

## Postdoctoral Researcher in Ecological Engineering

# Haga, Chihiro / 芳賀 智宏 Ph.D (Eng.)

Specially Appointed Researcher (Osaka University) / Collaborative Researcher (The Institute of Statistical Mathematics)

Haga, Chihiro is an ecological engineer conducting a scenario analysis of biodiversity and ecosystem services at a local scale. His research experiences include 1) localization of the LANDIS-II forest landscape model into Japan, and 2) applying the simulation for integrated social-ecological systems modeling.

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## RESEARCH AREAS

Landscape Ecology,	Landscape Modeling,	Biodiversity,	Ecosystem Services,
Climate Change,	Scenario Analysis,	Remote Sensing,	Renewable Energy

## EDUCATION

Doctor of Engineering <a href="#">Research Fellow (DC-1) of JSPS</a>	Division of Sustainable Energy and Environmental Engineering, Graduate School of Engineering, Osaka University, Japan	2021
Theme ( <a href="#">Link</a> ):	社会・生態システム統合モデルの開発と 生物多様性・生態系サービスの地域シナリオ分析 <b>Development of an Integrated Social-Ecological Systems Model for Scenario Analysis of Biodiversity and Ecosystem Services at Local Scales</b>	
Master of Engineering	Division of Sustainable Energy and Environmental Engineering, Graduate School of Engineering, Osaka University, Japan	2018
Theme ( <a href="#">Link</a> ):	LANDIS-IIを用いた自然資本と生態系サービスに関する 将来シミュレーションシステムの開発 ―日本の気候変動・社会変化シナリオとモデルの接続― <b>Development of Future Simulation System of Natural Capital and Ecosystem Services using LANDIS-II ―Linking the Model and Climate-Social Change Scenarios in Japan―</b>	
Bachelor of Engineering	Department of Sustainable Energy and Environmental Engineering, School of Engineering, Osaka University, Japan	2016
Theme ( <a href="#">Link</a> ):	LANDIS-IIモデルを用いた森林管理と耕作放棄による 森林構造および景観の多様性の変化のシミュレーション <b>Simulation of Changing Forest Structure and Landscape Diversity by Forestry Management and Abandonment of Cultivation using LANDIS-II model</b>	

## GRANTS

<b>Haga C.</b> , Kataoka Y., Matsui T., Tsuruta K., Nakagawa K., Kim J., and Kimura M. (PI). Development of a Forest Landscape Simulation Model for Assessing Disturbance Impacts on Forest Ecosystems in Shiga Prefecture, ISM Cooperative Research Program Foundation, Specially Promoted Research, 101,500 JPY.	2021 -2022
<b>Haga C.</b> (PI). A Comprehensive Scenario Analysis for Policy Interventions for Ecosystem Management in Social and Ecological Systems under the Shrinking Society, Sampo Environment Foundation, Grant Program for Doctoral Course Students, 30,000 JPY.	2019 -2021
<b>Haga C.</b> (PI). A Development of Scenario Simulation and Evaluation Systems for Terrestrial Ecosystems (S <sup>3</sup> -TEC), Japan Society for the Promotion of Science: Grant-in-Aid for JSPS Fellows. 2.2 million JPY.	2018 -2021

## AWARDS

Maeda M., **Haga C.**, Matsui T., Machimura T. (March 2019) Future Projection of Habitat Suitability for Animal Species Using Human Society - Land Management Scenarios and Forest Landscape Model, Poster Award, The Ecological Society of Japan

**Haga C.**, Matsui T., Machimura T. (October 2016) A Development of Simulation Process of Landscape Diversity In Satoyama Landscape For Future Scenario Assessment —Using The LANDIS-II Model And The Modified Satoyama Index—, Best student presentation award, Committee on Environmental Systems Japan Society of Civil Engineers

## PROFESSIONAL MEMBERSHIPS

The Ecological Society of America,

The Ecological Society of Japan,

International Association for Landscape Ecology,

Japan Association for Landscape Ecology,

The Japanese Forest Society,

Japan Geoscience Union

## COMMITTEE MEMBERSHIPS

International Exchange Committee, Japan Association for Landscape Ecology

2021 Jan. -  
2023 Dec.

## ACADEMIC ACTIVITIES

### SESSION CHAIR:

**Haga C.**, Hotta W., & Morimoto J.: Session chair of “SS05: Assessing the Resilience and Its Application to the Ecosystem Management in Forest Landscape,” *Global Land Programme 2021 Asia Conference*, 2021.09.14-17.

