Assessment of Sustainability at protected areas

Kalev Sepp

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Outline

- Concept of sustainability
- Cultural landscapes and settlements vitality index
- Visitor monitoring system in Estonia
- Visitor counting. Our experiences
- Bog surface carrying capacity – trampling experiment in Kullisoo, Estonia
**Sustainability**

- **Sustainability** is the ability to exist constantly.
- The capacity for the biosphere and human civilization to coexist.
- The sustainability of natural ecosystems can be defined as the dynamic equilibrium between natural inputs and outputs, modified by external events such as climatic change, etc.
- Modern use of the term sustainability is **broad** and **difficult to define precisely**.
- The Circles of Sustainability approach distinguished four domains of economic, ecological, political and cultural sustainability.
The concept of sustainability

Fundamental questions:
- Which system, subsystem, or characteristics are to be sustained;
- For how long they are to be sustained;
- When we can assess whether the system has actually been sustained
- How we assess the sustainability
- What are the best indicators.
  - Social
  - Economic
  - Environmental
The concept of sustainability in South-America

- The concept of the “threshold of sustainability.” This is the minimum level of investment in the tourism management capacity of a protected area needed to ensure that the area’s natural capital does not decline.

- The threshold of sustainability is reached by ensuring adequate investment in each of five key management capacity areas:
  - impact monitoring;
  - basic infrastructure;
  - security;
  - interpretation and information;
  - staff salaries and training
### Social indicators of sustainable tourism

<table>
<thead>
<tr>
<th>Sustainability issue</th>
<th>Practical component</th>
<th>( I_j )</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social–cultural effects of tourism on the host community</td>
<td>Capacity of services for sports activities</td>
<td>( I_{K1} )</td>
<td>Sports facilities per inhabitant</td>
</tr>
<tr>
<td></td>
<td>Capacity of health services</td>
<td>( I_{K2} )</td>
<td>Health-care equipment</td>
</tr>
<tr>
<td></td>
<td>Capacity of transport services</td>
<td>( I_{K3} )</td>
<td>Number of passenger transport vehicles per inhabitant</td>
</tr>
<tr>
<td></td>
<td>Capacity of financial services</td>
<td>( I_{K4} )</td>
<td>Number of financial establishments per inhabitant</td>
</tr>
<tr>
<td></td>
<td>Capacity of other services</td>
<td>( I_{K5} )</td>
<td>Number of service sector establishments per inhabitant</td>
</tr>
<tr>
<td></td>
<td>Capacity of chemist's services</td>
<td>( I_{K6} )</td>
<td>Number of chemist's per inhabitant</td>
</tr>
<tr>
<td></td>
<td>Tourist satisfaction with destination safety</td>
<td>( I_{K7} )</td>
<td>Evaluation of destination safety by tourists</td>
</tr>
<tr>
<td></td>
<td>Heritage designated as assets worthy of cultural protection</td>
<td>( I_{K8} )</td>
<td>Number of cultural sites designated as “assets of cultural interest”</td>
</tr>
<tr>
<td>Local public safety</td>
<td>Voluntary contributions to preservation of cultural heritage</td>
<td>( I_{K9} )</td>
<td>Number of cultural volunteers</td>
</tr>
<tr>
<td></td>
<td>Intensity of heritage use</td>
<td>( I_{K10} )</td>
<td>Pressure on cultural heritage</td>
</tr>
<tr>
<td>Conservation of the cultural heritage</td>
<td>Sustaining population levels</td>
<td>( I_{K11} )</td>
<td>Variation of population levels</td>
</tr>
<tr>
<td></td>
<td>Increase in the young population</td>
<td>( I_{K12} )</td>
<td>Percentage of young population</td>
</tr>
<tr>
<td></td>
<td>Ageing of the population</td>
<td>( I_{K13} )</td>
<td>Percentage of non-active older population</td>
</tr>
<tr>
<td></td>
<td>Population density</td>
<td>( I_{K14} )</td>
<td>Number of individuals per unit destination area</td>
</tr>
</tbody>
</table>

**Effects on the local population structure**

- Sustaining population levels
- Increase in the young population
- Ageing of the population
- Population density
Limits of Acceptable Change (LAC) as Applied in Finland (Kajala, 2012)

Sustainability

Principles of Sustainable Tourism

**Desired future conditions**
- Derived from the principles and adjusted for local circumstances
- The best available local indicators from the list of indicators
- Statistically valid and reasonable methods

**Indicators**
- Measuring and estimating current values
- Managerial decisions based on the best available knowledge
- Set of proactive and reactive management actions

**Methods of measuring**
- Current values
- Limits of acceptable change
- Management actions

Managerial decisions based on the best available knowledge
Protected Areas Are Used for...

