Sustainability of the Multifunctional Forest

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Objectives

- Explore the concept of sustainability in the context of forest soils
- Suggest a better way to select indicators of sustainable forest management
- Consider implications for management

Sustainable Forest Management

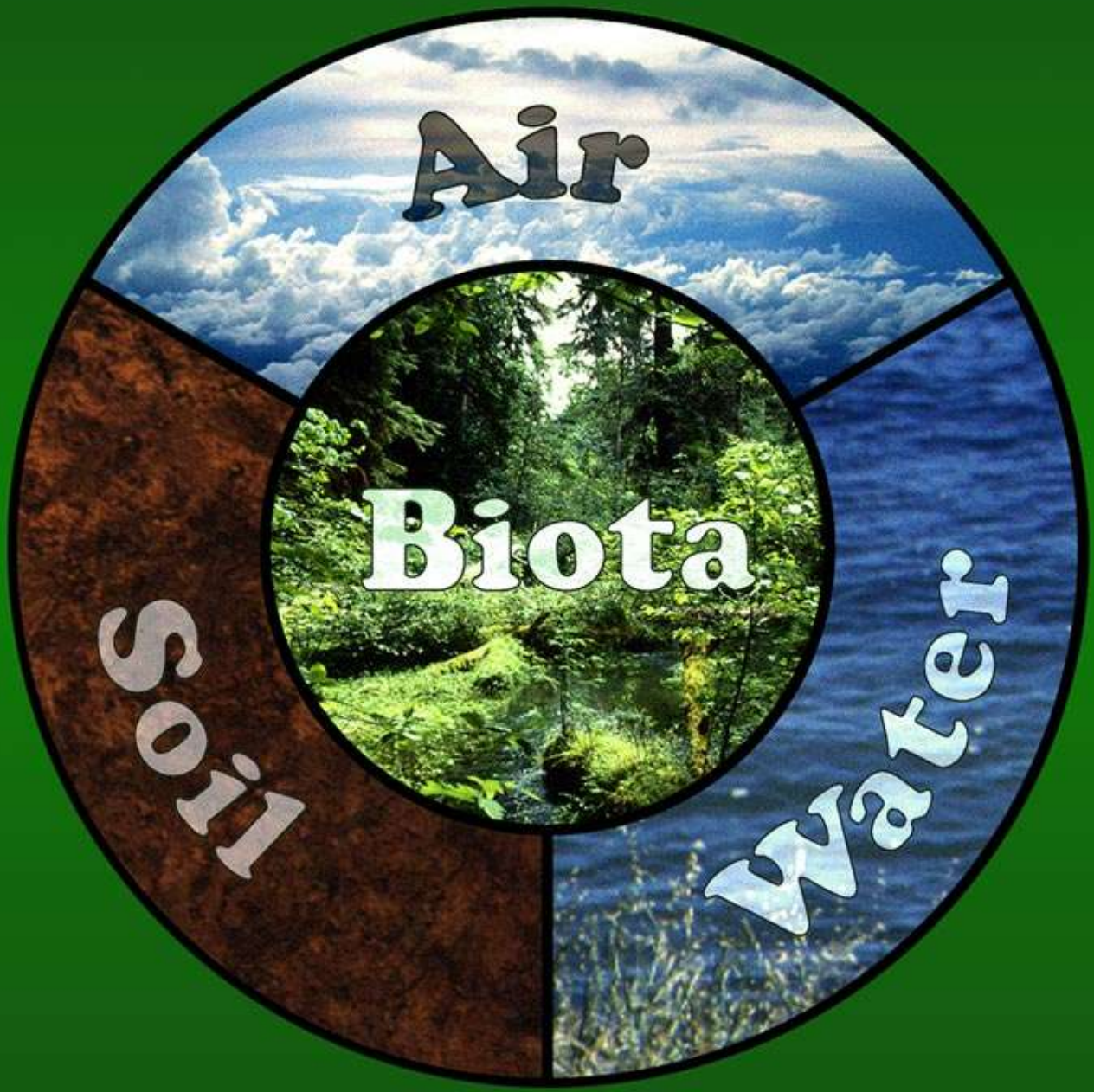
Maintenance of a balanced nutrition of the plant cover, maintenance of the soil capacity for future production, maintenance of the hydrological stability of catchments, or the maintenance of other more society-centred values and amenities.

The Multifunctional Forest

- Return to a traditional view of the forest
- Grazing
- Hunting
- Fuel
- Bedding
- Fodder

Sustainable Forest Management

- What does it really mean?
  - a contradiction in terms?
  - "cosmetic environmentalism"?


Air
Biota
Soil
Water

Implementation Problems

- Nature of forest soils
- Soil acidification
- Nutrient drain
- Limited use of soil amendments
- Erosion

Question:

For how long do we wish to sustain life on earth?

Answer:

For a long time.

Chasing a Moving Shadow?

"The situation appears to be that, at the end of the 20th century, a word has been decided upon to conjure up the desirable outcome of social and political endeavours. Scientists and professionals have taken (or been given) the impossible task of achieving definitive measurement of this word. The impossible task was to measure what was never potentially measurable: the immeasurable 'sustainability' Bell and Morse (1999)

A Goal We May Never Achieve

- Concept lacks precision.
- Nevertheless, it provides us with a useful objective to which managers can aspire.
- We may never achieve our goal
- But the journey towards it is well worthwhile.