### PLANNING & MANAGEMENT OF WORKSHOP:

**Haga C.**, & Hotta W.: *ITMoB Training Seminar Series #2: Modeling on Forest Landscape Change for Scenario Analysis*, 2021.12.07. (Planning, management, and lecturer)

Japanese Association for Landscape Ecology, LANDIS-II applications in Japan, *Managing Landscapes for Climate Change by IALE President, Prof. Robert Sheller*, 2021.09.20. (Planning, Management, Technical support, and Oral presentation)

Saito O., Hori K., **Haga C.**, & Matsui T.: Development and application of gravity-based population allocation model, *ITMoB Training Seminar Series #1: Modeling on Population Distribution Projection for Scenario Analysis*, 2021.09.03. (Planning, management, and lecturer)

Saito O., Hashimoto S., Huang W. & **Haga C.**: Introduction to LANDIS-II model, *PANCES Modelling Training Seminar*, 2021.03.10. (Planning, management, and presentation)

小林勇太, **芳賀智宏**: 100年後の森林を予測する～森林景観モデルにできること・できないこと～, *第5回毎木セミナー*, 2021.01.19. (企画, 発表)

Kobayashi Y. & **Haga C.**: What will forests be like in the future?, *The 67th annual meeting of the Ecological Society of Japan*, 2020.03.07. (Planning, management, and presentation)

## LANGUAGES

English: Fluent

Japanese: Native

## TECHNICAL SKILLS

Environmental modeling & software development  
(Stand ~ landscape scale forest dynamics, human intervention, and landscape change),

Data science  
(processing, statistics, machine learning, optimization, and visualization) ,

Tools  
(R, Python, Julia, shell, ArcGIS/QGIS, and C#)

Team management  
(GitHub, on-premise GitLab, slack, and internal wiki),  
PC / Server management  
(Windows, macOS, and Ubuntu)

