

Green and blue infrastructures

Reflections on their capacity to address contemporary environmental challenges

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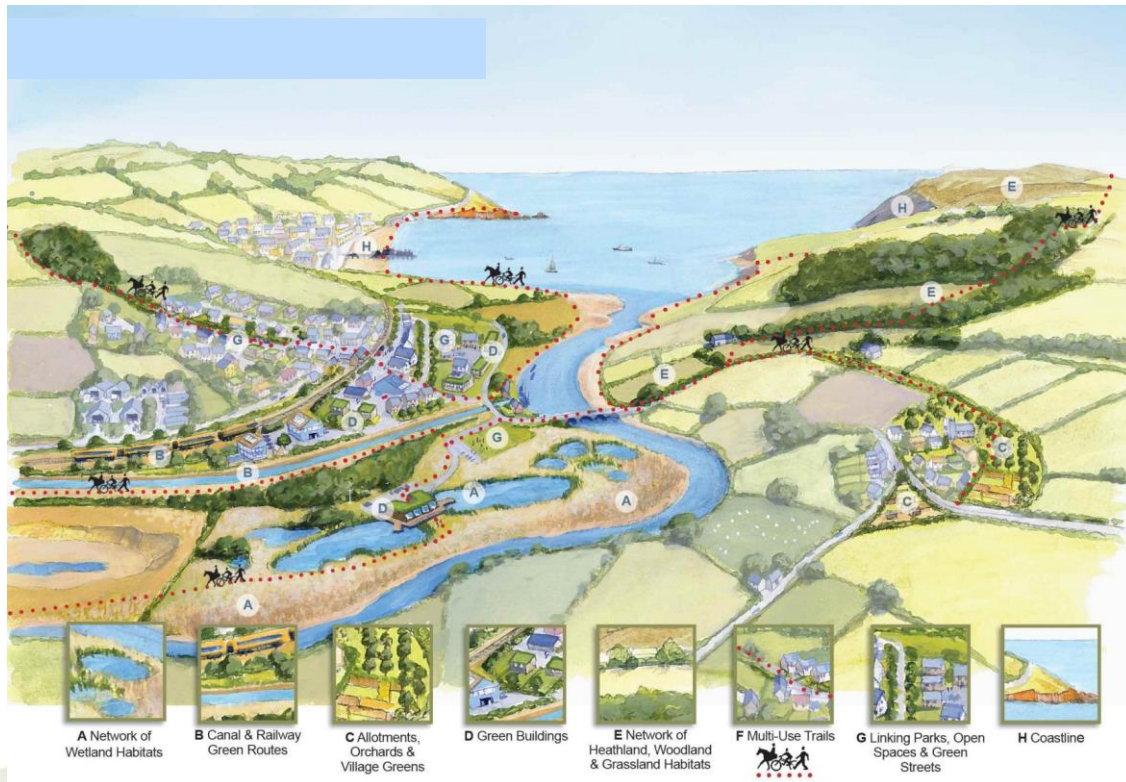


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What I want to explore with you

- My perspective as an interdisciplinary social scientist
- A basic proposition on the importance of GBIs
- The importance of understanding GBIs at different scales
- The origins and evolution of GBIs (not the concept)
- What has “gone wrong” with GBIs
- The ecosystem services lens as an entry point to the study of GBIs
- Grounding my perceptions and exploring lessons learned
- The promise and the pitfalls of policy solutions
- Knowledge gaps and research needs

