Marriage of design and science for the climate change adaptation

Doctor of Design (Kyushu University)
Japan Landscape Architecture Union (JLAU) IFLA Japan Delegate,
Shinshu University Associate Professor

Uehara is a delegate of JLAU (IFLA Japan) since 2015, he has also been the Asia representative member of the IFLA World Task Force (TF) for Landscape without Borders (2015-2017), Climate Change (2018-2020), and Agriculture and Landscape (2021-present). He majored in Design Sciences, a comprehensive department combining architecture, urban planning, and landscape architecture. His doctoral thesis explored the application of Design with Nature for innovative environmental evaluation. He has published 55 research papers in Japanese and English professional journals and 19 books in Springer Book, among others. The concept of Design with Nature serves as a valid principle to identify unsuitable locations for development on a watershed scale. He demonstrated through research and practice that this concept can predict the most severe complex disasters in the world and provide recovery design guidelines after tragic disasters seamlessly.

Awards:

Over the 17 years, he has received not only award-winning recognition for six design projects but also top honors in scientific fields, such as the prestigious 2021 Japan Prize Heisei Memorial Research Grant, awarded to only a select five researchers.

2000 Architectural Institute of Japan, Excellent Works for the Design Competition - Rural Residence in the New Century, selected by the Kyushu Branch

2006 Research Encouragement Prize of Japanese institute of landscape Architecture "Evaluation of Potential Regional Resources for Sustainable Society and Research on Land Use Planning"

2018 Africa, Asia Pacific, Middle East (AAPME) Awards 2018, Resilience by Design, International Federation of Landscape Architects, Outstanding Awards, Category: Natural Disasters and Weather Extremes

2018 Africa, Asia Pacific, Middle East (AAPME) Awards 2018 , Resilience by Design, International Federation of Landscape Architects, Honorable Mention, Category: Analysis and Master planning

2020, Ministry of Land, Infrastructure, Transport and Tourism of Japan, 1st Green Infrastructure Award, Excellence Award, Living Space Category

2021 Good Design Award (City block and community development) Disaster recovery through Design Science, Japan Institute of Design Promotion

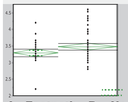
2021 Japan Prize Heisei Memorial Research Grant : An interactive design-research platform to the world through an online program for sharing Japan's experiences and issues of natural disasters, The Japan Prize Foundation

2022 Landscape Consultants Association Award (CLA Award 2022) Special Award of the Research and Planning, "Shinshu Urban Green Infrastructure Promotion Plan"

Design work:

1. **Compatibility of sustainable resource utilization and cultural landscape revitalization by historical land use patterns,**
2. **Post-catastrophe resilience and recovery from some of the world's most severe complex disasters,**
3. **Forest conservation and footpath creation to minimize stress during the COVID-19 pandemic,**
4. **Landscape design supervision for the inaugural linear motor train station in Nagano Prefecture**

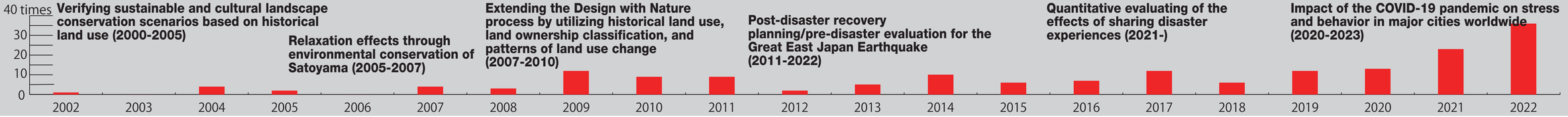
He successfully designed a footpath in privately owned forestland that was at risk of development, achieved green space conservation for abandoned solar panels, and reduced residents' stress even during the COVID-19 pandemic.



Footpath users show a significant decrease in stress compared to non-users."Height of the diamond" represent the 95% confidence interval of the mean value.

Research work:

The number of citation times of his research paper



Verifying sustainable and cultural landscape conservation scenarios based on historical land use (2000-2005)

Relaxation effects through environmental conservation of Satoyama (2005-2007)

Extending the Design with Nature process by utilizing historical land use, land ownership classification, and patterns of land use change (2007-2010)

Post-disaster recovery planning/pre-disaster evaluation for the Great East Japan Earthquake (2011-2022)

Quantitative evaluating of the effects of sharing disaster experiences (2021-)

Impact of the COVID-19 pandemic on stress and behavior in major cities worldwide (2020-2023)

Scientific proof of the effectiveness of Design with Nature principles vs Big Data (GIS) in multi-disaster prediction:

The 1980 JNLA historical environmental classification map and the relative disaster risk ranking score demonstrated the ability to predict not only the 2011 extensive damage to highways and buildings across the three northeastern prefectures with varying scales of the Great East Japan Earthquake but also the damage to related facilities of the Fukushima nuclear power plant. It is the same data that Uehara digitally restored and applied in the reconstruction plan for Shinchi Town, Fukushima Prefecture. Furthermore, it proved that the risk-predictive accuracy of his digitally-transformed landscape principle surpassed the 2019 sector-specific GIS risk assessment announced by the government. This achievement is recognized in the Landscape and Urban Planning journal research paper, which ranks in the top 10% in various research fields (regional and urban planning, geography, ecology, and environmental studies) globally in 2022.

