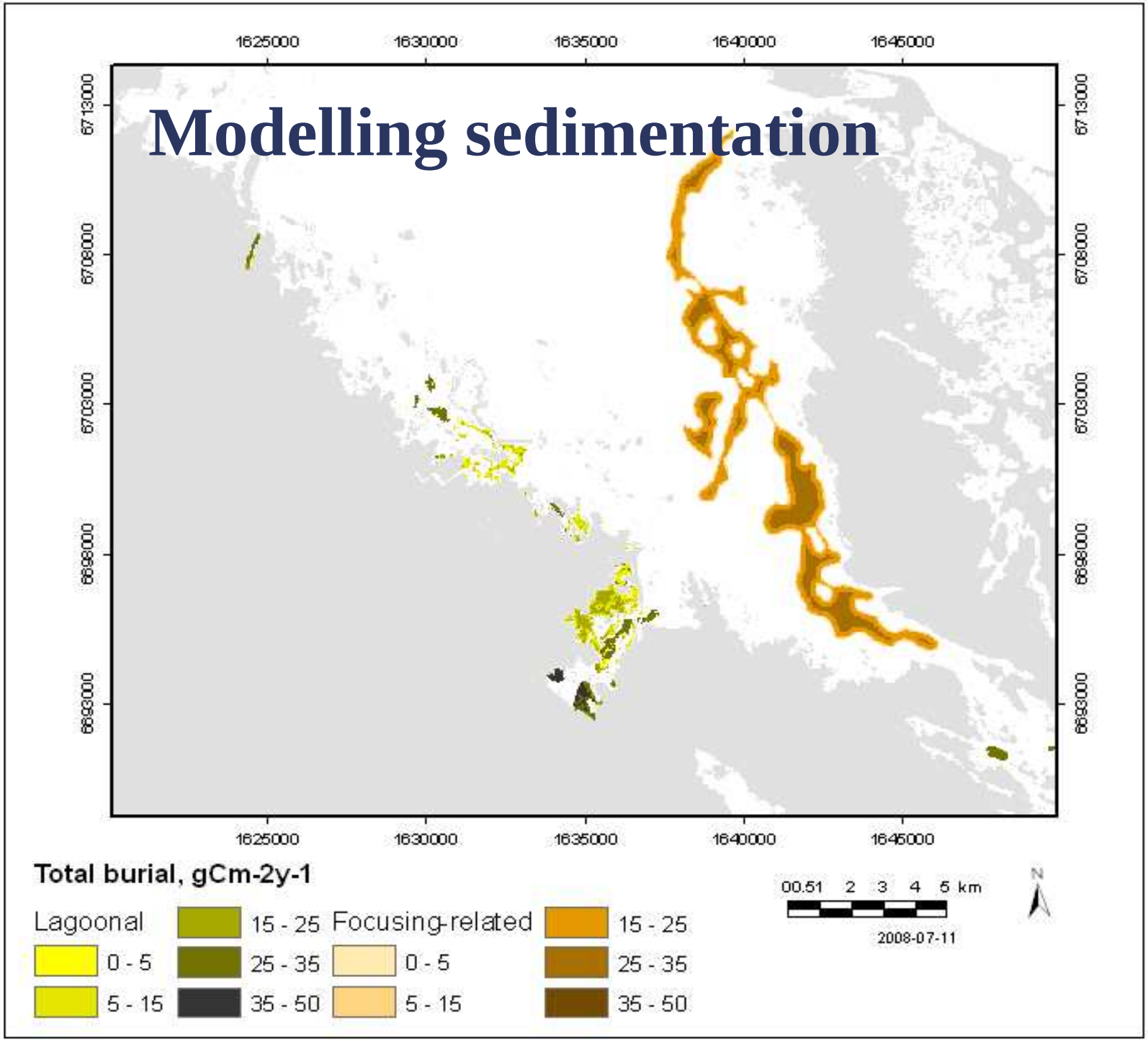
Site investigations 2001-2011 for high level repository