The basic proposition

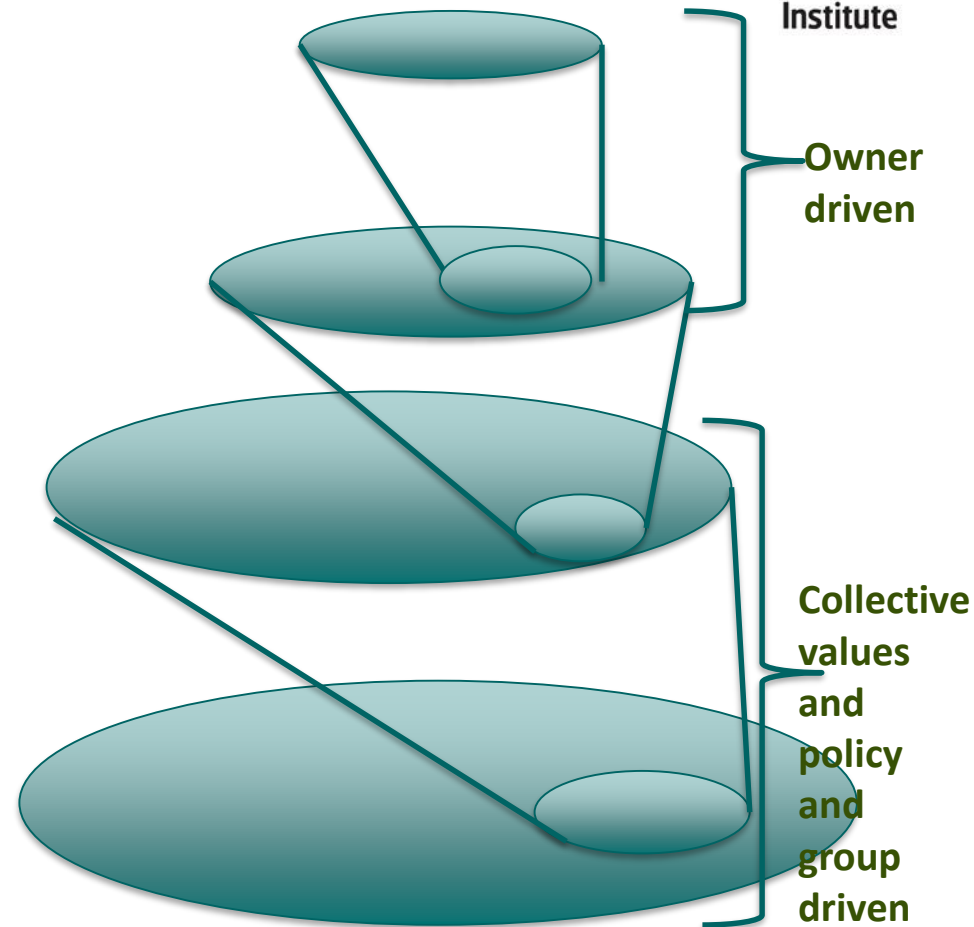


Green and blue infrastructures can deliver very important ecosystem services. Better understood, with better policy signalling and and better managed they could deliver even more.....

...but their enhancement poses some really big challenges, of biophysical understanding, of benefit measurement and trade-offs, of governance, of property rights, policy design and more

In investigating GBIs scale matters

- Field and crop - no thought about margins
- Farm Holding- margins, rotation and unused land are part of parcel
- (Sub-) Catchment- different farmers, different agents, different systems
- Region- greater diversity of farming types/styles and systems and more diverse agents



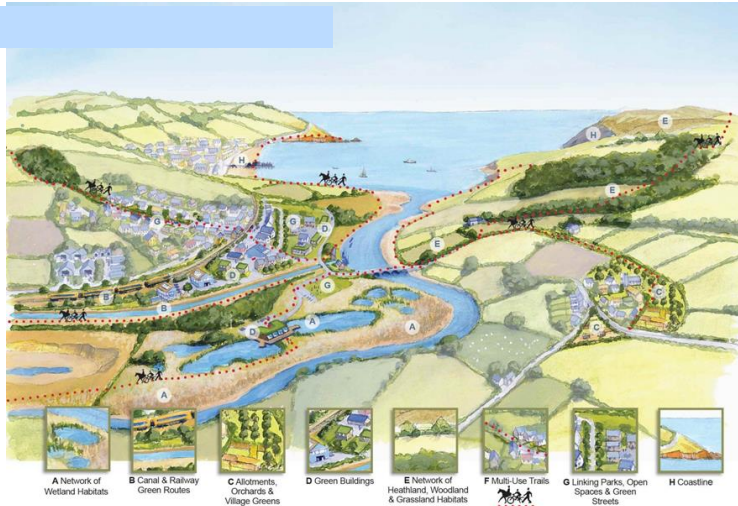
It is challenging to design systems of intervention to drive the behaviour of so many diverse actors/agents at multiple scales

