



The **CLIMSAVE** project

Climate Change Integrated Assessment
Methodology for Cross-Sectoral
Adaptation and Vulnerability in Europe

Report on the second CLIMSAVE European stakeholder workshop

Marc Gramberger¹, Kasper Kok², Marjan Maes¹, Benjamin Stuch³, Paula Harrison⁴,
Jill Jäger⁵, Marc Metzger⁶ and Abiy Kebede⁷

¹ *Prospex, Keerbergen, Belgium*

² *Land Dynamics Group, Wageningen University, The Netherlands*

³ *Center for Environmental Systems Research, University of Kassel, Germany*

⁴ *Environmental Change Institute, University of Oxford, United Kingdom*

⁵ *Sustainable Europe Research Institute, Austria*

⁶ *School of GeoSciences, The University of Edinburgh, United Kingdom*

⁷ *Tyndall Centre for Climate Change Research, University of Southampton, United Kingdom*

June 2012

Table of contents

- Introduction 3
- 1. Overview of the workshop 3
- 2. The scenarios 4
 - 2.1. Scenario logic 4
 - 2.2. Process 5
 - 2.3. We are the World 7
 - 2.3.1. Driving forces and uncertainties 7
 - 2.3.2. We are the World scenario dynamics 8
 - 2.3.3. We are the World storyline 9
 - 2.4. Icarus 12
 - 2.4.1. Driving forces and uncertainties 12
 - 2.4.2. Icarus scenario dynamics 13
 - 2.4.3. Icarus storyline 14
 - 2.5. Should I Stay or Should I Go 17
 - 2.5.1. Driving forces and uncertainties 17
 - 2.5.2. Should I Stay or Should I Go scenario dynamics 18
 - 2.5.3. Should I Stay or Should I Go storyline 19
 - 2.6. Riders on the Storm 22
 - 2.6.1. Driving forces and uncertainties 22
 - 2.6.2. Riders on the Storm scenario dynamics 23
 - 2.6.3. Riders on the Storm storyline 23
- 3. Quantification of selected key variables 27
 - 3.1. The quantification exercise explained 27
 - 3.1.2. We are the World scenario 29
 - 3.1.3. Icarus scenario 30
 - 3.1.4. Should I Stay or Should I Go scenario 31
 - 3.1.5. Riders on the Storm scenario 32
- 4. Adaptation options 33
 - 4.1. Adaptation options identified 33
 - 4.1.1. We are the World scenario 33
 - 4.1.2. Icarus scenario 34
 - 4.1.3. Should I Stay or Should I Go scenario 35
 - 4.1.4. Riders on the Storm scenario 36
 - 4.2. IAP options reviewed 38
 - 4.2.1. We are the World scenario 40
 - 4.2.2. Icarus scenario 41
 - 4.2.3. Should I Stay or Should I Go scenario 42
 - 4.2.4. Riders on the Storm scenario 43
- 5. Feedback from the stakeholders 44
- 6. Written evaluation 44
- 7. Next steps 45

- ANNEX 1: Agenda 46
- ANNEX 2: List of participants 48
- ANNEX 3: Selection of original workshop outputs 50

Introduction

Participatory scenario development processes have played an increasingly significant role in major climate change and environmental studies over the past few decades and already play a crucial role in adaptation assessment by providing a glimpse of the different socio-economic trends that will form the back-drop to long-term adaptation measures. Moreover, planning an adaptation measure will have to take into account the uncertainty of future climate impacts, and participatory scenarios are a useful method for incorporating this uncertainty into decision-making.

The CLIMSAVE methodology for participatory scenario development and analysis is specifically geared towards interactive climate impact and adaptation assessment. The second workshop focused on:

- Developing integrated and dynamic stories focusing on socio-economic elements;
- Quantifying socio-economic variables for the Integrated Assessment (IA) Platform;
- Identifying adaptation options per scenario; and
- Reviewing adaptation options incorporated within the IA Platform

CLIMSAVE scenarios are being developed up to the 2050s, with an intermediate time slice in the 2020s. The time horizon of 2055 is sufficient to include the impacts of climate change and the effect of several adaptation options. The methodology has been developed within CLIMSAVE and is tested in two case studies: a European case study and a regional case study (Scotland).

The careful selection of stakeholders for a participatory scenario development process, such as undertaken in CLIMSAVE, is an important factor in the exploration of plausible futures. This selection took place before the first workshop (10-12 May 2011). In order to safeguard continuity the same group of stakeholders was invited to the second workshop. The group of participants of the second workshop consisted of participants who had already participated in workshop 1 and new participants. New participants were either nominated by stakeholders who could not make it to this workshop, or additionally researched and invited participants.

This deliverable presents the results of the second European CLIMSAVE workshop. The workshop was organised in Prague on 6-8 February 2012.

1. Overview of the workshop

This section provides a summary of the activities that took place during the second workshop for the European CLIMSAVE case study. A detailed agenda can be found in Annex I and a list of participants in Annex II.

DAY 1:

The workshop started with registration, followed by presentations (re)introducing the project and the state-of-play to the participants:

- Welcome by Dr. Wolfram Schrimpf, DG Research, European Commission;
- Reintroduction to CLIMSAVE, Dr. Paula Harrison, University of Oxford;
- Reintroduction to the scenario development process, Dr. Marc Gramberger, Prospex.

Following these presentations the participants were split up into four groups and the process of reviewing and adapting the storylines started. At the end of the first day the facilitator of each group presented the changed storylines to the other groups. Feedback was given on each of the storylines to help refine them further.

DAY 2:

On the morning of day two, the participants went through the list of main drivers and uncertainties that was created in the first workshop. This activity helped to expand the storylines. Before lunch each group presented their storyline to the rest of the stakeholder panel and the CLIMSAVE research team.

In the afternoon the participants received more information on the IA Platform during a presentation by Dr. Ian Holman (University of Cranfield) and Benjamin Stuch (University of Kassel). Afterwards the stakeholders reviewed the quantified values for a set of predetermined variables for the IA Platform within their scenario group.

At the end of day two, the stakeholders were asked to determine specific adaptation options for their scenario. This exercise was continued on the morning of day three.

DAY 3:

On day three, the panellists first continued the exercise of identifying specific adaptation options within their scenario. Then they visited the other scenarios in order to add further options to the other scenarios. Back in their own scenario participants discussed the contributions from their colleagues and finalised the set of options for their own scenario.

As a final step all the stakeholders determined the importance within their scenario of a set of predetermined adaptation options which are incorporated within the IA Platform.

The workshop ended in plenary with the possibility for all stakeholders to provide oral and written feedback. The CLIMSAVE research team presented and discussed with stakeholders the next steps up to the final workshop. The final workshop will be held in Edinburgh on 3-4 December 2012.

2. The scenarios

2.1. Scenario logic

In the European case study participants developed four scenarios:

- *We are the World* is characterised by gradual economic development and effective solutions by innovation to the depletion of natural resources.
- *Icarus* is characterised by gradual economic development and ineffective solutions by innovation to the depletion of natural resources.

- *Should I Stay or Should I Go*¹ is characterised by a rollercoaster of economic development and ineffective solutions by innovation to the depletion of natural resources.
- *Riders on the Storm*² is characterised by a rollercoaster of economic development and effective solutions by innovation to the depletion of natural resources.



Figure 1: Scenario logic, with the name of each scenario in the respective quadrant.

2.2. Process

The stakeholders worked in four groups, each focussing on one of the four scenarios. The stakeholders that attended workshop 1 remained in the group they had joined before. The new stakeholders were divided across the four groups, ensuring a multi-disciplinary stakeholder group for each of the scenarios. In each group, the process was led by a professional facilitator. A scenario supporter from the CLIMSAVE research team attended to provide content support and to produce background notes on the discussion.

The following tasks were attributed to the stakeholders for the scenario development process:

- The participants reviewed the storylines and identified gaps and inconsistencies;

¹ On day two the group decided to rename the *Rollercoaster to Armageddon* scenario. The new name is *Should I Stay or Should I Go*.





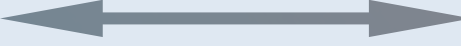





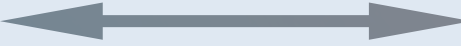



² On day two the group decided to rename the *i-Ticket to Ride* scenario. The new name is *Riders on the Storm*.

- The groups answered specific questions in order to fill in these gaps and expand the storylines:
 - We are the World:
 - Why does society become conscious and convinced of the need for strong measures for sustainability?
 - Does this also happen worldwide? If yes/no: Why and what are the consequences?
 - What are the challenges for society?
 - What are the earlier effects of technology in Europe? How about its acceptance (e.g. GMOs)?
 - Icarus:
 - What are the counter-forces that push the economy up? Why do they not succeed after 2020?
 - What effect does the gradual economic decline have on Europe and the rest of the world?
 - What kinds of technology failure occur and with what consequences?
 - Should I Stay or Should I Go:
 - Why and how is technology not delivering on the depletion of natural resources?
 - What about the UP-parts of the economic development?
 - How do societies and individuals react to the sudden ups and downs of the economy?
 - Which are the regions/areas inside and outside Europe that fare better? Why? What are the consequences?
 - Riders on the Storm:
 - What is the mechanism behind the rollercoaster economic development? What is feeding this?
 - How can we have both a rollercoaster economic development and innovation?
 - What type of society is this? Collective or individual?
- The participants specified their scenario in view of the main drivers and uncertainties;
- The participants clarified the dynamics of their scenario;
- The stakeholders identified the unique character of their scenario and had the opportunity to comment on the other scenarios. These comments were mostly focused on whether another scenario was too similar to their own. All comments were taken up in the scenario groups to further differentiate the scenarios.

