

Biodiversity and ecosystem services net gain: a comparison of metrics

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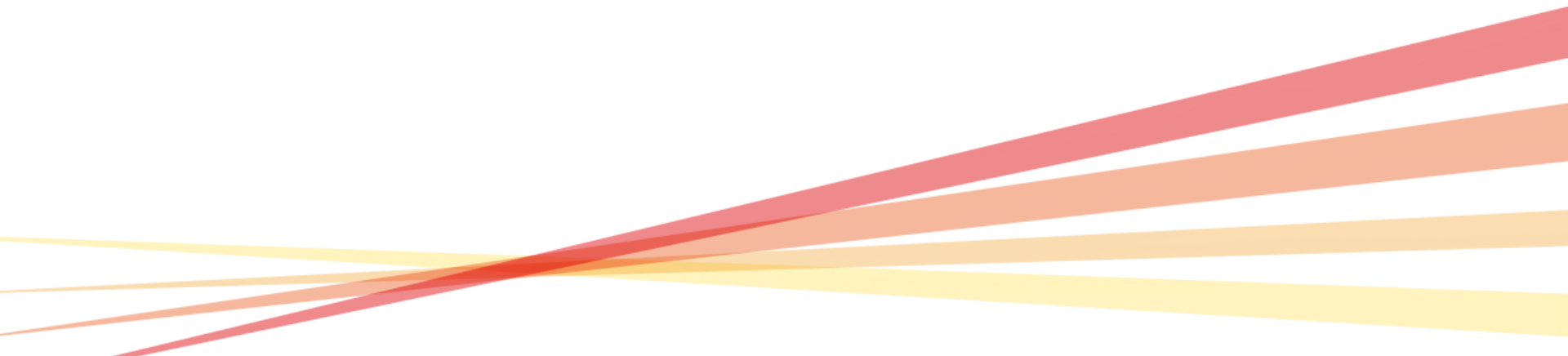


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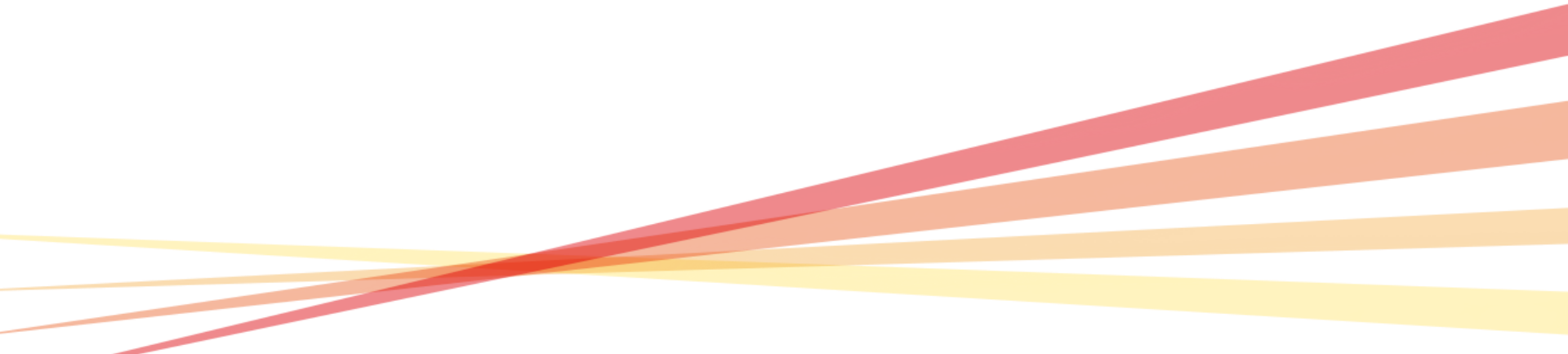
SEFARI 

The SEFARI logo icon consists of a central green plant-like shape with several white lines radiating outwards, resembling a sun or a starburst.

