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# Combining participative backcasting and exploratory scenario development: Experiences from the SCENES project

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ABSTRACT

Social, natural and cultural systems are changing rapidly, influencing the future of Europe's fresh waters. One of the drivers shaping this future is the implementation of the Water Framework Directive. Participatory scenario development is well-suited to the challenges posed by the WFD to develop a long-term view by involving stakeholders. In this paper we analyse the process and results of a series of stakeholder workshops to develop scenarios at pan-European level. Specifically, we aim at analysing the method and results of combining a backcasting methodology and exploratory scenario development process. Four exploratory scenarios (narrative storylines) were developed, in first instance based on a set of existing European scenarios. Results matched expectations; the process produced stories that are complex, integrated, and rich in detail. During the backcasting exercise, four timelines were constructed, each of which took one exploratory scenario as context. The backcasting process established a strong link with the exploratory scenarios by identifying a large number of obstacles and opportunities in the realisation of those timelines. An analysis across all backcasts yielded a list of 15 robust elements, i.e. elements that are potentially effective in all exploratory scenarios. A stakeholder questionnaire showed that overall there was a widespread satisfaction with both the process and the results. Stakeholders were satisfied with the overall methodology and the exploratory scenarios and somewhat more critical on the backcasting exercise and resulting robust strategies. Above all, we hope to have demonstrated that it is conceptually appealing, methodologically feasible, and practically useful to combine exploratory scenario development and backcasting analysis.



## 1. Introduction

Social, natural and cultural systems are changing rapidly as the world globalises. This creates large uncertainties, which gives the consideration of the future new urgency and importance for policy makers, scientists and citizens alike [1]. These issues are clearly evident in discussions about the future of Europe's freshwaters, which will be influenced by a combination of environmental, social, economic and policy drivers. One of the most important drivers is the implementation of the EU Water Framework Directive (WFD). The WFD promotes sustainable (fresh) water use based on long-term protection of water resources, in particular by mandating that Member States develop river basin management plans. Several major tasks need to be carried out to achieve the goals of the WFD, that require, among others, that the policy process better inform and include relevant stakeholders (water boards, water authorities, etc.) on the current status and future outlook of European fresh waters. Scenario development methods are particularly well-suited to the tasks of involving stakeholders and taking a long-term view (see e.g. [2]).

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### 1.1. Scenarios

Scenario development is emerging as a key method when uncertainty is high, the problem is complex and a long-term view is essential (see e.g. [3]). Increasingly, scenario initiatives encourage broad participation of scientists, policy makers, and citizens in exploring possible future development pathways [4]. By employing participatory methods, policy makers and other stakeholders can be directly involved in assessing possible futures, and thus be better placed to help shape the future or adapt to changing conditions.

First used for military planning purposes [5] and later refined by Royal Dutch/Shell [6], scenarios came to the attention of the general public in the 1970s with the publishing of The Limits to Growth [7]. Today, scenario development is used in a variety of different contexts ranging from political decision-making, to business planning, to local community management, and to global environmental understanding. The broad variety of applications has spawned a large diversity in the types of scenarios that have been developed. For recent comprehensive review of scenario methods framed within a scenario typology, we refer to Börjeson et al. [8]. Despite recent methodological innovations, however, the typology of Van Notten et al. [9] provides a good starting point in categorising types of scenarios. They propose a classification based on fourteen aspects, among which the most important are: Inclusion of norms: descriptive or normative; Vantage point: exploration or backcasting; Data collection: desk research or participatory; Data: qualitative or quantitative. Two types of scenarios have become particularly popular, both of which are recognised by Van Notten and colleagues [9]:

1. Exploratory scenarios, which recently are often developed with participatory methods and with strong quantitative and qualitative aspects.
2. Backcasting scenarios, which are inherently normative and developed either participatory or using desk research, and mostly with important quantitative aspects.

These two types differ mainly with respect to vantage point and inclusion of norms. Additionally, exploratory scenarios often strive for awareness raising, the stimulation of creative thinking, or gaining insight into the way social, economic, and environmental drivers influence each other. Backcasting scenarios are often used to examine paths to futures that vary according to their desirability. These – often value-laden – scenarios are mostly either preferable and optimistic, or disagreeable and pessimistic. Partly because of the difference in vantage point, the exploratory and normative scenarios have been developed to address different end users and stakeholders. Exploratory and normative scenario developers both have acknowledged the added value of either type of scenario process. Particularly the backcasting community has attempted to combine backcasting and foresighting approaches. Good examples are Robinson et al. [10], Carlsson-Kanyama et al. [11], and the work of David Banister (e.g. [12]). In this paper we describe an attempt from the community that has its roots in exploratory scenario development to combine these with a backcasting approach.

### 1.2. Overall objectives and methodology

A number of large projects have taken up the challenges posed by the WFD. In relation to water supply, stakeholder participation and social learning (e.g. [13,14]), hydrology and climate ([15]) as well as adaptive management (e.g. [16,17]) have all been topics of EC-funded projects. This paper reports on activities that took place within the SCENES project (www.environment.fi/syke/scenes), which set out to undertake a multi-dimensional multi-scale scenario process, with a strong foundation in science and broad participation of stakeholders. This should provide new ideas about managing the future of water in Europe. Scenarios were developed at three scales: for pan-Europe, for four large regions in Europe, and for ten Pilot Areas. In this paper we concentrate on the series of scenario workshops at the pan-European level and the qualitative scenarios that were developed during that process. The primary focus was the development of exploratory scenarios. As a final step in the methodology, backcasting scenarios were developed, particularly to translate the achievement of long-term futures to series of short-term actions. In broad outlines, the methodology was similar to other projects that use participatory scenario development methods. For example, Quist and Vergragt [18] describe five steps that effectively capture the overall methodology of the SCENES project as well: 1. Problem orientation; 2. Development of exploratory scenarios; 3. Backcasting; and 4–5: Defining action agenda and implementation. For more details on SCENES see Kämäri et al. [19]; for detailed results of the scenario development process we refer to the website of SCENES and project deliverables there, and a forthcoming special issue of the Journal of Water and Climate Change. Some of the novel aspects of the methodology are introduced in more detail in Section 2.

#### 1.2.1. Rationale of linking exploratory scenarios and backcasts

In general, both exploratory and backcasting scenarios are useful to tackle complex, wicked problems that give rise to high uncertainties on future developments while radical changes might be needed [20]. Within SCENES, it was decided that combining approaches would be beneficial for a variety of reasons. Firstly, it would maximise stakeholder involvement as different methods might appeal to different stakeholders. Secondly, different approaches to the same issue might shed light on different aspects. Finally, and most importantly, the objective of SCENES to inform water managers and policy makers was thought to be better served with a set of scenarios that included both long-term explorations and short-term (normative) actions. Particularly the notion of robust strategies – backcasting elements that are effective in all exploratory scenarios – was crucial in this combination.

### 1.3. Objectives

The main objective of this paper is to analyse the combination of exploratory and backcasting scenarios, both in terms of the feasibility of the method and the usefulness of the results for a pan-European case study. From the specific findings we will deduce a number of wider implications for developing scenarios by exploring commonalities and key differences between backcasting and exploratory methods and the resulting exploratory and normative scenarios.

Specific objectives include an analysis of the process and results of a series of four stakeholder workshops during which qualitative scenarios at pan-European level were developed. The emphasis is on the backcasting workshop, and particularly on the use of exploratory stories as contextual scenarios for the backcasting process. In order to meaningfully assess this workshop, the paper will first evaluate the process and results of two prior workshops that provided narrative exploratory storylines as inputs to the backcasting process, thereby highlighting novel aspects of the methodology. Similarly, the results of a stakeholder questionnaire distributed after the final workshop were used to assess how the stakeholders involved perceived the scenario development process.

