Establishing beaches at the Curonian Lagoon coast: an assessment applying a Systems Approach Framework

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Keywords

Pre-analyses

Stakeholder involvement

Stepwise up-scaling strategy

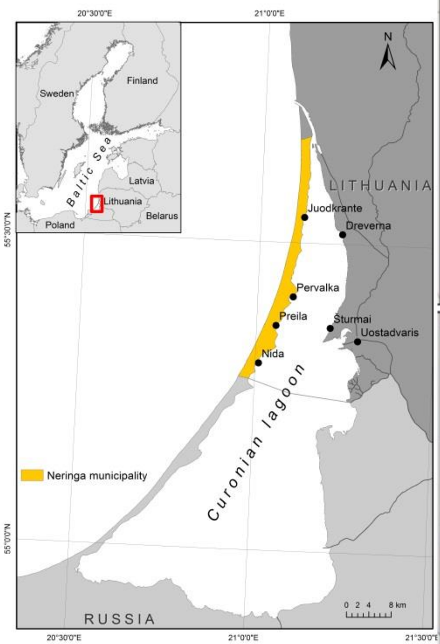
Introduction

The local municipality has plan to open the beach along Curonian lagoon. Still there are a lot of uncertainties.

The Systems Approach Framework (SAF) with its integrated Ecological-Social-Economic assessment is a stepwise, user-friendly methodology with high practical relevance that allows addressing problems and challenges in the coastal zone in a systematic way (Hopkins et al. 2011). It is a major approach to support Integrated Coastal Zone Management (ICZM) and an Ecosystem Approach to Management (EAM).

Objective of this paper is to **document an Ecological-Social-Economic (ESE) application as part of a SAF for new beach establishment at the Curonian Lagoon (Lithuania).**

Material and methods: description of the site



- Curonian Lagoon - fresh water dominated system separated from the Baltic Sea by the Curonian Spit.
- Total area - 1584 km² (Lithuania 413 km²).
- About 12 km out of nearly 50 km of Baltic Sea beaches along the Curonian Spit are used and have been awarded with the Blue Flag, Quality Coast and Global Top 100 Sustainable Destinations awards.
- The Baltic Sea possesses **excellent** bathing water quality according the Bathing Water Directive 2006/7/EC.
  - Bathing season starts **relatively late** - in the end of June, when the water temperature reaches 14-16°C.
- Curonian lagoon bathing water quality is **uncertain.**
  - Water warms up to 18°C in May.

- **Tourism is the major source** of income in Neringa, but it is concentrated in the summer months, with roughly **72% of overnight stays between June and August**, mainly due to the short bathing season in the Baltic Sea.

Material and Methods

2.1 Socio-economic data collection and surveys.

- New beaches along the Curonian Lagoon: perception, acceptance and perspectives.
- Cost-benefit analysis