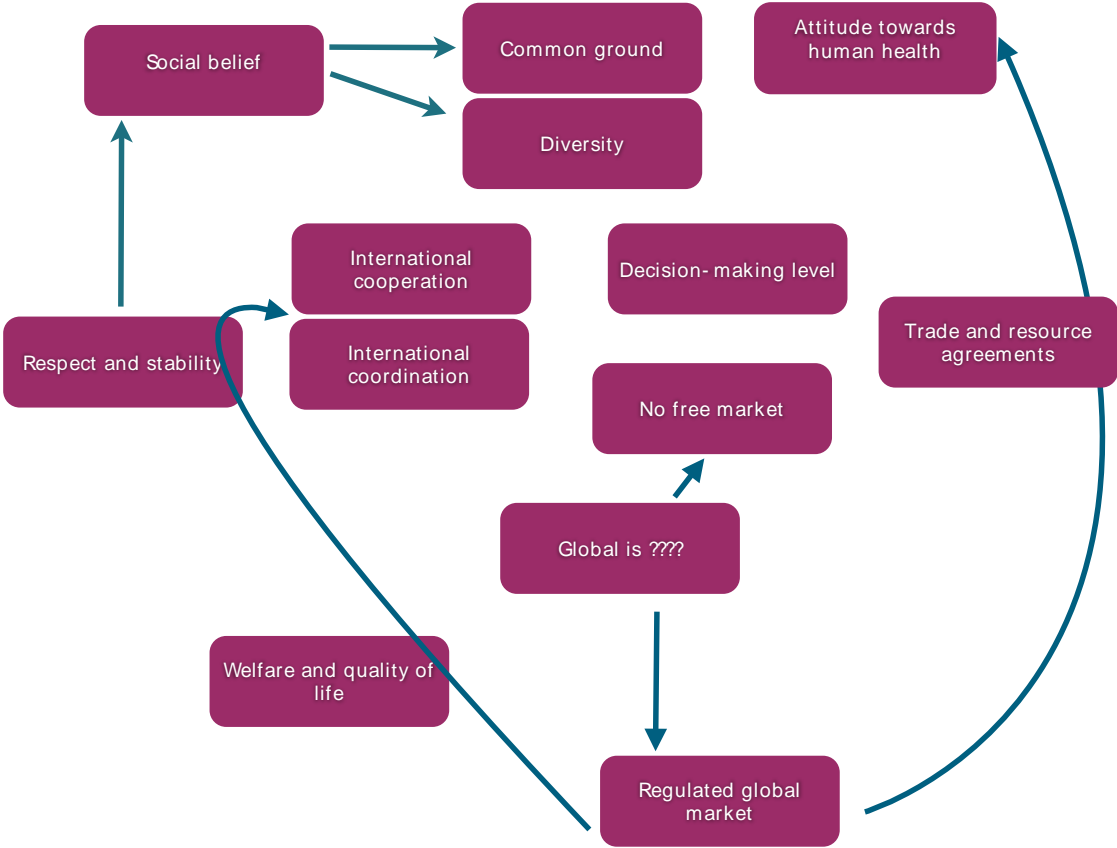
The stories and inputs were taken up by the CLIMSAVE team after the workshop. The CLIMSAVE team developed a refined and adapted written version of the storyline as developed by the participants in this workshop. This version takes account of the presentations and discussions during the workshop, including the background notes of scenario supporters. The revised storylines are presented on the following pages, including the revised tables of driving forces and uncertainties. Text in red marks the changes to the first version of the storylines developed in workshop 1.

2.3. We are the World

2.3.1. Driving forces and uncertainties

Polarity	Uncertainty	Polarity	In YOUR scenario
International dominant / Europe dominant	Decision-making level 	Nation-state dominant/ Local dominant	- 7 cultural blocs - Subsidiarity - Bottom-up initiative
Low Stability	Geopolitical stability 	High stability	Low then high
Strong cooperation	International cooperation 	Weak cooperation	Weak then strong
Low responsibility	Social and environmental respect of non-state actors 	High responsibility	High due to regulation
Migration within regions	Population and migration 	Migration between regions	- within: strong - between: highly skilled + the very poor
Gradual	Economic development (growth) 	Rollercoaster	Gradual
Unconstrained	Globalisation 	Constrained	Ideas flow, with constraints
Restricted	Choice 	Free	Free on the individual level, open society
Influential	Attitude towards human and natural health 	Respectful	Respectful
Low	Social cohesion 	High	High, with differences
Non-effective	Solutions by innovation to depletion of natural resources 	Effective	Effective
Plural	Social belief systems 	Dominant	Plural, respectful
Fragile and unstable	Perceived ability of natural system to deliver ecosystem services 	Resilient and stable	Resilient, under proper management
Low	Perceived impact of climate change and other natural hazards 	High	High

2.3.2. *We are the World scenario dynamics*³



³ The scenario dynamics are based on the flipchart created by the stakeholders during the workshop. An image of the original flipchart can be found in Annex 3.

2.3.3. *We are the World storyline*

Towards the 2020s

Europe is becoming used to global crises in the second decade of the 21st century. The financial crisis that started in 2008 continues to have strong repercussions; in Europe, national governments face the need to save the Eurozone, which is under considerable pressure since the first waves of instability in 2010 and 2011. With low growth rates in developed countries, EU leaders are gradually being forced towards further European financial policies in order to avoid breakdown and to safeguard economic development⁴.

Due to increased turbulence and conflict Iran has closed off the Strait of Hormuz. Russia has closed off the gas pipelines after a dispute with Ukraine. This energy crisis is reinforced by more extreme weather events. The Arctic has become ice-free during summer and several Pacific island states are permanently flooded. As a result of these energy and environmental struggles there are food shortages. This leads to high prices for energy and consumption products and scarcity, even in Europe.⁵

All over the world, people advocate for a global response to these crises in order to ensure stability and sustainability of the planet for the decades to come. These movements receive a lot of support from all layers of society as people gradually become aware that it is important to think global. A realisation of global interdependence takes the upper hand. The feeling that everybody's behaviour has to change to ensure sustainable growth for the next generations becomes stronger. There are protests against highly polluting SUV-drivers on a global scale. People want to be happy and no longer just successful. Italians lead the way of change by eating pasta instead of meat to combat climate change. Vegetarian risotto even becomes the EU's national dish. In fact, vegetarian meals are now more prevalent on the menu in restaurants than meat or fish.

Governments all over the world are being put under pressure to take ambitious measures on climate change. Parties with an ambitious programme on climate change and sustainable development do well in elections. Car traffic in cities is now restricted and work conditions have changed significantly, so that air-conditioning can be banned. Governments support innovative research facilities. In Europe several new techniques and technologies towards a sustainable environment are developed and Scottish wind power is linked to the European power grid. Energy efficiency goes up as scientists have discovered a way to store renewable energies, such as solar energy. Solar panels have also become more effective and precious metals are no longer needed in the production process. More attention goes to protecting endangered species and a new fishing technique has been developed, which means by-catch becomes a thing of the past.

Better quality of life leads to a growing feeling of security and safety among the European population. It is again safe to walk on the streets of Brussels, even at night, because the justice systems have become efficient and actually function in all EU countries. Criminality rates go down significantly, because criminals are prosecuted and punished.

⁴ Text in black is the original first draft of the storyline, as established during the first workshop.

⁵ Text in red are new additions to the storyline during workshop 2.

On a global scale governments overcome their differences. Trade wars and crises are solved by the increased effectiveness of governments worldwide. Countries such as Iran and Russia realise the importance of cooperation for staying in power. They accept negotiations and a global carbon capture and storage market is agreed upon by China, India, the USA, Europe and Brazil.

The change in values on a societal and governmental level has also led to more respect for other cultures. The developed countries decide to support Africa much more intensively. A fair trade agreement is signed and the African continent becomes a free trade zone. This leads to more stability on African, national and continental scales, with more reliable governance. The EU even decides to co-develop a solar plant with Africa to provide clean energy for Northern Africa and Southern Europe.

By 2025, the previous decade of crisis seems to have been forgotten. Continuous efforts to transform Europe and the rest of the world into a sustainable environment are now starting to pay their dividends. On a global scale, there is stable moderate economic growth. The well-being of people increases. In Africa growth is far stronger than in the developed countries. The changed global landscape feeds into a growing demand to reduce the UN Security Council to only seven members in order to increase its efficiency. Overall, governments follow a peaceful course of action, leading to cooperation between civilisations, which has made clashes a thing of the past.

Towards the 2050s

The feeling of being globally interdependent and working together for the same cause continues to appeal to many people. Intercontinental travel increases and people are eager to learn more about other cultures. There is a focus on welfare rather than on GDP in the more developed countries, which strengthens low, but sustainable growth. On the other hand Africa continues to develop at a quick pace. By 2030 a lasting peace is established in the Middle East. With support from the EU and China an African Union is created. The European Union has expanded further and the implementation of global governance, such as the Kyoto Protocol and the influence of the World Trade Organisation, has increased.

In this peaceful world there is no more demand for fighter planes, so Lockheed Martin goes bankrupt. The new generation consolidates the radical value change that has been visible in the previous decennium. It is no longer just socially acceptable to think and be green, it is now cool to be green. Insects are on the menu everywhere, even in Italy. And cockroach fritters are the latest hit at McDonald's.

People also sympathise more with those in society that do not have the same standard of living. Gradually people learn to value again the importance of meeting friends in real life instead of chatting to them via social networks. Social capital increases over time and the value of things is measured by the quality of life it gives you, not by their mere numerical value. This also leads unintentionally to a much safer world. Crime rates go down **even more**. As a result, people feel safe to use public transportation systems and to commute to work by bike without having to worry about it being stolen. In return, this contributes to less CO₂ emissions. **By now electric cars also outnumber petrol cars in Europe, which is why European greenhouse gas emissions have stopped rising.**

On a technological level there is a lot more international competition by 2030. Nature and the environment remain hot topics. The techniques towards a sustainable environment that were developed during the 2020s, such as the storage of renewable energies, are now implemented in society. Every company strives for major breakthroughs in environmental technology. Artificial meat is now produced on a large scale and organic cotton from genetically modified plants is used to produce T-shirts that can be washed a million times before showing wear and tear. More importantly, biofuels are now produced out of seaweed on a massive scale and Africa is a frontrunner in the production. The multinational Shell hands the seaweed oil patent to Africa in return for a 30% share in the distribution network.






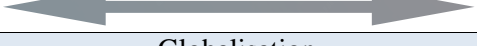
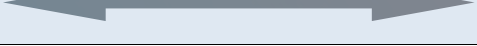







By 2035, we have moved a lot closer to a CO₂ free world. A technology is also developed to break down CO₂ into C and O₂. ~~By 2035, technological developments have made it possible to export solar energy from Africa.~~⁶ Moreover, genetically modified crops can now overcome droughts as well as floods. By 2040, air travel is finally officially declared a CO₂-neutral activity. Now people can finally travel to other parts of the world without having to feel guilty. ~~The interconnectedness between different countries has increased even more.~~ At the 93rd session of the UN General Assembly in 2041 a world constitution is adopted. The constitution is based on values such as equality and equal distribution of resources for all, and has safeguards in it for sustainable growth. The World Constitution also has a set of articles on how to elect a world government. ~~In 2035 an intergovernmental body is set up to select one world language.~~ The worldwide value change has in the end not led to a common language, but to a common understanding, with respect for cultural differences.

In 2050 technology has made it possible for us to live in a CO₂ neutral society. The energy problem is solved by the storage of renewable energy. The redistribution of wealth globally has led to less inequality, more cooperation and a conflict-free world.

⁶ Strike-out text (eg. ~~example~~) are lines of thought that have been taken out of the storyline.

