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Coastal Municipal Governance Developments in Latvia: Coastal Changes and Socio-Ecological Monitoring

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Janis Lapinskis
Erika Lagzdina
Janis Kaulins
Raimonds Ernšteins
Department of Environmental Science
University of Latvia

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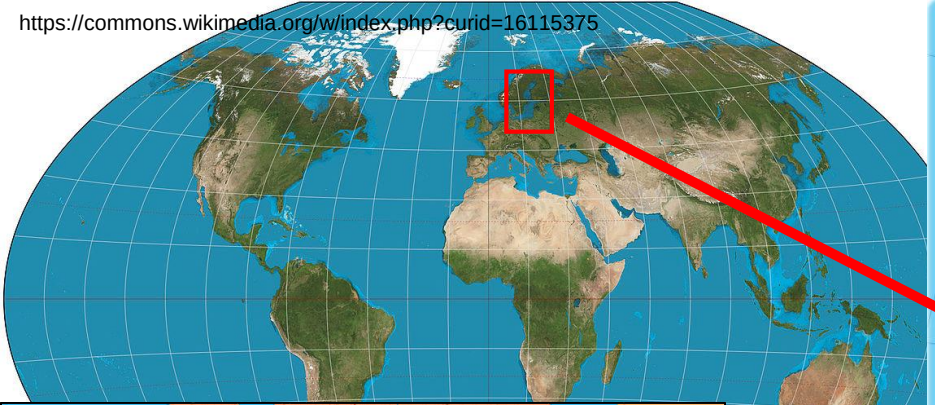
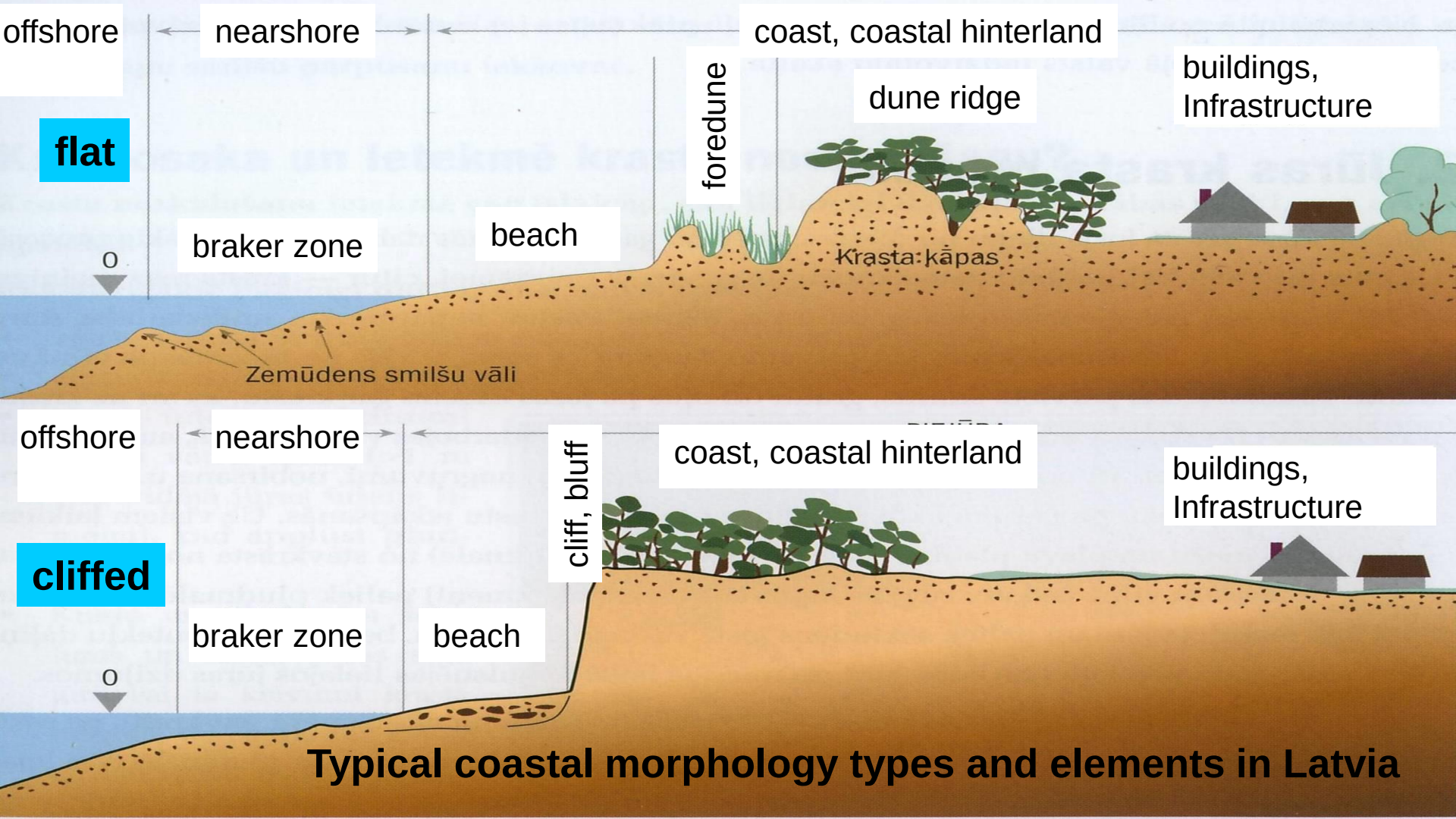




