OUR COMMON FUTURE UNDER CLIMATE CHANGE

International Scientific Conference

ABSTRACT BOOK

7-10 July 2015 • Paris, France

P-2214-04

Commodifying Nature, Where we were mistaken with Ecosystem Service Classification

A. Dhungana (1)
(1) Center for Climate and Environment Research, Policy and Economics Research Unit, Lalitpur, Nepal

Economic theory driven ecosystem valuation has been the fundamental areas for the Ecosystem Service (ES) and Payment for Ecosytem Services research in the last decade. The Classification of ES by MEA 2005, has diverted the whole research community to think Nature as a Commodity and the research community for this whole decade spend their huge effort in the monetary valuation of Nature, but still we are far away from the solution within nature-human-development nexus. The major problems in this classification was with the cultural service, weighted in similar fashion with other three provisional, supporting and regulating service. Our empirical Study has shown that, with all those three services, cultural service was interconnected and no way can be treated as a separate class. Besides, the complexity of natural process like hydrological cycle, nutient cycle and climate cycle, which were categorized in regulating and supporting services needed research on the long term nature, and it can no way be monitised like other economic goods, and hence resulted in the failure to measure and manage it for the transformative solutions in our societies. The economic theory like utility and welfare theories in no way could justify the interlinkage of nature and economy.

P-2214-05

Maintaining Habitat Connectivity for Vulnerable Ungulate to Mitigate the Impacts of Climate Change in Isfahan Province, Iran

S. Fakheran (1) ; S. Malakoutikhah (1) ; A. Soffianian (1) ; J. Senn (2)
(1) Department of Natural Resources, Isfahan university of technology, Isfahan, Islamic Republic of Iran; (2) Swiss Federal Institute for Forest, Snow and Landscape Research, Wsl, Zurich, Switzerland

Climate change is predicted to have substantial negative impacts on biodiversity for a wide variety of taxa across many regions of the world. The combined effects of climate change, habitat fragmentation and land use change is the most important conservation challenge we face. Maintaining connectivity is the most recommended strategy for conserving species in onset of climate change. In this study, we identified and evaluated migration corridors for two vulnerable ungulate species, the wild sheep (Ovis orientalis isphahanica), and the goitered gazelle (Gazella subguterrosa) between Mooteh and Ghamishloo wild life refuges in Isfahan province, Iran. Migration of goitered gazelle and wild sheep between these wildlife refuges is related to seasonal change in environmental conditions. To identify migration corridors, two connectivity models were used, Least-Cost Corridor (LCC), and Circuit Theory. Using LCC, two corridors were selected for each target species. The first least-cost corridors for the species included habitats of highest quality (lowest resistance) which stands for the minimum costs for movement. Theses corridor for giotered gazelle covered about 158 km2 (7.5% of the total area) and the one for Wild sheep covered 151 km2 (7.2% of the total area). Although the identified corridors in this study are currently used for round migrations between Mooteh and Ghamishloo wildlife refuges, they are most likely to be served as one way migration corridors from Ghamishloo to Mooteh protected area assisting the species to shift their ranges in response to climate change in an immediate future. Climatic conditions in Mooteh compared to Ghamishloo in terms of annual rainfall (249.16 mm in Mootieh in compared to 180.9 mm in Ghamishloo) and minimum average temperature (-8.5C in Mooteh compared to -1.6 C in Ghamishloo) indicates that Mooteh wildlife refuge will be used as a refugia to buffer these ungulates from the impacts of drought and climate change in this region.We conclude that protecting and incorporating of the remaining suitable migration corridors into the existing protected areas network of Iran is an urgent need in order to secure the survival of the migratory species. As the study area is not protected at present and is very likely to be developed in near future, it is very important identifying the areas with the easiest movement routes for future conservation which, if conserved, provide the easiest movement routes assisting species in the face of climate change and land use change. Improving connectivity is not only strategically smart, but a proven method of allowing wildlife to move in response to rapid environmental change.