The paper is structured as follows: Section 2 explains the details of the participatory methods that were used to develop exploratory and backcasting scenarios. Section 3 analyses the main results, particularly elaborating on the backcasting workshop. Section 4 discusses the results of the separate scenarios and the complementarities and differences between the exploratory and backcasting scenarios. Section 5 concludes with recommendations for future endeavours.

## 2. Methods — developing exploratory stories and backcasts

### 2.1. The pan-European panel workshops — general information

Qualitative scenarios were developed by a group of stakeholders, the so-called pan-European panel, that met for four scenario workshops between September 2007 and January 2010. The group of stakeholders included representatives from the private sector, policy, scientists, and non-governmental organisations, thus covering a broad range of expertise on water-related issues. The total group of stakeholders consisted of around 35 persons out of which 12–15 participated in any of the scenario workshops; 5 stakeholders participated in all three scenario development meetings. The group was completed by a number of representatives from the SCENES project, notably regional coordinators and a number of experts on drivers, models, indicators, and qualitative scenarios. Around 15–20 SCENES experts were present in any of the scenario workshops. Thus, all workshops had around 30 participants out of which half were stakeholders and half were SCENES experts. The first workshop (WS0) was a short introductory meeting that was not facilitated. The subsequent three meetings (WS 1–3) were scenario development workshops that were professionally facilitated by Dr. Marc Gramberger from PROSPEX, an internationally active and networked consulting and training company (www.prospex.com). During the first meeting, the overall methodology as proposed by SCENES was discussed and approved. During the first and second scenario development workshops (WS1 and WS2), narrative storylines were drafted; an online tool was used to finalise the stories (e-WS1). The fourth and final meeting (WS3) was largely a backcasting workshop. Table 1 has some of the details of the different scenario workshops.

### 2.2. Stakeholder questionnaire

An extensive questionnaire was handed out after each workshop. In particular the questionnaire distributed after the backcasting workshop was relevant as it contained around 25 questions on the process and results of the backcasting exercise as well as a few summarising questions on the whole scenario development process. There were two types of questions, about 10 asking for a 'yes' or 'no' answer, and about 15 asking for a grade from 1 (totally disagree) to 5 (totally agree). The questionnaire was completed by 13 stakeholders directly after the end of the workshop. The main findings of this questionnaire will be analysed here.

### 2.3. Developing exploratory scenarios

#### 2.3.1. Novel aspects: Story-And-Simulation and fast-track scenarios

The SCENES methodology included a broad mix of tools and methods to develop scenarios, covering a range of scales in order to maximise the types of issues that can be addressed concerning both long-term futures and short-term actions. An important

**Table 1**
Overview of basic data for the various stakeholder scenario workshops.

| Meeting | Date and location | Length (days) | Number of participants [a] | Main results |
|---|---|---|---|---|
| WS0 | September 2007 Grenada, Spain | 1 | 24 (9/15) | Consensus on methodology |
| WS1 | February 2009 Delft, Netherlands | 3 | 31 (15/16) | Zero-order storylines |
| WS2 | November 2009 Helsinki, Finland | 3 | 32 (15/17) | First-order storylines |
| e-WS1 | Online | 30 | 10 | Final draft storylines |
| WS3 | January 2010 Paris, France | 3 | 35 (17/18) | Backcasts and robust elements |

[a] Including SCENES experts, group facilitators, and observers.

underlying framework was the so-called Story-And-Simulation approach in which exploratory scenarios are qualitatively (narrative stories) developed by stakeholders and linked to quantitatively developed scenarios (mathematical model results) in an iterative procedure. Alcamo [21] describes a ten-step approach that is being adopted by a growing number of global, European, and local studies (e.g. [2,22–24]). Crucial to the Story-And-Simulation approach is the iteration between stakeholder-determined storylines and expert-driven model runs to ensure that scenarios are relevant for and credible to end-users, while models provide state-of-the-art scientific input.

When starting storyline development and quantitative model development from scratch, it can take years before either product is finalised and the iterative procedure between stories and models can start. Therefore, several steps were taken within SCENES to increases the number of iterations, the most important being to start with an existing set of scenarios, the so-called 'fast-track scenarios'. These fast-track scenarios were used to have a solid starting point in the first workshop and thus to speed up the process and increase the number of iterations of the Story-And-Simulation cycle. The principle of starting with existing scenarios is not uncommon in the development of exploratory scenarios (see e.g. [23,25,26]), even though it concerns almost always a set of higher-level scenarios that is subsequently downscaled. The use of a set of scenarios envisioned and developed at the same spatial scale has not been attempted before. The GEO-4 scenarios [20] – with their elaborate storylines specific for Europe; being recently completed; and with model runs available – were selected out of a set of about ten relevant scenario sets to be used as fast-track scenarios.

*2.3.2. Scenario development method*

By and large, the methodology adopted to develop exploratory storylines during stakeholder workshops followed the procedure used for the Millennium Ecosystem Assessment and described in detail in MA methods manual [27]. Broadly three stages are discerned: a first stage is geared towards identifying of main concerns about future developments; a second stage focuses on the discussion of key uncertainties and driving forces; and a third stage develops the actual scenarios. As described above, in addition we opted for the use of an existing set of scenarios as a starting point.

Combining the strategies above, the following methodological steps were taken in the following order:

- discuss the boundaries of the scenarios,
- discuss the current situation of Europe's freshwaters in terms of water quality and water use,
- discuss main uncertainties related to these factors,
- link key uncertainties to existing scenarios,
- develop stories based on uncertainties and existing scenarios,
- revise stories based on model results,
- finalise storylines.

*2.3.3. Discuss the boundaries of the scenarios (WS0)*

The first meeting was a scoping workshop, which was used to discuss and define the scenario boundaries in terms of theme, number of scenarios, spatial extent, and time horizon. An important issue discussed at the meeting was the role of the fast-track scenarios. This workshop was organised as early as possible in the project's lifetime to address issues crucial to the entire scenario development process.

*2.3.4. Discuss the current situation and main uncertainties (WS1)*

The first scenario development workshop started with a plenary session that began by listing all factors that were perceived as important for the current situation and the long-term future. For each of these factors two characteristics were noted: those aspects considered 'certain' from a short-term outlook; and those aspects considered 'uncertain' from a long-term outlook. In plenary, for each factor one crucial certainty and one crucial uncertainty were defined. In four smaller groups, uncertainties were discussed in the light of the fast-track scenarios, noting for each uncertainty how it would play out in each of the scenarios.

*2.3.5. Develop stories based on uncertainties and existing scenarios (WS1 and WS2)*

Narrative stories were developed during two consecutive workshops. In essence, stakeholders were given a large degree of freedom to develop their own scenarios, which in most cases led to a set of final storylines in which the fast-track starting points were recognisable only in broad outlines. It was stressed that text, key arguments, and triggering events could all be different from the scenario storylines originally provided as input to this process. Fig. 1, however, was presented to point out the positioning of the fast-track scenarios on the axes of two main uncertainties. Stakeholders were asked to develop scenarios that should be *coherent* with the fast-track scenarios. We followed the notion of Zurek and Henrichs [28], who define coherent scenarios as '… scenarios that follow the same scenario logics, which does not preclude substantial differences with regard to how the scenarios play out, both in the selection of important driving forces, their major trends and/or scenario outcomes'.

