Ecological Modelling 353 (2017) 1–4

Contents lists available at ScienceDirect

Ecological Modelling

journal homepage: www.elsevier.com/locate/ecolmodel

Editorial

Special issue of China–Korea joint seminars on multi-disciplinary and multi-method approaches toward sustainable human and nature interactions

1. Role of ecological modeling to meet international needs

Human activities have impacted ecosystem for a long period (Walther et al., 2002; Li et al., 2015). Key ecosystem components have been changed in various ways including changes in species composition, biological behaviors, spatial and temporal patterns, inter-relationships, ecological processes, etc., resulting in the changing of ecosystem functions as well as the roles on human beings. Therefore, we need multiple disciplines and diverse approaches to understand deeply these complex ecological processes and changes.

A model is an expression or a way of presenting the system processes in a qualitative or quantitative manner (Fath, 2014). Models can help us to understand complex ecosystem functions by running simulations according to ecological rules. Ecological models can aid management of environmental problems which humans are encountering.

The application and development of ecological models have international relevance. Recently, Chinese and Korean experts on ecological modeling organized two joint seminars, one in Beijing (2014) and another in Seoul (2015). During the seminars, they shared their knowledge and experiences in ecological modeling, and looked for solutions to handle the current complex ecological and environmental problems as well as the rapid social and economic development. Presentations and discussions focused on: mechanisms that explain ecological behavior, emergence of rules or patterns, and metrics to track ecosystem or environment changes.

Both China and Korea have very diverse ecosystems, including oceanic, lake, river, island, coastal zone and inland ecosystems. China has a large population and its rapid social and economic developments caused many ecological and environmental problems. Meanwhile, Korea had experienced serious environmental pollution in the past economic expansion period, and currently its environment and ecosystems show positive improvements. Ecological modeling is one tool that scientists and managers can use for sustainable ecosystem management (Park et al., 2015).

The significance of two joint seminars organized between China and Korea are that (i) experts with different research interests exchanged their experiences on selection, application, and results with ecological models; and (ii) experts were facilitated to know each other and to establish the potential collaborations in the field of ecological modeling. Two China-Korea joint seminars have established a platform for high level communication on research innovation for both sides. This special issue is one of the achievements of two joint seminars.

2. Topics of this special issue

The objectives of this special issue are: (1) to share the diverse practices of various modeling approaches in different fields, and (2) to show that we need collaboration under multi-disciplinary circumstances in order to fully understand the phenomenon and mechanism to solve the problems. More than 60 researchers offer their perspectives and contributions to this special issue. They have shared great insights into conservation in regions or countries with similar environmental conditions. After a standard peer-review process, a set of 17 papers have been selected to be published in this special issue. These papers cover wide-ranging ecological topics but all directly link to ecological modeling for sustainable ecosystem management.

We organized this special issue in three parts: (i) modeling for species and habitat conservation, (ii) modeling for ecosystem management, and (iii) modeling for urban and regional management. They applied existing models or developed integrated modeling approaches for sustainable human societies as well as natural ecosystems, which can be applied in other regions or countries in similar works.

2.1. Modeling for species and habitat conservation

The Korean fir (*Abies koreana*), a subalpine cold-adapted climatic relict, has declined in the Republic of Korea since the 1980's, and IUCN 3.1 has assessed it as a species endangered by global warming. Koo et al. (2017a) projected its thermal habitat suitability at the subalpine zone of Mt. Halla using high-resolution microclimatic and topographic variables and forecasted the effects of global warming on thermal suitability at a local scale. They used three single and one ensemble species distribution model (SDM) for the projection. The results showed that Korean fir was sensitive to heat stress and heat-associated drought stress, showing a strong preference for sites with low temperature, low radiation, and near streams.

http://dx.doi.org/10.1016/j.ecolmodel.2017.03.028
0304-3800/

The projections of SDMs have been critical knowledge for conservation planning under climate change in the world. However, its uncertainty has been criticized as a major challenge to reliable projections. Koo et al. (2017b) investigated uncertainty among competing models (model uncertainty) and uncertainty of future climate conditions (climate uncertainty) driving from different global circulation models (GCMs) and CO_2 emission scenarios (RCPs) in predicting the future distributions of plants. Using nine single-model algorithms and the pre-evaluation weighted ensemble method, they modeled the geographical distributions of Silver Magnolia (*Machilus thunbergii*), a warm-adapted evergreen broadleaved tree, and they predicted its future distributions under 20 climate change scenarios. Their results showed a great variation in the accuracies of nine single-model projections.

Multiple human disturbances influence vegetation, ungulates, and Amur tigers (*Panthera tigris altaica*) in Hunchun Nature Reserve in northeastern China. In order to understand the influence and relative contribution of human disturbance on Amur tigers, prey and vegetation, Li et al. (2017a) conducted transect lines and plot surveys of human disturbance inside the reserve from August to October 2013 and used generalized additive models, generalized liner models and structural equation models to explore the effects of human disturbance on vegetation, prey and Amur tigers. They then used hierarchical partitioning models to quantify the contribution of four main kinds of human disturbance. Their results suggested that all three models indicate that human disturbance can directly and indirectly affect prey and Amur tigers via 'bottom-up' chains.

