Linking Food Webs to Ecosystem Processes: Piecewise Linear Models of Soil Microcosms: An Article Critique

Overview

Nieminen wrote "Linking Food Webs to Ecosystem Processes: Piecewise Linear Models of Soil Microcosms," Nieminen wrote this paper based on the possibility of producing a complete analysis of ecosystems with few species. He started the discussion by presenting different models such as the Yellowstone thermal effluent system. Natural ecosystems that were easily controlled under laboratory conditions had become the subject of numerous ecological experiments. This was the reason aquatic bacterial microcosms were studied. In line with this, the author presented the model of soil organic matter decomposition that included microbes and provided numerical models through which microbial growth could be limited by C supply or by microbial demand. Different species were examined and evaluated according to their characteristics and relevance in their own ecosystems. The author also discussed about filamentous fungi. They were described as dominant decomposers in acid and dry boreal forest spoils. He used this microcosm to show that the direct contribution between soil animals and carbon mineralization is minimal.

He said that process-based models fail in explicitly considering specific organisms. He pointed out the gap in research between process-based ecosystem models and organism-oriented community models. He also pointed out that there were only a few models, including soil animals or models, which separated mycorrhizal from saprotrophic fungi in relation to this.

According to the author, the most complete quantitative model of a soil food web would be one that determined how there was over 80 percent faunal nitrogen mineralization in shortgrass prairie because of bacterial-feeding amobae and nematodes. He said that this was not a surprising outcome since fungal biomass has accounted for something less than 10

percent of microbial biomass in soil. Thus, he presented how the opposite could be true when it came to fungal-dominated forest soil. Nieminen determined how simple actual solutions, instead of mere simulations, could be obtained when it came to simpler laboratory microcosms. Soil ecologists frequently did this.

The author criticized early calculations based on the fact that models had assumed biomasses to be at a steady state. In reality, recent studies had already showed that there existed temporal dynamics and specific faunal groups that must be included into the biomasses mentioned above.

Models were also seen to have a direct effect on soil animals that were taken into account. The author pointed out how soil animals could also have an effect on the decomposition process through the engineering of the soil and affecting functional properties when it came to microbes.

He revealed the resources nematodes had to consume in order to meet the demand that they had to contain more nitrogen that they needed. He said that in order to discover if nematodes were important in a quantitative context to nitrogen mineralizers, they need to link their dynamics to nutrient cycling.

Piecewise linear model was presented to determine soil nitrogen dynamics and the investigation of fungal feeding nematodes in nutrient cycling with coniferous forest soil. The provision of a theoretical basis for the analysis of experimental data was important for soil ecologists.

Nieminen said that the present model have more capabilities than traditional and inadequate models. While it was functionally similar to other models of microbial growth, he revealed that the strength of the present model was its non-reliance on predator-prey equations. Because it was a simpler linear and dynamic model, the parameter was less

demanding than others. It was more apt to the simplicity offered by soil growth experiments as well.

Critique

The article provided an extensive presentation of the piecewise linear approach and how it was connected with decomposer biomass and soil nitrogen dynamics. While the author displayed much expertise in the completion of this paper, the article itself seemed very technical as it was written for a very limited audience. Reviewing the manner the paper was written could reveal certain hints of incoherence in the flow of the paper. The subject is complicated enough; the structure and syntax did not help in making the readers appreciate the findings of this paper in a better manner.

Nieminen effectively argued why other models did not adequately provide data researchers needed when it came to nematode dynamics and mineralization. He explained how a nutrient-limited model was more accurate to use. He showed how the complexity of the other models presented could hinder the process of studying soil and basic plant systems. Other models were still used to provide theoretical basis for his experimental model.

Research Problems and Benefits

The provision of a theoretical basis for the analysis of experimental data was important for soil ecologists. There was a need to find an adequate model that would not impede the work when it comes to the simpler ecosystems that they could actually implement actual solutions to instead of mere simulations. Since most soil ecological models were complex, they were not compatible with the simpler growth models. This would provide soil ecologists with a viable alternative model in constructing food webs from pure cultured organisms as well the maintenance of laboratory microcosms from fungal-based systems. The study also recommended evaluating the new model presented if it could obey the law of mass conservation as it was still an alternative approach. This was already characterized to be an

assemblage of classical and non-linear population models; however, it needed to be placed against a resource-explicit model for further evaluations.

Work Cited

Nieminen, Jouni. “Linking food webs to ecosystem processes: Piecewise linear models of soil microcosms.” *Ecological Modelling* 217 (2008): 87-94. Print.