Typical coastal morphology types and elements in Latvia

Is coastal erosion an issue in Latvia?

•Substantial changes in coastal “shape” (coastal hinterland retreat, destruction of dunes, migration of sediments etc.) are occurring only during relatively rare severe storm events. Depending on the exact location, there can be even more than 10 years in between such events.

•The total length of the coastal sections, where the coastline was retreating during several last decades is:

- •0.1–0.5 m/year ~ 120 km;
- •0.6–1.5 m/year ~ 50 km;
- •1.6–3.5 m/year ~10 km.

Coastline of Latvia – 496 km

Is coastal erosion an issue in Latvia?

Pros:

- Very few heavily developed areas with infrastructure and residential buildings in close proximity of coastline;
- Coastal sections severely affected by erosion are compiling less than 15% of total coastline;
- In most cases erosion is not considered as a treat to recreational resource of coastal areas.

Is coastal erosion an issue in Latvia?

Cons:

- Properties of geomorphology, geological structure and composition of coastal areas in Latvia makes it «sensitive» to changes in climate and sea level increase;
- Insufficient understanding about the need for improvement of coastal management practices (what to do in case of coastal erosion?, how to decrease future risks?, which course of action is more cost-efficient?).

Liepāja town sewage treatment plant is prone to destruction due to coastal retreat

SW Latvia,
Nīca municipality.