2.2 Microbiological pollution assessment

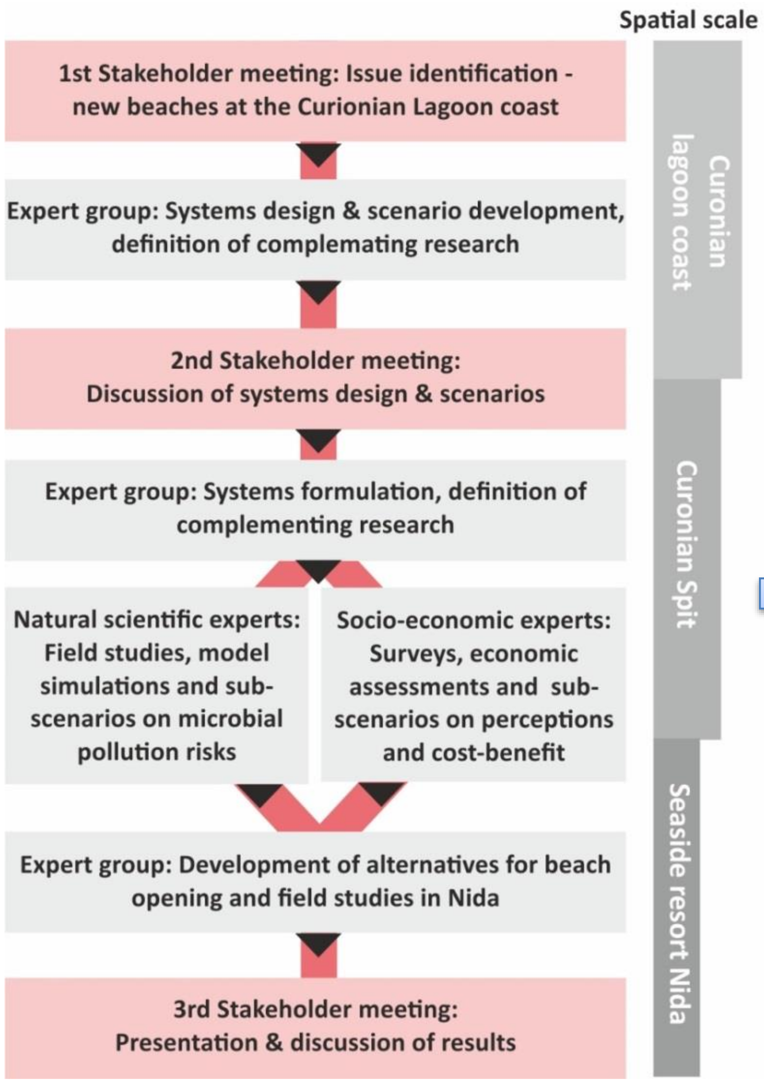
- Field trips and laboratory analysis during May-June 2015-2016

