THE ROLE OF GIS TECHNOLOGIES IN DETERMINING ECONOMIC AND ENVIRONMENTAL RISKS WITHIN THE BLUE ECONOMY

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According to the European Commission, the blue economy is all economic activities related to oceans, seas and coasts. Blue economy covers a wide range of interlinked established and emerging sectors [1]. Traditionally, like any sustainable concept, the blue economy includes the study of risks caused by economic-environmental conflicts [2].

Today, the use of GIS technology is increasingly used for research in various fields of science around the world. The coastal economics is one of the current scientific areas where the visualization of research results is based on GIS technologies. For example, scientists from North Carolina conduct research on current problems of the coastal economy, such as [3]:

- Economic impact of wild-caught commercial fisheries in the state;
- Economic impact of mariculture industry;
- Benefits and costs of off-road vehicle restrictions;
- Potential impacts of climate change on recreational fishing participation;
- Impact of water quality on economic production in the region;
- Value of beach nourishment programs;
- Effects of offshore wind farms on coastal property values;
- Value of submerged aquatic vegetation (SAV);
- Oil spills and recreation.

A working group on the economics of climate adaptation has been established as a partnership between the Global Environment Facility, McKinsey & Company, Swiss Re, the Rockefeller Foundation, Climate Works Foundation, the European Commission and Standard Chartered Bank. The Economics of Coastal Adaptation examines current and future risks associated with coastal hazards and compares the cost-effectiveness of nature-based, artificial, and policy solutions to reduce risks and
prevent damage in the Gulf of Mexico. This helps understand what drives coastal risks and helps inform adaptation decisions [4]. The Working Group on the Economics of Climate Change Adaptation conducts probability of damage modeling from natural disasters, which calculates the avoided damage (benefits) from natural and artificial adaptation solutions.

The research results are [4]:
- Visualize the value of residential, commercial, industrial and essential properties in low-lying areas by county or census tract.
- Assess future flood and wind risk by estimating expected hurricane damage under different economic growth and climate scenarios.
- Compare the cost-effectiveness of 8 different natural and man-made solutions, ranging from habitat restoration to home construction, assessing how much flood damage each solution would prevent versus how much it would cost to implement.

Also, as of today, a new set of resources describing the main characteristics of the coastline has already appeared and is available to everyone. The ecological coastal classification (Ecological Coastal Units (ECU)) was developed by the US Geological Survey (USGS) in collaboration with Esri and the Marine Biodiversity Observation Network (MBON). These data were developed as part of a Group on Earth Observation (GEO) initiative called GEO Ecosystems (GEO ECO). They are linked to the GEO ECO task of developing global data on coastal ecosystems. [5]. In Fig. 1 shows the distribution of 16 globally similar ecological coastal classes (ECUs) across the globe. Each of the 16 classes contains information on 10 parameters that describe the overall ecological situation of the coastal zone.

Ten parameters make up the ecological conditions of the coastal environment [5]:
1) five parameters of the ocean (hydrophysical parameter (temperature, salinity and oxygen content in the marine environment), chlorophyll, tidal range, wave height, water turbidity);
2) two parameters for land (climate (air temperature, precipitation), erosion index)
3) three parameters of the coastline (sinuosity, slope profile, river outflow index).

These data make it possible to visualize and isolate any part of the coastline on Earth, with the exception of Antarctica. If this information is integrated, for example, in numerical or simulation modeling of the processes of development of coastal zones under the influence of anthropogenic or natural factors, then there is an opportunity to calculate and take into account the economic and ecological risks that these factors cause to the coastal strip. It is possible to carry out economic, ecological, social assessments of the current state of coastal strips based on the results of such modeling. These assessments can serve as a basis for decision-making regarding the management of the coastal zones of the marine environment.

Thus, the given information indicates that modern GIS technologies are a very important auxiliary instrument in the adoption and implementation of management decisions regarding the sustainable or resilient development of the coastlines of the seas of Ukraine.

GIS technologies at the current stage of development have a very high potential for economic and ecological research of coastal ecosystems within the limits of the blue economy.

References: