Quantifying Nature-based Tourism in the Era of Big Data: A case study for Jeju Island, RO Korea

Choong-Ki Kim
Korea Environment Institute (KEI)
(ckkim@kei.re.kr)
Contents

1. Introduction
   - Objectives
   - Nature-based tourism & recreation

2. Use of Big Data to quantity nature-based Tourism & Recreation

3. A case study for Jeju Island, RO Korea

4. Summary & Discussion
Objective

- To measure and map the value of recreation and tourism to a place

- To understand what characteristics of the landscape attract tourists or deter them from visiting -- including both natural and other characteristics.
Use of Big Data to quantify nature-based Tourism & Recreation
visitation rate = predictor + predictor + predictor + predictor

( visits / time )

economic benefits ( $$ )

background

decision to visit

visits Site-1

visits Site-2

visits Site-3

visits Site-4

food

water quality

hotels

archaeology

coral reefs

cost

roads

fish

parks
This led us to searching for a global data source on visitation that we could use as a response variable to measure the effect of natural and other attributes in any location.
Compared photo-visitation rate against surveyed visitation rate at over 800 worldwide and found a correspondence. (Wood et al. 2013, Science Reports)
visitation rate = f (habitats and human activities)
Dynamic population mapping using mobile phone data (Deville et al. 2014)
A case study for Jeju Island, Korea

Mapping and Valuing Nature-based Recreation & Tourism
Main Issue of Natural Capital Management in Jeju

- Conservation Efforts vs. Development Pressure

<table>
<thead>
<tr>
<th>Year</th>
<th>Area (km²)</th>
<th>Agri. L.</th>
<th>Barren L.</th>
<th>Urban L.</th>
<th>Forest L.</th>
<th>Grassland</th>
<th>Water</th>
<th>Wetland</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989</td>
<td>379.32</td>
<td>7.83</td>
<td>69.39</td>
<td>924.93</td>
<td>466.55</td>
<td>37.12</td>
<td>0.59</td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>394.12</td>
<td>15.10</td>
<td>88.86</td>
<td>1035.46</td>
<td>322.08</td>
<td>29.16</td>
<td>0.39</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>819.76</td>
<td>15.34</td>
<td>98.89</td>
<td>649.29</td>
<td>271.38</td>
<td>30.50</td>
<td>0.38</td>
<td></td>
</tr>
</tbody>
</table>

Increase & Decrease Ratio(%) | +116 | +96 | +43 | -30 | -42 | -18 | -36 |
Objectives for the Jeju Applications

## Background

- Changes in Pressures
  - Urban and Agricultural Land ↑
  - Release of Protected Areas
  - International Free City
  - Development in Middle Mountainous Area
- Change of Ecosystem Structure
  - Damage of Natural Habitat
- Changes in provision of Ecosystem Service
  - Decrease of Biodiversity

## Main Objectives

1. Apply integrated ES modeling approaches to JeJu Island
2. Explore changes in ES in response to changes in LULC by time
3. Explore changes in ES under alternative scenarios
4. Use this information to inform decisions for SD for Jeju
Evaluation System of Ecosystem Service in Jeju

- Regulating Service
  - Carbon Seq. (tonC, \( W \))

- Cultural Service
  - Eco-tour (# of visitor, \( W \))
  - Big Data
    - Geo-tagged photos, Mobile phone, Credit card

- Supporting Service
  - Management
  - Sensitivity
  - Pressure

- Habitat Quality (Index)

- Land Cover Land Use

- Local Government
- Scenario
- Local Resident
평가방법 2. Quantitative relationships between visitation rates and attributes of the landscape
A Framework to Value Nature-Based Recreation and Tourism

1. Estimate the visitation rate
2. Regression analysis of visitation as a function of drivers
3. Expenses
4. Economic Value of Eco-Tourism

Drivers of Visitation

Big Data
Mapping and Valuing Nature-Based Recreation and Tourism in Jeju Island, Korea

Patterns of visitation based on Big Data

Flickr Photo user-days

Twitter user-days

Mobile Phone Users

Drivers of Visitation

Accessibility:

Natural Attractions:

Built Infrastructure:
Drivers of Visitation: predictor variables for Jeju

Are people more likely to visit places with higher conservation protections?
Mapping and Valuing Nature-Based Recreation and Tourism in Jeju Island, Korea

- 평가결과 1. 관광지별 방문 비율 비교

Observed

Photo-User-Day

Pearson’s r = 0.52

Twitter-U-D

Pearson’s r = 0.71

Mobile Phone Users

Pearson’s r = 0.56

Jeju City
(20 Tourist Sites)

SuKyPho City
(27 Tourist Sites)

47 Tourist Sites
Spatial variation of visitors can be explained by accessibility, natural and build attractions ($R^2 = 0.56$).
평가 결과 3. 지출 정보(객단가)

Avg. Expenses for Tourism:
$43.00/Credit Card Use

※ 객단가: 1회 평균 결제 금액
Mapping and Valuing Nature-Based Recreation and Tourism in Jeju Island, Korea

- 평가 결과 3. Credit Card Expenditure

<table>
<thead>
<tr>
<th>Category</th>
<th>Avg. Expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lodging</td>
<td>$46.00</td>
</tr>
<tr>
<td>Food</td>
<td>$40.00</td>
</tr>
<tr>
<td>Travel</td>
<td>$42.00</td>
</tr>
<tr>
<td>Activities</td>
<td>$76.00</td>
</tr>
</tbody>
</table>
평가 결과 3. 지출 정보(객단가)

연평균 지출

제주시 삼도2동 (Oriental Hotel)

제주시 애월읍 (Lodging)
The places people visit reveal their preferences about natural environments.

Quantitative relationships between visitation rates and attributes of the landscape show which attributes are most valued by tourists.

These relationships can be applied to future scenarios of development or conservation to understand how tourism patterns may change.
Thank You