## LIST OF PUBLICATIONS

### PEER REVIEWED PUBLICATIONS

#### INTERNATIONAL JOURNALS

- Shi X. \*, Matsui T., Machimura T., **Haga C.**, Hu A., Gan X. (2022) Impact of urbanization on the food–water–land–ecosystem nexus: A study of Shenzhen, China. *Science of The Total Environment*, 808:152138. Doi: [10.1016/j.scitotenv.2021.152138](https://doi.org/10.1016/j.scitotenv.2021.152138)
- Hotta W. \*, Morimoto J., **Haga C.**, Suzuki S.N., Inoue T., Matsui T., Owari T., Shibata H., Nakamura F. (2021) Long-term cumulative impacts of windthrow and subsequent management on tree species composition and aboveground biomass: A simulation study considering regeneration on downed logs, *Forest Ecology and Management* 502:119728-119728. Doi: [10.1016/j.foreco.2021.119728](https://doi.org/10.1016/j.foreco.2021.119728)
- Oda T. \*, **Haga C.**, Hosomi K., Matsui T., Bun R. (2021) Errors and uncertainties associated with the use of unconventional activity data for estimating CO2 emissions: the case for traffic emissions in Japan. *Environ Res Lett* 16:084058., 2021 Doi: [10.1088/1748-9326/ac109d](https://doi.org/10.1088/1748-9326/ac109d)
- Shi X. \*, Matsui T., **Haga C.**, Machimura T., Hashimoto S., Saito O.: A scenario- and spatial-downscaling-based land use modeling framework to improve the projections of plausible futures: A case study of the Guangdong–Hong Kong–Macao Greater Bay Area, China, *Sustainability Science*, 2021. Doi: [10.1007/s11625-021-01011-z](https://doi.org/10.1007/s11625-021-01011-z)
- Kobayashi K. \*, Masuda K., **Haga C.**, Matsui T., Fukui D., Machimura T.: Development of A Species Identification System of Japanese Bats From Echolocation Calls Using Convolutional Neural Networks. *Ecological Informatics*:101253, 2020. Doi: [10.1016/j.ecoinf.2021.101253](https://doi.org/10.1016/j.ecoinf.2021.101253)
- Maegawa Y. \*, Ushigome Y., Suzuki M., Taguchi K., Kobayashi K., **Haga C.**, and Matsui T.: A new survey method using convolutional neural networks for automatic classification of bird calls. *Ecological Informatics*:101164, 2020. Doi: [10.1016/j.ecoinf.2020.101164](https://doi.org/10.1016/j.ecoinf.2020.101164).
- Morimoto J. \*, Aiba M., Furukawa F., Mishima Y., Yoshimura N., Nayak S., Takemi T., **Haga C.**, Matsui T., and Nakamura F.: Risk assessment of forest disturbance by typhoons with heavy precipitation in northern Japan. *Forest Ecology and Management*, 479:118521, 2021. Doi: [10.1016/j.foreco.2020.118521](https://doi.org/10.1016/j.foreco.2020.118521)
- Haga C.** \*, Maeda M., Hotta W., Inoue T., Matsui T., Machimura T., Nakaoka M., Junko Morimoto, Hideaki Shibata, Shizuka Hashimoto, Osamu Saito: Scenario Analysis of Renewable Energy–Biodiversity Nexuses Using a Forest Landscape Model. *Frontiers in Ecology and Evolution* 8 5 27, 2020. Doi: [10.3389/fevo.2020.00155](https://doi.org/10.3389/fevo.2020.00155)
- Fujimoto A., **Haga C.**, Matsui T. \*, Machimura T., Hayashi K., Sugita S., Takagi H.: An End to End Process Development for UAV-SfM Based Forest Monitoring: Individual Tree Detection, Species Classification and Carbon Dynamics Simulation. *Forests*, Vol.10, 680, 2019. Doi: [10.3390/f10080680](https://doi.org/10.3390/f10080680)
- Haga C.** \*, Inoue T., Hotta W., Shibata R., Hashimoto S., Kurokawa H., Machimura T., Matsui T\*: Simulation of natural capital and ecosystem services in a watershed in Northern Japan focusing on the future underuse of nature: by linking forest landscape model and social scenarios. *Sustainability Science*, Vol.14, No.1, pp.89-106, 2019. Doi: [10.1007/s11625-018-0623-9](https://doi.org/10.1007/s11625-018-0623-9)
- Hashimoto S. \*, Das Gupta R., Kabaya K., Matsui T., **Haga C.**, Saito O., Takeuchi K.: Scenario analysis of land-use and ecosystem services of social-ecological landscapes: implications of alternative development pathways under declining population in the Noto Peninsula, Japan, *Sustainability Science* 14(1) 2019. Doi: [10.1007/s11625-018-0626-6](https://doi.org/10.1007/s11625-018-0626-6)

Matsui T.\*, **Haga C.**, Saito O., Hashimoto S.: Spatially explicit residential and working population assumptions for projecting and assessing natural capital and ecosystem services in Japan, *Sustainability Science* 14(1) 1-15 2019. Doi: [10.1007/s11625-018-0605-y](https://doi.org/10.1007/s11625-018-0605-y)

\* Correspondence authors

## DOMESTIC JOURNALS

Kim J., Iwakawa T., Kimura M., Matsui T., Saito O., Hori K., **Haga C.** (2021) Evaluation of Energy Utilization Scenarios for Wood Biomass as a Nature-based Solution. *Papers on Environmental Information Science ceis*, 35:131–136. Doi: [10.11492/ceispapers.ceis35.0\\_131](https://doi.org/10.11492/ceispapers.ceis35.0_131) (in Japanese)

Yuta K., **Haga C.**, Matsui T., Machimura T., Tsuruta K., Kimura M. (2021) Modeling Synergies and Trade-Offs of Forest Management in Shiga. *Papers on Environmental Information Science ceis*, 35:73–83. Doi: [10.11492/ceispapers.ceis35.0\\_73](https://doi.org/10.11492/ceispapers.ceis35.0_73) (in Japanese)

