



CONSERVATION ASIA 2016

ABSTRACT BOOK

SUSTAINABLE LANDSCAPES FOR PEOPLE, BUSINESS, AND BIODIVERSITY

Joint Meeting
Society for Conservation Biology Asia section
Association for Tropical Biology and Conservation Asia-Pacific chapter
29 June - 2 July 2016



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stages based on qualitative criteria without knowing their precise ages, and at a given site, distinct species assemblages can be recognized. In the current era of forest destruction, regeneration and restoration, we discuss about the value of second-growth forests for tree and wildlife conservation in the overall landscapes (γ -diversity). Conservation of maximum biodiversity and ecosystem function requires conserving multiple stages of second-growth and old-growth forests in a dynamic balance. This presents a considerable challenge to landscape conservation in which management units tend to be rigidly marked and inflexible, and in which old-growth forest is viewed as the optimal state everywhere and goal for conservation.

Inter-annual declines of terrestrial net primary production and carbon use efficiency: global patterns and hotspots over 2000-2014

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Terrestrial net primary production (NPP) generates products of biological origin, on which much of other ecosystem services depend. The primary production provides a basis for food production, biogeochemical cycles, carbon sequestration and habitats for diverse species. This study examined the global pattern of inter-annual NPP and vegetation's carbon use efficiency (CUE) over the Earth's terrestrial surface; thereby identify geographical hotspots of primary production degradation for better targeting in the restoration of degraded terrestrial ecosystems. We used MODIS17A3 data (1 km resolution) for calculating inter-annual trends of NPP and CUE (approximated by the NPP/GPP ratio) over 2000-2014. We found that about 13.8 million km² of the global land has been with significant NPP decline ($p < 0.05$). Of the declining NPP areas there has been 4.8 million km² (35%) being with the negative trend of CUE ($p < 0.05$), which are hotspots of biological production degradation. These hotspot areas are mainly distributed in the humid tropics of Southeast Asia (Malaysia, Indonesia and Philippines) and Western Amazon basin, as well as Southern Russia and Western Kazakhstan. The persistent trend of NPP/GPP ratio observed challenges the widely held assumption that given a location the ratio is stable over time and space, such as with many global ecosystem models. We also identified the factors controlling the changes of this ratio that includes climatic, land use and cover transitions. These hotspots need priority actions in both in-depth research and management measures to combat terrestrial ecosystem degradation.

Conservation of fruit and nut forests in Kyrgyzstan

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The mountains of Central Asia is a place with harsh conditions. However, the western slopes of Fergana ridge in the south of Kyrgyzstan are covered with unique fruit and nut forests, which are dominated by one tree species – the Persian walnut *Juglans regia*. Other species include wild relatives of domestic apple and pear. These are *Malus niedzwetzkyana* and *Pyrus korshinskyi*, which are globally threatened. The walnut forest and animal husbandry are among few major income sources for local people. This resulted in overgrazing and selective planting and cutting, contributing to suppression of the natural regeneration and loss of genetic diversity. A number of national and cooperative projects propose different management schemes for the forests, which are mainly trying to find a balance between the socio-economic and conservation goals. Forest units are the main official bodies dealing with the forests management; however, they lack resources and skills to fulfill their duties appropriately. Scientific agencies also lack capacity to conduct research to inform management strategies. Fauna & Flora International is implementing a multidimensional scheme considering various interests to improve the management and conservation of these forests. The efforts include monitoring of threatened tree species in 2 protected areas, reinforcement of rare trees population in the wild, capacity building of reserve and forestry staff, sustainable livelihoods for local people through small grants, development of management plans for natural resources, and climate change adaptation.