P-2214-06

Impacts of Biodiversity Loss in the Carbon Stock and Evapotranspiration Fluxes Regulation in Brazilian Amazon

R. Ferraz (1) ; M. Simões (2) ; M. Equihual (3) ; O. Maqueo (3) ; N. Alaniz (4) ; P. Verweij (5) ; A. Alvez (6)
(1) Embrapa, Embrapa Solos, Rio de Janeiro, RJ, Brazil; (2) Embrapa, Embrapa solos, Rio de Janeiro, Brazil; (3) INECOL, Instituto de ecologia a.c, Veracruz, Mexico; (4) CONABIO, Comisión nacional para el conocimiento y uso de la biodiversidad, Mexico DF, Mexico; (5) Wageningen-UR, Alterra, Wageningen, Netherlands; (6) Universidade do Estado do Rio de Janeiro, Programa de pós-graduação meio ambiente (ppgma), Rio de Janeiro, Brazil

Biodiversity supports many ecosystem services that are very important for climate change mitigation and adaptation, according to the Convention on Biological Diversity (CBD) there are clear interlinkages between biodiversity and climate changes. There is a functional link between the tropical forest ecosystem biodiversity and their capacity for carbon uptake and storage as well as regulation of evapotranspiration flux. Nevertheless, land use changes and agriculture expansion reduce the ecosystems integrity modifying the functions related directly to the ecosystem services. The relationship between biodiversity loss and the ecosystem services in tropical forests, in face of the ongoing global climate change, has been quite accepted by the scientific community, but needs to be better quantified and understood. The objective of this paper is to present the methodological approach and preliminary results on the impact estimation of land use changes and ecosystem biodiversity loss in carbon stock and evapotranspiration fluxes regulation ecosystem services. In order to fulfill that goal, the carbon stock and evapotranspiration spatial models were correlated with an ecosystem integrity model, used as an indicator of biodiversity loss for the Brazilian Amazon. The methodological approach of this work consists in the generation of an "ecosystem biodiversity loss" spatial model based on probability distribution of evidence parameters (Bayesian theory - Lindley 1972). The modeling was based on learning process (dada-driven model) using the Expectation Maximization algorithm (Buntime 1994). Bayesian network has been established from an expert conceptual model that related different spatial data (Thematic maps and Remote Sensing data): (i) Biomass (MODIS/ USGS - NASA); (ii) EVI; (iii) LAI- Leaf Area Index (MODIS/ USGS - NASA); (iv) Tree Cover (MODIS/ USGS - NASA); (v) GPP- Gross Primary Productivity (MODIS/ USGS - NASA). The carbon stock ecosystem service was estimated from aboveground carbon stocks spatial model developed by Baccini et. al. (2004) within the Pantropical National Level Carbon Stocks Project held by the Woods Hole Research Center - WHRC, Boston University and the University of Maryland (MA, USA). The methodology was based on ground data, MODIS 500m imagery and GLAS LiDAR data. The evapotranspiration fluxes ecosystem service was estimated from MODIS Surface Resistance and Evapotranspiration (MOD 16), data developed by Numerical Terradynamic Simulation Group (NTSG), College of Forestry & Conservation - University of Montana (Mu et al., 2007). Preliminary results were promising, allowing the establishment of the probabilistic distribution spatial patterns of biodiversity loss, as well as a preliminary assessment of the relationship with the carbon stocks (aboveground biomass) and evapotranspiration fluxes. This work is part of the ROBIN Project - Role of Biodiversity in Climate Change Mitigation - sponsored by the European Union (FP7 Edict ENV. 2011.2.1.4 -1: Potential of biodiversity and ecosystems for the mitigation of climate change).

Keywords: Spatial modeling; Bayesian networks; Climate changes: Climate mitigation

Baccini, A., Friedl, M., Woodcock, C. & Warbington, R. Forest biomass estimation over regional scales using multisource data. Geophysical Research Letters 31, L10501 (2004).
Buntime W. Operations for learning with graphical models. Journal of Artificial Intelligence Research, 2:159-225, 1994.
Lindley, D. V. (1972). Bayesian Statistics, a Review.

Philadelphia, PA: SIAM. [A sharp comprehensive review of the whole subject up to the 1970's, emphasizing its internal consistency].
Mu, Q., F. A. Heinsch, M. Zhao, and S. W. Running (2007b), Development of a global evapotranspiration algorithm based on MODIS and global meteorology data, Remote Sens. Environ., 111, 519-536, doi:10.1016/j.rse.2007.04.015.

