OVERLAY ANALYSIS OF LANDSCAPE INTEREST IN THE HYDROPOWER TENDER REGION OF CENTRAL WEST GREENLAND

Scientific Report from DCE – Danish Centre for Environment and Energy No. 695 2026

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Data sheet

Series title and no.: Scientific Report from DCE – Danish Centre for Environment and Energy No. 695

Category: Scientific advisory report

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Publisher: Aarhus University, DCE – Danish Centre for Environment and Energy ©
URL: https://dce.au.dk/en

Year of publication: February 2026
Editing completed: December 2025

Referee(s): Daniel Spelling Clausen
Quality assurance, DCE: Kirsten Bang

External comments: The report has been sent for external commenting at the Ministry of Business, Mineral Resources, Energy, Justice and Gender Equality, Government of Greenland. They had no comments.

Financial support: Naalakkersuisut (Government of Greenland), Ministry of Agriculture, Self-Sufficiency, Energy and Environment. During the preparation of the report the task was surpassed to Ministry of Business, Mineral Resources, Energy, Justice and Gender Equality.

Please cite as: Johansen, K. L., Zinglersen, K. B., Mosbech, A., Raundrup, K. & Fritt-Rasmussen, J. F. 2026. Overlay analysis of landscape interest in the hydropower tender region of Central West Greenland. Aarhus University, DCE – Danish Centre for Environment and Energy, 36 pp. Scientific Report No. 695

Abstract: This report presents a GIS-based overlay analysis of landscape interests in Central West Greenland to support the Government of Greenland's hydropower tender process for lakes Tasersiaq and Tarsartuup Tasersua. Using ArcGIS Pro and custom Python scripts, 81 map layers representing biological, human use, and cultural heritage interests are integrated to calculate an Overlay Index (OI), indicating how many interests that overlap in different parts of the landscape. Most of the area exhibits low to moderate OI-values, however with hotspots in the northern part of Angujaartorfiup Nunaa, the mouth of Nuup Kangerlua, and fjord systems hosting sensitive seabird colonies, such as Kangerlussuatsiaq (Evighedsfjorden) and Sermilinnguaq Fjord. The two hydropower resource areas show moderate to low OI-values, but downstream zones of both areas contain multiple interests. High OI-values highlight areas requiring careful consideration, but do not automatically preclude development. Low values may reflect few interests as well as data gaps and warrant careful examination. Accessible via WebGIS, the analysis provides a flexible foundation for strategic planning and environmental impact assessments in the hydropower tender region.

Keywords: Hydropower, West Greenland, overlay analysis, environment, human use, cultural heritage, Tasersiaq, Tarsartuup Tasersua

Front page photo: West Greenlandic landscape, Katrine Raundrup

ISBN: 978-87-7648-027-1
ISSN (electronic): 2244-9981

Number of pages: 36

Contents

Preface

This report presents a spatial analysis of overlapping landscape interest in Central West Greenland, based on data from the report "Background report prior to exploitation of hydropower potentials in Central West Greenland" (Fredsgaard et al. 2025). The work was commissioned by Department of Agriculture, Self-sufficiency, Energy and Environment, Government of Greenland, as part of a hydropower tender for the region, and carried out in collaboration between DCE - Danish Centre for Environment and Energy, Aarhus University, and Greenland Institute of Natural Resources.

The report is available in English, Danish and Greenlandic, and the results are included in the HydroPower WebGIS.

Summary

This report presents a Geographic Information System (GIS)-based overlay analysis of landscape interests in Central West Greenland, conducted to support the Government of Greenland's hydropower tender process for lakes Tasersiaq and Tarsartuup Tasersua. The analysis is based primarily on the comprehensive environmental and human-use dataset compiled in Fredsgaard et al. (2025) and aims to identify areas where multiple biological, human-use, and cultural heritage interests overlap, thereby informing strategic planning and impact assessments for industrial activities in the region.

The overlay analysis integrates 81 map layers representing diverse interests, including flora and fauna distributions, hunting and fishing areas, tourism activities, and cultural heritage sites. Using ArcGIS Pro 3.2.2 and custom Python scripts, all layers were standardized as binary raster maps (250×250 m cell size) and combined to calculate an overlay index (OI), which reflects the degree of spatial overlap between interests. Polygon features were directly converted to raster maps, while point and polyline features were initially buffered according to ecological, regulatory, and spatial uncertainty considerations. Habitat constraints on layers prevented misclassification across land, sea and ice during buffering. Additional processing included density surface analyses for raw distribution data, and use of multiple weighted raster layers to account for varying importance levels within themes, such as fisheries and hunting. A complex multi-layer setup was applied for seabird colonies, incorporating legal protection zones, species diversity and population sizes to reflect their ecological significance.

Three analyses were performed: a main analysis including all layers (n=81), and two sub-analyses focusing on biological interests (n=50) and human use/cultural heritage (n=39), respectively. Results reveal that most of the area of interest (AOI) exhibits low to moderate OI-values, with approximately 90% of the AOI scoring between 0 and 6.5 in the main analysis (max OI=16.5). Notable hotspots with many overlapping interests include the northern part of Angujaartorfiup Nunaa, characterized by rich vegetation, caribou and muskox concentrations, geese, hunting activities, tourism and cultural heritage sites. High-overlap zones also tend to cluster around towns and settlements, primarily because of human-use in the present and the past (cultural heritage sites), but also due to biological interest. Thus, the mouth of Nuup Kangerlua (Godthåbsfjorden) forms a large hotspot not only because of the extensive human use and the rich historical record, but also because of the area's importance to e.g., wintering seabirds and hump-back whales. Fjord systems like Kangerlussuatsiaq and Sermilinnguaq also stand out, primarily due to large, species-diverse seabird colonies, which are irreplaceable and highly sensitive to disturbance. The number of overlapping landscape interests in the two hydropower resource areas are moderate to low in all analyses, but downstream of both hydropower resources are areas with many overlapping interests.

The results of the overlay analyses should be interpreted with care. High OI-values signal areas requiring careful consideration as many landscape interests are at stake. However, they do not automatically preclude industrial development as the features present may perhaps co-exist with industrial facilities without significant negative effects. Conversely, low OI-values may reflect data gaps rather than absence of interests. And, although few in number,

the features present still need to be carefully considered as they may be particularly sensitive to the planned activities.

The results, which are accessible via the HydroPower WebGIS, provide a robust foundation for subsequent evaluations. As a flexible tool, the overlay analysis can be tailored to more specific analyses as need arise, and potentially be further developed for sensitivity analyses, when activity plans become more specific.

1 Introduction

Naalakkersuisut (Government of Greenland) has decided to put out to tender the utilisation of large hydropower potentials at lakes Tasersiaq and Tarsartuup Tasersua in central West Greenland for industrial projects. As part of this process, Nunalerinermut, Imminut pilersornermut, Nukissiuutinut Avatangiisinullu Naalakkersuisoqarfik (Department of Agriculture, Self-sufficiency, Energy and Environment (NIPNAN)) commissioned Pinngortitaleriffik (Greenland Institute of Natural Resources (GINR)) and DCE - Danish Centre for Environment and Energy, Aarhus University, to update the report "Aluminiumsmelter og vandkraft i det centrale Vestgrønland" (Johansen et al. 2008). This report from 2008 describes data on the environment and human use in the region from Nuup Kangerlua (Godthåbsfjorden) to Kangerlussuaq (Søndre Strømfjord) and was prepared as input to a strategic environmental impact assessment of hydropower and aluminium smelting. The updated and significantly extended report has recently been published (Fredsgaard et al. 2025) and is available online.

As a supplement to the updated report, NIPNAN has also commissioned GINR and DCE to conduct an overlay analysis of the data presented in the updated report:

NIPNAN wishes for the main report [Fredsgaard et al. 2025] *and subsequent assessments to be supported by geographical analyses of the collected data. This is to be carried out in the form of a so-called overlay analysis. The overlay analysis includes all or relevant collected map layers and data from the main report* [Fredsgaard et al. 2025] *in a geographical calculation of the number of overlapping area interest – both biological and related to human use – in different parts of the area of interest. The overlay analysis thus summarizes the entire data collection in the report* [Fredsgaard et al. 2025] *and provides an indication of where in the region there are many interests to consider in connection with construction activities and similar undertakings.*

The expected delivery consists of *a GIS overlay analysis, described in a 5–10-page report in English, Danish and Greenlandic, including descriptions of input data, methods and results, and associated maps*.

The present report is the English version of this delivery. The results section is intentionally kept short, as the overlay analysis is primarily intended to be used alongside Fredsgaard et al. (2025) in subsequent assessments of activity plans for the area. In addition to this report, the results of the overlay analysis are also available as part of the HydroPower WebGIS.

2 Method overview and guide to interpretation of results

An overlay analysis is a GIS (Geographic Information System) technique that combines multiple different map layers into a new composite map that integrates information from all the input maps (Figure 1). Often the maps are simply summed by adding pixel values across maps for pixels in the same location. It is a common method for site selection, and it is often used as a tool to support decisions on where to place activities or structures (suitability modelling), or where not to place them because of conflicting landscape interest (unsuitability modelling) (ESRI 2025a).

In Fredsgaard et al. (2025), a large number of maps have been presented, showing known distribution areas of important flora and fauna, and human use of the region for hunting, fishing, tourism etc. Likewise, Nunatta Katersugaasiva Allagaateqarfialu (Greenland National Museum & Archives (NKA)) has prepared a report with maps of cultural heritage sites in the region, including protected and vulnerable heritage areas (Madsen et al. 2025). All these features represent landscape interests that need to be considered when planning industrial activities, and the overlay analysis described in the present report visualizes how many of these landscape interests that overlap in different parts of the area of interest (Figure 2). The analysis involves no extrapolation or statistical prediction of occurrences. It simply summarises what is presently known and presented in the maps in Fredsgaard et al. (2025), Madsen et al. (2025) and a few other relevant reports (Johansen et al. 2008; Christensen et al. 2016).

Although updated, this knowledge still contains gaps, and this is important to bear in mind when interpreting the results of the overlay analysis. Areas with many overlaps (high Overlay Index (OI)) correspond to areas where we positively know many landscape interests are at stake. Areas with few overlaps (low OI) can on the other hand be the result of either lack of landscape interest, or lack of knowledge of landscape interest. The overlay analysis should therefore be used more as an unsuitability model than a suitability model.

It is also important to make clear that red coloured areas with many overlapping interests (high OI) do not necessarily preclude industrial activities. The biological, human use and cultural heritage interests included in the analysis may be affected very differently by different industrial activities, and some features can perhaps co-exist spatially with industrial facilities and infrastructure without significant negative effects. Thus, while an overlay analysis can be extended to a sensitivity analysis that highlights areas with features sensitive to particular stressors related to an industrial activity (e.g., noise, transmission lines, flooding of areas, changed water flow, shipping etc.) (see Christensen et al. (2015) as example), an overlay analysis is not in itself a sensitivity analysis.