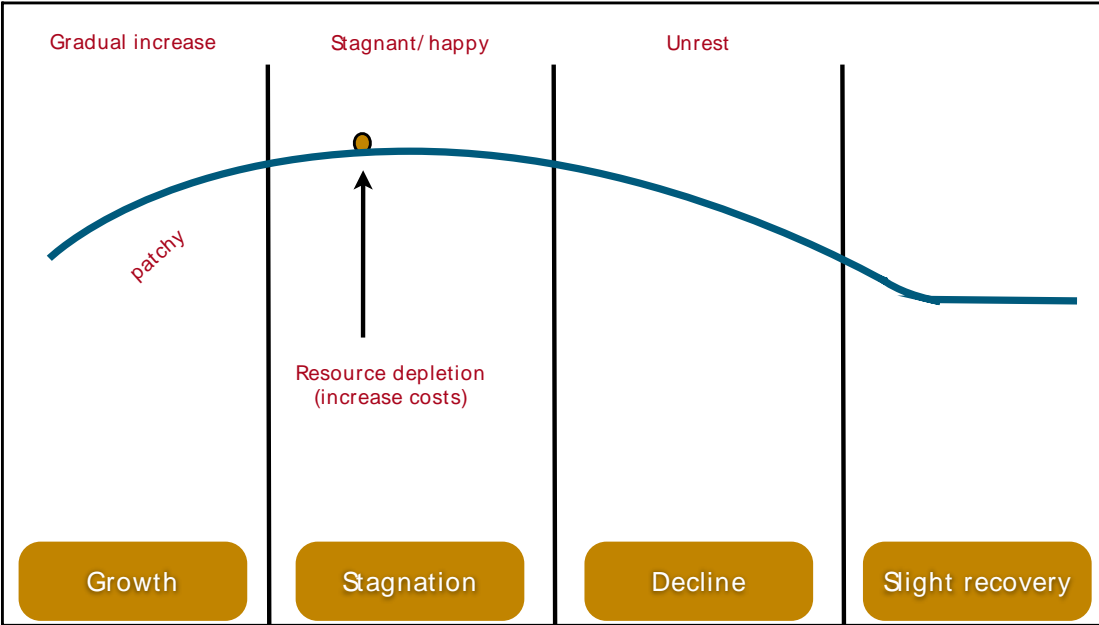
2.4. Icarus

2.4.1. Driving forces and uncertainties

Polarity	Uncertainty	Polarity	In YOUR scenario
International dominant / Europe dominant	Decision-making level 	Nation-state dominant/ Local dominant	Nation-state dominant: EU fragmentation
Low Stability	Geopolitical stability 	High stability	Low stability: first EU not stable, then conflict
Strong cooperation	International cooperation 	Weak cooperation	Rather weak cooperation
Low responsibility	Social and environmental respect of non-state actors 	High responsibility	First low, by 2040 they begin to take responsibility
Migration within regions	Population and migration 	Migration between regions	Both: migration to BRIC's
Gradual	Economic development (growth) 	Rollercoaster	Gradual
Unconstrained	Globalisation 	Constrained	Flows not restricted (especially from poor to rich) + some protectionism by the end
Restricted	Choice 	Free	Starts free, becomes restricted in EU as of period II ⁷
Influential	Attitude towards human and natural health 	Respectful	Not respectful anywhere
Low	Social cohesion 	High	Declines in phase II, starts picking up by end of III
Non-effective	Solutions by innovation to depletion of natural resources 	Effective	Non-effective
Plural	Social belief systems 	Dominant	Plural
Fragile and unstable	Perceived ability of natural system to deliver ecosystem services 	Resilient and stable	Fragile and unstable
Low	Perceived impact of climate change and other natural hazards 	High	High

⁷ The stakeholders agreed that there are four distinctive periods with their own characteristics for this scenario. See also figure p. 15.

2.4.2. Icarus scenario dynamics⁸



2025

High energy consumption	Focus on national interest	Social unrest and population decline	Acceptance to live with less
Decrease of natural resources	Gap between haves and have nots	Conflict	Continued migration
	Populism	Social mobility	Tense competition for resources
I	II	III	IV

⁸ The scenario dynamics is derived from the flipchart drawn by the stakeholders during the workshop. An image of the original flipcharts can be found in Annex 3.

2.4.3. Icarus storyline

Towards the 2020s

After the difficult years 2011⁹ and 2012¹⁰, in which the European economy leans towards a recession, the European economy picks up again gradually as of 2012¹¹. There is gradual economic growth for the next few years. With the economy gradually picking up, the demand for resources also increases. As a result the price for raw materials such as oil and steel goes up on the world market. Initially, it is possible for both developed as well as developing countries to benefit from this gradual economic growth. The EU countries and the other main industrialised countries can still afford to buy innovation from other emerging countries, but they no longer lead the development of innovative technologies. They continue to have access to relatively cheap energy sources (e.g. oil and natural gas), but the resources are running out. Extreme weather events start to affect Europe, but there is no response at the EU level.

In the meantime, Europe is accused of plundering resources in the less developed countries. The vulnerability of these countries is increasing, because of the loss of resources, and poverty is on the rise. Meanwhile India and China have become the two main centres of innovation. They invent and implement new technologies and get their resources from the continued exploitation of less developed countries in Africa and South America.

Towards the 2020s it becomes increasingly difficult for enterprises in developing countries to sustain their activities in the face of increasing prices for raw materials. Later on also industrialised economies start to struggle. The economic growth of the last decade, together with a strong demand for natural resources has been a tipping point for the state of the environment in the European Union. Severe ecosystem failures have started occurring by 2015. Extreme weather events continue to happen more and more frequently and further increase the cost of resources. This causes an economic climate in which enterprises can no longer afford the exuberant prices for oil. As of 2020, the economy in Europe is stagnating. This stagnation of the economy means the revenues of governments are going down.

In light of increasingly scarce public resources, long-term policy planning makes way for short-sighted policy measures driven by electoral gains. Populism is the new approach and there is hardly any money for education, research or innovation. Because politicians feel they can win elections on specific short-term issues, the political landscape fragments. In several European countries incumbent political parties disintegrate weeks before the elections. Political fragmentation forces political parties to form coalition governments, which weakens the position of the government. Policy shortism equally means that politicians focus on internal, domestic issues and they no longer see the added benefits of the EU. They are now mainly preoccupied with dealing with their nation's ageing population and the lack of education of their younger generation. By 2025 heads of states and governments no longer attend EU summits. This illustrates that governments find it more appropriate to combat cross-border problems such as an overall economic stagnation by domestic solutions. ~~After having been on the rise in the beginning of the millennium, nationalism weakened for a decade, but as of 2022 it is firmly on the rise again.~~ It is each country for itself. Only a few countries decide to stay in the European Union, the others leave. Autocratic regimes take over the countries that are no longer part of the EU. ~~In 2011, a schism over heavily indebted~~

⁹ Text in black is the original first draft of the storyline, as established during the first workshop.

¹⁰ Text in red are new additions to the storyline during workshop 2.

¹¹ Strike-out text (eg. ~~example~~) are lines of thought that have been taken out of the storyline.

~~countries in the EU was narrowly avoided through the will of politicians to keep the Euro zone together. This will is now totally absent and by 2028 a schism in the EU becomes reality.~~

Despite these problems, there is still no will to innovate in Europe. Short-sightedness is prevalent and there is a lack of people with ambitious ideas. In the BRIC's on the other hand, the implementation of innovative technology and effective solutions moves ahead. New technology is being developed in the fields of energy, agriculture and infrastructure. The innovation starts in the urban areas, but soon spreads to all corners of these countries. A young, educated and ambitious new generation takes the lead there. However, the exploitation of the poorer classes of society has not come to a halt.

Towards the 2050s

By 2025, the stagnation of the economy has repercussions on the European population. Unemployment rates go up and because public finances are going down, social benefits also shrink. ~~Governments can no longer afford the social pension system, which results in a widening gap between the haves and the have-nots in Europe. The richer people in society can afford to pay for the services and goods they need, while the poor cannot. Resource prices soar and with shortages in essential goods and services Europe is now exposed to a dependence on foreign resources.~~

People in countries with a weak economy are especially hit hard by the economic ~~stagnation decline~~. People move to other countries within Europe to find jobs. However, with nationalism on the rise, labour migrants are not well received in the host country. People are afraid migrants will steal their jobs and take away their social benefits. The social fabric disintegrates further, ~~conflicts are occurring more often and there is a massive brain drain from Europe to the BRIC countries. The European immigrants are joined in Asia, Russia and Brazil by low cost workers from developing countries also looking for a better life. The BRIC's have clearly become the economic leaders of the world, although the exponential growth they experienced in the previous decade has slowed down.~~

The flow of migrants is also strongly affected by the effects of climate variability. ~~The economic growth of the last decade, together with a strong demand for natural resources has been a tipping point for the state of the environment of the European Union. Severe ecosystem failures are starting to occur as of 2015 and.~~ By 2025 extreme weather events cause a high burden on Europe, its citizens and its economy. There is a further loss of biodiversity by 2030. In addition to migration because of economic reasons, people in those parts of Europe that are heavily affected by floods and droughts also move to safer areas. Labour migration, as well as climate migration, leads to expat ghettos in ~~Berlin~~ ~~several European capitals~~. The impact of extreme weather events, together with a stagnation of the economy brings about shortages of some essential goods and services; notably food and water. ~~At this point in time, the economy goes from stagnation into decline.~~ The economic downturn leads to agitation and frustration between different countries ~~and Europe gets its fair share of conflicts. By 2040 tensions over water at the border of Europe lead to conflict.~~

Towards the 2040s however, some counter-movements are starting to take root in Europe. Slowly society starts to realise the importance of increased education and some niches of innovation take off. The same movement arises in the developing countries, some of which start to innovate themselves. They try to become the new BRIC's, but struggle with the

challenges caused by a depleted resource base.





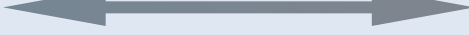







After 2040, the increased pressure and sense of urgency leads these emerging counter-movements ~~a counter-movement~~ to voice their concerns over the current state-of-affairs in Europe more loudly. There is a new generation '68, which has learned from the mistakes of their parents and is determined not to make them again. The main claim of the movement is that people in Europe have to start living in a different manner. People begin to accept that they will have to 'live with less' and realise they have to use more local produce to strengthen their own economy. ~~Post-modern values become more important.~~ Europe has become an economic backwater, but there is an increased will to change for the better. This triggers more action. Some signs of a slight economic recovery even start to show, although it is difficult to innovate with the meagre resource base that is left.

Migration from Europe to the BRIC countries has ceased, but labourers from the developing countries do not cease to move to the BRIC countries. By 2050, the BRIC's are still the global powerhouses, but they are aware that greediness, which has caused Europe's downfall, can be dangerous. That is why some niches of "live with less" also sprout in China, India, Russia and Brazil.