- Nature protection
- Research and Education
- Outdoor recreation
- Traditional use of nature resources
  - hunting, fishing and reindeer husbandry
- Promoting local economy and communities
- Nature tourism

- Protected areas are also a living environment for locals
- Many nature protection values are related to cultural landscapes

→ Requirement of Sustainability
Contraversial objectives of protection and visitation:

- Loose planning and laissez-faire development of visitor infrastructure (despite EU-funded) – risks of overexploiting nature and env. resources

- Developing the nature protection system (env. board, state forestry, operators, local authorities): the need for a formalised cross-sector monitoring system that ensures better services, articulates needs, maintains recreational value

- Sites with low levels of visitation are primarily visited by the locals and the more adventurous independent travellers, few crowded heritage sites

- Growth of visitation and use of sites, changes over time rather quickly
Protected areas in Estonia

All sites are protected by Nature Conservation Act as (01.09.2019):

- Protected areas:
  - National parks (6)
  - Nature conservation areas (172)
  - Landscape protection areas (153)
  - Other protected areas (63)
- Limited conservation areas (326)
- Species protection sites (609)

In total 18.8 % of Estonian land territory is protected, 95% of nationally protected areas are Natura 2000 sites
Management of protected areas

Institutions:

- Environmental Board
- State Forest Management Centre
- Environmental Agency
- Environmental Inspectorate

Based on protection rules and site level management plans.

EB – the administrator of all protected areas (e.g. Natura 2000 sites), also responsible for the management of the sites in private lands.
RMK – responsible for the management of protected sites in state owned lands, including restoration of habitats, visitor management etc
EEA – responsible for monitoring and databases
Env Inspectorate – responsible for supervision
Landcover(use) change – sustainability of land cover
Sustainability of Cultural landscapes
The Hamlets and Villages in Estonia

• Assumption: presence of settlement (and population) are absolutely necessary for maintaining valuable cultural landscapes
• This means the presence of population with balanced age-structure
• Measuring: via index of settlement vitality on hamlets/village level
• Ca 4,500 in total, Average size of population: 40; 102 of them without population (2017)
• The biggest: over 5000 inh., Average size of territory: 10 km²
## Vitality Index of Settlements and Indicators

<table>
<thead>
<tr>
<th>SETTLEMENTS</th>
<th>INDICATORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Empty and with high de-population risk</td>
<td>(1) No inhabitants; (2) or: 100% share of population 65+; (3) or: population present only in one 5-year age group</td>
</tr>
<tr>
<td>2. With medium de-population risk</td>
<td>(1) Population less than 10 (5-9); (2) or: population present in two 5-year age groups; (3) or: 50+% share of population 65+;</td>
</tr>
<tr>
<td>3. With smaller de-population risk</td>
<td>(1) Population less than 10 (5-9); (2) or: population present in three 5-year age groups;</td>
</tr>
</tbody>
</table>
### Results: Settlemens Vitality

<table>
<thead>
<tr>
<th>Settlemens Vitality</th>
<th>ESTONIA, TOTAL</th>
<th>PROTECTED AREAS</th>
<th>LÜMANDA PARISH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Empty and with high de-population risk settlements, %</td>
<td>5</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>2. With medium de-population risk settlements, %</td>
<td>8</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>3. With smaller de-population risk settlements, %</td>
<td>7</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>1+2+3</td>
<td>20</td>
<td>30</td>
<td>36</td>
</tr>
</tbody>
</table>
Results: Settlements Vitality Index in Lahemaa National Park
Results: Settlements Vitality Index in Haanja Nature Park
## Types of Settlements Vitality