Dune ridge destruction and coastal hinterland retreat

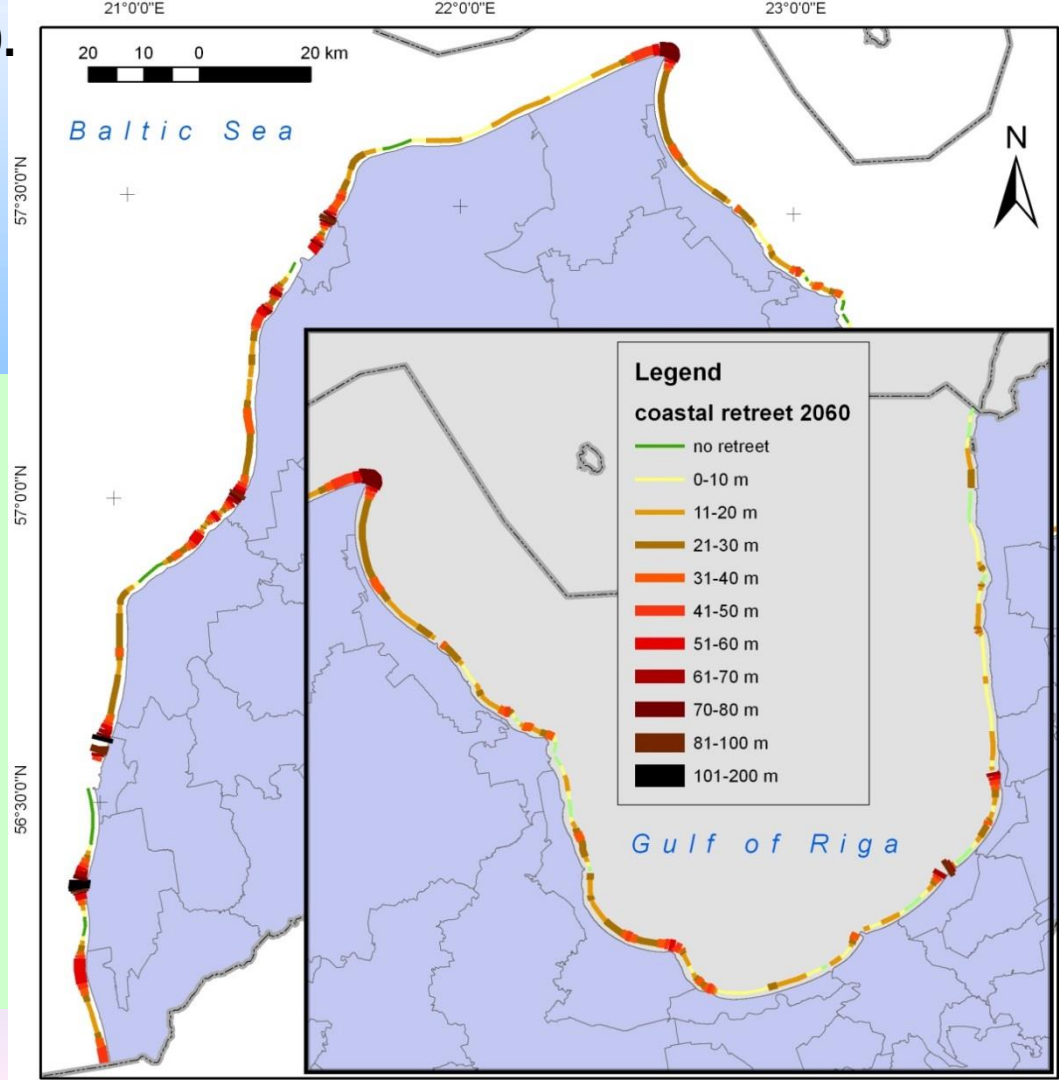
Coastal retreat forecast for year 2060.
Null-scenario (no intervention).

Based on extrapolation of existing historic data.

Increase in the total length of coastal sections affected by hinterland retreat by 17.8 % (Σ=331 km).

Maximum expected retreat (in separate, short sections) – 150-200 m until the year 2060.

Territory of Latvia will be reduced by approx. 9.0 km^2.



Who (what institution) manages coastal areas in Latvia? Public availability?