*2.4. Backcasting (WS3)*

*2.4.1. Background of backcasting approach*

The backcasting approach originates from the 1970s and was originally developed for the energy sector [29]. There is ample experience with backcasting, and consequently much has been said about the underlying principles (e.g. [20]), the methodological

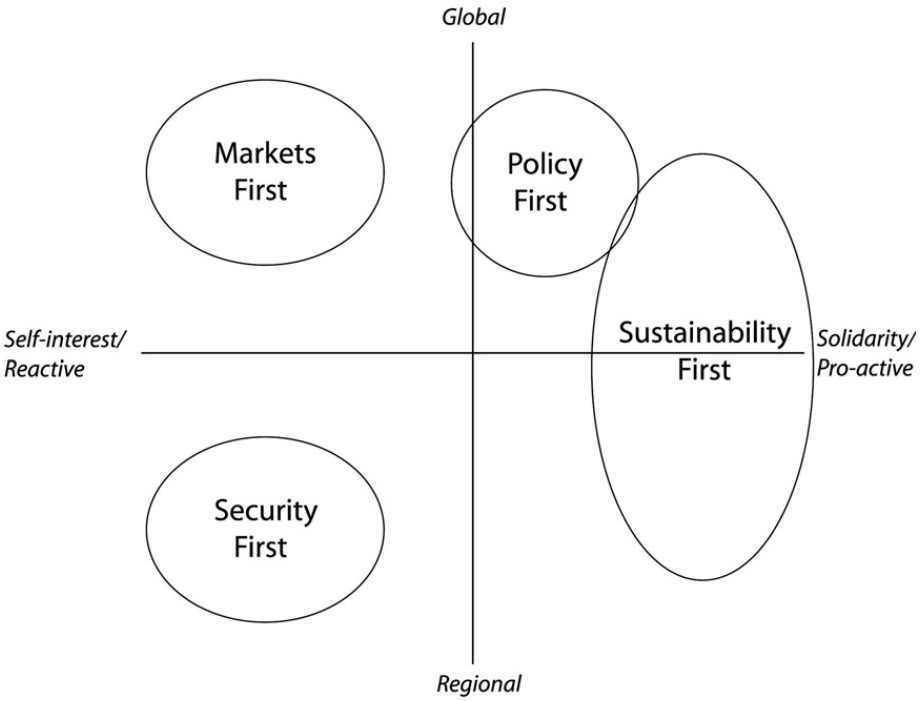


**Fig. 1.** Position of the GEO-4 scenarios on the two axes of main uncertainties often used in global scenario studies.

framework (e.g. [8,30–32]), and practical applications (e.g. [33–35]). Also the combination between backcasting and other types of scenarios has been acknowledged and documented (see [8,33]). In this context, particularly the development towards participatory backcasting which took place in the early 1990s is relevant. Case studies have been documented especially from the Netherlands (particularly SusHouse see [36,37]), Canada [10], and Sweden [11]. For more details on the wealth of backcasting studies we refer to the extensive work by Jaco Quist [30] and Quist and Vergragt (e.g. [18]).

*2.4.2. Application to case study*

In this case, backcasting was defined as a concrete backward-looking analysis, rather than an overall process. This analysis encompassed a group discussion process that first creates a desirable future vision or a normative scenario, followed by looking back at how this desirable future could be reached, before defining and planning follow-up activities and developing strategies leading towards that desirable future (see also [32]). The major distinguishing characteristic of this backcasting analysis as compared to exploratory scenarios is a concern, not with what futures are likely to happen, but with how desirable futures can be attained. It is thus explicitly normative [29]. Note that in this case, we only considered desirable goals, thus excluding undesirable visions.

*2.4.3. The role of exploratory scenarios during backcasting analysis*

Stakeholders were asked to treat the exploratory scenarios that they themselves previously developed as 'final'. That is, the explorations should now be used as contextual scenarios that could not be influenced. The approach is very similar to what is described in Börjeson et al. [8] as the use of "external" scenarios. Stakeholders were urged to construct backcasting strategies that specifically investigated desirable pathways within a given context. Because both explorations and backcasting deal with the entire system in Europe, it was decided to define a very specific end-point rather than a general vision for 2050. Thus, the exploratory scenarios set a mostly socio-economic and institutional context, within which the plausibility of reaching a specific, concrete, and water-related end-point was to be tested.

*2.4.4. Backcasting method*

The backcasting method used in SCENES was adopted from the COOL project [34,35]. They define a number of steps that were used in a slightly adapted form:

(1) select a vision that is taken as *end-point*;
(2) indicate the *obstacles* to be overcome and the *opportunities* to be taken to realize these changes;
(3) define *milestones* and interim objectives that need to be achieved to realise the end-point;
(4) identify (policy) *actions* and specify actors involved that help develop or take advantage of opportunities and help avoid or neutralize obstacles;
(5) identify of highways of change and *robust* elements in these strategies.

Step 1 Select a vision used as end-point. A very general statement on the state of water quality and quantity in 2050 was prepared in advance by the SCENES scenario team. During the backcasting workshop, in plenary this desired end-point that needed to be reached was discussed in detail. In groups, the end-point was modified further to better fit with the logic of the exploratory scenario that was used as context. Note that the use of the word 'end-point' followed e.g. [29], specifically also to distinguish between the very short description of the desired state in 2050 and the rather complex and long description which completes the exploratory scenarios.

Step 2 Indicate obstacles and opportunities. In this step a direct link was made between the exploratory scenarios developed during the first two scenario development workshops and the backcasting exercise. During the workshop, stakeholders discussed in groups what obstacles and opportunities arise from the exploratory scenario within the context of which the desired end-point should be reached. Note that this was the only step where a link between the normative backcasting and exploratory scenarios was directly possible.

Step 3 Define milestones and interim objectives. Given the desired end-point and the obstacles and opportunities arising from the exploratory scenarios, the question was then posed as to what intermediate milestones need to be reached in what order so as to reach the desired objective? In groups, stakeholders discussed which interim objectives needed to be reached, answering also the following specific questions: What is the milestone? When does it need to be reached? How does it relate to obstacles and opportunities? Milestones can also give rise to additional obstacles and opportunities.

Step 4 Identify (policy) actions. The penultimate step of the backcasting process was to discuss what (policy) actions are needed to reach milestones; overcome obstacles; and/or make use of opportunities. Stakeholders were asked to be as specific as possible on: Why, How, When, How long, What, and Who?

Step 5 Robust strategies. As a last step of the group work during the workshop, we asked stakeholders to summarise their backcast by identifying strands of connected actions and milestones.

Strategies developed in step 5 were labelled as 'highways' or main strategies within a backcast. Again in line with suggestions in Börjeson et al. [8], the question was posed as to which of these strategies or elements thereof would survive several kinds of external developments. Which strategies appear robust because they would be effective in all exploratory scenarios that were developed? Which strategies are robust because they could be successful independent of which exploratory scenario becomes a reality? Vice versa, we also analysed elements of the backcasting that were very specific to a certain exploratory scenario and would almost certainly fail in other scenarios. Note that the term 'strategy' is used here to denote sequential strands of related actions within a backcasting timeline fulfilling a certain final objective. This is very comparable to the definition given by Holmberg [38].

Three methods to identify robust elements were used:

- results from the analysis performed by stakeholders where each group indicated the robustness of their backcasting strategies in each of the other contextual scenarios.
- results from the concluding plenary session during the workshop, where stakeholders listed a number of robust elements.
- a comparison of the full detail of all backcasts *a posteriori*.

The main outputs of a backcasting exercise were thus twofold:

1. Four timelines with milestones, opportunities, obstacles, actions, and strategies needed to reach a certain objective in 2050, specific for four exploratory scenarios.
2. A list of robust actions and strategies, independent from the scenarios.

## 3. Results

### 3.1. Boundaries of the scenarios (WS0)

The first workshop led to a common understanding among participants that scenarios should include areas outside of the EU, making them truly pan-European. It also led to the choice to develop scenarios for 2050, rather than the originally proposed 2025 horizon, mostly to include the impact of climate change. Furthermore, the use of fast-track scenarios and the selection of the best set of scenarios was discussed in detail. It was decided to use the GEO-4 scenarios [20] developed for Europe (unpublished), where both qualitative storylines and model output had been used, as the starting point of the SCENES scenario development process. Finally, the workshop made clear that qualitative scenarios would focus on factors that impact the quality and quantity of Europe's freshwaters.

