BC2 Visualization of the Relational Values between the Human and Nature in Japan: applying Geospatial Data-driven Methodology

地理空間データ駆動の手法を応用した人間と自然のつながりを表す関係価値の可視化

地球循環共生工学領域　08E20037　周月茹（Yueru ZHOU）

Abstract: Recognition of nature's three specific diverse values, intrinsic, instrumental, and relational values, is important for biodiversity conservation. Especially, evaluating quantitative relational values (RVs) is a key challenge. Therefore, this study aims to develop a data-driven methodology to visualize RVs in Japanese natural landscapes and conduct verification. Drawing on the definition of RVs, nine geospatial indicators of individual identity, world view, and social cohesion, were selected from Japan Biodiversity Outlook 3. The result identified the potential hotspots of RVs of general nature: Mount Fuji, the Izu islands, Kyoto, North Osaka, and Okinawa. Further research is needed to evaluate other RV constructs: stewardship eudaimonic and social responsibility.

Keywords: biodiversity, nature's contributions to people, geographical information system, machine learning

1. Introduction

Relational value (RV) is one of the specific values of nature. It is the value of desirable and meaningful human relationships with nature. These relationships with specific natural landscape, species, and etc., include nature-individual relationships and human-collective relationships through nature [1]. RV can also be described as 風土 in Japanese. Despite the acknowledged importance of relational values (RVs) for biodiversity conservation, empirical methodologies to assess RVs distribution lack quantitative approaches and indicators at local and national scales [2, 3]. Therefore, this study aims to bridge this gap by proposing a geospatial data-driven methodology to visualize RVs .

2. Method

2.1. Developing an integrated RV indicator

The conceptual framework of RVs includes five constructs: individual identity, stewardship eudaimonic, world view, social responsibility, and social cohesion (**Table 1**) [4]. From 76 ecosystem services indicators in Japan Biodiversity Outlook 3 (JBO3), RV indicators were selected by reviewing 1) the ability to evaluate each RV construct and 2) availability of its geospatial data. Then, integrated RV indicator was calculated by summing min-max scaled individual RV indicators. Finally, the geospatial data was incorporate into Uber H3 grid system at resolution level 6 and Kepler.gl was used to visualize the spatial distribution and hotspot of RVs in Japan.

2.2. Quantitative verification in the Greater Tokyo area

The integrated RV indicator were compared with the factor scores derived from a stated preference survey (N = 488) on greater Tokyo residents [4] to perform verification of the visualization. Gradient Boosting Decision Trees (GBDT) model was built to predict factor scores using RVs geospatial data. The relative feature importance of RV indicators was computed to identify which indicator contribute the most to the prediction of factor scores.

Table 1. Definitions of five constructs of RVs [4].

Construct	Definition	Examples
Individual Identity	One's identity in relation to nature.	Identity
Stewardship Eudaimonic	Life satisfaction one can nurture by taking care of nature.	Autonomy, purpose in life and personal growth
World View	Worldview, attitude and thoughts for humans, nonhumans and nature. Some views are attributed to each individual and others are culturally shared with other people.	Responsibilities, principles, virtues, and preferences
Social Responsibility	Responsibilities towards human society. It includes future generations, the whole human society, and one's local community.	Wellbeing/job and resources/future generation
Social Cohesion	Connections with others you can obtain through nature (the base of the cultural identity).	Family, community

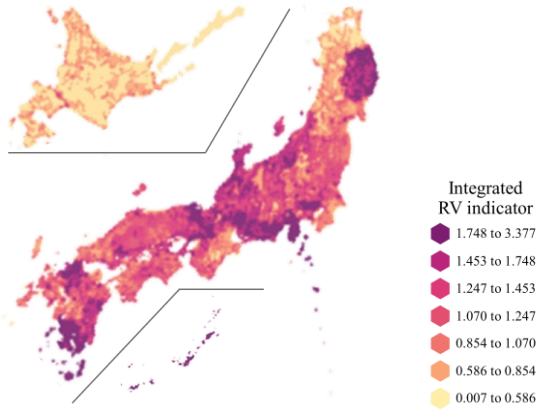

Figure 1. Visualization of integrated RV indicator.

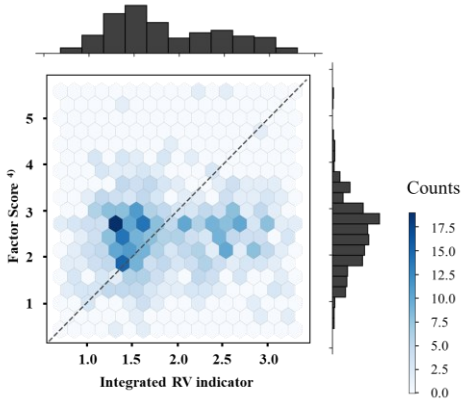

Figure 2. Density plot between the integrated RV indicator and factor scores.

3. Result and Discussion

3.1. Distribution of integrated RV indicators

After reviewing the ability to evaluate RVs and data availability in JBO3, nine indicators of individual identity, world view, and social cohesion were selected. However, no indicators for stewardship eudaimonic and social responsibility were found in JBO3. This implies that the policy makers focus on only RV constructs on identity but may ignore other human-nature relations, such as taking care of wild animals or plants, managing surrounding satoyama landscape with local community. **Figure 1** showed that the RVs heatmap highlighted Mount Fuji, the Izu islands, Kyoto, North Osaka, and Okinawa as potential hot spots of RVs. In these hotspots, famous nature-cultural landscapes, such as national parks and nature tourist attractions, are located in the hot spots. It suggested that the RVs heatmaps may be tend to captured the places that people can live with nature in general Japanese perspectives.

3.2. Verification of data-driven methodology

The correlation coefficient between the integrated RV indicator and the sum of factor scores derived from the previous stated preference survey was 0.05 (**Figure 2**). This implies that the data-driven method cannot fully capture the complexity of RVs as perceived by residents at this point. The GBDT model identified that the distribution of shrines, giant trees, and urban green spaces and the Satoyama index have high feature importance. These findings imply that the places rich in nature and intertwined with human relationships are likely to possess high RVs.

4. Future Perspectives

Further geospatial data is needed to capture place-based nature and stated preference survey at a larger scale is also needed to improve the data-driven method. Furthermore, incorporating a broader range of indicators can better capture RVs' complexity and diversity. This can involve indigenous people and local communities into policy making process, which can contribute to an inclusive and nature-positive future at both regional and national levels.

References

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