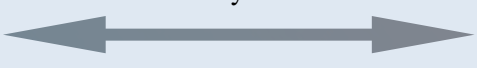

On a global scale, this means that post-modern values have become more important, but they remain nevertheless subordinate to hard economic values and the will of some to gain prosperity at the expense of others. There is more awareness, but not a complete value change. Food shortages remain common, mostly in those countries that have been affected by ~~the water wars, conflict and wars and the war in Africa between China and the West.~~ The developing countries especially continue to suffer from a tense competition for resources.

2.5. Should I Stay or Should I Go¹²

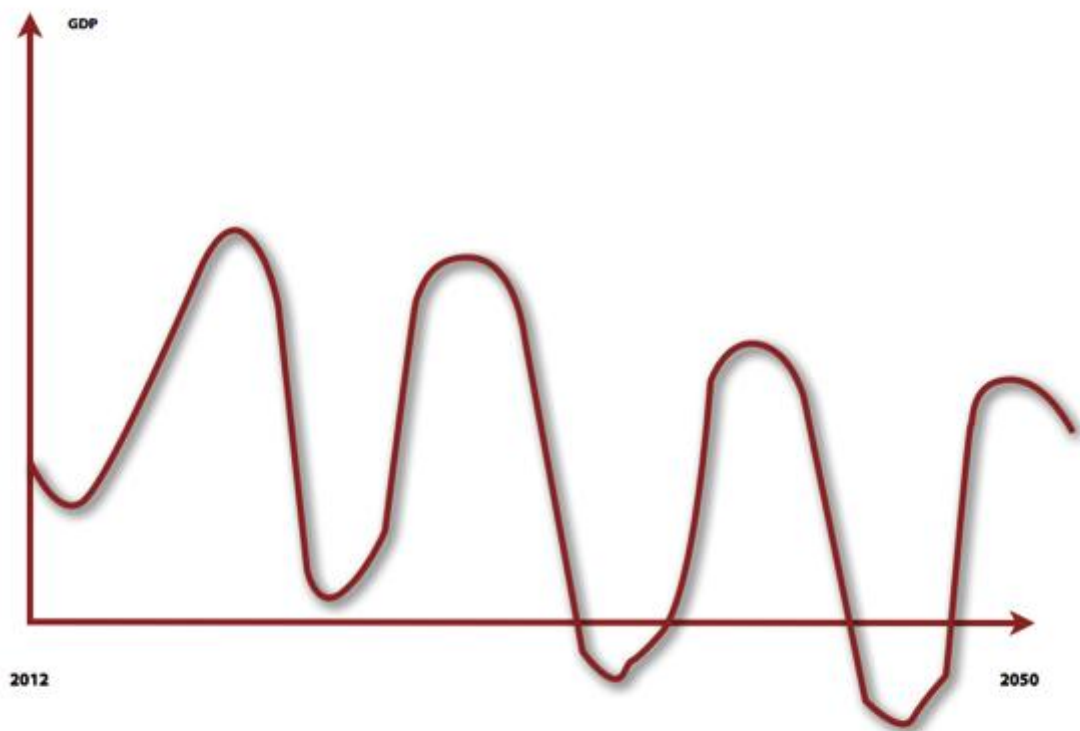
2.5.1. Driving forces and uncertainties

Polarity	Uncertainty	Polarity	In YOUR scenario
International dominant / Europe dominant	Decision-making level 	Nation-state dominant/ Local dominant	Start: EU, but fading out; splits End: Nations-state / local
Low Stability	Geopolitical stability 	High stability	Low stability: Pressures inside + outside; conflicts about resources hidden behind other masks
Strong cooperation	International cooperation 	Weak cooperation	Weak cooperation: weak regulation; also in banking system, specifically for long-term issues
Low responsibility	Social and environmental respect of non-state actors 	High responsibility	Generally low; can be high in selective communities
Migration within regions	Population and migration 	Migration between regions	Movement within regions; pressures for migration north and east; population plus; some niche brain-drain from EU
Gradual	Economic development (growth) 	Rollercoaster	Rollercoaster
Unconstrained	Globalisation 	Constrained	Unconstrained but with selective break-downs due to instability
Restricted	Choice 	Free	Free choice, but no means for the poor majority
Influential	Attitude towards human and natural health 	Respectful	Generally poor as not many options to be respectful, but some communities are respectful
Low	Social cohesion 	High	Low as more inequality, yet high in some communities
Non-effective	Solutions by innovation to depletion of natural resources 	Effective	Non-effective
Plural	Social belief systems 	Dominant	Plural; possibility for extremists; strong religious systems

¹² Previously Rollercoaster to Armageddon.

Fragile and unstable	Perceived ability of natural system to deliver ecosystem services 	Resilient and stable	Perceive that it is fragile and unstable, but strong pressure for land, water and food overrides any concern: danger of fatalism and cynicism
Low	Perceived impact of climate change and other natural hazards 	High	High, but feeling of incapability to do anything about it

2.5.2. Should I Stay or Should I Go scenario dynamics¹³



¹³ The scenario dynamics is derived from the flipchart drawn by the stakeholders during the workshop. An image of the original flipchart can be found in Annex 3.

2.5.3. *Should I Stay or Should I Go* storyline

Towards the 2020s

After the anni horribiles¹⁴ ~~from 2008 until 2012~~¹⁵, the European economy is in a bad shape ~~12 years into the new millennium~~.¹⁶ For the period of 2012-2015, the European economy temporarily revives thanks to innovations coming from the pharmaceutical industry. In an attempt to revamp the European economy even further European policy-makers decide to invest in innovations with a big return on investment in the short run. The military and nuclear industries receive subsidies to modernise themselves.

Meanwhile, the depletion of natural resources continues at an ever faster rate, but politicians and decision-makers at all levels turn a blind eye to these developments. The first priority for them is to get the economy back on track. Natural hazards, droughts, forest fires, and heavy rains all occur, but policy-makers decide to put the limited public resources into measures for stimulating the economy and not into innovative solutions to combat natural resources depletion. These measures spark economic growth and resource depletion continues. **There are no longer permanent positions in research, but scientists all work on short-term contracts. We have entered a period of short-termism, budget cuts and financial scarcity.**

The effects of a depletion of natural resources become increasingly visible. Crop failures occur and also the standard of living in those areas affected by droughts, floods and landslides decreases significantly. **There is less solidarity and therefore less money coming in when a region is hit by an extreme weather event.** Food prices go up on a global scale and also the price of other essential commodities such as energy goes up. **An oversimplification of the system of crop and animal production leads to an increased sensitivity of the system to diseases. The mad pig disease for example is spreading all over Europe. Meat and vegetables become extremely expensive, due to scarcity.**

There is also a slowly growing underclass that can no longer afford the increasing prices of utility services. By 2020, some budget is available to do research on cleaning up groundwater, but the attempt to fix it fails. Also other attempts to find innovative ecological solutions to combat the depletion of natural resources are unsuccessful. **Scientists do not manage to find a replacement for phosphorus, while we are steadily moving towards a complete depletion. Recycling would be a solution, but there is no infrastructure and the necessary investments cannot be made.**

The whole world, including Asia, suffers from a failure of the systems that deliver technology, rather than from the failure of technology itself. Researchers look for cheap short-cuts to optimise the production process. Alternative energy solutions disappoint and therefore nations try to keep their existing nuclear power plants going for longer. This, however, has consequences for the safety and reliability of the power plants. Power cuts tend to happen more often. In the meantime transport costs rocket due to the lack of energy. Public and private transport suffers from selective shut-downs and is unreliable. Infrastructure in Europe is old and there is a tension between the wish to safeguard traditions and cultural heritage and the lack of money for maintenance.

¹⁴ Text in black is the original first draft of the storyline, as established during the first workshop.

¹⁵ Text in red are new additions to the storyline during workshop 2.

¹⁶ Strike-out text (eg. ~~example~~) are lines of thought that have been taken out of the storyline.

The decreasing standard of living does not happen for all citizens in the same way. In countries / areas that are not severely affected by droughts and floods people can still maintain their standard of living, but in areas that are severely affected people pay a heavy price. By 2025, there is a widening gap in society between those that are affected by the depletion of natural resources and those that are not. ~~There is still access to health care, but for most people the access is limited. Only the rich receive a top-notch treatment. As a reaction local underground markets appear for food, water and energy. People try to produce food at home and be as self-sufficient as possible. This leads naturally to a struggle for land, which feeds social unrest. For example, the Scottish people accuse the English of nature exploitation. Demonstrations take place on a weekly basis. In general, people in the cities become poorer and poorer and we see a migration wave towards the countryside. This causes tensions with the local inhabitants.~~

This migration also takes place between regions in Europe. Northern and Eastern Europe have become popular for relocation, since natural resources and land are still available there. The race also leads to the Arctic becoming an area of tension. The world suffers from weaker top-down governance, half of the European Commission-staff is laid off during one of the severe dips of the economy and organised crime is on the rise. The world has altogether become a more dangerous place.

Towards the 2050s

Countries ~~not~~ less affected by the depletion of natural resources, extreme weather events and rising poverty levels become frontrunners in trying to lift Europe out of an economic dip. But without sustainable, innovative solutions, revamping the economy is always based on making use of those resources that are already severely depleted. This does not create a stable situation and eventually leads to a mini economic crisis every three to four years as of 2028. ~~Few people profit from the short ups of the economy, but every single person suffers from the downs. And even during the ups, it is only the economy that experiences a revival, the environment and quality of life constantly deteriorate. By now, 50% of red listed species have gone extinct due to land grab for food production.~~

Innovative solutions intended to halt resource depletion continue to fail. The short revivals only add to the increasing gap between rich and poor. Part of society just cannot adapt to this rollercoaster economy and suffers from health issues, unemployment and a loss of belief in reaching a real turning point. Food prices rocket leading to hunger marches and food riots in all world cities. The migration from city to countryside, and from Southern and Western Europe to available land in Eastern and Northern Europe becomes restricted. Farmers and local organisations in rural areas try to protect their land by force, because the government is no longer strong enough to protect them.

The divide between the “affected” and “not affected” not only leads to an increasing inequality, both within the EU as well as within countries, but also to conflicts. Conflicts over scarce resources take place at many different levels and have many different faces. Internally, inequality leads to political instability and government failures. Some states outside of Europe fail because they don’t succeed in distributing resources equally within their nation. The rulers of failed states try to sell ecosystems assets, while the governments of China, India and the United States decide to introduce a resource export ban. By 2040, inequality and resource redistribution leads to geopolitical instability and tensions all over the world. ~~Some people deprived from a number of essential resources migrate to resource abundant regions.~~

Eventually this leads to armed conflicts by 2045. The EU splits into pieces and has a lot less influence. They now focus solely on transnational issues. Conflicts on the local, regional and national level are a feeding ground for extremists. Some religious groups do not shy away from violence in order to spread their ideology throughout Europe.

