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Baltic Sea Maritime Spatial Planning
for Sustainable Ecosystem Services

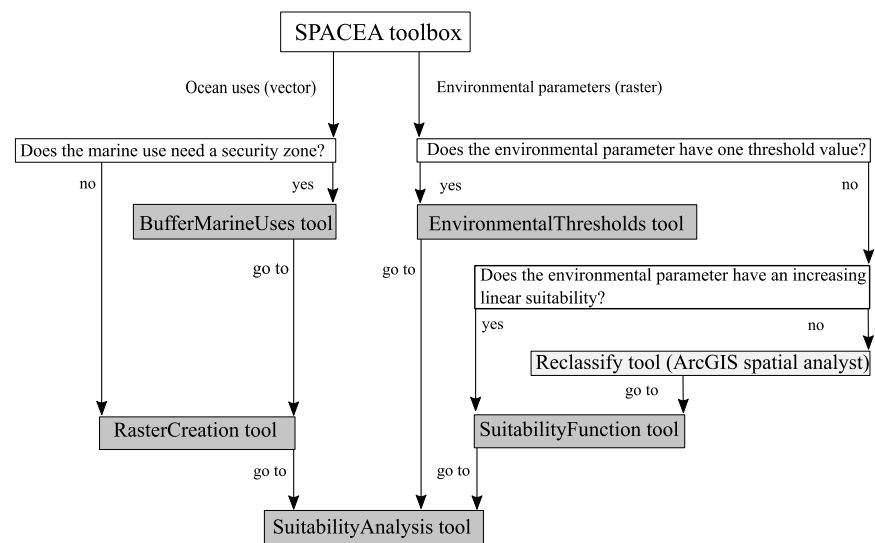
SPACEA: a GIS toolbox to facilitate easy spatial and environmental suitability analysis



suitable space in the sea

ArcGIS toolbox to simplify and bundle GIS analyses for MSP

-  Spacea.tbx
-  Buffer marine uses
-  Environmental thresholds
-  Raster creation
-  Reclassify
-  Suitability Analysis
-  Suitability function



