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Deliverable 2.1 Report describing methodology for scenario development at pan-European and pilot area scales

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SCENES
Water Scenarios for Europe and for Neighbouring States
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Deliverable 2.1
(WorkPackage 2, scenarios)

Report describing methodology for scenario development at pan-European and pilot Area scales

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1 Introduction

This document describes the methods, their goals and their use in the participatory scenario development process of SCENES. SCENES is a EC 6th FP project that aims on developing and analyzing a set of comprehensive scenarios of Europe's freshwater futures up to 2050. It consists of a highly participatory part that will develop qualitative scenarios (storylines) and a quantitative part (WaterGap, indicators and drivers). The different parts will interact with each other via the SAS-approach (Alcamo *et al.*, 2001). This document focuses on the participatory methods that will be used in the qualitative scenario development.

In this document an overview is given of a number of qualitative and semi-quantitative participatory methods. From this larger set of methods, a selection has been made that will be used for the qualitative part of the SCENES scenario development process (WP2). The methods are chosen in such a way that integrative scenarios will be developed, focussing on water and all relevant social, economical and environmental aspects related to water. The output will consist out of qualitative and semi-quantitative products. The semi-quantitative output will enhance the link between the qualitative storylines and the WaterGap model. The SCENES scenario development process will also provide end users with a set of short and medium term policy options. More background on the whole SCENES process can be found in the Description of Work (SCENES, 2006).

1.1 *Importance of work in larger context*

Water is connected to a lot of aspects in life and has large impacts on people's everyday lives. This has also been realised on the European level, which has resulted in a number of water related policies. The Water Framework Directive (WFD) is the one of the most important and influential policies. The WFD promotes sustainable water use based on long-term protection of water resource, by mandating that Member States develop river basin management plans for each river district in the light of the national and EU development strategies. The requirements for these basin plans will have a great influence on water planning. For example, the plan must include a report of how various water users are contributing to the recovery of costs of water services, based on harmonized datasets and reporting protocols. Moreover, they must address the multitude of dimensions of water use (domestic, industrial, agricultural sectors) and the water requirements of aquatic ecosystems. These plans also have taken a broad view: water availability, the quantity and quality of surface waters and groundwater, and the regenerating capacity of the various water resources in the long-term.

The WFD specifically mandated for public participation in the development and implementation of the river basin plans and other aspects of the WFD. The participatory approaches should lead to more attention to water issues in general as well "developing the attitude".

The working hypothesis of SCENES is that one dimensional, single sector focussed policies and directives, relying on a limited set of characteristics of the water system, will not lead to a sustainable future of European waters. Hence an integrated approach is needed. This is also the approach of the WFD.

In this document such an integrated approach is presented. The scenario process aims on developing integrated scenarios, which not only focus on direct water aspects but also on wider water related aspects. This will be done through a series of participatory workshops, contributing to that aspect of the WFD as well.

1.2 Place in the overall SCENES process and goals

The qualitative scenario development of WP2 will provide input for the other work packages (figure 1). The scenario development process will therefore include methods that can produce output that is useful for and can be easily adapted by the other work packages.
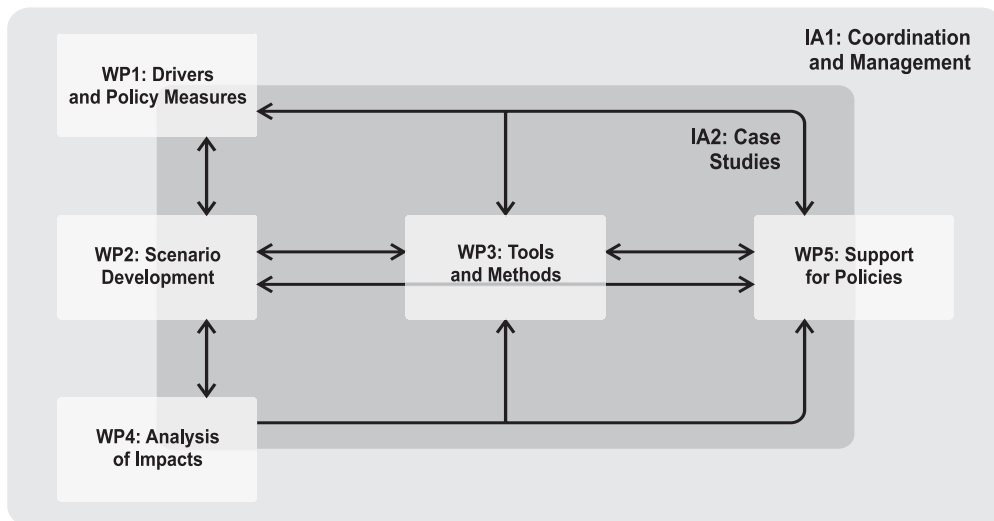
Figure 1; Basic organisation of work packages in the SCENES project.

Within SCENES the SAS (Story And Simulation) approach will be used. The SAS approach (Alcamo, 2001) accounts for all steps considered essential to develop scenarios at a single scale (see Figure 2). Important steps include the establishment of a scenario panel and scenario team (1); construction of storylines (3) that are quantified and revised (4-6) in an iterative procedure; and publication and distribution (10).
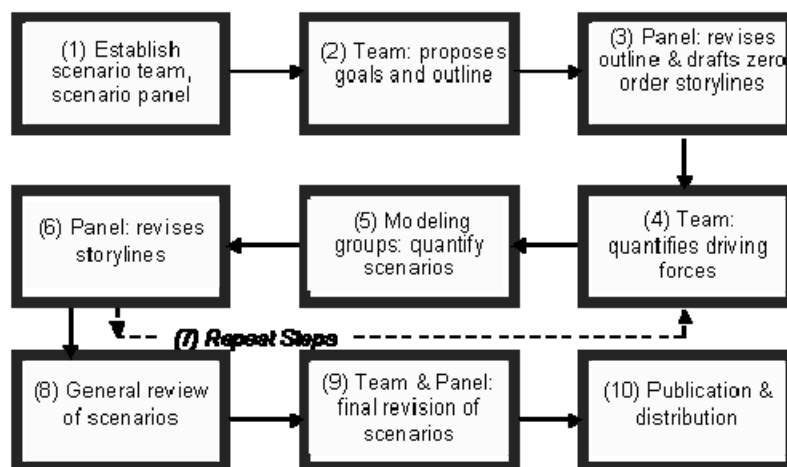
Figure 2; Overview of SAS (Story and Simulation) Approach to scenario development

The most difficult part in this process is the quantification of the qualitative scenarios. The developed storylines are often quite vague, in the sense that they do not give detailed information that can easily be quantified. For instance the storyline might say that tourism will increase much, but how big the increase will be exactly is not specified. This makes it difficult to translate into hard data needed for the models. For other variables mentioned in the storylines (like social capital, happiness) there is no hard data available. This leads to a gap between the quantitative models and the qualitative storylines.

In SCENES we will try to bridge this gap by using the semi-quantitative methods, and Fuzzy Cognitive Mapping in special. In some Pilot Areas Causal Loop Diagrams (§ 4.5.2) will be developed that in turn will be translated in stock and flow maps (§ 4.5.3). Fuzzy Cognitive Maps (§4.4) will give a structured overview of the stakeholders' perception of the current system and the system as it will be under each scenario. This can be used to identify in which aspects can serve as indicators and where the impacts are likely to be the largest. These outcomes can be used by work packages 1 and 4.

SCENES works with three different scales; pan-European, the regional and the Pilot Area scale (Figure 3;). When multiple (spatial) scales can be discerned often there are different issues playing at each scale. Often processes have stronger impacts on some scales then on others (Millenium Ecosystem Assessment, 2003). There are also interactions between scales, which can be detected better with a multi-scale approach (Biggs *et al.*, 2007). Scenarios that incorporate the different issues and relations will therefore be more relevant for all decision-making scales (Wollenberg *et al.*, 2000). SCENES therefore want to make at least one iterative cycle from European level to Pilot Area and back. The results of the Pilot Areas will be up-scaled to the regional level and used to enhance the pan-European scenarios. The pan-European panel outcomes will be fed back to the Pilot Areas to reach a good cross-scale fertilization. Before the first workshops Fast-Track scenario will be made, that will serve as framework for the Pilot Area scenario development process.
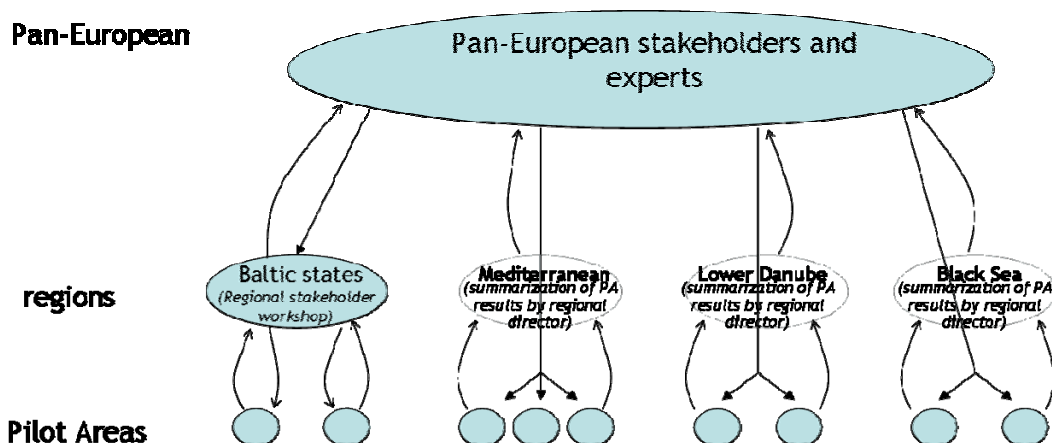

Figure 3; The scenario development process on the different scales and links between them.

Although this Deliverable focuses on the Pilot Area scale the methods described in it can also be used on the Pan-European and regional scales. The scenario development process on the pan-European scale has been sub-contracted to Prospex. Discussions on

the methods used at the pan-European scale had not yet taken place at the moment of publication of this Deliverable. It can however be expected that similar methods as described in this Deliverable will be used in the Pan-European panel meetings.

To increase the potential use and acceptance of the scenarios in a wider area than the Pilot Area it is good to involve higher level stakeholders. This type of stakeholders is however likely not to be able to allocate two days per workshop. The best option is then to involve them only in the last part of the workshops in which the products are presented and discussed.