The Scientist's Dilemma

- Our problem lies not in finding the answers to questions.
- The problem is to find the right questions to ask.

The Soil Scientist's Responsibility

1. Develop indicators which provide a true measure of sustainability
2. Improve our understanding of ecosystem function
3. Make recommendations for improved forest practice

Some things we need to learn

- The relative importance of resistance and resilience.
- To take the long view – sustainability is forever, is it not?.

Pan-European Forest Process

- Designed for application at national level.
- Product of political negotiation and compromise.

Initiatives Related to Sustainable Forest Management

- Soil quality
- Best forest practice guidelines
- Forestry standard statements
- Forest certification schemes

Indicators of Quality

"Inclusion and evaluation of soil properties in soil quality assessment is **largely based on inference regarding their role in critical forest soil functions**, rather than being based on concrete data"

Schoenholtz 2000

Aspects of Soil Quality

- **inherent soil quality**

  That aspect of soil quality relating to a soil's natural composition and properties as influenced by the factors and processes of soil formation.

- **dynamic soil quality**

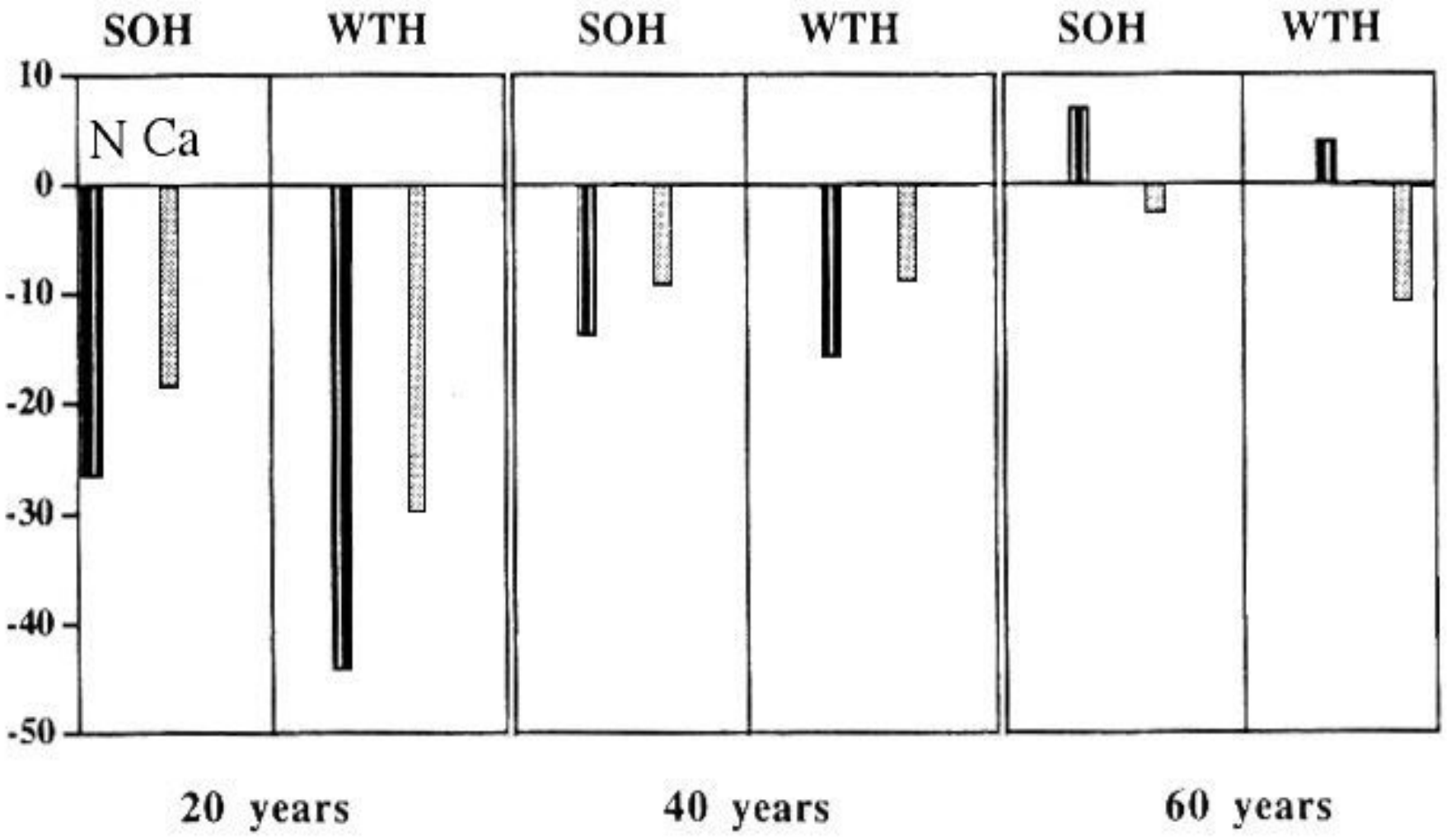
  That aspect of soil quality relating to soil properties that change as a result of soil use and management.