The unstable situation has exhausted the population. They feel insecure, unsafe and lack positive prospects. In an attempt to bring the rollercoaster of short exponential economic growth and deep economic crises to a halt, governments in Europe attempt to regulate the use of resources very strictly in 2050. A case in point is the regulation of food distribution and limited land use. They also instate power cuts and water rationing in order to initiate a behavioural change among the population. Investments, however, are still mostly short-term and governments tend to make popular decisions that are not always sustainable. The biggest counter-movement comes from the poor themselves, as they unite in solidarity groups as a reaction against both the rich and the government, which has not succeeded in improving the quality of life for all people. There is now less respect for rules and regulations and less control of the establishment. Living with less-movements begin to emerge, but they are still far and few between. ~~This proves to be a good recipe to avoid further chaos as tensions over resources ease off. Countries regulate more strictly the use of land, which takes away the pressure for internal and external conflict over resources. This has an immediate effect on the growth of GDP. The growth of GDP is not as strong as in previous years, but growth is now smaller, but more stable and sustainable because of the regulated use of resources. Inequalities do remain, especially in between different countries, but intra-country the inequalities decrease. The cost of living stabilises while the standards of living converge within a country. Natural hazards continue to occur, but their intensity and frequency has not changed much compared to the 2020s, so they remain a challenge in the 2050s.~~

By 2050, there is a lot more space for corruption. The rich manage to buy all the large country houses and many of the poor are forced to move back to the cities. The struggle for land continues and people just grab land and cut down the last remaining forests without government permission in order to grow food. Growing crops has also become increasingly more difficult, since power cuts are frequent and authorities have restricted water use to only 2 hours per day. People therefore have to rely on wastewater for irrigation. Metals in this water inevitably cause a loss of fertility of the soil.

Trade has also changed dramatically over the previous decades from a global market to local markets where the currencies we knew no longer count. People exchange goods, work or services for other goods or services, rather than for money. Apart from these local markets, there is also an extensive black market for natural resources. Organised crime has by now reached an all-time high. It has put the rule of law under pressure and people live in an insecure and instable world.

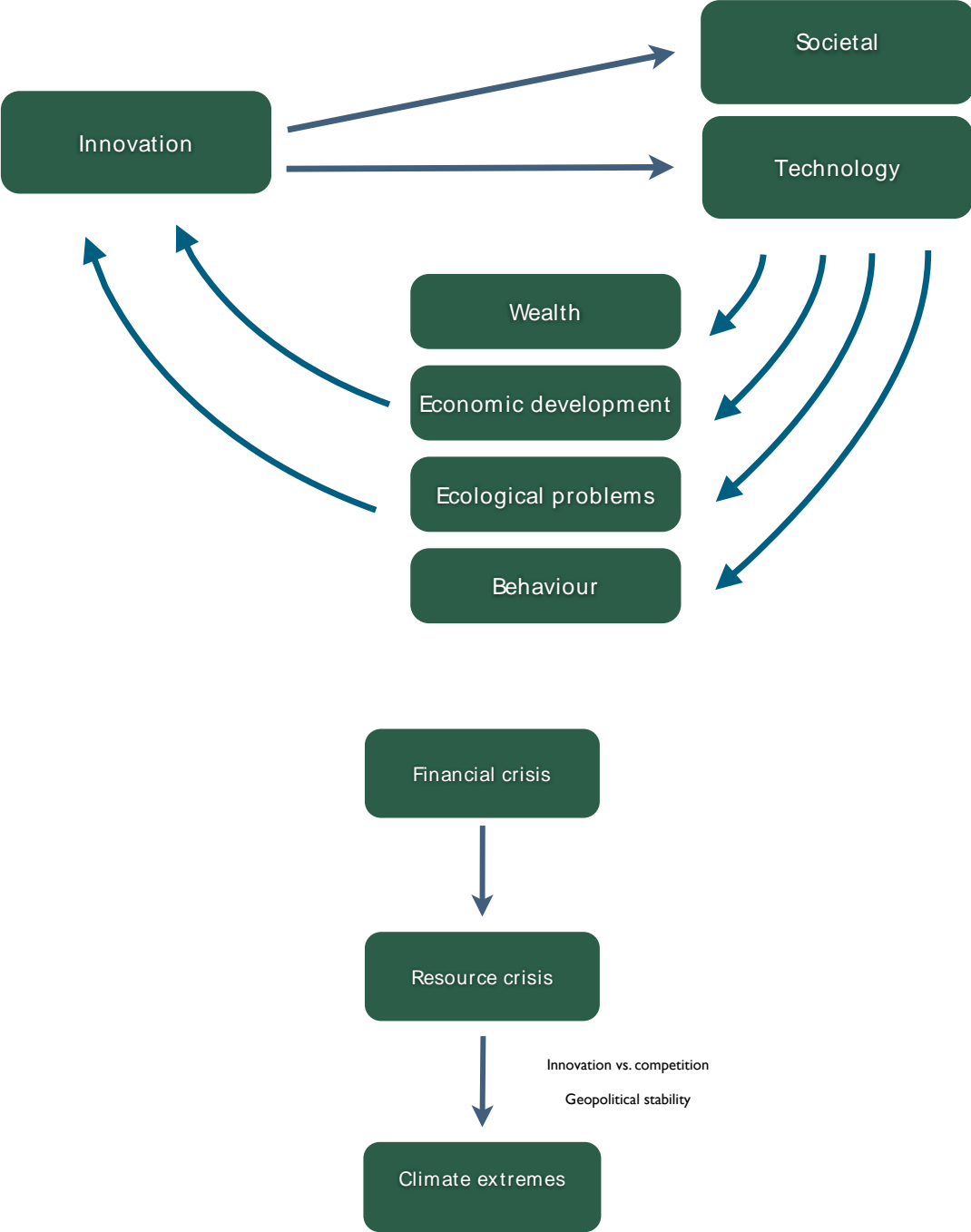
2.6. Riders on the Storm¹⁷

2.6.1. Driving forces and uncertainties

Polarity	Uncertainty	Polarity	In YOUR scenario
International dominant / Europe dominant	Decision-making level	Nation-state dominant/ Local dominant	No agreement
Low Stability	Geopolitical stability	High stability	First low, then medium; important for economic development
Strong cooperation	International cooperation	Weak cooperation	Competition, but later on more cooperation which influences innovation and policy-making
Low responsibility	Social and environmental respect of non-state actors	High responsibility	No agreement
Migration within regions	Population and migration	Migration between regions	No agreement
Gradual	Economic development (growth)	Rollercoaster	Rollercoaster
Unconstrained	Globalisation	Constrained	Unconstrained; markets for innovation and economic development
Restricted	Choice	Free	No agreement
Influential	Attitude towards human and natural health	Respectful	Awareness and education lead to more respect
Low	Social cohesion	High	Growing
Non-effective	Solutions by innovation to depletion of natural resources	Effective	Effective
Plural	Social belief systems	Dominant	Moving towards plural
Fragile and unstable	Perceived ability of natural system to deliver ecosystem services	Resilient and stable	Fragile and unstable = key driver
Low	Perceived impact of climate change and other natural hazards	High	High = key driver

¹⁷ Previously I-ticket to Ride.

2.6.2. Riders on the Storm scenario dynamics¹⁸



¹⁸ The scenario dynamics is derived from the flipchart drawn by the stakeholders during the workshop. An image of the original flipcharts can be found in Annex 3.

2.6.3. *Riders on the Storm Storyline*

Towards the 2020s

Since the financial crisis of 2008, the European economy has been fluctuating strongly. This trend, which originally people thought would only last a few years, is becoming the general pattern of development for Europe for the next decades.¹⁹

In 2012, world leaders fail to reach an agreement on the successor to the Kyoto protocol. However, extreme weather events in Europe demonstrate that adaptation measures are needed more than ever. Droughts in southern Europe lead to large-scale failures of harvests in large parts of Greece, Italy and Spain. Because those countries supply a lot of fruit and vegetables to the rest of Europe, the scarcity of fruit and vegetables leads to food shortages and inflation. Alternatives to fruit and vegetables from Southern Europe become very expensive. This is exacerbated by the production cost of fruit and vegetables in greenhouses in Western and Eastern Europe going up because of high oil prices.

Hence, the droughts in Southern Europe have a knock-on effect for the rest of Europe and its economy. Governments from Southern Europe have to bail out those sectors that have run into trouble. They make use of the permanent European Emergency Fund, which was set up in 2012 during the Euro crisis. For the first time, newspapers speak of climate change unemployment. **These problems have a strong negative influence on people's morale. Strikes and marches happen frequently in all the capitals of Europe as supplies go down and prices go up. The droughts, however, are not limited to Southern Europe alone. They cause water quality to go down on a continental scale. There is less water available for irrigation, rivers tend to dry up in the summer and this has an enormous impact on some of Europe's fragile ecosystems.**²⁰

In Europe, people become more and more aware of climate change and environmental issues. They unite themselves and support the NGO's, who get more attention in the media because of the distrust of government. Because of these strong bottom-up initiatives, ~~Despite no global agreement,~~²¹ the EU continues to put a lot of effort and resources into climate change adaptation measures. In its adaptation strategy, the EU is wholeheartedly committed to finding innovative solutions to the depletion of natural resources. Key to this strategy is public-private collaboration. In Eastern Europe, however, not all countries agree with this strategy and governments dissuade consumers from buying 'green' cars. This scandal leads to a public outcry and protest marches are held in no less than 15 EU countries.

Despite difficult economic times, the EU and national governments do not cut funding schemes for private initiatives. **They see the environment as a key priority and feel the need to be pro-active with regard to the challenges to come. On top of this, they want to avoid brain drain at all costs in these difficult times.** "Private initiatives for public solutions" becomes a very successful funding scheme.

Due to the increasing degradation of ecosystem services, education continuously focuses on awareness-raising and on the importance of sustainable solutions. Governments support this by setting up new research institutions and providing continuous funds that are not dependent

¹⁹ Text in black is the original first draft of the storyline, as established during the first workshop.

²⁰ Text in red are new additions to the storyline during workshop 2.

²¹ Strike-out text (eg. ~~example~~) are lines of thought that have been taken out of the storyline.

on the fluctuations of the global economy. They are convinced that innovation and technology are the only answers to a crisis. This constructive approach makes the EU stronger and more influential. It becomes a beacon of security in instable times.

~~But this is only the tip of the iceberg.~~ The funding scheme sets in motion a whole era dominated by the will to find innovative solutions to the depletion of natural resources. One of the first milestones of this era is the exponential growth of renewables. In 2020, when the peak of the global financial crisis is reached, the energy costs and resource prices soar and renewables finally become cost effective. More and more countries, also outside of Europe, begin to adapt their policies regarding green enterprises and support them financially. On a local level green initiatives have been successful for a few years now. They receive media coverage and governments support them with subsidies.

By 2025 the green economy is ~~finally~~ seriously booming. Managing the effects of extreme weather events becomes a new challenge in this era. The strong focus on eco-technology together with dynamic, instable global markets generally feed a rollercoaster GDP development in Europe. In the meantime the morale of the European population has gone up. They have collectively made a behavioural change and are happy to live with less.