1.3 Reading guide

In the next chapter a quick overview of the scenario development process is given, which consists out of four steps. These steps are then subsequently described in more detail. The tools and methods mentioned in the description of the steps are described in more detail in the following chapters. Chapter three describes the qualitative methods, chapter four the semi-quantitative methods or conceptual models. In chapter five some information is given on the evaluation of the workshops, including a tool called mood-o-meter. Work package 5 will provide a document with more information for the evaluation. Another method that will be used next to the workshops is shortly described in chapter six. In the last chapter a last overview is given on how it all fits together.

2   Description of the SCENES scenario development process

The scenario development process will consist of four steps in which the different qualitative and (semi-)quantitative methods are combined.
Step 1. Present and near future.
Step 2. Looking at the future (long-term visions).
Step 3. Critical review of developed visions.
Step 4. Playing it back (short-term options).

These steps are chosen in order to steadily build the storyline of the scenarios. A thorough understanding of the stakeholders' view of the present system is needed in order to understand why they think the future might evolve in a certain way. Therefore the first step is very important. In the first step a Fuzzy Cognitive Map is made for the present system, which will be used to compare the visions with the present. The present forms the starting point for the storylines.

In the second step visions are developed, these form the end point for the scenarios. These long-term visions give the ideas of the stakeholders on how the future might look like, given the external drivers from the fast-track scenarios. Fast-track input from other work packages can be used here.

The visions will be enriched in step 3, where the stakeholders will critically review the developed visions. The stakeholders will be confronted with there own work and with new input from other work packages and local models. It is expected that this will lead to changes in the visions and a more thorough story behind the visions. Also Fuzzy Cognitive Maps of each vision will be made so that they correctly represent the system under each vision separately.

In Step 4 the focus is moved from the end visions to the time lag between the end visions and the present. During this step the focus is more on short-term policy options that are needed to reach the desired visions. These will be plotted on a timeline. The developed Fuzzy Cognitive Maps form the framework for this exercise in order to stimulate system thinking.

The results of all steps are used in later steps; together they will form the final scenarios. A story of the future only makes sense if it is complete, it needs a beginning (present), a middle part in which it is described how things are changing (timeline), and an end (the vision).

2.1   Step1; Present and near future (short-term obstacles).

Step 1 is meant to gain insight in the stakeholders' perception on the present and short-term future situation of water-related issues in their region.
This step begins with a brainstorming session via card-techniques. All participants write their most important issues about the Pilot Area on post-its. The post-its are then grouped in clusters of similar issues. Spidergrams will be used to map the perceived importance of these issues in the view of stakeholders. The clusters of issues will form the starting point for a semi-quantitative conceptual modelling exercise. Using the Fuzzy Cognitive Mapping (FCM) technique, the feedbacks between the main issues are

identified and discussed. This will result in a fundamental understanding of the system and of potential inconsistencies or misconceptions that might exist among stakeholders. This should facilitate the communication between qualitative storylines and quantitative models.

Time trends will be made in order to show the perceived temporal behaviour of the concepts (clusters). These can be used by other WPs as 'reference modes'.

The FCMs can also be used by Work Package 4 and 1 to gain more knowledge on the perceived drivers and indicators. The system understanding from the FCMs show what the perceived drivers and indicators are and how they influence the system.

A questionnaire among a larger group of stakeholders who have not attended the workshop can enrich the outcomes. In the questionnaire stakeholders are asked to identify important aspects and to link them with each other. With this additional input more cluster can be identified which can be added to the FCMs developed in the workshop.

2.2 Step 2; Looking at the future (long-term visions).

 In the second step the scenarios are developed (e.g. in the form of rich pictures or collages). The four fast-track scenarios will serves as a framework within which local scenarios will be developed. They will be presented in the same way as the participants are asked to make them. When the fast-track scenarios are not distinguishable for the participants, because the drivers do not affect their scale, alternative scenarios can be formed.

In each scenario the (in workshop 1 identified) major aspects are likely to change. Spidergrams are used to map the stakeholders' perception of these changes. The spidergrams will form the basis for development of FCMs of the future systems. They will also be used during the backcasting exercise as input for the time trend development. With the comparison of the spidergrams (of present and vision) as starting point, time trends can be made indicating how the issue at stake changed.
In between step 2 and 3 these FCMs for each vision will be developed by SCENES experts.

2.3 Step 3; Critical review of developed storylines.

In the third step the scenarios will be reviewed and enriched by the stakeholders. They will receive the enriched pan-European scenarios, model output from the WaterGap model and local models (where available) and the computed FCMs to give them new insights. The feedback does not simply give single values but ranges of values. The ranges of values gain more meaning when one watches how they change in different locations.

The visions will be discussed in the morning. In the afternoon the participants are asked to change the FCM of the present (developed in step 1) into a FCM of the future, according to how the future system looks like in their vision. The participants can either start with the present FCM, or with a FCM of the vision's system created by

SCENES people. The FCMs made by SCENES people are based on the visions and the spidergrams of the visions made in step 2.

2.4 Step 4; Playing it back.

In Step 4, the aim is to develop a continuous story from the future back to the present, with a focus on short and medium term policy options. Participants will use the FCM of the present and from the scenario they are working with. This will give them an idea on how the system is changing in the scenario. The participants are therefore more forced into a system approach, which should lead to a richer backcasting exercise. In many backcasting exercises the story only addresses one aspect and participants tend to forget how this is connected with other aspects in the story. The danger of such narrow perspectives can be minimized by using modelling methods, such as FCM , that display a broad range of factors related to the scenario's dynamics.

The participants are then asked to think about the problems and obstacles that have to be solved to get to the vision. They will have to come up with policy actions that need to be taken to overcome these obstacles. The focus will be on short and medium term policies. The policies will be plotted on a time line.

After that the stakeholders are asked to make time trends (figure 4) that give the change in values of the main aspects (clusters from step 1) and other indicators. These graphs illustrate how the clusters change over time, within each scenario. These graphs can be compared with the "reference modes" for the way policy actions help us escape from the trap of the reference mode. They can also be used during the making of the system dynamics qualitative models (IIASA) and by other work packages.
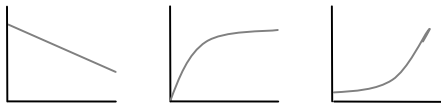
Figure 4; Time trends

2.5 The workshops

As fifth step the dissemination of the results of the whole SCENES project is envisioned. This part of the process will be part of work package 5 and is not further described in this deliverable.

The steps described above will ideally be taken in three to four workshops of at least two days each. A more detailed plan of each workshop can be found in appendix 2.
In some cases, where there is already a lot of data and knowledge available from previous participatory studies, parts of the first steps can be done in a shorter time interval, or even skipped altogether. Please discuss this with your scenario team contact person[1]. The following modules within the first 2 steps can be discerned:
1. defining concepts (creation of clusters)
2. defining the current system (creation of FCM)
3. development of reference modes
4. development of first set of visions

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[1] A list with contact persons can be found in the SCENES toolbox.

Besides the workshops questionnaires will be conducted. They will make it possible to incorporate the views of a larger group of stakeholders. The questionnaires are not discussed in detail in this deliverable.

3   Description of qualitative methods

3.1   Overview of available methods

There are a lot of different qualitative methods and tools for participatory processes. Many methods are closely related; sometimes the same method has different names in different literature sources. A short overview of various available methods is given in Appendix 1; overview of available participatory methods. Most of the qualitative methods that will be used in the SCENES scenario development process are well known in the scenario development community. The innovative part lies in the semi-quantitative methods and conceptual models. We have therefore chosen to keep the qualitative part relatively simple, so that the new methods can get more attention.

3.2   Talking pictures

Each participant is asked to take a picture or an object with him that symbolises a special aspect from the Pilot Area. The participant will introduce her/him self and shortly present the picture/object and what it symbolizes. This aspect should be something that the participant think is important for the future of the Pilot Area. The facilitator will write down the keywords on a flipchart or whiteboard. (website creativity techniques, 2007) After all participants have presented their picture and story behind it, the flipcharts can be the starting point for discussion or card technique exercises.

Take a picture or object with you yourself, with which you present yourself and f.i. your role in the workshop or the importance of the workshops and SCENES.

Goals:

All participants have at least spoken once, making it easier to speak again. The link person – picture also helps to remember names. The humour that is often generated from the unusual objects / pictures gives the meeting a nice start.
The other output related goal is to get a first quick idea of the main issues at stake in the Pilot Area.

Materials needed:
-    Thick felt-tip pens
-    Flipchart
-    Room layout in which everybody can see each other

3.3   Card-technique

Card techniques are used to organize, cluster and rank information. This technique is also known as Delphi technique, metaplanning or post-it session. This is one of the most useful and widely used techniques in workshop settings because of the ease with which many ideas can be quickly collated and organised.

The card-technique consists of two steps:

1. Ask the participants to put their main ideas about the topic under discussion on a card (or sticky note). Each idea or aspect has to be on a separate card. Give a limited number of cards in order to prevent from being overloaded with cards. Participants should not talk to each other, and come up with their own ideas.

2. Then, group connected items together and give a name or description to each cluster. Use a different colour card and pen for the cluster names. Exact duplicates of cards may be removed, but keep all ideas on the wall, also those that do not fit in any cluster.

(website msp portal, 2007)

The second step can also be done by throwing all cards on the ground and let the participants sort the cards into categories. Listen and watch for emerging categories and write them boldly on new cards. Anyone can get down on the ground and start sorting the cards. The nice thing is that on the ground those who are quieter tend to be more empowered. The dominant people may remain standing and be more out of power. If they do get down and sort, it is harder to dominate on all fours and less eye contact. Actually moving cards also reduces talking, making it easier for those less talkative. This is sometimes called the democracy of the ground. (Chambers, 2002)

Tips / Comments
- The card technique is generally used in a small group or workshop although it can be used by an individual trying to analyze information.
- Make sure that everybody has the same understanding of the items put forward on the cards.
- Make clear that all ideas, aspects etc are welcome as long as they are somehow related to the topic. If there is a card with an unknown relation, ask for the relation.
- Use one point on one card.

(website msp portal, 2007)

Goals:

This method makes it easy to get input from all participants; also the less talkative people can give just as much input. This method can quickly give a good overview of the different issues at stake in the Pilot Area. Clustering makes it easier to see the different overarching aspects and makes the large volume of issues easier to handle.