2.3 The hydrodynamic model (SHYFEM) for microbial pollution risk assessment in the Curonian Lagoon

Results: stakeholders and institutional mapping

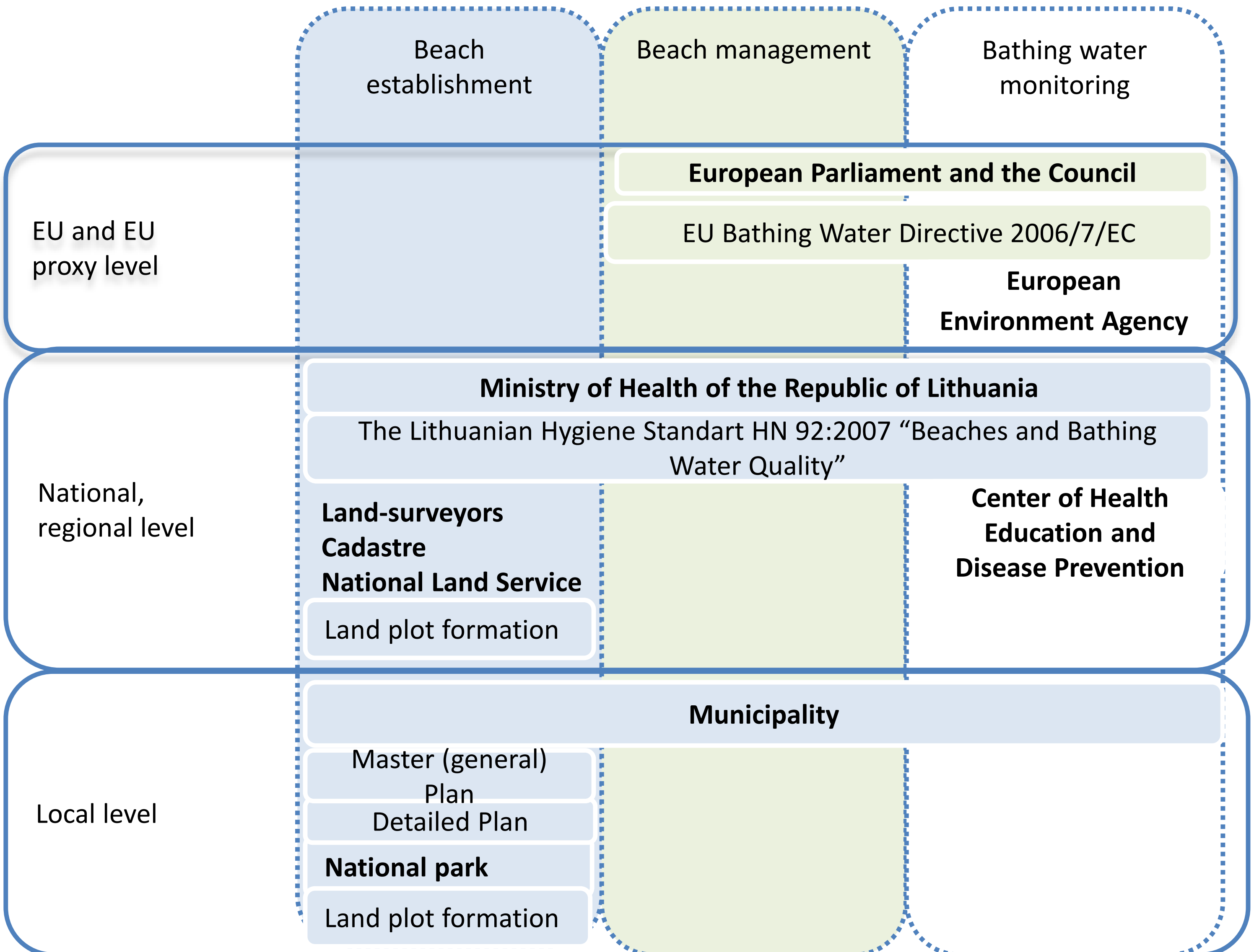
Human Activity	Associated stakeholder groups
Governance and residents	Governance representatives and local action groups Municipality
Tourism services	Tour operators Information services Accommodation services Wellness services Transport services Catering services Water tourism Leisure/incentive services Place for conferences organising NGOs
Fisheries	Fisheries association
Infrastructure/services	Infrastructure service providers
Natural heritage	National park and others
Education and art	Local educational and activity schools
Harbor authorities and sailing boats	Port services
Scientific research	Scientists/bachelor/master students (Thesis writing)

Results: stakeholder engagement strategy



3 meetings
7 to 10 stakeholder
Local representative involvement

Results: Clarification of policy issues and cause-effect relations



Results: Stakeholder main concerns and preferences

DPSIR1st cycle (problem oriented)

Driver:
Urbanisation of the lagoon area and intensification of agriculture

Pressure:
Increase of insufficiently treated waste waters to the Curonian Lagoon

State:
E. Coli bacteria concentrations exceed Bathing Water Quality Directive threshold

Impact:
Closure of beaches, negative impact on tourism

Response:
Improvement of sewage treatment (new plant 2008)

Consequence:
Improved bathing water qulity with possibility to open or re-open beaches

DPSIR 2nd cycle (opportunity oriented)

Driver:
Good bathing water quality and climate change with higher water temperatures create new opportunities