RESEARCH
PROGRAMON
Dryland Systems

*Food security and better livelihoods
for rural dryland communities*

Inter-annual Declines of Terrestrial Net Primary Production and Carbon Use Efficiency: Global Patterns and Hotspots over 2000 - 2014

Quang Bao Le

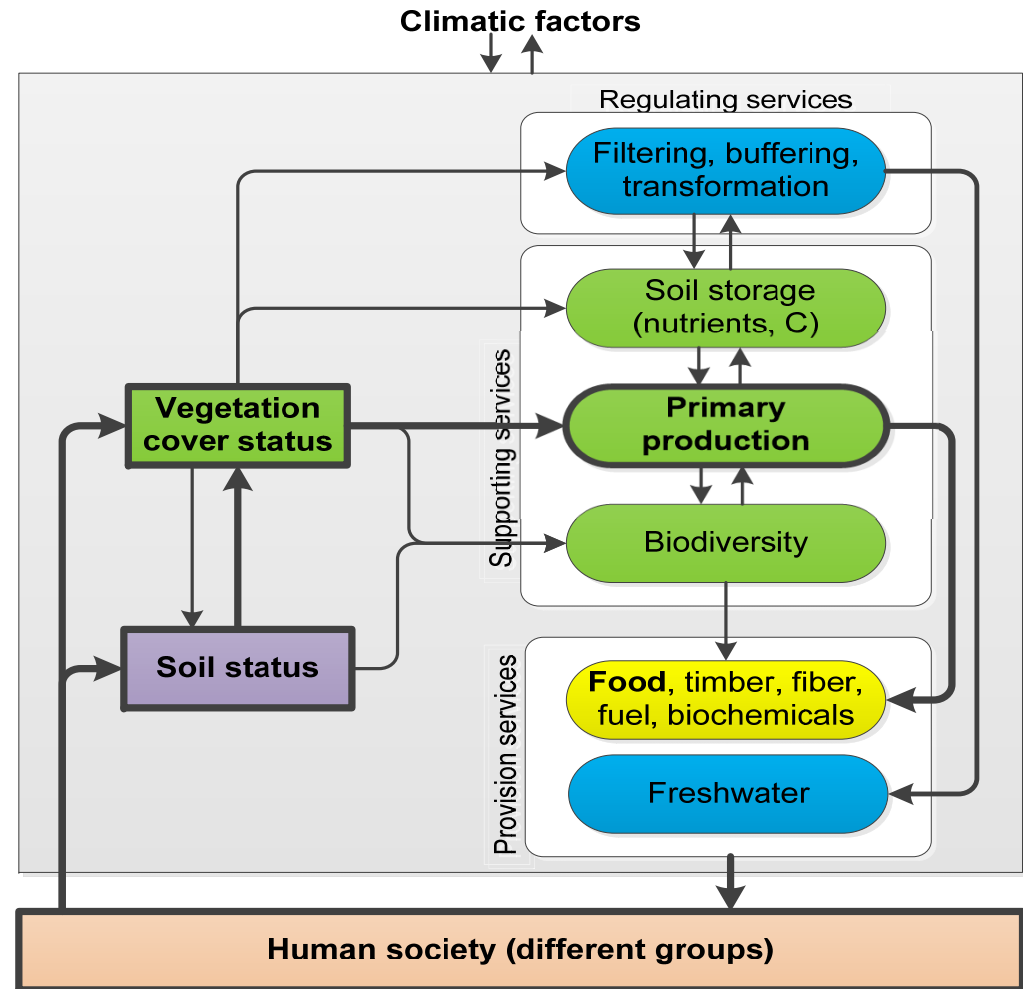
CGIAR Research Program on Dryland Systems
International Center for Agricultural Research
in Dry Areas (ICARDA)

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Key roles of Net Primary Production (NPP)

- NPP generates products of biological origin, on which much of ecosystem services depend
 - Basis for food production
 - Mediating biogeochemical cycles, carbon sequestration
 - Basis for soil protection and formation
 - Habitats for diverse species



Sources: Le (2013), Le (in prep.)