Accurately mapping the current distribution is crucial for research and conservation of endangered species. Liu et al. (2017a) aimed to estimate the potential habitat suitability of Sichuan golden monkeys (*Rhinopithecus roxellana*) in China using a species distribution model integrating presence-only data and environmental variables and to assess the fragmentation of habitat, and identify the potential dispersal corridors for the species. They constructed Maxent models with presence only data of this species collected from published references and current monitoring programs, and used least-cost path analysis to estimate the dispersal paths for the species in a fragmented landscape.

Analyses of animal species distribution in a neutral or minimally-interrupted habitat provide a baseline essential for assessment and conservation. Mei et al. (2017) surveyed the occurrence of the Yangtze finless porpoise (*Neophocaena asiaeorientalis asiaeorientalis*) and corresponding habitat characteristics in the newly established He-wang-miao reserve. Based on sightings from field surveys, the extent of occurrence of the finless porpoise was 9.532 km^2. General linear model analysis indicated the distribution of the finless porpoise was influenced by water depth and fish density. Habitat preference analysis illustrated a proxy to identify key habitat for the finless porpoise: moderate water depth, flat benthic slope and moderately-high fish density. We proposed that this proxy has great potential for conservation planning for Yangtze finless porpoise.

2.2. Modeling for ecosystem management

Pine wilt disease is a serious pest for pine trees in many countries, especially in Asia. Van Nguyen et al. (2017) characterized dispersal patterns (e.g., direction and area) of pine wilt disease in the southern part of Korea in four-year period using cross-correlation function. The most likely distance of the highest infestation probability after one year was around 1.2 km from the disease source according to the distribution of pairwise distance. Subsequently, they developed a spatially explicit model in two dimensions by incorporating biological and environmental events, including influence of infested neighborhoods, short- and long-distance dispersal, asymptomatic carriers and typhoon.

River habitat degradation has become more severe because of water abstraction, land use, dams and other human disturbances. Since benthic macroinvertebrate assembles can reflect the benthic stream conditions, Shi et al. (2017) accounted for the river habitat integrity based on benthic macroinvertebrate multi-metric model. The development and application of a benthic macroinvertebrate multi-metric index was based on collected samples at representative sites from upper to lower reaches in Luanhe River, Haihe River Basin, China. Hydromorphology, water quality and land use patterns were considered to define reference sites and metrics related to macroinvertebrate community composition, structure, function and tolerance to pollution were selected as candidate metrics. They used range, sensitivity and redundancy tests to select candidate metrics based on their ability to distinguish the reference and impaired sites.

The arid and semi-arid ecosystems are important components of global water cycle, and the water balance in these water-limited ecosystems is sensitive to global climate change. Huang et al. (2017) developed a process-based water balance model for semi-arid ecosystems, which is driven by daily meteorological data. In the model, the actual canopy transpiration and soil evaporation is calculated separately based on the Penman-Monteith Formula, energy partition with combining leaf area index (LAI) and canopy coverage, process-based stomatal conductance module, root distribution, available soil water, and so on. A simple bucket soil water module, with consideration of the preference flow, was applied in simulating the soil water content in four layers. They applied this model in Mu Us Sandland, the temperate semi-arid region of China, with the parameters obtained from a field experiment with two psammophytic communities.

The arid grassland ecosystem in Inner Mongolia experienced degradation and restoration phase with the policy turning point in 1998. With remote sensing data, Li et al. (2017b) analyzed land use/cover change (LUCC) of the arid grassland in the middle of Inner Mongolia between 1988 and 2011. According to the land surface energy balance equations, the four key variables of the regional climate system, normalized difference vegetation index, albedo, surface temperature, and evapotranspiration were calculated for their spatial-temporal pattern dynamic and also to perform the correlation analysis to explore the structure-function relationship in the land-atmosphere interaction. The interaction between LUCC and the regional climate change in the study area are addressed in the context of climate change and urbanization.

A fine spatial and spectral resolution dynamic modeling of wetland coverage is limited although efforts and progress have been made in wetland mapping using multi-source remotely sensed data. Chen et al. (2017) proposed a fusion model to generate fine-spatial-spectral-resolution images by blending multi-spectral images with fine spatial resolutions and hyperspectral images with coarse spatial resolutions. Applying the EO-1 Hyperion and China HJ-1A CCD/HSI data, they showed that the proposed model produced a reliable dataset that was not only able to capture spectral fidelity, but also could preserve spatial details. By integrating both fine-spatial contexts and hyperspectral characteristics, they further conducted a guided filtering based spectral-spatial mapping on the Poyang Lake wetland.

2.3. Modeling for urban and regional management

The design of a simulation system that captures the self-organizing and dynamic characteristics of urbanization is a challenging prospect. Han and Jia (2017) proposed an integrated modeling approach on the basis of Markov chain, logistic regression and cellular automata to study the dynamic change process of urban