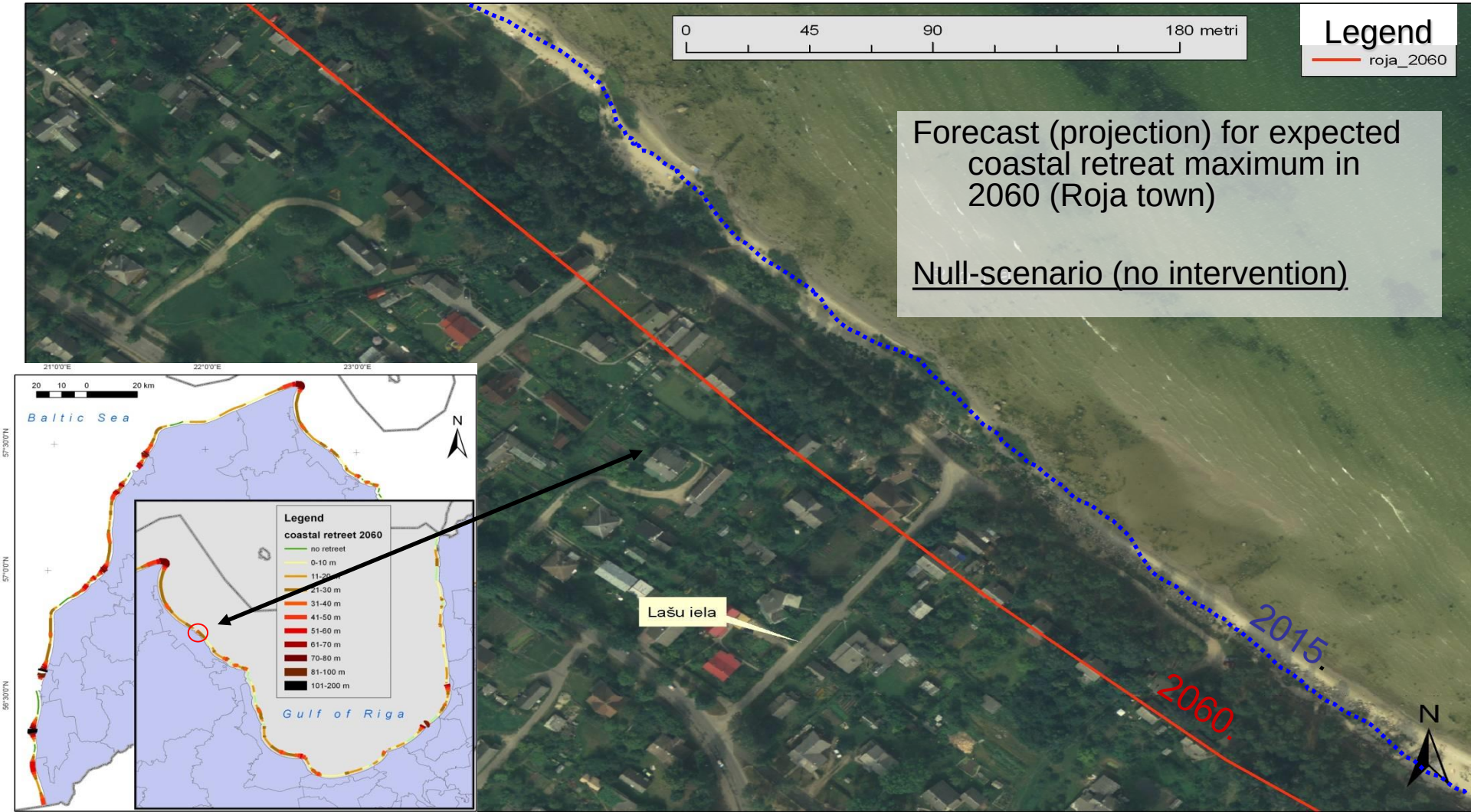
- According to the Civil Law, the coastal zone (beach and area up to the point that can be reached by highest waves) is considered as public waters (with few exceptions) and is available for general public.
- This territory belongs to the state, but up until recently, there were almost no cases of real management measures of this state property.
- Real responsibility and obligation to manage beach and foredune area is imposed upon local municipalities.

Defining priorities and searching for sustainability in coastal erosion management and risk mitigation

Among the main recommendations for coastal erosion management the most important is **restoration of the natural sediment balance and providing of space for coastal processes.**

Taking into account the complexity of issues of coastal erosion and aspects related to environmental protection, as well as the risks associated with problem of high irreducible uncertainty, **non-intervention strategy is considered as the highest priority** from all the possible coastal erosion management strategies. Therefore prioritization should be as follows (from best to worst):

1. No intervention (adaptation);
2. Non-invasive or minimally invasive anti-erosion measures (dune planting, beach nourishment and other “soft” measures);
3. "Aggressive" anti-erosion measures (structures) with relatively short service life and short “cowered” length of the coastline;
4. Highly "aggressive" measures (seawalls, impermeable groins) with long lifetime and high level of coastal alteration.


0
45
90
180 metri
Legend
roja_2060
Forecast (projection) for expected coastal retreat maximum in 2060 (Roja town)
Null-scenario (no intervention)
Lašu iela
2015.
2060.
N
Baltic Sea
Gulf of Riga
Legend
coastal retreet 2060
no retreet
0-10 m
11-20 m
21-30 m
31-40 m
41-50 m
51-60 m
61-70 m
70-80 m
81-100 m
101-200 m
20 km

Salacgriva municipality case study

The University of Latvia in the framework of EU BONUS ICZM program has been implementing several coastal research-and-development projects concerning:

- issues of coastal erosion and flood risk management,
- development of indicators system,
- complexity of the coastal socio-economic and governance issues.

The case study site – the Salacgriva municipality – is one of 17 Latvian coastal municipalities (638 km^2, 9000 population) stretching along coastline for 55 km in total.

Salacgriva municipality case study

Priority list of problems:

the state of environment problems (coastal erosion, litter/rubbish, biotopes degradation, forest damage, sea water quality, and algae blooming),

socio-economic problems or pressures (tourism impacts, restricted public access to the sea due to the construction and private fences, lack of sufficient coastal infrastructure, inadequate safety and rescue services, household caused pollution, eventual flooding.