Copenhagen's Climate planning

The multi-scalar approach in practice

Urban heat island effect and high surface temperatures	Level 1 Reduce probability	Level 2 Reduce scale	Level 3 Reduce vulnerability
Regional			
Municipality	Establishment of green, continuous structures, preserve and add to the existing green structure and include SUDS solutions in thinking	Planlægning Promote district cooling of buildings	Planning
District/neighbourhood	Establishment of green, continuous structures, establish stormwater basins etc., plant trees, preserve and add to the green structure	Planning. Incorporate green solutions into private and public initiatives	Planning. Incorporate green solutions into private and public initiatives
Street	Establishment of green, continuous structures, establish green walls and other green elements, rain gardens etc.	Planning. Incorporate green solutions into private and public initiatives	Planning. Incorporate green solutions into private and public initiatives
Building/Property	Establishment of green, continuous structures, establish stormwater ponds, rain gardens etc., green roofs and trees	Planning. Incorporate green solutions into private and public initiatives	Planning. Incorporate green solutions into private and public initiatives

Where do GBIs come from?



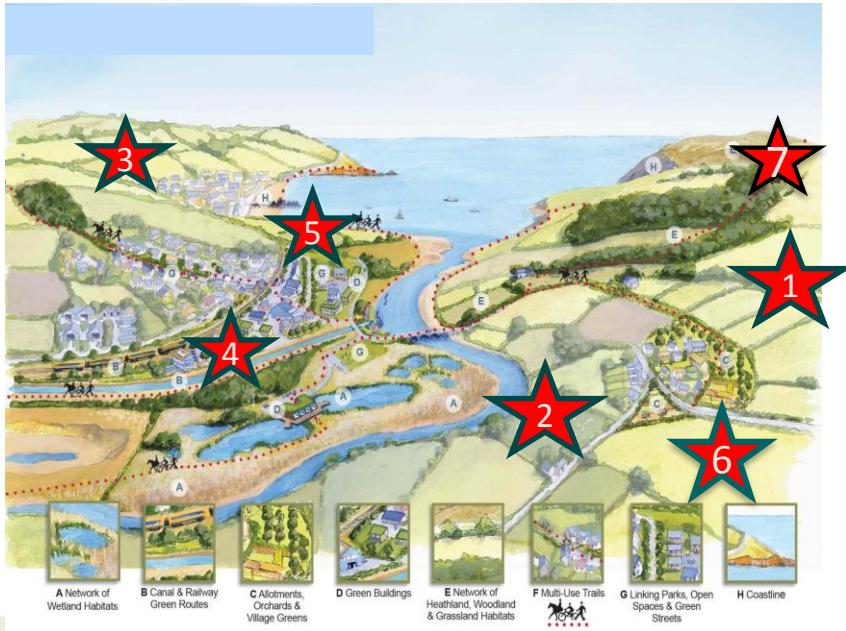
But others were planned (e.g. shelter belts) in the past but their contemporary value may not always be recognised and may have changed

Many core elements of the GBI have not been consciously planned; they are products of physiography, by-products of former functions or accidents of history including (often) an inability to bring some land into cultivation and productive use

What has gone wrong with GBIs? Some examples



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High carbon emitting, low water retention land use systems with depauperised ecologies are the norm in many areas

1. Field boundary removal and biodiversity loss – increased surface runoff
2. Increased N and P and faecal contaminants in watercourses from farm applications
3. Moorland transformed to pasture reduces soil water retention, releases carbon
4. Urban expansion and soil sealing increases runoff and flood risk. P from sewage works
5. Increased CO₂ levels increase storm surges and coastal flooding
6. Loss of fallow implicated in decline of farmland birds (in Spain)
7. Deintensification and abandonment