Key findings

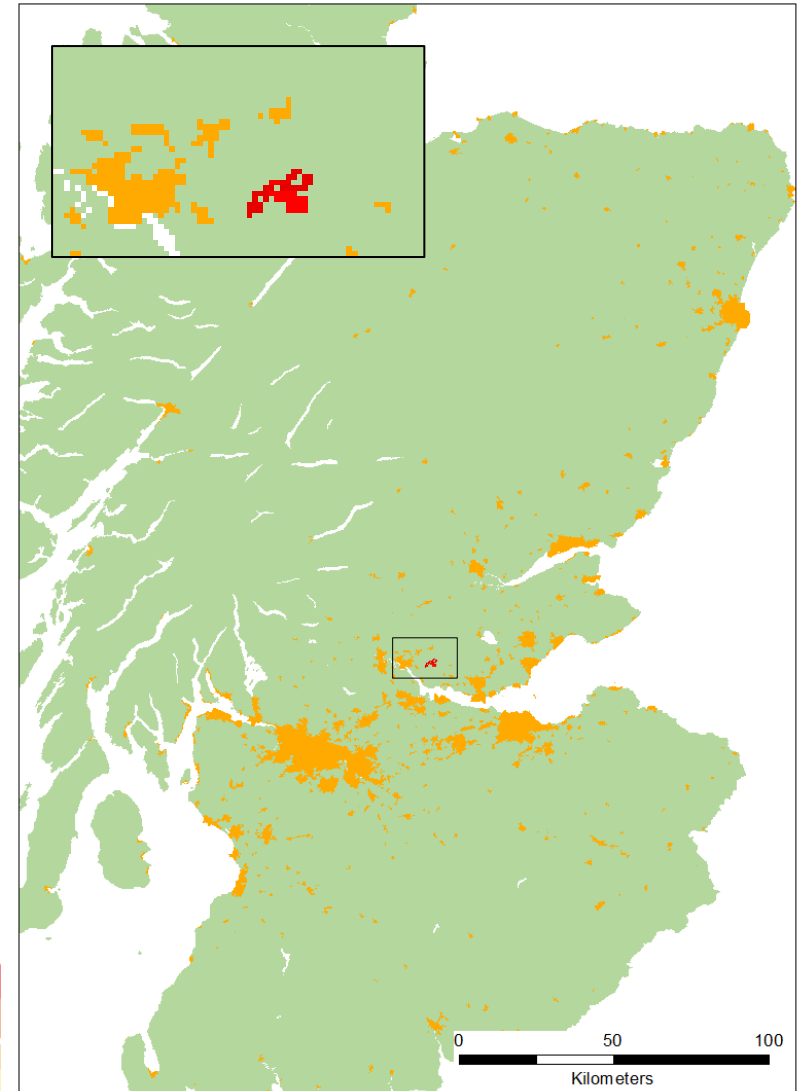


Rationale

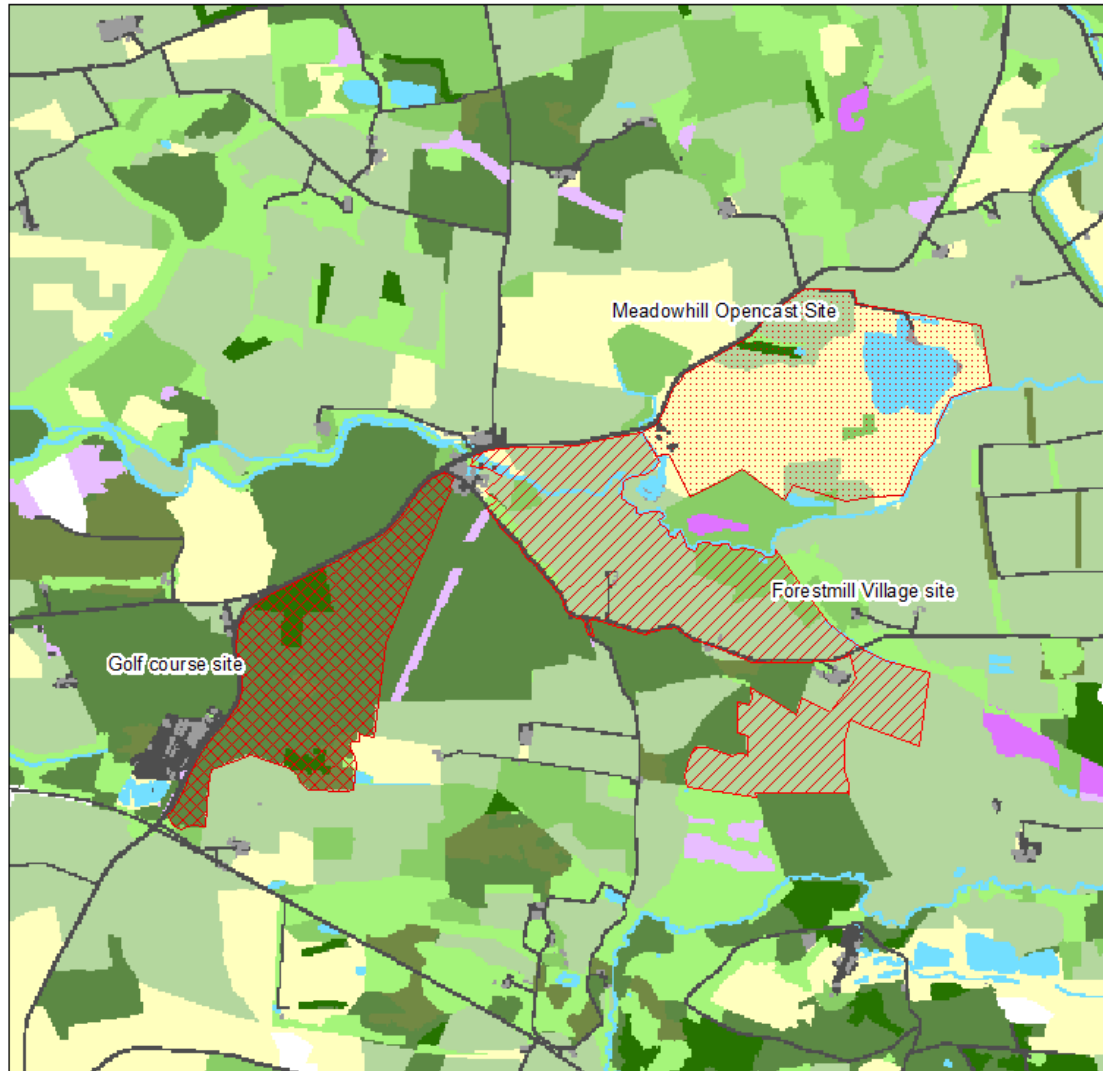
- Biodiversity offsetting metrics often focussed on narrow measures of extent and condition
 - Assessment requires field based assessment, reduces potential for more 'strategic' applications
 - Does not consider impacts on other ecosystem services
- 

Case study site

- Forestmill,
Clackmannanshire, central
Scotland
- Village site:
 - 121 ha site
 - 1250 new homes
- Woodland site:
 - Golf and hotel development
 - Semi-natural woodland
- Meadowhill
 - Restored open-cast mine
- Village approval linked to
restoration



Habitat map



Forestmill and associated development sites

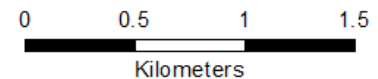
Legend

Development type

-  Forestmill village site
-  Forestmill golf course site
-  Meadowhill

EUNIS habitats

-  C Inland surface water
-  D1 Raised and blanket bogs
-  E Grasslands
-  E2 Mesic grasslands
-  F4 Temperate shrub heathland
-  G1 Broadleaved deciduous woodland
-  G3 Coniferous woodland
-  G4 Mixed deciduous and coniferous woodland
-  G5 Lines of trees, small anthropogenic woodland, recently felled woodland, early woodland/coppice
-  I1 Arable land
-  J1 Buildings
-  J4 Transport networks