Outside of Europe the economic and social landscape is mainly unstable. There is a tendency towards populism and this causes tensions. Because the world economy continues to decrease, global politics have become very unstable. Due to such instable conditions, Europe cannot export much of its innovative products.

Towards the 2050s

By 2030 it seems that the counter-measures in the EU are successful. ~~By 2030~~ Europe has successfully implemented new irrigation techniques to combat droughts. New irrigation techniques make it possible to reduce water use. People have become used to their lower standard of living and enjoy the outdoors more. Having your own vegetable garden has become very popular, as are local markets and fairs. The focus is on self-sufficiency and local trading, rather than on globalisation. People have more trust in local authority, rather than in national governance. The European continent has learned over the years to be a lot more energy efficient and renewable sources and green technology have reduced our dependency on natural resources. The EU also maintains its permanent funding of green research projects and continues to stimulate technological innovations.

In 2035, water use in London is reduced for the 10th year ~~running~~ in a row. In light of ever more disastrous effects of climate change, the resistance against geo-engineering eases off. Albeit still being very costly, geo-engineering picks up by 2040. A new milestone comes in 2042 when fusion power makes it possible to overcome the energy crises. New biotechnologies also drastically reduce the demand for natural resources. At an EU summit, it is proudly announced that the EU no longer depends on resources from outside the continent. On the contrary, Europe can now start exporting green solutions since the world economy and geo-political stability is increasing.

By 2040 the impact of climate change once again hits hard. Europe, with its long and continuous investments in innovative and green technologies, is prepared for this crisis. The developing and emerging countries, however, are not. They now have to pay the bill for the unsustainable and unlimited development of the last decades. Millions of people express the

wish to immigrate, but Europe does not allow it, since it would put too much strain on the already fragile ecosystems. The world economy suffers from the crisis in the emerging countries. The euro is not strong, but has stabilised and the EU works hard in gaining global trust for its research outcomes and education programmes.

By 2045-2050, a **global** change in attitude is noticeable ~~in Europe~~. Europeans have learned to master some of the negative effects of climate change **and the decline of ecosystem services**, but this does not make them reckless. Together with learning to master the effects of climate change, Europeans have also learned to have more respect for natural resources. Adaptation policies pay off, not only because there are technological solutions at hand, but also because the population is very supportive ~~and makes it possible for them to pay off~~. Hence there is a high increase in social capital. **Europe exports the technology to help restore degraded ecosystem services and to rebuild the economy more sustainably in developing and emerging countries.**

This trend continues in the 2050s and is reflected in a steady green GDP growth and an increase in purchasing power. The fact that Europe is a good place to live by 2050 is also reflected in a population increase compared to the 2020s. **The demand for green technology has also grown strongly now that the world economy has recovered once again. Other countries have copied some of the technology and now offer them for cheap prices. But Europe can take on the competition, since new technologies are constantly being developed. Research, education and innovation are the key strengths of the EU and by providing the necessary funds they manage to stay generally one step ahead of the rest of the world.**

Other countries copy the innovative green technologies and offer them cheaper, which causes a decline of GDP in Europe until the next innovation puts us ahead again. The enormous investments of the past decades finally pay off. However, the world economy remains turbulent. Europe is heavily affected by this volatility because it depends on exporting green technology. When other nations are doing well economically, so is Europe. But when they struggle, Europe struggles even harder.

3. Quantification of selected key variables

3.1. The quantification exercise explained

After finalising the scenarios, each scenario group specified values for key drivers as input to the set of meta-models within the CLIMSAVE IA Platform. These key drivers correspond to the set of drivers participants quantified in workshop 1. Six model variables²² were selected by the CLIMSAVE team to provide guidance on the quantification of a much wider range of socio-economic variables used within the meta-models. In addition to these six variables, a further set of seven variables were specified, five capitals (natural, human, social, manufactured and financial) and two variables that were not discussed in workshop 1 (labour costs and electricity production).

The list of specified variables is as follows:

1. GDP
2. Population
3. Food imports
4. Arable land for biofuels
5. Oil price
6. Household size
7. Natural capital
8. Human capital
9. Social capital
10. Manufactured capital
11. Financial capital
12. Labour costs
13. Electricity production

Two time scales were distinguished: the first from the present to the 2020s and the second from the 2020s to the 2050s. Stakeholders were asked to quantify the variables for these two time scales for the EU as a whole. Furthermore, they were asked to provide a graph of the evolution of each variable over time.

More specifically the stakeholders were asked to answer the following questions:

1. What is the average annual growth rate of GDP in the 2020s/2050s?
2. What is the annual growth rate of population in the 2020s/2050s?
3. What is the fraction of food imports from total consumed food in the 2020s/2050s?
4. What is the percentage of arable land used for biofuel production for now, the 2020s and the 2050s?
5. What is the oil price per barrel in the 2020s/2050s?
6. What is the household size in the 2020s/2050s?
7. How does natural capital evolve from now to the 2020s and from the 2020s to the 2050s?
8. How does human capital evolve from now to the 2020s and from the 2020s to the 2050s?

²² In workshop 1 there were seven. *Protected areas for nature* was dropped from the list as this is considered in the adaptation options list.

9. How does social capital evolve from now to the 2020s and from the 2020s to the 2050s?
10. How does manufactured capital evolve from now to the 2020s and from the 2020s to the 2050s?
11. How does financial capital evolve from now to the 2020s and from the 2020s to the 2050s?
12. How will labour costs change for the 2020s/2050s?
13. How will (thermal) electricity production change for the 2020s/2050s?

Additional background information on each variable was provided to stakeholders by means of a hand-out prepared by the CLIMSAVE team. Scenario specific posters were also provided for each of the scenario groups. The posters contained the outcomes from the fuzzy set analysis (workshop 1), including the scenario-specific translation keys. This enabled the stakeholders to become more aware of the numbers, how they were generated and the meaning of each qualitative class. In addition, graphs were presented for all variables illustrating the variable development over time under the specific scenario assumptions (of the first workshops). The translation keys were fixed from the first workshops and stakeholders were encouraged to use this information in scenario groups to evaluate their scenario drivers from two perspectives:

- Do the scenario driver values correspond with the stakeholders' expectations?
- Are the scenario drivers credible with respect to the storyline and consistent with the storyline, particularly since the stories might have changed significantly during their review and enrichment in the second workshop?

Then participants were requested to fill in their best estimates of how the variables develop under the storyline assumptions. For the questions on GDP, population, food import, arable land used for biofuel production, oil price and household size the following value categories were used:

vl = very low
 l = low
 m = medium
 h = high
 vh = very high

For the questions on the capitals, labour costs and electricity production the following value categories were used:

h+ = high increase
 m+ = moderate increase
 0 = no change
 m- = moderate decrease
 h- = high decrease

3.1.2. *We are the World scenario*

Variable	In our scenario: 2020s	In our scenario: 2050s	Graph
1. GDP	m	m	
2. Population	l	m	
3. Food imports	l	vl	
4. Arable land for biofuels	l	vl	
5. Oil price	vh	vl	
6. Household size	m	h	
7. Natural capital	h-	m+	No graph provided
8. Human capital	m+	h+	
9. Social capital	h+	m+	
10. Manufactured capital	m+	m+	No graph provided
11. Financial capital	m-	m-	No graph provided
12. Labour costs	m-	m+	No graph provided
13. Electricity production	m+	m+	No graph provided

3.1.3. Icarus scenario

Variable	In our scenario: 2020s	In our scenario: 2050s	Graph
1. GDP	l	vl, at the end l	
2. Population	m	l	
3. Food imports	h	l	
4. Arable land for biofuels	m	l	
5. Oil price	m	vh	
6. Household size	l	h	
7. Natural capital	m-	h-	
8. Human capital	0	h-	
9. Social capital	m-	0	
10. Manufactured capital	0	m-	
11. Financial capital	m+ or o	m-	No graph provided
12. Labour costs	m+	0	No graph provided
13. Electricity production	m+	m-	

3.1.4. *Should I Stay or Should I Go scenario*

Variable	In our scenario: 2020s	In our scenario: 2050s	Graph
1. GDP	l	vl	
2. Population	m	h	
3. Food imports	l	vl	
4. Arable land for biofuels	l	vl	
5. Oil price	m	h	
6. Household size	m	h	
7. Natural capital	m-	m-	
8. Human capital	0	m-	
9. Social capital	m-	m+	
10. Manufactured capital	m-	m- / h-	
11. Financial capital	m-	m-	No graph provided
12. Labour costs	m-	m-	No graph provided
13. Electricity production	0	m-	

3.1.5. Riders on the Storm scenario

Variable	In our scenario: 2020s	In our scenario: 2050s	Graph
1. GDP	l	m	
2. Population	m	m	
3. Food imports	m	vl	
4. Arable land for biofuels	l	vl	
5. Oil price	vh	vh	
6. Household size	m	m	
7. Natural capital	m-	h+	
8. Human capital	m+	h+	
9. Social capital	m+	m+	
10. Manufactured capital	m-	m+	
11. Financial capital	m-	m+	
12. Labour costs	m-	m+	
13. Electricity production	m+	m+	

4. Adaptation options

4.1. Adaptation options identified

4.1.1. *We are the World scenario*

The following adaptation options were identified and clustered by the participants. Options added by participants from outside the scenario group are in italics.

- State/EU subsidy for scaling up new technology
- Emergency procedures
- Back to the future
- *Joint adaptation strategy with Africa*
- *International environmental agreement*

- Ban/restriction on GMO in EU lifted
- Tax on food waste
- Food production adapted to different natural conditions
- New business opportunities in modified agriculture
- Locally produced food has priority
- Write recipe book with tasty insect recipes
- Urban agriculture
- Sea farms
- Develop efficient irrigation systems
- Adapt wine appellation contrôlée system
- Change dates of seeding and harvesting
- Improve agricultural productivity
- Invent crops able to survive droughts
- Salt water crops
- Aquaculture

- Improve connectivity of nature reserves
- Urban nature

- Legislation on flooding at the regional level
- Flood defences
- Improve dunes as coastal defence
- Leave lowlands
- New activities in lowlands
- Floating houses in low areas

- Joint water projects
- Saving water-projects in kindergarten
- Large infrastructure for water distribution
- Large storage system for water
- Improve water conservation
- Recycling systems
- New technology for water energy
- Use technology of oil to water
- *Effective flood warning systems*

- *Managing catchment*
- Urban forests
- Improve forest management
- Plant new tree species in forests
- International space station
- Tax on polluting/energy consuming imports
- Joint energy grids beyond Europe
- O₂ carbon footprint is like ID – obligatory
- Most favoured trade status with blocks that cooperate on fighting climate change
- Stimulation of measures improving energy efficiency
- Stock of food, fuel, medicines for disasters
- Emergency procedures at regional level in case a disaster happens
- Ban on airconditioning
- Subsidies for renewable energy
- Individual equipment for emergency
- Reliable street cameras without personal data leakages
- Insurance pool at EU level for natural disasters
- Bureaucracy for implementation for all measures is low
- Housing adaptation to extreme events
- Local energy grids connected at EU level – world wide web for local grids
- Working/building with nature
- Early warning systems (transport, agriculture)
- Infrastructure to store renewable energy
- Cycling infrastructure is improved
- Expert – campaign how to save energy
- Educate people for different ...²³
- Education by internet and working from home – avoid travel
- Develop new energy infrastructure
- New ICT-technology must be user-friendly and reliable
- Build a mountain in the Netherlands comprising green technology
- Light summer clothing is accepted
- Build artificial winter sports centers
- Menus in restaurants and cafeterias must be 80% vegetarian
- *Diverse energy production + distribution across and outside EU*

4.1.2. Icarus scenario

The following adaptation options were identified and clustered by the participants. Options added by participants from outside the scenario group are in italics.

