

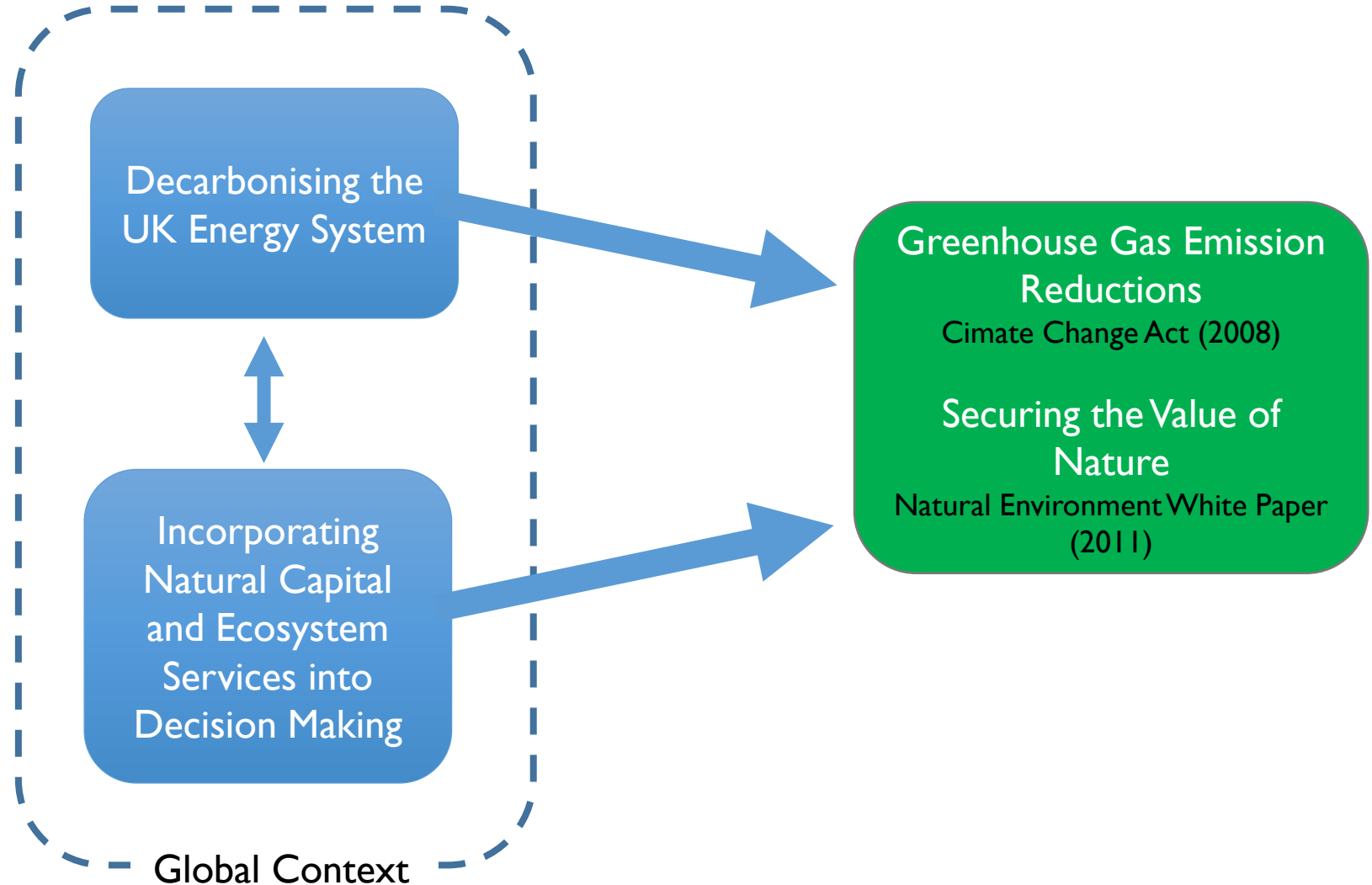
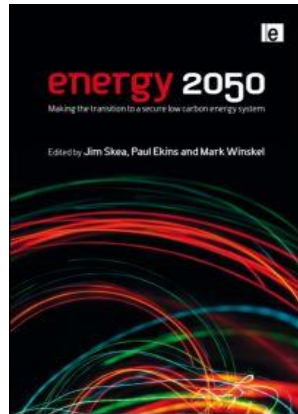
# Spatial Modelling of the Energy-Land-Water Nexus: Challenges and Opportunities