Summary of habitat



EUNIS code and description	Forestmill village	Forestmill golf course and hotel	Meadowhill opencast
C Inland surface water	3.2		13.3
E Grasslands	11.3	0.0	1.2
E2 Mesic grasslands	100.0	0.2	16.5
G1 Broadleaved deciduous woodland	1.7	0.3	0.6
G3 Coniferous woodland	0.5	60.1	
G5 Lines of trees, small anthropogenic woodland, recently felled woodland, early woodland/coppice		7.5	1.2
I1 Arable land and market gardens	0.9	0.1	65.6
Total	121.2	73.6	100.2

Applying the offsetting metric

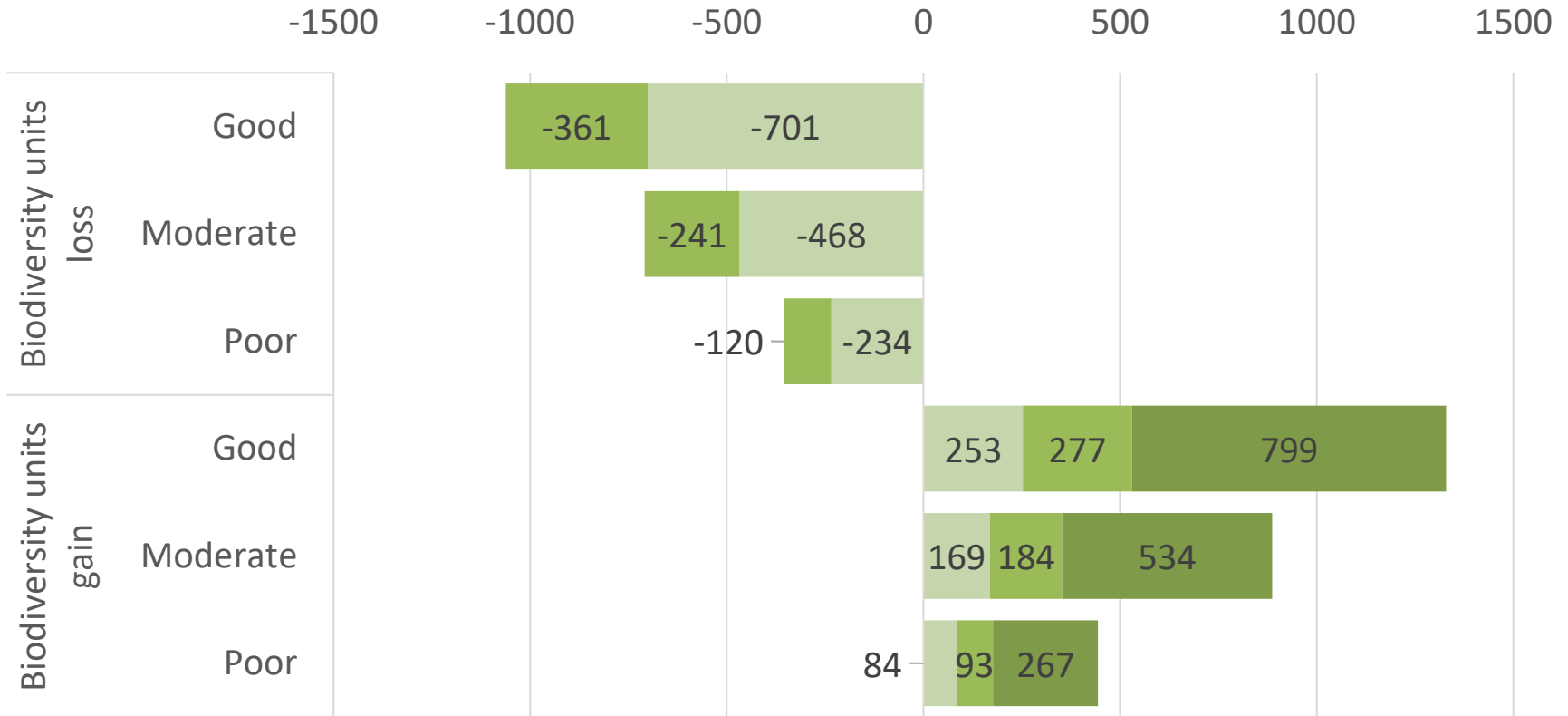


- $B_{ha} = D_{hab} \times C_{hab}$
 - B_{ha} is the number of biodiversity units per hectare,
 - D_{hab} is distinctiveness scored as 6, 4, or 2 for high, medium and low
 - C_{hab} is condition scored as 3, 2 or 1 for good, moderate or poor
- Distinctiveness can be determined from the EUNIS habitat
- Condition is difficult to determine remotely and across all habitats – used as a sensitivity measure

Biodiversity metric scores



Gain and losses of biodiversity units



■ Forestmill village
 ■ Forestmill golf course and hotel
 ■ Meadowhill restoration site

Offsetting outcomes



- Major habitat losses are grassland (village site) and coniferous woodland (golf course site)
- On-site habitat gains would need to be ‘high’ condition to offset losses where initial condition was ‘low’
- Adjacent habitat restoration can offset and achieve net gain
 - But, only if condition of restored habitat is at least as good as lost habitat

Applying an eco-metric

- Based on Natural England proposal
- $ES_{ind} = A \times C \times ES_{hab}$
 - ES_{ind} is the ecosystem service units for each individual service
 - A is the area (ha) of the habitat patch
 - C is the condition weighting calculated in the same way as the biodiversity offsetting metric
 - ES_{hab} is the individual ecosystem service potential score

Selected ES for assessment



- Mediation of liquid flows, i.e. flood risk reduction
- Pollination and seed dispersal
- Maintenance of water's chemical condition, i.e. water quality
- Global, regional and micro climate regulation
- Physical and experiential interactions, i.e. recreation