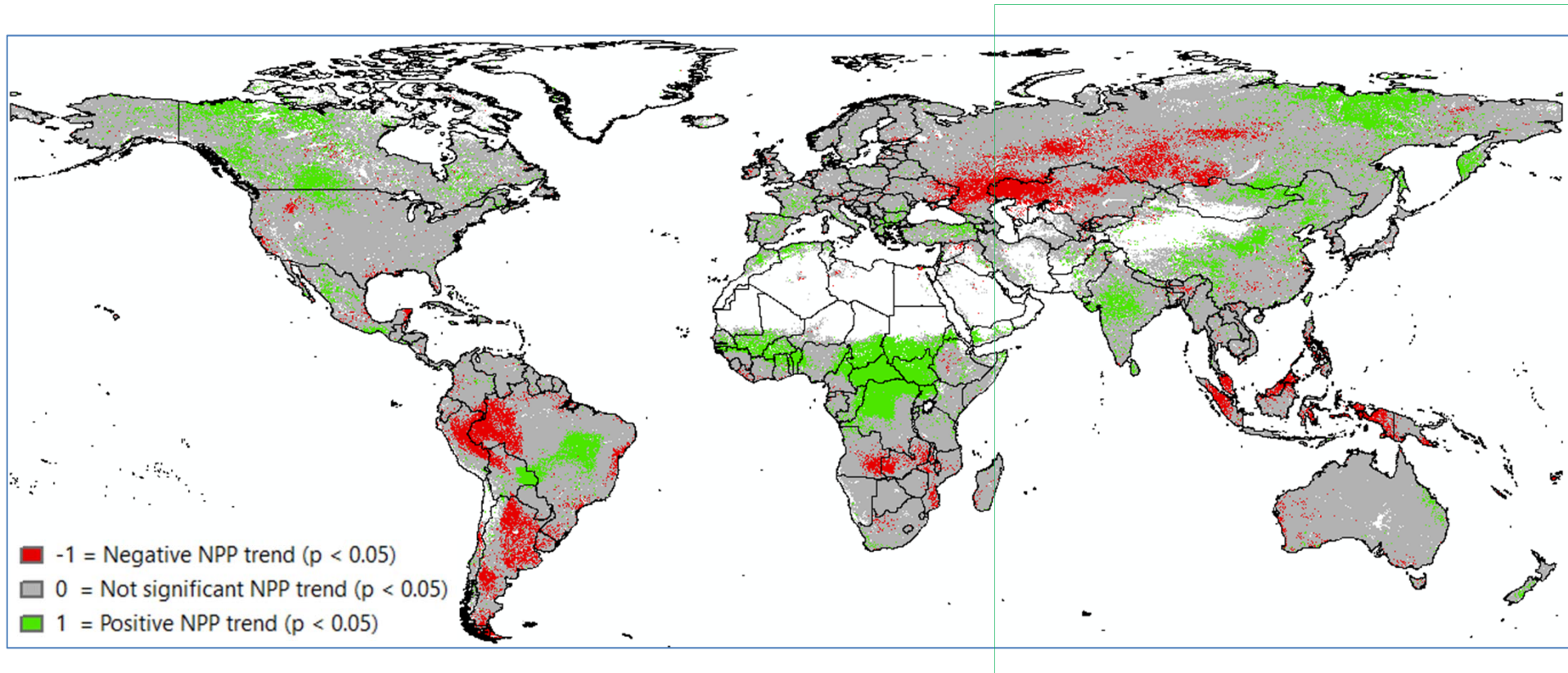
Aims

To examine the pattern of inter-annual NPP and vegetation's carbon use efficiency (CUE) over the global land mass, thereby identify **geographic hotspots** of degradation for better targeting in restoration strategies