P-2214-07

A theoretical analysis of a hypothetical auction program to pay for biodiversity in Peruvian Amazon nuts (Bertholletia excelsa) ecosystems

P. Flores Tenorio (1)
(1) La Trobe University, Department of Economics, Melbourne, Victoria, Australia

Peru is a megadiverse country with the second extension of forests in the Amazon basin. The design of efficient public policies for these territories is challenging due the fragility of public institutions and lack of economic valuation of important ecosystem services provided from old-growth forests.

This paper develops preliminary a dynamic system model and a theoretical analysis from the ecological economics perspective for a key non-timber forest product of the Peruvian Amazon basin: the Amazon nut (Bertholletia excelsa). Specially, we analyse the bioeconomic dimensions of two ecosystem services: pollination and the forest cover to provide habitat for flora and fauna.

The contribution of this paper is to present evidence that support the argument that decision makers from development countries have an excellent investment opportunity for conservation of biodiversity in indigenous lands with Amazon nuts.

P-2214-08

West Africa's most climate change vulnerable species: which, where and why?

W. Foden (1) ; J. Carr, (2) ; E. Belle, (3) ; N. Burgess, (4)
(1) Global Change and Sustainability Research Institute, University of the Witwatersrand, Gauteng, South Africa; (2) IUCN Global Species Programme, Cambridge, United Kingdom; (3) UNEP-World Conservation Monitoring Programme, Brussels, Belgium; (4) UNEP-World Conservation Monitoring Programme, Cambridge, United Kingdom

West Africa supports globally high levels of species richness and endemism but this exceptional biodiversity is subject to serious ongoing anthropogenic threats, particularly from land transformation and over-exploitation. Climate change is now recognised as a serious emerging threat to biodiversity due both to its direct impacts on species' health and habitats, and because some human responses are likely to exacerbate historical threats. In order to prepare sound climate change adaptation strategies for West Africa, it's necessary to understand how biological systems will be impacted. To address this need, we carried out climate change vulnerability assessments for almost all of the region's terrestrial and freshwater vertebrates, including mammals, birds, reptiles, amphibians and fishes (2,854 species). Using a trait-based approach, we worked with species experts to identify traits conferring high climate change sensitivity and low adaptive capacity for each taxonomic group, and then scored each species' degree of possession of these. Species' exposure to climate change was estimated using regional projections of future climate across their individual distribution ranges. Combining the resulting sensitivity, exposure and adaptive capacity scores, we categorised each species' overall climate change vulnerability. This allowed us to identify those facing highest risk from climate change, as well as the regions where such species are concentrated. Comparing the patterns of high climate change vulnerability with those of high threat from non-climate related factors allowed us to identify areas of greatest overall concern for West African species. By comparing these priorities with current protected area coverage, we highlight areas that are currently unprotected but in great need of protection, as well as the existing protected areas in which adaptation efforts should be prioritised.

P-2214-09

Pitfalls in reconciling greenhouse gas mitigation and biodiversity conservation

N. Fromin (1)
(1) Centre National de la Recherche Scientifique, Centre d'Ecologie Fonctionnelle et Evolutive, Montpellier, France

Current environmental policies urgently call for climate change mitigation strategies. Among these, biological sequestration of carbon (C) in soils through plant and soil management was identified as one of the most promising. Compared to other strategies such as oceanic sequestration or solar radiation management, biological C sequestration is cost effective, ecologically more attractive, relatively easily applicable, and has minimal side effects (Cusack et al. 2014). The potential for biological C sequestration in terrestrial ecosystems at the global scale is estimated between 1.7 and 2.4 GT C per year, which is roughly one fourth of the 9 GT C released annually to the atmosphere through human activity.

Biodiversity is often presented as critical to explain ecosystem processes, because more diverse organisms may exploit more efficiently the resources available in their environment. Yet, altering biodiversity might have strong functional consequences for C sequestration. The few meta-analyses dealing with biodiversity / ecosystem process relationships suggest, however, that protecting biodiversity is not necessarily the best way to optimize C sequestration in soils. Reciprocally, management strategies identified as favorable to C sequestration sometimes cause side effects on habitat structure and biodiversity. Because the conservation of biodiversity is also an internationally recognized priority in environmental policy, the potential for C sequestration management and its application must be assessed intimately with their consequences for biodiversity and sustainable development in the wider sense.