<table>
<thead>
<tr>
<th>Growth type</th>
<th>1. period</th>
<th>2. period</th>
<th>3. period</th>
<th>Score</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Viable</td>
<td>green</td>
<td>green</td>
<td>green</td>
<td>10</td>
<td>1. Viable</td>
</tr>
<tr>
<td>2. rather viable</td>
<td>green</td>
<td>green</td>
<td>green</td>
<td>6</td>
<td>2. rather viable</td>
</tr>
<tr>
<td>3. rather viable</td>
<td>green</td>
<td>green</td>
<td>green</td>
<td>5</td>
<td>2. rather viable</td>
</tr>
<tr>
<td>2. rather viable</td>
<td>green</td>
<td>green</td>
<td>green</td>
<td>4</td>
<td>2. rather viable</td>
</tr>
<tr>
<td>3. rather non-viable</td>
<td>green</td>
<td>green</td>
<td>green</td>
<td>3</td>
<td>3. rather non-viable</td>
</tr>
<tr>
<td>3. rather non-viable</td>
<td>green</td>
<td>green</td>
<td>green</td>
<td>1.5</td>
<td>3. rather non-viable</td>
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<td>3. rather non-viable</td>
<td>green</td>
<td>green</td>
<td>green</td>
<td>1</td>
<td>3. rather non-viable</td>
</tr>
<tr>
<td>4. non-viable</td>
<td>green</td>
<td>green</td>
<td>green</td>
<td>0</td>
<td>4. non-viable</td>
</tr>
<tr>
<td>Types of Settlements Vitality. Protected areas</td>
<td>Average score</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>---------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ahja</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kurtna</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Alam-Pedja</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Soomaa</td>
<td>2</td>
<td></td>
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<tr>
<td>Lahemaa</td>
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<tr>
<td>Vooremaa</td>
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<tr>
<td>Otepää</td>
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<tr>
<td>Kõrvemaa</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emajõe Suursoo</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Karula</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loodi</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Silma</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Matsalu</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Paganamaa</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Puhtu</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endla</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nigula</td>
<td>0</td>
<td></td>
<td></td>
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<table>
<thead>
<tr>
<th></th>
<th>1989</th>
<th>2000</th>
<th>2011</th>
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<tbody>
<tr>
<td>Average (arithm.) score</td>
<td>1.5</td>
<td>2.1</td>
<td>1.8</td>
</tr>
<tr>
<td>Median score</td>
<td>2.0</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Share of non-viable settlements, %</td>
<td>60</td>
<td>41</td>
<td>32</td>
</tr>
</tbody>
</table>
Controversial objectives of protection and visitation: Estonian case

- Developing the nature protection system (env. board, state forest management centre, tour operators, local authorities, etc): the need for a formalised cross-sector monitoring system that ensures better services, articulates needs, maintains recreational value

- Sites with low levels of visitation are primarily visited by the locals and the more adventurous independent travellers, few crowded heritage sites

- Growth of visitation and use of sites, changes over time rather quickly
Estonian background: historic review of surveys and experiences

- 1977-85: visitation surveys in Nigula, Viidumäe protected areas and in Sõrve Saaremaa
- 1988: Roosaluste on recreation impact on wetland communities
- 1980-90s: Forest Institute on recreation impacts on forest, cadastre of recreational forests
- 2002: RMK run visitor monitoring and surveys
- 2003: Leito&Poola survey on tourism impact on Kõpu coastal plants
- 2006: Sepp&Noorkõiv survey in Elva
- 2007: Kajala (ed) Visitor Monitoring manual
- 2008: Roose survey combining monitoring methods
- 2009: State Forest Centre began automatic counting
- 2009: Hurt et al methods to assess carrying capacity
- 2011: Roose & Sepp et al visitor monitoring methods, manual
- 2017: Kullisoo experiment. Bog surface carrying capacity
- 2019: Mobile positioning at Lahemaa and Alutaguse national Parks and Methodology how to measure visitor impact
• **RMK** (State Forest Management Centre of Estonia) has pioneered and run visitor monitoring and surveys systematically since 2002 in forest sites.

• **Environmental Board** has initiated comprehensive system development in 2009-2011.

