MAREA

Output O.T2.2.2

Regional tools for assessing feed-backs and trade-offs between marine ecosystem and anthropocentric systems

Part 2: Explore the relations between cultural services and environmental condition

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1. Introduction

In addition to developing a regional tool together with WP4 (see customized social-economic models in Deliverable D.T4.2.1 and the methodology document and user guide of the models in Deliverable D.T2.2.1 and Output O.T2.2.1), working package 2 (WP2) also conducted a survey on recreational and cultural activities related to the Baltic Sea to assess feedbacks and trade-offs between marine ecosystems and anthropocentric systems. The summary of the survey results can be found in Deliverable D.T2.2.2. This output focuses on exploring the relations and possible trade-offs among different cultural services and environmental conditions. This analysis provides a basis to test methods of linking the cultural services to the ecosystem condition and extent accounts in other continuous projects, which will be helpful for developing ecosystem accounting---- a framework that can apply to reveal the feedback and trade-offs between the marine ecosystem and anthropocentric systems (UN, 2021, see Deliverable D.T2.1.1).

The survey was designed to explore recreational and cultural services provided by the Baltic Sea and their links to environmental quality. The survey was provided in English (all three countries), Finnish and Swish for Finland, Estonian and Russian for Estonia, and Latvian and Russian for Latvia. The contents of the surveys are almost the same in the three countries, except for the examples provided help to name the marked places. In addition, an extra section was developed for the Finnish survey to understand the possible behavior change of visitors when the environmental condition change (see section 3 in this output). The survey includes a series of questions to ask the respondents to answer the environmental condition that they perceived at their most visited sites. Only the questions regarding the perceived biodiversity and perceived common reed patterns are explored in this output.

2. Perceived biodiversity vs. cultural services

The survey included questions on the perceived environmental conditions at the recreational marine sites that the respondents had visited the most during the last 3 years as well as the question on the frequency of in situ use of cultural ecosystem services at the site. Figure 1 shows Spearman correlations ($p < 0.10$) between the 6 perceived biodiversity factors asked in the survey and frequency of 22 types of cultural service use. Figure 1 shows that these correlations are very country-specific, and they vary between 0.03 and 0.47. The highest correlations are between boating and fishing activities, and fish and submerged biodiversity factors in Finland. However, the frequencies of in situ cultural service use can be correlated with each other and the same applies to the perceived biodiversity factors. Also, the perceptions of environmental conditions can depend on the background of the respondent as well as on the cultural services that the respondent uses. Therefore, more advanced statistical processes are needed to draw conclusions on the linkages between perceived environmental conditions and cultural ecosystem service use.