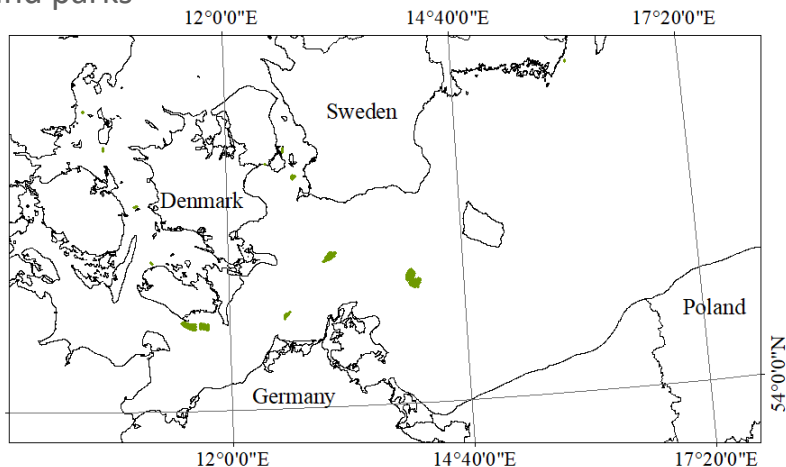
Application of the toolbox



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Marine use data

Wind parks



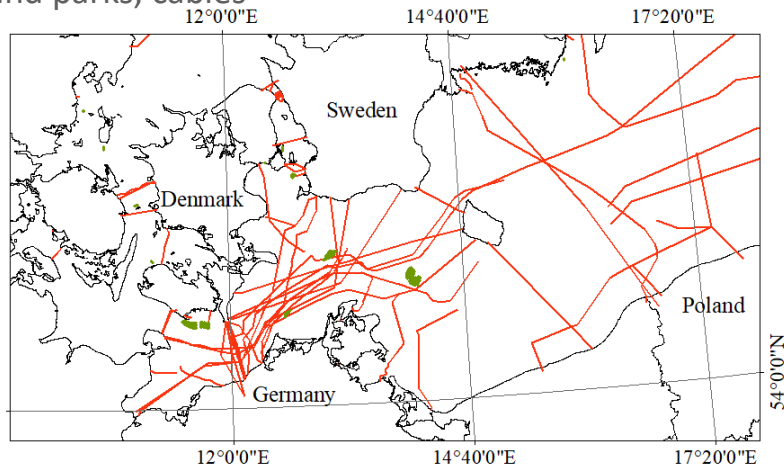
Application of the toolbox



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Marine use data

Wind parks, cables



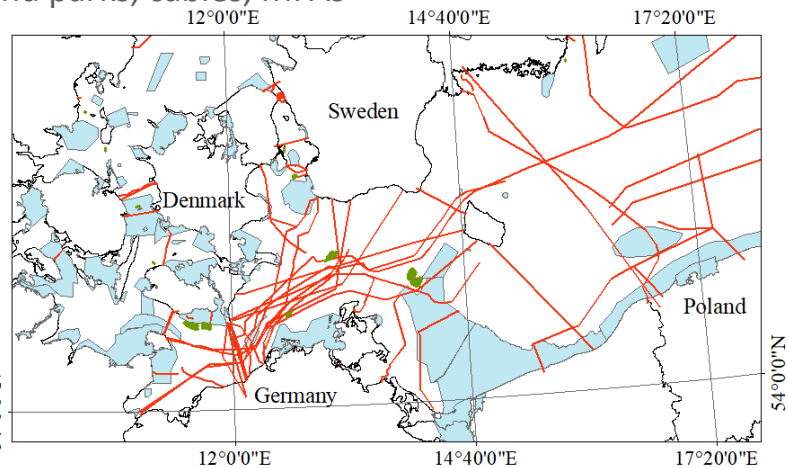
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Marine use data