### 3.2. Current situation and key future uncertainties (WS1)

Thirteen drivers and their associated main uncertain aspects were listed. The list includes among others 'water policies' (high or low impact); 'water valuation' (polluter pays principle or society pays); 'population' (high or low migration); 'global integration' (threat or opportunity); 'public involvement' (passive or active); and 'technology' (limited or widespread technology adoption). More details can be found in [39].

### 3.3. Exploratory scenarios (WS1 and WS2)

Four stories were developed in two stages. The zero-order drafts developed during the first scenario workshop (WS1) carried the titles from the GEO-4 scenarios: Markets First, Policy First, Security First, and Sustainability First. These drafts included parts of the original GEO-4 text, as well as new material related to the view of the subgroup on water-related issues and other developments. The first-order drafts developed during the second scenario workshop (WS2) did not include any original GEO-4 text, except for Economy First. WS2 stories contained largely new material reflecting the view of the subgroups. Additionally, the title of each story was changed, indicating the increased ownership of the stakeholders. The final scenarios were entitled: Economy First (EcF), Policy Rules (PoR), Fortress Europe (FoE), and Sustainability Eventually (SuE).

#### 3.3.1. Summaries of the exploratory scenarios

Although a crucial output, it is difficult and space-consuming to reproduce the storylines here. Instead, summaries of the stories are given in Table 2 and a schematic summary of developments of the main factors is provided in Table 3, similar to, for example, GEO-4 (see [23]). Details of the zero-order and first-order draft as well as the final versions of the storylines can be found in project Deliverables of SCENES [39,40]. The two top factors in Table 3 are the main uncertainties as can be associated with the GEO-4 scenarios. Table 3 allows a comparison across the storylines. Interesting observations include:

- Low population growth, but strong migration is assumed in most scenarios
- Water pricing is introduced as key instrument in all scenarios
- Technologies are important in all scenarios, but the type differs strongly, including water saving technologies, energy, or a broad spectrum of high-tech developments. Technology transfer and adoption rates differ likewise.
- The state of the environment improves only in Sustainability Eventually and Policy Rules.
- Climate change impacts are introduced that trigger nonlinear changes in all scenarios.

Finally, it should be noted that the exploratory scenarios provide very detailed projections of how the social, political, economic, and cultural conditions in Europe will change over the next 40 years.

### 3.4. Backcasting (WS3)

A full overview of the results of the backcasting exercise carried out in the final scenario workshop is beyond the scope of this paper. In particular, the separate timelines cannot be meaningfully discussed in detail here. Table 2 provides a short summary of the backcasting scenarios. Below we elaborate on the various elements that resulted from the backcasting exercise. The focus will be on the robust actions and strategies — besides the timeline the second main output of the backcasting exercise. Additional emphasis is on aspects in which the method of linking exploratory scenarios and backcasting differed from the prevailing methodology. A complete overview of all results of the backcasting exercise can be found in [41].

#### 3.4.1. Total number of items

A grand total of 243 actions, milestones, opportunities, and obstacles was defined, rather evenly spread among the four scenario groups (see Table 4). Of those, roughly 70% were actions and milestones, and 30% opportunities and obstacles. A few observations stand out. The group working within the context of Fortress Europe identified the highest number of opportunities and obstacles; possibly because of the pessimistic storyline of a continent under siege that might give rise to many obstacles. The Sustainability Eventually group identified the highest number of actions and milestones, which correlates with the large number of fundamental changes that need to be taken to reach the final objective. Policy Rules identified the lowest total number of items, possibly related to a combination of a storyline that remains rather close to the present day situation and an end-point that seems rather straightforward to attain.

#### 3.4.2. End-points

To a large extent all four scenario groups used the same end-point, as defined in plenary, for their backcasting exercise. Thus, the proposed end-point "Sustainable management, supply and use of water" translated into very similar phrases where 'sustainable' and 'water supply' were mentioned in three cases; and 'management' in two cases. Interestingly, all groups expanded on the end-point by adding 1–2 aspects that were crucial within the constraints defined by the contextual storyline. For instance, quality of life (Sustainability Eventually); secure water supply (Fortress Europe); or sufficient water for economic interest (Economy First) are all additions that highlight the underlying storyline. In other words, all groups stated that sustainable water supply has to be viewed through the lenses of the contextual variables. Importantly, in all groups it was made clear from the onset that sustainable water supply is secondary to the main line of reasoning in the exploratory scenario. The end-point can thus be read as:

Sustainable water supply as far as possible given that

- quality of life (Sustainability Eventually),
- economic interest (Economy First),
- security for people (Fortress Europe), or
- socio-political context (Policy Rules)

is safeguarded first.

**Table 2**
Summaries of explorative scenarios and backcasts.

| Scenario | Explorative story | Backcast |
|---|---|---|
| Economy first | The economy develops towards globalisation and liberalisation with rapidly spreading innovations. Yet income inequality, immigration and urban sprawl cause social tensions. Water use increases because of, among others, slow adoption of water-efficient technologies and low water-saving consciousness. Water ecosystems providing ecological goods and services for economies and society are preserved and improved. Thus, the WFD changes its conceptual focus from a good ecological status to preserving socio-economically valuable ecological services. Towards the 2040s, a number of (pollution) incidents catch the interest of media and public, resulting in a social upheaval. By 2050, governments have started to work with NGOs, industries and other representatives of civil society to safeguard economic prosperity while making ground for social coherence. | Four strategies are discerned that together lead to sufficient water across Europe: Firstly, various economic instruments are essential in reaching the goal. Important are emission payments, pollution taxes and voluntary agreements Secondly, a technological approach to problem solving is taken with investments in research and technology, that together with economic instruments lead to an efficient water management and supply. Thirdly, a successful international cross-border cooperation added to the mentioned measures guarantees sufficient water quality for health and economic interests. Finally, new public–private partnerships start emerging through awareness raising campaigns. Also growing awareness leads to a new governance structure and related policies that safeguard equitable access to water and restored biodiversity as well as help realizing other strategies. |
| Fortress Europe | The world becomes increasingly unstable due to a number of crises, which causes instability and an increase in terrorism across Europe. In turn, this gives rise to an increased (perceived) need for more security, as a result of which Europe starts closing its borders. An aim for self-sufficiency and market protectionism eventually spreads over all sectors. This leads to an increased exploitation and strict management of domestic natural resources, paying less attention to environmental consequences, for example through the institutionalisation of the Water Security Framework. Towards 2030, climate change becomes an issue, triggering new sets of conflicts. These are resolved by strong EU leadership and the newly formed border police, or otherwise neutralised by the fear of individual countries to be excluded from the EU. By 2050, resources are strictly managed and profits are spread over the EU. The gap between the rich and poor countries widens, yet the EU survives. | A crucial sector in this scenario is agriculture, both because of the high degree of self-sufficiency that is needed and the important role of 'water for food'. As water resources are limiting, agriculture is stimulated in areas with enough water, supported by additional storage capacity and irrigation systems. By 2050, water supply for agriculture is secured. Closely linked to this is an improved efficiency for industry. A changed industrial policy aims to get basic production back in the EU and works on diversification. This triggers tensions between the aim for reduced water use and the overall increase of industrial activities, further stressing the need for an improved efficiency. Flood damage is perceived as a security threat, as it diminish resources and is very costly. Both flood defence infrastructure and a good warning system are needed to lower flood impacts. This process is started by the establishment of the EU Flood Defence Agency in 2020, which is grounded in the Secure Flood Policy. In addition, securing energy supply, solving transboundary river conflicts, and achieving good ecological status are key issues. |
| Policy rules | Efforts to strengthen coordination of policies at EU level, are slowed by regional pursuit of economic self-interest. Policies become slowly more ineffective, and ecosystem services begin to deteriorate very significantly. Until 2030, the EC is increasingly disappointed in level of WFD compliance, particularly because of emerging and increasing pressures on water resources. After 2030, climate change hits hard, which replaces public apathy towards environmental issues with enthusiastic support that drives more innovative governance (public/private partnerships). This leads to WFD compliance that is higher than ever. Simultaneously, by 2030 public participation is increased which leads to a strong local government support for action. By 2050, Europe is at the forefront of a new socio-economic paradigm of public/private partnerships and is leading a global shift in this direction | The principal goal of the Policy Rules backcast was to sustainably provide acceptable levels of water quantity and quality in the EU in the socio-political context where policy has a leadership role in setting society's development path. With centuries of investment in existing infrastructure dominating the physical, political and financial landscape, it seems impossible to test and implement alternative solutions to sustainable water supply. The backcast therefore focused on institutional and economic strategies needed to overcome these obstacles. Key to the institutional strategy is the integration regional and river basin planning, substantiated by a number of new directives (e.g. Public Acceptance of WFD Governance). The economic measures are tightly connected to this, as institutions are the means to stimulate and refine economic processes, which start economic reform and increase economic performance of water technologies that help achieving the final goal. |
| Sustainability eventually | The main long-term changes towards 2050 include a transition towards environmental sustainability, in which the landscape has become the basic unit. The overall focus is on quality of life rather than economic indicators through local diversity which is governed by local networks. This transition to local sustainability is the result of a long-term process that starts with a set of strong top-down measures that is kick-started by a series of extreme events and which is later accompanied by behavioural change and a new governance structure. Because of the severity of the problem, measures are taken quicker and more effectively in water-poor countries, which results in a split with water-rich countries. Initially, a water pricing system is key in regulating water demand. By 2050, behavioural change structurally lowers water consumption, which in turn increases water quality and decreases water stress. | A key strain of actions leads to a fundamentally different spatial planning of land use throughout Europe, including the production of agricultural products in places that are most suitable. Simultaneously, energy-related aspects such as biofuels are incorporated in this spatial planning. Climate change related measures are many and likewise closely related to spatial planning. Given the focus on local initiatives, especially adaptation measures are manifold. The key underlying strategy in this backcast is related to institutional change, particularly the transition from a globalising EU-led government to a local, regionalised world where NGOs and multi-level governance models are most important. None of these changes, however, will be successful without a strong awareness raising campaign early in the backcast, which will result in a slow but eventually strong behavioural change. |

