Spatial Bioeconomics of Subsistence Hunting

Stephen David Ling

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Renewable Resources Assessment Group
Department of Environmental Science and Technology
Faculty of Life Sciences
Imperial College
ABSTRACT

The thesis reviews the significance and prevalence of hunting as a threat process in conservation, and then presents simple, general models exploring the stability of hunted populations, building upon fundamental principles of population dynamics. The adoption of a bioeconomic approach emerges from this consideration of human responses, rather than a conventional economic focus on maximising rents. The behaviour of a generic spatial bioeconomic model is explored to examine the influence of parameters, and to challenge the universality of conclusions based on previous, more specific models.

A case study of the subsistence hunting of ibex in the North Tien Shan mountains, along the Kazakh-Kyrgyz border, is developed to test the application of the generic bioeconomic model. Its practicability is tested by its ability to predict the outcome of a complex harvesting simulation, in which the macro behaviour of the system is an emergent property of numerous, low-level biological and behavioural mechanisms. This approach has parallels with the use of operating models in fisheries management, but the emphasis is not on producing a plausible virtual ecology rather than an accurate model for the North Tien Shan. The simple model can produce a reasonable ballpark estimate with limited data, or a highly similar outcome with perfect knowledge. There are substantial difficulties in characterizing real systems, however, and even if all parameters are known at any point in time, it may be difficult to predict behaviour in other states.

The final section explores the wider relevance of bioeconomics to conservation, showing that its quantification of incentives provides a basis for evaluating different management option involving people. Economic analysis reveals fundamental weaknesses of conventional biological approaches. Even if informational requirements are too severe for accurate quantification, incorporating human decision-making into models can provide exploratory tools for assessing the appropriateness of different management options. At present, economics is the only option for so doing.
**ABBREVIATIONS**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<tbody>
<tr>
<td>AC</td>
<td>Average Cost</td>
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<tr>
<td>ACTED</td>
<td>L'Agence d'Aide à la Coopération Technique et au Développement – French development NGO</td>
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<tr>
<td>ANN</td>
<td>Artificial Neural Network</td>
</tr>
<tr>
<td>AO</td>
<td>Aiyl Okmotu – Kyrgyz village council</td>
</tr>
<tr>
<td>BM</td>
<td>Biomass</td>
</tr>
<tr>
<td>CA</td>
<td>Central Asia</td>
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<tr>
<td>CI</td>
<td>Confidence Interval</td>
</tr>
<tr>
<td>CPUE</td>
<td>Catch Per Unit Effort</td>
</tr>
<tr>
<td>CV</td>
<td>Coefficient of Variation</td>
</tr>
<tr>
<td>DFID</td>
<td>Department For International Development – UK development agency</td>
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<tr>
<td>GA</td>
<td>Genetic Algorithm</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GEF</td>
<td>Global Environment Facility</td>
</tr>
<tr>
<td>GIS</td>
<td>Global Information System</td>
</tr>
<tr>
<td>ICAD</td>
<td>Integrated Conservation And Development</td>
</tr>
<tr>
<td>ING</td>
<td>Individual-based neural network genetic algorithm</td>
</tr>
<tr>
<td>INTAS</td>
<td>International Association – EU funding body for cooperation research with the Former Soviet Union</td>
</tr>
<tr>
<td>IUCN</td>
<td>World Conservation Union</td>
</tr>
<tr>
<td>LH/RH</td>
<td>Left-/Right-Hand</td>
</tr>
<tr>
<td>LHS/RHS</td>
<td>Left-/Right-Handside</td>
</tr>
<tr>
<td>MAS</td>
<td>Multi-Agent System</td>
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<tr>
<td>MC</td>
<td>Marginal Cost</td>
</tr>
<tr>
<td>MR</td>
<td>Marginal Revenue</td>
</tr>
<tr>
<td>MSY</td>
<td>Maximum Sustainable Yield</td>
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<tr>
<td>NABU</td>
<td>Naturschutzbund – German conservation NGO</td>
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<tr>
<td>ND</td>
<td>n-dimensional</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-Governmental Organisation</td>
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<tr>
<td>NTFP</td>
<td>Non-Timber Forest Product</td>
</tr>
<tr>
<td>NTS</td>
<td>North Tien Shan</td>
</tr>
<tr>
<td>PA</td>
<td>Protected Area</td>
</tr>
<tr>
<td>PPP</td>
<td>Purchasing Power Parity</td>
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<tr>
<td>PRA</td>
<td>Participatory Rural Assessment</td>
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<tr>
<td>S&amp;D</td>
<td>Supply and Demand</td>
</tr>
<tr>
<td>SD</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>SLT</td>
<td>International Snow Leopard Trust</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
</tr>
<tr>
<td>WWF</td>
<td>Worldwide Fund for Nature</td>
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