With all this in mind, we advise the following use of the overlay analysis: Red coloured areas with many overlaps should raise a warning flag. Here, many landscape interests are at stake, and careful consideration needs to be given to the individual features present and how these may be affected, if industrial activities are planned in the area. Green coloured areas signify that few overlapping interests are known, but it needs to be assessed, if this is due to lack of features or lack of knowledge (data gaps). And, although few in number, the features present still need to be carefully considered as they may be particularly sensitive to the planned activities.

3 Technical method description

3.1 Analysis setup

The overlay analysis was carried out in ArcGIS Pro 3.2.2 using custom Python scripts adapted from Johansen et al. (2023, 2024). The basic principle of the method is graphically illustrated in Figure 1. Map layers from the reports were converted into binary raster maps with a cell size of 250x250 m, perfectly aligned with each other, and covering a rectangular analysis area (AA) corresponding to the map frame in Figure 2. That is, each map layer is represented as a grid of cells, comparable to pixels in a digital photo, with each cell measuring 250x250 m and having a value of either 1 (feature(s) present in the cell centre) or 0 (features absent in the cell centre). Next, the cell values of the individual binary raster maps were multiplied by a layer weight specific to the map. The layer weight is a constant controlling the relative weight of a raster map in the overlay calculation (see Section 3.2.5). Most raster maps have the default layer weight 1 (resulting in cell values of 1*0=0 and 1*1=1), but some have layer weight 0.5 (resulting in cell values of 0.5*0=0 and 0.5*1=0.5) or 0.25 (resulting in cell values of 0.25*0=0 and 0.25*1=0.25). The weighted raster maps were then stacked on top of each other (overlayed), and for each position in the grid system of cells, the cell values were summed across the stack. This produces a new raster map - the overlay analysis result. In the overlay analysis result, we refer to the cell values as Overlay Index (OI) values. The OI-values are a measure of how many landscape interest that overlap in the different cells of the analysis area. Finally, all result maps from the overlay analyses were cropped with the area of interest (AOI) (Figure 2).

3.2 Data preparation

In many cases, the map layers from the reports had to be processed in different ways to be included in the overlay analysis. All specific map layer processing details are given in Table 1, and only the overall principles are described here.

3.2.1 Buffering of features

Map layers with vector polygons can be directly converted to raster maps as the polygons cover an area. All 250x250 m cells with centres spatially within a polygon were simply assigned the value 1, whereas cells with centres outside a polygon were assigned the value 0. However, many of the maps display features as points or polylines, and these geometry types do not cover an area. As features are required to cover an area to overlap cell centres and count in the overlay calculation, point and polyline features were buffered, effectively turning them into polygons. The buffer radii used were in some cases determined by legislative regulation, e.g., protection zones around archaeological sites or seabird colonies, in other cases by the degree of spatial uncertainty associated with data, or the real-world sizes of features. Some features were also buffered in accordance with a perceived zone of influence: When conducting activities within this distance, the feature needs to be considered. In some cases, even polygon features were buffered. Due to the grid size of the analysis, features need to have a radius of at least 177 m (half diagonal of 250x250 m cell) to ensure intersection between the feature and at least one cell centre. Thus, map layers with very small polygon features were buffered to ensure representation at the spatial scale of the analysis. Details on the buffering of individual map layers are given in Table 1.

3.2.2 Habitat constraints

Especially when buffering features, it becomes important to make sure that they are constrained to their right element, e.g., that hiking trails on land do not count in adjacent cells in the sea, even though these cells fall within the 500 m buffer zone of the polyline representing the hiking trail. Therefore, each input layer, buffered or not, was constrained to count (have values of 1) only in cells of the types specified in the column "Habitat" in Table 1 (values "Land", "Sea", "Land and Sea", "Ice free land").

3.2.3 Sub-selection of features

Map layers showing only important areas for a certain species, human use or cultural heritage interest were directly converted to raster maps. However, some map layers in Fredsgaard et al. (2025) cover the entire area of interest, and in that form, they will just add a constant (the value of 1) to all cells in the overlay analysis result and not contribute with any spatial structure. Thus, for some map layers only a subset of features (the most important ones) was included. For example, from the coastal oil spill sensitivity map, only coastlines with "Extreme" or "High" sensitivity were included, whereas coastlines with "Moderate" or "Low" sensitivity were excluded – otherwise, the coastline in the entire area of interest would just be elevated with 1 and no information on relative oil spill sensitivity would be conveyed. Any such sub-selections of features from the map layers are described in Table 1.

3.2.4 Density surface analyses

Some map layers in Fredsgaard et al. (2025) show "raw" distribution data rather than important areas identified based on analyses of these data, e.g., muskox and caribou observations from aerial surveys (Fredsgaard et al. 2025, Figure 2.5), or points where muskox and caribou were shot during hunting (Fredsgaard et al. 2025, Figure 8.2). To incorporate these data in the overlay analysis, we conducted different types of smoothed density surface analyses (kernel density (ESRI 2025b) and point density (ESRI 2025c)) of the raw distribution data. Subsequently, cells above a certain layer-specific density were given the value 1, and cells below the density threshold the value 0. Details on method and parameters are given in Table 1 for all map layers subjected to these types of analyses.

3.2.5 Layer weights

Several maps in Fredsgaard et al. (2025) show significant differences in the importance of areas for a given species or theme, e.g., ranging from very important areas, over moderately important areas, to areas of low or no importance. To represent this in the overlay analysis, we used multiple raster map layers with different layer weights. The cell values of the raster map (0 or 1) are multiplied by the layer weight prior to the overlay calculation. If the layer weight is 0.5, the raster map will only add the values 0.5*0=0 (features absent) and 0.5*1=0.5 (features present) to the overlay sum. Most of the raster map layers have the default layer weight 1, but a couple of examples illustrate the use of multiple raster maps with different layer weights: For each fishery map (Fredsgaard et al. 2025, Figures 8.10-13), we created two overlapping raster map layers. One with all fishery squares with catch>0 (all fishery areas for the given species). And one with all fishery squares with catch above the average catch in fishery squares with catch>0 (fishery core areas for the species in question). Both layers were given the layer weight 0.5, and so, in the overlay calculation, areas with no fishery add 0+0=0, areas with fishery below average add 0.5+0=0.5, and areas with fishery above average adds 0.5+0.5=1. Another example is muskox and caribou hunting (Fredsgaard et al. 2025, Figures 8.2-6). Here, each theme is also represented by two raster map layers: one with all hunting areas weighted 0.5, and one overlapping layer with hunting core areas weighted 0.5. The same approach was used for the subsistence fishery maps to represent the difference between normal and important fishing areas (Fredsgaard et al. 2025, Figures 8.10-13).

Thus, by creating multiple overlapping, weighted raster layers for one map layer from the reports, we can differentiate between different degrees of importance instead of just presence/absence. When one map layer or "theme" is represented as multiple raster map layers, the layer weights of the raster layers sum to 1, and so one map layer from the reports can at most add the value 1 to the overlay analysis. In this way, the layer weights are also used to reduce the weight of themes represented by several map layers. E.g., there is one map with shoreline oil spill sensitivity and four maps with offshore oil spill sensitivity, one for each season (Fredsgaard et al. 2025, Figures 4.9-10). In order not to inflate the relative importance of offshore vs. coastal oil spill sensitivity, just because offshore sensitivity was reported seasonally, the four offshore raster maps were given the layer weight 0.25.

With the weighting, some layers may add only 0.25 or 0.5 to the overlay sum. This means that the cell values in the overlay analysis result cannot be directly equated with the number of overlapping interests. The resulting cell values should be considered as an index of overlapping interests, and we refer to it simply as an overlay index (OI).

All information on layers weights and representations of maps from Fredsgaard et al. (2025) as multiple weighted raster maps is contained in Table 1.

3.2.6 Representation of seabird colonies

A complex multilayer setup was employed to represent the seabird colonies in the overlay analysis. According to the Bird Protection Act, all seabird colonies have three protection (no-entry) zones: a 100 m zone for drones, a 200-1000 m (species dependent) zone for disturbance and hunting, and a 500-3000 m (species dependent) zone for planes and helicopters. In addition, a few colonies (six in the AOI) are protected and have a 500 m general no-entry zone. In the overlay analysis, every colony is therefore represented by three overlapping raster maps, one for each type of protection zone, and a few with four raster maps (the six protected sites). As these raster maps are weighted 1, every colony adds 3 (or 4) to the overlay calculation, with values growing from 1 at the perimeter of the largest protection zone to 3 (or 4) at the centre of the colony.

While this may seem excessive, we still deemed this implementation to underrepresent the seabird colonies. Generally, there is one layer per species/area type in the overlay analysis (or layer weights sum to 1), but at the seabird colonies in the AOI, up to nine different species breed at the same site. Further, the seabird colonies are assessed to be among the most sensitive, site-specific and irreplaceable biological interests in the analysis area (up to c. 30,000 birds in the same small place every year). So, to better reflect the importance of large/diverse seabird colonies, we added six additional raster maps to the overlay analysis. Three overlapping raster maps represent colonies with 3 or more species, 5 or more species, and 7 or more species. Another three overlapping raster maps represent the top 50% largest colonies, the top 25% largest colonies, and the top 5% largest colonies in the analysis area, measured in terms of the number of breeding birds. The actual areas used in these six raster maps correspond to the largest of the four protection zones of the sites in question.

With this setup, the maximum contribution of a seabird colony to the overlay analysis index is 10, with a median and mean contribution of approx. 4. We consider this to be balanced given the many different species and large number of individuals that breed at these sensitive sites.

4 Results

Three different analyses were conducted: one main analysis including all 81 map layers in Table 1, reflecting both biology, human use and cultural heritage interests (Figures 3 and 7), one sub-analysis including 50 map layers with biological information (Figures 4 and 8), and one sub-analysis based on 39 map layers with information on human use and cultural heritage interests (Figures 5 and 9). It is not possible to make a strict distinction between biological layers and human use layers, mainly because some biological distributions are known only through spatial patterns in human use. Eight map layers are therefore included in both sub-analyses, which means that the sub-analyses are not entirely independent (see the column "Analysis" in Table 1).

As the number of included map layers are different in the three analyses, both the maximum and the median (typical) overlay index (OI) values in the resulting maps also vary. In the main analysis with all map layers, the maximum OI-value is 16.5, and the median is 3. In the biology sub-analysis, the maximum OI-value is 14 and the median is 2, whereas in the human use sub-analysis with fewest map layers, the maximum OI-value is 10 and the median is 1. In Figures 3-5, the colour scale (green->yellow->red) is stretched from the minimum OI-value (0 in all cases) to the maximum OI-value (16.5, 14 and 10, respectively). This approach is chosen to provide as much spatial detail in the maps as possible. However, it means that colours can only be compared within maps, and not between maps (the colour scales are relative to the analysis).

In all three analyses, the OI-values are very unevenly distributed (Figure 6). In the main analysis, approx. 90% of the area of interest has OI-values between 0 and 6.5, whereas areas with OI-values between 6.5 and 16.5 only cover approx. 10% of the AOI. So, most areas have few overlapping interests, and only a small area has many overlapping interests.