Salacgriva municipality case study

Study area:

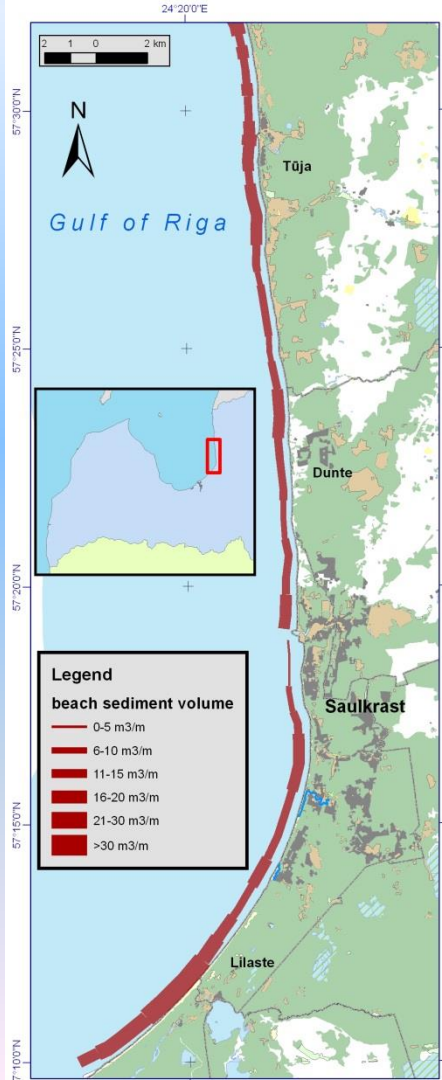
- Location – Eastern part of Gulf of Riga in Latvia.
- It is configured mostly in submeridional (N-S) direction and thus exposed to dominant southwesterly (SW) and westerly (W) winds, as well as rare, but impactful NW storms.
- The coastal features (soft cliffs) are formed mostly of Quaternary deposits.
- According to previous publications, rate of bluff/cliff retreat in this section during the last 70-100 years was around 0.05-0.5 m/year.

Salacgriva municipality case study

Study area:

- The range of coastal environments includes moderate energy, balanced or sediment deficient sections, thus – typical features of subaerial coastal slope (beach and primary dunes) usually are very underdeveloped.

Total beach sediment volume during the summer of 2016.