- Green roofs as local solution
- Adapted construction solutions – building design
- Trees and plants in cities
- *Floating houses*
- Early warning systems

²³ Post-it is partly illegible.

- Insurance schemes for storm and flood damage
- Crop insurance against drought, hail, etc.
- Change crops for more resilient available crops
- Urban agriculture
- Low tech water saving solutions (water saving valves)

- National support for migration settlement strategies
- Allow settled areas to flood – telling people to move at national level

- Bigger fuel reserves

- Cool rooms for the elderly
- Public awareness campaign on heat waves – dress code
- Disease medication development
- *Home care service for the ageing from private companies*

4.1.3. *Should I Stay or Should I Go scenario*

The following adaptation options were identified and clustered by the participants. Options added by participants from outside the scenario group are in italics.

- Economic incentives (depending on if in up or down of the economic rollercoaster)

- Damage prevention policies
- *High tax on 'bad' food + energy consumption, none on production²⁴*
- *New insurances for extreme events²⁵*
- *Engage private sector for efficiency*
- *Saving as governance focus – private + public organisations and citizens*
- *EU as stabilizing force – EU pharaoh Barroso or Van Rompuy – EU religion?*

- Rain-water harvesting local rather than big systems
- Rain-water harvesting for agriculture and in urban areas

- Dietary education
- Food regulation – minimum access to food (rationing)
- Spatial planning regulation to prevent urban sprawl and restrict development on green field sites that are needed for natural resources
- Promoting local food (education about transport costs)
- Reduce food waste at all levels (farm to retail)
- Taxing calories
- Vegetarian push with some livestock for soil fertility
- Mixed farming, more integrated farming systems (back to traditional farming)
- Protecting biodiversity outside protected areas
- *Crop insurance for heat waves*

- Holistic multi-functional landscape
- More sustainable land management

²⁴ Scenario group did not agree with this one.

²⁵ Scenario group thinks this will not work.

- Planning against urban sprawl
- Green use of house obligatory
- Greening the cities for draining, cooling, reducing flood risks, food production
- More attractive cities for living
- Compact living spaces
- Quick-built infrastructure
- Low cost green infrastructure
- *Cheap concrete house production*
- *Retrofit houses/buildings*
- *Floating buildings*

- Try to create 'deichmaster' culture locally
- Flood defence is focus of governance
- Water as focus of EU governance
- *Invest in warning systems*
- *Build walls for flood protection*

- Prize for good local climate change adaptation
- Professionalism at the local level
- Mediators between local units
- Pan-local fora (coordinated education so as not to lose local traditional knowledge; professionalise the local level)
- Increased powers to basic authorities
- *Local post-crisis plans*
- *Sharing local best practices*
- *Self-sufficiency locally*
- *Local energy grids*
- *Local food supply*
- *More local democracy, more local governance*
- *Religious neighbourhood help during heat waves and floods*

- *Simple guiding principles: low cost, low tech and simple*

- *Promote rural areas for migrants*

4.1.4. Riders on the Storm scenario

The following adaptation options were identified and clustered by the participants. Options added by participants from outside the scenario group are in italics.

- Social behaviour
- Capacity building
- Education – awareness of vulnerability to weather/climate
- Health care
- Educate people about fresh water availability and how to live green (higher taxes?)
- Health: AC, neighbourhood support, green cities
- Volunteering projects (during crisis)
- Communicate outreach
- *Education: curriculum changes*

- Biodiversity: More protected areas, protected areas network, higher quality of protected areas, reintroduction of species
- *Drought and storm resistant forests*

- Recovery (post crisis management)
- Invest in dealing with calamities (such as evacuations on large scale)
- *Modeling/simulation of impact of calamities*

- Reduce EU IP complexity
- Accelerate idea to implementation process
- *Faster “directive” implementation (framework)*
- *Education cross-disciplinary, aimed at dealing with grand challenges*
- *“Industrial” PhD*
- *EU champion in innovation*
- *Objective driven directives (instead of means)*
- *Accelerate recovery*
- *Information and expert knowledge available to anticipate change research*

- Heat: buildings constructed or retrofitted for higher temperatures
- Climate-proved infrastructure
- Increase and improve green space in cities against heat and flooding
- *Building materials*
- *Sustainable cities*
- *Smart cities*
- *Smart mobility*

- Starting an EU water experts centre – research about clean water and how to recycle, use salt water
- EU coastal expert centre: research and education + make this technology widely available in the EU
- Upgrade flood defence / coastal structures
- ICEM and ...²⁶
- Flood risk management: sustainable catchment management, natural farming, green spaces
- Water supply: water storage, desalination

- Provide financial support mechanism for research
- *Tax/incentives to accelerate transformation to green economy*
- *Increase capital requirements for banks (financial stability goes up)*
- *Attract relevant actors (companies) to EU*
- *Public/private capital*
- *Banks investing in long-term research (in exchange for state support)*
- *Subsidies for innovators*

- Land use management to optimise resources but also improve ecosystem services
- New crops and agriculture practices

²⁶ Post-it is partly illegible.

- Have more food supplies available with ‘green’ labels. Different approach for agriculture – new products
- Agriculture: genetic technology – irrigation – wind protection
- Water efficiency, new methods in irrigation
- *Crops growing on less favorable soils*
- *Crops resistant to extreme conditions*
- *Agriculture: systems to protect animals (cattle,...)*
- *Agriculture management (combinations of crops, etc.)*
- *Storm and drought resistant crop combinations*

- *Stimulate cross-sectoral initiatives (value chain constellations)*

- *Weather/seasonal forecast systems*
- *Forecast/monitoring/alerting*
- *Forecasting linked to mobilising social capital*

4.2. IA Platform options reviewed

As a second exercise the panellists were asked in their scenario groups whether a table consisting of those adaptation options which are represented within the IA Platform were of low, medium or high importance in their scenario. The options analysed by the participants were:

1. Spatial planning: Planning policy to control urban expansion and so protect land availability for food and biodiversity.
2. Limit coastal development: Discouraging coastal development to reduce exposure to coastal flooding.
3. Improve flood defences: By upgrading the standard for flood protection.
4. Reduce water demand: By using technology.
5. Reduce water use: By promoting a behavioural change through education, training, water pricing.
6. Prioritise water demand: How water should be prioritised when demand is greater than availability (food, environment, industrial,...)
7. Change irrigation water cost: Changing irrigation water price to change water use efficiency and demand.
8. Improve irrigation efficiency: Changing the amount of water used to produce a fixed amount of food.
9. Yield improvement: Due to plant breeding and agronomy (leading to increases) or environmental priorities (leading to decreases).

10. Change in dietary preference: Reducing meat consumption in response to anticipated food shortages.
11. Wetland creation: Managed re-alignment where flood defences are moved inland to make space for the creation of coastal wetlands.
12. Reduce flood impact: By taking measures to diminish the damage caused by a flood.
13. Set-aside of land: Removing a percentage of land from production for environmental benefits or to regulate production.
14. Forest management: Lower intensity management with good nature and recreation/cultural values and reasonable/reduced timber production.
15. Enlarge existing protected areas: Improves the ability of species to cope with change.
16. Increase number of protected areas: Adding new PA's to fill gaps in the network and to assist species to move across the landscape.

4.2.1. *We are the World scenario*

Option group	Low, medium or high importance?	Extra comments
1. Spatial planning	Medium – high	
2. Limit coastal development	High	
3. Improve flood defences	High	Dynamic
4. Reduce water demand	High	Efficiency
5. Reduce water use	High	+ better infrastructure
6. Prioritise water demand	High	On the regional level
7. Change irrigation water cost	No priority	Not against, but not a priority
8. Improve irrigation efficiency	High	
9. Yield improvement	High	Farm management, balanced (stress on breeding and agronomy)
10. Change in dietary preference	Medium	But not linked to food shortage
11. Wetland creation	High	Same as flood defences
12. Reduce flood impact	High	Improve potential and recovery
13. Set-aside of land	High	Part of strategic land use planning
14. Forest management	Low	Except areas close to urban
15. Enlarge existing protected areas	High	
16. Increase number of protected areas	High	

4.2.2. Icarus scenario

Option group	Low, medium or high importance?	Extra comments
1. Spatial planning	High	But no expansion
2. Limit coastal development	High	
3. Improve flood defences	Low	
4. Reduce water demand	Low	But only with low-tech or available techniques
5. Reduce water use	High	
6. Prioritise water demand	Medium	
7. Change irrigation water cost	High	
8. Improve irrigation efficiency	Low	
9. Yield improvement	Low	
10. Change in dietary preference	Medium	Could be high at the end
11. Wetland creation	High	For managed realignment, but not for creating wetlands
12. Reduce flood impact	Low	Medium if low-tech
13. Set-aside of land	Low	
14. Forest management	Low	
15. Enlarge existing protected areas	Low	
16. Increase number of protected areas	Low	

4.2.3. *Should I Stay or Should I Go scenario*

Option group	Low, medium or high importance?	Extra comments
1. Spatial planning	High	But efficiency is medium due to weak governance
2. Limit coastal development	Medium	
3. Improve flood defences	High	Local flood protection + EU level governance focus
4. Reduce water demand	Low	
5. Reduce water use	High	Pressure on resource
6. Prioritise water demand	High	Food is priority
7. Change irrigation water cost	Low	Need is high, but practice is low
8. Improve irrigation efficiency	High	More labour
9. Yield improvement	High	Emphasis is on improving agronomy, not breeding
10. Change in dietary preference	High	Cost-driven
11. Wetland creation	High	Make do with situation rather than optimise
12. Reduce flood impact	High	
13. Set-aside of land	Low	Everything is needed for food production
14. Forest management	High	Manage for fuel, not biodiversity
15. Enlarge existing protected areas	Low	
16. Increase number of protected areas	Low	

4.2.4. Riders on the Storm scenario

Option group	Low, medium or high importance?	Extra comments
1. Spatial planning	Medium ²⁷	
2. Limit coastal development	Low ²⁸	
3. Improve flood defences	High	
4. Reduce water demand	High	
5. Reduce water use	High	
6. Prioritise water demand	Low ²⁸	
7. Change irrigation water cost	High	
8. Improve irrigation efficiency	High	
9. Yield improvement	Low - medium ²⁸	
10. Change in dietary preference	High	
11. Wetland creation	Medium ²⁸	
12. Reduce flood impact	High	
13. Set-aside of land	Medium ²⁸	
14. Forest management	High	
15. Enlarge existing protected areas	Medium ²⁸	
16. Increase number of protected areas	Medium ²⁸	

²⁷ There was no final agreement during the workshop. This is an interpretation of the Riders on the Storm scenario supporter based on the discussions between the stakeholders.