Indicators of Soil Quality

- organic carbon/organic matter status
- nutrient availability
- soil acidity
- base saturation
- salinity or conductivity

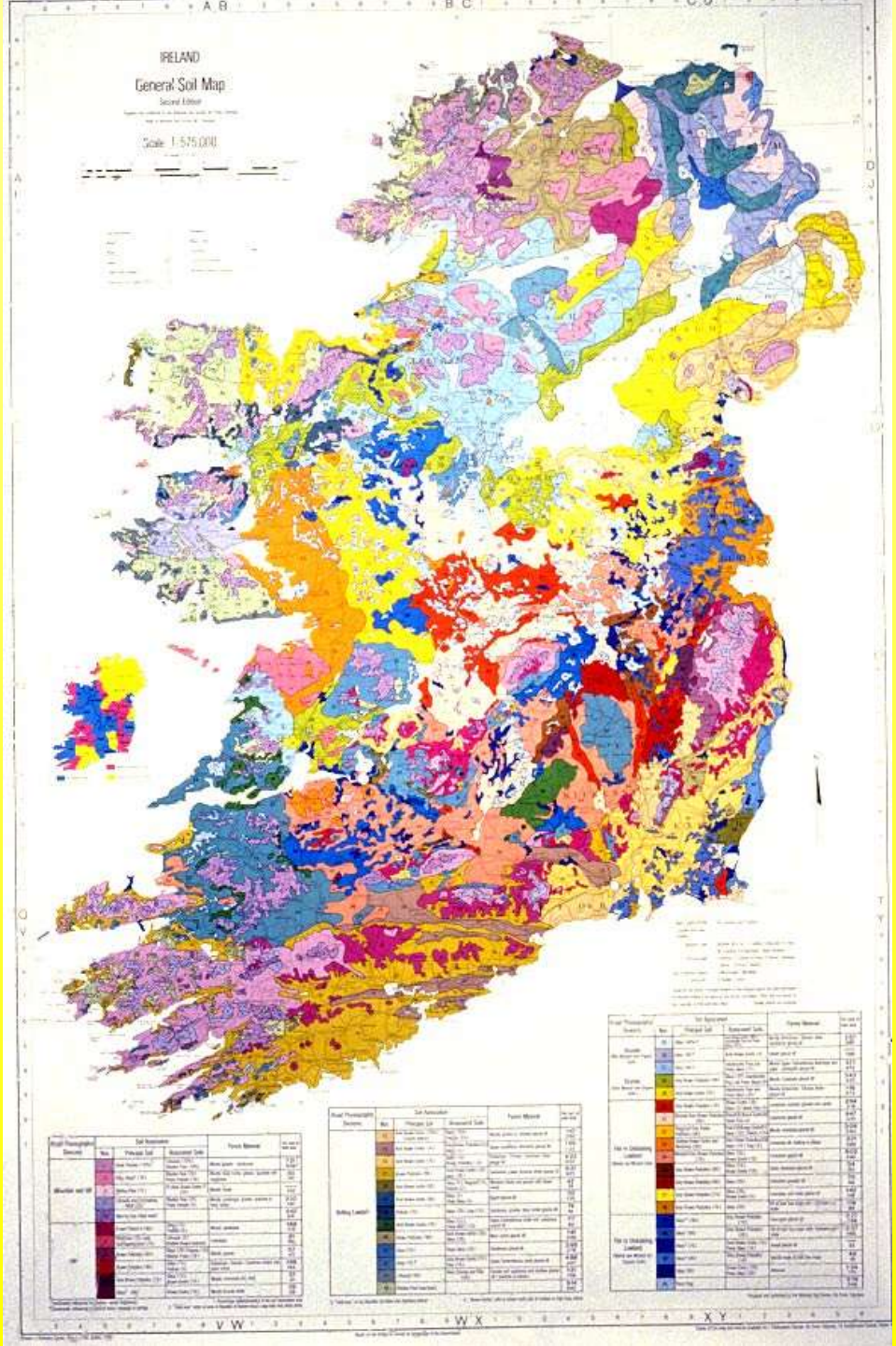
Two Lines of Investigation

- Input-Output Budgets
- The Legacy of Land Use Change



SOH: Stem only harvesting. WTH: Whole tree harvesting

Source: Ranger and Turpault (1999)