Wind parks, cables, MPAs

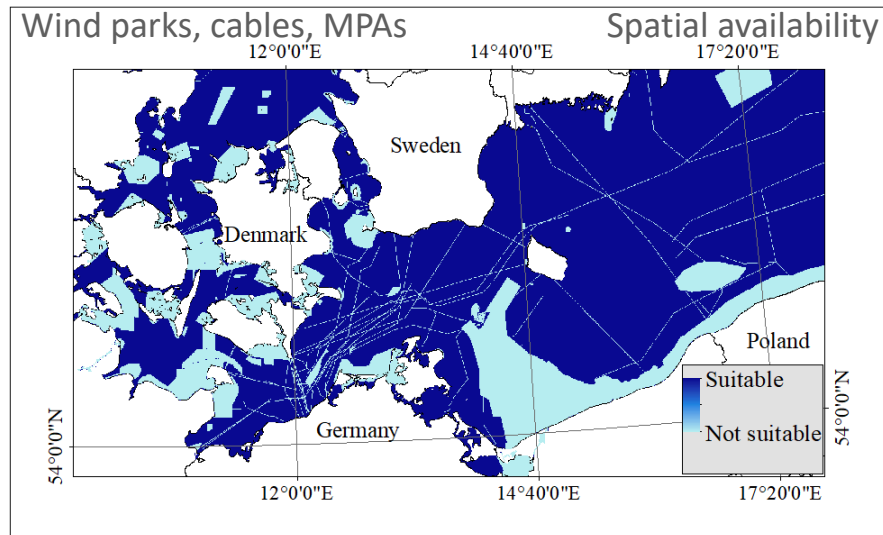


Application of the toolbox



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Marine use data



Application of the toolbox



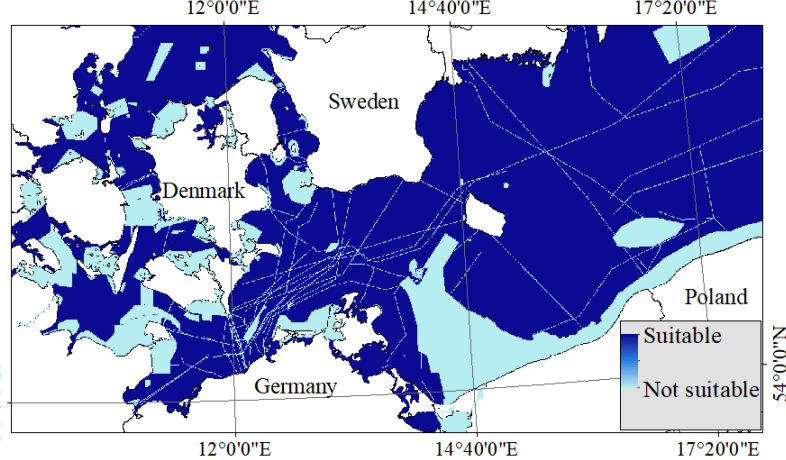
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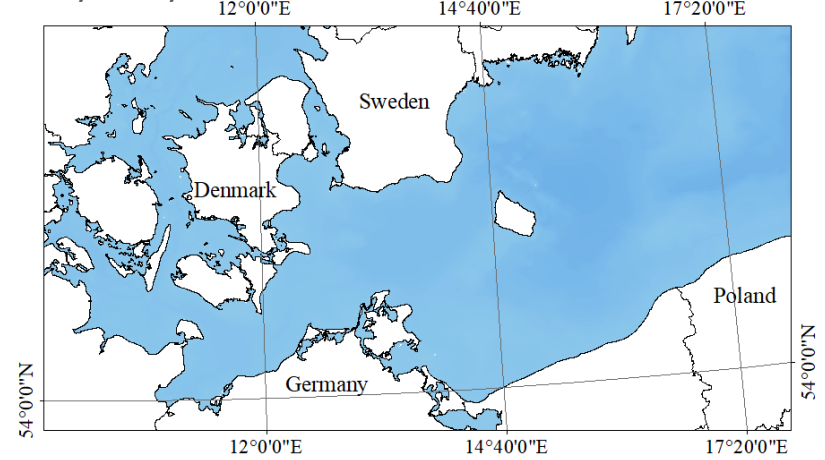
Wind parks, cables, MPAs