Saito R.\*, Hirai C., **Haga C.**, Matsui T., Shirakawa H., Tanikawa H.: Development of a Method of Estimation of Total Floor Area Using Deep Learning based on Nighttime-Light Data, *Journal of Environmental Systems Research*, in print (in Japanese)

**Haga C.\***, Matsui T., Machimura T.: A development of simulation process of landscape diversity in satoyama landscape for future scenario assessment —using the LANDIS-II model and the modified satoyama index—, *Journal of Environmental Systems Research* 72(6) II\_299-II\_309, 2016. Doi: [10.2208/jscejer.72.II\\_299](https://doi.org/10.2208/jscejer.72.II_299) (in Japanese)

\* Correspondence authors

## CONFERENCE PROCEEDINGS (ORAL PRESENTATIONS)

### INTERNATIONAL CONFERENCE

**Haga C.**, Matsui T. (2021) Predicting and Assessing Natural Capital and Ecosystem Services (PANCES) project in Japan, *3rd ESP Asia Conference*, 2021.12.

Nakahira T., Miyamoto T., **Haga C.**, Matsui T., Kamei M., Saito O. (2021) An Input-Output Analysis of Japanese Industry's Dependency on Nature, *3rd ESP Asia Conference*, 2021.12.

Zhou Y., Ishida S., **Haga C.**, Matsui T. (2021) Biodiversity Mainstreaming: An International Comparative Investigation of Concerns Toward Biodiversity in Chinese- and Japanese-speaking Communities, *3rd ESP Asia Conference*, 2021.12.

**Haga C.**, Matsui T. (2021) Scenario analysis of Nexuses between Renewable Energy, Biodiversity, and Ecosystem Services in the Bekambeushi River Watershed, Japan, *INREM 2021*, 2021.11.

**Haga C.**, Hotta W., Inoue T., Matsui T., Aiba M., Owari T., Suzuki S.N., Mishima Y., Morimoto J., Shibata H. (2021) What are Robust Post-Windthrow Managements for Forest Recovery under the Future Climate Change?, *3rd GLP Asia Conference*, Sapporo, Japan, 2021.9.

**Haga C.**, Maeda M., Matsui T., Machimura T.: Are there potential conflicts among renewable energy, biodiversity, and ecosystem services? Scenario analysis of land use management and selection among renewable energy alternatives, *International Association for Landscape Ecology*, T0421, Milan, Italy, 2019.7.

**Haga C.**, Inoue T., Matsui T., Morimoto J., Shibata H., Machimura T.: Scenario analysis of landscape change and evaluation of terrestrial ecosystem services and landscape diversity using Forest Landscape Model, *Global Land Programme 2018 Aisa conference proceedings*, 18087, Taipei, Taiwan, 2018.9.

Inoue T., Shibata H., Nakazumi N., **Haga C.**, Matsui T.: Combined effects of future changes land use/cover and climate on nitrogen leaching to stream water in a forest, farmland and wetland dominated landscape, northern Japan, *Global Land Programme 2018 Aisa conference proceedings*, Taipei, Taiwan, 2018.9.

**Haga C.**, Inoue T., Hotta W., Shibata R., Kurokawa H., Hashimoto S., Machimura T., Matsui T., Morimoto J., Shibata H. (2017) A Development of Future Scenario Simulation System of Natural Capital and Ecosystem Services on LANDIS-II —Linking Qualitative Scenarios and Landscape Change

Model in Japan—, *The 9th Ecosystem Services Partnership World conference*, T5-3, Shenzhen, China, 2017.12.

Hashimoto S, Rajarshi Das Gupta, Kabaya K, Matsui T, **Haga C**, Saito O, Takeuchi K: Exploring alternative futures for the social-ecological production landscapes of Noto: implications of land use change on the provision of ecosystem services, *The 9th Ecosystem Services Partnership World conference proceedings*, 2017.12.