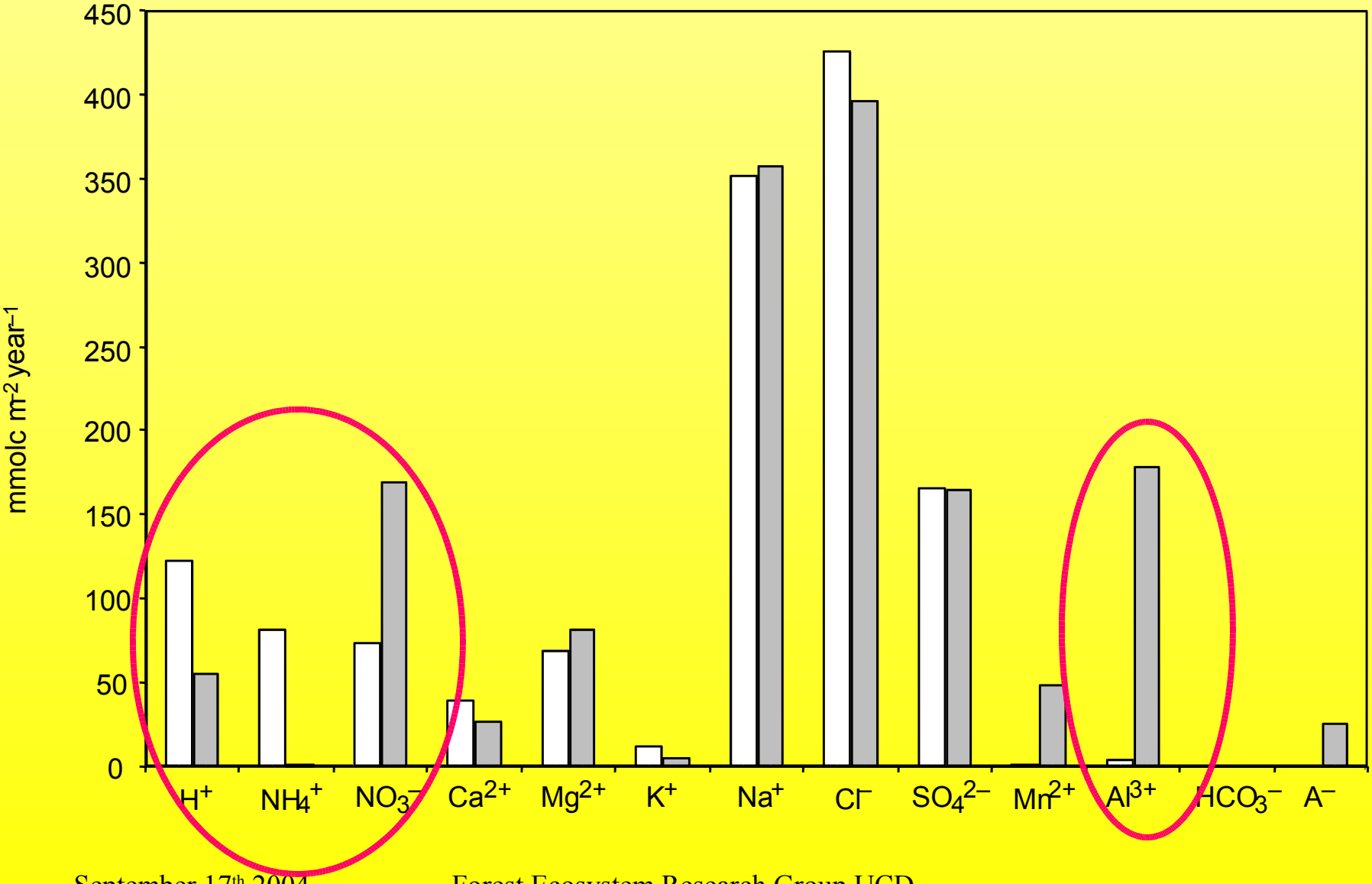


September 17th 2004

Roundwood, Co Wicklow

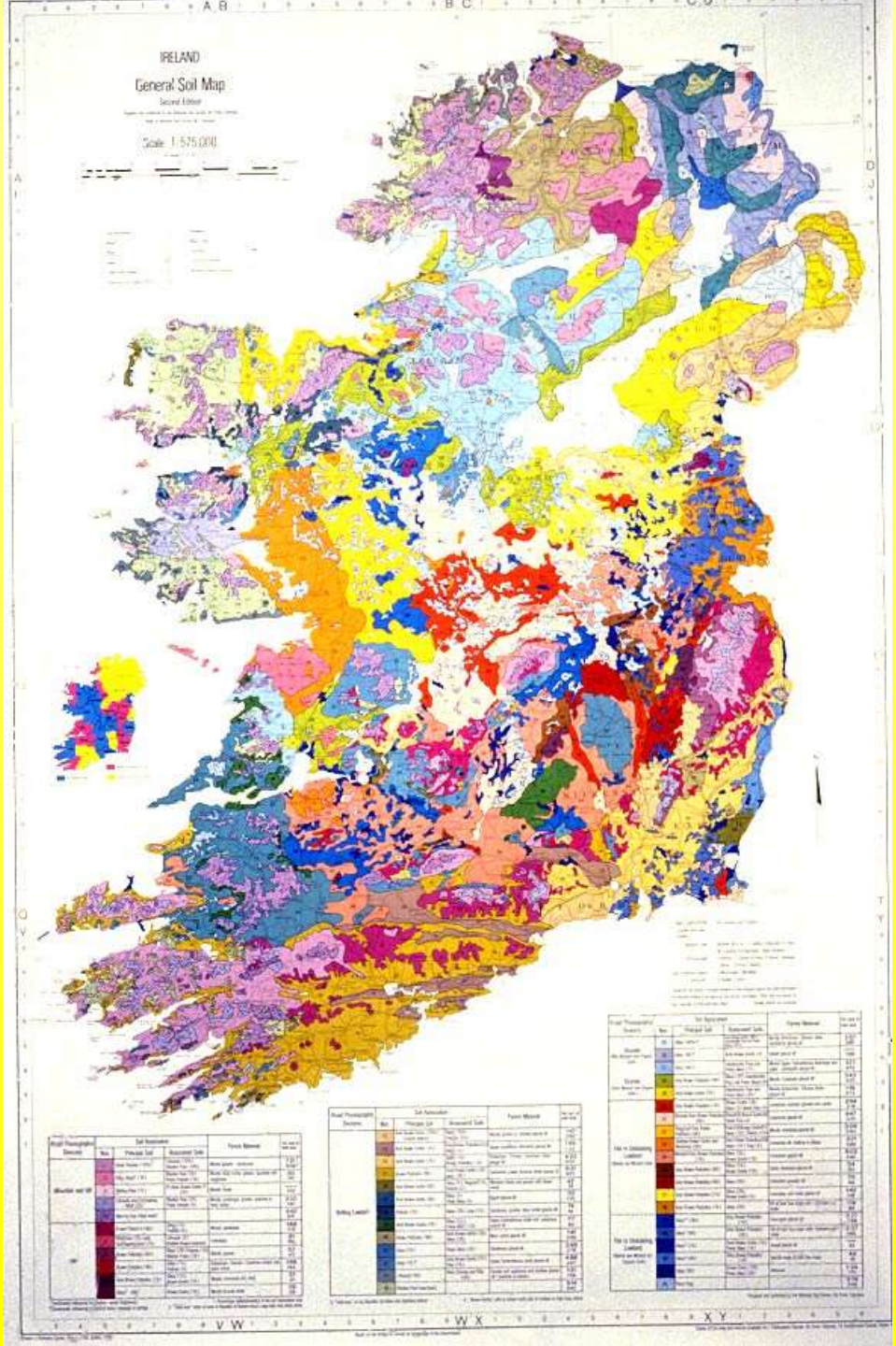
- Altitude: 395m
- Geology: schist, quartzite
- Soil: peaty podzol (spodosol)
- Species: *Picea sitchensis*
- Planting year: 1955
- Yield Class: 18

White=input; grey=output



Measures of Sustainability

Criterion	Critical limit	Current Value	Outcome
External:Internal H^+ Sources	< 0.5	4.3	**Fail**
Critical load of acidity	193 $mmol_c\ m^{-2}\ yr^{-1}$	Exceeded by 73 $mmol_c\ m^{-2}\ yr^{-1}$	**Fail**
Soil Solution pH B horizon	> 4.4	4.2	**Fail**
Nitrogen saturation (nitrogen leaching)	outputs–inputs < 0	16 $mmol_c\ m^{-2}\ yr^{-}$	**Fail**