Methods

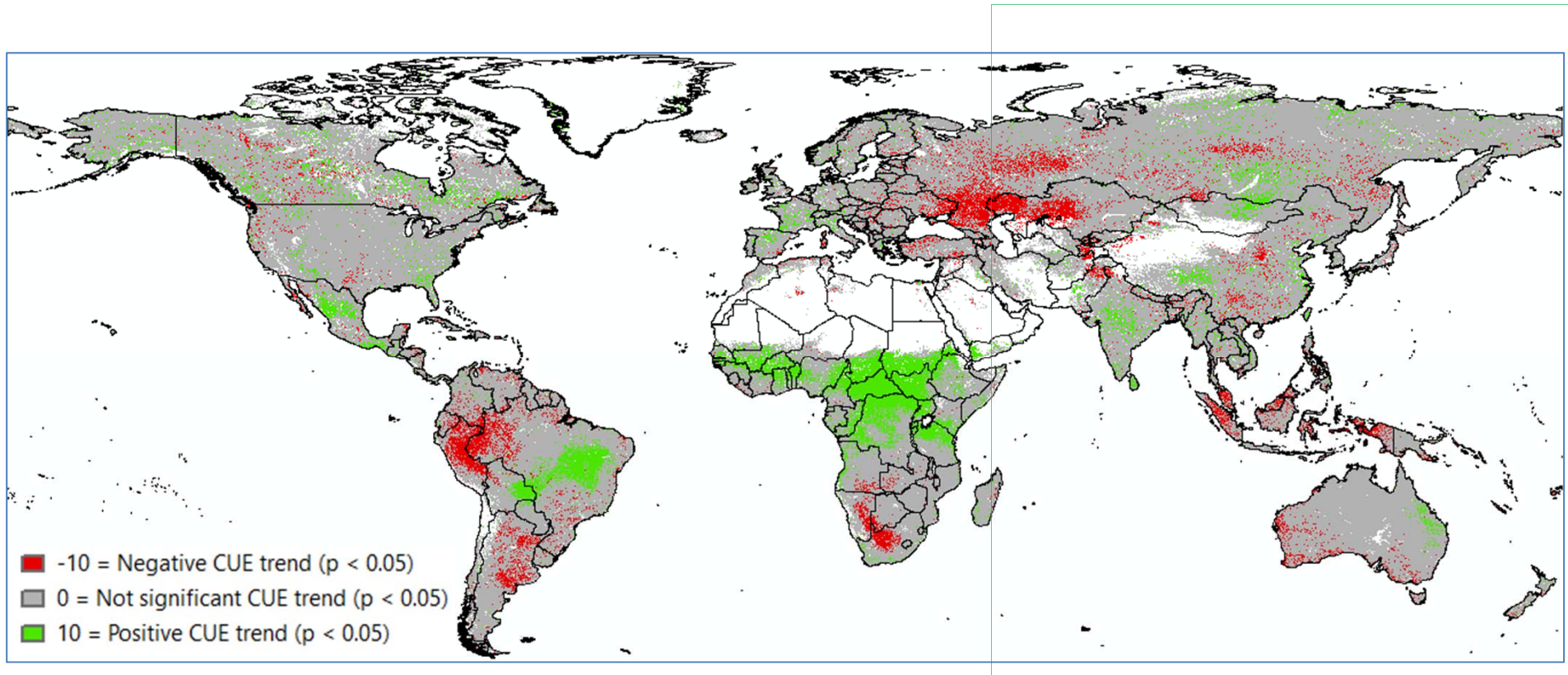
- Data source: MODIS 17A3
 - Evaluated modeled annual Gross Primary Production (GPP) and NPP over 2000-2014 (Zhao et al. 2010)
 - Spatial resolution: 1 km
- Vegetation's carbon use efficiency (CUE) = NPP/GPP
 - Spatial resolution: 1 km
- Analyses of inter-annual trends of NPP and CUE
 - For every pixel
 - Significant tests of the computed trends at 95% ($p < 0.05$)
- Criteria for defining hotspots
 - Areas facing the negative trends of **both NPP and CUE** need special attentions