ES potential scores

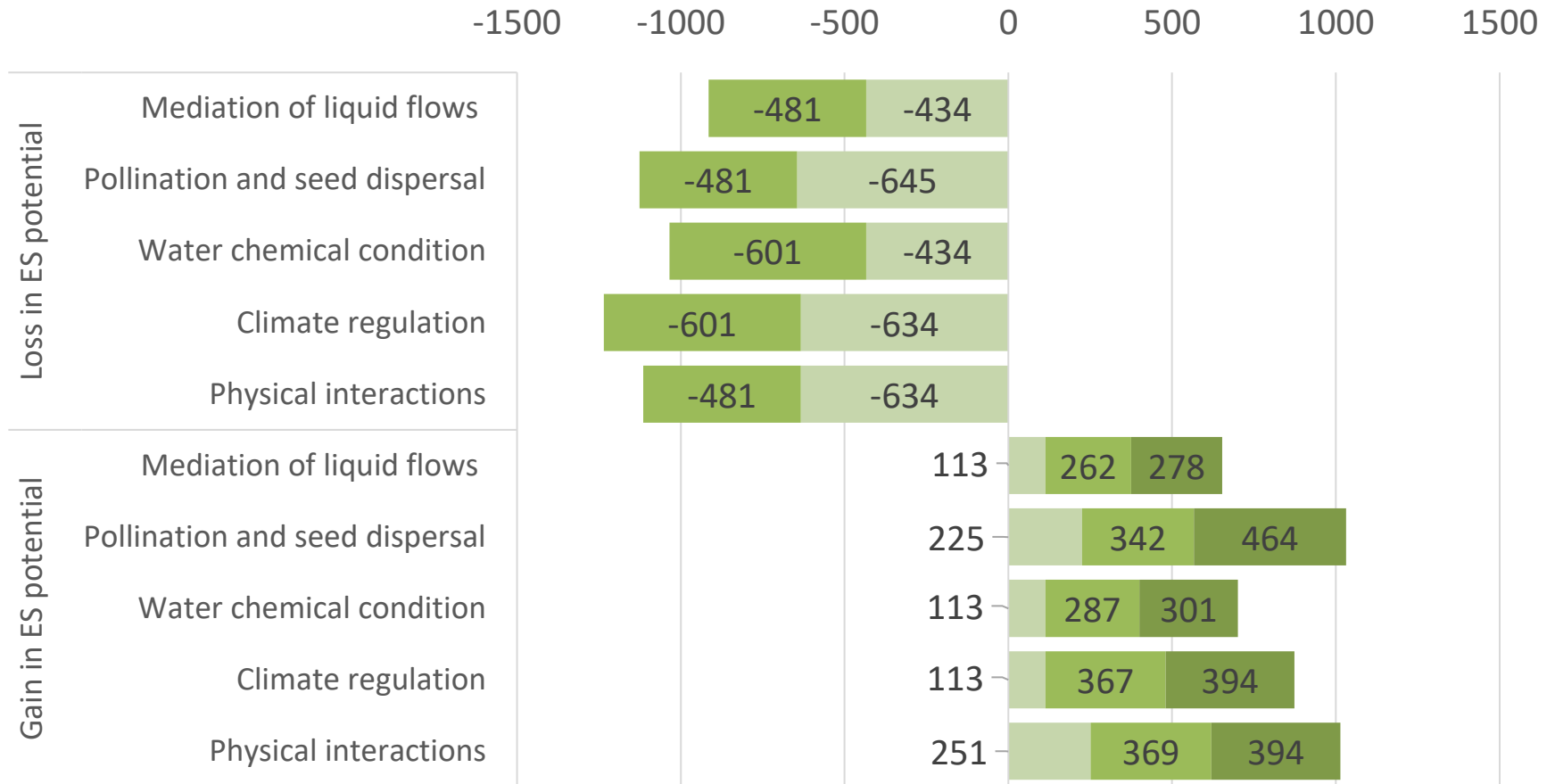


EUNIS habitat	Liquid flows	Pollination and seed dispersal	Water quality	Climate regulation	Physical and experiential interactions
C Inland surface water	5	1	3	2	5
E Grasslands (rough grazing)	3	4	3	3	3
E2 Mesic grassland (lowland meadow)	2	4	2	3	3
E2 Mesic grasslands (intensive)	2	3	2	3	3
E7 Sparsely wooded grasslands	2	4	2	2	2
G1 Broadleaved deciduous woodland	4	4	5	5	5
G3 Coniferous woodland	4	4	5	5	4
G4 Mixed deciduous and coniferous woodland	4	4	5	5	5
G5 Lines of trees...	3	4	4	3	3

Ecosystem services impacts



Ecosystem services potential losses and gains



■ Forestmill villlage site
 ■ Forestmill golf course and hotel
 ■ Meadowhill restoration site

