ECOLOGICAL MODELLING

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**ECOLOGICAL MODELLING AND
SYSTEMS ECOLOGY**

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$$\{\ln \lambda_+ (T, a)\}$$

Editor-in-chief
Brian D. Fath

Ecological Modelling

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Editorial Board

Highlights

► We analysed food web robustness to species loss using stochastic simulations. ► The extinction risk of highly connected species increases with parameter I. ► Food web robustness declines sharply after a threshold value of I. ► Link-dense networks are more robust to an increase of I. ► Robustness decreases faster with increasing I in larger food webs.

Highlights

► CO_2 assimilation in *Pinus pinea* regeneration is modeled using the non-rectangular hyperbola. ► Temperature, soil moisture, light environment and needle type control photosynthesis. ► Complex environmental interactions define the optimum niche for *P. pinea* seedlings. ► Less favorable conditions are attained in plants fully exposed at midday summer.

Matthew B. Russell, Christopher W. Woodall, Shawn Fraver, Anthony W. D'Amato

Highlights

► This study used repeated downed woody debris (DWD) measurements across the eastern United States. ► We model DWD decay class transitions with cumulative link mixed models. ► Models use DWD piece length, initial decay class, climatic regime, and forest type. ► Results provide an initial assessment of DWD decay across forests in the eastern United States.

Trait contributions to fish community assembly emerge from trophic interactions in an individual-based model

Highlights

► An individual-based model for fish community dynamics and assembly is proposed. ► The model integrates life history and trophic traits in a common simulation arena. ► Traits differed greatly in importance for assembly on environmental gradients. ► Dynamical patterns were shaped by the environment and emergent trait composition. ► Priority effects suppressed diversity and prevented selection on secondary traits.

Application of genetic algorithm and greedy stepwise to select input variables in classification tree models for the prediction of habitat requirements of *Azolla filiculoides* (Lam.) in Anzali wetland, Iran

Highlights

► We model the habitat requirements of *Azolla* before and after variable selection. ► The models are more reliable after variable selection. ► Enlarging data and more relevant variables will further improve the prediction. ► Structural habitat variables will have more contribution to the prediction. ► Such models can be used for wetland conservation/restoration programs.

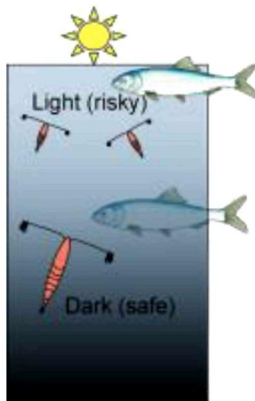## A mass-balanced pelagic ecosystem model with size-structured

behaviourally adaptive zooplankton and fish

Graphical abstract

Highlights

► We present a marine ecosystem model with fish and size-resolved mesozooplankton. ► The model includes adaptive spatial behavioural responses and diets. ► The behavioural responses affect ecosystem structure and function. ► Indirect behavioural effects from intraguild predation increase fish biomass.

What mark variograms tell about spatial plant interactions

Highlights

► Mark variograms are useful for studying the processes forming spatial patterns in forests. ► There are important differences between mark and geostatistical variograms. ► We identified five ecological processes leading to negative autocorrelation. ► Negatively autocorrelated mark variograms often indicate disturbances.

Grazing management or physiography? Factors controlling vegetation

recovery in Mediterranean grasslands

Carlos P. Carmona, Achim Röder, Francisco M. Azcárate, Begoña Peco

Highlights

► Monitoring grazing effects on vegetation is essential for rangeland management. ► We evaluated differences in herbaceous vegetation cover between dry and wet seasons. ► We evaluated the effects of grazing management and physiographical variables. ► Differences in cover maximized at intermediate grazing pressures in humid areas. ► Our methodology can help detecting land degradation at landscape level.

Emergy evaluation of DNA and culture in 'information cycles'

Thomas Abel

Highlights

► I reprise H.T. Odum's detailed demonstration of information emergy. ► Which includes four kinds of information of increasing quality. ► I produce a parallel 'cultural' demonstration of the emergy of conversation. ► Resulting in a blueprint to extend emergy to the next frontier of culture. ► Transformities are calculated for the conversation forms.