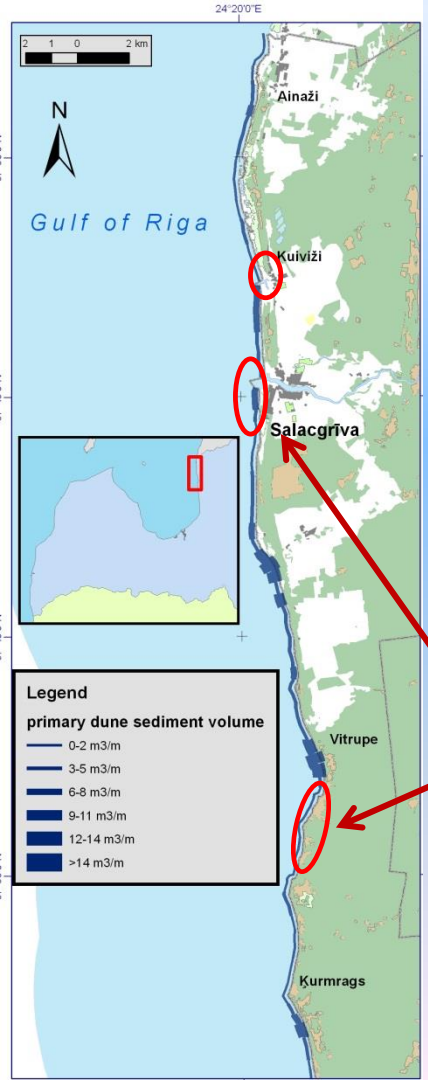
Salacgriva municipality case study

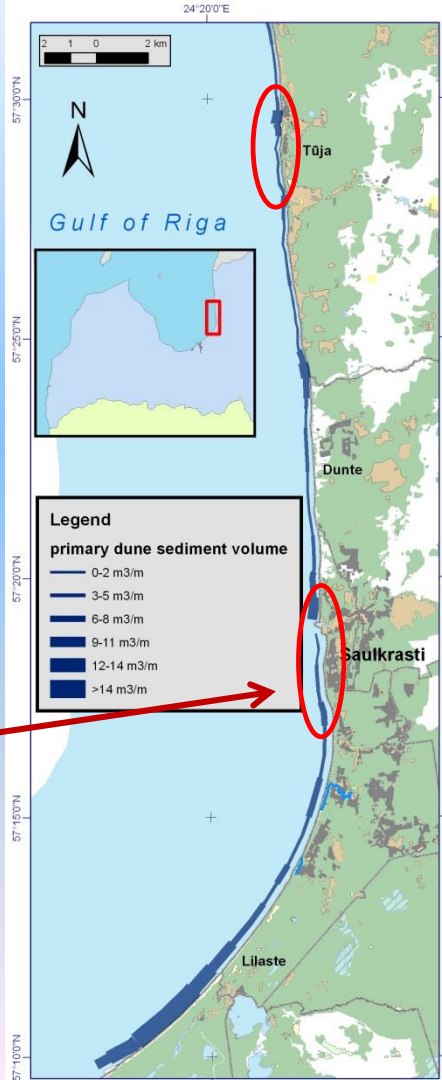
Study area:

Significant part of coastal area is undeveloped and has only several localized spots of anthropogenic impact on sediment balance.

Areas of considerable anthropoghenic impact on coastal processes.

Total primary dune sediment volume during the summer of 2016.





Salacgriva municipality case study

Physical factors: coastal erosion and retreat:

- Using historical data from 2005 and data collected during the field work in the Salacgriva municipality in 2015 and 2016, several coastal sections is distinguished where coastal retreat can be considered as a significant issue for coastal management;
- At approximately 25% of the municipal coastline over the course of last 13 years the average retreat rate was between 0.3 and 0.6 m/year.

Salacgriva municipality case study

Erosion caused by severe storm of 2005:

- During the storm of 2005, eastern part of the Gulf of Riga was subjected to severe conditions due to particularly high surge level that persisted for more than 24 hours.
- Loss of fine-grined sediments due to coastal erosion reached **0.3-0.6 milj. m^3.**
- Retreat of the hinterlend in several sections of Salacgriva municipality reached 10-15 m.
- The changes in coastal sediment distribution and slope parameters generated by this rare event can persist for decades and create new coastal retreat risk areas in long-term.

Salacgriva municipality case study

Materials and methods:

Coastal geological processes monitoring network in study area consists of 90 cross-shore leveling stations that are perpendicular to the coastline and are covering subaerial part of the coastal slope.

The measurements have been conducted on the yearly basis in late summer and early autumn.

Analysis of changes (dynamics) in the volume of sediment, was undertaken separately for the beach and the active aeolian relief (primary dunes, if present) employing a least squares technique.

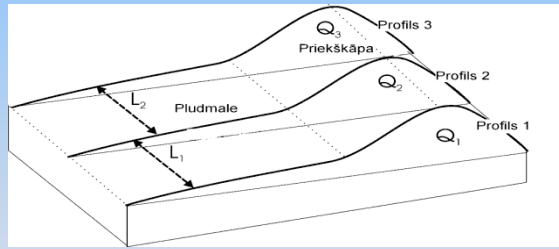
Salacgriva municipality case study

Materials and methods:

The amount of beach and primary dune sediments were calculated by using the formula:

$$V = \sum_{i} \frac{\left(Q_i + Q_{i+1}\right) \cdot L_i}{2}$$

- **V** – volume of sediments in a particular coastal area;
- **i** = 1, 2, ...n.;
- **Q** – area of coastal slope crossection;
- **L** – distance between coastal slope crossections.