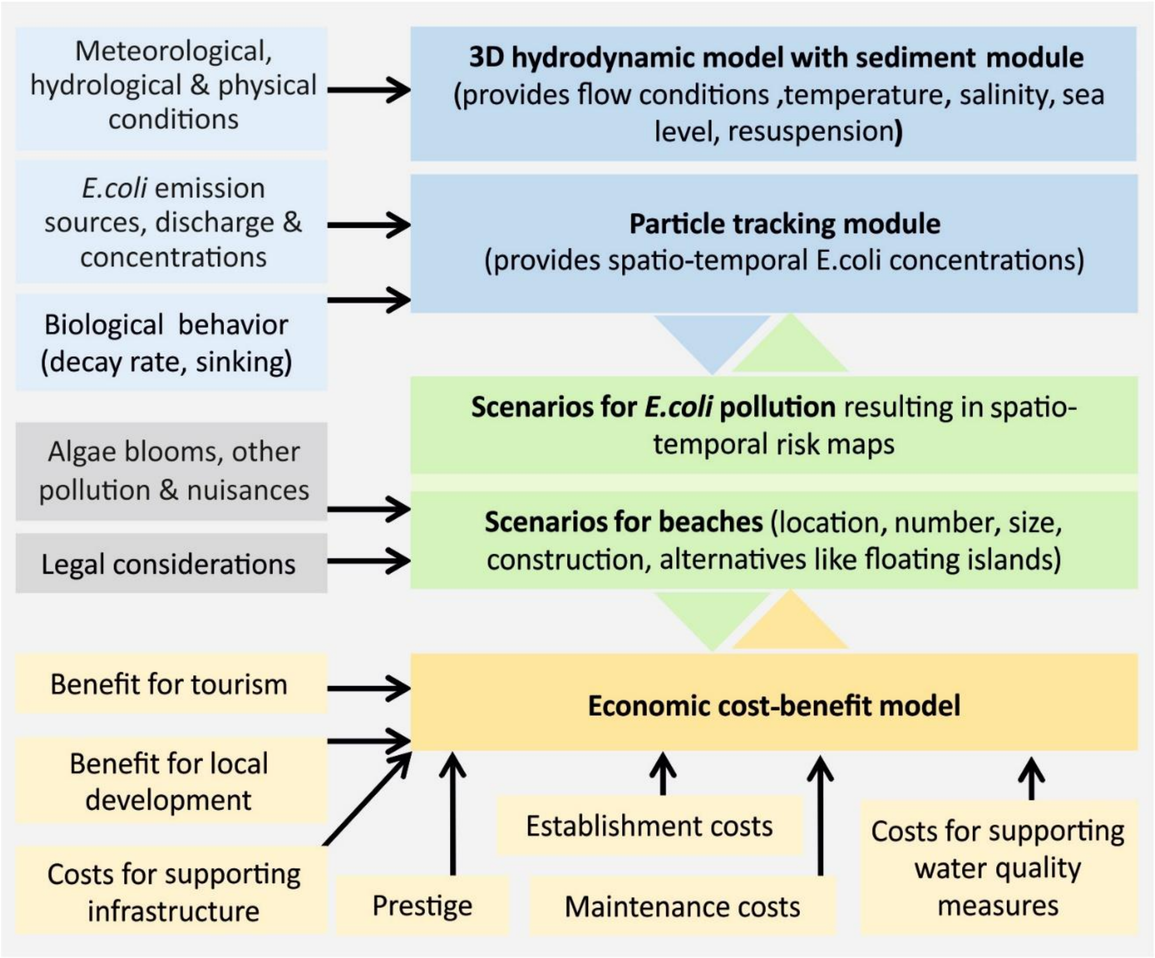
Pressure:
Increasing demand for sustainable tourism and socio-economic development in Neringa municipality

State:
Short summer season with temporary over-expoited tourism infrastructure and high prices