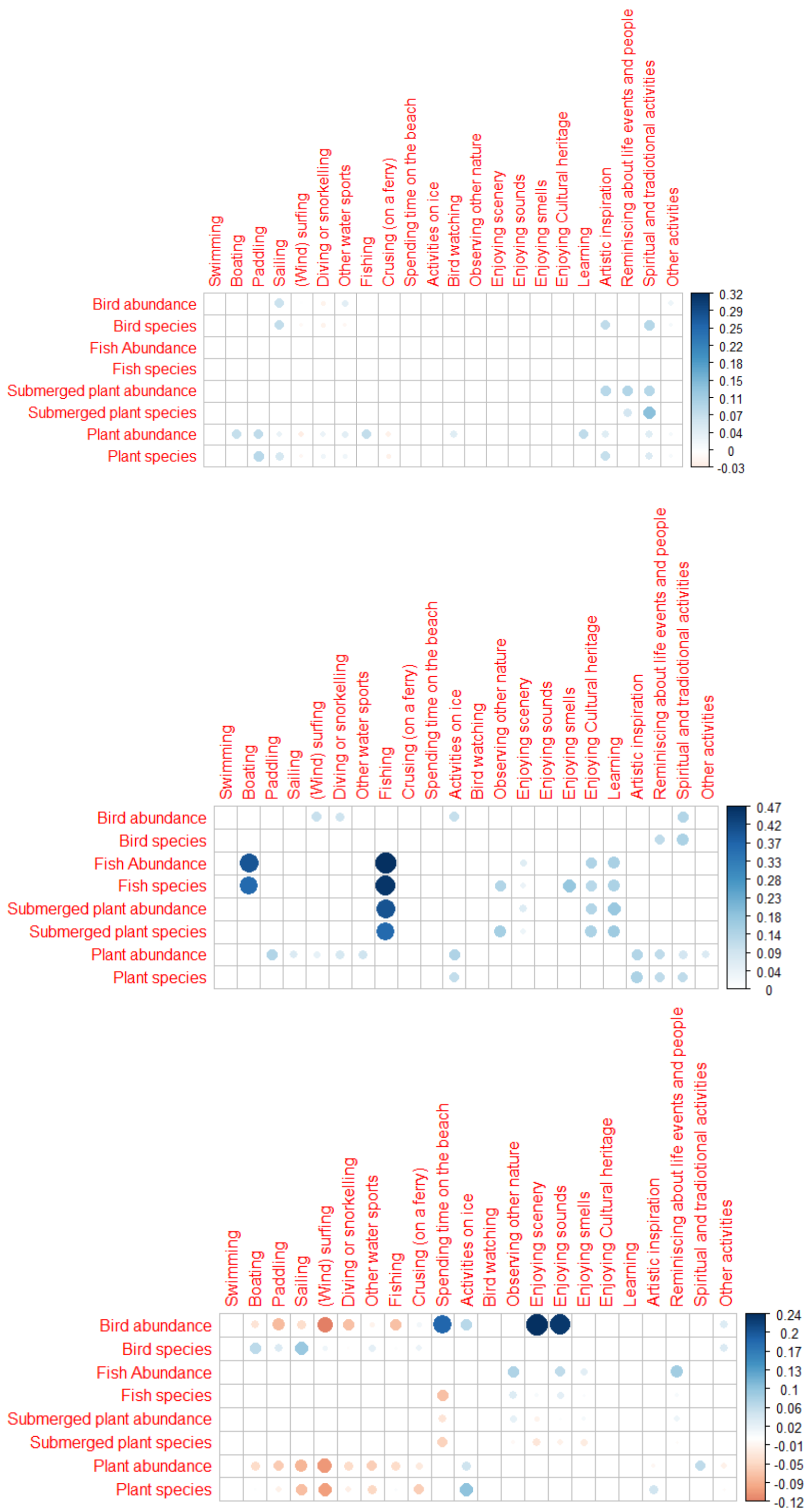

Figure 1 Spearman correlations (p<10%) between perceived biodiversity factors and frequency of in situ use of cultural ecosystem services for Estonia, Finland and Latvia respectively.

To understand how the actual or modelled environment corresponds with the perceived environment, and further assess the linkages between actual or modelled environment and cultural ecosystem service use, we need to examine the actual or modelled environmental conditions at the visited sites. In the survey, respondents were able to mark their most visited locations on the map using a map-based survey tool and/or name the visited site by giving a text answer. Figure 2a shows the responses where the sites were marked on the map, but text answer was not provided. For the locations presented in Figure 2b, we tried to match place names with actual locations using Digitransit[1] geocoding API and R programming language. Digitransit geocoding API provides a way to perform searches using site names. Geocoding results are returned in GeoJSON format including a confidence parameter for each search result, which indicates the similarity between the name used in the search and the search result. These confidence parameters were used to evaluate if the matched locations were adequate. Figure 2b shows the adequate matches for the 443 survey responses that included only text answers. We were able to find 252 adequate matches, which means that we could not define a location for 191 sites that only answer the location in the text form. Locations presented in Figure 2c include responses with both map and text answers (N=364) for which we could not find adequate matches (N=151). For these matches, the adequacy criteria also included distances to the marked map answers, so that only matches that were within the 50 km distance from the map answer were included. Finally, Figure 2d includes the 213 responses with both text and map answers with an adequate match (cyan dots) connected with lines to the map answers (magenta dots). The average distance between the locations based on map answer and adequately matched site is 9.5 km with a median of 3.8 km.

