ASSETS: Attaining Sustainable Services from Ecosystems through Trade-off Scenarios

Food security in poor rural communities often relies significantly on flows of ecosystem services from 'natural' environments. For millennia mankind has engaged in thinking and learning experiences which have shaped the processes underpinning the production of food and the management of land, addressing multiple factors and tradeoffs.

However, many food production systems require intensive management and are prone to failure outside of the range of their optimal environmental conditions. Concerns are growing about the ability of current agricultural systems to support rising human populations without further degrading critical ecosystem services (such as water provisioning, pollination).

During extreme events, such as drought, or other shocks or crises (environmental, social or economic), the dependence of rural communities on ecosystem services to meet their nutritional and livelihood needs often increases. This highlights the importance of minimising the impacts of agricultural systems on ecosystems and the services they provide. Strategies for coping with food insecurity may, in turn, have an impact on the capacity of ecosystems to deliver ecosystem services as the spatial and temporal nature of feedbacks between socio-economic and ecological systems can be complex.

This project aimed to explicitly quantify the linkages between ecosystem services that affect - and are affected by - food security and nutritional health for the rural poor at the forest-agricultural interface.

By integrating a suite of complexity tools and cutting edge models with more traditional participatory assessments in the field, the project aimed to:

- identify how dynamic ecosystem services at the landscape scale translate to local-level nutritional diets and health
- inform policy makers on how future land use and climate change will affect both food security and

the ecosystem services associated with it.

Addressing the sustainability of natural resource management and rural livelihoods requires integrated thinking across disciplines. The complex transformations which can, or have already occurred from natural forest to managed landscapes must be fully understood so that systems can be adopted which promote sustainable transformations and/or can mitigate any negative impacts. This project therefore brought together expertise in social sciences, economics, ecology, risk management, spatial planning, climate change and complexity sciences to design and integrate a suite of models and methods to analyse how dynamic stocks and flows of ecosystem services translate to local-level food security and nutritional health. The project examined the multiple (and multi-directional) links between ecosystem services, food security and maternal and child health outcomes in poor rural communities, addressing three main themes:

1. Drivers, pressures and linkages between food security, nutritional health and ecosystem services;
2. Crises and tipping points: Past, present and future interactions between food insecurity and ecosystem services at the forest-agricultural interface;
3. The science-policy interface: How can we manage ecosystem services to reduce food insecurity and increase nutritional health?

Key academic findings comprised:

1. Food insecurity is not necessarily a result of low production but of access, for example infrastructure, markets, and means to buy.
2. Markets have become important food sources because they are available all year round with decent volumes andf diversity. But they are largely inaccessible to the resource poor.
3. Fruit production and diversity is low, and this is reflected in the rarity of fruit in meals.
4. There is a mismatch between knowledge and action - knowledge about environmental degradation is high, but there is inertia to take action by all stakeholders.

Further information:

- **ASSETS website (http://espa-assets.org/)**
- Working paper - **A Roadmap To Domain Specific Programming Languages For Environmental Modelling (http://www.espa.ac.uk/files/espa/A%20Roadmap%20To%20Domain%20Specific%20Programming%20Languages%20For%20Environmental%**
- Technical manual - **First Household Survey On Livelihoods Productive Activities And Natural Resources (http://www.espa.ac.uk/files/espa/First%20Household%20Survey%20On%20Livelihoods%2C%20Productive%20Activities%20And%20Natural%**
- Technical manual - **Scenario Parameterisation Model (http://www.espa.ac.uk/files/espa/Scenario%20Parameterisation%20Manual.pdf)**
- Blog - **Fire Season in Malawi (http://espa-assets.org/archives/568)**

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Start Date: 30/04/12
End Date: 30/09/16
Project Code: NE/J002267-1

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OVERVIEW PUBLICATIONS PEOPLE

Agent-based modelling to assess community food security and sustainable livelihoods (/publications/agent-based-modelling-assess-community-food-security-and-sustainable-livelihoods)

Authors: Dobbie, S.; Schreckenberg, K.; Dyke, J.G.; Schaafsma, M.; Balbi, S.

Year: 2018

Assessing and mapping cultural ecosystem services at community level in the Colombian Amazon (/publications/assessing-and-mapping-cultural-ecosystem-services-community-level-colombian-amazon)

Authors: Angarita-Baéz, J.A.; Pérez-Miñana, E.; Vargas, J.E.Beltrá; Agudelo, C.A.Ruiz; Ortiz, A.Paez; Palacios, E.; Willcock, S.

Year: 2017

Partnership in climate change adaptation (/publications/partnership-climate-

change-adaptation)

Authors: Chiotha, S.

Year: 2017

Management and motivations to manage “wild” food plants. A case study in a mestizo village in the Amazon deforestation frontier (/publications/management-and-motivations-manage-%E2%80%9Cwild%E2%80%9D-food-plants-case-study-mestizo-village-amazon)

Authors: Cruz-Garcia, G.S.