While Figures 3-5 show the whole range of OI-values, Figures 7-9 highlight the areas with most overlapping landscape interests. Here, we have mapped the top ~5% and the top ~25% of the area of interest with highest OI-values in each of the three analyses. The actual OI-values corresponding to these area percentage thresholds are relative to the analyses and given in the figures.

4.1 Main analysis of all map layers

The main analysis based on all map layers highlights a large terrestrial area southeast of the inner part of Kangerlussuaq (Søndre Strømfjord), corresponding to the northern part of Angujaartorfiup Nunaa (Figures 3 and 7, see placenames on Figure 2). This is a relatively lush area with many records of e.g. red-listed plants, and a core area for caribou and muskox, and for the hunting of these two species. There are also many other interests present, including archaeological sites, protected areas (Arnangarnup Qoorua/Paradisdalen) and tourist activities (hiking trails, tent camps etc.). This important area continues north of the border of the AOI.

Another large area with many overlapping landscape interests is the mouth of Nuup Kangerlua (Godthåbsfjorden) (Figures 3 and 7). The proximity to Nuuk means many human use interests, both recreational and commercial (fishery, tourism), but there are also several biological interests in the area, including seabird breeding colonies and important seabird wintering areas, as well humpback whale areas with significance for tourism. The rich prehistoric and historic records in the area also mean that there are many cultural heritage sites as well as vulnerable and protected heritage areas.

It is a general tendency in Figures 3 and 7 that areas with many overlapping interests are often clustered around towns and settlements. This is mainly due to current and historic human use activities, the latter witnessed by associated concentrations of heritage sites. The concentration of biological and cultural heritage interests near towns and settlements can partly be explained by a larger research effort (and knowledge) in these areas over time (Madsen et al. 2025), but the deep historical connection between human settlement patterns and occurrence of natural (biological) resources in Greenland probably also plays a part. Thus, both pre-colonial and colonial settlements were often located in areas with many natural resources, and quite often these areas are still biologically important today.

Besides the larger, more continuous areas with many overlapping interests, there are also smaller hotspot, or clusters of hotpots. In this respect, Kangerlussuatsiaq (Evighedsfjorden) and Sermilinnguaq Fjord stand out, primarily because of many, large and species-diverse seabird colonies, but also because of human use interests. Slightly further south, Søndre Isortoq also has large seabird colonies. While these fjords are not entirely red in Figure 7, the hotspots in them are nevertheless connected, because they are part of the same fjord system. Further, the hotspots related to seabird colonies are special because they are site-specific and irreplaceable in the sense that another area cannot compensate for their loss – they are bound to the specific local topography and oceanography (Labansen, 2021). It is noteworthy that Kangerlussuatsiaq, Sermilinnguaq and Søndre Isortoq display significantly more overlapping interests than the outer part of Kangerlussuaq (Søndre Strømfjord) and several of the other fjords, and the reasons behind should be investigated further.

The number of overlapping landscape interests in the two hydropower resource areas are moderate to low (Figures 3 and 7). However, downstream of both hydropower resources there are areas with many overlapping interests.

4.2 Sub-analyses of biological and human use map layers

The results of both sub-analyses resemble the main analysis of all layers, but to varying degrees. The biological sub-analysis (Figures 4 and 8) resembles the main analysis more than the human use sub-analysis (Figures 5 and 9), because of more shared map layers (the main analysis is based on 42 biological layers, 31 human use layers, and 8 layers that are included in both sub-analyses). Compared to the main analysis, the biological sub-analysis gives more relative weight to the terrestrial area in the northern part of Angujaartorfiup Nunaa (vegetation, caribou, muskox, geese etc.). Along the coast, it is mainly areas with many seabirds (breeding colonies and wintering areas) that stand out, and to a lesser degree areas in proximity to towns and settlements. In the human use sub-analysis, on the other hand, areas with many overlapping interests are strongly concentrated around towns and settlements (Maniitsoq, Kangaamiut, and all of Nuup Kangerlua), whereas the northern part of Angujaartorfiup Nunaa is significantly less emphasized (primarily caribou/muskox hunting, heritage sites and tourist activities). In the northern hydropower resource area, there are some smaller areas with OI > 3 in the human use analysis. This is primarily due to combinations of a snowmobile winter-driving zone, area allotments, Asia stations and archaeological sites.

5 Closing remarks

As closing remark to this report, it is worth re-iterating that although the overlay analyses depict an area as red or yellow (high OI-values), it does not necessarily mean that industrial activities will have a high impact here. It does, however, emphasise that, based on our present knowledge, many different landscape interests need to be carefully addressed, if activities are planned here. At the other end of the spectrum, areas with low OI-values do not necessarily guarantee absence of conflicting interest. It needs to be investigated, if the low OI-values are due to lack of landscape interests or lack of knowledge (data gaps). And even if there are only few interests, the ones present still need to be given attention as they may be particularly sensitive to the planned activities. New data will add details to the picture, but overall, we consider the overlay analyses to be robust, as the AOI is a relatively data rich region in Greenland.

The results of the overlay analyses are available at the HydroPower WebGIS and ready to be used in assessments of activity plans for the area. With all the data layers prepared, more specialized analyses with e.g., different layer selections and/or modified layer weights can also quickly be run, highlighting other aspects of the dataset. As activity plans become more concrete and different stressors related to the activities can be more clearly specified, the overlay analysis may be developed into a sensitivity analysis that highlights areas with features sensitive to particular stressors related to the activities. This presupposes that the effects of the stressors on the different species/interests can be quantified, which is challenging but not impossible. In that sense, the overlay analysis should be seen also as tool that can be further developed to support decision making during the hydropower tender process.

6 Figures and tables

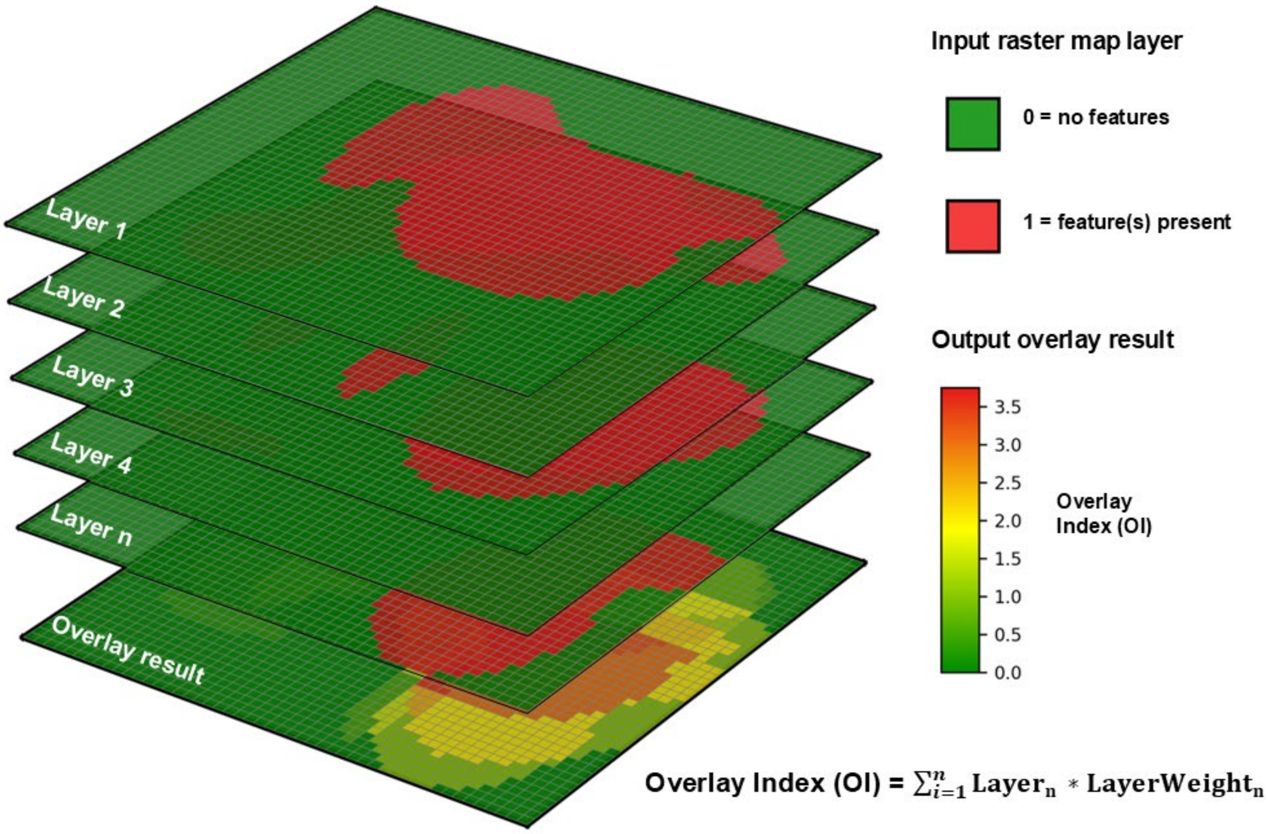

Figure 1. Graphic representation of the overlay analysis method used in the report. The input binary raster map layers are multiplied by their respective layer weights (see table 1) and summed. Thus, in the overlay analysis result layer at the bottom of the stack, the Overlay Index (OI) value of a particular cell is the sum of cell values across all weighted input raster maps in that grid position. Illustration created with aid from Microsoft Office 365 Copilot.

