Evaluating strategies for diffuse pollution under climate-induced landuse change
A case study of the River Tamar, UK

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Euro-limpacs Decision Support System

- GIS tool to evaluate catchment management strategies in the context of climate change
- Flexible structure can be applied to different problem types (e.g. diffuse pollution, flooding, acidification)
- Uses Multi-criteria Analysis (MCA) to assess which strategy is preferable
Multi-criteria Analysis

- Identify key environmental, social and economic variables influenced by management strategies
- Determining the optimum strategy needs to consider the trade-offs between variables (e.g. cost and water quality)
- Partly a scientific assessment and partly a subjective stakeholder view (e.g. how important is fishing compared to potable water?)
Multi-criteria Analysis

- Normalise the variables by transforming from metric (e.g. ha, mg/l, diversity score) to scale from 0 to 1
- Number of methods for doing this
  - Policy thresholds
  - Ecosystem limits
- Weight the values and sum to give overall score for the condition of the catchment
Application to the Tamar, UK

• Problem with diffuse pollution
• Measures to address diffuse pollution:
  – reduction in fertiliser applications and improved fertiliser practices
  – reduction in stocking density
  – shift back from arable to pasture
  – restoration of wetlands
• What will happen under climate change?
Climate Scenarios and Management Strategies

• Management Strategies
  – Business as usual
  – Policy Targets
  – Deep Green

• Climate scenarios
  – IPCC scenarios A2 and B2
  – Years 2050 and 2085
Variables

- Nitrate concentration at the outlet of each of the major sub-catchments of the Tamar
  - yearly average
  - April to September (low flow, ecologically sensitive period)
  - October to March – higher flows
- Costs of implementing the measures
- Biodiversity indicators
  - area of non-farmed land
  - wetland area
- Hydrology
  - mean flow
  - high flow
  - low flow
Models – quantify the variables

• Climate and Landuse Allocation Model (CLUAM)
  – Predicts changes in agricultural landuse distribution, incorporating climate change
  – Based on global economic models, crop requirements

• INCA-N
  – Models nitrate concentration using climate, landuse and management
Climate data → Landuse Stock levels → Scenario landuse and stock levels → Nitrate, Flow, Costs, Non-farmed area

CLUAM

INCA

Historical data → Wetland area
<table>
<thead>
<tr>
<th></th>
<th>Upper Lake</th>
<th>Upper Lake</th>
<th>Lower Lake</th>
<th>Tamarstone</th>
<th>Crawford</th>
<th>Deer</th>
<th>Boyton</th>
<th>Nether</th>
<th>Poison</th>
<th>Greyston</th>
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<tbody>
<tr>
<td>Mean flow (m³/s)</td>
<td>0.10</td>
<td>0.14</td>
<td>0.19</td>
<td>0.53</td>
<td>0.88</td>
<td>1.13</td>
<td>2.31</td>
<td>4.06</td>
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<td>Q5</td>
<td>0.52</td>
<td>0.75</td>
<td>0.96</td>
<td>2.77</td>
<td>4.56</td>
<td>5.91</td>
<td>11.75</td>
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<td>Mean N (mg/l)</td>
<td>2.27</td>
<td>0.57</td>
<td>0.44</td>
<td>0.77</td>
<td>0.81</td>
<td>0.83</td>
<td>1.02</td>
<td>1.42</td>
<td>3.32</td>
<td>1.65</td>
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<tr>
<td>Apr-Sept N</td>
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<td>0.49</td>
<td>0.33</td>
<td>0.75</td>
<td>0.79</td>
<td>0.83</td>
<td>1.10</td>
<td>1.54</td>
<td>2.67</td>
<td>1.48</td>
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<td>Oct-Mar N</td>
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<td>0.54</td>
<td>0.79</td>
<td>0.82</td>
<td>0.84</td>
<td>0.95</td>
<td>1.30</td>
<td>3.97</td>
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<td>3.17</td>
<td>17.51</td>
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0.34  0.22  0.67  0.76  0.82  0.45  0.54  0.32  0.63  0.78  0.57
Total A2 2085:

- Current
- Business as usual
- Policy Targets
- Deep Green
Conclusions

• Flexible tool for evaluating catchment management strategies and climate interactions

• Important to integrate environmental, social and economic variables in an evaluation