Materials needed:
- Thick felt-tip pens
- pencils
- Flipcharts
- Cards / post-its
- Enough space to cluster the cards
- Enough space (on the wall) to put the clusters on

3.4 Collages

Collages can be used as a means to present scenarios. Collages are always combined with a presentation/written text, that explains what the collage represents. The participants will first discuss how they think the future of there area will look like

regarding the developments in the rest of Europe (as described in the fast-track scenarios). The participant shall then try to visualize that future in the collage. They can use a large number of magazines with lot of pictures. They can all give input to the collage by choosing pictures that represent a certain aspect of the vision they are working on. How the collages will look like is up to the participants. They can make it as a sort of flow-diagram, but can also use the pictures on a map of the Pilot Area, or make a story board out of it. Words, symbols and drawings can also be added. Ask the participants to keep the system understanding, obtained via the FCM, in the back of their mind. Let them think about the changes in the system behaviour.

During the presentation the key elements and key linkages between them are described, within the story about the future. The facilitators of the sub-groups have the important task to write down the stories and the way they are developed during the scenario making process. The process description should for instance include who had most influence (see also WP 5 template).

Figure 5; Collages

The collages are easy to refer to and can also be used later in the scenario development process. For an example of a collage workshop see; (Kok and Patel, 2003).

Goals:

To make a visual presentation of the scenario storyline. Dominant people tend to talk mainly, less dominant people can put their ideas in the collage by choosing the right pictures and sticking them on the paper. The activity of choosing the right pictures and cutting and sticking them makes it more fun to do then only talking and makes people also more creative. One collage can say just as much as a couple of papers written text.

Materials needed:
- Lots of magazines with pictures (travel magazines, glossies, etc)
- Felt-tip Pencils
- Flipcharts / large paper
- glue

-   Enough space (on the wall) to put the collages on
-   Group setting, so that all groups can see the presentations as well

3.5 Rich pictures

Rich pictures are a representation of the elements that are important in the visions. They can include stakeholders and issues, and the interactions and connections between them. The rich pictures are used to present the visions, and come with a story that is told during the presentation (and written down by the group facilitator).

Each group get a couple of large sheet of paper to draw a "picture" of the vision on. Although it is meant to be a visual, words and symbols can also be used. Try to include the critical aspects of the vision and links between them. It might be helpful to make a sketch version first and than redraw the picture for the presentation. Then you know better what you want to put where and how large it can be. Of course the quality of the drawings itself do not really matter, as long as the ideas behind it are clear.
An existing map of the region can also be used to draw the different items / pictures in. (website msp portal, 2007)

Ask the participants to keep the system understanding, obtained via the FCM, in the back of their mind. Let them think about the changes in the system behaviour.
During the presentation the key elements and linkages are described, as part of the story on the future. The facilitators of the sub-groups have the important task to write down the stories and the way they are developed during the scenario making process. The process description should for instance include who had most influence (see also WP 5 template).

Figure 6; Rich picture (source: (website School of ISE))

Goals:

To make a visual presentation of the scenario storyline. Dominant people tend to talk mainly, less dominant people can put their ideas in the rich picture by drawing, adding symbols and arrows. The activity of drawing makes it more fun to do then only talking and makes people also more creative. Drawings on the first sketch also make it easier to discuss. One rich picture can say just as much as a couple op papers written text.

Materials needed:
- Felt-tip Pencils
- Flipcharts / large paper
- Enough space (on the wall) to put the rich pictures on
- Group setting, so that all groups can see the presentations as well

3.6 Timeline

Timeline is a widely used participatory tool to understand a kind of history of a community. (website msp portal, 2007) It can however also be used during the 'playing it back' (backcasting) session of the scenario development. The end vision is then put at the end of the timeline and the present at the beginning (although you might even go back further to put things in a historical perspective).

It is meant to enrich the storylines of the scenarios with the short and medium term policy actions needed to reach the visions. The Fuzzy Cognitive Maps (FCMs) that are developed of the present and the future system of the vision are used as starting points. The system as it is now will need to be changed. The current and future problems need to be solved. There will be barriers that need to be taken. The participants are asked to think of policy actions that are needed to change the present system in such a way that it becomes the future system. The focus should be on short and medium term actions. These actions are (roughly) plotted on the time line.

Goals:

The goal of this exercise is to develop the visions into real storylines, describing the whole time from present to the desired vision, including the policy actions. The timeline is used to plot the actions on, making it easier to follow which action has to be taken first and which later. Some actions might also take a lot of time implement, which can be easily visualized on the timeline.

Materials needed:
- Felt-tip Pencils
- Flipcharts / large papers
- Enough space (on the wall) to put the time lines on
- Group setting, so that all groups can see the presentations as well

4   Description of semi-quantitative methods

4.1   Overview of available methods

The scenarios developed in the workshops will be translated to a set of quantified parameters that are the input for the quantitative model (WaterGAP) and the drivers and indicators. Previous assessments show that this process is often difficult because of the qualitative nature of most scenarios developed by stakeholders. These scenarios often stay quite vague, making it hard to quantify. There are also variables that are difficult to translate into hard data because of their nature (like happiness). These issues make that that there is a gap between the qualitative scenarios and quantitative models. The semi-quantitative methods should serve as a bridge between the storylines and the models.

An overview of a number of semi-quantitative methods can be found in Appendix 1. Most of the conceptual models are quite similar. Fuzzy Cognitive Maps are chosen because they can be used to structure the outcomes of the participatory processes by introducing system thinking. Causal Loop Diagrams are more formalised and quantitative, and take a longer time to develop. They will not be used in the workshops but serve as a extra tool for SCENES people and the interaction between work packages.

Fuzzy Cognitive Mapping will be used in all Pilot Areas such that all teams can focus on the same set of methods and the scenarios are more comparable. Other modelling tools, such as Causal Loop Diagrams and system dynamics qualitative models, are resource-intensive methods that will only be used in some of the Pilot Areas where IIASA will focus on. However, we anticipate that the generality of many of the themes and issues considered by IIASA methods will mean that this limited number of models will still be useful for all Pilot Areas to consider when they examine what causal mechanisms underlie different scenarios.

4.2   Spidergrams

Spidergrams will be used to get a quick visual representation of the importance of the main issues in each Pilot Area. They can be made both for the present and the future. Participants will get an A4 or A5 paper with lines in a star form. Each axis represents one of the main issues. On the outside the value of importance of the issue is very high (10), at the cross none (0).

Make a flipchart that represent an empty spidergram telling which issue is located on which axis, so that all participants place the issue at the same axis. This will make it much easier to compare.

The participant places a dot or cross on the value of importance that he thinks the issues has. When the importance of each issue has been decided upon the dots are connected and a spider web appears.

Ask the participants to write their name on the paper, so that you can compare the different stakeholder groups with each other.
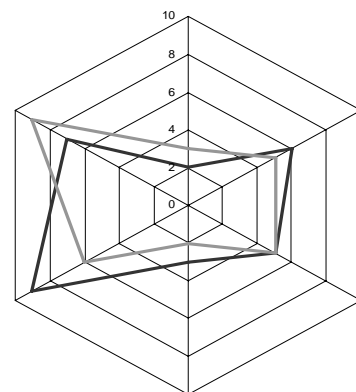

Figure 7; Spidergram

This tool will be used during the first workshop and the enrichment workshop. The spidergrams makes is easy to compare the visions with each other and with the present on the importance of the issues.

Goals:

Spidergrams give a visual representation of the importance of different issues. It will help to compare the present situation with the visions and the compare the different pilot areas with each other. It will also serve as input for the Fuzzy Cognitive Maps.
This exercise can be done individually, giving everybody the same change to influence the outcomes and express their thoughts.

Materials needed:
- Empty spidergrams, with as many axes as issues (Excel document)
- Pencils, different colour for present and the vision
- One large spidergrame, with the issues on the axes.

4.3 Time trend (fuzzy graphs)

This is a simple tool to understand the expected change of any development. It helps to understand and analyze the fluctuation situation of development progress and their reasons during the different time interval. (website msp portal, 2007)

In the SCENES scenario development process time trends will be used in the 'playing it back' session. The participants are asked to make (fuzzy) graphs of how they think that an indicator will change. The graphs thus illustrate time behaviours that constitute a problem or issue of concern to stakeholders. They make yet another visual tool with which scenarios can easily be compared with each other. Time trends made for the business as usual development can be "reference modes" against which scenarios can be compared for the way policy actions help us escape from the trap of the reference mode.

Goals:

The time trends will give another easy to understand visual representation of the scenarios. It forces the participants to think not only about the present and the vision, but also about the time in between. How do they think that the actions plotted on the timeline effect those indicators? The time trends (although fuzzy) will also give valuable information to the model, indicator and impact work packages.

Materials needed:
- (felt-tip) pencils
- Paper to draw the graphs on

4.4 Fuzzy Cognitive Map

A Cognitive Map is the graphical representation of a system, where components are represented as boxes and relationships as arrows. The term Cognitive indicates that the Map is a cognitive interpretation of the system. It is a tool for formalizing

understandings of conceptual and causal relationships. (Kosko, 1993) The term Fuzzy (see (Kosko, 1986)) indicates that the state of a system component is not exact but rather represented in a number of classes ('strong' or 'weak'), that are relative to each other.

With the Fuzzy Cognitive Maps (FCMs) we will try to get a better understanding of the stakeholders' perception of both the present system and the system state in the visions. The starting points for the development of the present system are the main issues concerning the Pilot Area (as derived during the card-techniques session). They will form the nodes/boxes. In the second step the feedbacks / relations between the main issues have to be determined. Try to take as many feedbacks into account as you can. Feedbacks can be either positive or negative. A feedback is positive when an increase in the first variable leads to an increase in the second variable. It is negative when the increase in the first variable leads to a decrease in the second variable. Try to use nouns when using the variables names, so not 'increasing costs' but 'costs'. Also use variables that represent quantities that are clear in which way they change, 'happiness' is better then 'state of mind'. The variables can best be written on cards, so that they can be moved easier, when the FCM becomes messy with too many crossing arrows.