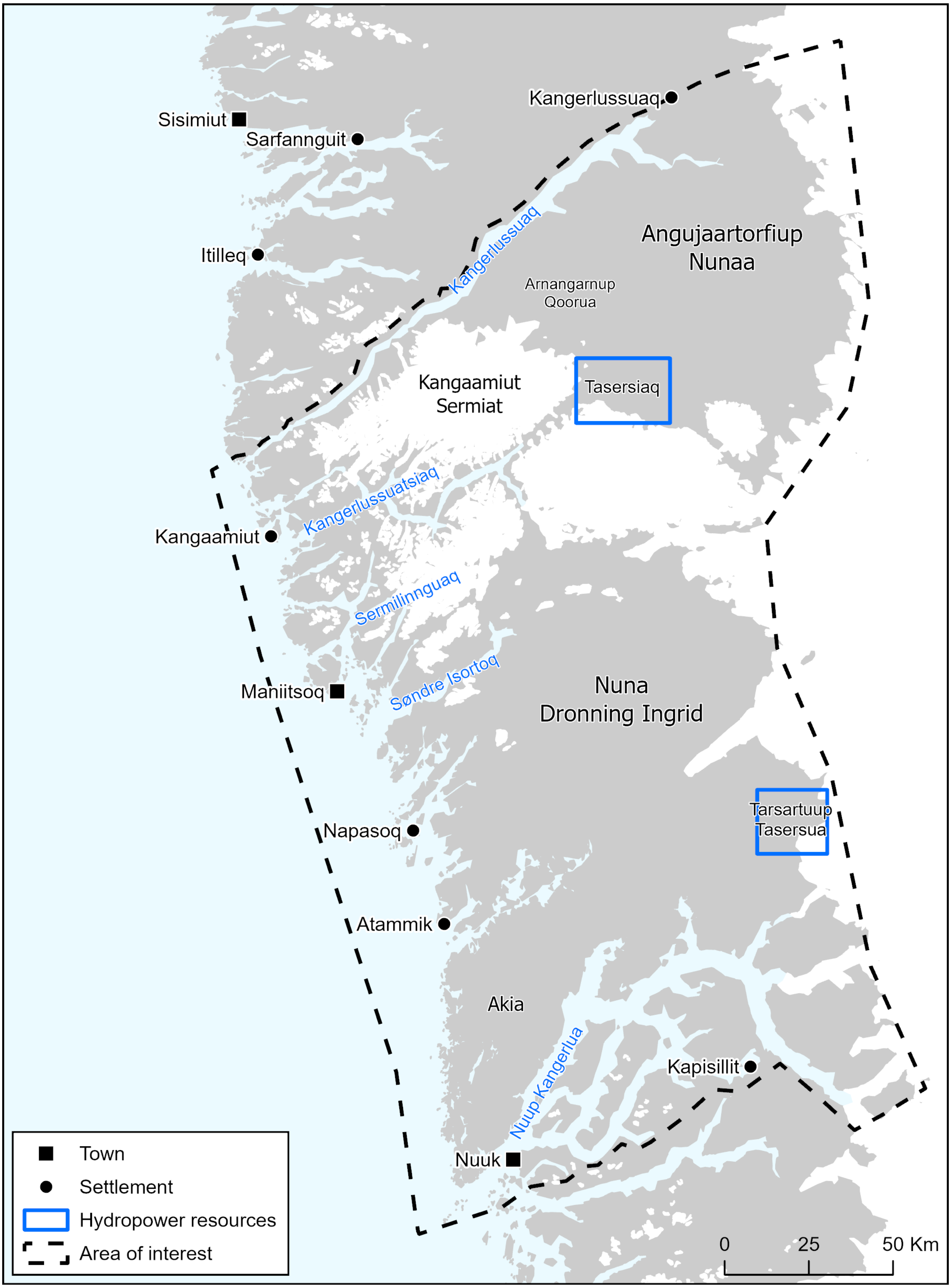

Figure 2. The area of interest (AOI) for the present report, and placenames referred to in the text. The map frame in this and all other maps in the report corresponds to the analysis area (AA).

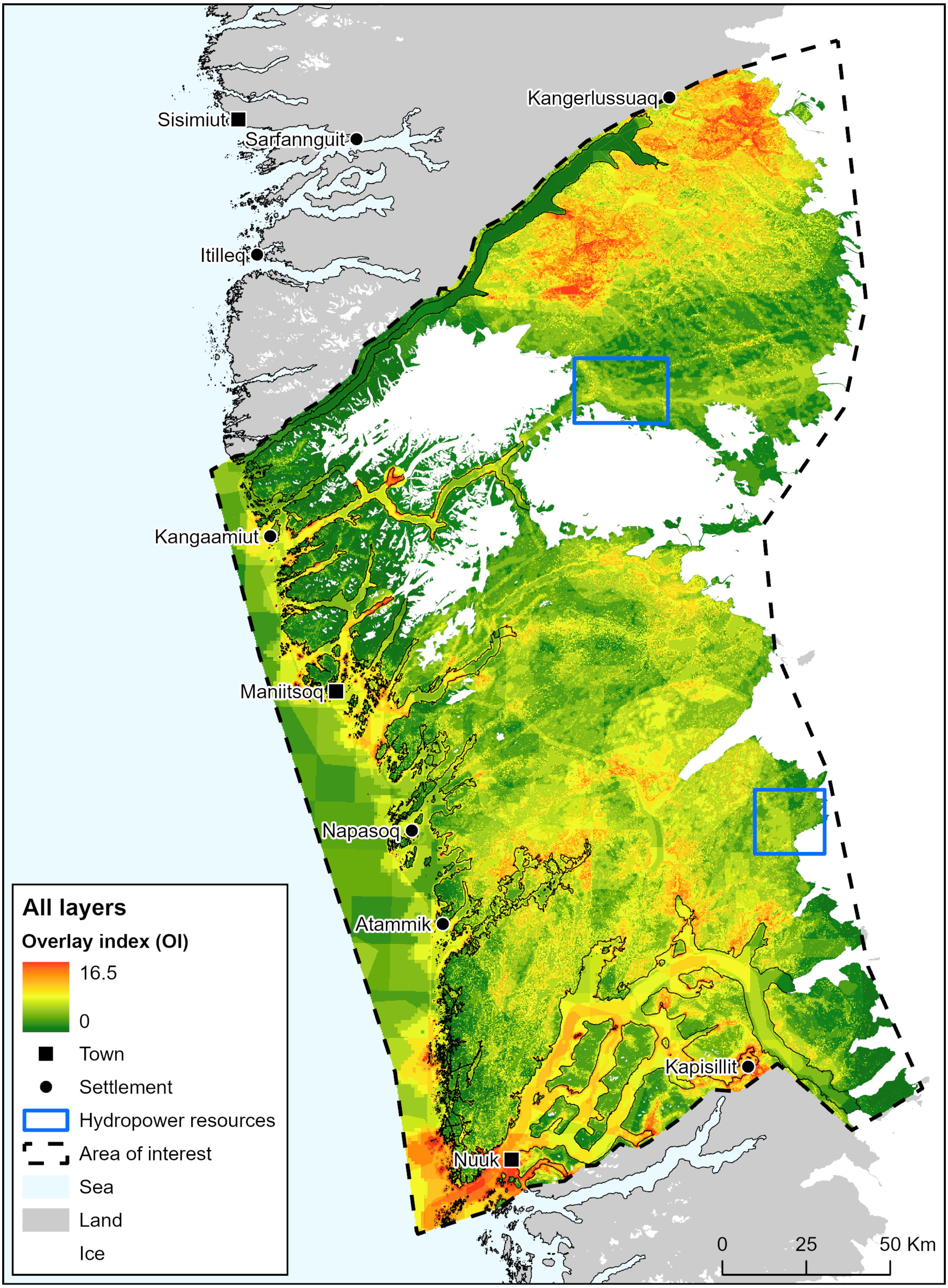

Figure 3. Result of overlay analysis of all map layers (n=81) from Table 1. Note that the colour scale is relative to map and cannot be directly compared to Figures 4 and 5.

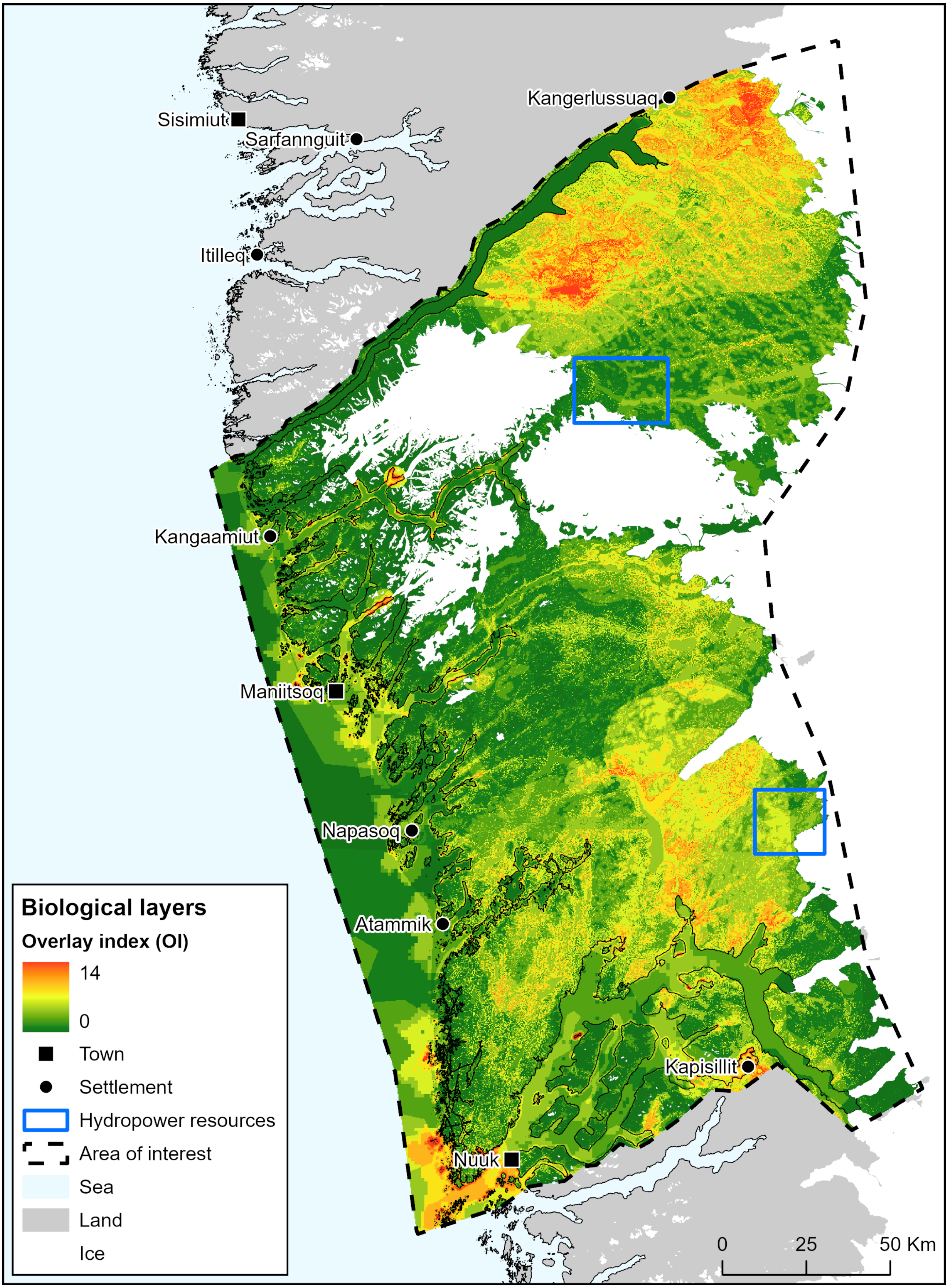

Figure 4. Result of overlay analysis of biological map layers (n=50) from Table 1. Note that the colour scale is relative to map and cannot be directly compared to Figures 3 and 5.