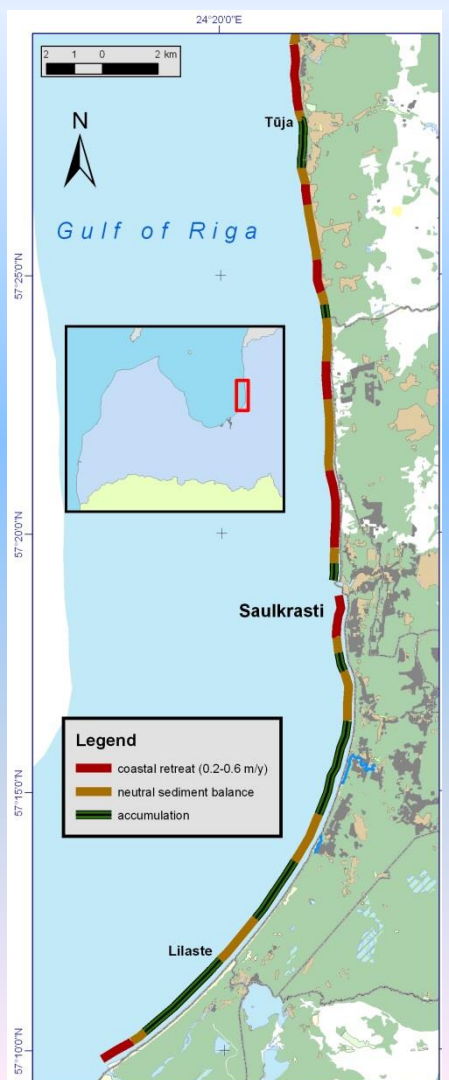


After an analysis of the data obtained from the on-site cross-shore leveling stations, sediment balance in beach and primary dunes were determined, and the long-term rate of coastal erosion was calculated (m/year).

Salacgriva municipality case study

Results:

- According to total sediment volume changes calculated, three coastal evolution trends can be distinguished within study area.
- Approximately 24 % of study area is dominated by erosion, 46 % is dominated by accumulation and 30 % does not show significant long-term changes.



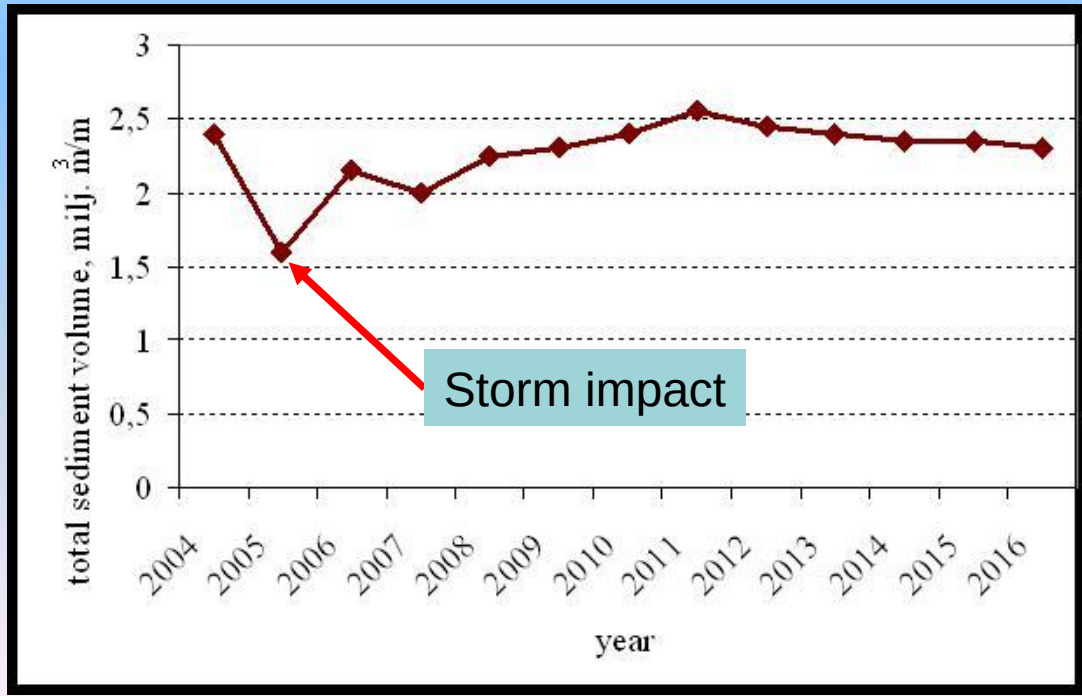
Salacgriva municipality case study

Results:

Storm of 2005 impact:

Loss of sediments caused by severe storm of January 2005 has been relatively similar within all study area, reaching volumes around 10 m^3/m with some short exceptions, where eroded volume was as high as 40 m^3/m.

The so-called «post-storm recovery» phenomena can be observed in all coastal types during the first year after erosion episode.



Salacgriva municipality case study

Results:

- Partialy as a result of severe erosion during storm of January 2005, **“guerilla” coastal protection actions** in the most erosion prone areas has been intensified.
- While until now the possible negative consequences of such actions are not unambiguously identifiable, probability of resultant erosion section “migration” and overall erosion intensification is very real.

Thank You!

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