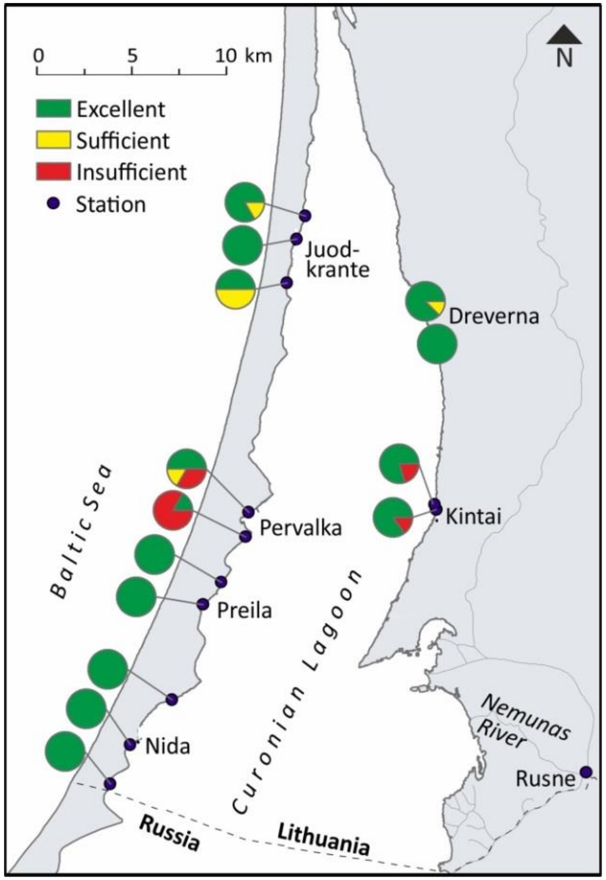
Impact:
Poor annual utilization of the infrastructure; seasonal jobs and social imbalances

Response:
Establishment of lagoon beaches which support longer seasons (precondition is maintenance of a good Bathing Water Quality)

Results: description of virtual system



Data and description of the ESE model: Ecological sub-models



Microbial pollution assessment in the area – the Nida as the most suitable regards the low microbial pollution risk.

Data and description of the ESE model: Ecological sub-models

Scenario: **Beach opening in the Nida** (lagoon) – sub scenarios on microbial pollution risk

Name	Period	Description
Reference (R)	2015	Reference simulation, calibrated inputs
Scenario 1 (S1)	2015	Tourism season on the Spit (input*5)
Scenario 2 (S2)	2015	Extreme wind conditions (wind*2)
Scenario 3 (S3)	2015	Breakdown of sewage system (input*10)
Scenario 4 (S4)	2015	High loading from rivers (input*10)
Scenario 5 (S5)	2015	Input from Russian side
Reference long (RL)	2014-2015	Reference simulation for 12 years
Scenario 3 long (S3L)	2014-2015	No sewage system for 12 years

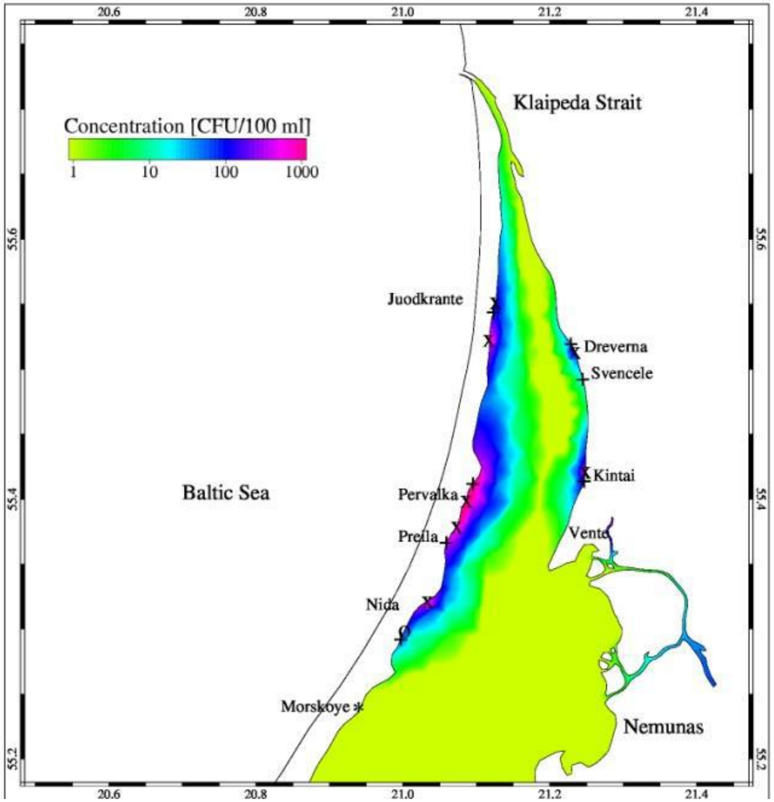
$$k_b = (0.8 + 0.02S)1.07^{T-20} + \frac{\alpha I_0}{k_e H}(1 - e^{-k_e H}) + F_p \frac{V_S}{H}$$

