Coastal management measures in Lithuanian Baltic coast

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Lithuania has a shortest part of coastline among all Baltic Sea countries. The length of the Lithuanian Baltic coast is 90.6 km.
Lithuanian coasts belong to united litho-dynamic region from Sambian peninsula (Kaliningradskaja Oblast, Russia) to Kolkos rags (Latvia).

The development of the coasts in late Baltic Sea formation phase (Post-Litorina) was characterized by large sand resources in mobilization zone and clearly expressed South-North direction of longshore sediment drift.
Lithuanian Baltic coast, according to its genesis, belongs to two different parts: **Curonian Spit and mainland coast.**

**Curonian Spit**
Curonian Spit as accumulative structure was formed during intensive sand drift from Sambian peninsula to the North. In the current situation after decrees of sand resources in the feeding zone coast gets insufficient quantity of sediments.

In the southern part of the Spit an eroded coastal segment is formed, in the middle part – dynamic balance and in the northern part – accumulative/stable segment; except the very end of the Spit where the erosion process began after the beginning of active deepening of Klaipeda Sea Port.

Curonian Spit coastal zone consists of coastal underwater slope with sandy bars, beach and protective foredune.
**State of the coast: mainland coast**

Mainland coast belongs to accumulative – abrasive coastal type. Coast comprises of different geological structure strips, with dominating sand or till. Eroded and accumulative coastal stripes change each other along the coast.

Mainland coastal zone sandy underwater slope passes to the eroded moraine plateau relief. Upper coastal zone consists of the beach, foredune, coastal dunes or scarp.

Most of the Lithuanian coast hydro-technical constructions are put in the mainland coast. Breakwaters and entrances channel of Klaipėda port intercept about a half of the nearshore migrating sand deposit and that is why mainland coast suffers additional scars of sand.
Development tendencies: 1993-2003

Intensification of abrasive processes
Increasing length of eroded strips
Intensifying coastal erosion – trans-national problem

In Kaliningrad district length of eroded strips increased from 50% in 1995 up to 73% in 2005.

Total length of the EU coastline is more than 100 thousands km, and more than 20 % is intensively eroded.
Main reasons of coast degradation

- Reduction of sand volume in the nearshore zone of Sambian peninsula
- Natural processes (sea level rise, increasing number and frequency of stormy days)
- Human activities (urban development, recreation, hydrotechnical constructions)

Intensifying degradation of European coasts provides the necessity to take radical political decisions and ensure the effective coastal management
Experience of coastal management in Lithuania

- Organizational measures
- Financial measures
- Legal measures (laws)
- Coastal management programs
- Coastal management projects
Organizational measures

Institution responsible for coastal protection – Lithuanian Ministry of Environment.

Lithuanian Ministry of Environment is responsible for:

Initiation and preparation of laws and other normative documents, related to coastal management

Organisation of coastal management programmes development (on a tendering basis, programmes developed by coastal management experts)

Organisation of coastal management technical projects development (on a tendering basis, projects developed by project-based organizations in collaboration with coastal management experts)

Organisation of coastal management works – selection of contractors for the implementation of coastal management projects

Organisational changes in 2010:
Until the middle of 2010 the responsibility for organisation of coastal management technical projects development and organisation of coastal management works was taken by Klaipeda County Governor’s Administration, which are now eliminated and all functions goes to Ministry of Environment.
Consultancy working group

Consultancy working group, which included the representatives of the Ministry of Environment, stakeholders and famous scientist, dealing with coastal zone management was established by the Order Nr. 634 of the Minister of Environment on „Supervision of coastal management programme implementation“ (2003-12-11)

Functions of the working group:

Consultancy of Ministry of Environment in coastal management issues
Organisation of coastal research and monitoring
Evaluation of the state of the coasts
Identification of major coastal management problems and provision of possible measures
Supervision of coastal management programmes preparation
Supervision of coastal management project implementation
Financial measures

**EU funds** – financial support for the improvement of general state of Lithuanian coast or for the management of priority coastal sectors

**State budget** – reinforcement and maintenance of protective foredune

**Municipal budget** – supervision of beaches, reinforcement of protective foredune and its protection from recreational impact

**Private finances** (Klaipeda port, Butinge Oil Terminal) – measures for the compensation of negative impact from economic activity
Legal measures

In Lithuania Baltic Sea coast protection principals are formed according to:

- 1995 year HELCOM recommendation 16/3 “On preservation of natural coastal dynamics”
- EC Euroision study recommendations (2004)

Coastal zone management and use is regulated by Lithuanian law:

- “The law of Sea coast protection and use regulation” (2000)
- “Lithuanian Baltic Sea coastal protection strategy” (2001)
- “The law of coastal strip” (2002).

Zone for coastal protection regulated by the laws limits up to 20 m depth isobaths to the sea and not less than 300 m on land.
Main principles of coastal protection laws

The priority is given to preservation of natural landscape and natural coastal formation processes, complex coordination of coastal protection and coastal use.