Andrew Lovett, Brett Day, Amii Harwood,  
Anthony De-Gol, Gilla Sünnerberg, Ian Bateman

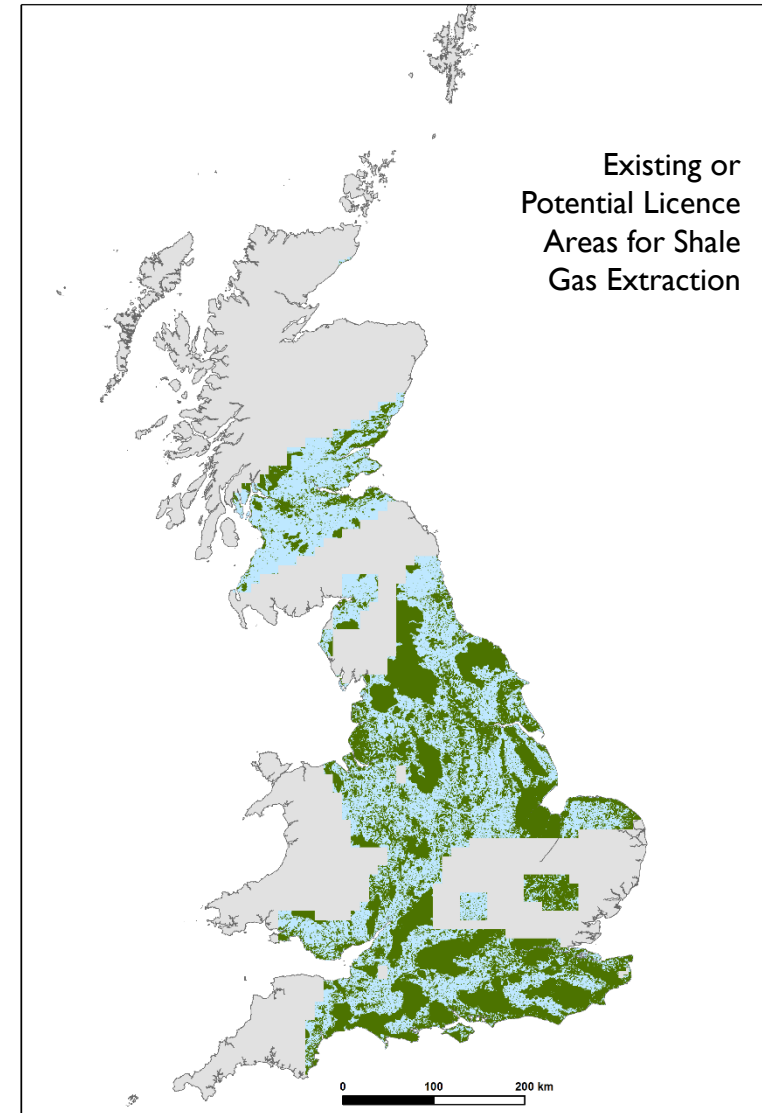
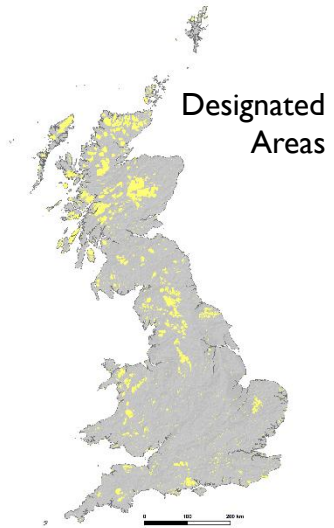
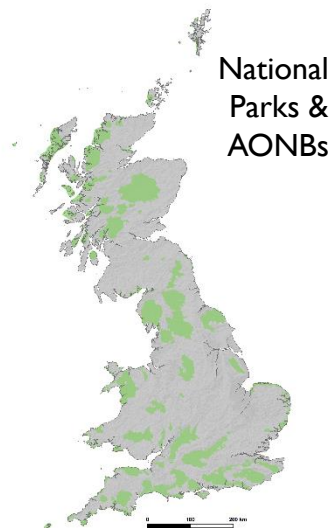
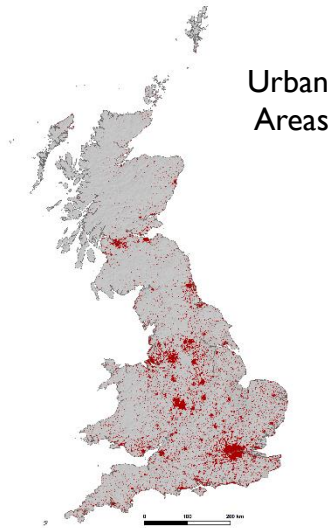
School of Environmental Sciences,  
University of East Anglia