G. Umgiesser et al. (under review)

Data and description of the ESE model: Ecological sub-models

Scenario: Beach opening in the Nida (lagoon) – sub scenarios on microbial pollution risk

Name	Max concentration		Hours over threshold		Days over threshold	
	spring	summer	spring	summer	spring	summer
R	95.2	74.5	0	0	0	0
S1	475.9	372.5	0	0	0	0
S2	155.1	90.8	0	0	0	0
S3	951.9	744.9	23	81	4	13
S4	95.2	74.5	0	0	0	0
S5	95.2	74.5	0	0	0	0
S3d	951.9	744.9	23	81	4	13
S5a	95.2	74.5	0	0	0	0



Maximum values and hours over threshold of *E. coli* summer based on 3D modelling (SHYFFEM)

G. Umgiesser et al. (under review)

Data and description of the ESE model: Economic sub-models

For the socio-economic evaluation initial conditions were defined:

- Beach is open only when the Curonian Lagoon water temperature is above 18 °C;
- When the Curonian lagoon beach is open all the tourist accommodation places are full (simulating high season example);
- The socio-economic evaluation presented not only the **expenses** and possible **revenue** of an open beach in Curonian lagoon, but also allowed to **predict** Payback periods for different scenarios. The annual Profit for each scenario was calculated according to the formula:

$$\mathbf{P_{scenario} = ((€_{tourist} + €_{extra}) - (E_{closed\ b.} + E_{beach\ m.}))^{*}\ t_{b.operation},}$$

where $€_{tourist}$ – average earnings from tourists (accommodation and expenses);
$€_{extra}$ – earnings from services provided at the beach;
$E_{closed\ b.}$ – loss of prestige expenses (compensation for beach being closed);
$E_{beach\ m.}$ – expenses for beach maintenance;
$t_{b.\ operation}$ – number of beach operation day.

Cost of beach maintenance included: Beach equipment, Initial installation of a beach, monitoring of pollutants, Blue Flag costs, Periodic maintenance of a beach (inland/outland), Additional beach costs, Beach sand cleaning, Manual beach cleaning, Bio-toilet services, Force majeure costs, Publicity/advertisement campaigns