Ecosystem services (after TEEB)

■ Provisioning

- Food
- Fibre
- Water
- Raw materials

■ Regulating

- Sequestration of C
- Flood regulation
- Pollination

■ Supporting

- Habitats
- Genetic diversity

■ Cultural

- Recreation and mental and physical health
- (Some) tourism
- Aesthetic and spiritual experience

GBIs both deliver wider ecosystem services of great importance and support provisioning services

At least two ways to look at the challenge

- A macrocosmic view
 - A global or macro-regional view
- A microcosmic view
 - Look at specific (city-)regions, sub-regions/catchments, farms, forests or even fields or stands
 - Can we find good examples of green and blue infrastructures working in harmony with primary industries?
 - Can we identify policies driving positive change?
 - Can we identify regions with greater problems and better solutions?

A microcosmic view

- Look at somewhere that you know rather well with its geographical specificities at a micro scale
- Explore and explain the inter-relations between green and blue infrastructures and primary land use
- At this scale the problems have a human face and a specific policy framing

My home: The Vale of Alford Aberdeenshire Scotland – an area of 150 Square kilometres



Another view of the Howe



More on the Howe



Some large arable areas with few fringe habitats and permanent arable systems – a depauperized green infrastructure



Other areas where efforts are being made to create fringe habitats (but older hedges are much richer ecologically)

Mixed farming with shelter belts



Some areas well endowed with shelter belts and small woodland with commercial forestry and *calluna* moorland above

OSR



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And a share of quite intensive crops: OSR in the recent past with high neonicotinoid applications

Arable land too close to watercourses



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No buffer strips to speak of; little biodiversity in watercourse; high phosphates in water; high sediment yields; too much autumn ploughing

Major soil disturbance with potato production



This is perhaps the most disruptive agricultural operation on the soil



And harvesting with heavy machines adds to the damage function

Forestry is a direct parallel with farming



This style of forestry generates an industrialised landscape

Intensive systems of exotic conifers generate significant environmental impacts- loss of biodiversity, soil loss at clearfell etc.



But carbon sequestration is a bonus

Blue infrastructure

30th Dec 2015 Storm Frank



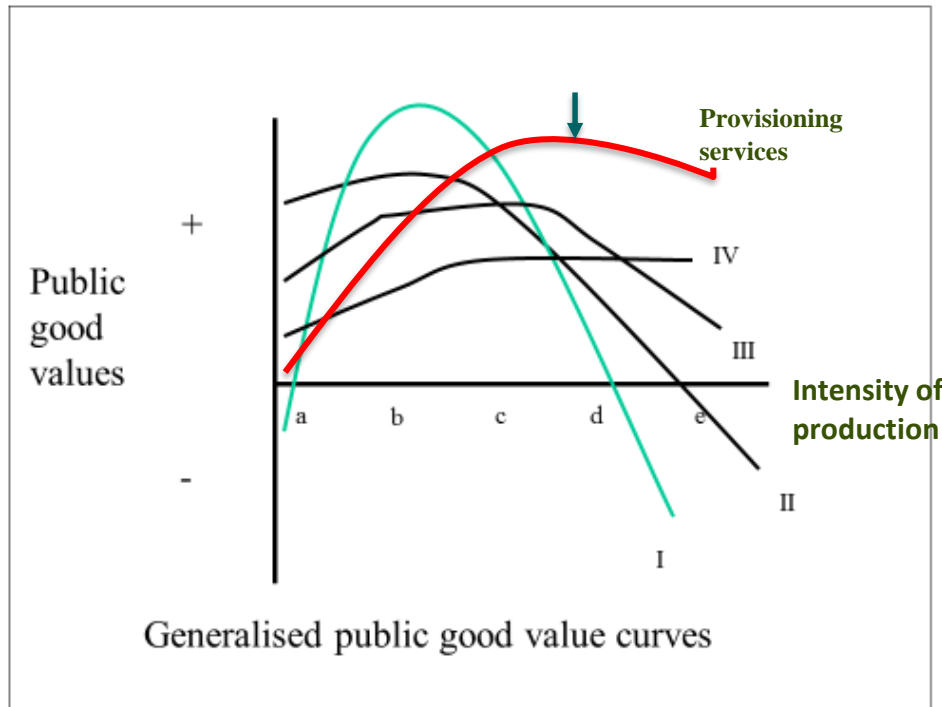
Rural land use directly implicated in high runoff, especially unforested uplands.