[1] https://digitransit.fi/en/developers/apis/2-geocoding-api/

a) b) c) d)

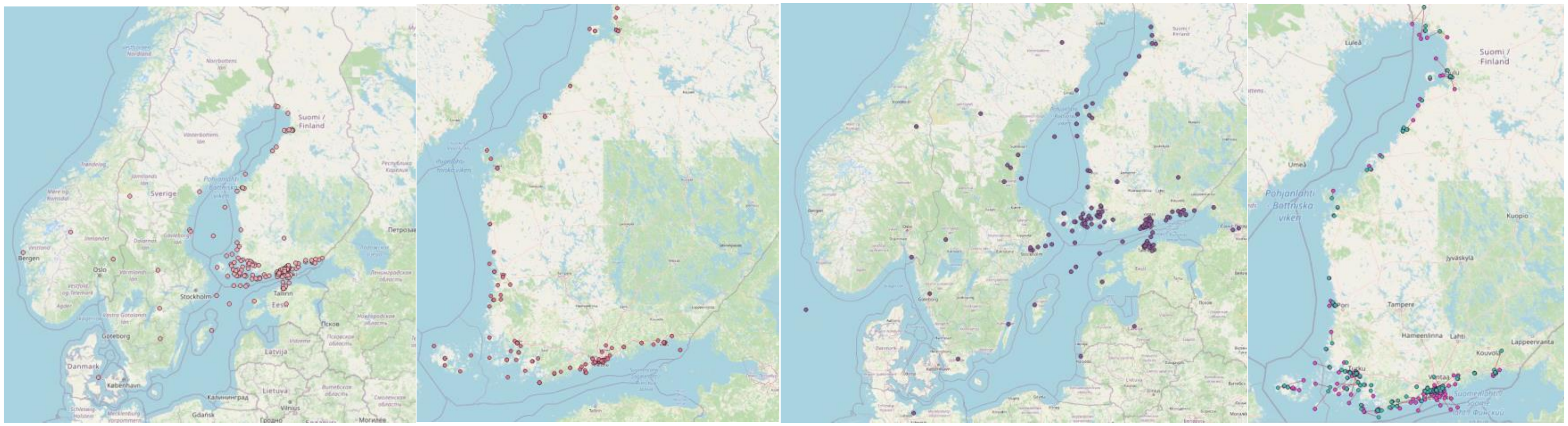

Figure 2 a) Map answers only, b) Text answers only, c) No adequate match for responses with both answers d) Adequate match found for responses with bot answers

Finally, to demonstrate the perceived environmental conditions at the visited sites, we picked up perceived abundance of birds and bird species from the 6 perceived biodiversity factors listed in Figure 1. We projected perceived abundance of birds and bird species for all 801 responses defined in Figure 2. These values are presented in Figure 3, where 1 equals “high”, 2 “Rather high”, 3 “Rather low”, 4 “low” and 5 “no appearances/species”. “I don’t know” answers are marked with magenta dots.

