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Mapping Scenarios for the Netherlands in 2050

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ABSTRACT

Maps are powerful tools to communicate and discuss the content of spatial scenarios with policymakers, planners and the public. Scenario projects become more accessible when visually presented by maps, thereby fostering greater understanding of the spatial features and differences. This, in turn, leads to more inclusive and well-informed discussions about possible futures and spatial choices. In 2023, PBL Netherlands Environmental Assessment Agency published a research study including four scenario maps showing what the Netherlands could look like in 2050. This article describes how the scenarios and associated maps were developed and reflects on the multiple functions the maps had in different phases of the scenario study.

KEYWORDS

Mapping; Spatial Planning; Scenario Method; Research by Design; Multidisciplinary Approach

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Introduction

In March 2023, PBL Netherlands Environmental Assessment Agency published the scenario study Ruimtelijke Verkenning 2023 (Spatial Outlook 2023), containing four spatial scenarios for the Netherlands in 2050.[1] In this multidisciplinary scenario study, a combination of storylines, maps and other visualizations was elaborated on to explore and describe what the country could look like following a transition towards a climate-neutral and circular society (Fig. 1).

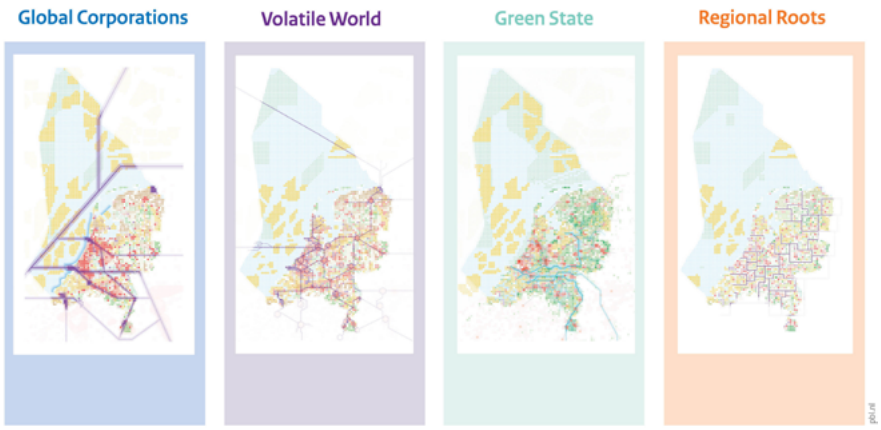

FIG. 1 Conceptual maps of the four spatial scenarios of the Spatial Outlook 2023, source: PBL and PosadMaxwan

The four scenarios presented in the Spatial Outlook 2023 have enabled policymakers and planners to understand, explore and discuss advantages, disadvantages and possible conflicts of spatial choices.[2] Maps played an important role during the scenario development process and were crucial in the presentation of the four scenarios upon publication. Maps, with their ability to convey spatial relationships and patterns,[3] are powerful tools to help develop spatial scenarios and to help communicate and discuss the content of the given scenarios with policymakers, planners and the public.[4] This article describes how the scenarios and associated scenario maps were developed by applying a multidisciplinary and participatory approach and by combining geospatial modelling

1 PBL – Netherlands Environmental Assessment Agency. Ruimtelijke Verkenning 2023. (The Hague: PBL, 2023).

2 Kersten Nabielek, David Hamers and Rienk Kuiper "Spatial Scenarios as a Tool For Future-Proof Spatial Planning in the Netherlands" (Proceedings of the AESOP Annual Congress 2024): 2320-2333. https://www.pbl.nl/system/files/document/2024-07/pbl-2024-spatial-scenarios-as-a-tool-for-future-proof-spatial-planning-in-the-netherlands-5593.pdf

3 Carola Hein and Yvonne van Mil. "Towards a Comparative Spatial Analysis for Port City Regions Based on Historical Geo-spatial Mapping," PORTUSplus. 8 (2019), https://portusplus.org/index.php/pp/article/view/189.

4 Christian Salewski. Dutch New Worlds, Scenarios in Physical Planning and Design in the Netherlands, 1970-2000. (Rotterdam: 010 publishers, 2012).

techniques with creative methods of research by design.[5] Moreover, this article reflects on the multiple functions the maps had during the research phase, in the publication phase and in the post-publication, dissemination phase.

Spatial Challenges in the Netherlands

Before describing the development of scenarios and the maps in more detail, it is important to provide more insight into the Dutch situation and context regarding spatial planning. The Netherlands faces major challenges in the field of the living environment, such as building houses and creating space for industry, mobility and nature.[6] Additionally, there is the ambition to realize several transitions (fundamental system changes) towards a more sustainable economy and society. This includes making the energy supply climate-neutral, making the economy circular and adapting cities to climate change. Meeting the environmental challenges and realizing the sustainability transitions will require major spatial interventions, such as the construction of wind and solar parks and the redevelopment of rural and urban areas.

Scenarios as a Tool in Policymaking Processes

Although the scenarios of the Spatial Outlook 2023 were created to support national policies, they are also useful for provincial, regional and municipal policies. Dutch provinces and municipalities are in the process of making or updating their spatial and environmental strategies. In all these trajectories, scenarios can help policymakers to develop more coherent and future-proof spatial and environmental policies.

However, applying scenarios in a policy context can be challenging and most policymakers are not used to working with scenarios. Therefore, PBL offered support to organize workshops to put the scenario method into practice after the publication of the scenario study. Between Spring 2023 until the end of 2024, the PBL project team organized more than 200 activities to raise awareness of the scenarios involved and to promote the use of the scenario study in general. These activities were named 'Spatial Outlook on Tour' and included giving presentations, organizing workshops and participating in conferences and exhibitions.[7]

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5 PBL. Vier scenario's voor de inrichting van Nederland in 2050. Ruimtelijke Verkenning 2023, Achtergrondrapport. (The Hague: PBL, 2023).

6 PBL – Netherlands Environmental Assessment Agency. Grote opgaven in een beperkte ruimte. (The Hague: PBL, 2021).

7 Ed Dammers, Rienk Kuiper, Kersten Nabielek and Leo Pols, Scenario's voor beleidsvisies: een handreiking. (The Hague: PBL, 2025).

About the Making of the Scenarios

The Spatial Outlook 2023 builds on societal values developed in PBL's Rehearsing the Future report.[8] Whereas the report Rehearsing the Future did not include maps of possible future spatial land use, the ambition of the Spatial Outlook 2023 was to create four integral maps of what land use in the Netherlands could look like in 2050. Four scenarios were developed, reflecting diverse societal preferences, and focused on five key themes **(Fig. 2)** aligned with the Dutch national spatial and environmental strategy (NOVI).[9] Created over two years (2021–2023) by PBL and several advisory research partners, the scenarios emphasize the transition to a circular, climate-neutral society by 2050 and are based on demographic projections and GIS modeling.

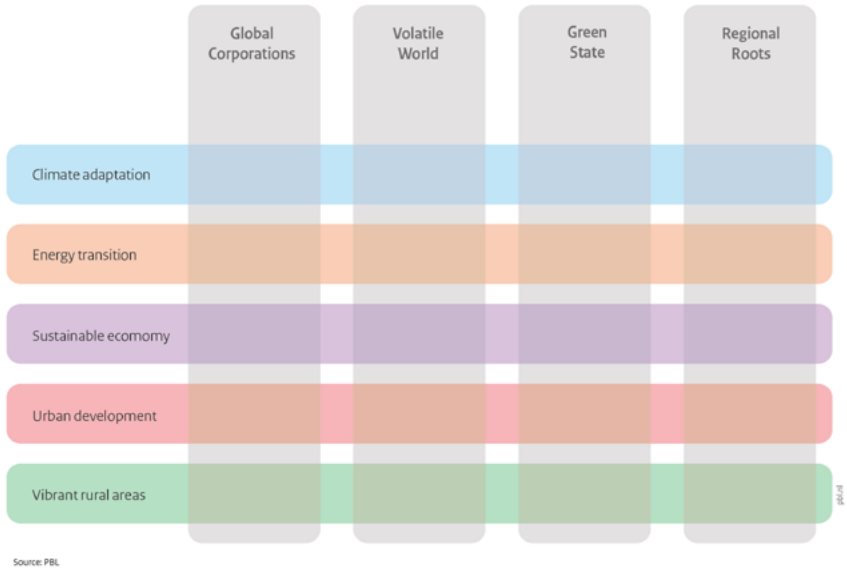

FIG. 2 Four scenarios and five main themes of the Spatial Outlook 2023, source: PBL

An interactive process with experts and stakeholders, including policymakers, shaped the scenario narratives and maps. Workshops with policymakers and stakeholders helped refine the maps, later published in a book and online with an interactive maps viewer.[10] While the maps are not prescriptive blueprints, they inspire policymakers and adapt to various spatial contexts **(Fig. 3)**. After the publication, PBL conducted lectures and workshops, using the maps to clarify planning concepts, explore scenarios, and promote understanding of spatial patterns.

8 PBL, Rehearsing the Future. (The Hague: PBL, 2020).

9 BZK, Nationale Omgevingsvisie. (The Hague: PBL, 2020).

10 https://themasites.pbl.nl/scenarios-inrichting-nl2050

FIG. 3 Translating national scenario maps of the Spatial Outlook 2023 to regional scenario maps in a workshop with stakeholders and spatial designers, source: PBL

About the Making of the Maps

As mentioned earlier in this article, the process of mapping and the final maps themselves played an important role in the different phases of the scenario study. Spatial scenarios can be visualized in various ways: through maps, but also through collages, artist impressions, photo editing and the like. The visualizations are especially suitable for analyzing and depicting the future use of space according to the scenarios. In addition, the visualizations help to make the content of the scenarios visible in concrete terms, which helps to communicate with the users of the scenarios. For instance, well-chosen and appropriate visual language can make the essence of the scenarios clear even at a glance. Furthermore, a vivid visualization can increase the imaginative power of the scenarios, which equally enhances communication.[11]

The design process of making the maps for the four scenarios started with the ambition to create integral and legible maps with a certain level of detail for the Netherlands in 2050. The challenge while making the maps was to find a good balance between making the maps easy to understand for national policymakers and the general public and, at the same time, making the maps detailed enough to be useful for regional and local policymakers and planners. As spatial planning in the Netherlands has been decentralized from the national government to provinces and municipalities in the past decades, spatial planning decisions are mostly taken a decentral level.[12]

11 Christian Salewski. Dutch New Worlds, Scenarios in Physical Planning and Design in the Netherlands, 1970-2000. (Rotterdam: 010 publishers, 2012).

12 Kersten Nabielek, David Hamers and Rienk Kuiper. "Spatial planning in times of uncertainty," Informationen zur Raumplanung 4/2022 (Bonn: BBSR, March 2023): 134-145.

Netherlands Now as Design (NNAO 1987) | The Netherlands 2030 (RPD 1997) | The Netherlands in the Future (MNP 2007) | Spatial Outlook 2023 (PBL 2023)

FIG. 4 Four national spatial scenario studies from 1987 to 2023, source: PBL

A Dutch Tradition of Mapping Scenarios

Since 1987, a national scenario study with spatial maps has been published more or less every ten years in the Netherlands **(Fig. 4)**. With the publication of Spatial Outlook 2023, PBL participated in this tradition.

The study The Netherlands Now as Design (NNAO)[13] was the first design-based scenario study to explore the spatial development of the country in a comprehensive way. The scenario study succeeded in developing four desirable scenarios based on underlying values, thereby enabling the possibility of discussing a desirable future rather than propagating a specific future. While the maps in NNAO (1987) and The Netherlands 2030 (1997)[14] were manually drawn in explorative and artistic manners, the maps in The Netherlands in the Future (2007)[15] were the result of precise GIS-based land use modelling. Whereas the maps of NNAO were criticized for being too artistic and not always readable,[16] the maps of The Netherlands in the Future were criticized for being too technical and overly precise, making them look like plans rather than exploratory scenarios. Reflecting on the methods of mapping in earlier scenario studies, the project team of the Spatial Outlook 2023 therefore decided to develop detailed maps based on GIS land use modelling and to complement and improve the readability of the maps with creative and participatory methods of research and design.

13 Stichting Nederland Nu als Ontwerp. Nieuw Nederland: ontwerp van ontwerp – Nieuw Nederland 2050. (The Hague: Staatsuitgeverij, 1987).

14 RPD. Nederland 2030 – Perspectieven. (The Hague: VROM, 1997).

15 MNP. Netherlands in the Future. Second Sustainability Outlook, the physical living environment in the Netherlands. (Bilthoven: MNP, 2007).

16 Christian Salewski. Dutch New Worlds, Scenarios in Physical Planning and Design in the Netherlands, 1970-2000. (Rotterdam: 010 publishers, 2012).

Sketch Maps, Detailed Maps and Conceptual Maps

At an early stage of the research, sketch maps for the four scenarios were drawn with coloured pencils on top of printed base maps of the country. These initial rough sketch maps helped to communicate basic spatial developments and features related to the storylines of the scenarios in meetings with the project team and in the national workshops with stakeholders. After the initial phase with the sketch maps, detailed maps were generated based on land use modelling by applying the models Land Use Scanner (PBL) and the Model for Nature Policy (WUR). Finally, the detailed maps derived from the GIS modelling were enriched, edited and graphically stylized by a team of urban designers to create comprehensive and readable maps.

The central ambition for the scenario maps was to give general input for the national spatial and environmental planning strategy as well as more detailed map information for local and regional planning strategies. Therefore, the decision was made to create two types of maps for the publication: detailed maps and conceptual maps. After the detailed maps were produced by a combination of GIS land use modelling and research by design methods, the designers made a strongly simplified and stylized version of the maps (Fig. 1). These conceptual maps have a more iconic character and only show the most important spatial elements. That makes them easier to read and more accessible for both policymakers and the general public.

GIS-Based Land Use Modelling

The Land Use Scanner is a GIS-based spatial allocation model containing an extensive database of maps of existing land use in Nederland (infrastructure, buildings and other land use), ownership and spatial and environmental law provisions.[17] From the database, the local availability and suitability of specific locations for possible transformations for each scenario were derived, for example, from industrial sites or agricultural land to new residential neighborhoods (Fig. 5). Based on the scenario and model logic, the Land Use Scanner quite literally maps the most probable transformations and their effects on land use. This is done very precisely on a grid with a resolution of 25 x 25 meters.

17 Jip Claassens, Eric Koomen and Bart Rijken. "Actualisering landgebruiksimulatie Deltascenario's: Achtergronddocument bij Ruimtescanner inzet," Spinlab Research Memorandum, Volume 12. (Vrije Universiteit Amsterdam, 2017).

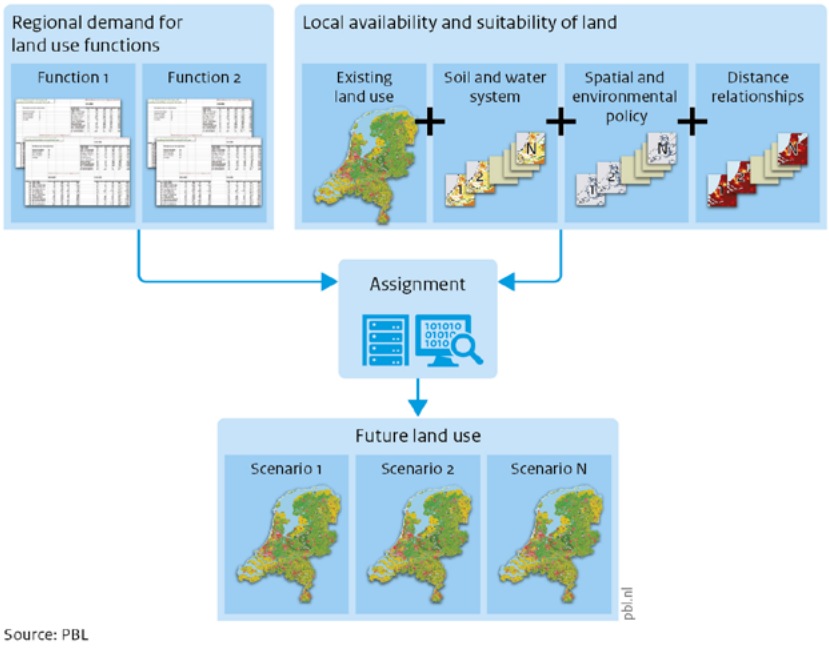

FIG. 5 Work process of the PBL Land Use Scanner, source: PBL

Research by Design

The Land Use Scanner is a very capable tool to create maps for the development of housing areas, business areas, wind parks and solar parks. However, other topics, such as the spatial effects of a circular economy, spatial interventions related to climate adaptation and the spatial development of the North Sea, cannot be modelled by the Land Use Scanner. Therefore, additional map layers were added using research by design methods. Central to research by design is the use of empirical evidence to inform options and decisions for spatial planning processes. Planners gather data, analyze trends and assess case studies to understand the context, challenges and opportunities of a specific area. This evidence-based approach enhances the quality and effectiveness of the design solutions. To add additional map layers, we collaborated closely with the urban design office PosadMaxwan which helped us to develop additional maps based on various existing scenario studies and additional expert judgment. PosadMaxwan also edited the maps of the Land Use Scanner to make them look less technical and visually more coherent with the other layers. The different versions of the detailed maps in development underpinned the national and regional workshops. This was done to feed discussions on the different options for future spatial planning and to provide insight into the spatial effects of the policy scenarios. In turn, the feedback from the internal sessions and the national and regional workshops was used to adjust and enrich the national scenario maps.

Superimposing Layers

Finally, the five thematic layers, which were based on the outcomes of the GIS land use modelling and research by design methods, were superimposed to produce the detailed maps of the four scenarios (Fig. 6). In doing so, we have chosen a particular order. The layer of water, nature and agricultural areas serves as underlay for the maps. The next map layer is that of residential areas, working areas and main infrastructure (roads, railways). This is followed by the layer of energy network and the layer of climate adaptation. The integral detailed maps as well as the separate thematic map layers can be viewed via the online map viewer. The viewer makes it possible to show or hide layers, to display them separately or in various combinations, to zoom in or out and to compare the scenarios.

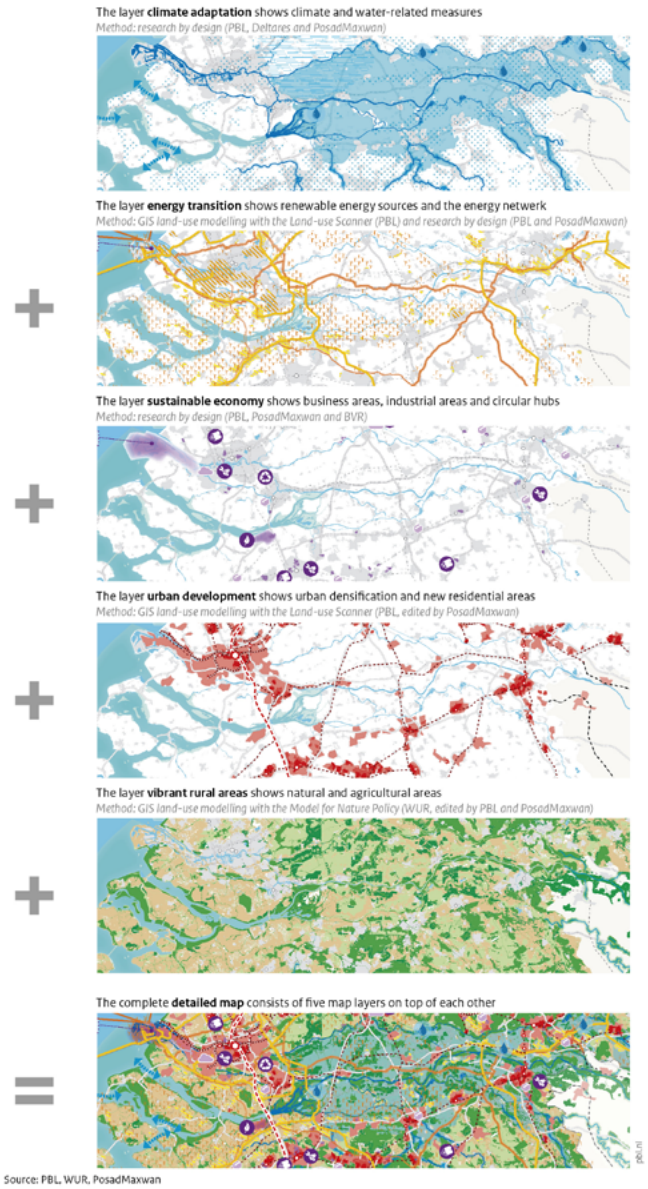

FIG. 6 Layers and methods of mapping of the detailed scenario maps, source: PBL and PosadMaxwan

Reflections on the Value of Mapping in the Scenario Study

As described in this article, a specific mixed methods approach has been applied for the development of the maps for the Spatial Outlook 2023 scenario study. The mixed methods approach combines participatory and multidisciplinary scenario development, GIS-based land use modeling and creative tools of research by design. The mapping process, from preliminary to final maps, has played a central and essential role during the development, for the publication and after the publication scenario study. In the different phases of the project, three main functions of the maps can be distinguished:

- Firstly, the maps served as 'conversation piece' during the development of the scenarios;
- Secondly, the maps served as 'communication tools' for the publication of the project, and;
- Thirdly, the maps were used as 'boundary objects' in workshops with policymakers and planners after the publication scenario study.

These functions are described in the following three paragraphs, respectively.

Maps as Conversation Pieces for Research and Design

During the development of the project, preliminary sketch maps had the function of a 'conversation piece' for the multidisciplinary project team as well as for stakeholders with different backgrounds. The sketch maps were important tools for discussing the content and the spatial specificities of the scenarios in an early phase of the research process. That was relevant for developing the story lines of the scenarios by the research team, as well as for discussions and reflections in workshops with national and regional stakeholders. Next to the early sketch maps, GIS-based land use modelling was important to set the ground for a more detailed investigation of the possible future land use. At the same time, the feedback from the research team and the stakeholders on the maps were used to improve the quality of the maps and to create plausible spatial interpretations of the storylines and underlying societal values.

Maps as Communication Tools to Explain Future Options

Based on GIS land use modelling and the outcomes of the participatory research and design approach, the design office created two sets of maps of graphically consistent maps for the printed publication of the Spatial Outlook 2023: a set of detailed maps and a set of conceptual maps that are easier to read for the general public. These maps were important 'communication tools' to attract the attention of policymakers, planners and any interested parties, including the broader public. The conceptual maps show the most relevant spatial features of the four scenarios at a glance and were used for publications and press releases. The detailed maps, on the other hand, show the results of the thorough GIS land use modelling and design research processes and are the fundamental basis for in-depth discussions of spatial options for future land use with policy-makers and experts in the field of spatial planning. Alongside the printed publication, the detailed maps were also made available on an interactive website with a map viewer, as high resolution image download files as well as printed on banners that to be used for workshops. Furthermore, the maps were also used for an exhibition about spatial future studies in the Netherlands.

Maps as Boundary Objects to Bridge Gaps Between Groups and Disciplines

In scenario workshops involving multiple disciplines, the maps functioned as 'boundary objects', allowing for different meanings to different people, but having the potential to integrate different types of expertise, norms, and values[18] and to bridge gaps between different groups or disciplines.[19] By using maps, actors can co-create and participate in complex spatial and environmental policy and planning processes.[20] Visual representations through maps are universally understood and serve as a shared reference point, transcending sectoral and interdisciplinary barriers. As such, maps have an important function to help in the knowledge integration process and to facilitate effective communication between planners, policymakers and the public.

Conclusions

18 Paul Carlile. "View of Knowledge and Boundaries: Boundary Objects in New Product Development," Organization Science, 13 (4), (2002): 442–455, https://doi.org/10.1287/orsc.13.4.442.2953.

19 Maarten Hajer and Peter Pelzer. "2050 – An Energetic Odyssey: Understanding 'Techniques of Futuring' in the transition towards renewable energy," Energy Research & Social Science, Volume 44 (2018): 222-231, https://doi.org/10.1016/j.erss.2018.01.013.

20 Tamara Metze. "Visualization in Environmental Policy and Planning: a Systematic Review and Research Agenda," Journal of Environmental Policy & Planning, 22:5 (2020): 745-760, https://doi.org/10.1080/1523908X.2020.1798751

As described in this article, maps can have different functions in different phases of a spatial scenario study. Mapping allows for the creation and comparison of multiple planning scenarios. Moreover, mapping empowers researchers, planners and policymakers to make informed recommendations and decisions by providing a clear understanding of the existing conditions and potential consequences of various choices. However, tensions can arise when creating and using maps. Indeed, for the analyses, it is important to have detailed and data-based maps, which accurately indicate locations and specific spatial features. For the communication of scenarios, however, it is relevant to have stylized conceptual maps, which only show the essence and avoid false accuracy. In the development of the maps for the Spatial Outlook 2023, GIS-based land use tools and research by design techniques have been combined to produce 'new' knowledge that supports future-proof spatial decision making. In the study, the use of maps has enabled effective communication between researchers, planners and policymakers on various scales. Complex spatial developments become more accessible when presented visually by maps, fostering greater understanding of the scenarios and spatial planning choices. This, in turn, leads to more inclusive and well-informed discussions on possible future-proof spatial and environmental policies.

Acknowledgments

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The PBL Netherlands Environmental Assessment Agency is the Dutch national institute for strategic policy analysis in the fields of the environment, nature, and spatial planning. The institute contributes to improving the quality of political and administrative decision-making by conducting outlook studies, analyses, and evaluations in which an integrated approach is considered paramount.

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