ES impacts summary



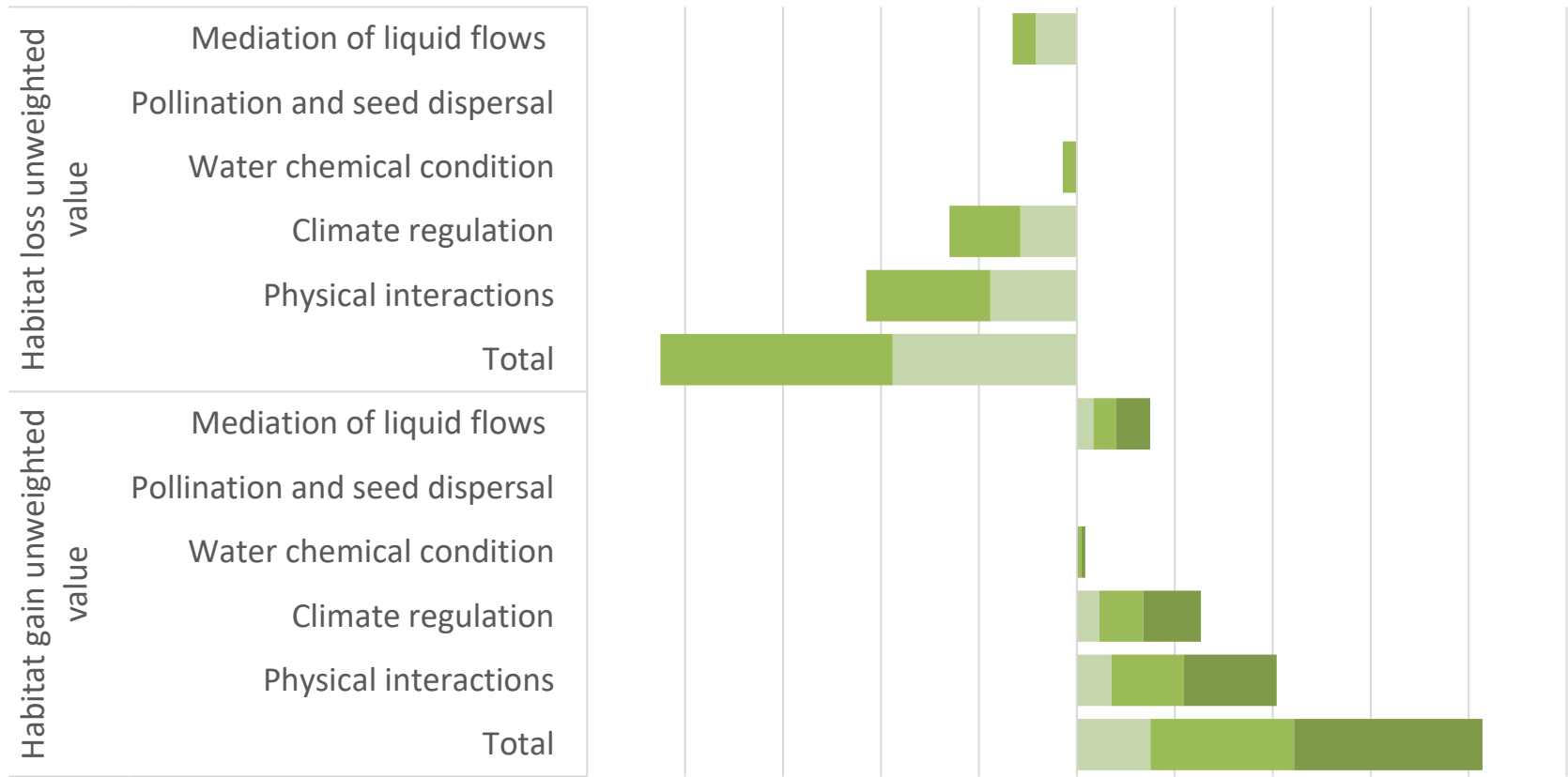
- Loss of ES potential is not offset either within each site or overall
 - Except small gains on golf course site for pollination and recreation
- But! The scoring does not account for ES demand or changes in other impacts
 - Development will bring more people to sites, i.e. residents and golf course users
 - Will also increase pressures, e.g. greater sealed surface adds to flood and water quality risks
- An accounting approach using valuation may be more appropriate

Applying ES values (unweighted)