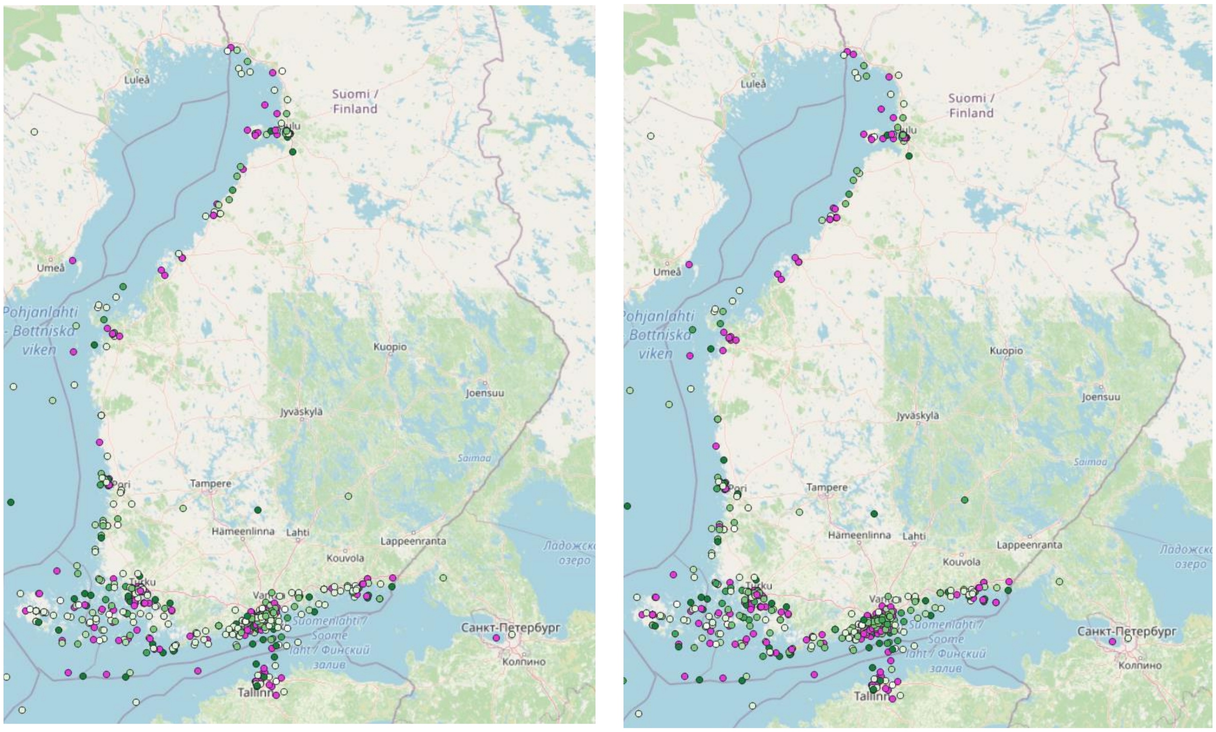

Figure 3 Perceived abundance of birds (on the left) and perceived abundance of bird species (on the right)

Avenues for future works include closer inspection of perceived environmental conditions in relation to the actual or modelled environment and further implications on the supply and demand of cultural ecosystem services. It is apparent that in most cases the defined sites based on map answers or names cannot be used to represent very accurate locations of visited sites. However, conditions on the defined sites can perhaps be studied with respect to regional conditions of the marine environment representing a larger area around the defined sites.

3. Preference of common reed vs. cultural services (Finnish case)

Common reed (*Phragmites australis*) is one of the common coastal habitat types in Finland, and it causes concerns in Finland as their extent spread significantly recently due to the increasing eutrophication In the Baltic Sea (Altartouri et al., 2014). Therefore, in the MAREA Finnish survey on recreational and cultural activities related to the Baltic Sea, a specific section was designed to investigate how the visiting behavior would change under the condition that common reed patterns change. With other parts of the questionnaires that asked the respondents about their observation of common reed patterns at their most visited sites and the activities they do at the sites, we explored if there are preferences differences and trade-offs among the users of different cultural services.

Figure 4 shows the common reed patterns that the respondent observed when they visited their most visited site at the Baltic Sea or its coast from the last of the visits before answering the survey. 914 of the respondents answer this question, 102 of which have the right to manage the common reed on the sites by cutting the reeds or dredging, and 812 of them do not have the right to manage the reed on site. Reeds appearing in patches (B in Figure 4) is the most commonly observed pattern at the respondent's most visited site, regardless of whether the samples cover all targeted responses or only those who do not have the right to manage the reed at the site. The group of respondents who do not have the right to manage the common reed on site are the target to ask for their behavior change of visiting under the condition that common reed patterns change.