Exact solution of a non-autonomous logistic population model

Hamizah M. Safuan, Zlatko Jovanoski, Isaac N. Towers, Harvinder S. Sidhu

Highlights

► We derive the exact solution of a non-autonomous logistic equation. ► The solution is found via a power series and may be truncated. ► A simple criterion leads to a good approximate solution. ► The solution is in good agreement with the numerical simulations. ► The relative errors were calculated to determine the numerical accuracy.

Sustainability analysis: Viability concepts to consider transient and

asymptotical dynamics in socio-ecological tourism-based systems

Original Research Article
Pages 103-113
W. Wei, I. Alvarez, S. Martin

Highlights

► Asymptotic analysis lacks essential information for sustainability assessment. ► Viability kernel computations provide the maximal distance to attractor. ► Capture basin computations provide the time to reach attractor neighborhoods. ► Viability concepts are also valuable for controlled dynamics and desirable state sets.

Effects of canopy architectural parameterizations on the modeling of radiative transfer mechanism

Original Research Article
Pages 114-126
Ajit Govind, Dominique Guyon, Jean-Louis Roujean, Nathalie Yauschew-Raguenes, Jyothi Kumari, Jan Pisek, Jean-Pierre Wigneron

Highlights

► Demonstrated the variability of the G and Ω with SZA in a forest stand. ► Show that the simplified G and Ω functions create biased simulation of CRTM. ► Identified the best combination of G and Ω parameterizations.

The integration of facilitation into the neutral theory of community assembly

Original Research Article
Pages 127-134
Sa Xiao, Liang Zhao, Jia-Lin Zhang, Xiang-Tai Wang, Shu-Yan Chen

Highlights

► Individual-based was used model to explore facilitation on neutral community. ► Facilitation increases community's abundance by increasing reproductive rates. ► Facilitation has the stabilizing mechanisms by promoting rare species. ► Facilitation causes the decrease of richness from low to medium severity gradients. ► Facilitation has the similar impacts on neutral community and niche community.

A model of phosphorus cycling to explore the role of biomass turnover in

submerged aquatic vegetation wetlands for Everglades restoration

Highlights

▶ New model for P cycling in wetland systems dominated by submerged aquatic vegetation. ▶ P cycle hypothesis supported by lake studies, yet previously unapplied to engineered wetlands. ▶ Study links several large, diverse, and unique datasets from a study site in south Florida. ▶ Model calibration conducted using recent developments in Monte Carlo-based uncertainty methods. ▶ Results relevant to optimization of Stormwater Treatment Areas for Everglades restoration.

Using a microclimate model to evaluate impacts of climate change on sea turtles

Highlights

▶ The effectiveness of a correlative and microclimate model to investigate the impacts of climate change on sea turtles was explored. ▶ The two approaches accurately and congruently model current soil temperature. ▶ The microclimate model provided a more robust picture of the incubating environment and impacts. ▶ Applied management will also benefit from the use of microclimate models.

An empirically parameterized individual based model of animal movement, perception, and memory

Highlights

▶ What do moving animals know? ▶ A fully parametric cognitive algorithm is presented. ▶ Informational state while traveling through heterogeneous space is modeled. ▶ Parameterization

based on readily available positional and environmental data. ► Evaluates the likelihood of alternative cognitive processes.

The Scaled Subspaces Method: A new trait-based approach to model communities of populations with largely inhomogeneous density

Highlights

► We present a new method for IBM of many populations with widely inhomogeneous density. ► We use this method to evolve a pelagic microbial mixotrophic food web. ► The IBM generates biologically plausible and consistent mixotrophic communities. ► We show that the IBM produces the same solutions as an state-variable model.

Consistency of fuzzy rules in an ecological context

Highlights

► We assess fuzzy models to explore beetle diversity–environment relationships in ponds. ► Fuzzy models evaluated were calibrated using evolutionary algorithms. ► The best fuzzy model explained more than 76% of diversity variance. ► The consistency of the rules was carried out with a new index developed in this work. ► Water beetle diversity appears to be driven by a relatively short set of fuzzy rules.

