Mechanisms and consequences of tipping points in lowland agricultural landscapes (TPAL)

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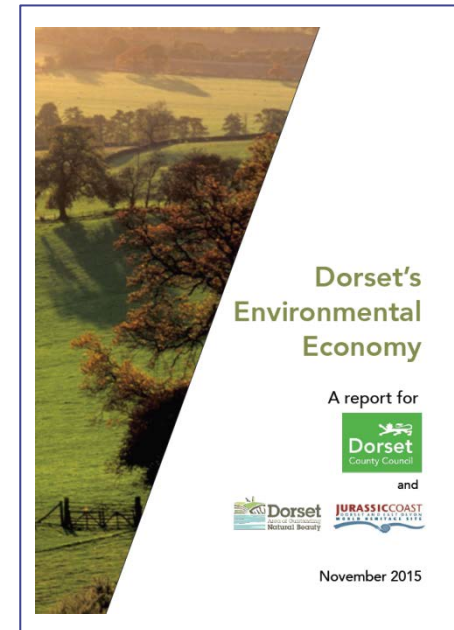
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Aims and objectives

Overall aim: to examine the mechanisms and consequences of tipping points in lowland agricultural landscapes.
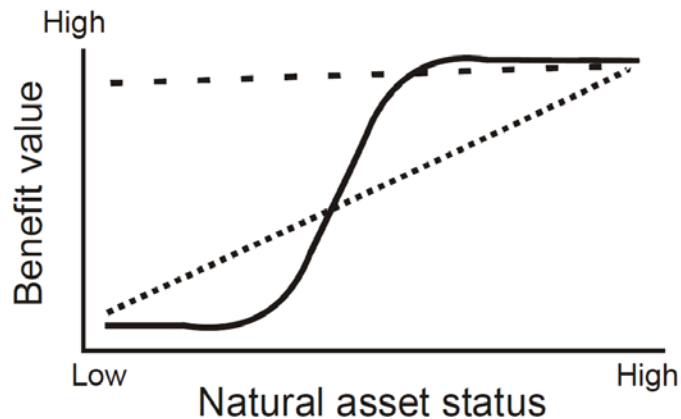
Specific hypotheses:
• when landscapes are subjected to increasing anthropogenic pressures, the relationships between natural asset status and benefits will display threshold responses (tipping points);
• threshold responses will be observed between the dimensions of asset status (quantity, quality, spatial configuration), both independently and in combination, and the provision of benefits;
• as thresholds in natural assets are reached and exceeded, the values of ecosystem services and benefits will decline rapidly throughout socio-economic systems;
• the principal mechanisms underlying threshold responses are interactions and feedbacks between anthropogenic pressures and the ecological processes influencing service flows.

Overview

• Research partners include Centre for Ecology & Hydrology and University of Cambridge, and the Dorset Economic & Environmental Model (DEEM) project

• The project will focus on the county of Dorset, UK, taking advantage of existing datasets (eg R. Good biodiversity data, CEH heathland survey, INVEST maps etc.)

• Key target stakeholders will be the Dorset Local Enterprise Partnership (LEP) and the Dorset Local Nature Partnership (LNP)

• The analytical framework will be based on that of Mace et al. (2015) / Natural Capital Committee

Dorset's Environmental Economy

A report for

Dorset County Council

and

Dorset Area of Outstanding Natural Beauty

JURASSIC COAST

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Analytical framework

Alternative forms of natural capital asset–benefit relationships, as hypothesized by Mace et al. (2015), *J. Appl. Ecol.*
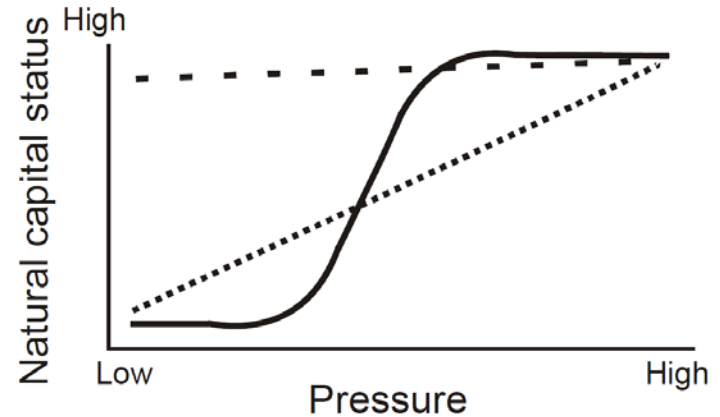
We hypothesize that the relationship between anthropogenic pressures and natural capital status may also demonstrate a threshold response (continuous line). This provides a potential mechanism for tipping points in benefit provision.

Analytical framework

Mace et al. (2015) identify three dimensions of asset status:

(i) *quantity* or 'amount' of the asset (i.e. its area, volume or mass);
(ii) *quality*, which refers to the condition of the asset; and
(iii) *spatial configuration*, which refers to its location and spatial distribution pattern.

