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Inaugural editorial

Abstract: This inaugural editorial introduces the research topics addressed by the journal Change and Adaptation in Socio-Ecological Systems (CASES). A recent literature analysis revealed that the amount of integrative, inter- and transdisciplinary research activities on climate and global change, adaptive strategies, actor behaviors and response opportunities has increased significantly in the last few decades. Also, research activities on major drivers for the change and adaptation of socio-ecological systems, namely climate change, socio-economic and political changes and technological development have increased considerably since the 1950s. A publication platform that allows for overarching perspectives, integrative viewpoints, and the exchange of ideas among related disciplines in Socio-Ecological Systems (SES) science is provided by the new journal CASES.

Keywords: Socio-ecological systems, global change, sustainable use of natural resources, land use and land cover change, adaptation and mitigation

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1 Background

With a growing world population, the competition for space and natural resources, including energy, is increasing rapidly and win-win situations where all needs are satisfied can often not be achieved [1,2]. Climate change, including an increasing number of extreme events, puts additional pressures on socio-ecological systems and creates new vulnerabilities that can trigger societal and political changes leading to unsustainable land uses [3]. Alarming trends, such as the high rate of desertification and land degradation in developing countries, and increasing damages through flooding, drought and wildfires in industrialized countries highlight the impacts of overlapping global change phenomena [4,5]. Such impacts suggest that the thresholds for sustainable use and the resilience of natural ecosystems may have already been passed; reports including the Limits to Growth ([6] or the Stern Review [7] warned earlier about such risks. As a result, the provision of the most basic ecosystem services for some populations is threatened [8] and the requests of future generations need to be considered in current decision making [9]. The Club of Rome [9] warns that the human demand on the biosphere already exceeds the global bio-capacity by some 40%.

Adaptation strategies to protect societies from such global change phenomena hold promise, relative to climate change greenhouse gas mitigation measures [10]. However, the development of adaptation measures must be based on a thorough understanding of the functioning and characteristics of SES [11] along with rigorous monitoring of current impacts. SES encompass bio-geo-physical system components and human behavior and allow structured analysis of cause-effect relationships between them and across spatial and temporal scales [12]. They experience constant change including adaptation processes through, for example, environmental policies that lead to land use and land management changes and trigger environmental responses. Additionally, external influences such as global market trends can force the dynamic development of SES [13]. The boundaries of are determined by environmental parameters or socio-cultural factors [14]. This offers great potential to

incorporate individual decisions and public needs into the development of successful adaptation strategies [15]. Such strategies can build on synergies arising from optimal combinations of where, how and when to exploit, or not, natural resources, such as land and energy in a sustainable manner [16].

2 Challenges for socio-ecological systems research and the role of CASES

The amount of integrative, inter- and transdisciplinary research activities on climate and global change, adaptive strategies, actor behaviors and response opportunities has increased significantly in the last few decades. Figure 1 illustrates this trend based on the number of articles published on SES and Human-Environmental Systems (HES) – here understood as a synonym for SES. The focus on SES gained in importance after 2000. Based on this, we identify a great need for a publication platform that allows for overarching perspectives, integrative viewpoints, and the exchange of ideas among related disciplines in SES science.

The focus of CASES is on SES research with a motivation to enhance opportunities for bridging disciplinary boundaries by providing a platform for integrating natural and social science perspectives. This facilitates the discussion of needed solutions that can encompass a broader range of areas including engineering sciences and technological development. In this context, the wider ambition of CASES is to provide a comprehensive forum to address the current dissemination of papers on SES in publication media with more focused disciplinary or sectoral perspectives.

3 Key topics for research and publication

An important research question is the behavior of SES under the influence of climate change, socio-economic and political changes, and technological development. These are the main drivers for land use change and adaptation as demonstrated, for instance, by Geist and Lambin [17] with respect to deforestation in tropical areas or by Verburg et al. [18] in their analysis of rural futures in Europe. Figure 2 illustrates the importance of these drivers as reflected in publications from 1950 – 2014. The number of publications on land use change drivers increased considerably after the 1980s. From 2000 to the present, published research that considers climate change or a combination of the different driving forces in complex systems has gained in importance. In the most recent literature (2010-2014), we observe a relatively balanced emphasis on single drivers and their combinations. The multi-component analysis