When the discussion about the feedbacks is over, values can be assigned. The stronger the relation is, the higher the value should be. Use values between -1 and 1. Most stakeholders will however feel more comfortable with using words like weak, moderate and much, which then later can be converged to numbers. Use 3 or 5 words maximum, which are used in the same manner by all stakeholders.
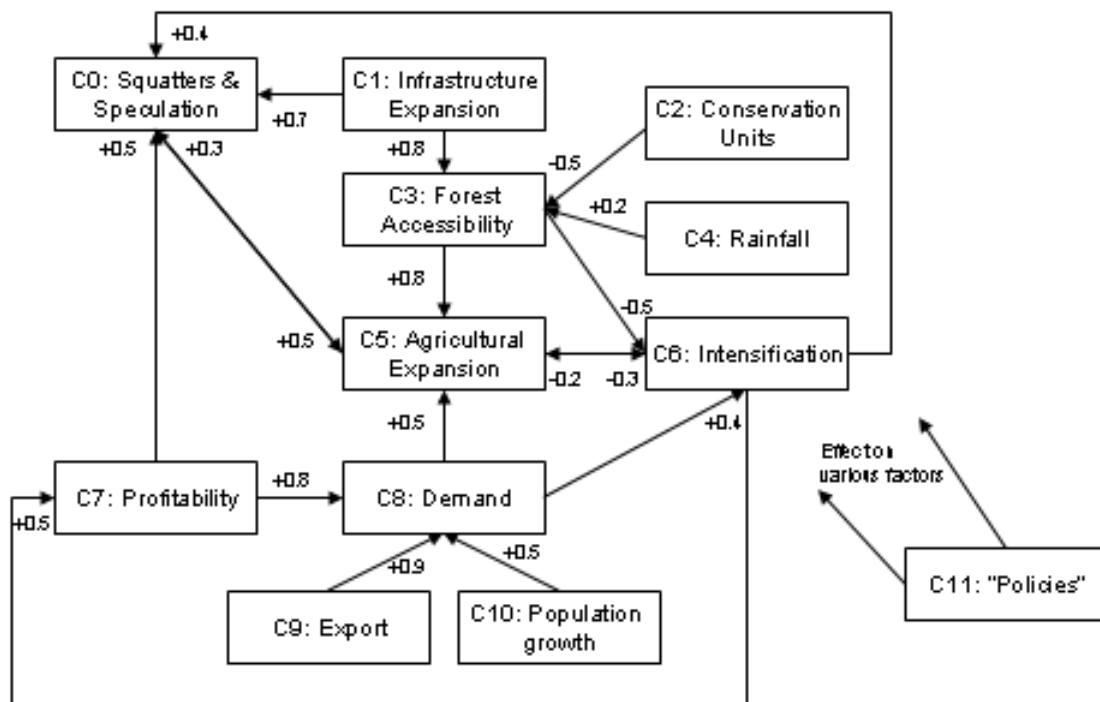

Figure 8; Fuzzy Cognitive Map from Brazilian rainforest deforestation (source: Kok, 2007)

Fuzzy Cognitive Maps forces the participants to be explicit in their description of the system. The visual presentation can be displayed so that it is easy for everyone to comment on it. Stakeholders will learn about variables and feedbacks perceived by others and can take them into account. This can be variables and feedback that they themselves might have forgotten or did not know about. This offers a good learning possibility (see also Cole and Persichitte (2000) for more on FCMs and learning).

After the workshop the Fuzzy Cognitive Maps will be structured further by SCENES people. They will also translate the verbal strengths of the feedbacks into real numbers (-1,1). Feedbacks without specific values will be given values based on the questionnaires, local knowledge of SCENES people and literature study. With these values the cognitive map can be transformed into an adjacency matrix (Özesmi and Özesmi, 2003). A FCM with *C(n)* concepts can be represented in an *NxN* matrix (Cole and Persichitte, 2000). The variables are listed on the vertical and horizontal axis. When a feedback exists between two variables the value of the feedback is coded in the matrix. (Özesmi and Özesmi, 2003)

When these matrixes are fed into a simple computer model (vector matrix calculation, simple version can be made in Excel) the effects of the feedbacks on the relative weights of the variables can be calculated. This will give a graph such as the graph below (graph 1). It gives the relative strengths/importance of the variables.

Feedbacks can be changed, giving different outputs. So if one feedback (for instance a policy) becomes stronger, the model calculates how this affects the other variables. The relative effects of stronger policies can then be seen.

In the examples below (graphs 1 and 2) are about land speculation and deforestation in Brazil. The numbers in the graph corresponded with the numbers in Figure 8;. In the first set there are no policies, in the second graph there has been an implementation of a policy to reduce the export (C11). As effect of this policy, export (C9) becomes lower. Also the agricultural expansions (C5) and squatting (C0) becomes lower. Unfortunately also profitability (C7) gets lower.
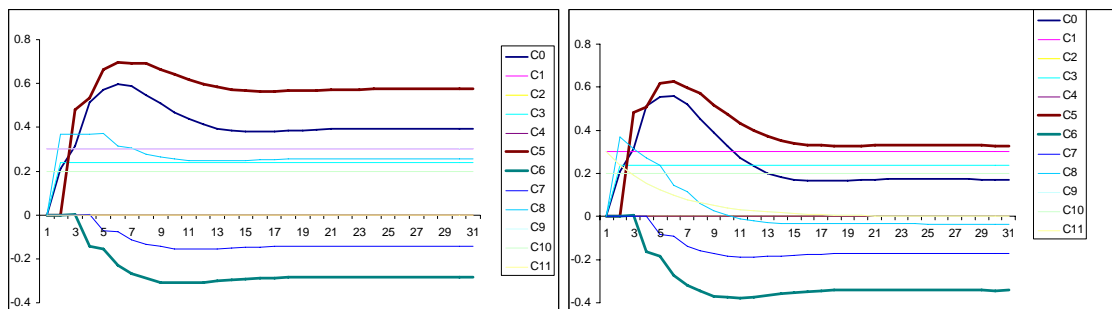
Graph 1; no policies   *Graph 2; policy to lower export*

By playing around, you can see how the system will react on certain changes. This can learn you more about the way the stakeholders perceive the system. The outcomes might lead to a change of perception of the system.

Goals:

Fuzzy Cognitive Maps will be used for multiple goals:
- To get a clear presentation of the system as perceived by the stakeholders.
- To structure the discussion on the system

- To make the ideas of stakeholders explicit
- To create a better learning method for the stakeholders (meta-knowledge)
- As starting points for the playing-it-back exercise

Materials needed:
- Paper cards (for the boxes, making it easier to change the FCM)
- (felt-tip) pencils
- pencils and erasers
- Excel spreadsheet with empty FCM

4.5 Qualitative System Dynamics Models

The principle modelling tools for examining hypotheses about interactions underlying scenarios are described above (pages 12-22). Each tool has special advantages that allow us to look at different system aspects and gain the diverse perspectives of different participants. To maintain coherence across all our scenario development processes, this tool set will be the standard used at every scale from Pilot Areas to the Pan-EU. It is rich and diverse enough to satisfy most needs in scenario development, but small enough to keep our scenario development process as uniform and efficient as possible. Another path to building a coherent capacity to look across all our scenarios and related products is to examine what causal mechanisms are common or different in the different scenarios and geographical contexts. That task will be addressed using Qualitative System Dynamics models (Causal Loop Diagrams, Stocks and Flows Maps). The method looks at the causal relations between variables, but does not use (fuzzy) numbers to estimate the intensity of the relations. It can thus also qualify as a qualitative method, but will be used in the same way as FCMs and has therefore been placed under this heading. It will be used to explore a range of hypotheses about what causal patterns are critical to scenario trajectories.

These models will not be created on site (in each Pilot Area) in a participatory manner, because time does not permit using so many modelling tools, and too much diversity can be confusing. They will be made (in house) by IIASA for a limited number of Pilot Areas. They can serve as a support tool to discuss with the SCENES Pilot Area leaders certain problems or issues that Qualitative System Dynamics models are particularly powerful in explaining.

4.5.1 System Dynamics Methodology

System Dynamics models creation follows the context of each situation where it is applied, and is rarely the same in any two cases. However, a general framework for System Dynamics conceptual modelling can be summarized as a template in designing such a process in the following series of steps, also presented in Figure 9;

1a) Problem Articulation (setting overall bounds and internal dimensions)
- Identify the coupled human-environment system as the subject of analysis
- Defining the problems
- Identifying variables critical to the problem
- Defining horizons in time, in geographical space and in institutional space
- Investigating problem dynamics (Defining Reference Modes)

1b) Mapping Assumptions (using graphical facilitation techniques to visualize the system structure)
- Survey of existing explanations for problem causes

- Building Conceptual Model(s) of perceived reality (Identify variables and their interrelationships
- Identify major uncertainties and unknowns
2. Policy Formulation
    - Setting Objectives
    - Structured Debate on Change - Designing Policies by building Conceptual Model(s) of ideal reality (how the world should be) and compare these models with the models of perceived reality, than analyze the plausible scenarios
    - Finding Indicators
3. Policy Implementation
4. Monitoring - feeding back into the Problem Articulation.
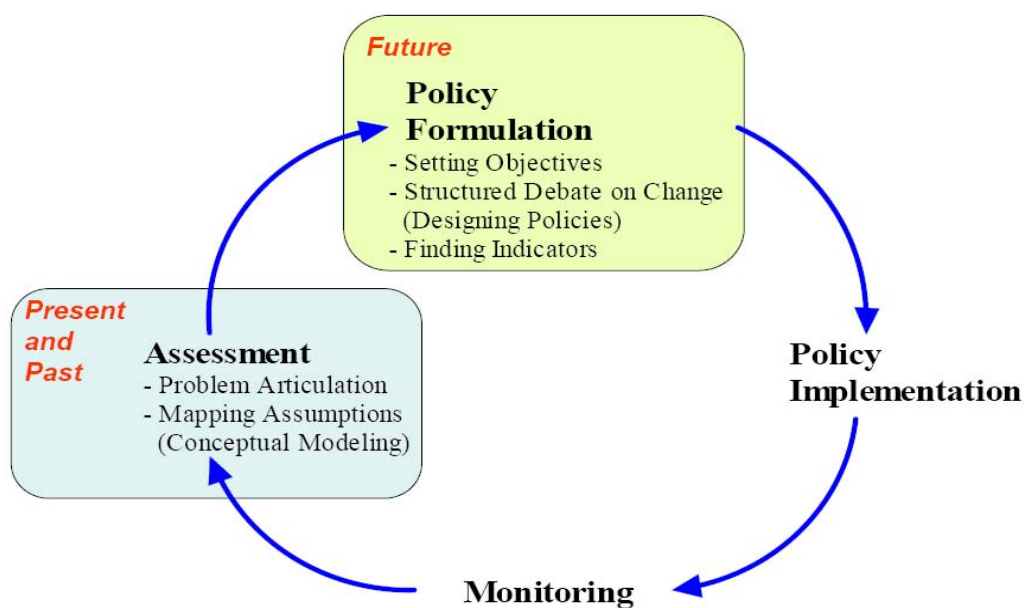
Figure 9; A general framework for conceptual modelling use for a policy integrated assessment.