Spatial availability

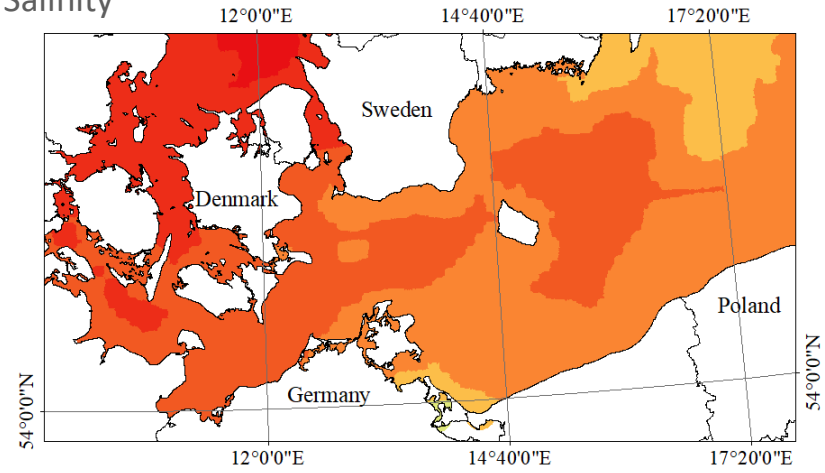


Environmental data

Bathymetry



Salinity

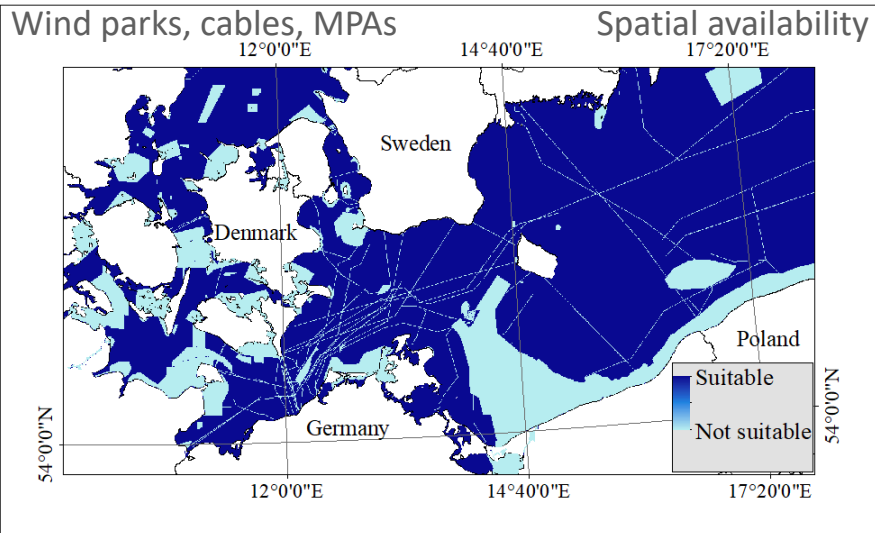


Application of the toolbox

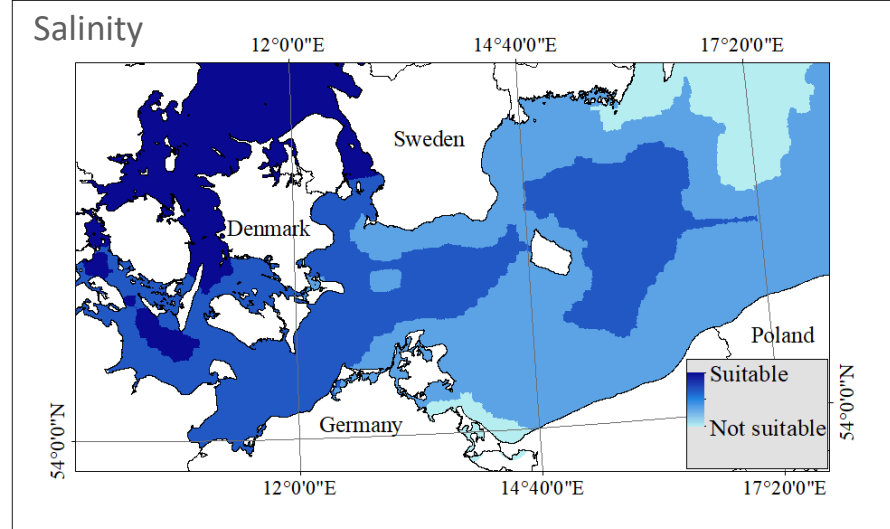
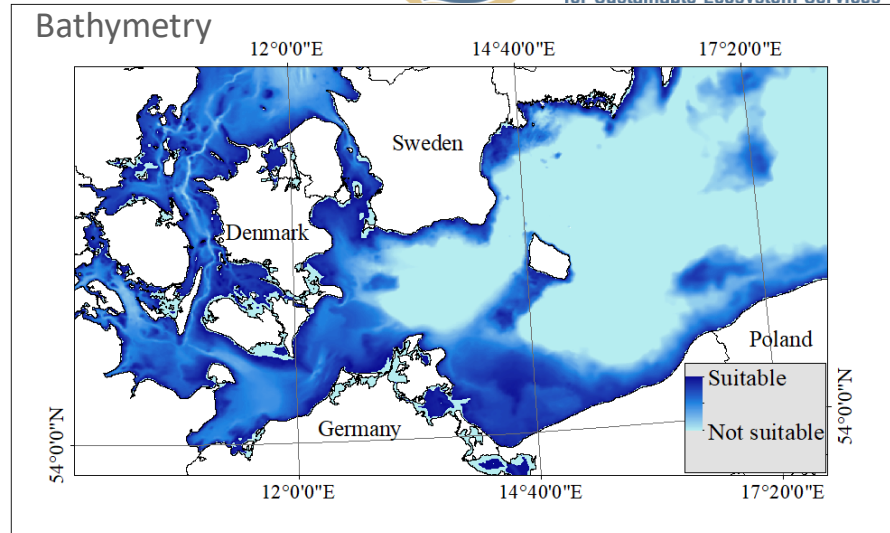