Mapping of deposits



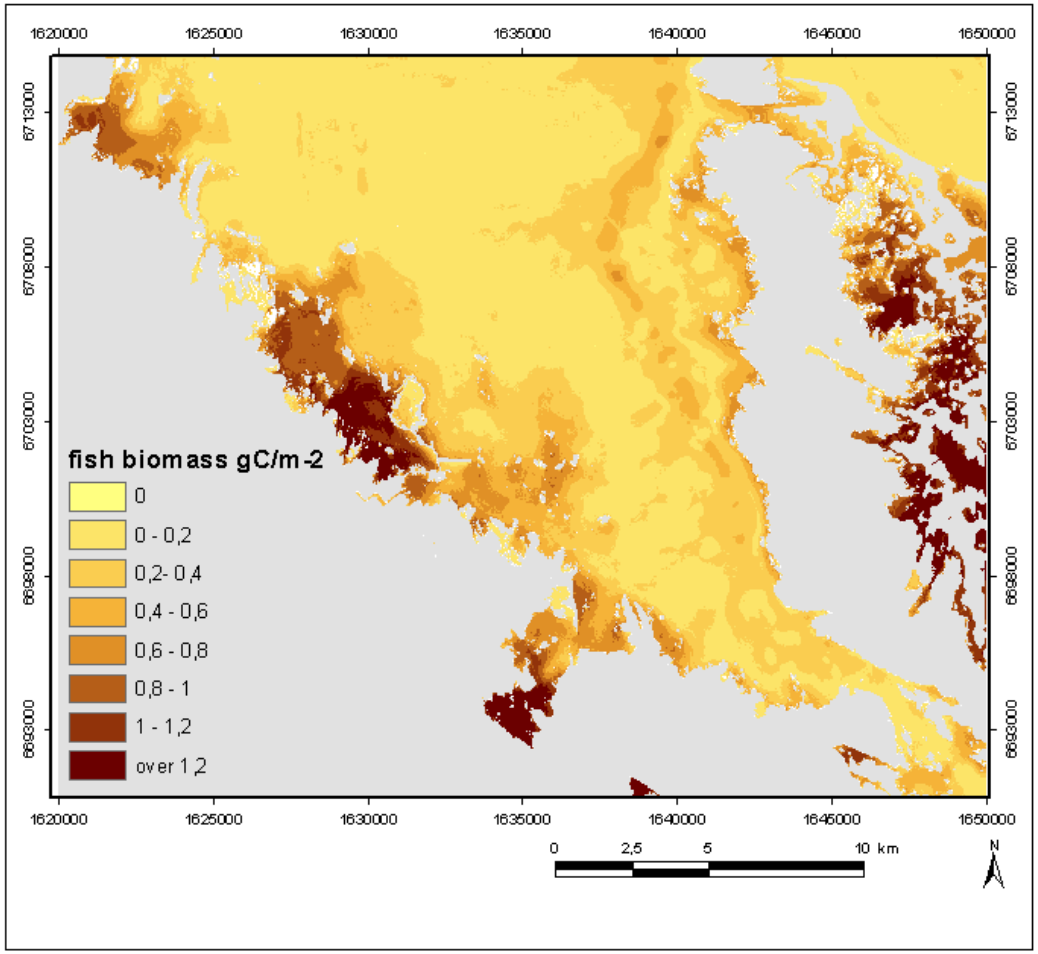
Modelling sedimentation



General description - fish

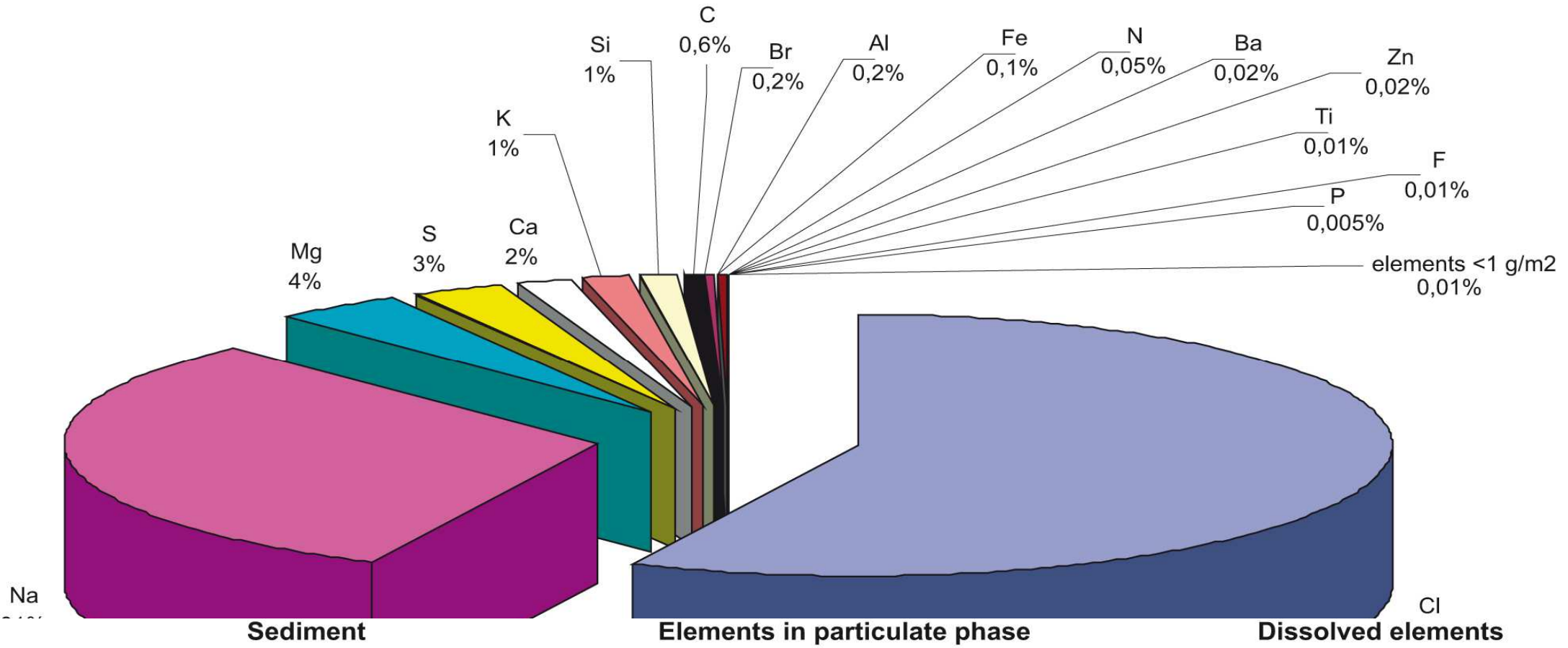
•Coastal fish community, Herring and sprat dominates (60-70 kg/ha)

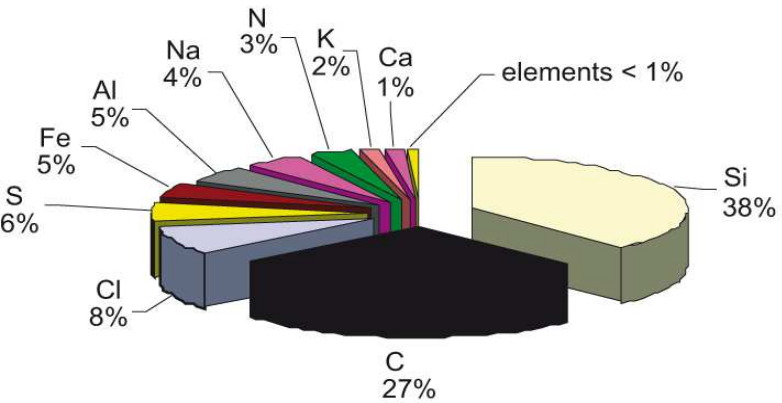
•Inner bays, perch, roach and white bream dominates