Email [a.lovett@uea.ac.uk](mailto:a.lovett@uea.ac.uk)

# The Energy – Land – Water Challenge



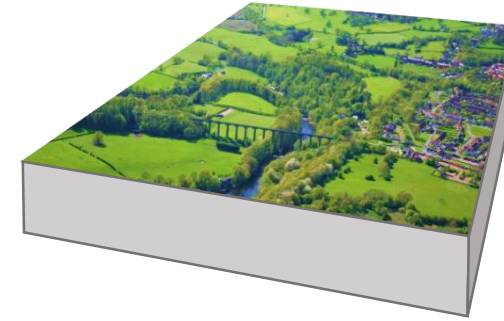
# The Need for a Spatial Perspective



Licence  
areas =  
50% of GB

Area after  
excluding  
4 potential  
constraints  
= 24%

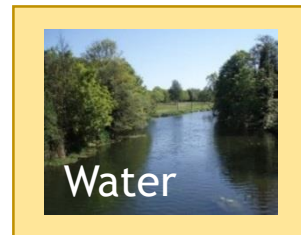
# Valuing Land Use Change



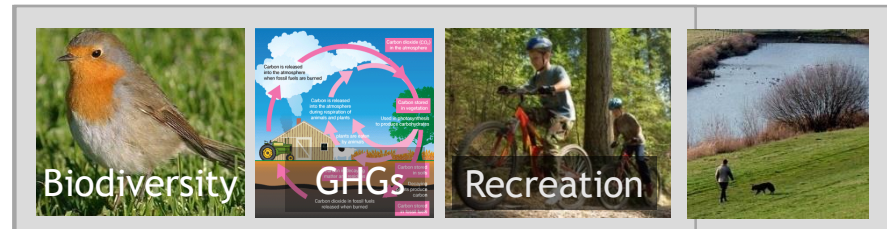
Land Use:



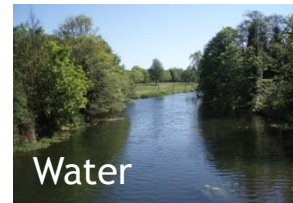
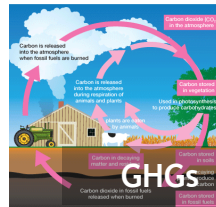
Market Goods:



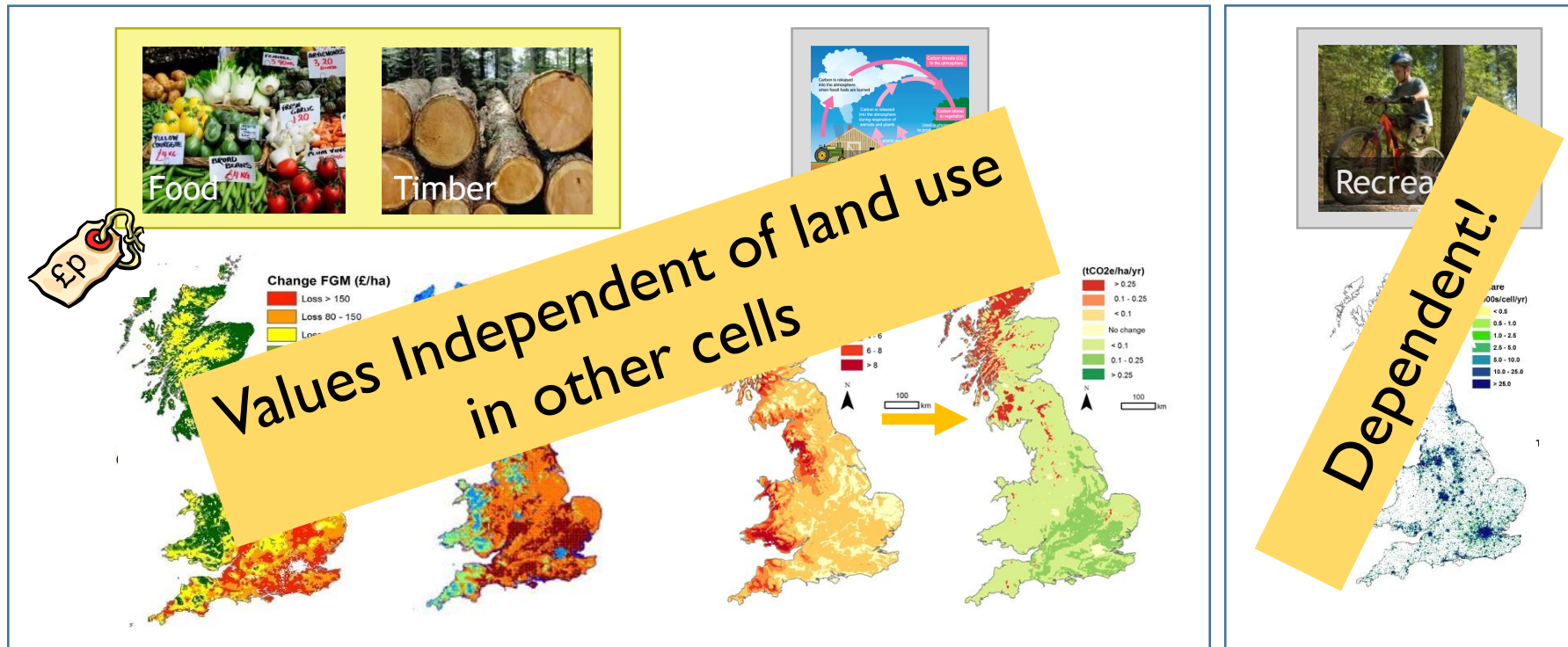
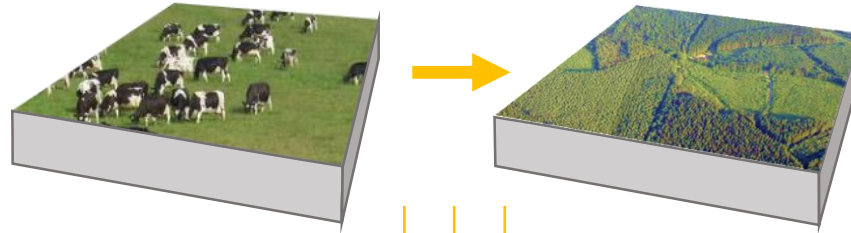
Non-Market Goods:



# The Research Question



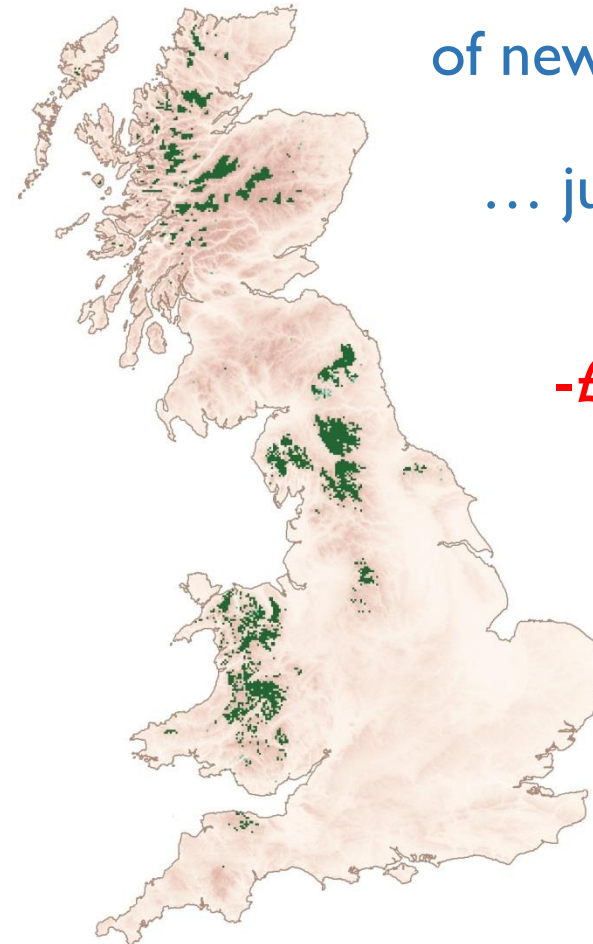
# Policy Appraisal



# The Integrated Model (TIM)

```
TIM.m x
25 %% MAIN SIMULATION LOOP
26 %*****
27 preMainLoopSetup
28
29 disp('MAIN LOOP GO')
30 if (MP.PLANTING); disp('Evaluating planting scenario'); else disp ('Running without planting'); end;
31 tic
32 for y = 1:MP.PERIOD:MP.NUMYEARS % (NB NUMYEARS is number of year AFTER baseline year)
33     year=GENFUN.currYear(y); % Alternatively just use the function in place of year.
34     disp(year)
35
36     % CLIMATE CHANGE:
37     UpdateClimate
38
39     % POLICY DECISIONS:% Decide where to plant trees:
40     if (MP.PLANTING)
41         ApplyPolicyDecisions
42         if (~MP.ReRun); RecordPlantingDecision; end;
43     end
44
45     % Land Use and Livestock
46     UpdateAgModel
47     AgModel.AgIncome(:,y) = AgModel.LUProfits+AgModel.LSProfits-PV.TotalFarmLand.*MP.SUBTRACTSFPM.P.SFP;
48     AgModel.SFP(:,y) = (1-MP.SUBTRACTSFPM)*GENFUN.RemFarm.*MP.SFP;
49
50     % Subdivide output from AgModel
51     calcSUBAGDerived
52     calcCONDEC
53
54     % Biodiversity
55     calcBioDiversity
56
57     % Cool Farm Tool:
58     calcCFTEmissions
59     CFT.Total(:,y) = sum(CFT.per_cell_Em,2)+sum(CFT.per_cell_LSEm,2);
60
61     % Water Quality
62     calcWaterQuality
63
64     % Record Scenario Data
65     RecordScenarioData
66
67 end
68 disp('Main Loop Finished')
69 LoopRunTime = toc
70 clear y year totcells tmpr species sc speccode
71
```