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Marine use data



Environmental data



Application of the toolbox

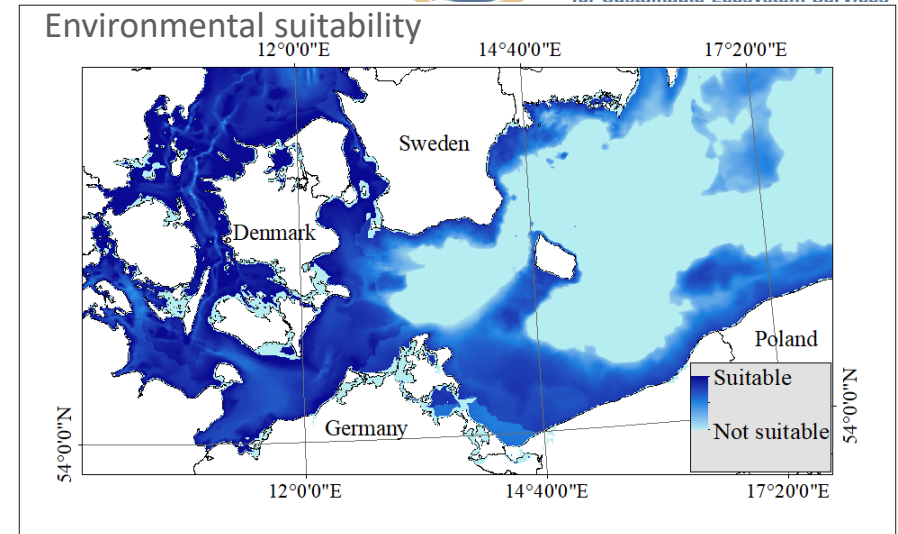
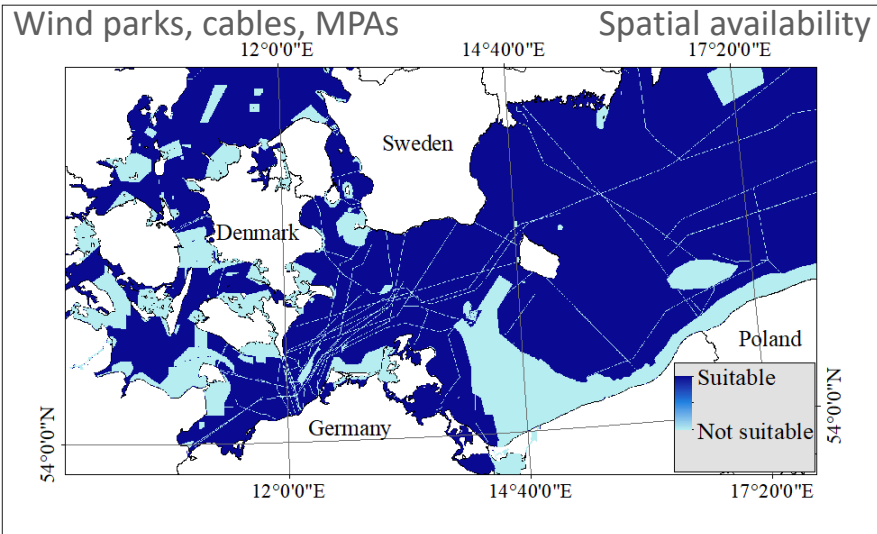