4.5.2 Causal Loop Diagrams

Causal Loop Diagrams (CLDs) provide a graphic language that helps us to explore causal patterns that are important to system dynamics but are rarely appreciated or understood in everyday life. Identification of a cause and an effect are for many people the basic strategy for dealing with problems – find a cause of a problem and eliminate it. However circular logic and system structure (feedback loops, delays, and webs) are not sufficiently explored to have a real impact on decision making. Most people tend to think linearly, as if every action causes a simple chain of reactions with no feedbacks that loop around to change conditions at any point on the chain.

CLDs represent the feedback structure of a system. They help to capture hypotheses how the system structure influences the dynamics and consider how these hypotheses relate to one another. The variables, causal relations, overall structure and conversations occurring during model construction all offer insights into what mental models are salient for particular individuals or teams. CLDs can serve for

communicating the important system features, especially feedbacks, which are believed to be responsible for the emergence of a particular issue or problem.

An example of CLD with two loops: reinforcing (R) and balancing (B) is presented in Figure 10.

Figure 10; An example of CLD with two loops: reinforcing (R) and balancing (B).
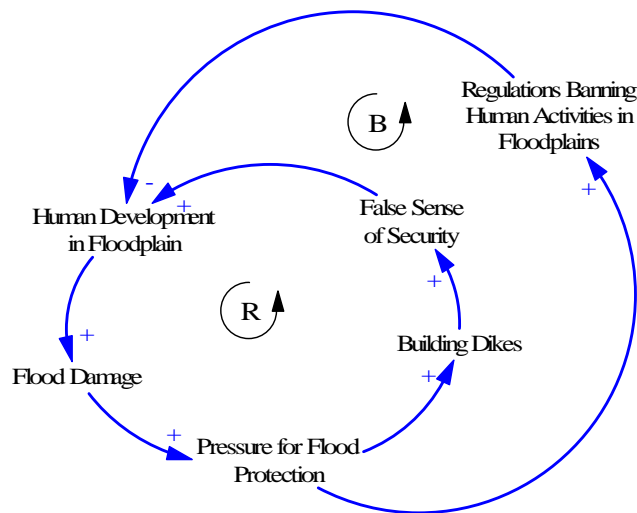
A positive link (indicated with +) means that if the cause increases, *ceteris paribus* (holding all other variables constant) the effect increases above what it would otherwise have been, and if the cause decreases, *ceteris paribus* the effect also decreases below what it would otherwise have been.

A negative link (indicated with -) means that if the cause increases, *ceteris paribus* the effect decreases below what it would otherwise have been, and if the cause decreases, *ceteris paribus* the effect increases above what it would otherwise have been.

Figure 10 presents an analysis of flood damage problem. The more Flood Damage occurs, the more Pressure for Flood Protection there is, the more Dikes is being build that increases the False Sense of Security, so that the more Human Development in Floodplain is attracted, which in turn aggravate the Flood Damage problem. In this case we are dealing with a reinforcing feedback loop. However, in case of Pressure for Flood Protection other measures can be applied, like for instance Regulations Banning Human Activities in Floodplains, which will have a negative impact on Human Development in Floodplain balancing this Flood Damage feedback loop.

4.5.3 Stocks and Flows Maps

Systems Dynamics "*Stocks and Flows Maps*" enrich the language of Causal Loop Diagrams by identifying variables who accumulate in time (stocks) and those who cause stocks to change (flows). Stocks and flows maps cannot be used to make prediction, but give output that is credible to stakeholders for all variables in the model. Figures 11 and 12 are examples of Systems Dynamics stocks and flows maps.
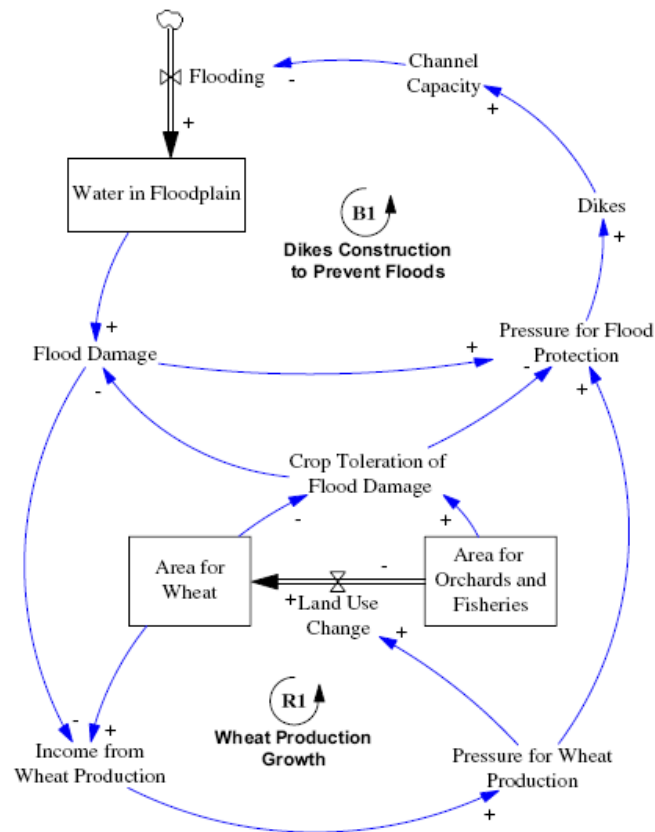
Figure 11; Tisza Conceptual Model. Submodel view of dike construction and wheat production feedback loops linking the water and agricultural sectors.

In this diagramming notation *stocks* are represented by rectangles and *inflows* and *outflows* are represented by an arrow respectively adding to or subtracting from the stock. *Valves* (which appear like an hourglass (⧖) straddling the flow) symbolize the processes that control the flows. They regulate the amount flowing in or out. *Clouds* represent the sources and sinks for the flows, which are assumed to have infinite capacity and can never constrain the flows they support.

Figures 11 and 12 present an analysis of flood problem looking from a water sector perspective in the Tisza River Basin (TRB). This is by no means a complete description of all the variables determining flooding - rather the variables are selected to represent important feedback loops contributing to unexpected and disastrous results of the agricultural policy that massively restructured the TRB so as to maximize grain production. For clarity we describe here two feedback loops extracted from the full model, and because of this not all the model variables are shown on these diagrams.

Figure 10 illustrates how, as a result of the strategy to intensify production and increase income, the initial *Pressure for Wheat Production* shifts the traditionally diverse land cover mosaic to simpler patterns increasingly dominated in area by one use: wheat (*Area for Wheat)*. The manner in which any trend in one variable is propagated by change in the same direction by other variables in the loop – increased *Income from Wheat Production* leads to further *Pressure for Wheat Production* - is described by the reinforcing loop R1. As the result of this process the *Pressure for Flood Protection* increases to secure wheat production. Flood prevention is achieved

through building or raising *Dikes,* which is expected to decrease *Flooding* through increased *Channel Capacity*. In this way the policy aims to prevent *Flood Damage* to the crops coming from *Water in Floodplain*. However, this development plan did not take into account the eventual response of the system that counteracted the initial policy efforts.

Figure 12; Tisza Conceptual Model. Submodel view of modified water flow and human development of floodplain feedback loops linking the water and agricultural sectors.

The agricultural metamorphosis to wheat production precipitated a massive intervention into the water sector, *Dikes* construction, which is shown in Figure 12 along with related effects. The trap inherent in this strategy only became evident over a century. Short-term successes of dike enhancement were eventually undone by unexpected and often delayed system responses, which mount in impact as evident in the increasing frequency and severity of floods. This "policy resistance" can be described by the way feedback loops (B2, R2, R3, R4) modify the desired system behavior from feedback loop B1. First, *Dikes* successfully keep the water out of the floodplain, but this decreases water retention upstream (*Water Retention in Floodplain*), which increases the peak wave downstream, leading to more *Flooding* (Loop R2). Second, the sediments previously distributed in the floodplain now are kept within the channel and accumulate, raising *Channel Elevation* and decreasing *Channel Capacity* (Loop B2). Third, *Dikes* disrupt the local water cycle leading to water stagnation in the floodplain (Loop R3). Finally *Dikes* provide a false sense of security that sustains *Human Development in Floodplain,* adding asset value to the flooding zone and thereby driving up flood damage costs (Loop R4). The oscillation in dominance between Loop B1 and these latter feedback loops explains the policy resistance in this case – why initially successful policy can create more problems than it solves.

5 Evaluation

The evaluation of the scenario development process and the methods is mainly done by work package 5. They will offer a template for the evaluation and observation of the workshops. Here we give you a small and quick tool to get a quick idea of how the stakeholders like the workshops. Mood-o-meters (§5.1) can be held during lunch breaks and at the end of each day. Participants can put sad, neutral or happy smilies(☹ ☺ ☺) under a small number of topics regarding the workshop and it's facilitators. At the end of each workshop participants are asked to fill in a survey (set up by WP5) covering a larger array of topics. Facilitators are also asked to fill in a survey at the end of each workshop. It might be helpful to make short notes (during brakes) on special things happening during the workshop. An observer, who is not participating in any way, can devote all time on taking notes and observing groups processes, facilitators actions, etc. These notes might prove helpful during the study of the outcomes of the workshops and the methods. More information can be found in the WP5 document.

The goal is to be able to review the methods. It also helps to get a better understanding of how the scenarios are developed; who had a large influence and who was silent.

5.1 Mood-o-meter

With the mood-o-meter you can quickly monitor how the participants feel about a small number of aspects. This can even been done during exercises, but we suggest to do it during lunch and at the end of the day. On a flipchart, write the points that the participants are asked to give feedback on.

There are two options; either participants put (pre-made) post-its with the desired smiley on it at the different points or you can make a table like below, and ask participants to draw an X under the smiley that represents their feelings best.