**Table 3**
Development of main factors in the final four exploratory scenarios. Arrows indicate the overall direction of change during the scenario period across Europe; regional differences and short-term variability are not represented here.

| Main factors | Economy first | Policy rules | Fortress Europe | Sustainability Eventually |
|---|---|---|---|---|
| Globalisation | globalisation | globalisation | regionalisation | regionalisation |
| Attitude towards environmental management | reactive | proactive | reactive | proactive |
| Population dynamics (migration) | urban sprawl | strong urbanisation | migration only within EU | strong migration |
| Expansion of EU | expansion | vastly expanded | EU closed | increase, later breakdown |
| International cooperation | multinationals dominate | strong | within Europe | eco-region based |
| Water pricing | key instrument | important | important | limited |
| Economic growth | strong thoughout | somewhat lower | slow after recession | low |
| Water policies (WFD) | limited success WFD | all policies crucial importance | changed focus to security | WFD leading instrument |
| Agricultural intensification (and role CAP) | intensification with weak CAP | agriculture strong CAP strong | intensification with strong CAP | less intensive with weak CAP |
| Alternative energy sources | alternatives slowly introduced | change to energy crops | fossil fuels strong | new generations of biofuels |
| Water quality | generally declining | first down, then up | overall down | first down then up |
| Water consumption | increase because of ec. growth | increases to a certain level | increases leading to conflicts | strongly reduced |
| Technology | high-tech growth | focus on new energy technologies | technologies outdated | strong water saving technologies |
| Environmental awareness | declines | increases later | not important, thus decline | critical and strong increase |
| State of the environment | declines | improve in later phases | declines | improves |
| Governance (bottom-up initiatives and role NGOs) | multinationals dictate | top-down dominates | cooperation is difficult | bottom-up dominates |
| Climate change impacts (droughts and floodings) | quick and rather strong | first climate cooling | moderate impacts later | strong and immediate |

**Table 4**
Total number of elements present in the four backcasts, distinguishing obstacles, opportunities, milestones and actions.

| Scenario group | Obstacles | Opportunities | Milestones | Actions | Total |
|---|---|---|---|---|---|
| Economy First | 15 | 8 | 17 | 24 | 64 |
| Sustainability Eventually | 5 | 3 | 30 | 28 | 66 |
| Fortress Europe | 18 | 11 | 30 | 23 | 72 |
| Policy Rules | 6 | 5 | 13 | 17 | 41 |
| Total | 44 | 27 | 80 | 92 | 243 |

*3.4.3. Key obstacles and opportunities*

In total 71 obstacles and opportunities were identified (see Table 4), covering a broad range of issues, mostly specific to the exploratory scenario. Yet, despite the strong differences between the four exploratory scenarios, four opportunities (out of a total of 27) were identified in more than one group:

- Climate change impacts (all groups)
- CAP reform (FoE, PoR, SuE, see key actions and milestones)
- Technology spread (FoE and EcF)
- EU integration and governance (FoE, EcF, and PoR, though meaning very different things in each of the different backcasts)

Similarly, there are a number of recurring obstacles in the various backcasts. First and foremost, lack of money is mentioned in all four backcasts as problematic, either in the beginning during the current financial crisis, or in later phases. In none of the backcasts did there seem to be sufficient funds to reach the desired end-point.

Other elements that are mentioned in more than one backcast include: Lack of awareness (EcF, SuE, and PoR); weak governance early in the scenario (PoR and SuE); and climate change (FoE and SuE but mostly viewed as an opportunity).

*3.4.4. Key actions and milestones*

The distinction between actions and milestones was not always clear to all stakeholders, because of which they are combined here into one category. A total of 172 actions and milestones was identified (see Table 4). Again, a very broad variety of issues, interim objectives, and concrete actions are mentioned. A number of recurring actions were identified:

- Awareness and Education. Awareness-raising through education and/or media is mentioned in all four backcasting exercises, but with very strong differences. Awareness-raising takes place in different periods (between 2010 and 2030); is organised by different actors; and has a slightly different goal depending on the context of the storyline.
- Public–private partnerships. All backcasts provide ample information on institutional change. Common ground is limited, but all have some kind of role for public–private partnerships.
- Common Agricultural Policy (CAP). Despite differences in viewing the changing role of the CAP as action, milestone, or opportunity, its importance is evident across the scenarios.
- Biodiversity. All backcasts specifically mention biodiversity (Action Plans and Directive) and related efforts to maintain or increase. Besides water, it is the most central impact in most backcasts.
- Water Framework Directive (WFD). The WFD either fails (EcF); is substantially modified into the Water Security Framework, with only minimal attention to water quality (FoE); succeeds only when accompanied with strong awareness campaigns (SuE) or is strengthened in response to heightened awareness of rising climate change impacts (PoR). According to all groups, its current timeline is overly optimistic. Timing of successful implementation depends mostly on the timing of institutional change and behavioural changes.

In conclusion, there are a number of key actions and milestones that appear in (almost) all backcasts. Despite obvious mismatches in timing, key actor and/or exact focus of the action/milestone, these seem to have potential irrespective of the contextual storyline.

*3.4.5. Strategies of actions*

All scenario groups identified 3–5 strategies of actions/milestones. Some (Sustainability Eventually) beforehand, others during (Fortress Europe) or after the exercise (Policy Rules and Economy First). Four strategies were identified in more than one group:

1. Institutions (EcF and PoR; fundamental to FoE and SuE)
2. Economy (EcF and PoR; noted as absent in SuE)
3. Climate-related (SuE and FoE; extreme events noted as fundamental in PoR)
4. Agriculture (FoE and SuE)

All backcasts have a central role for institutions and institutional change. In fact, a large share of all milestones and actions across the backcasts is devoted to the institutional setting. The role is notably strong in Sustainability Eventually, where so-called 'Trust-Based Networks' become leading governance structures, and in Fortress Europe, where the fortification of Europe is central. The second key aspect is that of economy viability, often in combination with either agricultural developments or the energy

sector. The presence of various climate-related strategies is a consequence of the presence of climate-related obstacles and opportunities.

