Journal of Ecosystem & Ecography
ISSN: 2157-7625



Editorial Open Access

# From The Stand to the Regional Scale: An Assessment of Modelling Managed Forest Ecosystems in Sweden

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**Abstract**

The dynamic vegetation model LPJ-GUESS now includes a forest management module that enables analysis and forecasting of management treatment impacts on the carbon cycle and forest ecosystem structure. In this study, LPJ-GUESS is compared to observational data from the Swedish National Forest Inventory at the regional level. For the four most prevalent forest types in the nation, observed standing volume and simulations of standing volume are contrasted. Furthermore, to assess model predictions of net ecosystem exchange (NEE), gross primary production (GPP), and ecosystem respiration (Reco) at the site scale, eddy-covariance flux measurements from the Integrated Carbon Observation System (ICOS) are employed. For regional simulations in southern and Eastern Europe, the model results point to a sufficient depiction of standing volume in Norway spruce and Scots pine monocultures. The modified parameter values overestimated the standing volume in Norway spruce monocultures for northern Sweden. When compared to eddy-covariance data from two sites, one in central Sweden and one in the south, the model's predictions for carbon fluxes at the stand scale were inconsistent.

**Keywords:** Vegetation; Forest ecosystems; Carbon cycle

## Introduction

Together, boreal and temperate forests make up over 40% of the world's forest area and account for 2/3 of the yearly net global forest carbon sink. A crucial ecosystem service that reduces greenhouse gas emissions and the severity of the negative effects of changes to the Earth's climate is the storage of carbon by forests [1]. The ability of forest ecosystems to sequester carbon depends on a variety of natural elements, such as climate, terrain, soil, and historical disturbance patterns, as well as on human land use practises like forest management. In Sweden, forests make about 69% of the country's total land area, and even-aged silvicultural management techniques. Since Sweden's forests offer around 10% of the world's total production of timber and pulp, biomass is extracted very effectively. [2, 3].

## Model of an Ecosystem

LPJ-GUESS is a dynamic vegetation model (DVM) that depicts ecosystem function and vegetation structure using a process-based approach. The model includes a thorough explanation of nitrogen cycling as well as the exchange of carbon and water between the atmosphere and the biosphere. Simulated terrestrial vegetation reacts dynamically to input of outside climate data. The ecosystem simulates the daily time steps of photosynthesis, respiration, stomatal regulation, and phenological development in plants. A two-layer soil profile is used to model the water intake by plants and the hydrology of the soil. Based on the CENTURY model, LPJ-GUESS contains dynamic nitrogen and soil carbon cycle. A buildup of nitrogen in the soil. Mineralization of litter, biological nitrogen fixation assessed using simulated evapotranspiration rates, and nitrogen deposition all contribute to soil nitrogen build-up. According to Smith, nitrogen deposition is calculated using data from an external dataset, while mineralization and nitrogen fixation are represented as internal model functions [4, 5].

The model calls for a 500-year spin-up period during which ecosystem vegetation, soil carbon, and nitrogen levels progressively increase from bare ground. For cohorts of various plant functional types (PFTs), vegetation is simulated in patches where resource competition influences regeneration, growth, and mortality Tree algometry, lifespan, and root distribution are species-specific factors that affect the competition for light, water, and nutrients (N) within each simulated patch. The potential for each PFT's natural geographic range is determined by bioclimatic constraints for establishment and survival [6].

## Discussion

The DVM LPJ-GUESS for managed forests in Sweden's nemoral and boreal zones was evaluated in this study. Based on data from central Sweden, improved parameterizations of Norway spruce and Scots pine produced regional averages of standing volume in monocultures in southern and central Sweden that were more in line with actual values. The revised parameters, however, did not perform well for mixed stands or for northern Sweden. An examination of the model's ability to replicate the structure of two forest stands and the corresponding interannual fluctuation of carbon fluxes was conducted in addition to the regional scale study. Simulated yearly NEE values fell beyond the EC data's range of error, demonstrating a discrepancy in how site-specific conditions were represented. The model gave accurate estimates of Norunda's GPP's magnitude but understated Hyltemossa's GPP. A second indication that more fine-tuning and site-specific design may be necessary to take into account variations in site quality at the stand scale is the discrepancy between observed and simulated stand characteristics [7, 8].