☹ ☹	☹	😐	☺	☺ ☺
x	x x	x x x x	x x x x x x x x	x x x x x x x x x

This method gives a very quick and visual impression about the participants' feelings about the workshop and the facilitators. If the results are extremely negative, they should be discussed to bring up suggestions for improvement. (Rao and Velarde, 2005; Evans *et al.*, 2006b) We want to keep the stakeholders with the project and participating in follow-up workshops as well. Use their comments and make sure that they feel you take their problems serious.
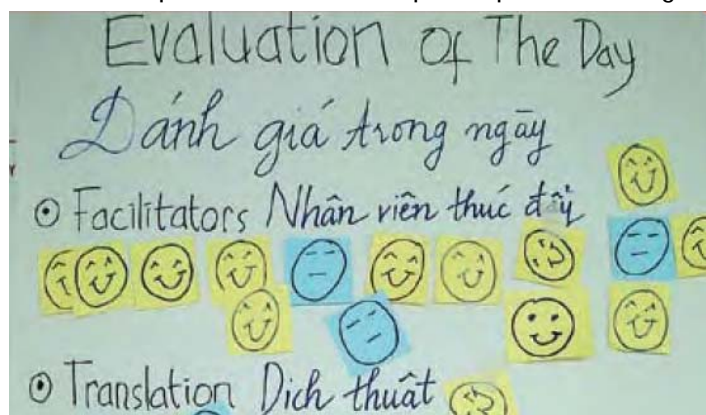

Figure 13; Example of mood-o-meter in use. (source: (Evans et al., 2006b))

6 Questionnaires

Next to the workshops questionnaires will be held. The questionnaires will reach a larger group of stakeholders (40-50 people) and can be used to enrich the outcomes of the workshops. Questionnaires might also include questions for other workshops. For instance questions on possible indicators can lead to valuable information for WP4. The questionnaires will mainly be used in the beginning of the process, to gather information similar to the information gathered during steps one and two. The questionnaires can be constructed in such a way that it will be possible to create (Fuzzy) Cognitive Maps from it. More information on the questionnaires will follow later.

Tips / Comments
Questionnaires have to be made in such a way that they do not steer towards a certain answer. So no questions like:
Scientists think that draughts will be the biggest problem in the next 20 years, do you think so too?
But: what do you think will be the biggest problem in the next 20 years?

Not: Do you also think this is right?
But: what do you think about this?

Also questions should be simple, only one question per question.
So not: What is the relation between water quality and wetlands and why is this important?
But: What is the relation between water quality and wetlands?
        Why is this relation important?

Try not to give too many examples, people will tend to think along the lines of these questions and forget to mention other aspects that they might have thought of otherwise.

Try to use simple words; do not use difficult 'scientific' words. All the respondents should be able to understand what you are asking.

7 Conclusions

This document has described the various methods that exist and in more detail those that will be used in the SCENES participatory scenario development process. It focuses mainly on the process at the Pilot Area level. The process on the Pan-European level will be different in the sense that there will be no real scenario development, only enrichment of scenarios and discussions about the products from the Pilot Areas (via the regions). A lot of the described tools will however also be used at the pan-European level.

At the regional level the same methods can be used where a scenario panel exists. The regions without a regional scenario panel will up-scale the scenarios from the Pilot Areas. They will have to look for common ideas, mechanisms and solutions. The Fuzzy Cognitive Maps and Causal Loop Diagrams will help in the comparison, as they give in a relative easy overview the different systems. Focal points can easily be identified in each FCM, making the Pilot Areas easier to compare. Also the spidergrams, and timetrends will be easily to compare. This will help the regional experts in up scaling the Pilot Area scenarios to the regional level. The details from the visions and storylines themselves can be used as examples to explain the important issues. Of course not only the similarities between the Pilot Areas, but also the differences should be highlighted.

On page 31 an overview is given of the timeschedule for the different meetings that will be held for the qualitative scenario development (WP2 & 5).

7.1 How it all fits together

The methods described above all provide input for other methods in the workshops and/or for other work packages. In the first two steps brainstorming methods will be used, which generate input for the FCMs and visions. In the second step the first visions for the scenarios will be made. Questionnaires can be used to incorporate the views of a larger group of stakeholders in the products. These will be enriched in step 3. Also input from other work packages and local models will be used to enrich the scenarios. The back casting exercises (playing it back) will provide short and medium term policy options for each scenario. During this last step the outputs from previous steps will be used (see also figure 14, next page). This implies that all parts of the workshops should be conducted. Only when there is already a lot of knowledge available parts of the first workshop could be done quicker, or skipped. Please discuss this with your scenario team contact person.

All the output will also be used by the other work packages for their products. It will also be used by the pan-European and regional levels, therefore it is important to stick to the time schedule. That way all processes can interact and learn from each other, which will lead to a better and stronger end result.

7.2 Overall goals

The difference in methods and their aims on integrative and system thinking steers the process towards integrative scenarios. The Water Framework Directive tries to make the water management practises in Europe more integrative as well. It also aims at participatory of water users in the process of developing new water policies. The

SCENES scenario development will also produce new policy options and will involve all the major stakeholders in the Pilot Areas. It can thus contribute highly to the new task set by the Water Framework Directive.

7.3 SCENES goals

The scenario development process as described above will create input for the other work packages. The output from especially the Fuzzy Cognitive Maps will be in an easy to understand and use format. The process wills smaller the gap between the qualitative storylines and the quantitative models by using semi-quantitative methods such as Fuzzy Cognitive Maps and qualitative methods such as qualitative system dynamics models and local models (both only in some Pilot Areas). This will contribute to the improved use of the SAS approach.
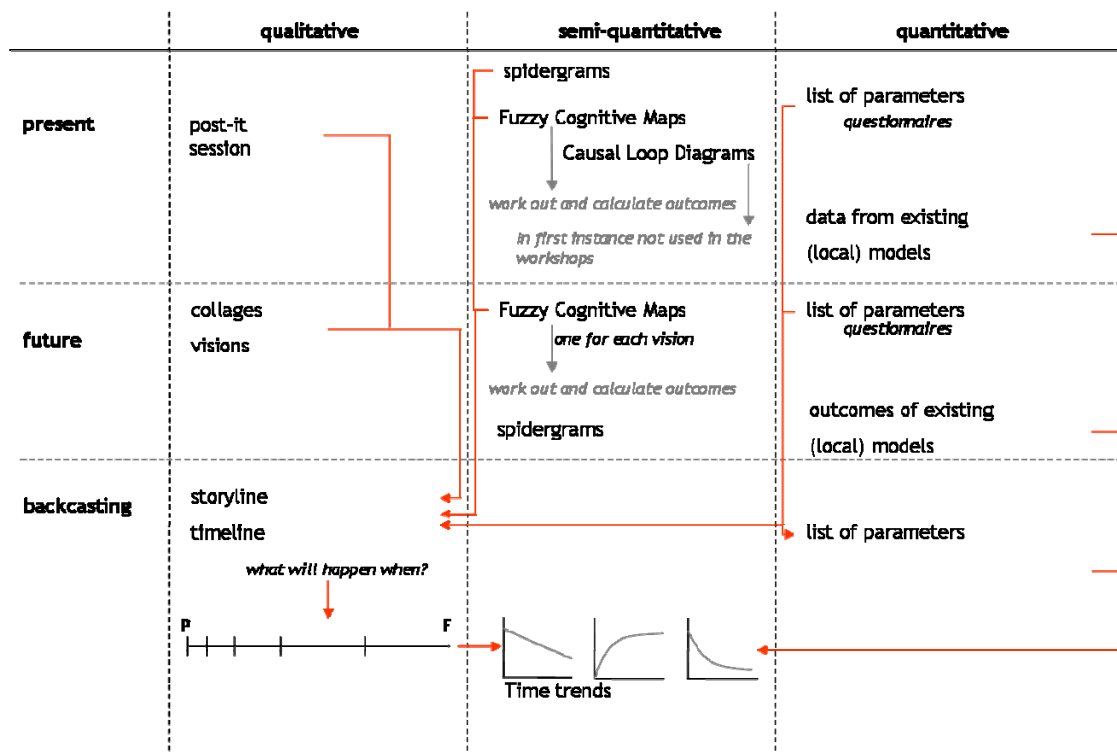

Figure 14; Interaction between the qualitative, semi-quantitative and quantitative methods.
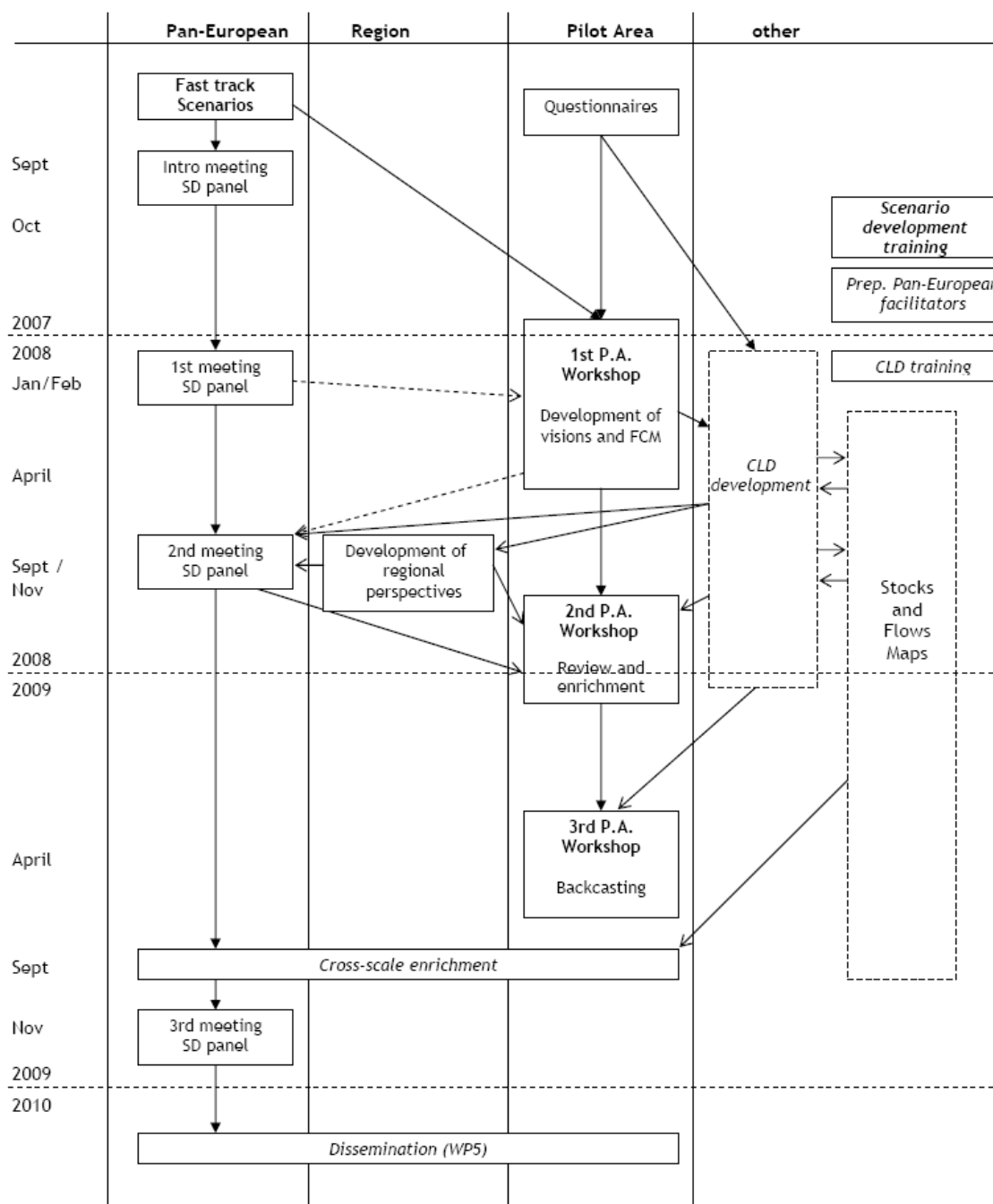
Figure 15; Overview of the different WP 2 and 5 meetings

