

Human impact on dynamics of western coast of Yamal, Kara sea

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The western coast of Yamal around the site of Bovanenkovo-Ukhta gas pipeline landfall (Baydarata bay, Kara sea) consists of two types of shore, with specific kind of human impact for each of them. These are low and gentle accumulative shores, which in this case are most influenced since the landfall site is situated within this type, and high bluffy abrasion shores. The heaviness of impact depends on degree of anthropogenic activity influencing the topography (this degree relates to proximity to main construction sites and intensity of human activity), and natural relief features, mainly its resistance to anthropogenic destruction and ability to restore itself. Accumulative shores are more resistant to destruction; main morphogenetic processes are marine accumulation (mainly within tideland) and aeolian transport, especially in areas without vegetation (tideland, beach and often the onshore sand bar). In the meantime, most part of construction (dams, roads, buildings, infrastructural sites) is located within accumulative coast, since it's generally more stable and good for construction. Abrasion coast is more prone to destruction because of human activity, but is much less subject to human impact since no direct construction activity is held here, and main types of this impact are usually traffic of heavy motor transport and allocation of construction waste (often brought by the sea).

There are the following types of direct human impact on topography at pipeline landfall construction sites: 1) construction of large artificial accumulative bodies (dams, banks, sand deposits), which leads to additional sediment inflow at the site; 2) creation of negative forms like pits and trenches while taking sand material for construction (leads to erosion and decrease in tideland and beach width, rebuilding of submerged bar system); 3) change of surface properties during construction and traffic, destruction or suppression of vegetation (leads to activation of erosion). The indirect types of impact are: 1) emerging of human-induced accumulative forms in the coastal zone, related to sediment transport redistribution, like filling reentering angles formed by construction (i.e. cofferdam); 2) emerging of negative forms within beaches and tidelands, caused by activation of erosion due to sediment transport disturbance or destruction of equilibrium profile of beach; 3) activation of deflation on disturbed surfaces (i.e. sand bars).

The sediment transport at the construction site is defined by three main factors. The first one is the regional sediment drift which corresponds to the whole area and depends on local lithodynamic situation. The second one is the structure and intensity of natural sediment inflow from the shore due to abrasion (along with thermoabrasion), and alluvial transport. The third one is the sediment inflow due to human activity: 1) direct withdrawal or deposition of sediments within the offshore slope for both construction (trenching and backfilling) and support (aggradation, shore protection) purposes; 2) dredging and aggradation works in the mouth of Yarayakha river where the port is located, which results in increase of amount of sediments delivered by the river; 3) construction works within low marine terrace which is often flooded by the sea, i.e. banking and landfilling, destruction of vegetation that binds fine sediments prevalent on the terrace surface.

Thus, the human impact on topography and sediment transport in coastal zones of Arctic regions has a complicated structure. Since the Arctic nature is highly vulnerable, and, in the same time, the importance of exploration of the region is growing, the experience of construction activity in terms of ecological management becomes highly important.