Multiple criteria GIS toolbox (POLYSCAPE) Tool Review

Ecosystem Services Tools

TABLES Project 2012: Mini reviews	
Guidance	*Using your experience and expertise, consider the following tasks in relation to the tool. It may not be possible to complete all tasks for each tool due to a lack of available information, the task not applying to the tool, etc.* ***Please note where this is the case by writing in the reason in the space provided****. Please use a maximum of 6 pages of A4 (excluding diagrams and appendices).* ***Your responses are required in the white spaces****.*
Task 1: Basic information	
Name of the tool	POLYSCAPE: Multiple criteria GIS toolbox for negotiating landscape scale ecosystem service provision (renamed LUCI)
Type of tool (list all that apply)	Mapping, modelling, decision, ecosystem services
Group members	1. Ron Corstanje
	2. Jim Harris
	3. Alister Scott/Simon Smart
	4. Claudia Carter
Please provide a brief synopsis of the tool	Polyscape, now known as LUCI**,** is a GIS toolbox that uses multiple criteria analysis to explore the impacts of decisions on land use or management changes. It is primarily an effective visualisation tool for determining trade-offs in different ecosystem service provision at the landscape scale, with a strong focus on agricultural landscapes. There are six tools; five consider current and potential impacts of land management change on single service criteria. These are 1) habitat networks; 2) flooding; 3) erosion/sediment delivery; 4) carbon sequestration; 5) agricultural productivity. The sixth tool displays synergies and trade-offs amongst any number of these five ecosystem services. The tool is implemented in ArcGIS. Changes in land management at field level can be inputted to the tool and "traffic light" coded impact maps, produced in seconds to minutes, allowing quick visualisation of the impact of different decisions on ecosystem services manifest at landscape scales. Interactive capabilities to facilitate stakeholder engagement and to allow local requirements and knowledge to be easily incorporated in decision making are included. Polyscapes/LUCI offers a means for prioritising existing features and identification of opportunities for landscape change. Polyscape is a GIS toolbox designed to explore spatially explicit synergies and trade-offs amongst ecosystem services to support landscape management (from individual fields through to catchments up to 10,000 km^2 scale. It quantifies and maps a variety of ecosystem services. It includes algorithms to calculate where trade-offs and/or synergies between services exist by combining GIS layers using simple rules.
Task 2: Use of the tool	

Position / Use

Stage	Currently used	Could be used
Ideas	Y	Y
Survey	Y	Y
Assess	N	Y
Policy / decision	N	Y
Implement	N	Y
Evaluate	N	Y

Please add any further comments here:

Task 3: Existing literature about the tool	
Are you aware of any KEY policy and / or academic literature evaluating your tool?	Web links: http://www.werh.org/documents/healeycardiff.pdf http://www.slideshare.net/CPWF/polyscape-multiple-criteria-gis-toolbox-for-negotiating-landscape-scale-ecosystem-service-provision http://www.cambrianmountains.co.uk/the-region/ecosystems/adaptive-landscapes-project Jackson, B., Pagella, T., Sinclair, F., Orellana, B., Henshaw, A., Reynolds, B., Mcintyre, N., Wheater, H. and Eycott, A. (2012) Polyscape: a GIS mapping toolbox providing efficient and spatially explicit landscape-scale valuation of multiple ecosystem services. *Urban and Landscape Planning*.
Task 4: Your experience of working on the tool	
Have you done any research/consultancy work on this tool in terms of its development, testing and/or evaluation?	No: drawing on recent work by Smart *et al.* to inform the review.
Guidance	For Tasks 5-7, please also try to consider the **future** development and application of this tool in the TABLES project in your answers.
Task 5: Incorporating the ecosystem approach (EA) and ecosystem services (ES)	
Using examples (from practice, research or consultancy), explain how EA and/or ES are currently incorporated in/by the tool	It quantifies and maps a variety of ecosystem services, such as agriculture, water regulation, erosion and sediment control, carbon sequestration, habitat connectivity. Polyscape/LUCI includes algorithms to calculate where trade-offs and/or synergies between services exist by combining GIS layers using simple rules to support landscape management. It has been applied at farm-scale up to landscape/catchment scales (up to approximately 10,000 km^2 and with the capability to handle larger areas). Case studies have been applied within Wales, New Zealand, Ghana, Greece and England (the Bassenthwaite catchment and the Loweswater catchment).
How could the ecosystem approach and/or ecosystem services be (further) incorporated within the	Mapping of ecosystem services, decision support at farm and larger scales, identifying areas with maximum potential for change in land use, and also existing features or management regimes in the landscape that are worthy of protection.

existing tool?	