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Appendix 1; overview of available participatory methods

method:	sort:	use:	aims:	use in SCENES	literature:
Hexagon method	knowledge elicitation	Elicitation of mental models. Write down ideas on hexagons, cluster them and find relations between issues and clusters.	Elicit ontological, relational and general structural knowledge about systems from groups or individuals, and it incorporates it directly into a graphical model.	not, but similar to FCM	(Hodgson, 1992), (Pahl-Wostl, 2006), (website creativity techniques, 2007)
Cause and effect mapping	knowledge elicitation	Start with the topic and then map causes and effects of the topic.	To understand the contributing causes or reasons for a particular problem or issue, or to identify effects or impacts of a particular change.	not, but similar to FCM	(website msp portal, 2007)
Conceptual modelling	knowledge elicitation	Create a flow chart that displays the system on a certain point in time.	To elicit relational and structural knowledge about the system and present is in a flow form diagram.	not, but similar to FCM	
Interrelationship diagrams	knowledge elicitation	Write down in a circle a number of factors that contribute to the problem. Then draw arrows indication relations between the factors, only one way arrows.	To identify which out of a series of contributing causes are the most important and how they relate to each other.	not, but similar to FCM	
Fuzzy Cognitive Maps	knowledge elicitation	Write down the main factors in the system under study, define the feedbacks and assign fuzzy strengths to the feedbacks	To elicit stakeholders' views on the system, present it in a graphical model and to calculate effects of changes in the system.	Yes	e.g. (Kosko, 1986)
Causal loop diagram	knowledge elicitation	To explore causal patterns that are important to system dynamics focussing on feedback loops	To show the feedback structure of a system, and the causal relations. To elicit the mental maps of stakeholders	Yes	e.g. (Sendzimir *et al.*, 2007)
Nominal Group Technique	knowledge elicitation	Individuals silently write down ideas. Ideas are listed in a round-robin fashion on a flip chart. Each idea on the list is discussed for clarification and evaluation. Individual rank-ordering or rating of ideas and voting.	To efectivly genete and evaluate a number of ideas	No	

group model building	knowledge elicitation/problem analysis	facilitated sessions in which the participants (help to) build a model	elicit stakeholders knowledge and implement it into the model. improved understanding of the issue	No	e.g. (Vennix, 1999)
Tree mapping	problem analysis	Identify topic area, write all issues concerning the topic on cards. Split the cards in two groups according to the most importance difference. Write the difference on the split up point of the three. Then split up each group again, etc.	Gather and organize information based on their similarities and differences, clarify and compare the views of different parties, and make informed decisions regarding the issues at hand.	No, finding differences is not an aim	(Website SAS², 2007)
Problem tree	problem analysis	Select core problem, use this as trunk of tree. Search for cause of the problem (roots) and after that for effects (branches), this can be continued for second level cause and effects.	To identify a core problem and its effects and root causes, and to clarify and come to an agreement on core objectives and necessary activities to tackle the problem.	No,	(website msp portal, 2007)
Force field	problem analysis	Define common goal, list driving forces to achieve the goal, list restraining forces that keep you from the goal.	To systematically analyse the driving and restraining forces in a situation and graphically represent them.	No, driving forces will become apparent in FCMs	(Website SAS², 2007), (website msp portal, 2007)
Role Play	problem analysis, consensus building	Participants will get a role (different from their normal one) in a play in which different stakeholders with different interests are involved. It is discussed afterwards.	To encourage groups of people to get into the roles of different stakeholders, trying to reach consensus and common action, while optimizing the individual interests.		(website msp portal)
Rich Pictures	visions presentation	Draw all the physical entities involved, and key linkages between them. Use arrows and symbols to add extra meaning.	To stimulate participants creativity, and get a visual representation of desirable future. Focus is on relations between the different aspects.	Yes	

Collages	visions presentation	Make a collage from pictures from magazines/newspapers/own pictures visualizing the important issues. Present with explanation on key linkages between issues.	to stimulate participants creativity to make a visual representation made with pictures from magazines/newspapers, etc. of desirable future, with arrows and symbols to add extra meaning	Yes	
Cartoon Story Board	visions presentation	With small drawings create a story of important thing needed to get from present to desired goal.	visual representation of the story on how to get to the desirable future in a small number of steps. Subscript can add meaning.	No, possible use in back-casting	(website creativity techniques, 2007)
Essay writing	visions presentation	Write an essay/short story about the issue	writing a short story about the issue can enable the flow of ideas, imagination, speculation etc. since it does not have the same boundaries as a formal report writing method.	No, but collages/rich pictures might come with a story	
time line	scenario presentation	present the whole storyline in a easy overview (or get a understanding of the history)	to think about all that needs to happen to get from the present to a certain end state.	yes, during backcasting	(website msp portal, 2007), (Website SAS^2, 2007)
Card-techniques	brainstorming	Each participant writes down issues on 3 to 5 cards, which are than put together and sorted.	To retrieve information from the stakeholders and let them learn from each others ideas. It makes sure that everybody's ideas will be represented	Yes	(website msp portal, 2007), (Chambers, 2002), (Evans *et al.*, 2006b)
mind-mapping	brainstorming	start with a central issue/problem and connect all relevant issues with it (and relevant issues on those issues etc.)	To retrieve information from the stakeholders and let them learn from each others ideas. Also gives an idea how issues are connected	no	(website msp portal, 2007), (Website SAS^2, 2007)
fish-bowl	brainstorming	half the group starts brainstorming in the middle of circle, the other half writes down what their 'partner' says. After a limited time the group changes, until there are no new ideas	To retrieve information from the stakeholders and let them learn from each others ideas.	no	

Citizen's jury	knowledge elicitation and consensus building	Participants can ask question to experts and learn and discuss about an issue which is under public discussion. At the end they have to reach a verdict on the case.	a series of meetings, in which a randomly selected group of people representing the public has to reach a 'verdict' after learning and discussing on an issue. They can ask questions to experts.	No, scenario development can be part of a citizen's jury.	e.g. (Pimbert and Wakeford, 2002)
Evaluation wheel	evaluation/comparison method	A small number of criteria for evaluating are chosen and a wheel with the same number of spokes as criteria chosen drew. The spokes represent a scale with low or zero at the centre and high or 10 at the edge. Each participant scores each criterion by marking the spoke at the right point along the scale.	Evaluate different aspects in a visual way.	No, but similar to spider grams	(website msp portal, 2007)
The wheel	comparison method	Define the topic and criteria. Define the rating criteria and rating scale and draw a wheel with spokes. Mark each spoke at the right point along the scale	Visualize and compare multiple ratings of different stakeholders.	No, but similar to spider grams	(Website SAS[2], 2007)
Spidergrams	comparison method	Define the issues you want to compare, draw as many spokes as needed (not too many) with low at the centre and high at the ends. Score each criterion by marking the spoke at the right point along the scale. Connect the points so they form a spiderweb	Visual representation of (fuzzy) quantitative answers or indicators. The spidergrams from different people/groups are easy to compare.	yes	(Evans et al., 2006a)

Reasons for choosing methods:

We have chosen for most of the qualitative methods because they are often used in scenario development. These methods have proven themselves to be useful and effective. This will give the scenario development a good basis. The semi-quantitative methods are used in order to try to bridge the gap between the qualitative storylines and quantitative models. They are new to scenario development, but they have been used in other types of assessments. They will however have to prove themselves in the scenario development. This is the reason why we use well know qualitative methods. The innovation is in the semi-quantitative methods and conceptual models.

There are multiple ways to elicit mental models and represent them in a conceptual model. Fuzzy Cognitive Maps ad the fuzzy factor to the feedbacks identified in the system, adding more information about the feedbacks and the importance of the identified aspects. It makes it also possible to identify relative little changes in the systems behaviour, that otherwise might have got lost. If a feedback still exists, but has become weaker, this affects the system. It however does not become apparent if you do not assign fuzzy values. This makes Fuzzy Cognitive Maps more interesting for scenario development, when also small changes matter.

IIASA has quite some experience with Causal Loop Diagrams, which will bring extra emphasis on the causal relations. Their outputs can be compared with the FCM outputs in other Pilot Areas. Causal Loop Diagrams further offer the option to be transformed in Stock and Flow Maps. There are many models that are more or less similar to spidergrams and have a different name. This is also the case with some of the other methods. In those cases we have chosen the name that we found most suitable. We have for instance chosen for the name spidergram, as the lines between the rating points often do not form a circle or wheel, but are more irregular, like a spider web. Of course there are other comparison methods as well, but spidergrams have the advantage of giving a visual representation.

Appendix 2; example planning for the workshops

The following planning is a guideline, use it, but do not be too strict. The time planning is the minimum needed. For the first two steps three days would be ideal, for the other workshops two days is the minimum needed. The first two steps (WS1, day 1 and 2) are better worked out then the others; their planning might also be changed when there is a better knowledge on the outcomes of the previous steps. You will receive updated versions before each workshop.