Gains and losses in unweighted ES values

-50000 -40000 -30000 -20000 -10000 0 10000 20000 30000 40000 50000

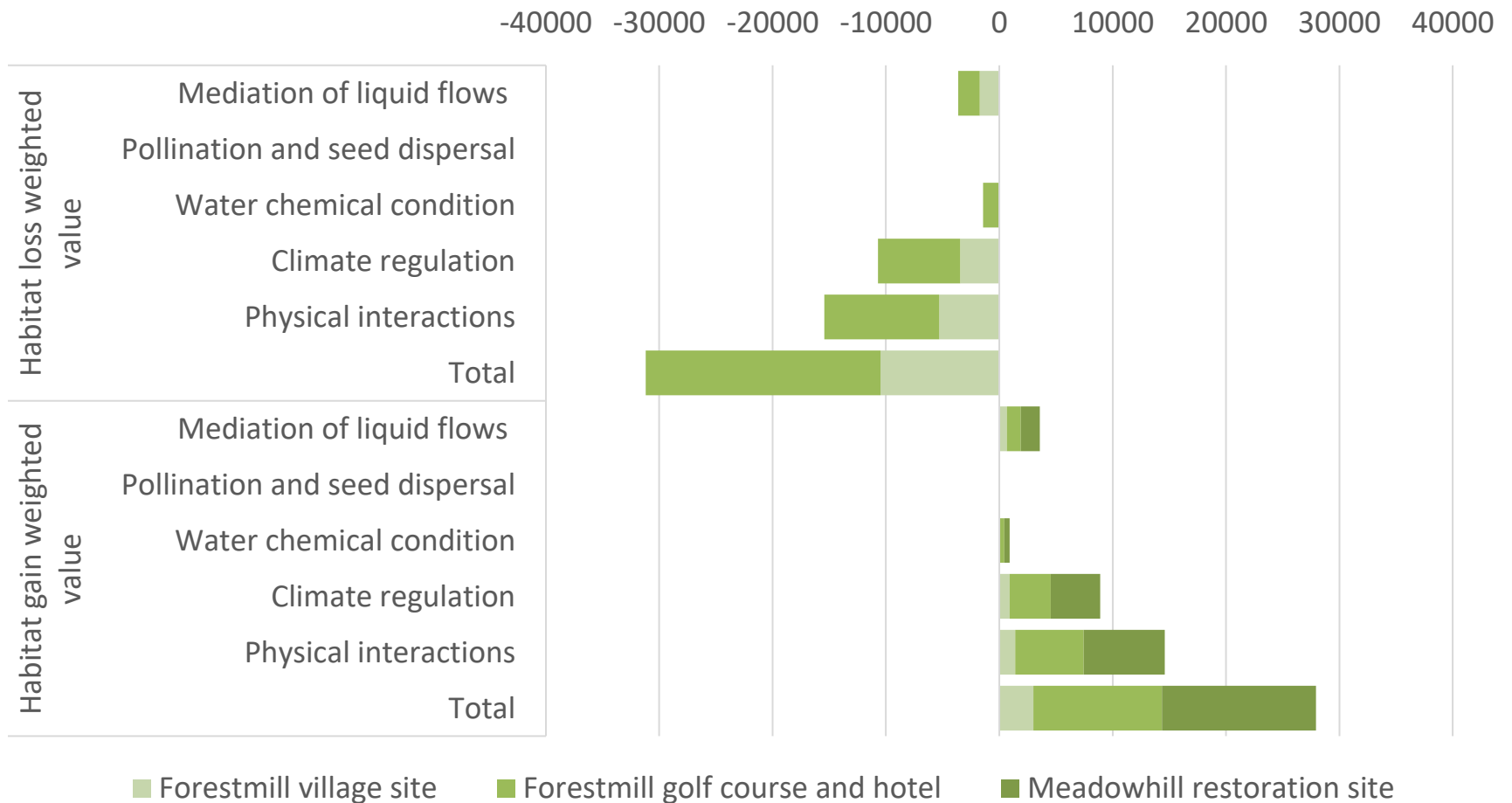


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Applying ES values (weighted)



Gains and losses in weighted ES values



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