Potentially, tipping points could be associated with each of these three dimensions, although this has not been examined systematically.
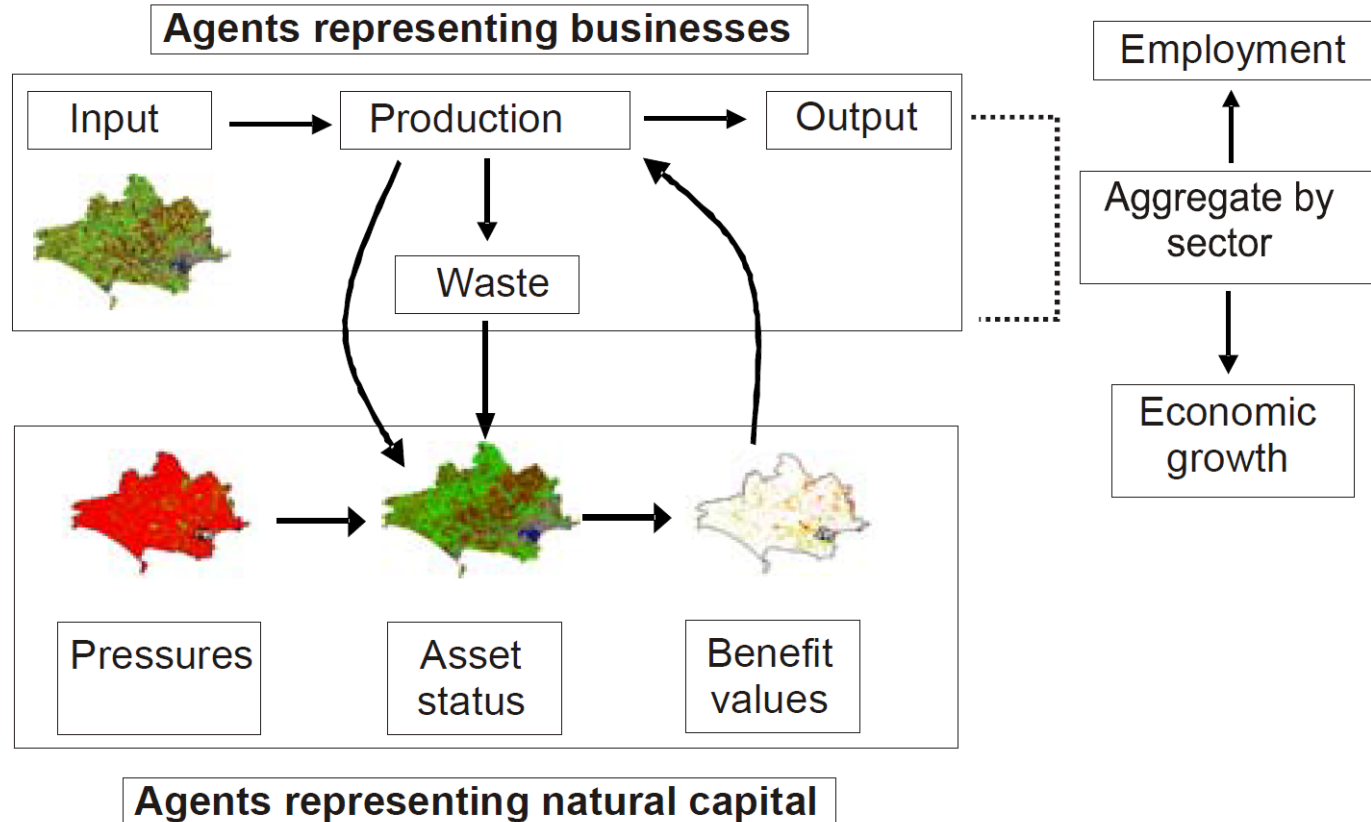
Consequently, we will examine each of these three dimensions independently.

Approaches

The aim is to detect and analyse tipping points in the:

- *past* – using analysis of long-term data sets (WP1)

- *present* – using gradient analysis (WP2)

- *future* – using agent based modelling (WP3)

Agent based model linking natural capital to the economy

Agents representing businesses

Input → Production → Output

Waste

Employment

Aggregate by sector

Economic growth

Pressures → Asset status → Benefit values

Agents representing natural capital

Outputs

(i) **spatial database** incorporating measures of natural asset condition, ecosystem services and benefit values for Dorset;

(ii) **analyses of long-term datasets** to determine the occurrence and impacts of tipping points;

(iii) **field data** describing asset condition and benefit provision along multiple gradients within Dorset;

(iv) **spatially explicit model** of natural asset and ecosystem service dynamics parameterised and calibrated, to enable the impacts of tipping points to be evaluated;

(v) **scenarios** developed of the potential impacts of land use decisions on the occurrence of tipping points, and of the potential impacts of tipping points on the local economy;

(vi) **at least four publications** in international journals.