**Haga C**, Matsui T, Hashimoto S, Saito O, Machimura T: A development of simulation process of landscape diversity in satoyama landscapes for future scenario analysis -using the LANDIS-II model and the modified Satoyama index -, *the first Asian Ecosystem Services Partnership Conference*, T1, Ansan-si, Republic of Korea, 2016.6.

## DOMESTIC CONFERENCE

**芳賀智宏**, 田中健太郎, 堀啓子, 松井孝典: 社会・生態システムでの再生可能エネルギーケースの分析: 導入ポテンシャルの高空間解像度化プログラムの公開, 日本景観生態学会第31回大会要旨集, 2021.09.

田中健太郎, **芳賀智宏**, 松井孝典, 堀啓子, 町村尚: 再生可能エネルギーポテンシャル空間明示マップの開発と応用, 第40回エネルギー・資源学会研究発表会予稿集, 18-6, 2021.08.03

**Haga C.**: Mainstreaming renewable energy in decade of action requires ecologists, Public Online Symposium of Ecological Society of Japan “Human-nature systems in ecological studies and ecosystem/resource management”, Zoom, 2021.07.26.

**Haga C.**, Matsui T., Inoue T., Hotta W., Aiba M., Owari T., Suzuki S., Mishima Y., Morimoto J. & Shibata H.: Adaptation after windthrow: Conservation of forest ecosystem in a future climate, *The 68th annual meeting of the Ecological Society of Japan proceedings*, W08-4, 2021.03.

Hori K., **Haga C.**, Matsui T., Saito O., Hashimoto S., Yoshida T., Huang W., Kumagai J., Wakamatsu M., And Managi S.: A Survey on Domestic Migration and Related Population and Estimation of Related Population by Prefecture, *Proceedings of 48th Annual Meeting of Environmental Systems Research 2020*, Committee on Environmental Systems, Japan Society of Civil Engineers.

Fukumori F., **Haga C.**, Matsui T., and Machimura T.: A Development of Visualization Method of Climate Justice for Supporting Complementarity among Local Areas under Climate Change, *Proceedings of 48th Annual Meeting of Environmental Systems Research 2020*, Committee on Environmental Systems, Japan Society of Civil Engineers.

Miyamoto T., **Haga C.**, Matsui T., Machimura T., Hori K., Saito O., and Hashimoto S. A Demand-Supply Gap Analysis of Ecosystem Services and Evaluation of Area Coupling Effect for Forming Regional Circular Ecological Sphere, *Proceedings of 48th Annual Meeting of Environmental Systems Research 2020*, Committee on Environmental Systems, Japan Society of Civil Engineers.

**芳賀智宏**, 前田真里美, 堀田亘, 井上貴央, 松井孝典, 町村尚, 仲岡雅裕, 森本淳子, 柴田英昭, 橋本禪, 齊藤修: 生物多様性保全と再生可能エネルギーの導入は両立可能か?—別寒辺牛川流域を対象として—, 日本景観生態学会第30回大会要旨集, 1-2-3, 2020.09.

Namba A, **Haga C**, Matsui T, Oba M, Machimura T: Future Prediction of Biomass Supply Potential under Climate Change Scenarios using Forest Landscape Simulation Model for Regional Circular and Ecological Sphere, *JpGU-AGU Joint Meeting 2020*, 2020.07.

Kobayashi K, **Haga C**, Matsui T, Fukui D, Machimura T: Development of Environmental Sound Classification Technology for Achieving the SDGs: Development of the 30 Japanese bat species classification system with deep learning, 2020.05.

**Haga C**: What is LANDIS-II?, *The 67th annual meeting of the Ecological Society of Japan Proceedings*, W17-2, 2020.03.07.

**Haga C**, Horio R, Matsui T, Machimura T: Simulation of Changes in Forest Biomass and Tree Species Composition after Natural Regeneration For Adaptation To Climate Change —Case Study In

Ishikawa Prefecture—, *Proceedings of Annual Meeting of Environmental Systems Research*, B-41, 2017.10.