Workshop1; story of the present

time	activity	description	goals
Morning			
10.00	Arrival	coffee/thee	
10.30	Welcome	short introduction about meaning of project	
10.45	Introduction of stakeholders	each participant brings a picture/object that for him/her represents an important aspect of the Pilot Area. They shortly will tell their names and background	Getting to know each other, ice breaking, creating nice 'atmosphere', mapping biggest issues, getting everyone to talk
11.10	What are the important aspects in the Pilot Area? (Card-technique)	Group similar aspects together (only throw away complete duplicates) and give each cluster a name.	Mapping biggest issues, get input from all participants. useable as indicators? WP4
12.15	spidergrams (individual, write name on it) and time trends for the top 3 problem aspects for likely change	make spidergrams, using the clusters from the morning session. Give relative importance of each cluster (1-10) and connect points	get an impression of importance of the different issues for each stakeholder. (can later be used for finalizing FCMs)
12.30	LUNCH (mood-o-meter)☹☺☺		Informal contacts
Afternoon			
14.00	Introduction of FCM	Explanation of system thinking and FCM	
14.30	*Split up in smaller groups**	Split up with mixing groups	get input from different fields in the different groups
14.45	Creating a FCM; assign feedbacks	Let each group make a flowchart of the clusters -> look for feedbacks and relations (start for FCM, system thinking)	System thinking, getting a better understanding of relations between main aspects.
16.00	*break*		
16.30	Creating a FCM; Assign values to feedbacks	-> Are the feedbacks positive or negative? How strong are they -> relative, scale 0-1 How important are the different boxes -> relative, (if time permits!)	System thinking, getting a better understanding of relations between main aspects.
17.00	Compare the FCMs (plenary)	Let each group present their FCM, explain the feedback and why they are positive or negative (and how strong they are)	Further discussion, integrate different views,
17.45	Indicators list(45 min) and timetrends	Discussion on which indicators are useful, start with concluding with the ones that fit the clusters derived on day 1. And make timetrends on expected changes of main indicators (individual/pairs)	Input for other WPs
18.30	(mood-o-meter) ☹☺☺	find out how SHs like the first day, make clear that feedback is welcome…	better facilitation, methods that better suit SHs
18.40	End		
Evening	Dinner and social events		

* use energizing group division: jigsaw, number clumbs, etc.

Workshop 1, day 2; Scenario building

time	Activity	description	goals
Morning			
9.00	Recap of WS 1, show results of FCMs, short discussion on results	Shortly describe the current state of the system	Easy start, wake up time, check if everything was understood correctly
9.30	Changes in the past	short description of changes that happened in the Pilot Area and some discussion on 'normality of change'.	Understanding that change is natural.
9.45	Introduction of fast-track scenarios Plus short discussion	Introduction of fast-track scenarios, presented as collage First discussion on how the current changes fit in these scenarios. Do the FT scenarios make sense for local circumstances	Creating framework for local scenarios Getting familiar with scenarios and future thinking.
10.30	*Break*		
11.00	Explanation of scenario development exercise		
11.30	Scenario development in four groups	Each group consist of broad array of SHs. They will create the local scenario, if possible within one of the four FT scenarios. Collages or rich pictures will be used.	four scenarios social learning collages summary of process (by facilitator)
13.00	LUNCH (mood-o-meter) ☹☺☺		Informal contacts
Afternoon			
14.30	Development of scenarios continued	Create presentation, with a short story. Think especially about chances to system chancing feedbacks?	
15.30	presentation of scenarios and discussion (plenary)	presentation of the collage and the story behind it for each scenario. discussion on each scenario on missing aspects, new ideas	inclusion of other views
16.30	*Break*		
17.00	Spidergrams (15 min)	develop spidergrams for the clusters of yesterday morning, how do they change under 'your' vision? (on 1 to 10 scale) use the 'old' spidergrams from yesterday	input for other WPs, input for development of FCMs of visions.
17.15	wrap-up	what did we accomplish? Thanks for attending, hope to see them next time	make SHs feel that they really contributed something worth much.
17.45	short survey for all SHs, including mood-o-meter ☹☺☺	how did they like it? Was it understandable? Where their voices heard? (in cooperation with WP5)	evaluation of methods and process
18.00	End		

(times for back-to-back workshop with Day 1, if separate, everything 1 our later)

Workshop 2; Scenario enrichment

time	activity	description	goals
Morning			
10.00	Arrival	coffee/thee	
10.30	Welcome	short introduction about meaning of project	Make purpose of project clear.
9.30	present FCMs and explain the outcomes of calculations		
10.00	first discussion on outcomes FCM		
10.30	*break*		
11.00	change FCM of present (old groups)		
12.00	discuss new outcomes		
13.00	LUNCH (mood-o-meter) ☹ ☺ ☺		Informal contacts
Afternoon			
15.00	change FCM of present to FCM for vision (in groups, 1 for each vision)	how did the system change under each vision, did some feedbacks became stronger or weaker?	input for new FCMs for each vision (together with spidergrams)
15.45	plenary discussion on changed feedbacks in FCMs	give everybody the possibility to give their view on the feedbacks	
17.45	wrap-up	what did we accomplish? Thanks for attending, hope to see them next time	make SHs feel that they really contributed something worth much.
18.00	short survey for all SHs, including mood-o-meter ☹ ☺ ☺	how did they like it? Was it understandable? Where their voices heard? (in cooperation with WP5)	evaluation of methods and process
18.15	end		

Workshop 2, day 2

time	Activity	description	goals
Morning			
9.00	Recap of day 1, show results and short discussion on results	Shortly describe the current state of the system	Easy start, wake up time, check if everything was understood correctly
9.30	presentation of visions from WS 1	show FCM of present, show collages from scenarios, tell what SCENES did with it.	(re)introduction to scenarios and system thinking. Get participants motivated.
10.00	break		
10.30	present outcomes regional /pan-European enrichment findings.	discussion on the new information -> changes needed? SH ideas about the new information	
11.00	present outcomes WaterGap/local models	discussion on the new information -> changes needed? SH ideas about the new information	get new views incorporated
11.30	discussion on visions	give newcomers possibility to give their view on the scenarios	get new views incorporated
12.00	rewriting of the visions small groups (same as WS1)		
13.00	LUNCH (mood-o-meter) ☹☺☺		Informal contacts
Afternoon			
15.00	influence of critical events on visions	how would a critical event (f.i. quick/strong climate change, new agriculture methods) influence the visions?	make visions more robust
16.00	*break*		
16.30	critical events: plenary		
17.30	wrap-up		
18.00	short survey for all SHs, including mood-o-meter ☹☺☺	how did they like it? Was it understandable? Where their voices heard? (in cooperation with WP5)	evaluation of methods and process
18.15	end		

Workshop 3; playing it back

activities	description	goals
Arrival	coffee/thee	
Welcome	short introduction about meaning of project	Make purpose of project clear.
presentation of scenarios		(re)introduction to scenarios
presentation of FCMs of present and future	find out the differences between present and future system	system thinking
start playing it back exercise (in 4 groups, same as made the visions)	plot action needed to change from one system to the other system. Use FCMs as starting point/guides.	timeline with actions, developing a continuous storyline
continuing playing it back	plot action needed to change from one system to the other system	timeline with actions, developing a continuous storyline
plenary presentation and discussion of timelines	discussion on timeline for each vision find similarities	get different views included get list of actions needed under all scenarios
time trends of important indicators (groups*)	discuss how some of the indicators will change under each scenario, with use of spidergrams, FCMs and timeline	semi-quantitative input for other WPs
discussion on time trends of important indicators (plenary)	find similarities, discussion on differences	semi-quantitative input for other WPs
short survey for all SHs, including mood-o-meter ☹ ☺ ☺	how did they like it? Was it understandable? Where their voices heard? (in cooperation with WP5)	evaluation of methods and process
end		

* Use grouping methods that are also energizers: number clumbs, jig saw, symbols on name tags, fruit bowl

Workshop 4; dissemination

During a final workshop the outcomes from all Work Packages will be presented. Of course there will also be time for discussion of the results. The aim is to invite all participants of previous workshops and the end-users. More information on this workshop will follow.

Appendix 3; Energizers and Icebreakers

Energizers and Icebreakers are use to 'break the ice', it gets people active, (re)gains there interest, creates a nice atmosphere and boost the energy levels. They are especially useful during low times; the end of the morning and the early afternoon, after lunch. Respect those people that do not want to join in, give the good example by taking part yourself.
Energizers can be found in multitude on the web, here follows just a very small selection, based on no criteria at all. Most come from "Participatory workshops", by Robert Chambers (2002).

Simple energizers
Not all energizers need to be spectacular; they can also be part of the process.

You move, all move:
When you move, for instance to a flipchart at the other end of the room, all will have to move (a bit) in order to follow you. So put the posters on three of the walls, so that you move when presenting.

Buzz:
At the end of a presentation you can invite the participants to buzz with other next to them. Let them talk shortly about what has just been presented, what it means for them, how they see it is useful, etc. It will wake people up, and make them learn by talking.

Group forming:
There are many ways to form groups, that involve some small activity.

By number:
you can let them give each themselves a number. Start with the first one, he be number one, then they have to number themselves up to the number of people you want to have in a group. When that has been reached they start at one again. Of course you can count for them, but this makes it a bit more active.

Picture jigsaw:
Make jigsaws out of post-cards, as many as you need groups, in as many people as you want to have in the group. Randomly hand the pieces out, the participants have to find their group mates to complement the picture.

Name plates:
When you want to work with name plates you can a symbol to each name plate. People with the same symbol form a group. This way you can also steer in advance.

Number clumps:
A very active one, participants have to form groups by themselves. You give the group sizes, but only the third or fourth time will be the real group making.
So shout for instance:

2 of 5, 1 of 7, 3 of 2 (and the rest forms the last group)
4 of 3, 2 of 6 (and the rest forms the last group)
And the last time you call the groups you make sure that all groups are (more or less) the same size.

More energetic

These surely will make people awake again. It depends on the situation and the people involved how far you can go, but they are fun…

Body writing:
Write your name with different parts of the body and let the others do the same. Start with your right (or left) finger, then make it more difficult, like writing with your elbow, feet, or head.

Mirrors:
Let the group divide in pairs. One is the actor, the other one the mirror. The mirror does everything the actor does, after a few minutes you can change.

Think yourself of more nice ways to get people awake again!