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Marine use data

Environmental data



Application of the toolbox

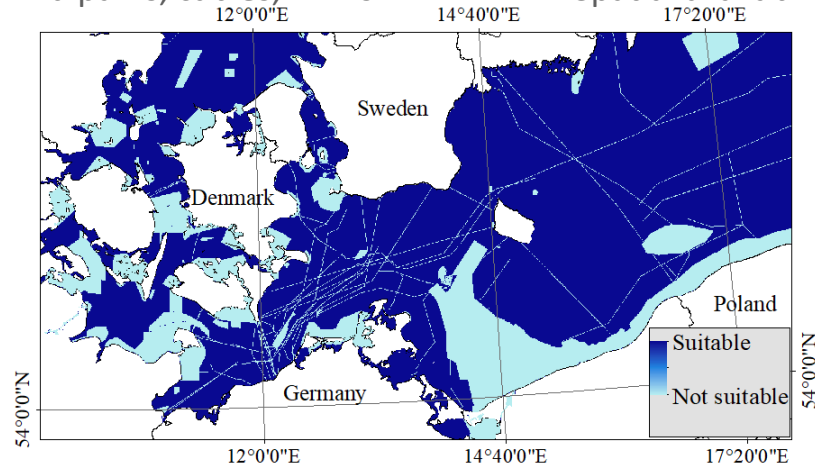


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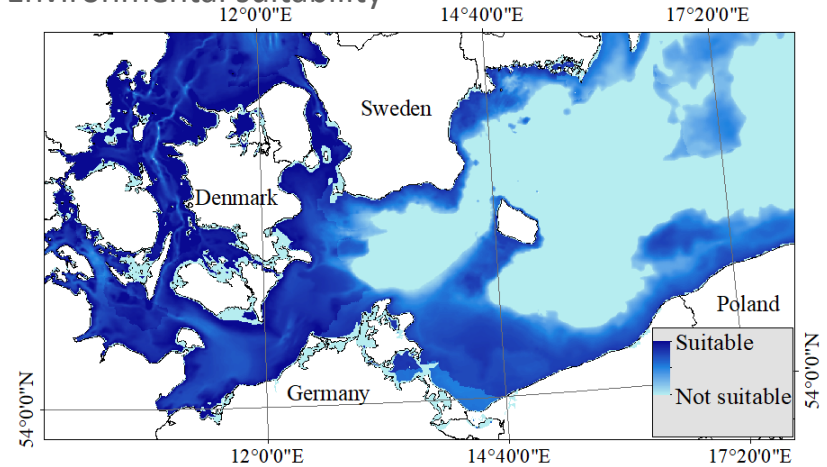
Wind parks, cables, MPAs

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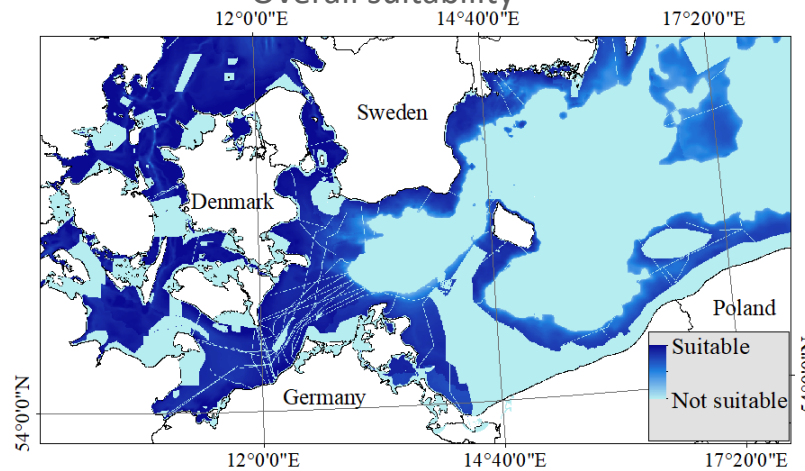


Environmental data

Environmental suitability



Overall suitability



Application of the toolbox



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Application of the toolbox to
a suitability analysis for
mussel farming in the Baltic
Sea

Workflow



BufferMarineUses tool

Input: **wind parks, cables**
Buffer: 500m, 200m
Output: wind500, cables200

RasterCreation tool

Input: **wind500, cables200, Natura2000 areas**
Cell size: 50m
Output: wind_raster1, cabl_raster2, Natu_raster3