• Visitor monitoring is still quite loose and needs harmonising in regard of multitude of stakeholders and multi-layer nature protection system.
Visitor monitoring model – integrated into protection management

**SETTING OBJECTIVES**
Define protection and visitation objectives

**PROTECTION AND VISITATION MANAGEMENT**
Change policies, rules and act

**VISITOR MONITORING SYSTEM**
Methods, indicators, surveys

**EVALUATION**
Benchmarking, trends, targets achieved, information needs, improving monitoring
Objectives of visitor monitoring system

To introduce comprehensive national visitor monitoring system for nature protected areas

• Reporting and statistics
• Assessment of protection actions (efficiency) and change monitoring, human impact
• Reacting to inconsistencies and mitigating risks in case of negative impacts
• Planning protected area management and efficiently allocating resources
• Local development dimension: economic and social added value of nature tourism
Visitor monitoring system
three modules

Visitor counting
Counting:
• Manual
• Semiautomatic
• Automatic

Impact monitoring
• Biophysical features
• Field surveys on indicators
• Ecosystem and landscape surveys
• Impact assessments

Visitor survey
• Visitor questionnaire
• Client surveys
Visitor monitoring method

- Based on best practice and data (testing and piloting)
- Applicable on protected area and regional level, allows national reporting and international comparisons
- Based on instrumental and automatic monitoring, analysis is based on latest research methods, critical approach, impact assessment
- Applicable by area officers and rangers
### Indicators of visitor monitoring

<table>
<thead>
<tr>
<th>Module</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I Visitor counting</strong></td>
<td>Number of visitors annually</td>
</tr>
<tr>
<td>(3 indicators)</td>
<td>Number of visitors – weekly max</td>
</tr>
<tr>
<td></td>
<td>Number of visitors – daily max</td>
</tr>
<tr>
<td><strong>II Impact on physical environment and trail erosion</strong></td>
<td>Weight of category</td>
</tr>
<tr>
<td>(3 indicators)</td>
<td>Changes/trends in category</td>
</tr>
<tr>
<td></td>
<td>Unplanned trails</td>
</tr>
<tr>
<td><strong>II Ecological impact</strong></td>
<td>Status class of Natura area (A, B, C), Status of indicator species</td>
</tr>
<tr>
<td>(0-2 indicators)</td>
<td></td>
</tr>
<tr>
<td><strong>II Firewood and waste management</strong></td>
<td>Volume, uncontrolled fireplaces, uncontrolled littering (location)</td>
</tr>
<tr>
<td>(3 indicators)</td>
<td></td>
</tr>
<tr>
<td><strong>II Quality of infrastructure</strong></td>
<td>Status class</td>
</tr>
<tr>
<td>(1 indicator)</td>
<td></td>
</tr>
<tr>
<td><strong>III Visitor survey</strong></td>
<td>Characteristics of visitors (age, sex, education, activities, overnights rate, motives, satisfaction, expenditures, arrival mode, location of origin)</td>
</tr>
<tr>
<td>(10 indicators)</td>
<td></td>
</tr>
<tr>
<td><strong>III Entrepreneur survey and feedback</strong></td>
<td>Number of accommodation units, staff</td>
</tr>
<tr>
<td>(2 indicators)</td>
<td></td>
</tr>
</tbody>
</table>
# Criteria for selection of monitoring site

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Condition</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of protected area</td>
<td>National park</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Landscape protection area</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Nature protection area</td>
<td>2</td>
</tr>
<tr>
<td>Visitor infrastructure at Natura priority areas</td>
<td>Visitor’s centre, trail, tower etc (more than 3 units)</td>
<td>3</td>
</tr>
<tr>
<td>Visitor infrastructure</td>
<td>Areas located near-by city or up to 20 km</td>
<td>3</td>
</tr>
<tr>
<td>Accessibility</td>
<td>Good</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Poor</td>
<td>0</td>
</tr>
<tr>
<td>Tourism impact on protected area (previously)</td>
<td>Expert assessment: high</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>0</td>
</tr>
<tr>
<td>Attractive leisure spot (e.g beach)</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Event site (concerts, sports etc)</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>
Visitor counting

**Decision tree** – choosing technical solution and monitoring scheme for specific area. Based on physical impact: 1) Type of tourism use; 2) Geography and location; 3) Parking; 4) Attractive spots; 5) Trails

Each location is unique!
Data processing:
Data flow from the counters to the end-user

- Monitoring requires validated and calibrated data
- Both raw data and calibrated data have to be kept in different databases to avoid misuse and misinterpretations.
Two counting systems – one unified database

- Data is centralised and processed in one single database for consistency and homogeneity
- Allows for quick and simple data storage and retrieval
- Allows for easy access to data
- Allows for simple analysis and comparison of data
- Serves as a backup
Visitor counting