The proposed soil management strategies for increasing C sequestration include afforestation / reduction of deforestation, biofuel energy plantations, no-till or conservative tillage systems, nutrient management and the use of biochar. In this poster, I will present their respective potential for C sequestration, their feedbacks on biodiversity, but also their reliability, ecological risks, and their economic and social acceptance. The literature treating biological C sequestration increasingly referred to it as an 'ecosystem service' in its own right. However, as I will show, C sequestration is a complex process with strong scale dependent properties and interacting with other ecosystem functions in often non-linear ways. Therefore, I will argue that C sequestration cannot be evaluated in isolation of other ecosystem functions and should not be identified as an independent 'ecosystem service'.

Cusack et al. (2014) An interdisciplinary assessment of climate engineering strategies. Frontiers in Ecology.

P-2214-10

Climate change impacts on the fisheries in the Himalayan Kingdom of Nepal

MA. Husen (1)
(1) Nepal Agricultural Research Council, Agricultural Research Station (Fisheries), Kaski, Pokhara, Nepal, Pokhara, Nepal

Besides land locked country, Nepal is home of more than 200 fish species. The resident of these species are rivers and lakes of this country. Rise of temperature with changes in precipitation have been effecting on the Himalayan river flow rate with un- expected floods and runoff. These increased flow rates have been altering the habitat of fish species. These will be affecting on the diversity of fish species in these river and lakes. The bank of rivers and lakes are known to home of many ethnic fishers and livelihood of these ethnic communities depends on its capture fishery. Thus, vulnerability of fisher community due to climate change is at high risk in this country. Proper adaption measures needed to combat the climate change and its hazards.

Our Common Future Under Climate Change
International Scientific Conference
7-10th JULY 2015 Paris, France

Impacts of Biodiversity Loss in the Carbon Stock and Evapotranspiration Fluxes Regulation in Brazilian Amazon

Margareth Simões[1,2] , Rodrigo Ferraz[1], Miguel Equihual[3], Octavio Maqueo[3], Nashieli Alaniz[4], Peter Verweij[5], Andrei Alves[2]

(1) Embrapa Solos, Rua Jardim Botânico 1024, Rio de Janeiro, Brasil [rodrigo.demonte@embrapa.br]
(2) Rio de Janeiro State University/PPGMA, Rua Maracanã 524, Rio de Janeiro, Brasil [margareth.simoes@embrapa.br]
(3) INECOL - Instituto de Ecologia A.C., Coatepec 351, 91070 Xalapa, Veracruz, Mexico [miguel.equihua@inecol.edu.mx], [octavio.maqueo@inecol.edu.mx]
(4) CONABIO, Comisión nacional para el conocimiento y uso de la biodiversidad, Mexico DF, Mexico. [ngalaniz@gmail.com]
(5) Alterra, Wagheningen-UR, P.O. Box 47, 6700 AA Wageningen, The Netherland [peter.verweij@wur.nl]

Introduction

Biodiversity supports many ecosystem services that are very important for climate change mitigation and adaptation. According to the Convention on Biological Diversity (CBD) there are clear interlinkages between biodiversity and climate changes. There is a functional link between the tropical forest ecosystem biodiversity and their capacity for carbon uptake and storage as well as regulation of evapotranspiration flux. Land use changes (LUC) are intrinsically related with biodiversity loss and integrity decrease of natural systems as well as the decrease of their ecosystem services (ES). Landscape patterns can be correlated with different levels of ecosystem integrity (EI) and consequently with the potential environmental services provision. Then it is possible to predict the impacts on the environmental services provision in the future, like carbon uptake and storage as well as regulation of evapotranspiration flux.

Objective

In order to predict the impacts of land use changes and ecosystem biodiversity loss in carbon stock and evapotranspiration fluxes regulation ecosystem services in the Brazilian Amazon, this work presents an integrative methodological approach able to establish the relationship between the Ecosystem Integrity decrease due to the biodiversity loss caused by land use changes and Ecosystem Services provision.