*3.4.6. Robust elements*

Results are presented in Table 5. A number of observations stand out:

1. *In total 15 robust elements were identified.* This was more than expected beforehand, given the many factors (elements, connections, trajectories) distinguishing different exploratory scenarios.
2. *The overall list covers a variety of sectors, actors, and factors.* The overall list shows a broad set of highly integrated factors, actors and sectors. Emphasis seems to be on Agriculture, Economy, Energy, and Education.
3. *Different analysis, different candidates for robustness.* Only one candidate for robustness emerged from all three analyses: awareness-raising.
4. *Stakeholders focused strongly on water aspects.* The largest number of actions directly related to the water system came from the last discussion with stakeholders.
5. *The a posteriori analysis singled out lack of financial resources and weak governance as key obstacles across all scenarios.* Both factors, a lack of financial resources and a lack of institutional power ('weak governance'), are crucial to the execution of some of the key actions.

Despite all differences in exploratory scenarios, backcasts, and timings of individual robust elements, the following overall summary seems valid. Note that this story only includes elements of backcasts that are identified as being robust, i.e. the story is valid in any of the four exploratory scenarios.

> The road to the desired end-point of sustainable water supply of Europe's freshwaters is difficult because lack of money and a rather weak government/governance structure obstruct any type of structural change. Triggered by extreme events (notably climate change impacts — floodings and droughts), actions to accomplish institutional change by a variety of multi-scale actors, accompanied by large-scale awareness-raising campaigns (education and media) can lead to a future with a more sustainable water supply. The exact emphasis on sectors and factors is partly unclear, but the list should include the energy sector (supergrid, diversification, and Action Plans), agriculture (first through the CAP; later also more bottom-up), and the economy (pollution taxes; and, importantly, water pricing). The shift from government to governance includes a prominent role for private–public partnerships. Yet, even if all these changes are set in motion as soon as possible, compliance with the Water Framework Directive will be very difficult at best; failure of the current WFD being more plausible. The WFD needs to be replaced by other – more successful – initiatives of which details differ depending on the future outlook.

### 3.5. Scenario development process — questionnaire results

The most important results from the questionnaire handed out after the backcasting workshop are given in Table 6. All but one (on learning) questions were related to an assessment of the method used and results obtained. Overall, there was widespread satisfaction among stakeholders on both the process and the results. Satisfaction was high for the resulting storylines (85%) with a rating of 3.7 on a scale of 1–5. Stakeholders were also very positive on the usefulness for their own work (3.9). Stakeholders were somewhat more critical on the usefulness of the backcasting results for water managers (3.2). Scores for other questions ranged from 3.5 to 4.4 with high scores for 'my ideas have been included in the results' (4.4); 'the process was very useful' (4.2), and 'the results helped me understanding water issues in Europe' (4.2). Stakeholders were less positive on 'the link that backcasting made between long-term storylines and short-term decision making' (3.5) and the 'understanding for policy actions needed' (3.5).

**Table 5**
Robust elements as identified through an *a posteriori* analysis of the backcasts (first column), and by stakeholders (last two columns).

| No. | From backcast analyses | From last plenary | From analysis of last plenary |
|---|---|---|---|
| 1 | Institutions (strategy) | International agreements | |
| 2 | Economy (strategy) | Economic instruments | |
| 3 | Agriculture (strategy) | | Spatial planning |
| 4 | Awareness raising (action/milestone) | Education | Awareness campaigns |
| 5 | Public–private partnerships (action/milestone) | | |
| 6 | Common agricultural policy (action/opportunity) | | Phasing out of subsidies |
| 7 | (Failure of) water framework directive (action/obstacle) | | |
| 8 | Climate change impacts (opportunity) | | |
| 9 | Lack of money (obstacle) | | |
| 10 | Weak governance (obstacle) | | |
| 11 | | Water-saving strategies | |
| 12 | | Pilot experiments | |
| 13 | | Flood prevention/mitigation | Early-warning systems |
| 14 | | | Energy (strategy) |
| 15 | | | Technological investments |

**Table 6**
A selection of questions posed to stakeholders and answers provided after completion of the last stakeholder workshop (WS3). A total of 13 stakeholders completed the questionnaire. Main comments serve as illustration; the list is not exhaustive.

| Question | % Yes | Average score (1–5 scale) | Main comments |
|---|---|---|---|
| *Method and results* | | | |
| Are you satisfied with the explorative scenarios? | 85% | – | "Storylines are consistent and plausible"<br>"Some twists in the logic of some scenarios are unlikely" |
| Are you satisfied with the resulting robust strategies? | 54% | – | "The result is impressive and the methodology very interesting"<br>"Strategies were too general" |
| Have you used the knowledge that you gained in the workshops | 77% | – | – |
| How would you grade this workshop? | – | 3.7 | – |
| Usefulness of the knowledge for your work? | – | 3.9 | "Interesting new points of view"<br>"It was good to be involved in a scenario development exercise" |
| Usefulness of the knowledge for European management? | – | 3.2 | "No close link to the WFD. Needs to be considered."<br>"Limited outcomes for policy making and water management" |
| Are your ideas represented in the final outcome? | – | 4.4 | – |
| Were the backcasting results linked to present day decision making? | – | 3.5 | – |
| Are the backcasts useful for planning? | – | 4.2 | – |
| I have a more comprehensive understanding of European water issues | – | 4.2 | – |
| Participation helped me to understand policy actions needed | – | 3.5 | – |
| Methods used allowed surprising issues to emerge | – | 3.9 | – |
| Methods used helped finding novel linkages between factors | – | 4.0 | – |
| Thinking along long time horizons helped assessing problems | – | 4.1 | – |
| Thinking about water issues using four exploratory scenarios helped identify robust actions | – | 3.8 | – |
| Other comments related to method and results | – | – | "I was confused by starting with a desired end-point while working within an exploratory scenario"<br>"I want to highlight the good professional work of the project team. The methodologies and approaches used in SCENES are innovative." |
| *Learning* | | | |
| What were the most useful things that you learned? | – | – | "Information on WaterGAP"<br>"Different methods and approaches"<br>"Process from storyline to scenario"<br>"Learning about new methods was interesting"<br>"Usefulness of long-term scenarios"<br>"Unexpected relations between actions and consequences" |

Finally, stakeholders were satisfied with the use of long-term scenarios (4.1) and the mix of exploration and backcasting (3.8).

Most often heard compliments concerned mostly the overall methodology:

- "Good professional work from the project team"
- "Innovative method"
- "Interesting new points of view"

On aspects, criticisms were voiced:

- "We had lack of expertise in the group [to] meaningfully discuss certain sectors" (on backcasting)
- "The results are too general and too sketchy" (backcasting)
- "More time is needed" (general process)
- "Results need to be finalised and disseminated before I can judge their usefulness" (general process).

One question related to an aspect of (social) learning. It is included here to show that by and large stakeholders indicated that they learned most about the process, method, and models that were used to develop scenarios, with many statements such as "learning about new methods was interesting". Very few stakeholders commented on the process of social learning through the interaction with other stakeholders.

In short, stakeholders were (very) satisfied with the overall process as well as the specific process of the backcasting workshop. They seem to have understood and appreciated the methodology, and they see value in most of the results that were produced.

Stakeholders were most critical about the lack of time available for any of the workshops and about the added value that backcasts provided for managers and policy makers that they perceived as not (yet) proven. The fact that at least one participant was confused by the mix of exploratory and normative elements shows the complexity of that part of the methodology.