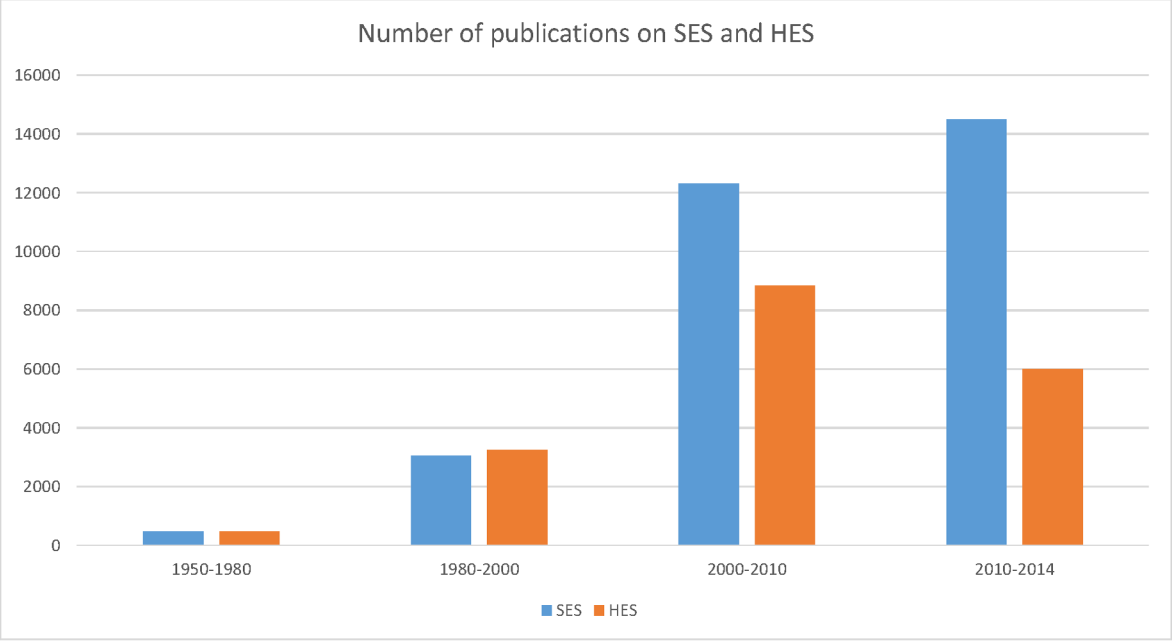

Figure 1: Number of publications on SES and HES from 1950 to 2014. (Source: Search in Scopus, Web of Knowledge and Google Scholar focusing on research articles in peer-reviewed journals, 03-14).

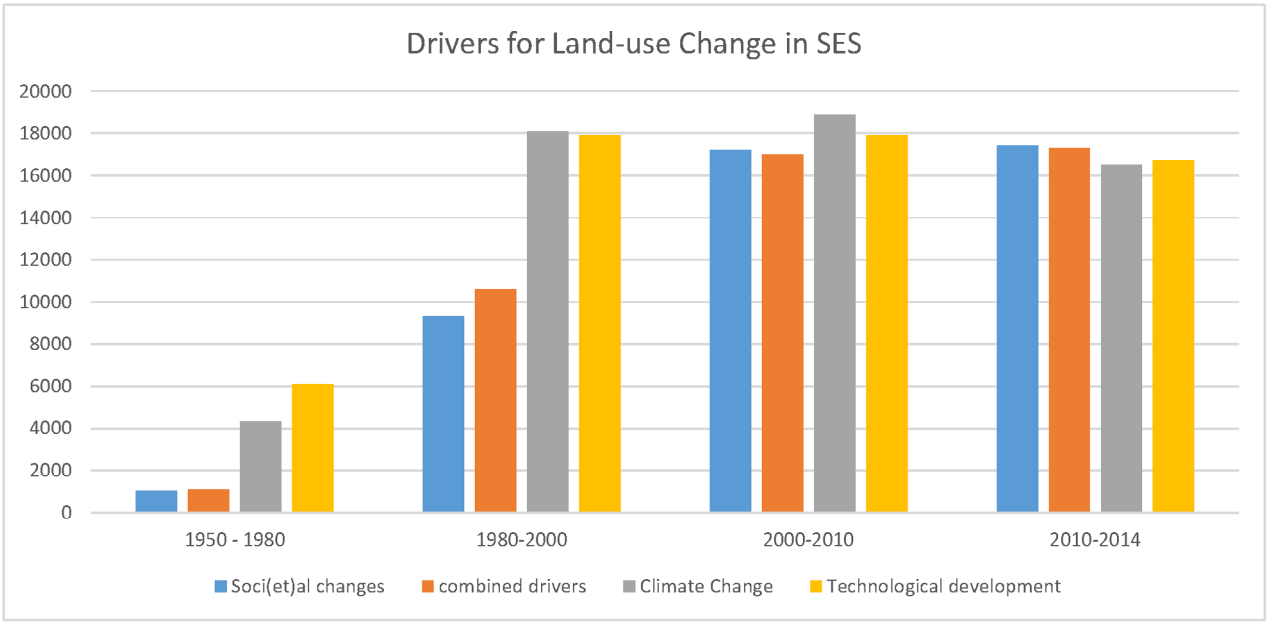

Figure 2: Number of articles focusing on selected single or combined drivers of land-use change in SES from 1950 to 2014. (Source: analysis in Scopus, Web of Knowledge and Google Scholar, 03-14)

that is needed to understand the impacts of each of the drivers or of their combined effects on SES requires highly interdisciplinary research for which CASES offers a highly attractive publication opportunity.