- Natural coastal processes and natural coastal landscape is of the first priority;
- Coastal use and coastal protection have to correspond to each other;
- Coastal protection measures have to be selected according to the functional use of the coast (environmental protection, recreation, industry use);
- Coastal protection measures have to be harmonized according to coastal formation processes dynamic;
- The use of coastal protection measures have to be independed from sectorial interests and administrative division;
- Coastal zone users are responsible for impact to the coast and take part in implementation of coastal protection measures.
Coastal management approach depends on character and functional use of the coast

**Environmental protection**
- Mainland coast – 40% of total length
- Curonian Spit – protected area

**Intensive recreation**
- Mainland coast – 61% of total length
- Curonian Spit – 35% of total length

**Use for industry needs**
- Klaipeda port
- Butinge Oil Terminal
Coastal management in coast with environmental protection priority

- Curonian Spit: UNESCO, NATURA 2000, national park
- Seaside regional park: NATURA 2000

**Approach:** nature values and cultural heritage protection.

In Curonian Spit main coastal protection objective – formation of the protective foredune and stopping sand movement with plants, branches decking and special fence.

In Seaside regional park natural coastal processes are protected.
Main impact on coastal processes is made by Klaipeda Sea port hydrotechnical infrastructure, which stopped longshore sand drift.

**Approach:** compensation measures for restoration of sand balance in nearshore.

Sand dredged from entrance channel is used for nearshore nourishment.

During 2000-2010 years the nearshore was nourished by 790 000 m³ of sand.

This let to stop coastal erosion process and retreatment of coastline north from Klaipeda harbor.
Coastal management in coast with intensive recreation priority

The main Lithuanian resort is Palanga.

Because of human and nature impact sandy beaches and dunes was catastrophically washed out during year 1995-1999.

Beach width:
end of XIX century - 150-180 m
1967-1970 - 60-80 m
1999-2000 - 10-14 m

Approach:
- regulation of lithodynamical processes by hard construction (groin);
- beach reconstruction and restoration of stable profile of nearshore by sand nourishment.
"Program for coastal strip management" (2003).

The priority is given for “soft” coastal protection measures:
- beaches and neashore nourishment,
- foredune maintenance with decking and special fence twined of dry branches to retain the dune sand, planting.

These measures are formed by principles of natural analogues and stopping coastal erosion they fell into the natural coastal formation principles.

"Lithuanian Baltic sea coasts management program for 2008-2013" (G.Žilinskas et al., 2008; approved by Environmental ministry)

This program specify:
- the way of use of separate coastal segments;
- in which coastal segments the state of the coast does not meet its functional destination;
- which areas are most problematic;

According to all this possibilities and priorities of use of different type of coastal protection and management measures will be set down.
Implementation of coastal protection measures

I stage: 2004-2006
- Stabilisation of coast at Palanga pier: reconstruction of Palanga beach groin;
- Preparation European Union Structural Funds supported project “Restoration and preservation of Baltic Sea Lithuanian coastal strip”;
- Preparation of Possibilities study for "Sand use and application of hydro-technical measures for coastal protection";
- Implemented measures:
  - application of elementary coastal protection measures in mainland and Curonian spit coasts;
  - Palanga beach nourishment with 40 000 m$^3$ of sand from sand inland sources.

II stage: 2006-2008
- Palanga beach nourishment by sand from offshore sand sources;
- foredune maintenance with decking, planting and other elementary measures in all coastal strip.

III stage: 2008-2013
- Palanga beach nourishment by sand from offshore sand sources;
- Nearshore nourishment by sand from offshore sand sources;
- Foredune maintenance by elementary measures.

IV stage: 2013-2020
New challenges:
- Reconstruction of Šventoji port;
- Building of Klaipėda deepwater port.


*Palanga beach nourishment: 2006 and 2008*

*Works done:*

- **40 000 m$^3$ from the inland quarry (2006)**
- **110 000 m$^3$ of sand from the sea bottom (2008)**
Results of beach nourishment

In 2006, in segment of 800 m length there was 40000 m$^3$ of sand put along the beach. Sand was brought from the inland quarry. The beach was heightened and expanded up to 40 m width.

In 2008, in segment of 1200 m length there was 110000 m$^3$ of sand put along the beach. Sand was taken from the sea bottom resources. The beach was heightened and expanded up to 70 m width.
Changes of sand volume during 2008-2009 period

During the one year period 10 000 m$^3$ of sand were washed out from the Palanga beach and nearshore.
Works according the “Lithuanian Baltic sea coasts management program for 2008-2013”:

- Further application of elementary measures for the foredune maintenance: brushwood flooring, brushwood fences, wooden stairs and footpaths.

- Palanga recreational zone beach and nearshore nourishment by sand.

- Sediment deficit compensation in Melnragė – Giruliai neashore zone using dredged material from Klaipėda port entrance channel.
Palanga beach nourishment project (2011 – 2013)

- Beach nourishment (70 000 m³)
- Beach nourishment (130 000 m³)
- Nearshore nourishment
Results of beach nourishment: before and after
New challenges for coastal protection

- Reconstruction of Šventoji port
- Building of Klaipėda deepwater port

Reconstruction and construction works should be carried out in parallel with the implementation of relevant coastal protection measures.

Need of permanent morphometric, hydrodynamic and lithodynamic investigations of the nearshore for the appropriate modeling of coastal zone development tendencies, choosing of coastal protective measures and increasing the efficiency.
**Conclusions**

Coastal formation processes, climate changes and more intensive use of the coast require to ensure permanent coastal management and protections works.

In Lithuania effective and properly working coastal protection system, consisting of research, legal basis, financial structure, is implemented. This secure the implementation of real coastal management projects in whole Lithuanian coastline.

It is necessary to improve the performance of the research of coastal formation processes and to cooperate in preparing coastal management projects in whole united coastal zone of Southern Baltic region.
Thank you for your attention