## 4. Discussion

### 4.1. Developing exploratory scenarios

In general it can be stated that the development of exploratory scenarios was successful. The questionnaires show that stakeholders were satisfied with the process and the results (see Section 3.5; partly unpublished data) of the exploratory scenario development. The resulting stories are all highly integrated, complex, water-relevant, and contain surprising, non-linear elements, often triggered by climate change impacts. As such, the results lived up to the original expectations. Final exploratory scenarios are comparable to those developed in similar endeavours. Note that it is difficult to assess the quality of the resulting scenarios. Work to develop scenario quality indicators is ongoing [42]. It has also been suggested to include 'signposts' in the exploratory scenarios, i.e. factors to monitor over time that might help to identify which of the scenario paths the world appears to be progressing along.

#### 4.1.1. Fast-track scenarios

The approach of starting with a set of existing scenarios to increase the number of iterative revisions between stories and expert-driven models was a unique experiment. In literature there are ample examples of using an existing set of scenarios, but in all (documented) cases it concerned a set of *higher-level* scenarios that were subsequently downscaled using the starting scenarios as boundary conditions. This was the first time that a set of scenarios was used at the same (European) scale. We identified a number of strong and weak points of the methodology, the following of which are particularly relevant for this paper:

Strong points:

- The number of iterations to compare and revise stories and models was increased. Besides increasing consistency of stories, this also informed stakeholders on model-based projections of impacts on water-related issues under the conditions set by these storylines, thus preparing them better for the backcasting exercise. This is reflected in the list of robust elements drafted by the stakeholders.
- Fast-track scenarios provided the stakeholders with an extra opportunity at the outset to discuss the storylines. This led to a larger feeling of ownership of the stories; significant changes during the second scenario development meeting; and vivid discussions on the exact content and logic of all four stories. As a result, the role of contextual scenarios in the backcasting workshops was strengthened. This is reflected by the large number of obstacles and opportunities that were identified.

Weak points:

- Stakeholders had difficulties understanding the logic of the four GEO-4 scenarios. The (double) task of fundamentally understanding a set of existing scenarios, which by themselves are products of years of previous collaborative work, and subsequently drafting new stories that should be consistent with an existing set was a difficult process that took more time than envisioned.
- Not all fast-track scenarios were accepted. During the second workshop it was noted that the zero-order draft of Security First story was "overly negative". Consequently, the first-order draft developed during the subsequent workshop was different from the zero-order draft they started out with. For similar reasons, the Policy First scenario was changed to a large extent as well.

Summarising, fast-track scenarios are very useful from a methodological point of view and a good addition to the Story-And-Simulation method. The final set of exploratory scenarios is a rich set of stories that have been thoroughly discussed; that are rich in water-relevant information; and that are a product that all stakeholders have embraced as "their" scenario. Thus, through a number of iterations the fast-track GEO-4 scenarios were transformed to a set of SCENES water scenarios. Importantly, using fast-track scenarios holds a promise when linking exploratory and backcasting methods, as it can potentially speed up the process of developing exploratory scenarios, leaving more time for a backcasting analysis.

### 4.2. Developing backcasts

Stakeholders voiced their general satisfaction with the process and the results. Yet, contrary to the exploratory process, there was more criticism on the backcasting process and results. Only half of the stakeholders were satisfied with the resulting strategies; some stakeholders were confused with the mix of exploratory and normative aspects; and they were only moderately convinced of the link with 'real' policy actions.

Overall the SCENES scenario team was satisfied with the results of the backcasting workshop. Four timelines with ample detail were developed. We were particularly satisfied with the number of obstacles and opportunities that were identified. This substantiates our gut feeling that stakeholders felt ownership of the exploratory scenarios and could put themselves in the scenario mindset before embarking upon the backcasting exercise. The fact that end-points were all specified with an element from the exploratory scenario corroborates this finding. Although the number of actions and milestones was high, we were somewhat less satisfied with these elements. As pointed out in the methodology (see Section 2.4), we asked stakeholders to be as specific as possible on a number of aspects. Due to the nature of the product, stakeholders were very specific on the 'when' and

'how long'. Much less detail, however, was provided on, for example, 'who', 'how', and 'what'. Consequently, the results were more general than we aimed for.

Both the criticism from stakeholders and the observations from SCENES researchers point towards lack of time as a significant limitation to realising the goals of both exploratory and backcasting exercises. Executing a backcasting exercise should perhaps not be concentrated in one workshop. When more time is available, robust strategies could be worked out in more detail, and links with policies could be established. This might also help to overcome worries from the workshop facilitators who indicated that backcasting is a difficult method to execute. In particular, the art of reasoning backwards is not easy to master.

### 4.3. Robust elements

From the onset of the SCENES project, a list of recommendations on how to manage the future of Europe's freshwaters was singled out as one of the key products. Rather than a set of exploratory scenarios that provides a set of different 'plausible' futures, SCENES aimed at scenario-independent findings. As such, the list of robust elements was a crucial output. As previously said, we were satisfied with the number of elements on the list and its broad coverage of sectors, actors, and factors. A strong message emerged with a call for action on important areas such as awareness raising, implementing economic instruments (water pricing and taxes), and investing in technological developments in a number directions. Additionally, details on what needs to be done and when action needs to be taken can be extracted from the individual backcasts. In short, as a summarising final product from the series of stakeholder workshops, working towards one list was very useful.

On the other hand, the gap between this list of robust elements and policy recommendations is large. Most elements are rather general – missing e.g. which actor will be responsible – to be directly of any use, which frustrated some stakeholders. Additionally, none of the elements seem fully robust, as there are crucial differences in timing, responsible actor, or financing body. A good example is the element of technology development, which is mentioned in all backcasts, but wildly different in conception. Working towards behavioural change through education and new media seems to be one of the most robust findings.

### 4.4. Combining exploratory and backcasting scenarios

Fig. 2 attempts to summarise the process of first diverging towards different exploratory futures and then converging through a backcasting exercise to a short list of robust elements.

