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# A fuzzy cognitive map approach to understand the management of anthropogenic sandy shores in the Netherlands

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## Abstract

Anthropogenic sandy shores (ASSH) are shores that are newly created or heavily modified by mega nourishments. Large amounts of offshore dredged sand are deposited at and near the shore, after which waves, wind, and currents spread the sand to reinforce the foredune for coastal safety, while wider beaches and lagoon features provide space for recreational activities and various habitats. Previous studies about ASSH mainly focused on understanding the biophysical system (morphology and vegetation), paying little attention to interaction with the social system on ASSH. This research aims to better understand the management activities and their interactions with user activities as well as the biophysical system on ASSH. A participatory modelling process is applied to better understand the management activities on ASSH based on first-hand stakeholders' knowledge, experience, and perception. First, semi-structured interviews with stakeholders from the management sector are conducted to collect information on each stakeholder's management activities and strategies on ASSH (past, present, and future), prevailing values, interests, aims, and interaction with other stakeholders and the biophysical system. Next, a workshop with identified stakeholders is organised to develop the management activities' conceptual model on ASSH by using the Fuzzy Cognitive Mapping method. In this workshop, the model's spatial boundary and principal components (e.g. management and recreational activities, recreational facilities, and biophysical elements (e.g. lagoon, dune, foredune, plants, and sand)), the interaction between stakeholders, the interaction between management activities and uses as well as the biophysical system are defined. It is the first time that the ASSH social system is analysed in this way. The developed conceptual model of the management activities provides the basis for developing ASSH's socio-biophysical model in future studies. The socio-biophysical model of ASSH will help researchers and policymakers to explore human impact on ASSH's functions (e.g. flood safety, recreational activities, and nature development).


**Figure 1:** Example of an anthropogenic sandy shore in the Netherlands: A) Sand Motor on the Dutch North Sea coast near The Hague, the Netherlands B) Beach houses and restaurant on Sand Motor and spread of beach users around them.

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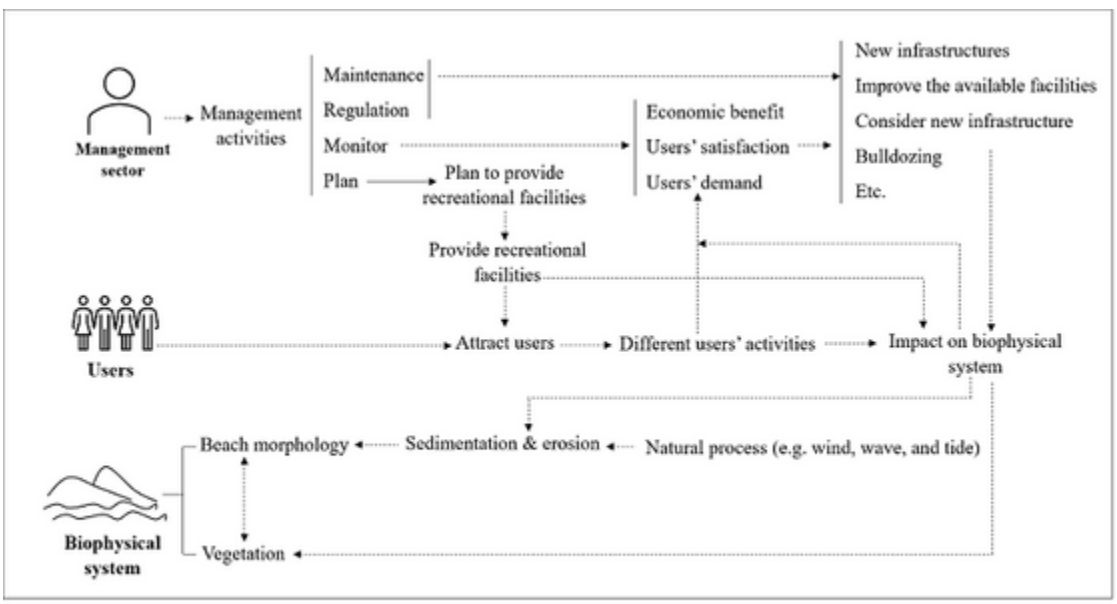


**Figure 2:** The primitive conceptual model of interaction between management activities, users and biophysical system

**Keywords**

Anthropogenic Sandy Shores, Coastal Management, Participatory Modelling, Fuzzy Cognitive Mapping