Task 6: Situating the tool within priority questions/criteria arising from the scoping interviews

Explain how the tool can be situated within the priority questions/criteria that arose in the scoping interviews

Priority question/criteria	**Does your tool address/implement this question/criteria?** *If yes, please explain how.*
Language and communication	
1. Contribution to aiding the development of shared vocabulary within which principles of EA and ES can be shared with multiple stakeholders across built and/or natural environment	Yes, through visualisation.
2. Capacity of the tool to develop shared understandings of the many identities and values of places from the perspectives of multiple visitors, residents and businesses	No.
3. Capacity of the tool to improve or enable engagement across different publics so avoiding the usual suspect problem	Yes, through visualisation and scenarios.
Learning from experience/pedagogy	
4. Capacity of the tool to help reveal and value 'hidden' assets that are not recognised by communities or publics that use them	The Tool reviews the ecosystem services of an area: assets perhaps unknown beforehand.
5. Extent to which tool is building on other tools or EA/ES progress	It enables a visualisation of ES.
6. Extent to which tool is locally derived or grounded or can be adjusted to closely reflect 'local' context. Is the tool suitable for an open source approach?	Yes, in principle it should be able to be adapted. Has been applied at farm-scale, for example and for 'detailed' catchment studies (e.g. Bassenthwaite and Loweswater catchments).
7. Extent to which the tool is open to interpretation and application in a variety of forms (that reflect 'cultural' differences)	Yes, through the networks.
Developing and selecting tools	
8. Is the tool dependent on a specific funding source? How onerous is the application	No, some modelling background is needed in its application.

procedure? What are the chances of success?	
9. Does skills development (essential or optional?) and support exist for the tool or is there a body to ensure the optimal and correct use of it?	Some skill and knowledge in use and application required.
10. Extent to which current statutory hooks can be exploited by the tool or will benefit the quality or application of the tool (e.g. NNPF's duty to cooperate, SUDS, ecol. networks)	N/A
Informing resultant policies effectively	
11. Extent to which the tool informs or improves policies/decisions. What does the tool cover? (full range of positive and negative economic, social and environment impacts / tradeoffs?)	Very strong. The tool supplies ecosystem service flows and is specifically designed to address this requirement.
12. How does the tool link into the planning system (applications and processes). At what cost / extra burden?	None at the moment.
Delivering management objectives	
13. Suitability or capacity of the tool to assist with managing visitor needs and pressures within protected areas / the considered area? How?	The tool can provide a visualisation of assets and thus enable managers to review how pressures are impacting on particular areas.
Local ownership/new governance	
14. To what extent can the tool assist in developing statutory plans (local and management plans) and improve ownership and use by publics?	In principle it should be able to visualize the delivery of ecosystem services.
15. To what extent does/could the tool contribute to a new form of community governance in management of the environment?	N/A
Improved tools: understanding flows, interconnections and spatial issues	
16. Capacity to improve spatial understandings of the flows and interactions of various ecosystem services between sectors and at different scales	Very effective.
17. Capacity of the tool to reconcile assessments of options and benefits across different scales (and sectors)	Very effective.

18. Extent to which the tools is capable or can be manipulated to work across sectoral and administrative boundaries	It is a GIS based tool that can applied at a variety of scales.
19. Extent to which the tool can handle data shortages and gaps (or is effectiveness considerably compromised?)	It will struggle; major limitation.
20. To what extent has/could the tool put landscape/nature conservation and designated species/sites on the radar (positively or resulting in resentment?)	Can visualise benefits.

Please add any further comments here:

Task 7: A SWOT analysis of the tool

Referring back to the relevant policy and academic literature (listed in Task 3), plus your own expertise (listed in Task 4) and the way in which the tool is situated within the priority questions/criteria (listed in Task 6), please complete a summary SWOT analysis ensuring that each point is well justified

Strengths *(of the tool in delivering intended outcomes)*
Novel algorithms to explore synergies and trade-offs amongst these ecosystem service impacts have also been developed and implemented.

Weaknesses *(factors that detract from the tool's ability to deliver intended outcomes)*
Simple representation of process models, focussed on agricultural systems.
Data gaps limit overall tool effectiveness.