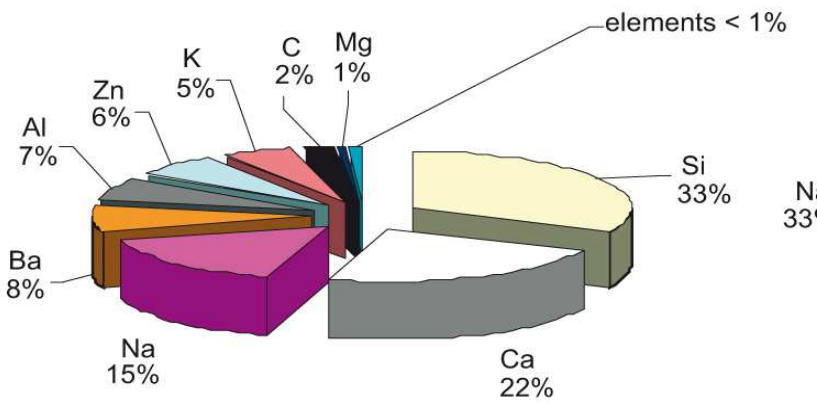


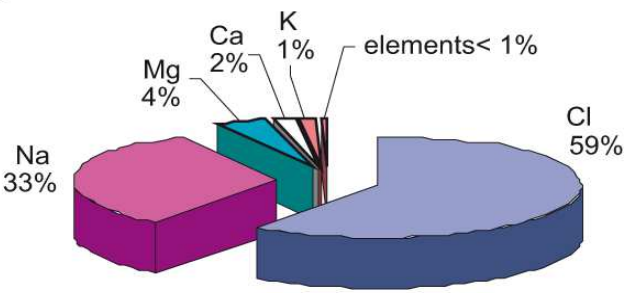
Bradshaw, C., U. Kautsky, L. Kumblad. 2012. Ecological stoichiometry and multi-element transfer in a coastal ecosystem. *Ecosystems* 15: 591–603.

Chemical composition (e.g. ICP-MS, AS)