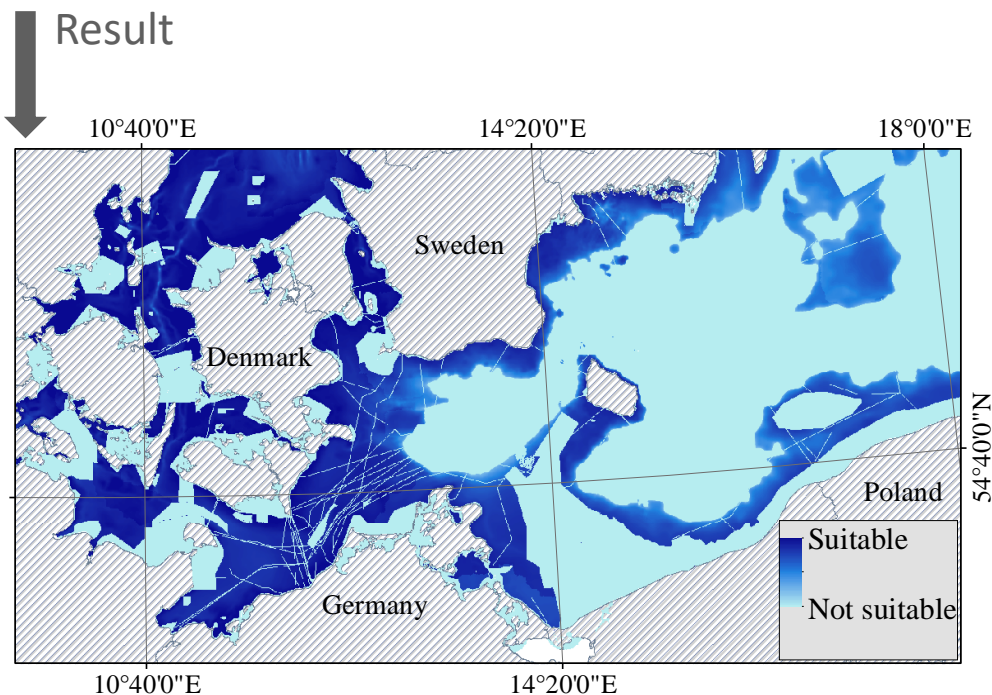
SuitabilityFunction tool

Input: salinity	Input: water depth
min value: 1	min value: -40
value < min value: 0	value < min value: 0
max value: 6	max value: -5
value > max value: 1	value > max value: 0
Output: salinity_1_6	Output: depth_-40_-5

SuitabilityAnalysis tool

Input: **wind_raster1, cabl_raster2, Natu_raster3, salinity, water depth**
Output: **marineUses, environment, suitability**

Result



Applications of tools for MSP



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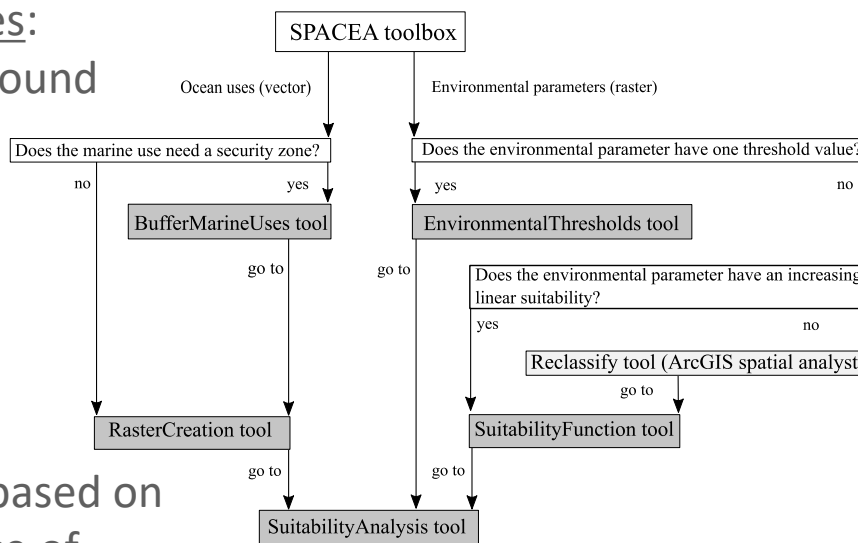
BufferMarineUses:
security zones around
marine uses



RasterCreation: based on
presence/absence of
marine uses



SuitabilityAnalysis: combination of raster layers
to identify suitable areas



EnvironmentalThreshold:
identification of risk or
suitable areas



SuitabilityFunction:
continuous suitability
function for environmental
parameters

- Starting point: existing functionalities in ArcGIS
- Development: custom-made script tools with ArcPy(thon)
- Two key aspects:
 1. User-friendliness:
 - Minimum user input
 - Clear documentation
 - Different access points (tool window, ArcGIS python window, python scripts)
 2. Flexibility:
 - Modular toolbox
 - Single or multiple input layers & values

Limitations:

- Results only as good as quality of input data
- Temporal & vertical dimensions can only indirectly be considered
- Suitability analysis in essence a multi-criteria analysis; so far, no weighting method integrated

Conclusion



- A simple toolbox to process data on marine uses & environmental conditions in a planning area
- Combination of tools results in suitability maps
- Generic functions can be applied to terrestrial planning (e.g. suitability analyses for windparks)
- The spatial (suitability) analyses can provide useful input for the management of both terrestrial and marine areas

Further resources:

von Thenen, M., Hansen, H.S., Schiele, K.S. SPACEA: a custom-made GIS toolbox for basic marine spatial planning analyses. In press. Computational Science and Its Applications -- ICCSA 2020.

Thank you!



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DENMARK



**AARHUS
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