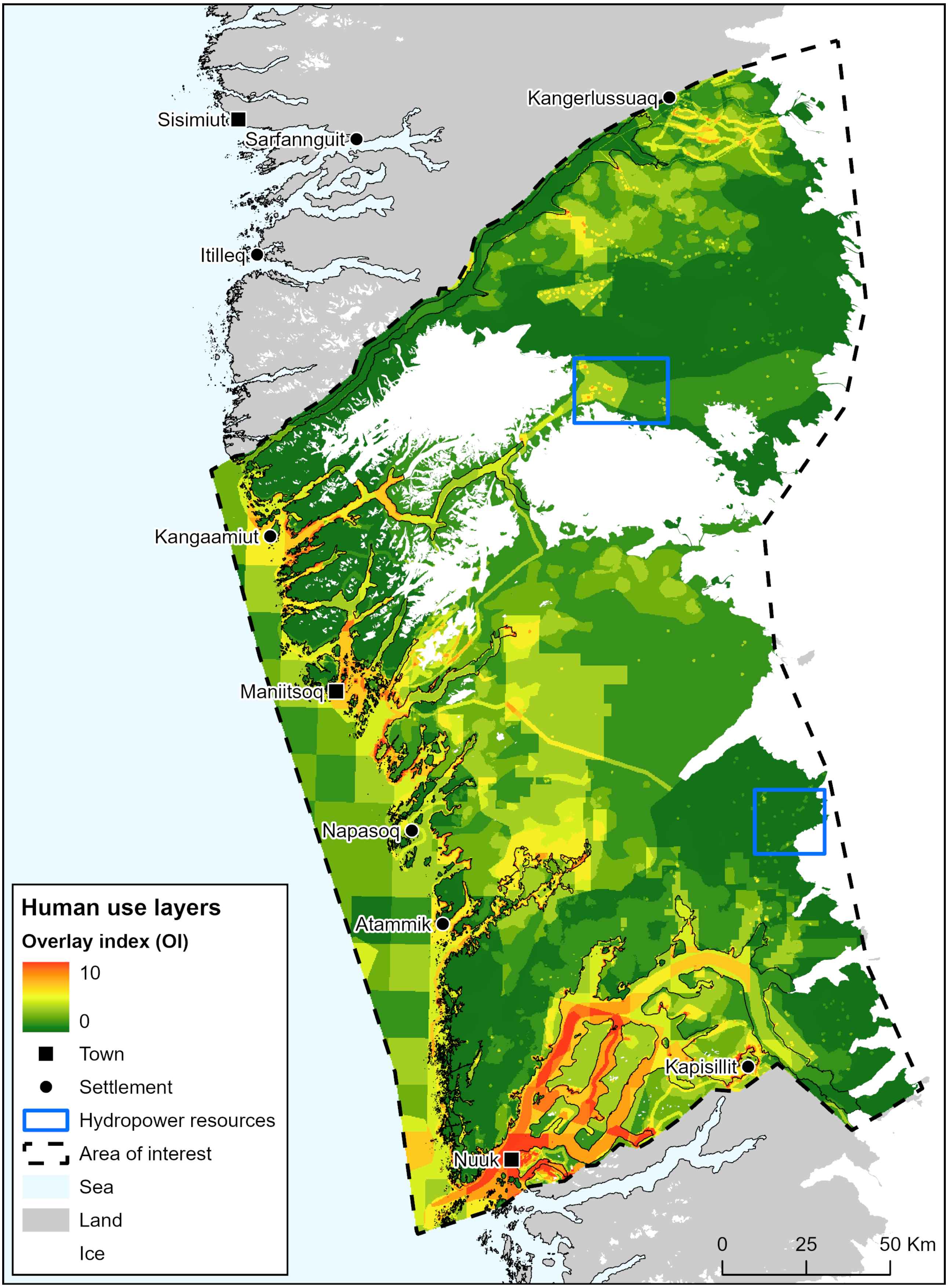

Figure 5. Result of overlay analysis of map layers relating to human use and cultural heritage interest (n=39) from Table 1. Note that the colour scale is relative to map and cannot be directly compared to Figures 3 and 4.

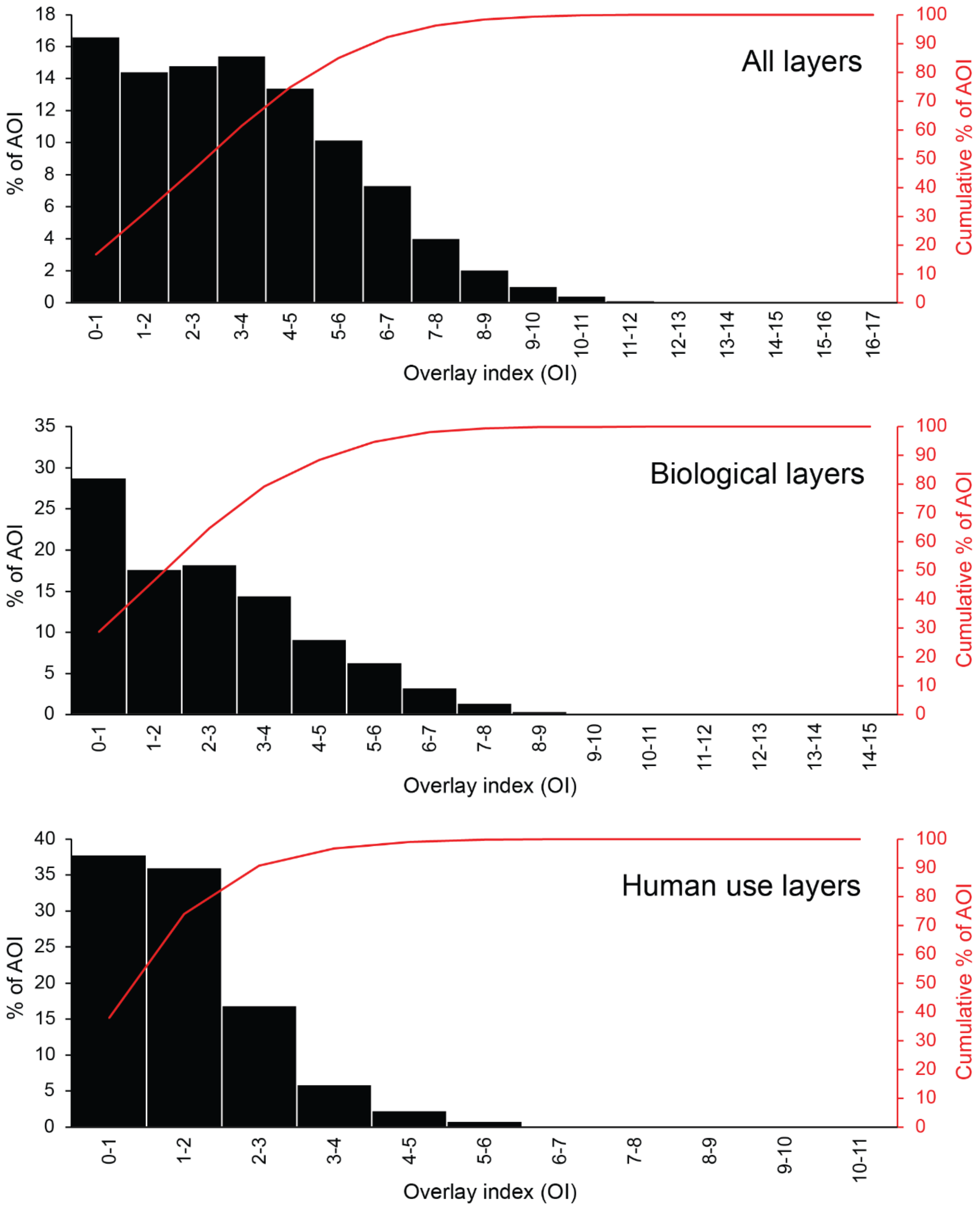

Figure 6. The distribution of overlay index values (OI) in the three overlay analyses. The black bars show how large a percentage of the area of interest (AOI) that is covered by different overlay index values, whereas the red curves are cumulative percentages. In all three analyses, most of the AOI has relatively low OI-values, whereas areas with many overlapping interests only cover a small part of the AOI.

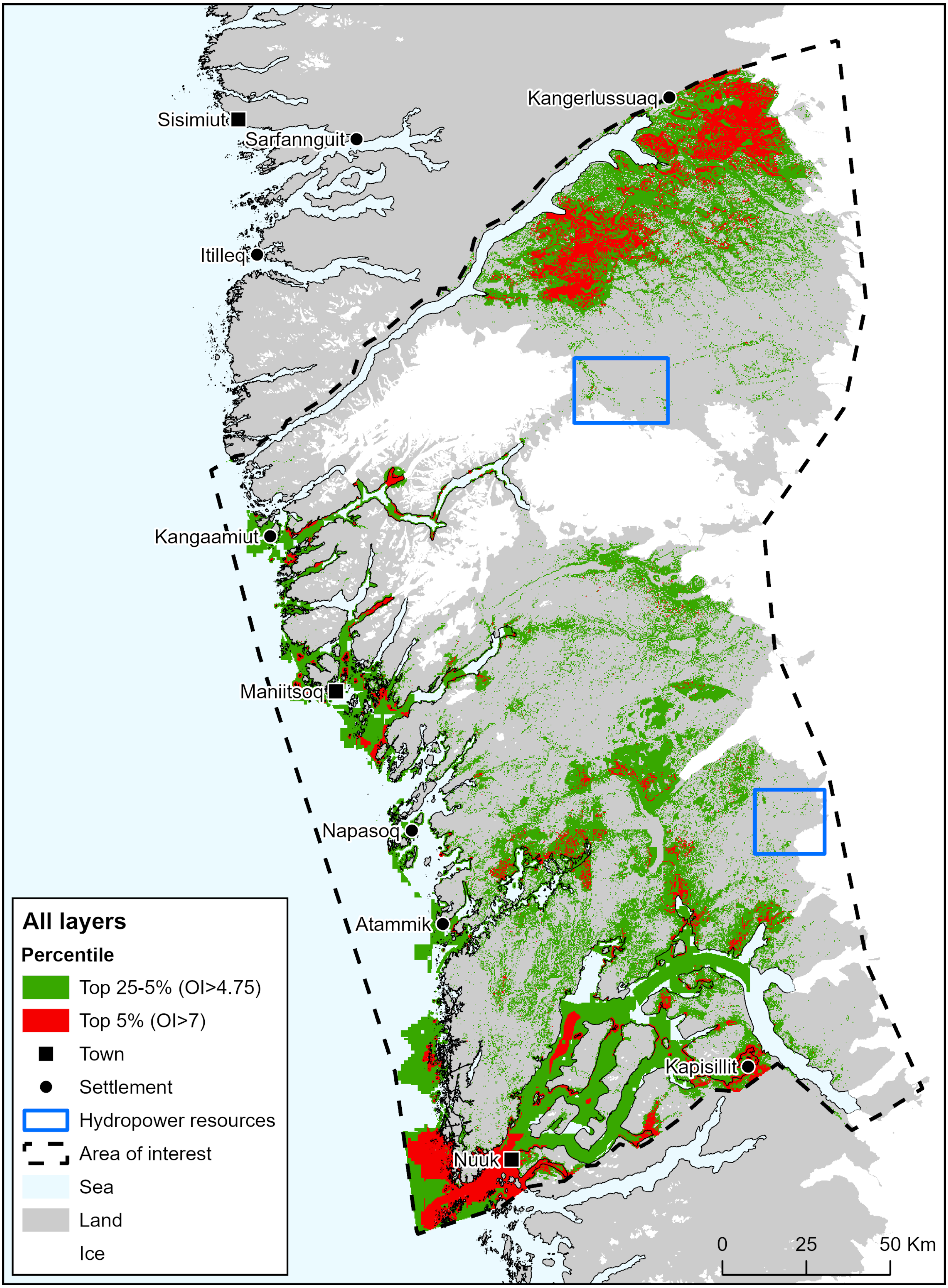

Figure 7. The top 5% (red) and top 25% (green plus red) of the area of interest with most overlapping landscape interests in the overlay analysis based on all map layers (n=81) from Table 1.