With respect to the above mentioned drivers, we have formulated research topics to be promoted in the future as follows:

3.1 Climate change

Climate change impacts on SES will come from variability in precipitation and temperature, general warming and changes in growing seasons [19,20]. This will affect the productivity of land systems in terms of food, fodder and timber provision [21]. It will also affect the availability and quality of drinking water, the amount of water for irrigation [22] and the management of wastewater and other residuals [23]. The abundance of species and their interspecific competition within natural/semi-natural ecosystems will be altered due to increased warming [24].

Furthermore, increasing risks to human health and well-being will result from climate change impacts related to more intense heat waves and fires, under-nutrition, lost work capacity and reduced labor productivity, and food- and water-borne diseases [25]. Climate change in recent decades has contributed to ill-health in many countries: populations in developing countries are at most risk of future health impacts due to social and economic vulnerabilities [25]. Climate induced changes to SES will require proactive measures to protect health. For example, changes in breeding periods and winter survival rates of vectors, parasites and other carriers of human, livestock and plant diseases will require new forms of interventions including ecosystem-based approaches such as biological pest control in land management [26]. These strategies will need to be flexible to cope with the magnitude, speed and uncertainty of climate change. Many strategies that have recently been put forward are cost effective [27], but they require an in depth understanding of SES to be developed and implemented. Integrated adaptation strategies that address the full range of socio-economic and bio-physical constraints in production systems will benefit efforts to address other environmental changes, such as advancing land degradation.

3.2 Societal, policy and economic changes

An important research question in the area of SES is how changing population dynamics, and specifically the age distribution in societies, will affect these systems and create different adaptation needs [28]. In highly industrialized countries, aging of the population will create different stresses on societies with respect to resources and infrastructures and will help determine how SES are impacted in the future [29]. In developing countries, some populations will continue to have lower average age distributions, but will still face poorer education levels and employment opportunities, less access to natural

resources and underdeveloped infrastructures [30]. At the same time, changes in local, regional and national economies will modify demands in the provision of essential natural resources. Consequently, this will impact the demand and supply side in natural resources and ecosystem services and might bring up new challenges in ensuring human health and economic security [31]. Continuation of such trends has the potential to increase conflicts and pressures on the sustainable use of land with implications for shifts in environmental governance schemes and political systems [32]. Inadequate land use policies have often contributed to disasters by affecting population vulnerability to environmental shocks augmented by climate change. In contrast, properly designed and implemented environmental policies, such as payments for environmental services, which are common in developed countries, are gaining importance in developing countries, towards enhanced climate resilience.

3.3 Technological development

Technical and technological development have increased the exploitation of natural resources and contributed to substantial progress in terms of food and water security within societies [33]. On the other hand, the belief that technology can solve almost all problems has led to feelings of over security. Due to overestimating the engineering capacities to mitigate climate change effects such as flooding, or to reduce risks from earthquakes, avalanches, landslides or tsunamis, the impacts of these events have often been worsened as they hit unprepared populations in densely settled areas [34]. Within agriculture and forestry as the main terrestrial land use sectors, technological development and higher intensity cultivation have, in some areas, increased trade-offs between greater yields and soil degradation, lowered drinking water quality and reduced biodiversity [35]. However, intensification is seen as the most promising pathway for sustainable development by directing the use of spare land for purposes other than food, fodder and timber production [36].

4 Mission statement

To serve as a platform for the growing SES research community, we focus on publications that present an interdisciplinary point of view from the operational management of lands scale up to the level of policy development on adaptive approaches. Thematically, all contributions that have a focus on land use and land management, human-environment interactions in land systems, and on impacts of global change on societies are invited. We particularly encourage joint contributions by natural and social scientists that further the understanding of SES, their complexity and how to deal with the manifold interactions and back-coupling mechanisms within them. To build the current state of knowledge and discover promising pathways for expanding the understanding of SES science including the identification of gaps, we welcome synthesis papers and those which clearly communicate lessons learned and recommendations for future research. This also includes “non-success-stories”, which have a great potential to support learning and further develop knowledge in and on SES.

We believe that CASES offers an open and attractive forum for the growing research community that is tackling the complexities of SES through interdisciplinary and integrative research. With this inaugural editorial we wish to warmly invite relevant research communities to share research and results, enrich knowledge of lessons learnt and shape SES science into the future.

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