An optimization approach to runoff regulation for potential estuarine eutrophication control: Model development and a case study of Yangtze Estuary, China

Highlights

► River runoff management model is used to control estuarine eutrophication potential. ► ICEP is embedded into river runoff management model as an ecological objective. ► Dissolved

silicon flux formula is modified by using dam, TMZ retention coefficients. ► Immune clone optimization algorithm is used to solve the runoff optimization model.

A model for high-altitude alpine lake ecosystems and the effect of introduced fish

Ulrika Magnea, Roberta Sciascia, Francesco Paparella, Rocco Tiberti, Antonello Provenzale

Highlights

► We discuss ecosystem measurements of 12 high-altitude alpine lakes. ► We develop a simplified ecosystem model for these high-altitude lakes. ► We study the effect of introduced fish in the high-altitude lakes. ► Model output and data compare favorably showing a strong effect on lake ecosystem.

Soil organic carbon stock changes in Swedish forest soils—A comparison of uncertainties and their sources through a national inventory and two simulation models

Carina A. Ortiz, Jari Liski, Annemieke I. Gärdenäs, Aleksi Lehtonen, Mattias Lundblad, Johan Stendahl, Göran I. Ågren, Erik Karltun

Highlights

► We estimated forest soil organic carbon changes at the regional scale. ► Two decomposition models were compared with inventory data. ► We assessed uncertainty contributions from parameters, litter and climate input. ► Uncertainties in data and simulations match in magnitude but their origins differ. ► Litter input was the major source of uncertainty in model estimates.

Carbon turnover in mixed stands: Modelling possible shifts under climate change

Vladimir Shanin, Alexander Komarov, Yulia Khoraskina, Sergey Bykhovets, Tapio Linkosalo, Raisa Mäkipää

Highlights

► We simulated growth of mixed stands at climate change with an individual-based model. ► Spatially explicit competition among trees for light and soil nutrition was simulated. ► Climate change led to a gain in productivity for all species, especially conifers. ► Carbon in soil increased with stand growth while climate change sped up decomposition.

Modeling of decadal scale phosphorus retention in lake sediment under varying redox conditions

Original Research Article
Pages 246-259
Sergei Katsev, Maria Dittrich

Highlights

► We applied reaction-transport modeling to analyze the sediment phosphorus (P). ► We studied the effects of aeration and the organic carbon loading on P retention. ► On short time scales the release of iron-bound P impacted the P fluxes. ► On long time scales P fluxes followed the sedimentation of organic matter.

The influence of habitat autocorrelation on plants and their seed-eating pollinators

Original Research Article
Pages 260-270
A. Bradley Duthie, Matthew R. Falcy

Highlights

► We model an obligate mutualism between a plant and seed-eating pollinator. ► We examine pollinator and seed production, and susceptibility to exploitation at different habitat autocorrelations. ► Habitat autocorrelation increases the mean number of pollinator visits to plants. ► Frequent pollinator visits to plants increases global pollinator production, but decreases seed production and exploitation. ► Turnover of spatial variation in seed and pollinator production depends on pollinator dispersal distance.

Effects of space partitioning in a plant species diversity model

Original Research Article
Pages 271-278
Jinbao Liao, Zhenqing Li, Jan J. Quets, Ivan Nijs

Highlights

► It incorporates neighbourhood competition by dynamic space partitioning. ► Dynamic Voronoi partitioning under local dispersal promotes species coexistence. ► Grid-based models overestimate species extinction rates. ► Trait variation among species reduces species richness.

Forest patch connectivity diagnostics and prioritization using graph theory

Original Research Article
Pages 279-287
B.S. Shanthala Devi, M.S.R. Murthy, Bijan Debnath, C.S. Jha

Highlights

► We evaluated patch size, number, inter distance, and connectivity indices. ► Prioritized action for forest connectivity of the deciduous forest landscape is analyzed. ► 191 components at optimal distance of 250 m using graph theory is obtained. ► Five patches within the component were identified for prioritization. ► Proposed connectivity could enhance the forest habitat network through these potential patches.