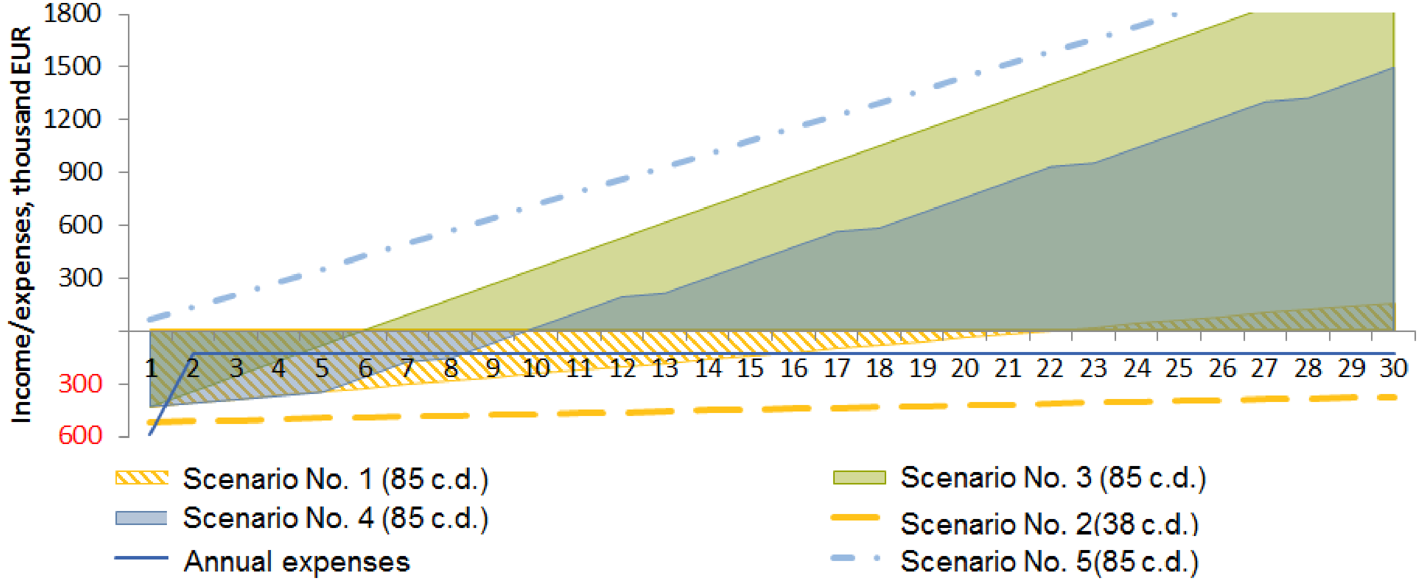
Results: Scenario simulations chosen

Scenario: Beach opening in the Nida (lagoon) – sub scenarios on perception and cost-benefit

No.	Description
Sub1.1	**Full season scenario.** Period of 85 calendar days (amount of total days when Curonian lagoon water temperature is above 18 °C).
Sub1.2	**Curonian lagoon beach scenario.** Period of 38 calendar days (amount of days when only Curonian lagoon water temperature is above 18 °C) and excludes periodic maintenance of a beach (refilling with sand, cleaning the Curonian lagoon bottom for the beach territory).
Sub1.3	**Private beach scenario.** 85 calendar days of operation, but manual beach cleanings are performed only every second day and there is no publicity/advertisement campaigns before and during beach opening.
Sub1.4	**Periodic marketing scenario.** 85 calendar days of operation, but exclude periodic cleaning of a beach water and inland territory. The publicity campaigns are performed annually for the first 5 years and the every 3-5 years.
Sub1.5	**No expenses for installation scenario.** 85 calendar days of operation. The expenses for the initial beach installation are excluded and manual beach cleanings are limited to 43 days per season.

Results: Outcome of scenario simulations

Scenario 1: Beach opening in the Nida (lagoon) – sub scenarios on perception and cost-benefit



All scenarios of beach opening in Nida (Curonian lagoon) would be financially sustainable investment in long term perspective.

Results: Scenario simulations chosen

Alternative scenarios with stakeholders discussed
(instead investing in the beach at Curonian lagoon opening):

1. New/old nature paths
2. Tourism service related of visiting another part of Curonian Spit
3. Advertisement of nature activities pre and post season
4. Advertisement of decreased rent coasts (pre-post seasons)
5. The airport use and marketing
6. Events during the post and pre season
7. Alternative recreational activities in the water (like diving)
8. Covering the ferry costs during pre and post season

Combining a) **nature tourisms**, with b) **advertisement** of lower **accommodation prices** and c) **beach area** at lagoon and targeting d) **Lithuanian families -** optional solution for more sustainable tourism in **pre** and **post season**.

Conclusion

1. **Systematic analysis of possible topics, their local relevance and local interest** before starting a SAF and accompanying **scientific theses** in the early SAF process to broaden the view and the foundation for the SAF process.

2. **Strong stakeholder involvement** and discussions during 3 meetings were important. The **active involvement of stakeholders in the scientific team** during the entire SAF process is highly relevant, to have available local and internal knowledge and to increased acceptance by and accessibility of locals.

3. Address a **defined local problem** that can be tackled easily with available resources and a in relatively short time to ensure a successful process and convincing results. Success ensures support. During this time develop **an upscaling strategy** and only afterwards carry out a stepwise spatial up-scaling and increase the complexity of the context.

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