芳賀智宏, 松井孝典, 堀尾亮太, 町村尚: 里山での人為的攪乱に伴う植生の遷移と景観の多様性の変化, 日本農業気象学会近畿支部大会講演論文集, 2016.11.

## CONFERENCE PROCEEDINGS (POSTER)

### INTERNATIONAL CONFERENCE

**Haga C**, Hotta W, Morimoto J, Owari T, Inoue T, Shibata H, Aiba M, Matsui T: Simulation of recovery of above-ground biomass after windthrow damage under future climate change, *2020 Ecological Society of America Annual Meeting proceedings*, 2020.08.

Hotta W, **Haga C**, Inoue T, Morimoto J, Matsui T, Suzuki S, Owari T, Shibata H, Nakamura F: Simulating the long-term impacts of salvage logging after windthrow on forest carbon stocks and species composition in northern Japan, *2020 Ecological Society of America Annual Meeting proceedings*, 2020.08.

Inoue T, Shibata H, **Haga C**, Matsui T: Effects of land use change and climate change on soil nitrogen cycle at a watershed scale in eastern Hokkaido, Japan, *The 9th Ecosystem Services Partnership World conference proceedings*, 2017.12.

### DOMESTIC CONFERENCE

Hotta W., **Haga C**, Morimoto J., Inoue T., Suzuki S., Matsui T., Owari T., Shibata T., & Nakamura F.: Simulating the long-term effects of post-windthrow management on carbon balance in boreal forests under climate change. *The 68th annual meeting of the Ecological Society of Japan proceedings*, P1-394, 2021.03.

Inoue T, Shibata H, **Haga C**, Matsui T: Modeling ecosystem functions in a forest of eastern Hokkaido using LANDIS-II, *131st Annual Japan Forest Society Meeting proceedings*, 2020.03.

**Haga C**, Hotta W, Morimoto J, Owari T, Inoue T, Shibata H, Aiba M, Matsui T: Numerical simulation of climate change impact on forest biomass resilience after windthrow in southern Hokkaido, *The 67th annual meeting of the Ecological Society of Japan proceedings*, 2020.03.

Hotta W, **Haga C**, Inoue T, Morimoto J, Matsui T, Suzuki S, Owari T, Shibata H, Nakamura F: The effects of salvage logging after windthrow on carbon balance in boreal forest ecosystems —Simulation in the current climate—, *The 67th annual meeting of the Ecological Society of Japan proceedings*, 2020.03.

Maeda M, **Haga C**, Matsui T, Machimura T, Hashimoto S, Saito O: How can we translate future simulation results of social and ecological systems for communication with local people?, *The 67th annual meeting of the Ecological Society of Japan proceedings*, 2020.03.

田中健太郎, 堀啓子, 芳賀智宏, 松井孝典, 町村尚: 再生可能エネルギーミックスの組合せ最適化計算ツールによる地域連携効果の多目的評価, 2019年度環境情報科学研究発表大会, 東京都千代田区, 2019.11.

Maeda M, **Haga C**, Matsui T, Machimura T: Future Projection of Habitat Suitability for Animal Species Using Human Society - Land Management Scenarios and Forest Landscape Model, *The 66th annual meeting of the Ecological Society of Japan proceedings*, P1-263, 2019.03.

**Haga C**, Inoue T, Hotta W, Machimura T, Matsui T, Morimoto J, Shibata H: Development of methodology for scenario analysis of natural capitals and ecosystem services using forest landscape model, *The 65th annual meeting of the Ecological Society of Japan proceedings*, P2-134, 2018.03.

堀尾亮太, 芳賀智宏, 松井孝典, 町村尚 (2017) LANDIS-II を用いた気候変動と森林施業によるバイオマスと樹種構成のシミュレーション, 気候変動適応技術社会実装プログラム (SI-CAT) 気候変動適応技術の情報共有ワークショップ, 茨城県つくば市, 2017.3.

松井孝典, 芳賀智宏, 堀啓子, 町村尚: 生態系サービスの将来シナリオ評価のためのストック・フローおよびサプライ・デマンド統合シミュレーションモデルの開発に向けて, 2016年環境経済・政策学会年次大会報告要旨集 9 2016