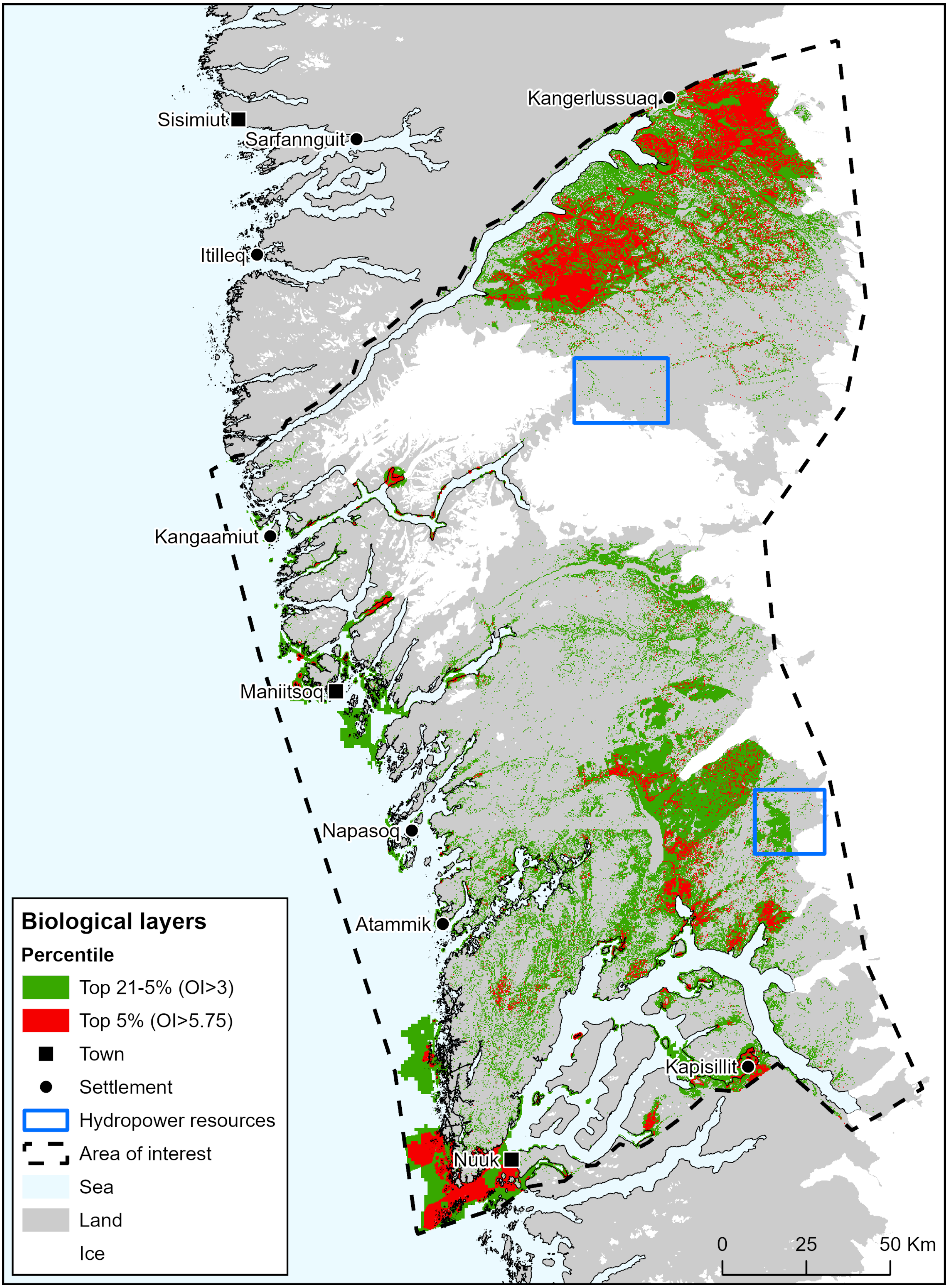

Figure 8. The top 5% (red) and top 21% (green plus red) of the area of interest with most overlapping landscape interests in the overlay analysis of biological map layers (n=50) from Table 1.

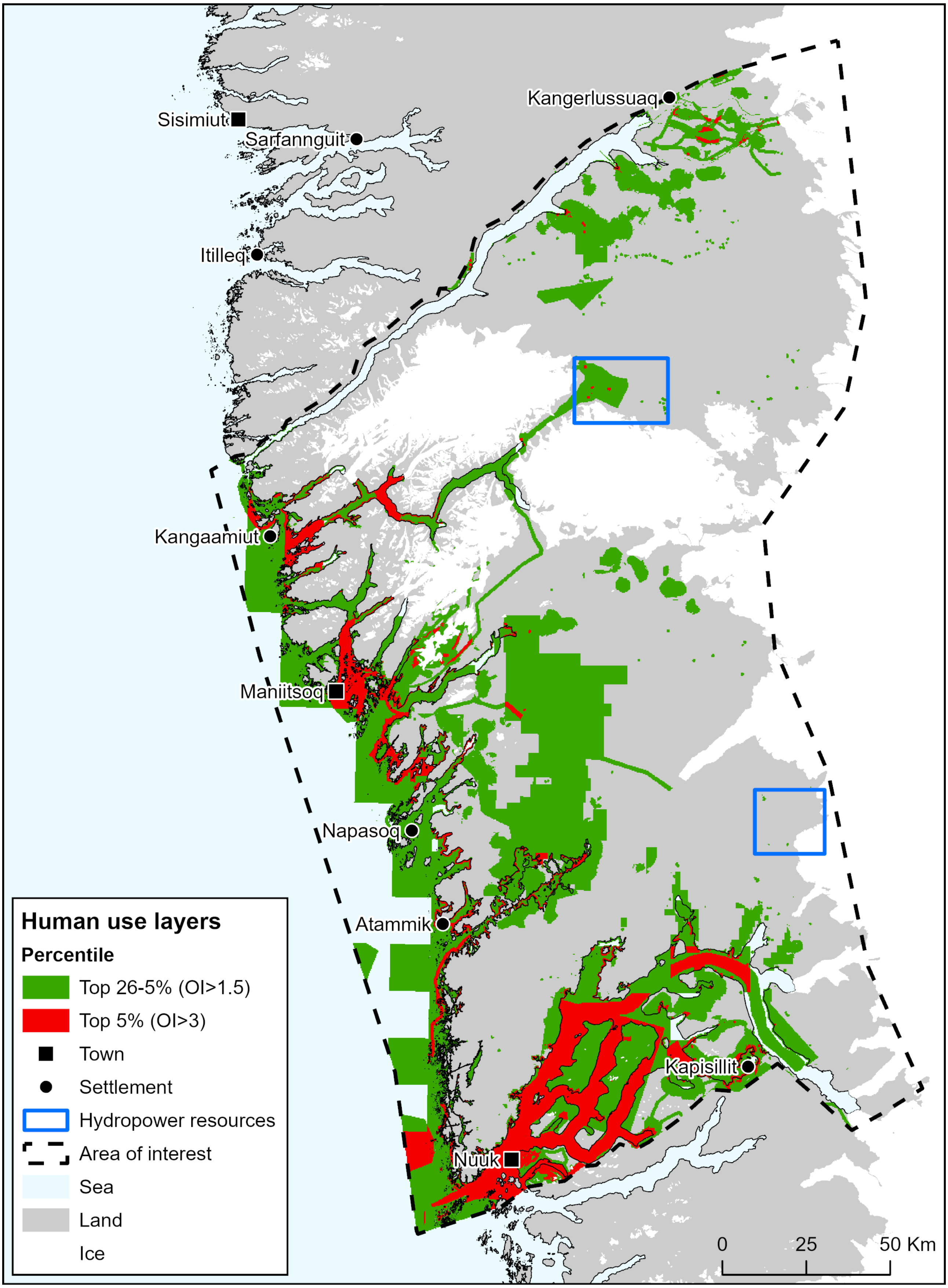

Figure 9. The top 5% (red) and top 26% (green plus red) of the area of interest with most overlapping landscape interests in the overlay analysis of map layers relating to human use and cultural heritage interests (n=39) from Table 1.

Table 1. List of all raster map layers (n=81) included in the three overlay analyses. “Fig” refers to the figure number in Fredsgaard et al. (2025). “Analysis” indicates if the map layer is included in the biological sub-analysis (“Bio”=1, n=50), or the human use sub-analysis (“Hu”=1, n=39), or both. The main analysis includes all 81 map layers. “Layer weight” and “Habitat” are explained in the technical method description. “% of AOI” lists the percentage of the area of interest (AOI) that the map layer covers. “Description” gives details on how the raster map layer was processed and on which data it is based.

Fig	Map layer	Analysis		Layer weight	Habitat	% of AOI	Description
		Bio	Hu				
2.1	Vegetated areas	1		1	Ice free land	17.5	All vegetated areas (dwarf shrub heath, fen, copse) from fig 2.1 in Fredsgaard et al. (2025). Layer only co-vers the area of interest (AOI) in fig. 1 in Fredsgaard et al. (2025), not the remaining part of the overlay analysis area (AA).
2.1	Fen areas	1		1	Ice free land	0.9	All fen areas from fig. 2.1 in Fredsgaard et al. (2025). Layer only covers the area of interest (AOI) in fig. 1 in Fredsgaard et al. (2025), not the remaining part of the overlay analysis area (AA).
	Freshwater systems	1		1	Ice free land	35.7	All freshwater systems (lakes, rivers, small streams) from topographic map of Greenland 1:50.000 (GLV50). As small streams are mapped as line fea-tures, and some lakes are very small polygons, a 177m buffer radius was applied to all features (half analysis cell diagonal) to ensure representation at the analysis resolution (250x250m cells).
2.2	Fertile vegetation	1		1	Ice free land	15.7	All areas with NDVI>=0.5 in fig. 2.2 in Fredsgaard et al. (2025). Layer only covers the area of interest (AOI) in fig. 1 in Fredsgaard et al. (2025), not the remaining part of the overlay analysis area (AA).
2.4	Red-listed plants	1		1	Ice free land	3.9	Included as polygons shown in fig. 2.4 in Fredsgaard et al. (2025) (4 km buffers around sites with red-listed plants).
2.5	Caribou core areas	1		1	Ice free land	24.3	Calculated kernel density (search radius=25km, cell size=250m, population field=flock size) of caribou ob-servations shown in fig. 2.5 in Fredsgaard et al. (2025) and extracted all areas with kernel density >= 0.10 as core areas.
2.5	Muskox core areas	1		1	Ice free land	9.3	Calculated kernel density (search radius=25km, cell size=250m, population field=flock size) of muskox ob-servations shown in fig. 2.5 in Fredsgaard et al. (2025) and extracted all areas with kernel density >= 0.10 as core areas.
2.7	Caribou calving ar-eas 2000	1		1	Ice free land	3.6	Caribou calving areas from year 2000 shown in fig. 2.7 in Fredsgaard et al. (2025).
2.7	Caribou calving ar-eas 2024	1		1	Ice free land	0.7	Caribou calving areas from year 2024 shown in fig. 2.7 in Fredsgaard et al. (2025).
2.8	Harlequin duck breeding sites	1		1	Ice free land	1.0	For each point observation of harlequin ducks in fig. 2.8 in Fredsgaard et al. (2025), the nearest continuous freshwater system from GLV50 was selected and clipped with buffer of 5km radius around the point ob-servation. A 500m buffer radius was subsequently added to the clipped freshwater system polygons to represent the harlequin duck breeding sites.