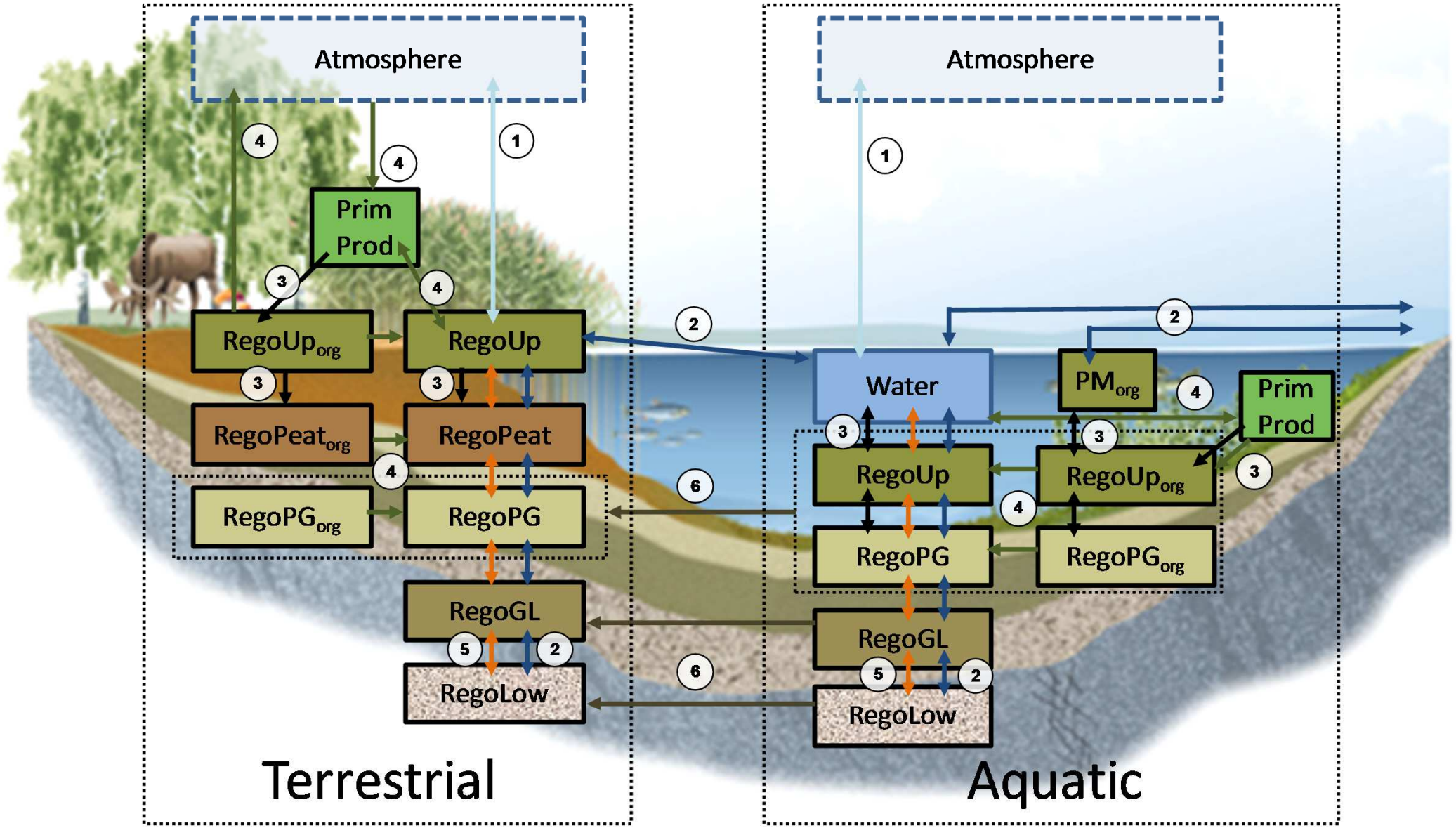




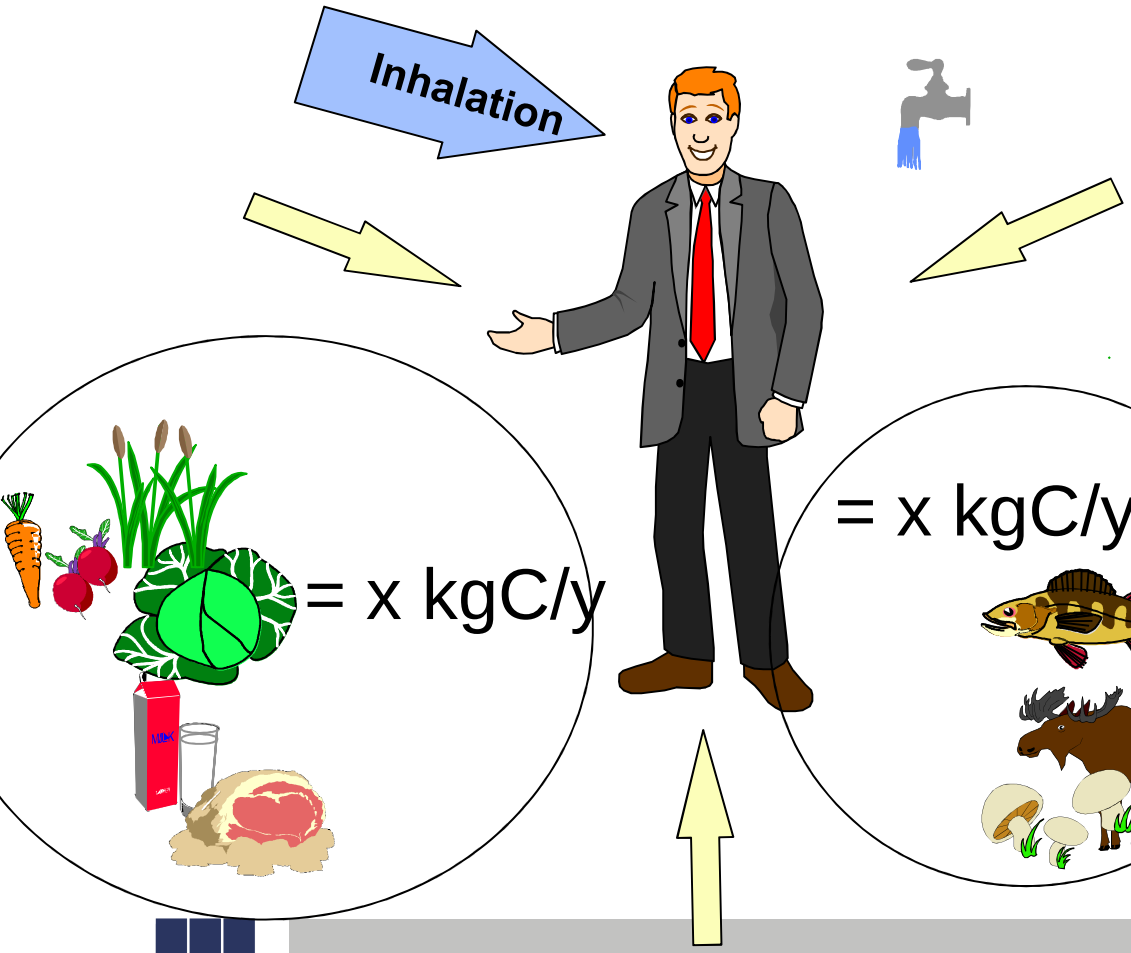




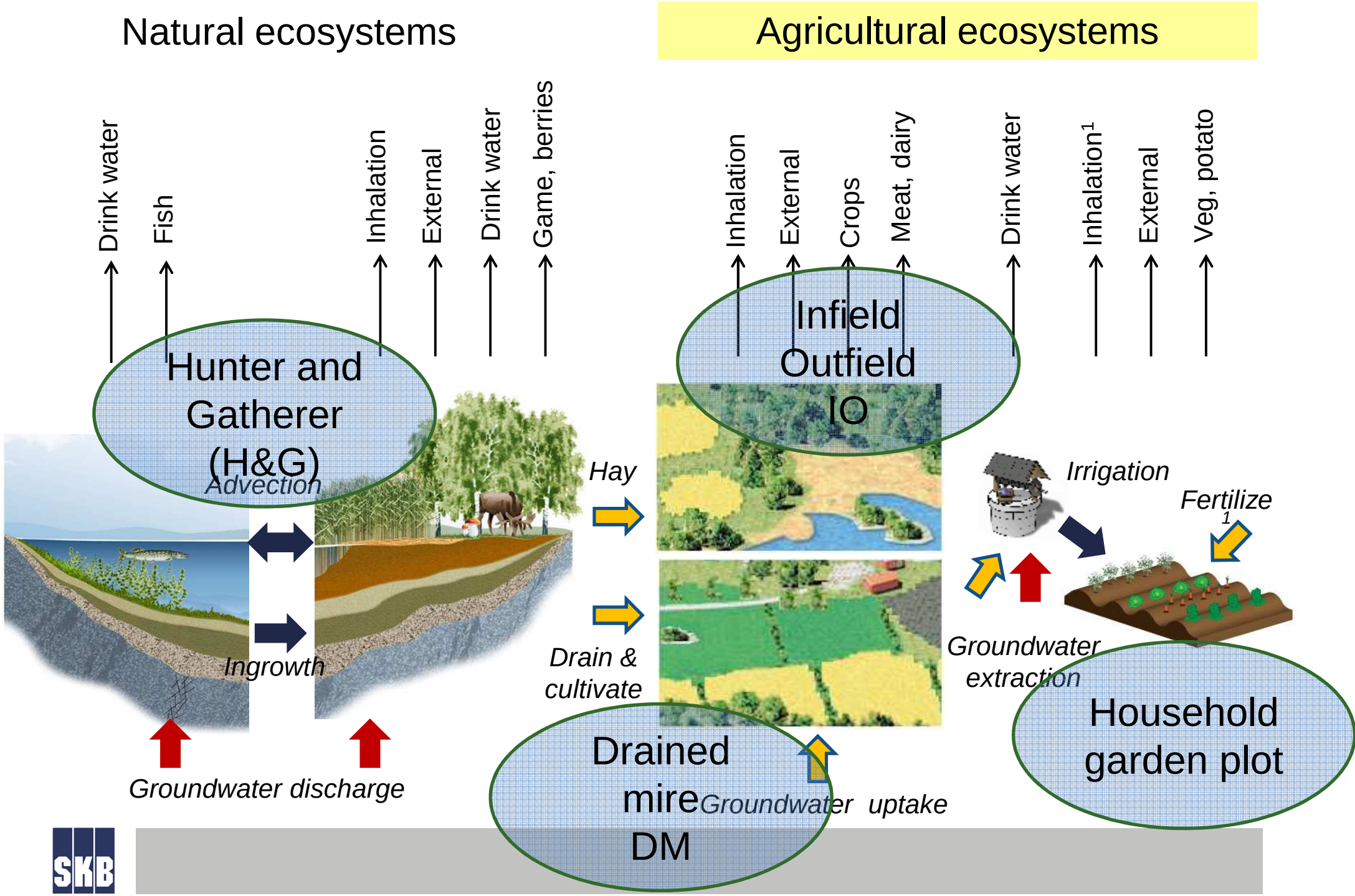
Biosphere model extended for C-14

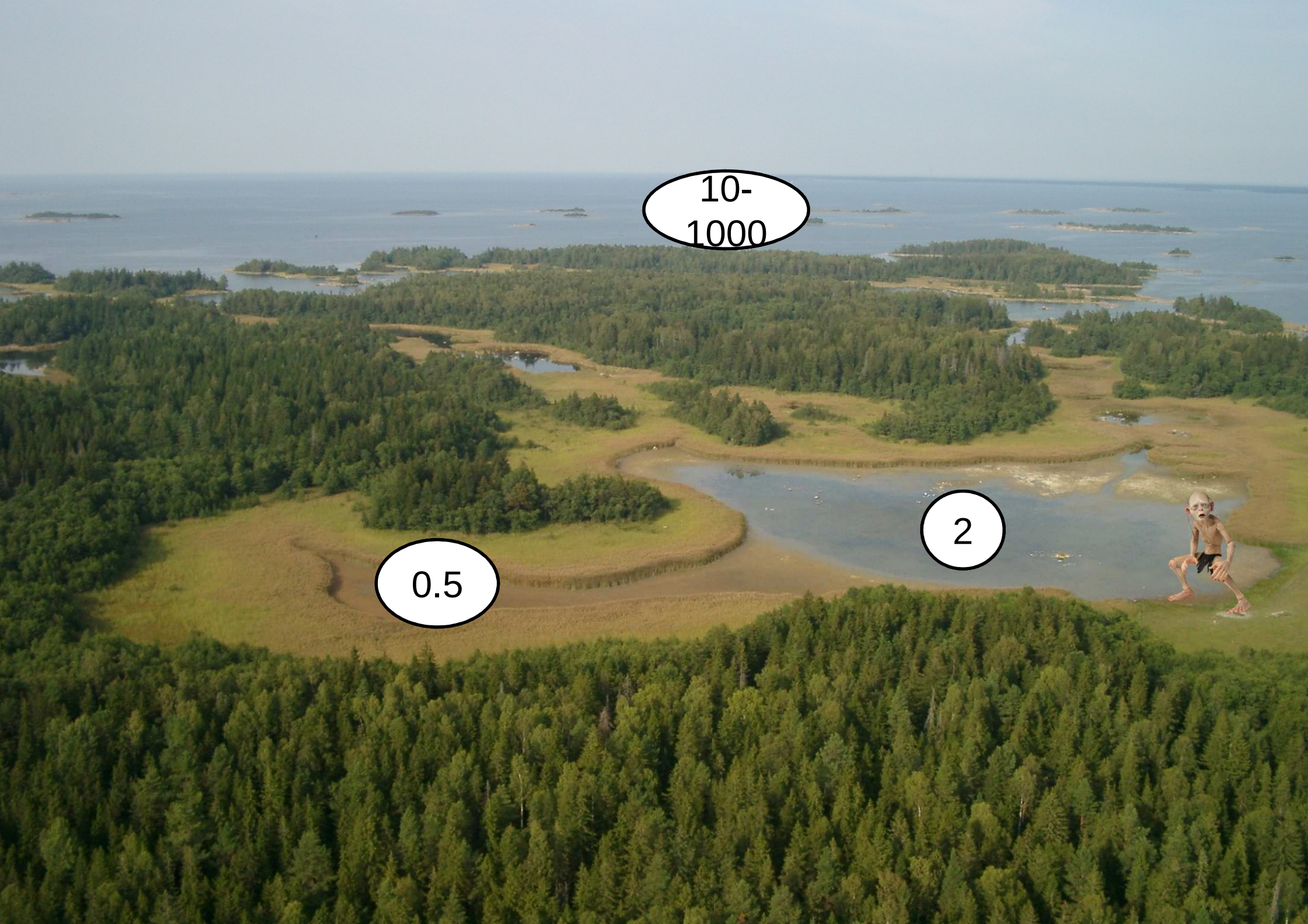


Human exposure in Sr-Site

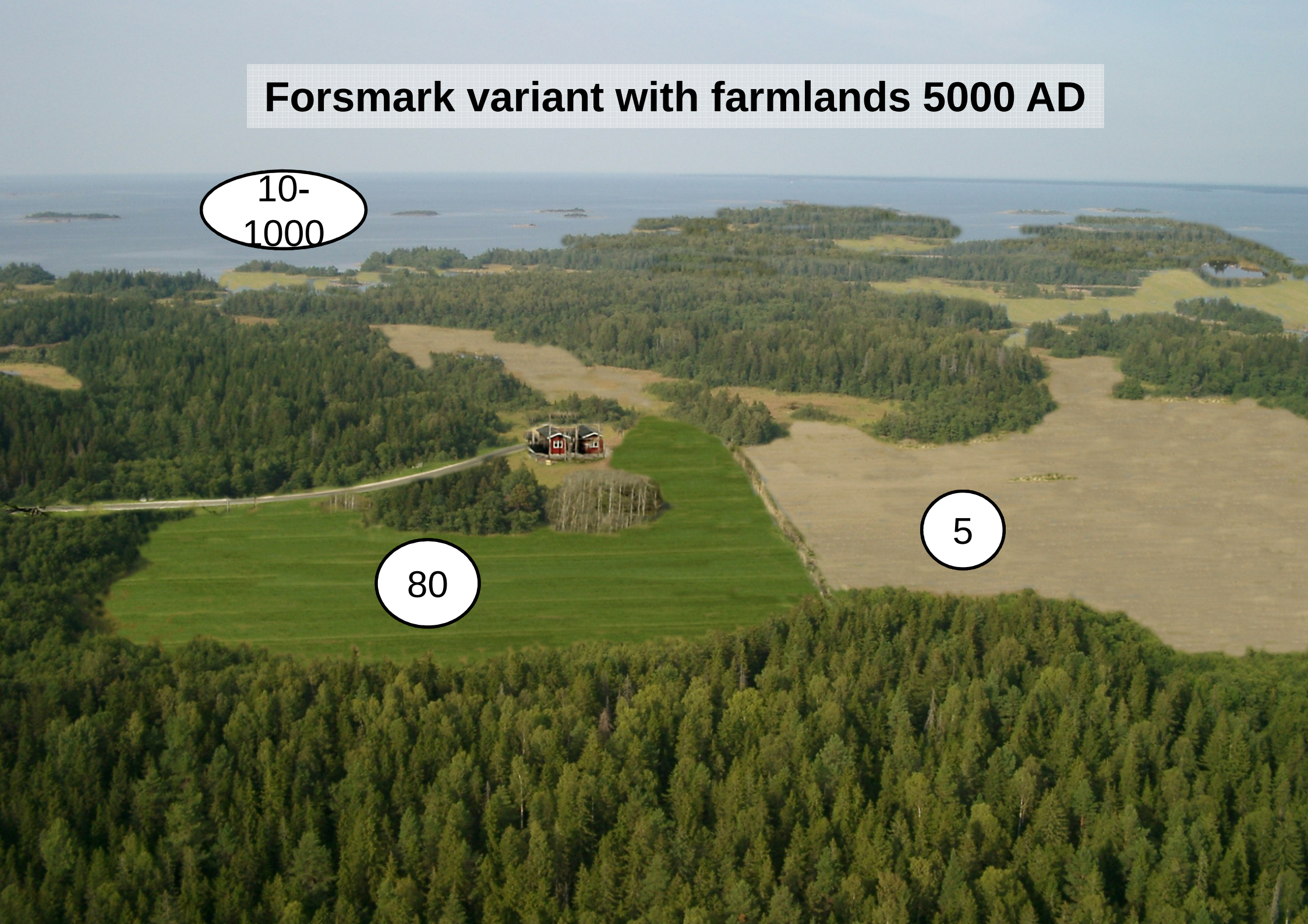


- Intake totally 110kgC/y
- Everything edible in the object is used