Year: 2017

Children and wild foods in the context of deforestation in rural Malawi (/publications/children-and-wild-foods-context-deforestation-rural-malawi)

Authors: Maseko, H.; Shackleton, C.M.; Nagoli, J.; Pullanikkatil, D.

Year: 2017

A methodological approach for the non-monetary valuation of ecosystem services in three communities of the Colombian Amazon (/publications/methodological-approach-non-monetary-valuation-ecosystem-services-three-communities)

Authors: H., Z.Duran; A., H.Arguello; Tapasco, J.

Year: 2016

Using the Soil and Water Assessment Tool (SWAT) to model ecosystem services: A systematic review (/publications/using-soil-and-water-assessment-tool-swat-model-ecosystem-services-systematic-review)

Authors: Francesconi, W.; Srinivasan, R.; Pérez-Miñana, E.; Willcock, S.P.; Quintero, M.

Year: 2016

Are the major imperatives of food security missing in ecosystem services research? (/publications/are-major-imperatives-food-security-missing-ecosystem-services-research)

Authors: Cruz-Garcia, G.S.; Sachet, E.; Vanegas, M.; Piispanen, K.

Year: 2016

Deforestation since independence: a quantitative assessment of four decades of land-cover change in Malawi (/publications/deforestation-independence-quantitative-assessment-four-decades-land-cover-change)

Authors: Tsirinzeni, M.; Hudson, M.D.; Parks, K.E.; Bone, R.A.; Willcock, S.
Year: 2016

Spatial modeling of deforestation processes in the Central Peruvian Amazon (/publications/spatial-modeling-deforestation-processes-central-peruvian-amazon)

Authors: Bax, V.; Francesconi, W.; Quintero, M.
Year: 2016

Managing complex systems to enhance sustainability (/publications/managing-complex-systems-enhance-sustainability)

Authors: Willcock, S.; Hossain, S.; Poppy, G.M.
Year: 2016

The impact of animals on crop yields in Malawian rural villages (/publications/impact-animals-crop-yields-malawian-rural-villages)

Authors: Weyell, J.; Eigenbrod, F.; Hudson, M.; Kafumbata, D.; Tsirizeni, M.; Chiotha, S.; Poppy, G.; Wilcock, S.
Year: 2015

Changing forest dynamics: plot-based evidence (/publications/changing-forest-dynamics-plot-based-evidence)

Authors: Peh, K.
Year: 2015

Analysis of ecosystem services provision in the Colombian Amazon using participatory research and mapping techniques (/publications/analysis-ecosystem-services-provision-colombian-amazon-using-participatory-research-and)

Authors: Ramirez-Gomez, S.O.I.; Torres-Vitolas, C.A.; Schreckenberg, K.; Honzak, M.; Cruz-Garcia, G.S.; Willcock, S.; Palacios, E.; Pérez-Miñana, E.; Verweij, P.A.; Poppy, G.M.
Year: 2014

A methodology for adaptable and robust ecosystem services assessment (/publications/methodology-adaptable-and-robust-ecosystem-services-assessment)

Authors: Villa, F.; Bagstad, K.J.; Voigt, B.; Johnson, G.W.; Portela, R.; Honzak, M.; Batker, D.
Year: 2014

Food security in a perfect storm: using the ecosystem services framework to increase understanding (/publications/food-security-perfect-storm-using-ecosystem-services-framework-increase-understanding)

Authors: Poppy, G.M.; Chiotha, S.; Eigenbrod, F.; Harvey, C.A.; Honzák, M.; Hudson, M.D.; Jarvis, A.; Madise, N.J.; Schreckenberg, K.; Shackleton, C.M.; Villa, F.; Dawson, T.P.

Year: 2014

New perspectives in ecosystem services science as instruments to understand environmental securities (/publications/new-perspectives-ecosystem-services-science-instruments-understand-environmental)

Authors: Villa, F.; Voigt, B.; Erickson, J.D.

Year: 2014

Riparian ecosystem resilience and livelihood strategies under test: lessons from Lake Chilwa in Malawi and other lakes in Africa (/publications/riparian-ecosystem-resilience-and-livelihood-strategies-under-test-lessons-lake-chilwa)

Authors: Kafumbata, D.; Jamu, D.; Chiotha, S.

Year: 2014

Spatial dynamics of ecosystem service flows: A comprehensive approach to quantifying actual services (/publications/spatial-dynamics-ecosystem-service-flows-comprehensive-approach-quantifying-actual)

Authors: Bagstad, K.J.; Johnson, G.W.; Voigt, B.; Villa, F.

Year: 2013

Quantifying and valuing ecosystem services: an application of ARIES to the San Pedro River basin, USA (/publications/quantifying-and-valuing-ecosystem-services-application-aries-san-pedro-river-basin-usa)

Authors: Bagstad, K.; Johnson, G.; Semmens, D.; Villa, F.

Year: 2013

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Start Date: 30/04/12

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