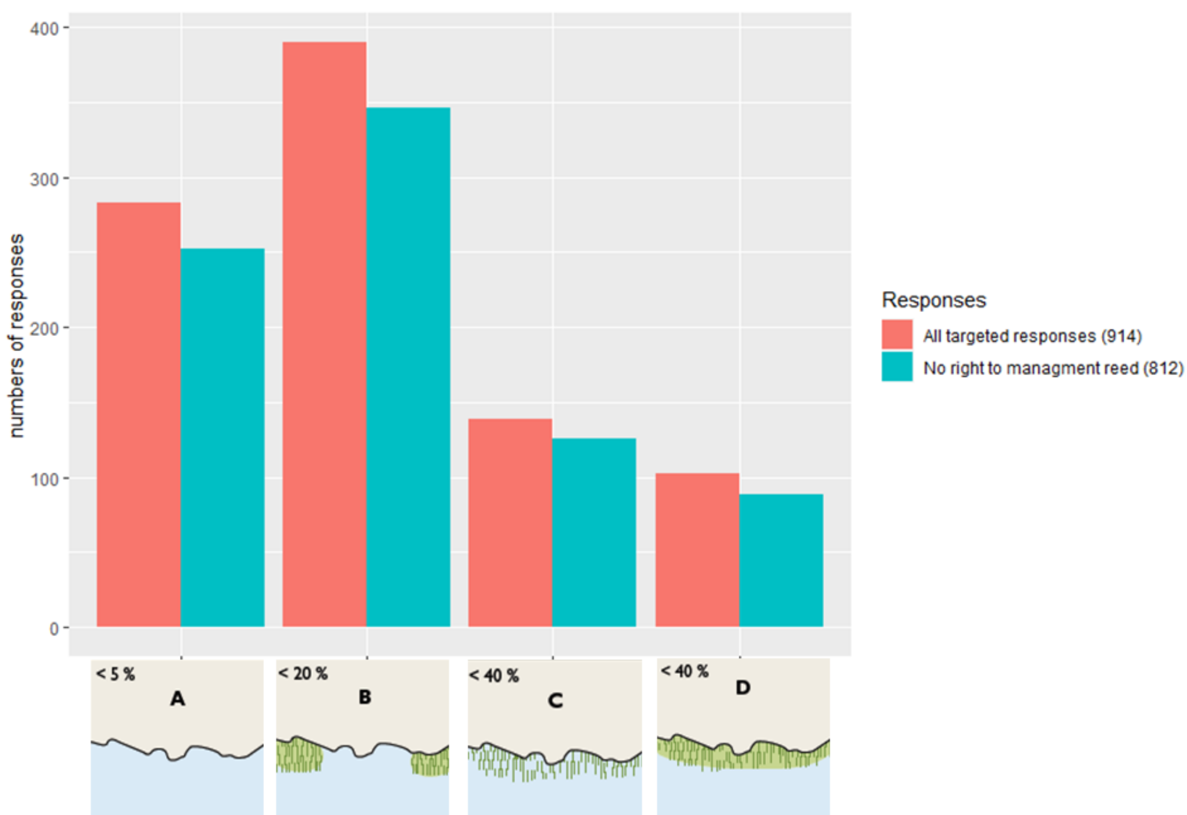

Figure 4 Distribution of the observed patterns of the common reed coverage at the most visited site. A: There are no or very few reeds. B: The reeds extend/appear in patches. C: Reeds cover the entire shoreline with a low-density zone. D: Reeds cover the entire shoreline with a high-density zone. (The figure of reed patterns was revied from figure used in Laukkonen et al. (2012) and deigned by Erika Varkony)