Opportunities *(consider opportunities for application of the ecosystem approach and services)*

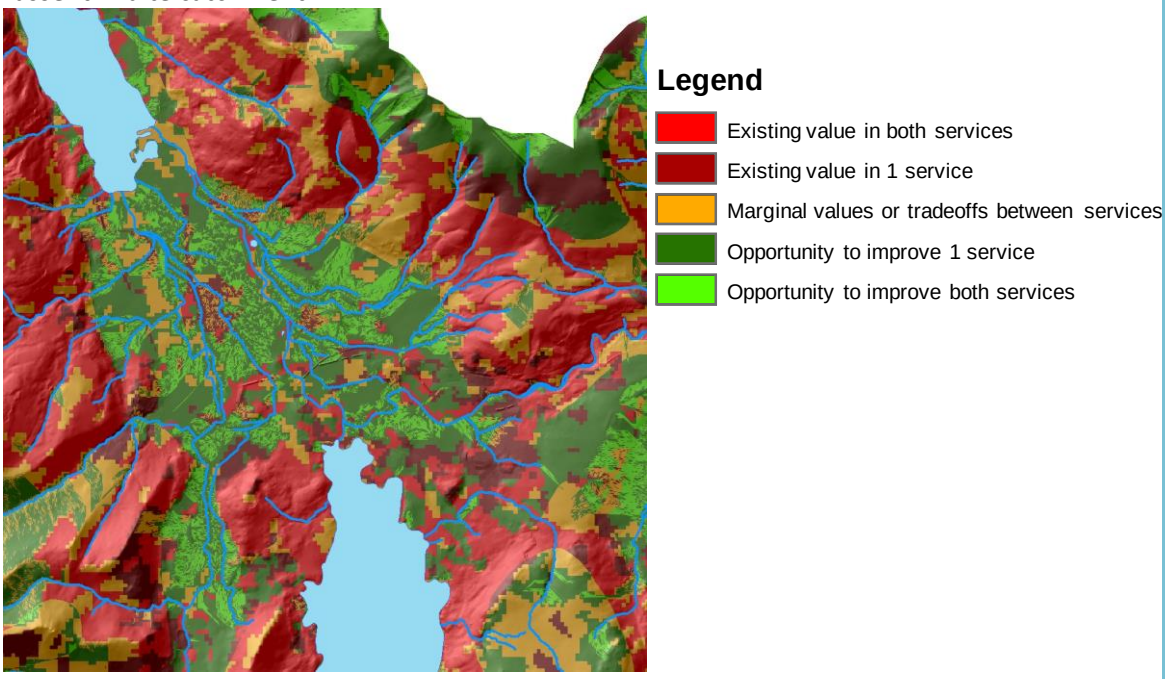
Could enable managers and other key actors to visualise services more effectively.

Threats *(factors which negatively affect the tool and its outcomes)*

Threat	Seriousness (high, medium, low)	Probability of occurrence (high, medium, low)
GIS technical expertise	Medium	Medium
Data	Medium	Medium

Please add further comments here:

Guidance *Please now use the remainder of the document (box below) to make any general comments, observations or analyses of the tool*

Further comments	Several case studies used the older version Polyscape in Wales; LUCI (as it is now known as) is being run as a new case study for the Bassenthwaite catchment. This and other case study work demonstrated how statistical models of ecosystem service indicators could be developed and used for future projection and scenario testing (Smart *et al.* 2011). In addition, the advent of cloud computing provides new online platforms where multiple tools can be accessed and run with varying degrees of dynamic linkage between them. Two such possible platforms are the Environmental Virtual Observatory (EVO)[1] and the My Environment portal soon to be rolled out for England. Figure: Example of flood mitigation / carbon trade-off layer in Polyscape application for Bassenthwaite catchment  The water regulation and erosion/sediment delivery models are novel algorithms combining established physical relationships related to water holding capacity, infiltration capacity etc and spatially explicit topographic routing. The agricultural model uses a simple rule set based on slope, aspect, fertility, and hydraulic properties. The carbon layer follows IPCC guidelines, and considers both current carbon stocks and emission/sequestration, while the habitat connectivity is an automation of the Forestry Commission's habitat connectivity model 'BEETLE' (Biological and Environmental Evaluation Tools for Landscape Ecology). Smart *et al.* (2011) An Integrated Assessment of Countryside Survey to investigate Ecosystem Services in Great Britain. www.countrysidesurvey.org.uk

[1] http://www.evo-uk.org/evo-cloud-services-portals/data-analysis-visualisation/
neat.ecosystemsknowledge.net