## Conclusion

With the help of a user-defined regime, the forest management module simulates even-aged or uneven-aged silvicultural systems and starts a naturally growing or artificially planted forest stand.It provides

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**Received:** 03-Jan-2023, Manuscript No: jee-23-86202; **Editor assigned:** 05-Jan-2023, Pre-QC No: jee-23-86202 (PQ); **Reviewed:** 19-Jan-2023, QC No: jee-23-86202; **Revised:** 21-Jan-2023, Manuscript No: jee-23-86202 (R); **Published:** 28-Jan-2023, DOI: 10.4172/2157-7625.1000373

**Citation:** Sparks S (2023) From The Stand to the Regional Scale: An Assessment of Modelling Managed Forest Ecosystems in Sweden. J Ecosys Ecograph 13: 373.

a thorough set of guidelines that control the time and scope of planting, thinning, and clear-cutting for certain tree species [9, 10].

## Acknowledgement

The Forest Vision project, FORMAS grant number 2019-01968, benefited from the study's contribution. We appreciate ICOS Sweden for providing the information, and we also thank Ulf Johansson and Anders Lindroth for their suggestions. The Swedish Research Council funds ICOS Sweden as a national research infrastructure (grant number 2019-00205). We also acknowledge the contributions of Christofer Engberg Hydén and Johan Stendahl from the Swedish Forest Soil Inventory.

## Potential Conflict of Interest

No conflict or competing interests in the publication of this paper.

### References

1. Gouveia L, Oliveira AC (2009) Micro algae as a raw material for biofuels production. J Ind Microbiol Biotechnol 36: 269-274.
2. Liang Y, Sarkany N, Cui Y (2009) Biomass and lipid productivities of *Chlorella vulgaris* under autotrophic, heterotrophic and mixotrophic growth conditions. Biotechnol Lett 31: 1043-1049.
3. Widjaja A, Chien CC, Ju YH (2009) Study of increasing lipid production from fresh water microalgae *Chlorella vulgaris*. J Taiwan Inst Chem Eng 40: 13-20.
4. Yeh KL, Chang JS, Chen W (2010) Effect of light supply and carbon source on cell growth and cellular composition of a newly isolated microalga *Chlorella vulgaris* ESP-31. Eng Life Sci 10: 201-208.
5. Koussoroplis AM, Lemarchand C, Bec A, Desvilettes C, Amblard C (2008) From Aquatic to Terrestrial Food Webs: Decrease of the Docosa Hexaenoic Acid/Linoleic Acid Ratio. Lipids 43: 461-466.
6. Bhatta LD, Sunita CH, Anju P, Himlal B, Partha JD, et al. (2016) Ecosystem Service Changes and Livelihood Impacts in the Maguri-Motapung Wetlands of Assam, India. Land 5: 15.
7. Intergovernmental Panel on Climate Change (2007) Climate Change: Impacts, Adaptation and Vulnerability. Cambridge University Press, New York.
8. Dechasa F, Feyera S, Dawit D (2019) Determinants of Household Wetland Resources Use and Management Behavior in the Central Rift Valley of Ethiopia. Environ Sustain 2: 355-368.
9. Deka S, Om PT, Ashish P (2019) Perception-Based Assessment of Ecosystem Services of Ghagra Pahar Forest of Assam, Northeast India. Geol Ecol Landsc 3: 197-209.
10. Elias E, Weldemariam S, Bereket T, Wondwosen G (2019) Impact of Land Use/Cover Changes on Lake Ecosystem of Ethiopia Central Rift Valley. Cogent Food Agric 5.