Methodology

The methodological integrated approach (figure 1) consists in the follow steps:

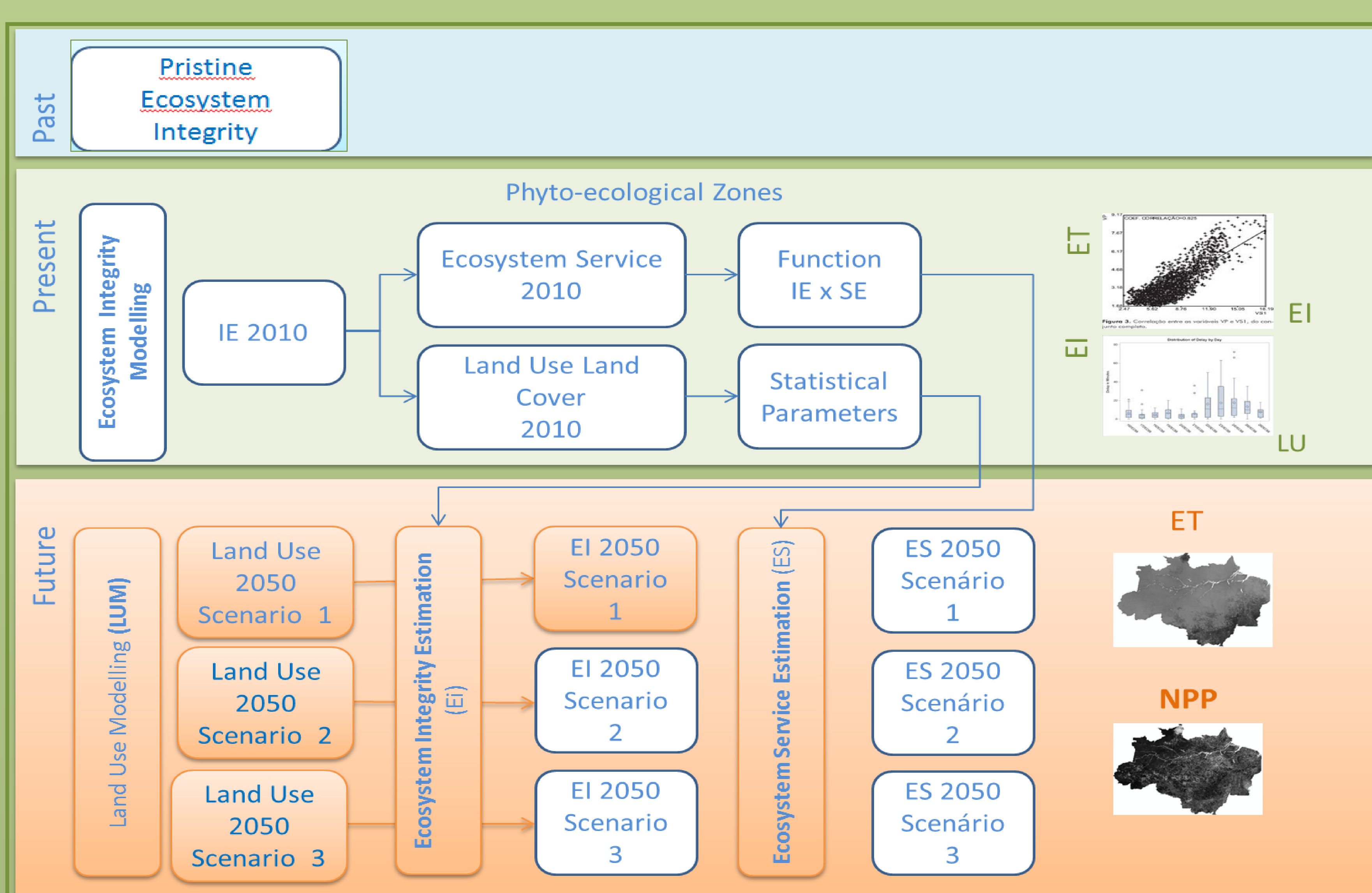

Figure 1. General methodological approach, from past to future, Modeling and linking Land Use Changes, Biodiversity Loss (EI) and Climate Ecosystem Services at the Legal Brazilian Amazon.