Vooremaa landscape reserve:
Open cultural landscape, multiple gates, commonly accessed by numerous points around the perimeter
Visitor counting

Emajõe Suursoo mire reserve

Few gates (3), naturally protected, straightforward monitoring scheme
Mobile positioning 5x5 km Emajõe-Suursoo foreign visitors February 2007-2008:

Ahas et al 2008. Tourism Management 29. 469-486. Mobile positioning as a new data source and method for tourism surveys: an Estonian Case Study
Visitation reporting templates: Day-of-week and Time-of-day

Total daily counts

Daily totals are reported on monthly basis to explore pattern of visitation.

Time-of-day profile

Hourly counts are summed over one month to identify peaks of use within a day, trends and patterns of use.
Visitation modes according to day-of-week profiles

Vapramäe near Tartu/Elva  Soomaa Ingatsi trail

September 2010

Periurban destinations

Weekend destinations

Average counts along the week. Vapramäe (September)

Average counts along the week. Soomaa (September)
Visitation modes according to day-of-week profiles

Panga cliff in Saaremaa

Peak season: July 2010

Low-season: September 2010

Average counts along the week. Panga Pank (July)

Average counts along the week. Panga Pank (September)
Visitation modes according to day-of-week profiles

Midsummer Day 24 June, 2010

Panga cliff in Saaremaa

Haanja upland Vällamäe trail

Panga Pank (June)

777 counts

Haanja (June)

77 counts
Issues concerning visitor monitoring system and methods

- Institutional barriers

Methods:
- Statistical confidence levels?
- Locational matters: area-specific, zoning, hot spots?
- Financial constraints and cost-efficiency
Bogshoeing in Estonian mires – is it a problem?

- The mires are important resource in nature tourism and their role is increasing
- The ancient devices – bogshoes (rääts, padin jms) were taken in use about 10 years ago (used all year round)
- The remote bogs have become accessible to numerous travellers
- With increasing interest there may occur negative impact on mire ecosystems (trampling, disturbing, other?)
More than 20 companies offering bogshoes hiking in ca 45 bogs in Estonia (Erit 2019)
Methodology?

- Good methods for wildlife and mineral soils
- Some papers on trampling in bogs, no good information about recovery
- No papers or methods about bogshoeing
In 2017–... a comparative trampling experiment in Kullisoo, by foot (boots) and by bogshoes

- **3 habitat types:** wooded bog, open bog with cottongrass and hollows and wooded cottongrass bog
- **3 trampling loads:** 32 times x 10 days, 16 times x 10 days, 8 times x 10 days
How to measure the impact/path on peat?

- Transects – 10 m, 4 plots on each
- Geobotanical analyse – 0.5 x 0.5 m plots
- Surface profile (compared to reference flagpole)

MEASUREMENTS:
- 2017 July – (trampling )– Sept-Oct
- 2018 August – Sept
- 2019 late August
Some results (visual estimation):

• Bogshoes leave as noticeable traces on bog surface as ordinary trampling by foot in most habitats and microforms
• Small groups/trampling loads (8 x 10) recover well in 2 years by both trampling types
• Bogshoe damages in wet sites with heavy loads become well evident only after some years (hard to estimate, if *Sphagnum* is dead or not)
• *Sphagnum rubellum* is more tolerant than others to trampling and is first moss to recover
Timeline: Bog woodland, 16 x 10, bogshoe
Wooded bog, trampling by bogshoes (32x) blue – before and red after trampling.
By foot, in the wooded bog, 32 x 10

Wooded bog, trampling by foot (32x) blue- before trampling, red – after trampling
Timeline: Wooded bog with cottongrass, bogshoe, 32x10
## Timeline: open bog, bogshoes 32 x 10

<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017 before</td>
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<td>2017 after</td>
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<tr>
<td>2018</td>
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<td>2019</td>
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</tbody>
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In wet habitats, hollows, the impact is bigger than in other places!

- Bogshoe, 32 x 10, in 2018
Small groups do not leave visually significant impact
Developing visitor management policy and infrastructure

- Visitor management system should be unified with protection policy and system, harmonised with protection plans and measures.
- To intensify visitor counting and visitor questionnaires and to move forward to carrying capacity surveys.
- Focus on target group based management & marketing not just universe message and action-lines.