Key lessons from the microcosmic view

- At this scale, we can identify good and bad practices **between** landholdings
- Path dependencies matter: some current “good practices” reflect past choices (e.g. shelter belts and mixed woodland on poorer land).
- Style of farming matters and this is driven largely by personal and managerial choices
- Prices matter: of inputs and outputs; a cost-price squeeze may not be good for the environment
- The whole infrastructure of policy matters- **it is still too easy to do damage to the environment and get away with it**
- Less than 10% of the land is probably generating 80% of the environmental costs- so let's find the hotspots (and sweet spots).
- Getting collaborative action may not be easy, but landscape-scale planning is needed
- We know what is needed to improve the GBI: the issue is less ecological knowledge than applying the remedies through policy and regulation!

There is a sweet spot for delivering GBI Ecosystem Services



I = recreation
II = biodiversity
III = landscape/cultural
IV = carbon

a = no management
b = modest management
c = medium management
d = semi-intensive management
e = intensive management

And it is not where there is no production
.and it is shaped by biophysical characteristics
...and it varies from place to place
.....and deintensification can be a problem as well as intensification

Finding the sweet spot

- In the past this point occurred to a degree “naturally” in rural areas, because the dominant land use systems and technical optima still left space for nature. The GBIs were in place serendipitously
- Intensification, increased use of fertiliser and pesticides and boundary removal have all removed much of that space for nature- and often degraded the functional GBIs
- In the last 30 years, ESAs then other agri-environmental schemes have endeavoured to nudge farmers towards improved environmental outcomes....but “Outstanding research questions include whether AESs enhance ecosystem services.” Batary et al. 2015
- Productivist farming cultures often militate against accepting environmental improvements even if these changes are compensated
- Some micro-scale ecological remediation may also be very good for production functions and may be low cost (beetle banks, uncultivated headlands)

Karl Falkenberg 2016

“The current pattern (of the CAP) increases not only social inequalities, but also environmental problems, monocultures and rural desertification. Long-term trends on rural employment, farming incomes and major environmental indicators for soil quality and biodiversity remain problematic.”

The IPBES 2019 recommendations



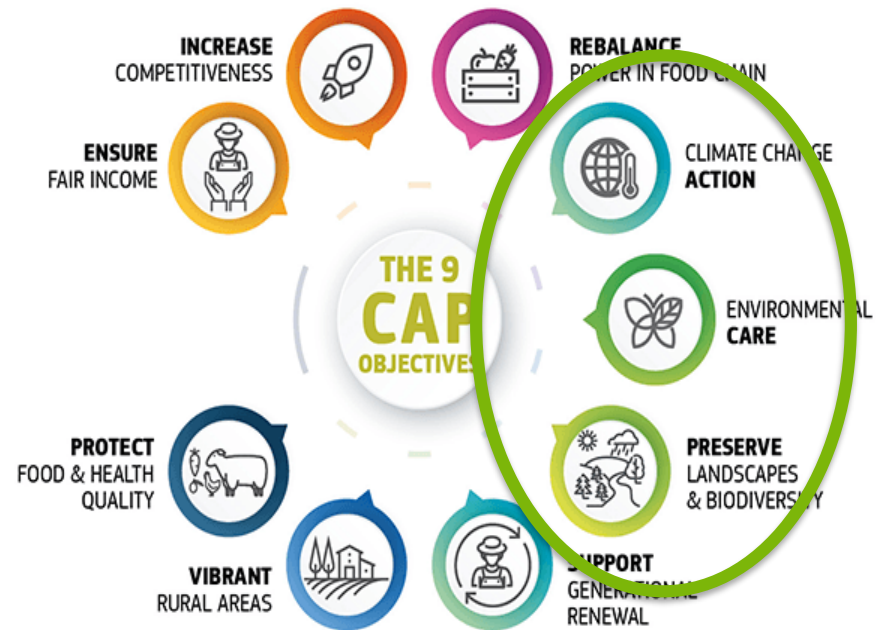
Where is EU policy and practice in relation to these approaches?
Not that far forward, I suspect.