# Farming vs Forestry



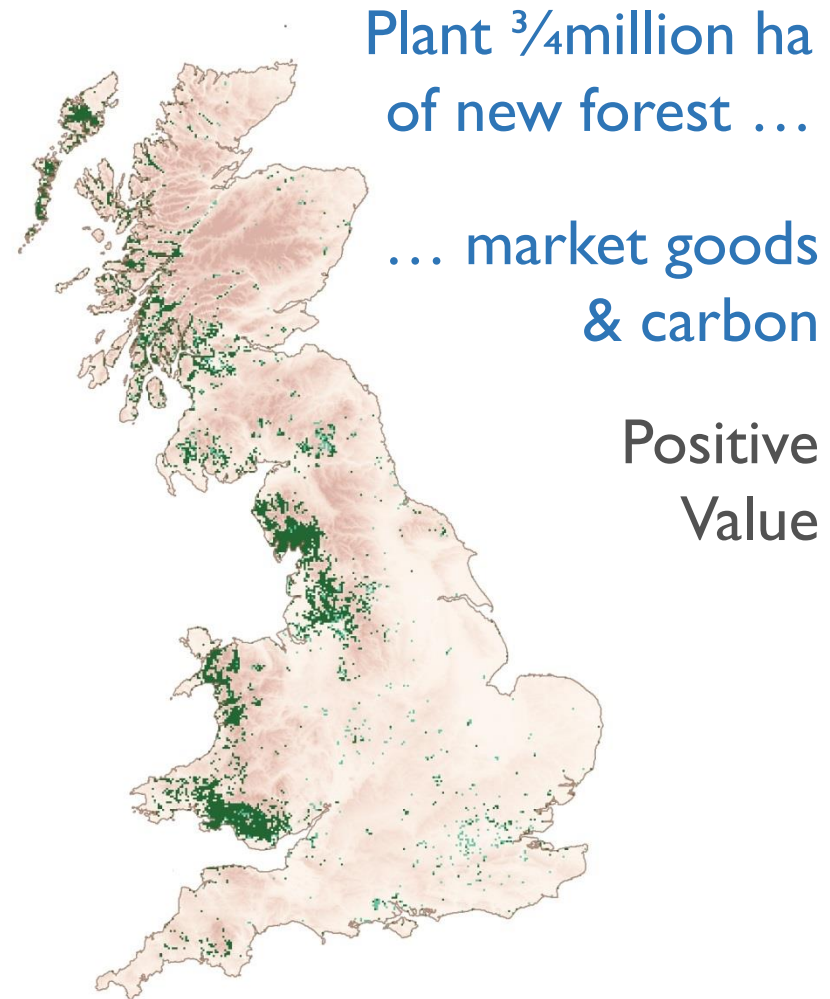
Plant  $\frac{3}{4}$  million ha  
of new forest ...

... just market  
goods

-£65 million  
per year



# ... and Carbon ?

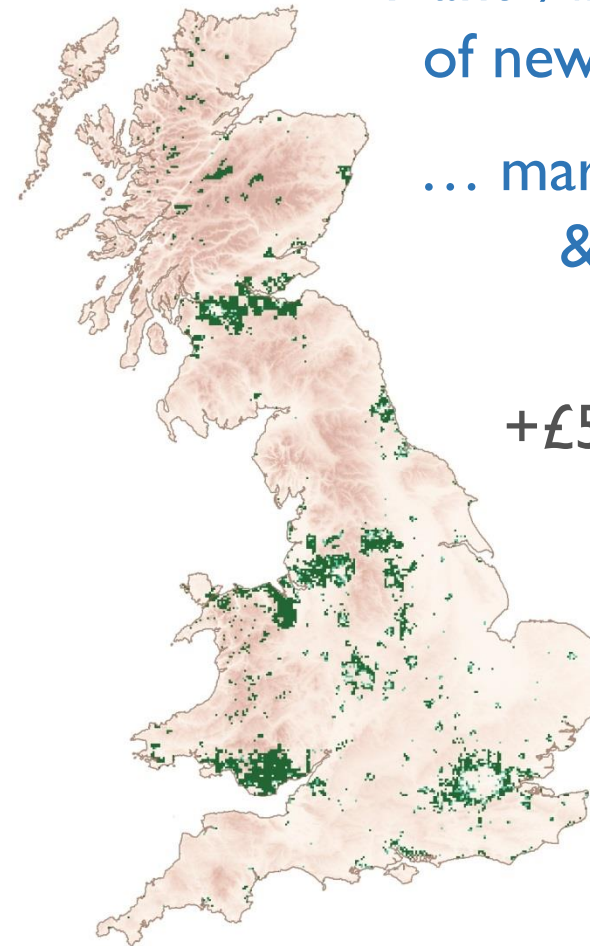


Plant  $\frac{3}{4}$ million ha  
of new forest ...

... market goods  
& carbon

Positive  
Value

# ... and Recreation?



Plant  $\frac{3}{4}$ million ha  
of new forest ...