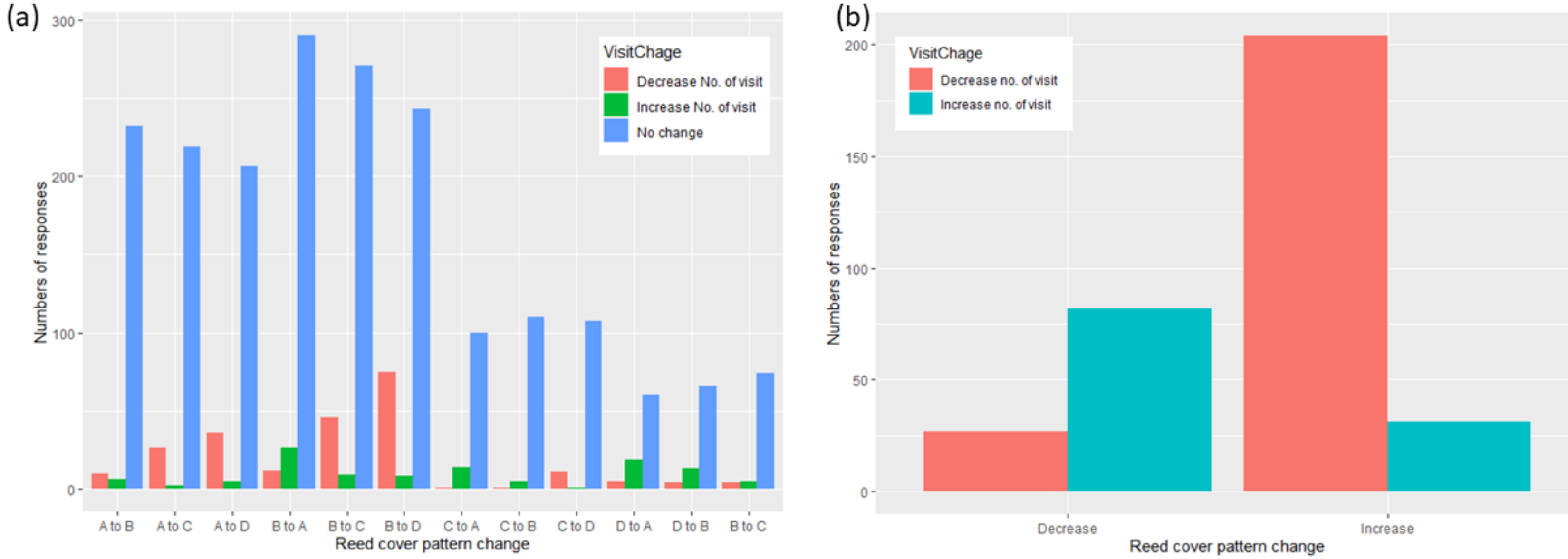

Figure 5 (a) How the numbers of visit to the most visited site would change if the reed cover of the site change. Each respondent was asked the change of reed pattern from current observation to the other three types of reed coverage. (b) Groped results of (a) based on the pattern change is increasing (e.g., B to C or D) or decreeing (e.g., B to A).

Figure 5 shows how the number of visits to the site from the respondents who do not have the right to manage the reeds would change if the common reed pattern changed. Most of the responses (71-94%, depending on the current reed patterns and the expected change of the pattern) would not change their numbers of visits to sites (Figure 5 (a)). For those who tend to change their number of visits due to the reed cover change, the change of visits reflects a preference for less reed cover (Figure 5 (a) and (b)).

We further compare such reed pattern preferences with the frequency of using 22 different types of cultural services (same cultural services shown in Figure 1). Several most used services are quite similar between those who prefer less reed and those who prefer more: “enjoying scenery”, “enjoying sounds”, “enjoying smells”, and “spending time on the beach (e.g., reading, sunbathing, walking, jogging, or biking)”, “Enjoying cultural heritage (e.g., historical buildings, lighthouses)”, and “observing nature (excluding bird-watching)” are the top 5 services in both groups. However, few services clearly coincide with the reed pattern preferences. For instance, “bird-watching” is the top service that is sometimes used by the respondents who prefer more reed covers but not a popular service for those who prefer fewer reeds.

Avenues for future works include developing the travel cost model to explore if such common reed patterns changes would influence the number of visits or value of the recreational services. Also, the procedures demonstrated in section 2, to establish the link from perceived common reed patterns to actual common reed patterns will also need to be implemented. Such works also lead to the investigation of whether a such indicator is possible to be included in the development of ecosystem accounting in the future.

Reference

Altartouri, A, Nurminen, L & Jolma, A. 2014. Modeling the role of the close- range effect and environmental variables in the occurrence and spread of Phragmites australis in four sites on the Finnish coast of the Gulf of Finland and the Archipelago Sea. Ecology and Evolution, vol. 4 , no. 7 , pp. 987-1005. https://doi.org/10.1002/ece3.986

Laukkonen et al. 2012. Ruovikoituminen ja vedenlaatu Suomenlahdella: kyselytutkimuksen tulokset. Suomen ympäristö, vol. 25, Suomen ympäristökeskus, Helsinki.

United Nations. 2021. System of Environmental-Economic Accounting— Ecosystem Accounting: Final Draft, Prepared by the Committee of Experts on Environmental-Economic Accounting.