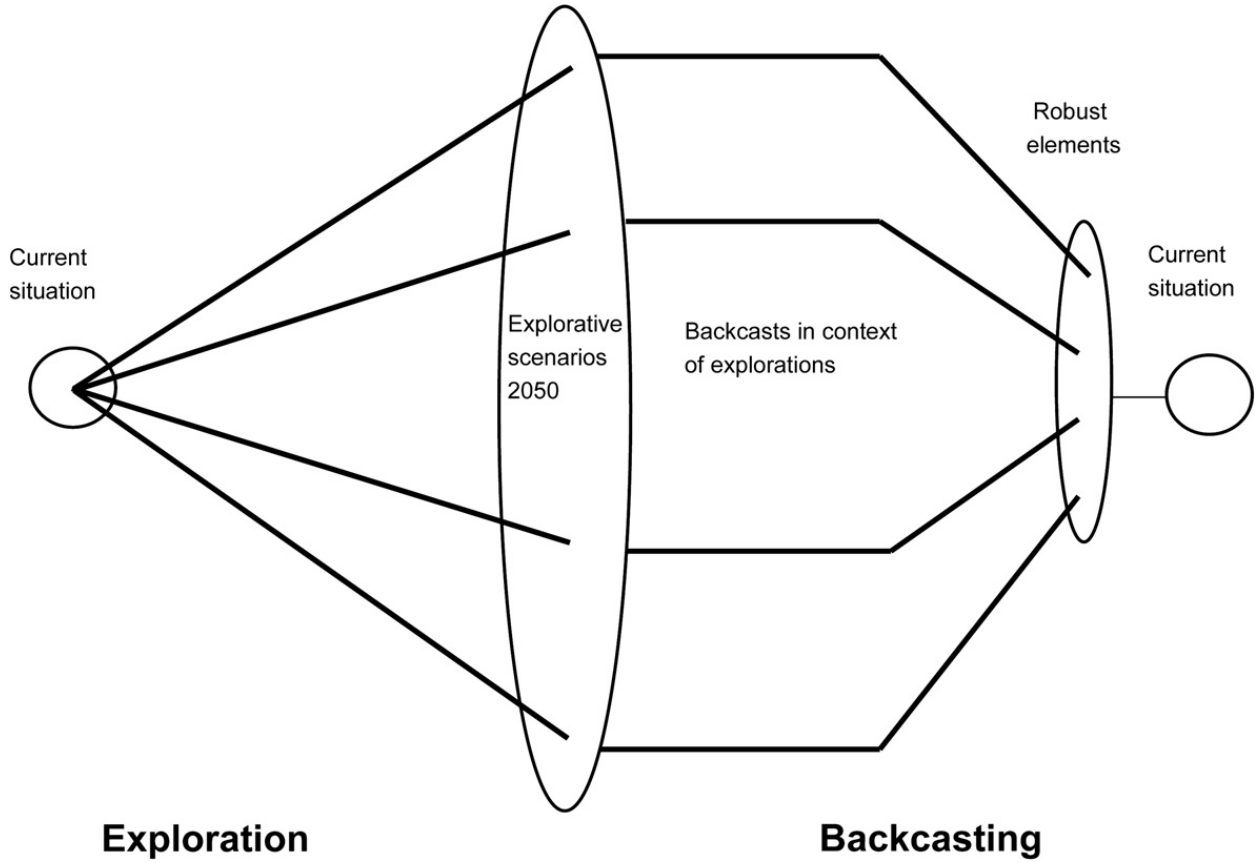


**Fig. 2.** Schematic summary of the process of first diverging towards different exploratory futures and then converging through a backcasting exercise to a short list of robust elements.

#### 4.4.1. Methodological feasibility

Combining two fundamentally distinct methods to develop scenarios is a very intensive process. It is difficult to strike the right balance between the number of methods and the time available. Moreover, a participatory process has its own dynamics and satisfying the needs and demands of the stakeholders present is an additional complicating factor. Yet, we were mostly successful on all accounts. Stakeholders indicated their satisfaction with the overall process, as well as with the separate products, even though not all stakeholders bought into the process. Additionally, methodological advances were made, including the use of fast-track scenarios and the combination of exploratory and normative scenarios. As such, it is methodologically feasible to conduct a small series of workshops in which exploratory and backcasting approaches are combined.

Setting the agenda for every stakeholder meeting, however, was a long process, and not all goals as defined at the onset of the project could be satisfied. Specifically, SCENES was a multi-scale project and a cross-scale comparison and integration of the resulting scenarios was an important aim. Although other means to achieve this goal were found, the multi-scale character of the pan-European scenarios was not to the extent as originally planned. This shows that modesty in the number of goals that need to be satisfied during a participatory process is important.

#### 4.4.2. Usefulness of resulting scenarios

First and foremost, the mix of methods resulted in a mix of products that highlighted different and often highly complementary aspects of the future of Europe's freshwaters. The list of main uncertainties can be said to stress the current and short-term fears of stakeholders involved. Climate change impacts, migration, weak governance structures, lack of economic instruments, etc. all stress the current problems. The exploratory scenarios substantiated a broad range of long-term expectations, in this case mostly along plausible developments of globalisation versus regionalisation and a proactive versus reactive attitude. The backcasting timelines portrayed long-term hopes and short-term solutions, which culminated in a list of robust strategies in which the long-term hopes are checked against long-term expectations. By working towards different products, the overall picture sketched by the stakeholders became more and more complete.

When comparing the summaries of exploratory scenarios and backcasts in Table 2, however, aspects of inconsistency and even contradiction also become apparent. For instance, the backcast related to Economy First is more positive than the exploratory scenario from which e.g. awareness raising and monitoring systems are absent. In Sustainability Eventually, the split between water-rich and water-poor countries does not materialise in the backcast. As a result the backcast includes strategies across Europe that are partly inconsistent with this split. A good example of a contradiction is the future of the Water Framework Directive. The exploratory scenarios provide a basket of different futures for the WFD. In Sustainability Eventually and Economy First it is successful in part of Europe and for different reasons. In Fortress Europe and in Policy Rules it is restructured fundamentally. In the backcasting timeline, on the other hand, the WFD does not meet its goals in any of the cases. In Sustainability Eventually it eventually succeeds, but only after an initial failure. In all other backcasts, compliance is very far away. It seems that the explorations were relatively optimistic on compliance, and more specific on regional differences. An additional workshop revisiting the exploratory scenarios would be needed to clarify this contradiction.

On a more conceptual level, the conclusion seems justified that the added value of developing a full set of exploratory scenarios prior to the backcasting exercise differed by scenario. Particularly those exploratory scenarios that are different from the current situation in some (but not all) key aspects seem suitable to identify desired sustainable pathways. In this case, the Policy Rules exploration which differs from the current situation in its proactive attitude but not in its globalising world and Fortress Europe which differs in its regional world but not in its proactive attitude seem more apt to serve as inspiring contexts. The information in these backcasts can be seen as complementary to the exploratory scenarios and as such of added value to explore sustainable pathways within the contextual stories.

On the one hand, the usefulness of combining explorations and backcasts is high, because of the ability to identify robust elements that can lead to policy recommendations independent from the exploratory scenarios. Also, the two methodologies lead to results that are in some cases highly complementary. On the other hand, there are clear indications that in other cases the two products contained contradictory elements.

## 5. Conclusions and recommendations

### 5.1. Combining exploratory and backcasting scenarios

Including a backcasting workshop in an exploratory scenario development process has a number of (dis)advantages related to either the process or the results. Table 7 attempts to summarise the main findings of this paper, by listing the pros and cons on including a backcasting exercise. By and large, it can be concluded from the experiences in the SCENES project that it is beneficial to include a backcasting analysis, provided that sufficient time is allocated to the backcasting and provided that a consistency check between products takes place. However, linking a fully elaborated set of explorations to a backcasting exercise is logistically difficult and conceptually challenging.

### 5.2. How can a backcasting analysis be included in an exploratory method?

Firstly, elements of backcasting could be included earlier in the exploratory procedure. Especially where envisioned changes are large (Sustainability Eventually), direct backcasting seems a more logical solution, and should perhaps not be preceded by a

**Table 7**
Advantages and disadvantages of including a backcasting workshop in an exploratory scenario development process.

| | Process | Results |
|---|---|---|
| Advantage | Stakeholders are comfortable with the final goal of converging robust actions next to diverging explorations | Working towards a broad mix of products will lead to a more complete picture of the future. |
| Disadvantage | Understanding and executing a backcasting exercise is intuitively difficult for some stakeholders | There might be inconsistencies or even contradictions between the explorations and backcasts. |

(long) exploratory process. Alternatively, it can be reasoned that it is better not to explore future outlooks that simultaneously break with most current trends. Additionally, as was concluded by Dreborg [20], scenarios that are too far away from present day reality are unlikely to stimulate stakeholders' creativity, partly for the same reason. In short, more implausible (yet certainly possible) futures are better tackled with a backcasting exercise.

### *5.3. Which elements of an exploratory method could be included in a backcasting?*

In keeping with the conclusions above, elements of exploratory scenario development might be useful to consider in a backcasting analysis. Using fast-track exploratory scenarios might be a way to quickly include these elements without having to invest too much time or money. Additionally, the Story-And-Simulation framework offers a detailed and reproducible set of steps most of which have potential to be considered in a backcasting approach.

Above all, we hope that we have illustrated with this paper that it is conceptually appealing, methodologically feasible, and practically useful to combine exploratory scenario development and a backcasting analysis. In particular, we tried to demonstrate how a combined methodology calls for a comprehensive set of interlinked tools and methods that together can aid stakeholders to develop a set of consistent scenarios, while helping researchers to get a better understanding of the perception of the stakeholders involved. By indicating some of the potential pitfalls we have tried to make clear where specific approaches can help avoiding them.

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