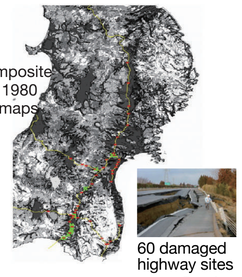
Map overlay of three different 2011 damage with the 1980 JNLA composite risk map (top three) , and the 2019 MLIT composite risk map(bottom three) .

1980 JNLA environmental classification maps with relative risk rank score

- Vege & Landuse map → High liquefaction risk
- Geology map → High landslide risk, High earthquake risk
- Slope map → High slope failure
- Terrain map → High flood risk

Digitize map and extract high hazard

Creating a composite risk map from 1980 digitize JNLA maps



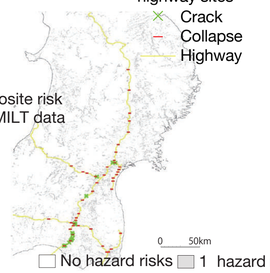
60 damaged highway sites

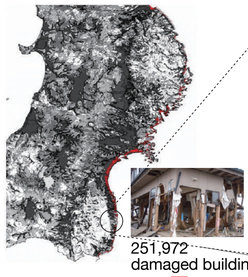
Open web GIS government data (MLIT) of 2019 hazard areas

4 types of slope-related risk

- Landslide
- Debris flow
- Slope failure
- Avalanche
- Flood risk

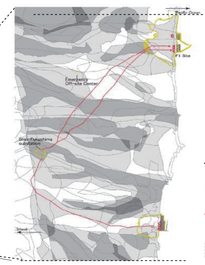
Creating a composite risk map from 2019 MILT data





251,972 damaged buildings

damaged buildings



The damaged Fukushima nuclear power plants and associated facilities

- Transmission network of three important facilities
- Nuclear power plant F1, F2, External power supply node(Shin-Fukushima substation)
- Facilities of nuclear power plant F1, F2

The white areas on the MILT risk map, which could not evaluate for risk, give the wrong impression of being safe. In addition, without cross-disciplinary disaster calculations, complex risks such as vulnerability to earthquakes and high flood risk also could not be visualized.

No hazard risks | 1 hazard risks | 2 hazard risks | 3 hazard risks | 4 hazard risks

Applying Design with Nature Principles for rapid recovery from the World's Worst Fukushima complex disaster:

The earthquake energy of M9.1 from the Great East Japan Earthquake was 32 times bigger than that of the Turkey-Syria earthquake in 2023, and the flooded area was 4.8 times larger than that of the 2012 Hurricane Sandy. The radioactive contamination was at the same worst level as the Chernobyl disaster in Ukraine in 1986. The recovery of whole affected municipalities cost 32 trillion yen. In addition, even after 10 years, the population has not recovered, with 380,000 people having left their towns. In contrast, In just three years, his planning for recovery in Shinchi town, Fukushima Prefecture has allowed for the achievement of disaster-resistant, nature-endowed relocation. The application of this landscape architect's principle has become a simple and reliable indicator for discussing the usefulness of long-term spatial planning and for facilitating chaotic community discussions after the world's worst compound disaster.

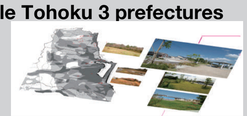
2011.3.11 M9.1Earthquake Whole Tohoku 3 prefectures

1969

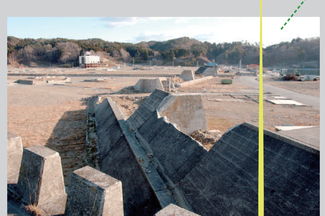
Ian L. McHarg published "Design with Nature"

1980

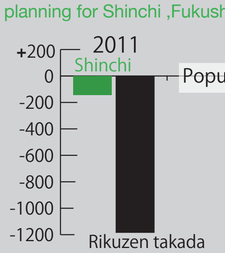
"Land use Suitability Investigation through Ecological Planning Concept" 1980 Japan National Land Agency (JNLA)



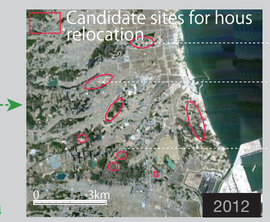
My main work : The application of 1980's JNLA database and McHarg's landscape planning principle for reconstruction planning for Shinchi ,Fukushima

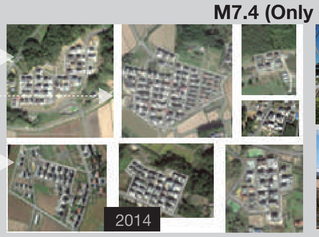


Intensive reconstruction with fragmented and specialized work (Ex. Rikuzen-Takata, Iwate)



Population change





M7.4 (Only Fukushima prefecture)

Even after 2011, Fukushima (Shinchi town) suffered from multiple huge earthquakes, but it has regenerated as a living town and has become my second home

M7.1 M7.4 (Only Fukushima)

Recovery planning from the 2011 Catastrophe by Bottom-up, point-by-point relocation planning using Design with Nature principle, Reconstruction cost ($0.023B), Reconstruction period (3 years)

COST	GAIN	LOSS
$(0.023B)	437person	-245person
$ (1.2B)	12	-1856

Rikuzen-Takata's Cost =Shinchi's cost × 52

Top-down relocation through area-based land readjustment and landfill , Reconstruction cost ($1.2B), Reconstruction period (10 years)