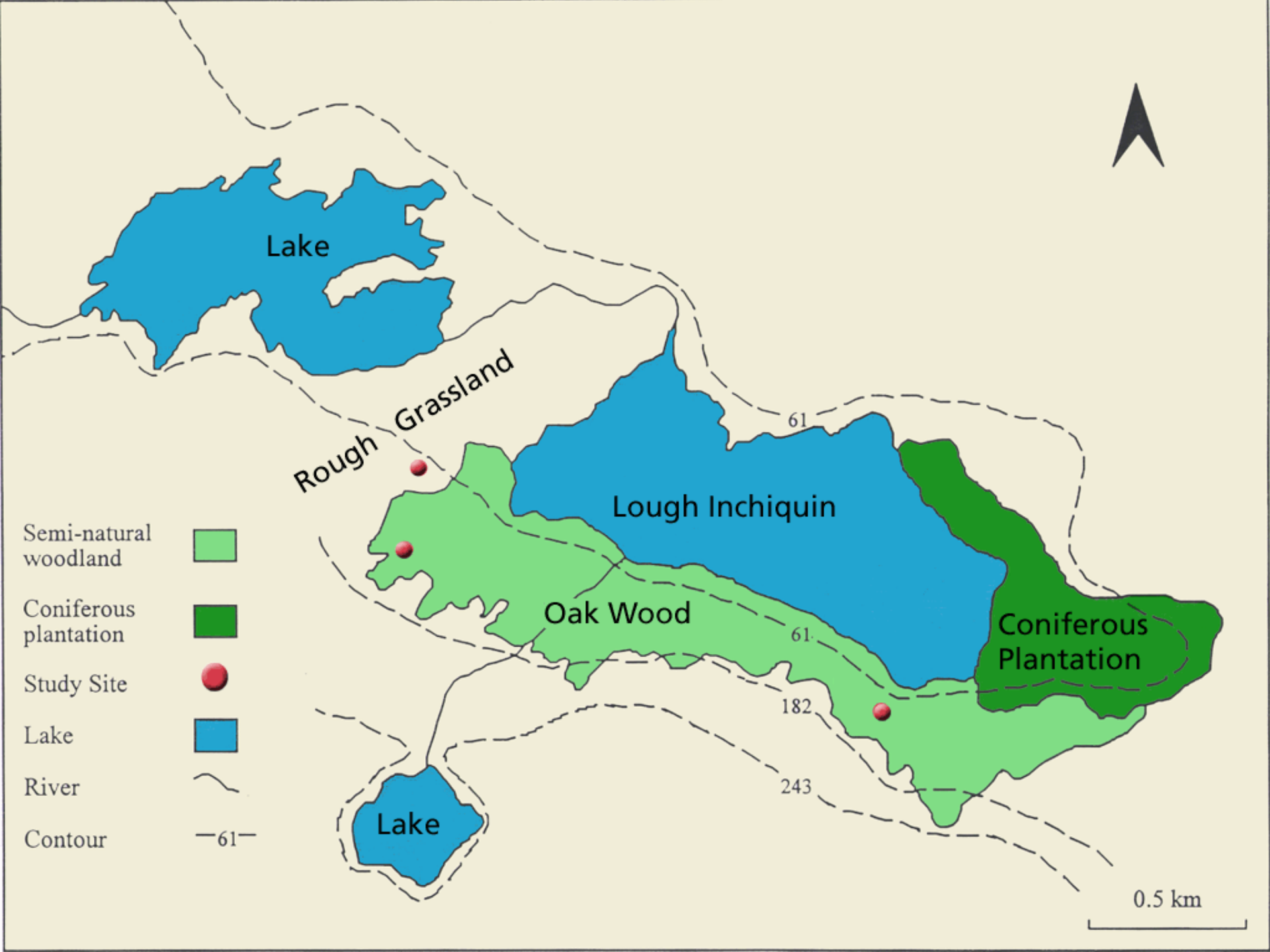


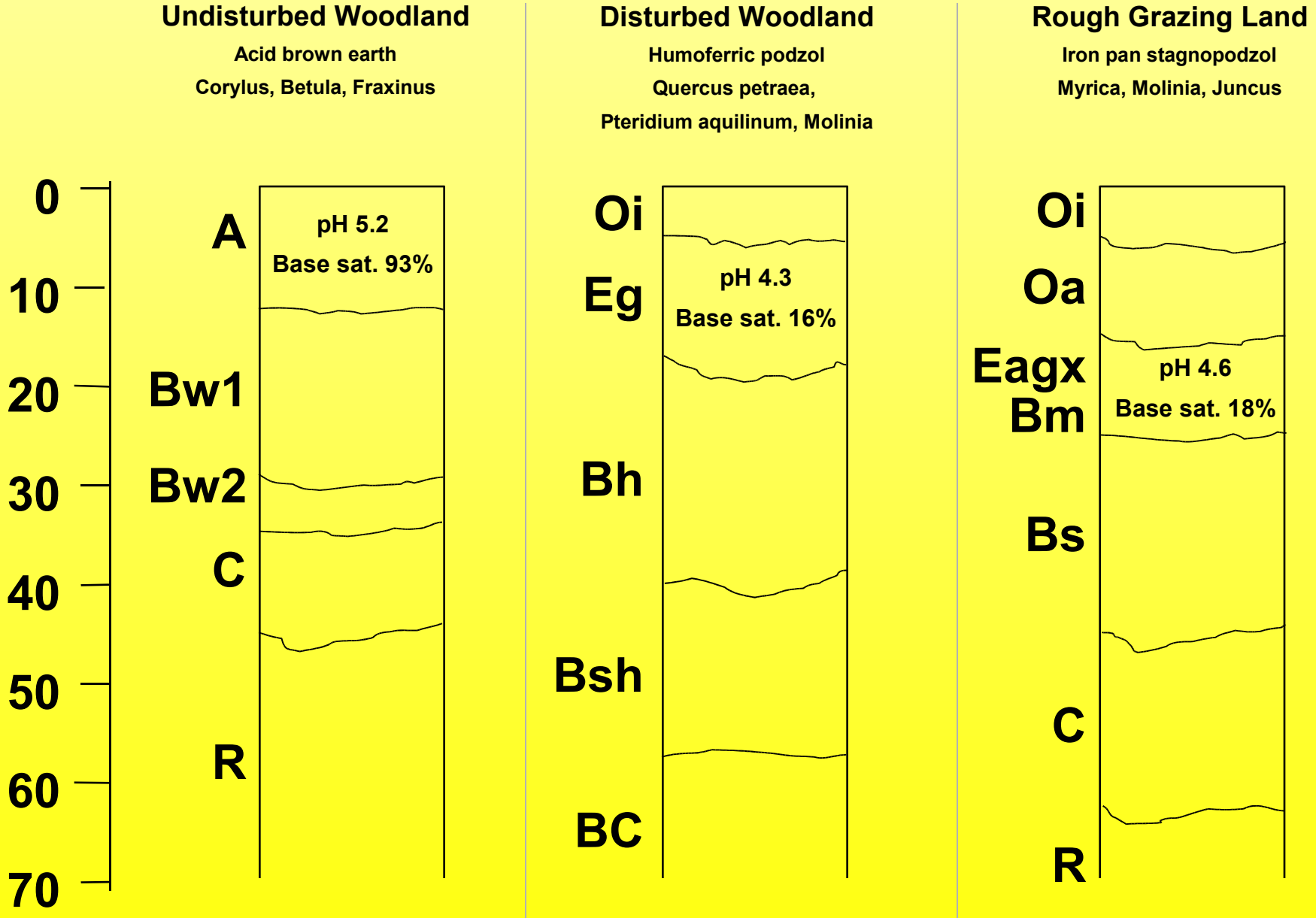
September 17th 2004

Uragh Wood, Co Kerry

- Parent material: Upper Devonian sandstone
- Climate: cool maritime, annual precipitation 1400mm
- *Quercus petraea*
- Grazing, felling, charcoal production, tillage agriculture over several centuries
- Partly cleared c. 1650

September 17th 2004


Lake
Rough Grassland
Lough Inchiquin
Oak Wood
Coniferous Plantation
Lake
61
61
182
243
Semi-natural woodland
Coniferous plantation
Study Site
Lake
River
Contour
61
0.5 km


Undisturbed Woodland
Acid brown earth
Corylus, Betula, Fraxinus
Disturbed Woodland
Humoferric podzol
Quercus petraea,
Pteridium aquilinum, Molinia
Rough Grazing Land
Iron pan stagnopodzol
Myrica, Molinia, Juncus
0
10
20
30
40
50
60
70
A
Bw1
Bw2
C
R
pH 5.2
Base sat. 93%
Oi
Eg
Bh
Bsh
BC
pH 4.3
Base sat. 16%
Oi
Oa
Eagx
Bm
Bs
C
R
pH 4.6
Base sat. 18%

Lessons from Uragh

- What value would conventional indicators have been over past 400 years?
- How would we measure sustainable forest management of a newly established plantation forest?
- Do the measured morphological changes suggest new indicators?

Conclusions 1

- Sustainability is for ever!
- We must find true measures of sustainability
- It is not easy to measure
- It is not necessary to measure lots of things frequently; better make meaningful measurements infrequently
- Sustainability should not be confused short-term changes in soil quality