(I) Ecosystem Integrity Spatial Model: (*a*) Brazilian legal Amazon (regional scale - pixel 1kmx1km); (*b*) evidences probabilistic distribution based on learning process (*data-driven models*) (Expectation Maximization algorithm - Buntime, 1994); (*c*) Bayesian network (figure 2): expert conceptual model that related different spatial data (Remote Sensing data): (i) Biomass (MODIS/ USGS – NASA); (ii) EVI; (iii) LAI - Leaf Area Index (MODIS/ USGS – NASA); (iv) Tree Cover (MODIS/ USGS – NASA); (v) GPP- Gross Primary Productivity (MODIS/ USGS – NASA); (*d*) validation of the model is being held through the specific knowledge and control-areas where there are available forestry and biodiversity data inventories;

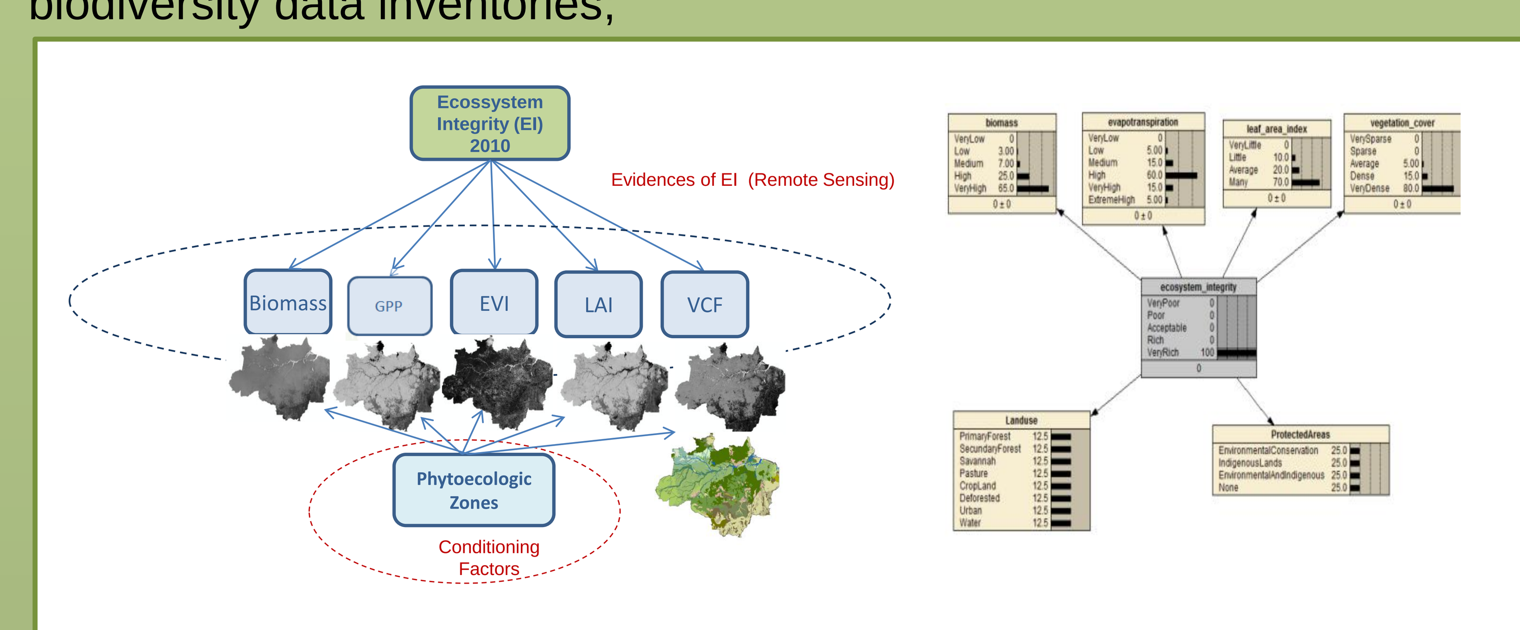

Figure 2. Methodological approach: Conceptual (left) and operational/Netica (right) Bayesian network applied to Ecosystem Integrity estimation for the Brazilian legal Amazon.