Areas of NPP decline



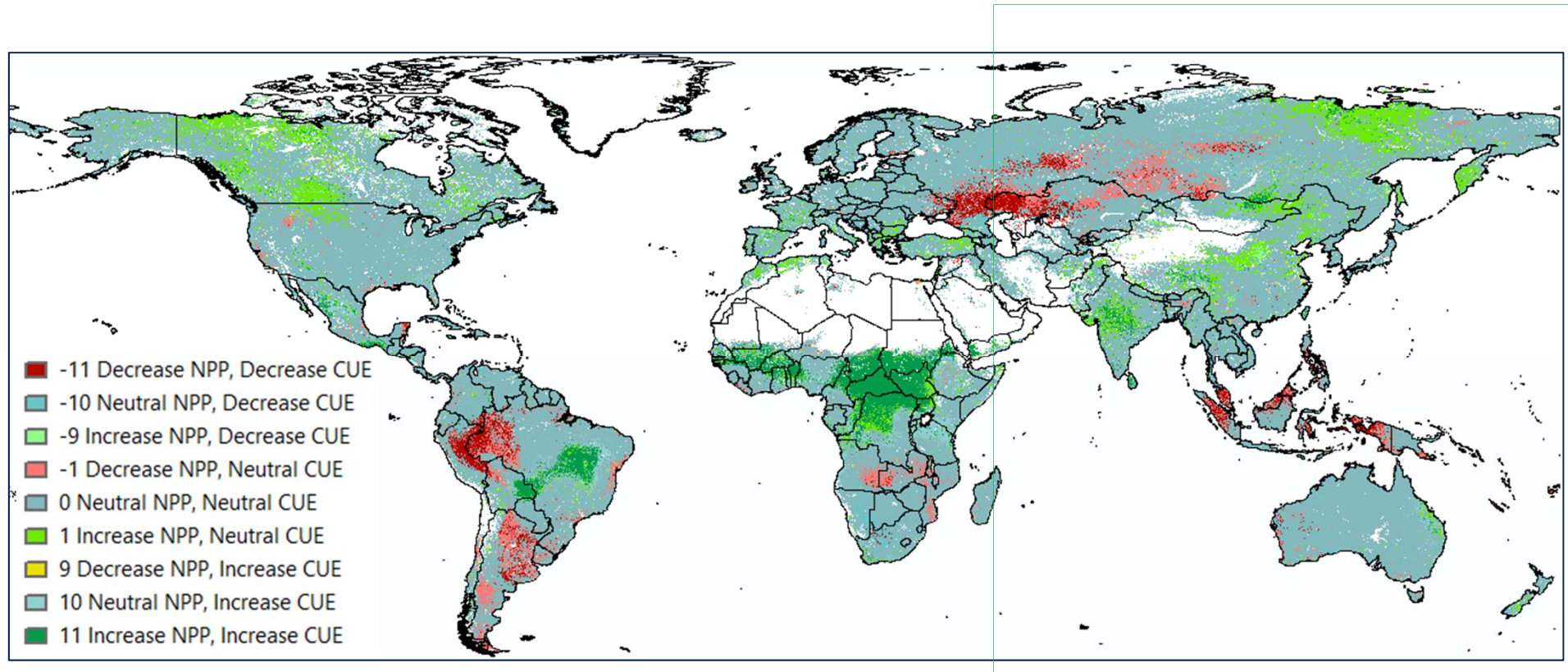
- About 13.8 million km² of the global land has been with NPP decline (**areas in red**)
- Degradation hotspots in Asia: areas in Indonesia, Malaysia, Southern Russia, Kazakhstan