- Production of food (kgC) is spatially constrained → a limited population can be feed on the space
- Food intake and population is connected and thus exposure
- Not necessary to count potatoes and carrots

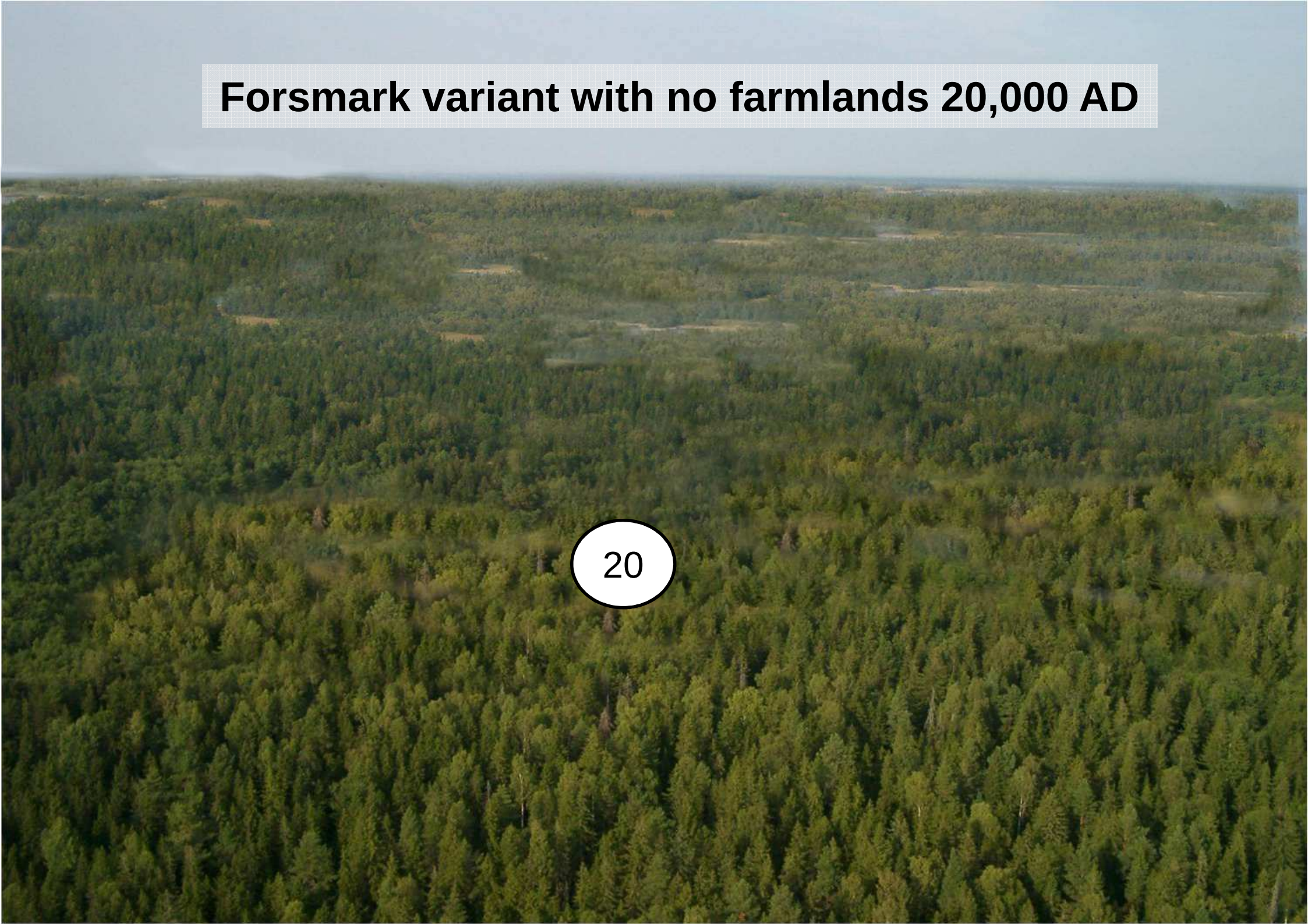

Natural ecosystems
Agricultural ecosystems
Drink water
Fish
Inhalation
External
Drink water
Game, berries
Inhalation
External
Crops
Meat, dairy
Drink water
Inhalation1
External
Veg, potato
Hunter and Gatherer (H&G)
Infield Outfield IO
Household garden plot
Drained mire DM
Advection
Ingrowth
Hay
Drain & cultivate
Irrigation
Fertilize 1
Groundwater extraction
Groundwater discharge
Groundwater uptake