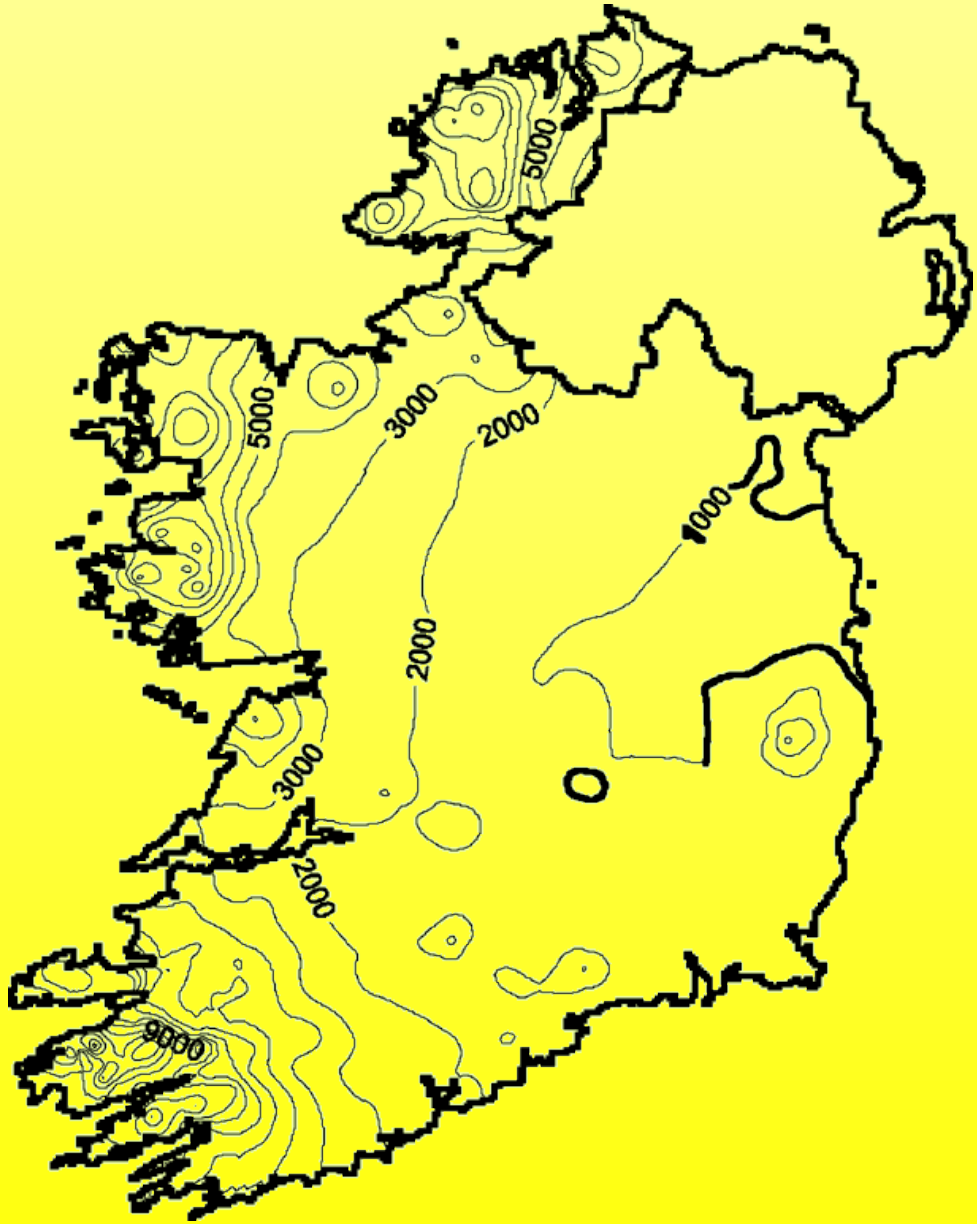
Conclusions 2

- We must continue to develop codes of forest practice in order to protect our forests, our soils and surface waters
- Scientists and managers must continue to learn how ecosystems work
- Remember the legacy of land-use change!
- Managers should know the ecological implications of their decisions

Conclusions 3

- We should not pretend we have all the right answers
- Instead, we should try to find the right questions

Thank’s for listening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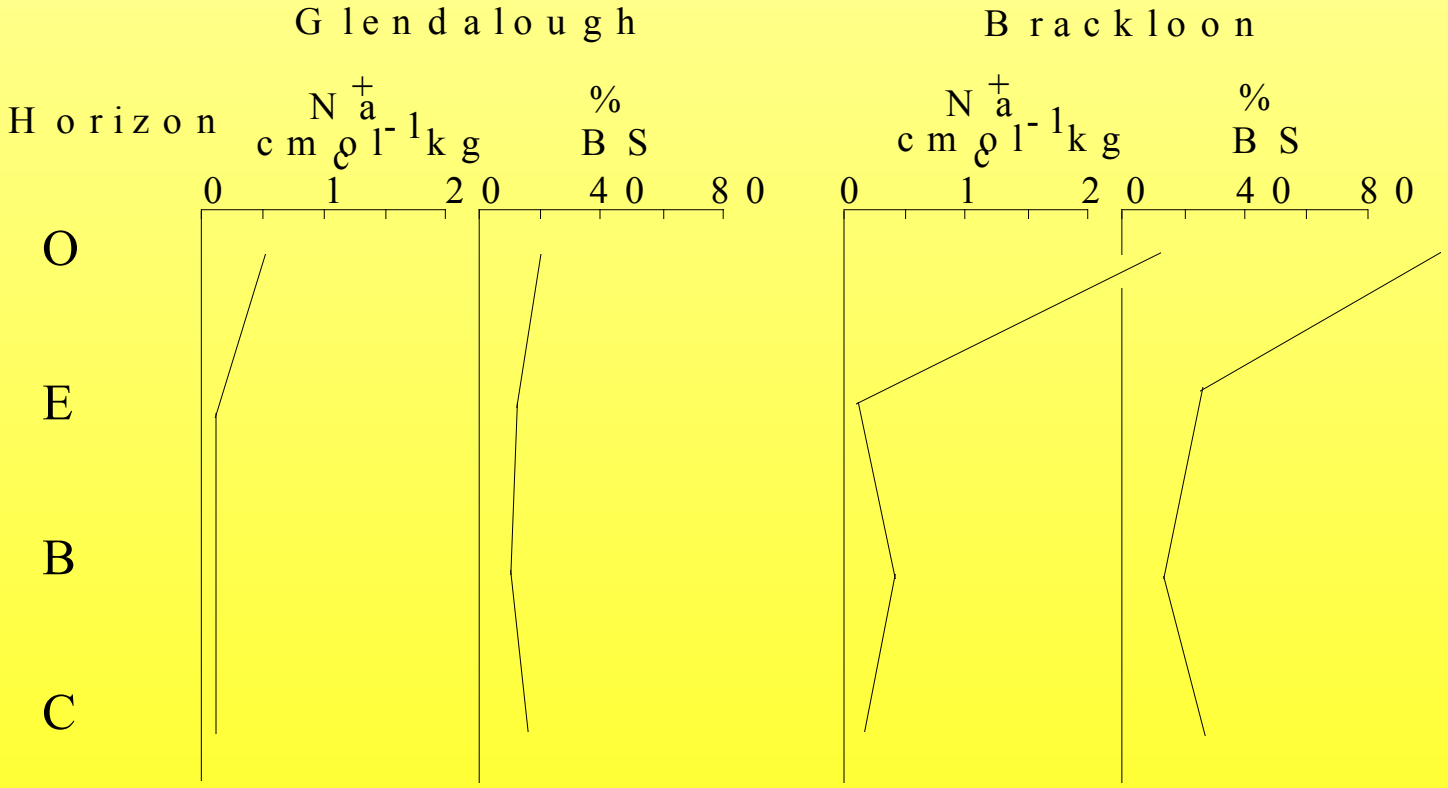

Exchangeable sodium and percent base saturation of podzol profiles in mature oakwoods at east coast (Glendalough) and west coast (Brackloon) sites in Ireland (after Little, 1994).