Areas of CUE decline



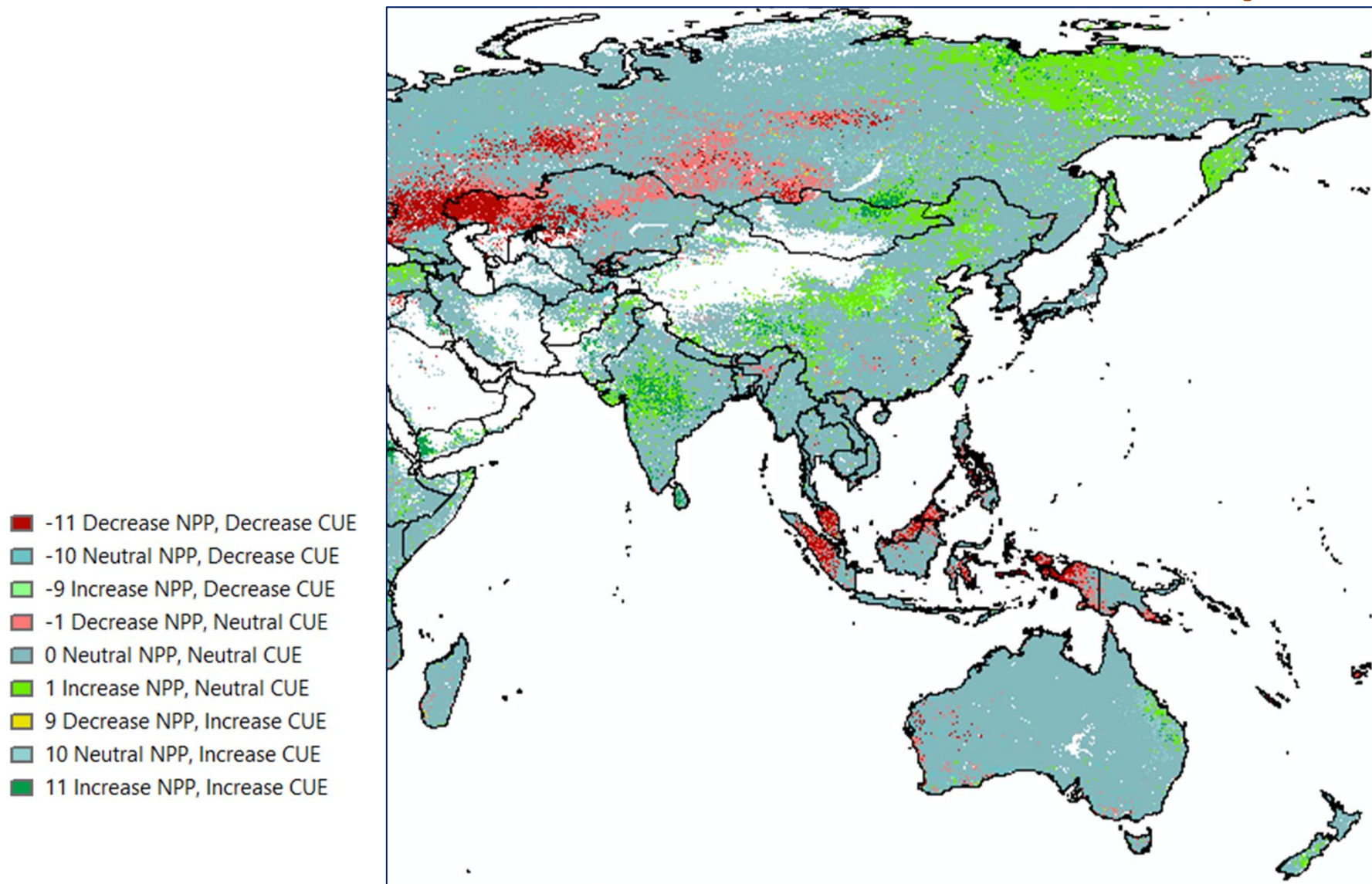
- Degradation hotspots in term of CUE in Asia (**areas in red**): areas in Indonesia, Malaysia, Southern Russia, Kazakhstan, China, Pakistan, Australia

Areas of NPP and CUE decline - Hotspots



- About 4.8 million km² of the global land has been with both NPP and CUE declines (areas in dark red)

Areas of NPP and CUE decline – Asian Hotspots



- Degradation hotspots in Asia (**areas in dark red**): areas in Indonesia, Malaysia, Southern Russia, Kazakhstan

Discussions

- The identified hotspots would need priorities of in-depth research for better understanding of the changes and management measures to combat terrestrial ecosystem degradation
- The persistent trends of CUE, i.e. NPP/GNP ratio, in many areas challenge the assumption of steady CUE widely used in many global ecosystem models
 - Business-as-usual assumption: NPP/GNP is stable over time given a location
 - Factors making NPP/GNP variable: climate changes, land use/cover changes (companion/follow-up studies)

Our companion/follow-up studies

- Effects of climatic, demographic and land use factors on the NPP and CUE trends (Le et al., 2016a; Le, in prep.)
 - Climatic factors: rainfall, temperature
 - Atmospheric fertilization: elevated CO₂, reactive nitrogen NH_x and No_x
 - Demographics: population density, urban/rural ratio
 - Economic growth and biomass-based products trading
 - Land uses
- Mapping of socio-ecological typologies as spatial domains for better contextually targeting with ground-based studies, out-and up-scaling (Le et al., 2016b; Le, in prep.)