Fig	Map layer	Analysis		Layer weight	Habitat	% of AOI	Description
		Bio	Hu				
2.10	White-fronted goose spring staging areas	1		1	Ice free land	0.3	White-fronted goose spring staging areas from the WebMap "Areas Important to Wildlife" hosted on NatureMap (https://naturemap-nature.hub.arcgis.com/) and described in Boertmann et al. 2022. Layer serves as substitute for point data in fig. 2.10 in Fredsgaard et al. (2025).
	Goose moulting habitats	1		1	Ice free land	5.5	Potential goose moulting habitat defined as all areas within 250m radius of lakes and rivers (not streams) from GLV50 that have NDVI>=0.5 in fig. 2.2 in Fredsgaard et al. (2025). These criteria are based on Glahder et al. (2010) and Madsen & Mortensen (1987). Layer serves as substitute for old survey data in figs. 2.12 and 2.14 in Fredsgaard et al. (2025).
2.16	White-tailed eagle territories	1		1	Land and sea	0.6	Included as 1km radius buffers around known white-tailed eagle nest sites (confidential data GINR/DCE). Data are shown in summarized form in fig. 2.16 in Fredsgaard et al. (2025).
3.1	Arctic char river mouths with fishery	1	1	0.5	Sea	0.1	Included as 1km radius buffers around all Arctic char fishery sites shown in fig. 3.1 in Fredsgaard et al. (2025).
3.1	Arctic char river mouths with important fishery	1	1	0.5	Sea	0.1	Included as 1km radius buffers around important Arctic char fishery sites shown in fig. 3.1 in Fredsgaard et al. (2025).
3.1	Arctic char coastal netting areas		1	1	Sea	0.2	Included as polygons shown in fig. 3.1 in Fredsgaard et al. (2025).
3.1	Arctic char freshwater systems	1		1	Land	31.2	For each point location with Arctic char fishery shown in fig. 3.1 in Fredsgaard et al. (2025), the nearest continuous freshwater system from GLV50 was selected, and a 500m buffer radius was subsequently added to the selected freshwater system.
4.1	Seabird colony protection zone against drones	1		1	Land and sea	0.1	Seabird colony protection zones against drones from the WebMap "Areas Important to Wildlife" hosted on NatureMap (https://naturemap-nature.hub.arcgis.com/) and described in Johansen et al. (2022). 100m radius around seabird colony sites shown in fig. 4.1 in Fredsgaard et al. (2025).
4.1	Seabird colony protection zone against disturbance	1		1	Land and sea	0.6	Seabird colony protection zones against disturbance from the WebMap "Areas Important to Wildlife" hosted on NatureMap (https://naturemap-nature.hub.arcgis.com/) and described in Johansen et al. (2022). 200m to 1km radius around seabird colony sites depending on the species breeding. Sites shown in fig. 4.1 in Fredsgaard et al. (2025).
4.1	Seabird colony protection zone against overflight	1		1	Land and sea	0.7	Seabird colony protection zones against overflight from the WebMap "Areas Important to Wildlife" hosted on NatureMap (https://naturemap-nature.hub.arcgis.com/) and described in Johansen et al. (2022). 500m to 3km radius around seabird colony sites depending on the species breeding. Sites shown in fig. 4.1 in Fredsgaard et al. (2025).

Fig	Map layer	Analysis		Layer weight	Habitat	% of AOI	Description
		Bio	Hu				
4.1	Seabird colony bird protection area	1		1	Land and sea	<0.1	Seabird colony bird protection areas from the Web-Map "Areas Important to Wildlife" hosted on Na-tureMap (https://naturemap-nature.hub.arcgis.com/) and described in Johansen et al. (2022). 500m radius around selected seabird colony sites designated as bird protection areas. Six of the sites shown in fig. 4.1 in Fredsgaard et al. (2025).
4.2	Seabird colonies with 3 or more species	1		1	Land and sea	0.7	Buffer around seabird colonies with 3 or more different species breeding. The buffer size corresponds to the largest seabird colony protection zone for the given site - either 0.5, 1 or 3 km depending on the species breeding. Protection zones are from the WebMap "Ar-eas Important to Wildlife" hosted on NatureMap (https://naturemap-nature.hub.arcgis.com/), described in Johansen et al. (2022).
4.2	Seabird colonies with 5 or more species	1		1	Land and sea	0.4	Buffer around seabird colonies with 5 or more different species breeding. The buffer size corresponds to the largest seabird colony protection zone for the given site - either 0.5, 1 or 3 km depending on the species breeding. Protection zones are from the WebMap "Ar-eas Important to Wildlife" hosted on NatureMap (https://naturemap-nature.hub.arcgis.com/), described in Johansen et al. (2022).
4.2	Seabird colonies with 7 or more species	1		1	Land and sea	0.1	Buffer around seabird colonies with 7 or more different species breeding. The buffer size corresponds to the largest seabird colony protection zone for the given site - either 0.5, 1 or 3 km depending on the species breeding. Protection zones are from the WebMap "Ar-eas Important to Wildlife" hosted on NatureMap (https://naturemap-nature.hub.arcgis.com/), described in Johansen et al. (2022).
4.2	Seabird colonies, 50% largest	1		1	Land and sea	0.6	Buffer around seabird colonies that are among the 50% largest sites in the analysis area (AA) in terms of number of birds breeding (individuals>= 70). The buffer size corresponds to the largest seabird colony protection zone for the given site - either 0.5, 1 or 3 km depending on the species breeding. Protection zones are from the WebMap "Areas Important to Wild-life" hosted on NatureMap (https://naturemap-na-ture.hub.arcgis.com/), described in Johansen et al. (2022).
4.2	Seabird colonies, 25% largest	1		1	Land and sea	0.4	Buffer around seabird colonies that are among the 25% largest sites in the analysis area (AA) in terms of number of birds breeding (individuals>= 161). The buffer size corresponds to the largest seabird colony protection zone for the given site - either 0.5, 1 or 3 km depending on the species breeding. Protection zones are from the WebMap "Areas Important to Wild-life" hosted on NatureMap (https://naturemap-na-ture.hub.arcgis.com/), described in Johansen et al. (2022).

Fig	Map layer	Analysis		Layer weight	Habitat	% of AOI	Description
		Bio	Hu				
4.2	Seabird colonies, 5% largest	1		1	Land and sea	0.3	Buffer around seabird colonies that are among the 5% largest sites in the analysis area (AA) in terms of number of birds breeding (individuals>= 1720). The buffer size corresponds to the largest seabird colony protection zone for the given site - either 0.5, 1 or 3 km depending on the species breeding. Protection zones are from the WebMap "Areas Important to Wildlife" hosted on NatureMap (https://naturemap-nature.hub.arcgis.com/), described in Johansen et al. 2022.
4.4	Common eider winter concentrations	1		1	Sea	8.1	All areas with common eider density >= 10 indv/km2 in fig. 4.4 in Fredsgaard et al. (2025).
4.4	Long-tailed duck winter concentrations	1		1	Sea	3.6	All areas with long-tailed duck density >= 1 indv/km2 in fig. 4.4 in Fredsgaard et al. (2025).
4.4	King eider winter concentrations	1		1	Sea	1.8	All areas with king eider density >= 5 indv/km2 in fig. 4.4 in Fredsgaard et al. (2025).
4.5	Important area for eiders and waders	1		1	Sea	0.1	Area shown in fig. 4.5 in Fredsgaard et al. (2025).
4.6	Capelin, all fishing areas	1	1	0.5	Sea	1.3	All capelin fishing areas shown in fig. 4.6 in Fredsgaard et al. (2025).
4.6	Capelin, important fishing areas	1	1	0.5	Sea	0.8	Important capelin fishing areas shown in fig. 4.6 in Fredsgaard et al. (2025).
4.6	Capelin spawning areas	1		1	Sea	0.1	Capelin spawning areas shown in fig. 4.6 in Fredsgaard et al. (2025).
4.7	Lumpsucker, all fishing areas	1	1	0.5	Sea	1.2	All lumpsucker fishing areas shown in fig. 4.7 in Fredsgaard et al. (2025).
4.7	Lumpsucker, important fishing areas	1	1	0.5	Sea	0.8	Important lumpsucker fishing areas shown in fig. 4.7 in Fredsgaard et al. (2025).
4.8	Harbour seal, important areas	1		1	Land and sea	0.1	Areas 19 and 23 from fig. 4.8 in Fredsgaard et al. (2025).
4.9	Oil spill sensitivity, priority areas for response	1		1	Sea	0.6	Selected areas for oil spill response in fig. 4.9 in Fredsgaard et al. (2025).
4.9	Oil spill sensitive shorelines	1		1	Land and sea	5.9	500m radius buffer around coastlines with "High" or "Extreme" oil spill sensitivity in fig. 4.9 in Fredsgaard et al. (2025).
4.10	Oil spill sensitive offshore areas, autumn	1		0.25	Sea	12.5	Offshore areas with "High" or "Extreme" oil spill sensitivity in autumn from fig. 4.10 in Fredsgaard et al. (2025).
4.10	Oil spill sensitive offshore areas, spring	1		0.25	Sea	12.5	Offshore areas with "High" or "Extreme" oil spill sensitivity in spring from fig. 4.10 in Fredsgaard et al. (2025).
4.10	Oil spill sensitive offshore areas, summer	1		0.25	Sea	8.7	Offshore areas with "High" or "Extreme" oil spill sensitivity in summer from fig. 4.10 in Fredsgaard et al. (2025).
4.10	Oil spill sensitive offshore areas, winter	1		0.25	Sea	12.5	Offshore areas with "High" or "Extreme" oil spill sensitivity in winter from fig. 4.10 in Fredsgaard et al. (2025).
5.4	Humpback whale photo-ID areas	1	1	1	Sea	2.4	Humpback-whale photo-ID areas from fig. 5.4 in Fredsgaard et al. (2025).
6.1	Kapisillit salmon protection areas	1		1	Land and sea	0.3	Kapisillit salmon protection areas from fig. 6.1 in Fredsgaard et al. (2025).