(II) Correlation of Ecosystem Integrity Spatial Model and Ecosystem Processes/Services Models (figure 3): (*a*) Evapotranspiration fluxes ecosystem service*:* estimated from MODIS Surface Resistance and Evapotranspiration (MOD 16), data developed by Numerical Terradynamic Simulation Group (NTSG), College of Forestry & Conservation - University of Montana. (Mu et al., 2007); (*b*) Carbon stocks spatial model: estimated from aboveground carbon stocks spatial model developed by Baccini *et. al*. (2004) within the Pantropical National Level Carbon Stocks Project (Woods Hole Research Center – WHRC, Boston University and the University of Maryland (MA, USA). The methodology was based on ground data, MODIS 500m imagery and GLAS LiDAR data;

(III) LUC-SSPs scenarios: generation of a Land Use Changes Model (Clue Model) for the Brazilian legal Amazon region based on SSPs scenarios and considering the current sectorial policies in Brazil;

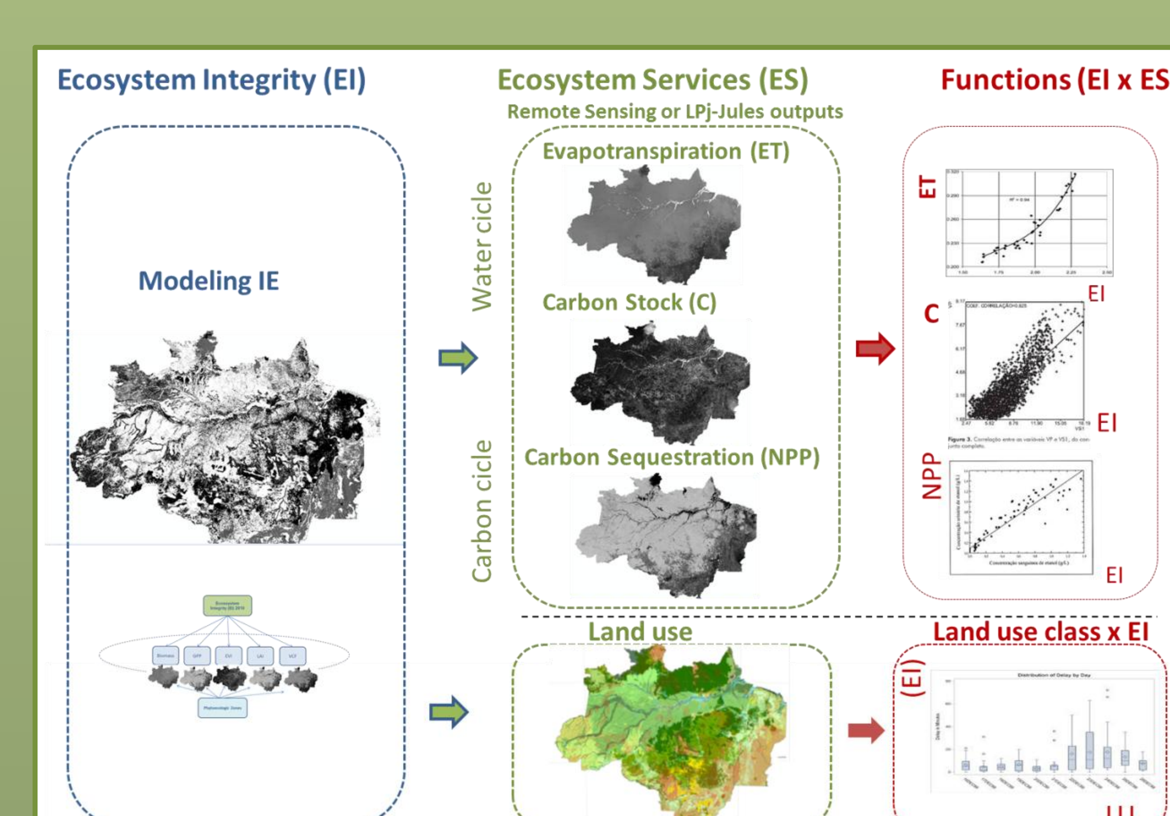

Figure 3 . Correlation approach linking Land Use Changes, Biodiversity Loss (EI) and Ecosystem Services at Brazilian Legal Amazon.