... market goods  
& carbon &  
recreation

+£546 million  
per year

# The ADVENT Project

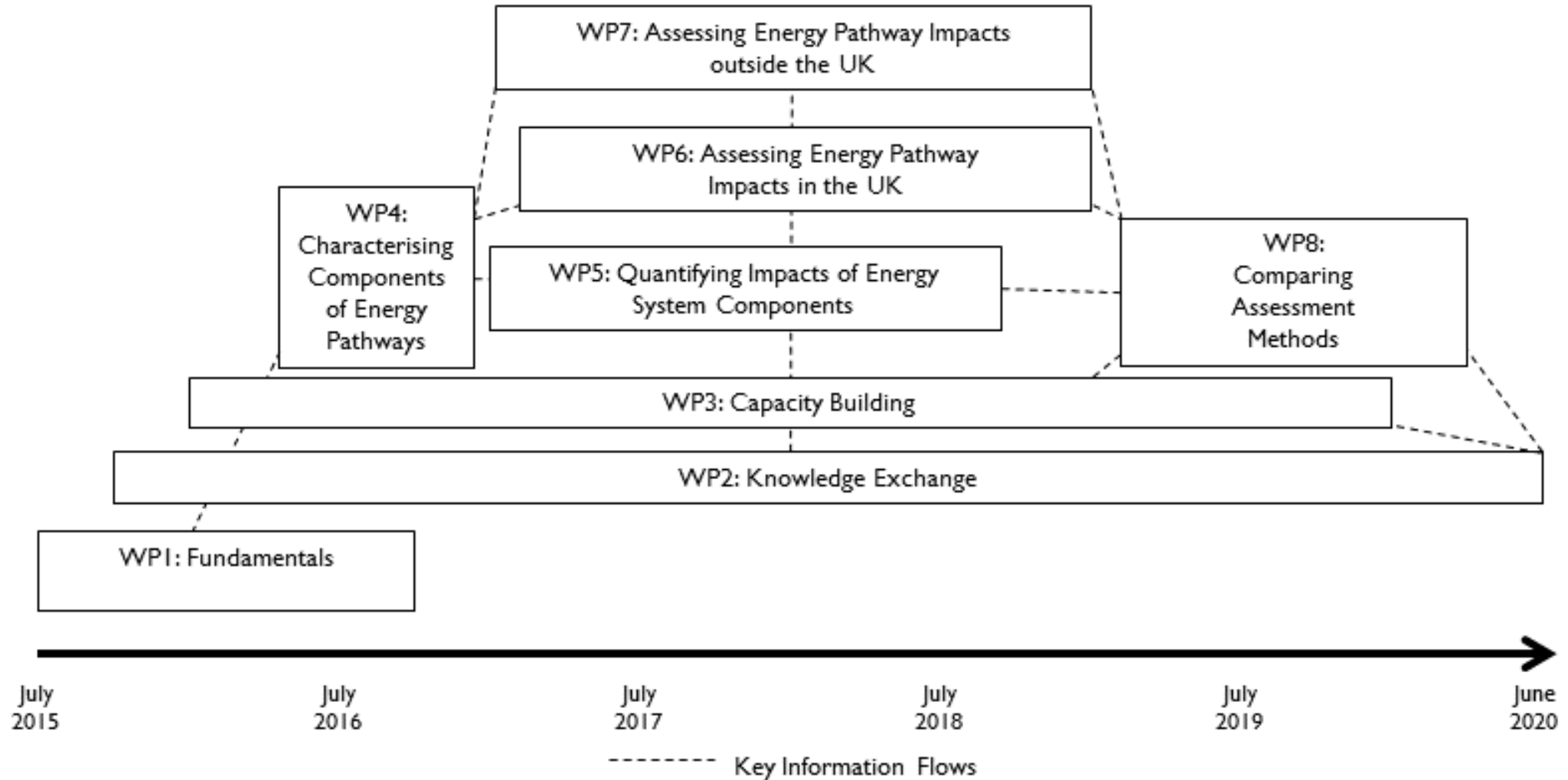


The NEAFO spatial modelling approach will be extended to include the implications of prospective UK energy pathways as part of the new ADVENT (ADdressing Valuation of Energy and Nature Together) project.

ADVENT is funded by NERC and runs from 2015-20 as a 'grand challenge' associated with the UKERC Phase 3 Research programme. It involves a consortium of six partners.



# Programme of Research



# Integration of Pathway Evaluation