Looking forwards to a new CAP

Conclusions of recent PEGASUS project (2018)

“Current regulations and CAP funded incentives provide an essential foundation for the provision of environmental and social benefits by agriculture and forestry in the EU.

However, they have not been used so far in a way that sufficiently delivers the wide-ranging, long-lasting changes that are required to meet the objectives set out in EU legislation”



Or more of the same? The wider aspiration is evident but change is very slow

Why have the instruments not been used sufficiently?

- Most EU instruments that promote good biodiversity and good environmental management are discretionary “carrots”
- Some “sticks” e.g. regulations such as WFD; Pesticides Directorate
- Sticks, carrots and sermons are all needed...
- But many sermons are only preaching to the converted
- There is a big cohort of farmers that is slow to learn and difficult to shift towards new land management cultures, including GBIs
- There is too much income security provided by the SPS and Pillar 1
- Too often the sticks are too weak

Many promising initiatives

- The results of these **BiodivERsA** studies will significantly inform the debate
- But can we generalise? To what extent are the positive findings contingent on local/sub-regional biophysical context, policy architecture, local economy and local people?
- We still almost certainly need practice-based education backed by bigger sticks and redirective policy carrots
- But some communities are especially hard to reach:
 - Areas experiencing desertification of people and land
 - Areas of entrenched poverty in remoter regions (sometimes)
 - Highly productivist areas where technocratic money oriented farmers and the agro-food complex supports intensive production

And there remain gaps in knowledge

- Compound causal effects (habitat loss, herbicides and insecticides, climate change interactions) and their impacts
- Soil biology and microbiology: below the surface ecosystems, including plant microbial interactions and plant disease resistance. Soil as critical green infrastructure
- The full social and environmental costs of land use system simplification remain understudied
- The GBI values of emerging land use systems- e.g. abandoned low grade farmland, scrub woodland, even motorway embankments need to be better understood
- Creating appropriate institutional architecture to deliver effective change is crucial.

Some further questions about GBIs?

- Just how significant (in ES terms) are the legacy GBIs, the relics of the earlier cultivated and uncultivated landscapes?
- What are the most cost-effective strategies and optimal policy mixes to create new GBIs in different settings? What are the most effective underpinning policies and practices in say climate proofing a city such as Copenhagen?
- What is the scope for GBIs to mitigate the adverse effects of climate change (flooding, connectivity in landscape, C sequestration etc. etc.)?
- What stacked benefits can arise in both rural and urban GBIs? Again the Copenhagen model stands out.

Conclusions: The core thinking is in place

“Ecosystem services should be part of a sustainable European **agriculture**, using **“green infrastructures”** to address issues like floods, climate change, soil erosion.” Falkenberg 2016

Even if the direction of travel is right, **the pace of movement is far too slow**. There is an urgency which is evidenced in all sorts of ways, from climate change, to biodiversity loss, to soil loss, to water quality decline.

The power of agribusiness in rural areas and of unbridled capital in urban contexts must be addressed and realignment towards circular economy principles and internalization of externalities must be policy driven.

We cannot understand the importance of GBIs through a single species or single ES lens. Because of inter-connectivity, we need whole system studies to explore stacking and interactions.

Thank you

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