10-1000
2
0.5

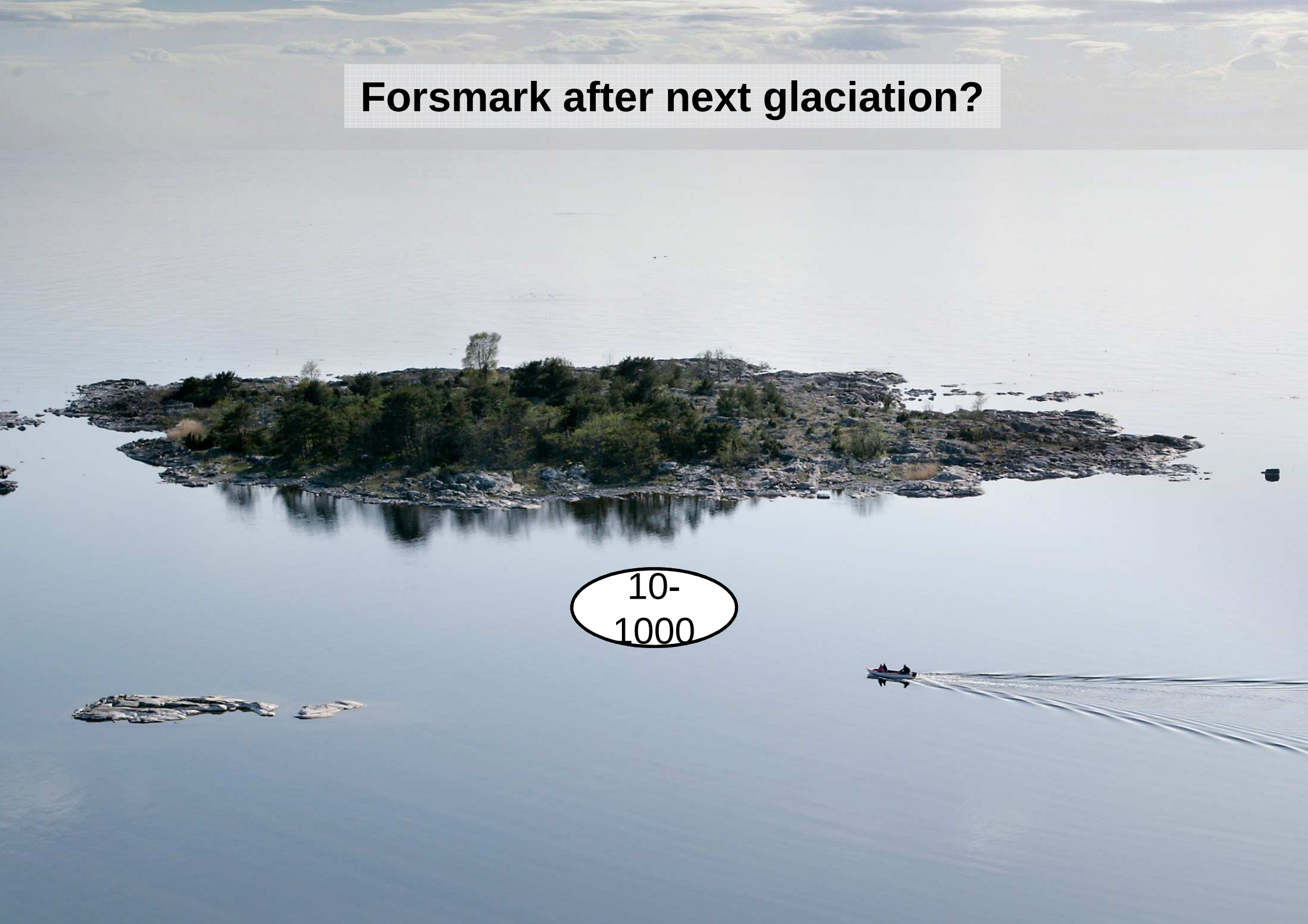
Forsmark variant with farmlands 5000 AD



Forsmark variant with no farmlands 20,000 AD

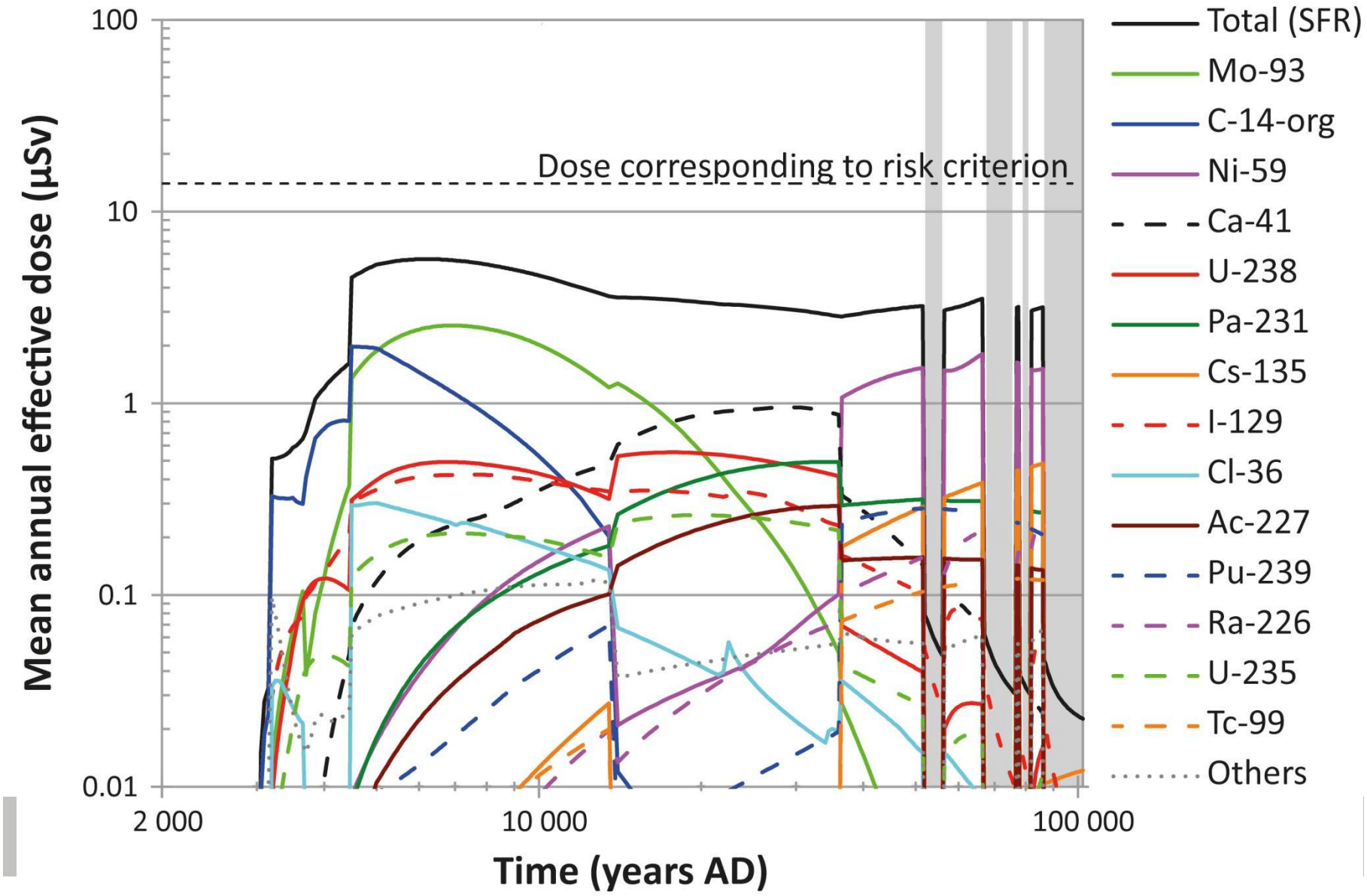


Forsmark after next glaciation?

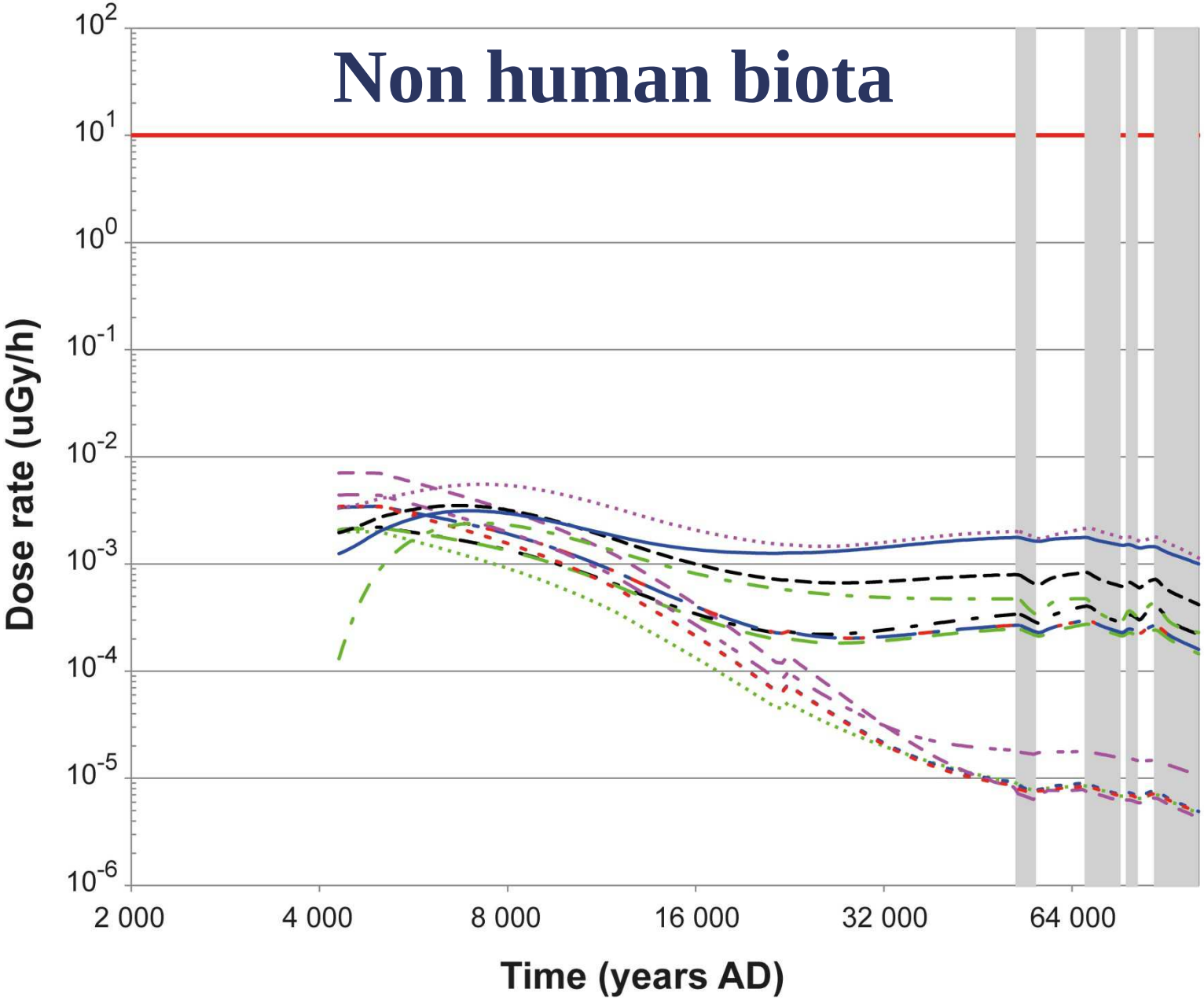


...or during next glaciation?

Results from LLW (SFR)



Non human biota



Summary

- A ecosystem focused assessment
  - Natural productivity
    - Constrained in space
  - Nutritional demand
    - Population constraint
    - Habitat constraints
  - Non human biota
  - Other environmental hazards
- Site specific data
  - Reduced variability
  - Realistic combination of data
- Shore line displacement driver
  - Geometry the major factor
- Next step to use element concentration modelling for radionuclide uptake
- Report at www.skb.se

- AMBIO 2013 vol 42:4
- Open access http://link.springer.com/journal/13280/42/4/page/1