Results

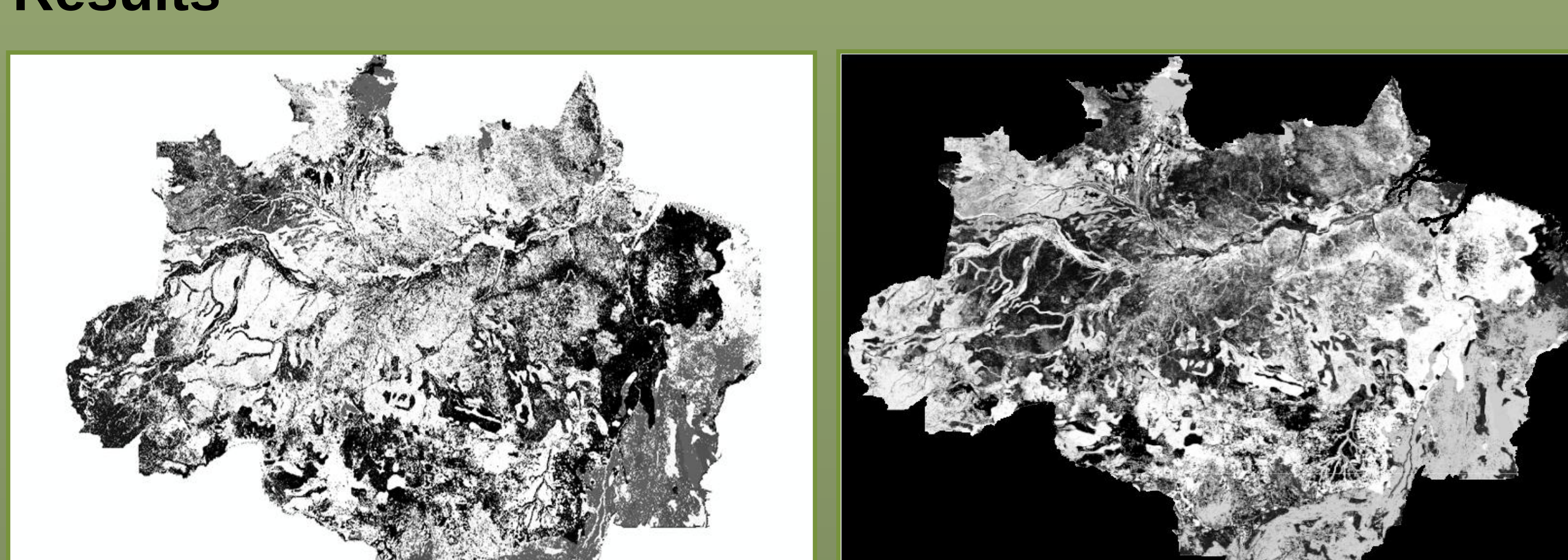

Figure 4. Ecosystem Integrity estimation for the Brazilian legal Amazon: (i) Left: EI present (Range between white and dark = high to low EI; (ii) Right: Loss on EI =▲IE = IE present – IE pristine (Range between white and dark = high to low Loss on EI). *Note: Models are still in validation.*

Conclusion

The preliminary results show that the methodological approach proposed was able to establish the relationship between the Ecosystem Integrity, carbon stock and evapotranspiration fluxes regulation ecosystem services and Land Use Changes, considering the scale adopted and models accuracy.

Acknowledgement

ROBIN Project - Role of Biodiversity in the Climate Change Mitigation – EU FP7; Embrapa – Empresa Brasileira de Pesquisa Agropecuária - CNPS

References

Baccini, A., Friedl, M., Woodcock, C. & Warbington, R. **Forest biomass estimation over regional scales using multisource data**. Geophysical Research Letters 31, L10501 (2004).
Buntime W. **Operations for learning with graphical models**. Journal of Artificial Intelligence Research, 2:159–225, 1994.
Lindley, D. V. (1972). **Bayesian Statistics, a Review**. Philadelphia, PA: SIAM. [A sharp comprehensive review of the whole subject up to the 1970's, emphasizing its internal consistency].
Mu, Q., F. A. Heinsch, M. Zhao, and S. W. Running (2007b), **Development of a global evapotranspiration algorithm based on MODIS and global meteorology data**, Remote Sens. Environ., 111, 519–536, doi:10.1016/j.rse.2007.04.015.