An exploration of reliable methods of estimating emergy requirements at the regional scale: Traditional emergy analysis, regional thermodynamic input–output analysis, or the conservation rule-implicit method

Original Research Article
Pages 288-296
Cheol-Joo Cho

Highlights

► Methods of estimating emergy consumption on the regional scale are established. ► The interregional I–O scheme is advantageous in estimating emergy requirements. ► The conservation rule-implicit interregional scheme also offers a reliable outlet.

Wildfire risk prediction in Southeastern Mississippi using population interaction

Original Research Article
Pages 297-306
R. Sadasivuni, W.H. Cooke, S. Bhushan

Highlights

► Modeling of human interaction using gravity model. ► Wildfire prediction using combined forest fuel layer and population interaction. ► Wildfire prediction in Southeastern Mississippi. ► Comparison with road density fire potential prediction model.

Projection matrices in variable environments: λ_1 in theory and practice

Dmitrii O. Logofet

Graphical abstract
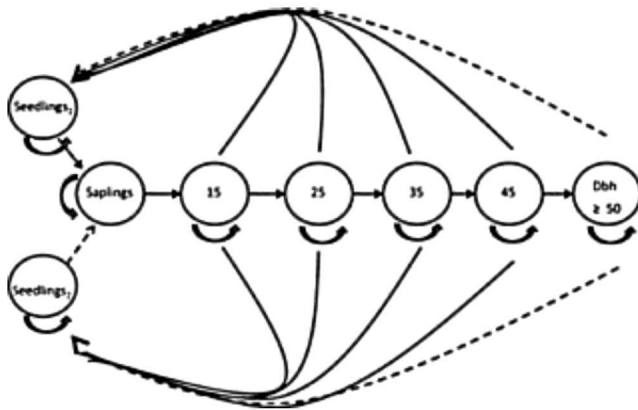
Highlights

► The true λ_1 is the dominant eigenvalue of the reproductive submatrix. ► Routine calculation of λ_1 may result in a false growth rate instead of the true λ_1. ► The false growth rate can only be <1, yet it still overestimates the true λ_1. ► "Geometric mean" of annual projection matrices depends on the order of cofactors. ► Simulation method to estimate the stochastic growth rate avoids the both problems.
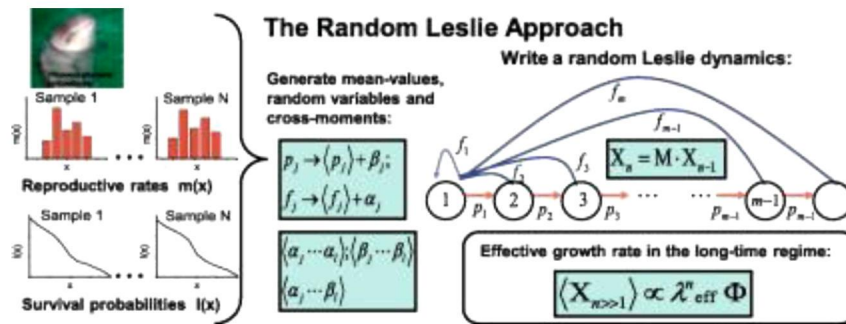
Calculating effective growth rate from a random Leslie model: Application to incidental mortality analysis

Manuel O. Cáceres, Iris Cáceres-Saez

Graphical abstract

The Random Leslie Approach

Highlights

► We present an algorithm to tackle random survival models in a Leslie matrix dynamics. ► We exemplify the method using a random incidental mortality population growth model. ► We define an effective growth rate taking into account the time evolution of an age structured population. ► A mathematical approach has been presented to calculate, by random perturbation, the growth of the mean-value vector population dynamics.

ERRATUM

Erratum to "Temperature-dependent consumer-resource dynamics: A coupled structured model for *Gammarus pulex* (L.) and leaf litter [Ecol. Model. 247 (2012) 157–167]

Pages 323-326

Moritz Kupisch, Sylvia Moenickes, Jeanette Schlief, Marieke Frassl, Otto Richter

ANNOUNCEMENT

First Announcement: International Society for Ecological Modelling Conference (ISEM 2013)

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