Fig	Map layer	Analysis		Layer weight	Habitat	% of AOI	Description
		Bio	Hu				
6.1	Drinking water resources		1	1	Land	0.3	Drinking water resource areas from fig. 6.1 in Fredsgaard et al. (2025).
6.1	Protected areas	1	1	1	Land and sea	0.3	Protected areas from fig. 6.1 in Fredsgaard et al. (2025).
6.1	Salt or saline lakes	1		1	Land	<0.1	Salt or saline lakes from fig. 6.1 in Fredsgaard et al. (2025). The features represent 100m radius buffers around salt or saline lakes as stated in the protection act. However, due to the small size of the features an additional 400m buffer radius was applied to all features to ensure representation at the analysis resolution.
	Biological area of interest no 11 and 13	1		1	Ice free land	5.3	Biological area of interest no. 11 and 13 from figs. 53 and 54 in Christensen et al. (2016). In the overlay analysis these areas are implemented as covering only ice-free land.
	Biological area of interest no 16	1		1	Land and sea	11.7	Biological area of interest no. 16 from fig. 55 in Christensen et al. (2016). In the overlay analysis this area is implemented as covering both land and sea.
	Biological area of interest no 10, 12, 14 and 15	1		1	Sea	6.5	Biological area of interest no. 10, 12, 14 and 15 from figs. 53-55 in Christensen et al. (2016). In the overlay analysis these areas are implemented as covering only the sea.
8.3	Caribou hunting, all areas		1	0.5	Ice free land	22.3	All caribou hunting areas 2013-23 from fig. 8.3 in Fredsgaard et al. (2025).
8.4	Caribou hunting, core areas		1	0.5	Ice free land	9.0	Calculated point density (search radius=2.5km, cell size=250m) of all reported caribou kills 2000-23 (point data summarized in fig. 8.4 in Fredsgaard et al. (2025)) and extracted all areas with >= 1 caribou kills per km2 as core areas. Recordings in the city centre of Nuuk were excluded from the point density calculation.
8.5	Muskox hunting, all areas		1	0.5	Ice free land	7.5	All muskox hunting areas 2013-23 from fig. 8.5 in Fredsgaard et al. (2025).
8.6	Muskox hunting, core areas		1	0.5	Ice free land	3.4	Calculated point density (search radius=2.5km, cell size=250m) of all reported muskox kills 2000-23 (point data summarized in fig. 8.6 in Fredsgaard et al. (2025)) and extracted all areas with >= 2 muskox kills per km2 as core areas.
8.10	Lumpfish roe fishery, all areas		1	0.5	Sea	16.3	All fishery squares with lumpsucker roe catch > 0 t in fig. 8.10 in Fredsgaard et al. (2025).
8.10	Lumpfish roe fishery, core areas		1	0.5	Sea	5.4	Calculated average lumpsucker roe catch of all fishery squares with lumpsucker roe catch >0 t in fig. 8.10 in Fredsgaard et al. (2025) and subsequently extracted all fishery squares with lumpsucker roe catch >= the average (30.2 t in AA) as core areas.
8.11	Atlantic cod fishery, all areas		1	0.5	Sea	18.8	All fishery squares with Atlantic cod catch>0 t in fig. 8.11 in Fredsgaard et al. (2025).
8.11	Atlantic cod fishery, core areas		1	0.5	Sea	6.6	Calculated average Atlantic cod catch of all fishery squares with Atlantic cod catch > 0 t in fig. 8.11 in Fredsgaard et al. (2025) and subsequently extracted all fishery squares with Atlantic cod catch >= the average (425.8 t in AA) as core areas.

Fig	Map layer	Analysis		Layer weight	Habitat	% of AOI	Description
		Bio	Hu				
8.12	Greenland halibut fishery, all areas		1	0.5	Sea	12.8	All fishery squares with Greenland halibut catch >0 t in fig. 8.12 in Fredsgaard et al. (2025).
8.12	Greenland halibut fishery, core areas		1	0.5	Sea	3.6	Calculated average Greenland halibut catch of all fishery squares with Greenland halibut catch > 0 t in fig. 8.12 in Fredsgaard et al. (2025) and subsequently extracted all fishery squares with Greenland halibut catch >= the average (76.8 t in AA) as core areas.
8.13	Snow crab fishery, all areas		1	0.5	Sea	11.3	All fishery squares with snow crab catch >0 t in fig. 8.13 in Fredsgaard et al. (2025).
8.13	Snow crab fishery, core areas		1	0.5	Sea	0.5	Calculated average snow crab catch of all fishery squares with snow crab catch > 0 t in fig. 8.13 in Fredsgaard et al. (2025) and subsequently extracted all fishery squares with snow crab catch >= the average (44.8 t in AA) as core areas.
8.14	Municipality plan areas, Qeqqata		1	1	Land	4.1	All area types from Qeqqata municipality plan in fig. 8.14 in Fredsgaard et al. (2025), except vacant areas ("friholdte områder").
8.14	Municipality plan areas, Sermersooq		1	1	Land	0.4	All area types from Sermersooq municipality plan in fig. 8.14 in Fredsgaard et al. (2025), except vacant areas ("friholdte områder").
8.15	Area allocations		1	1	Land and sea	0.6	All area allocations from fig. 8.15 in Fredsgaard et al. (2025). As some features are very small, a 177m buffer radius was applied to all features to ensure representation at the analysis resolution.
8.16	Cabins in Nuuk area		1	1	Land	0.2	Cabins in Nuuk area from fig. 8.16 in Fredsgaard et al. (2025). As the cabins are mapped as point features, a 500m buffer radius was applied to each feature to convert it to an area (a polygon) that can be included in the overlay analysis.
	Cabin areas in Maniitsoq area		1	1	Land	0.2	Cabin areas in Maniitsoq area from fig. 7.16 in Johansen et al. (2008).
	Cabins in Sisimiut area		1	1	Land	<0.1	All cabin types in Sisimiut area from fig. 7.18 in Johansen et al. (2008). As the cabins are mapped as point features, a 500m buffer radius was applied to each feature to convert it to an area (a polygon) that can be included in the overlay analysis.
8.17	Glamping sites in Nuuk areas		1	1	Land	<0.1	Glamping sites from fig. 8.17 in Fredsgaard et al. (2025). As the glamping sites are mapped as point features, a 500m buffer radius was applied to each feature to convert it to an area (a polygon) that can be included in the overlay analysis.
8.17	Hiking trails		1	1	Land	1.5	Hiking trails from fig. 8.17 in Fredsgaard et al. (2025). As the hiking trails are mapped as line features, a 500m buffer radius was applied to each feature to convert it to an area (a polygon) that can be included in the overlay analysis.
8.17	Tent camp sites		1	1	Land	<0.1	Tent camp sites from fig. 8.17 in Fredsgaard et al. (2025). As the tent sites are mapped as point features, a 500m buffer radius was applied to each feature to convert it to an area (a polygon) that can be included in the overlay analysis.

Fig	Map layer	Analysis		Layer weight	Habitat	% of AOI	Description
		Bio	Hu				
8.18	Motorized winter driving prohibited	1		1	Land and sea	18.2	All areas from fig. 8.18 in Fredsgaard et al. (2025), where motorized winter driving is prohibited (with exceptions).
8.18	Motorized winter driving allowed		1	1	Land and sea	28.5	All areas from fig. 8.18 in Fredsgaard et al. (2025), where motorized winter driving is allowed (4 different area types).
8.19	Mineral resources license areas		1	1	Land and sea	10.6	Mineral resources license areas from fig. 8.19 in Fredsgaard et al. (2025).
8.20	Asiaq stations		1	1	Land and sea	0.1	Asiaq stations from fig. 8.20 in Fredsgaard et al. (2025). As the stations are mapped as point features, a 500m buffer radius was applied to each feature to convert it to an area (a polygon) that can be included in the overlay analysis.
8.20	GEM research areas		1	1	Land and sea	1.2	GEM research areas from fig. 8.20 in Fredsgaard et al. (2025).
8.20	Promice stations		1	1	Land and sea	>0.1	Promice stations from fig. 8.20 in Fredsgaard et al. (2025). As the stations are mapped as point features, a 500m buffer radius was applied to each feature to convert it to an area (a polygon) that can be included in the overlay analysis.
	Cultural heritage, protected areas (zone 1)		1	1	Land and sea	0.3	Cultural heritage zone 1 areas (protected areas) from figs. 4-11 in Madsen et al. (2025). As some areas are very small, a 177m buffer radius (=half analysis cell diagonal) was applied to all areas to ensure full representation at the analysis resolution. Layer only covers the area of interest (AOI), not the remaining part of the overlay analysis area (AA).
	Cultural heritage, vulnerable areas (zone 2)		1	1	Land and sea	0.3	Cultural heritage zone 2 areas (vulnerable areas) from figs. 12-31 in Madsen et al. (2025). As some areas are very small, a 177m buffer radius (=half analysis cell diagonal) was applied to all areas to ensure full representation at the analysis resolution. Layer only covers the area of interest (AOI), not the remaining part of the overlay analysis area (AA).
	Cultural heritage, site buffers (zone 3)		1	1	Land and sea	1.0	Cultural heritage zone 3 areas (site buffers) based on recorded heritage sites (green dots) shown in figs. 2-3 in Madsen et al. (2025). Zone 3 is defined as a 250m buffer radius around the site centre point. However, an additional 177m buffer radius (=half analysis cell diagonal) was added to all zone 3 site buffers (total buffer radius 427m) to ensure full representation at the analysis resolution.

7 References

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OVERLAY ANALYSIS OF LANDSCAPE INTEREST IN THE HYDROPOWER TENDER REGION OF CENTRAL WEST GREENLAND

This report presents a GIS-based overlay analysis of landscape interests in Central West Greenland to support the Government of Greenland's hydropower tender process for lakes Tasersiaq and Tarsartuup Tasersua. Using ArcGIS Pro and custom Python scripts, 81 map layers representing biological, human use, and cultural heritage interests are integrated to calculate an Overlay Index (OI), indicating how many interests that overlap in different parts of the landscape. Most of the area exhibits low to moderate OI-values, however with hotspots in the northern part of Angujaartorfiup Nunaa, the mouth of Nuup Kangerlua, and fjord systems hosting sensitive seabird colonies, such as Kangerlussuatsiaq (Evighedsfjorden) and Sermil-innguaq Fjord. The two hydropower resource areas show moderate to low OI-values, but downstream zones of both areas contain multiple interests. High OI-values highlight areas requiring careful consideration, but do not automatically preclude development. Low values may reflect few interests as well as data gaps and warrant careful examination. Accessible via WebGIS, the analysis provides a flexible foundation for strategic planning and environmental impact assessments in the hydropower tender region.

ISBN: 978-87-7648-027-1
ISSN: 2244-9981