²⁸ Interpreted after the workshop.

5. Feedback from the stakeholders

At the end of the workshop stakeholders were asked to share openly any comments on the process so far – accompanying a written evaluation (see section 6). This resulted in the following comments:

- ‘I would like to hear about scenarios and how scientific it all is.’
- ‘It is now clear what the outcome of the project is supposed to be.’
- ‘Very efficient process of the workshop. A lot of energy.’
- ‘Tool to assess the options could have been helpful. This could assist our choices.’
- ‘More information on quantification exercise would have been useful.’
- ‘Very interesting experience.’

6. Written evaluation

Feedback form

You are kindly requested to give your feedback on the workshop:

1. What is your overall rating of the workshop?

Please mark:

4 Very good 6 Good OK Bad Very bad

Comments: ‘Interesting’ – ‘Panel was small’ – ‘Quite interesting. Looking forward to the final results.’ – ‘CLIMSAVE was having too much input.’ – ‘The workshop was excellent.’ - ‘Panel might have been bigger in size and more geographic representativeness. Group work is nice but the experts of groups were very diverse and may have covered only partially key issues.’ – ‘Very good facilitation of discussions. Good logic flow and lots of time for discussion.’ – ‘This workshop was a lot more concrete. I finally have the idea we can do something.’

2. How do you rate the practical arrangement for this event (invitation, travel, meeting room, hotel, catering)?

Please mark:

7 Very good 3 Good OK Bad Very bad

Comments: ‘Nice location, good logistics’ – ‘Very good, but agenda came late’

3. How do you rate the introductory presentations?

Please mark:

2 Very good 6 Good 2 OK Bad Very bad

Comments: ‘Compliments’ – ‘Good and clear’ – ‘Sometimes I would have liked more background information. It was a bit academic and hard to follow now and then.’ – ‘Good and clear, but it is easy to quickly forget the bigger context of the scenario development.’

4. How do you rate the work of the facilitators?

Please mark:

7 Very good 2 Good 1 OK Bad Very bad

Comments: 'Thanks Steven' – 'Good facilitation of discussions'

5. What are your views on the scenario development process so far?

Please write: 'Positive' – 'Slightly worried about how scientific it is'- 'Interesting. Looking forward to seeing the online platform.' – 'I gained different insights, but am still concerned with regard to the scenario's being not different enough.' – 'Good process.' – 'Sometimes lost in details and too much repetition so miss the bottom-line.' – 'I am just a little worried about how scientific it all is. I think you need time to review the consistency.' – 'On some aspects (economics, demography,...) I feel we would have needed background input/expertise.' – 'Very interesting.' – 'Very interesting discussion with different viewpoints.'

6. What are your views on the quantification session? – Please leave this field open if you did not attend this session (morning of day 3)

Please write: 'Good process' – 'Lost in details' – 'Needs some fine-tuning still.' – 'Often lost in details.' – 'The most difficult session. It would have been useful to have more technical information and data to take into account.' – 'Need to cross-check the quantification outputs between the four scenarios so that they are consistent with the respective storylines.' – 'Choice of the indicators calculated by the platform may be critical. Some indicators might not be suitable at global or European scale.' – 'Difficult.' – 'It became a lot clearer how the IAP works and what it is going to be used for.'

7. Any further comments?

Please write: 'I really enjoyed the experience' – 'Curious to see the final products' – 'I would like to see the final product as soon as possible.' – 'I really enjoyed it.' – 'I have enjoyed the sessions. Let's see if the results are coherent and useful.' – 'No agreement on lots of things in Riders on the Storm, but the discussions were constructive.'

7. Next steps

The third and final workshop will be held on 3-4 December 2012 in Edinburgh, Scotland. The aim is to run the workshop in parallel with the final regional case study workshop, which is Scotland.

During this workshop the stakeholders will receive feedback from the IA Platform on the options developed for the specific scenarios. Participants will develop strategic adaptation approaches to the challenges and vulnerabilities specified for each scenario and receive direct feedback on the consequences of these approaches from the Platform.

ANNEX 1: Agenda

Monday 6 February 2012

12:30 Lunch and registration

WELCOME & GENERAL INTRODUCTION

14:00 Welcome - Dr. Wolfram Schrimpf (DG Research European Commission)

Introduction to CLIMSAVE – Dr. Paula Harrison (University of Oxford)

Introduction to the scenario process and overview of the workshop – Dr. Marc Gramberger (Prospex)

REVIEW OF SCENARIO STORYLINES

15:20 Scenario storyline review

16:00 Coffee / Tea

16:30 Scenario storyline review continued

17:45 Presentation & discussion

18:30 End of day's work

20:00 Group dinner - hotel

Tuesday 7 February 2012

09:00 Overview of the day

SPECIFYING STORYLINES

09:10 Specifying uncertainties and expanding storylines

10:30 Coffee / Tea

11:00 Specifying uncertainties and expanding storylines continued

12:00 Presentation and discussion

13:00 Lunch break (hotel restaurant)

LINKING TO MODELLING

- 14:30 Presentation of results from modelling and the Integrated Assessment Platform
- Dr. Ian Holman (University of Cranfield) and Dr. Benjamin Stuch
(University of Kassel)
- 14:50 Discussion
- 15:10 Review of modelling / input to modelling per scenario
- 16:45 Coffee / Tea

IDENTIFICATION OF ADAPTATION OPTIONS

- 17:00 First identification of options
- 17:55 Plenary wrap-up
- 18:00 End of day's work
- 19:00 Departure for group dinner

Wednesday, 8 February, 2012

- 09:00 Overview of the day
- 09:10 Second identification of options
- 09:40 Consolidation of options
- 10:00 Reviewing options from the IAP: Integrated Assessment Platform
- 11:00 Coffee / Tea
- 11:30 Plenary review

WRAP-UP AND CLOSURE

- 12:30 From here to the final workshop
- 12:40 Wrap-up and evaluation
- 13:00 End of workshop
- Lunch and departure

ANNEX 2: List of participants

Participants:

Chloupkova	Jarka	Independent	Independent
Dolmans	Constantijn	Amlin Corporate Insurance	Binder Manager
Fernandez	Jose Maria	Ihobe	Head of Climate Change and Biodiversity department
Hagg	Joseph	Adaptation Scotland	Science Officer
Giovani Bastos Lima	Mairon	Ecumenical Youth Council in Europe (EYCE)	Campaign Coordinator
Jiraneck	Tomas	Czech Chamber of Architects	Member of the Board of Directors
Koolhaas	Marlies	Rotterdam School of Management, Erasmus University	Programme Manager
Marino	Trimboli	European Federation of Geologists	Board EU Delegate
Pace	Lara	Ministry for Resources and Rural Affairs	Legal Advisor to the Permanent Secretary
Schrimpf	Wolfram	European Commission - DG Research	Deputy Head of Unit
Torterotot	Jean Philippe	Cemagref / EWA European Water Association	Deputy Director of Strategy and Research / President
Zinkernagel	Roland	City of Malmö / Eurocities	Sustainability Strategist
Zrimsek	Barbara	RTV Slovenia	Editor

Scientific advisors:

Harrison	Paula	University of Oxford	Senior Research Scientist
Holman	Ian	Cranfield University	Senior Lecturer
Jaeger	Jill	SERI	Senior Researcher
Kebede	Abiy	University of Southampton	PhD Researcher
Stuch	Benjamin	CESR - University of Kassel	Researcher
Metzger	Marc	University of Edinburgh	Senior Research Fellow

Process facilitators:

Gramberger	Marc	Prospex bvba	Lead facilitator
Watson	Martin	Prospex bvba	Facilitator
Chiamparino	Tommaso	Prospex bvba	Facilitator
Libbrecht	Steven	Prospex bvba	Facilitator
Maes	Marjan	Prospex bvba	Reporter

ANNEX 3: Selection of original workshop outputs

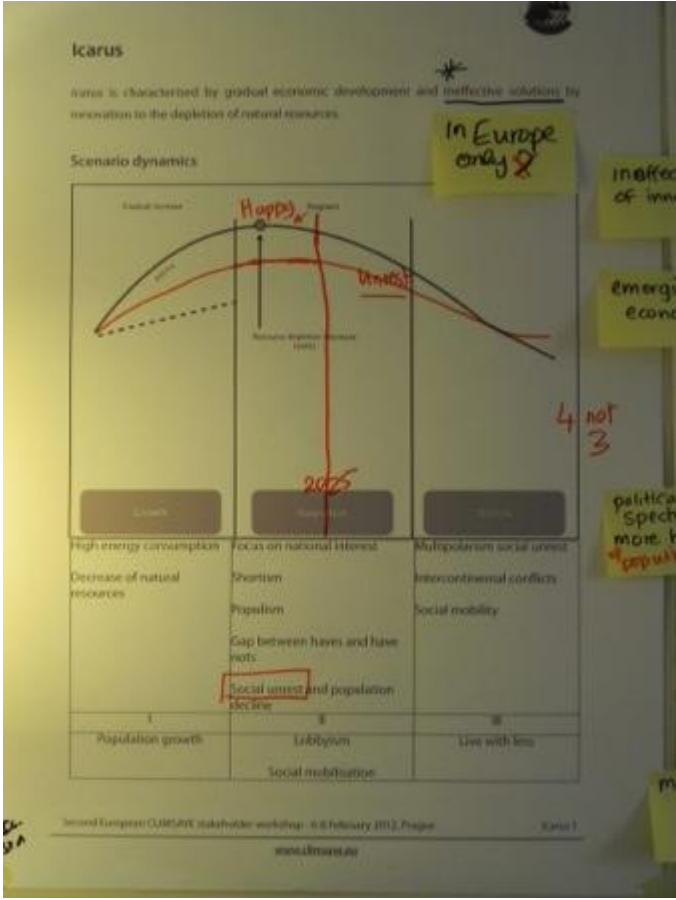
Original flipchart diagram and post-its of the We are the World scenario dynamics:



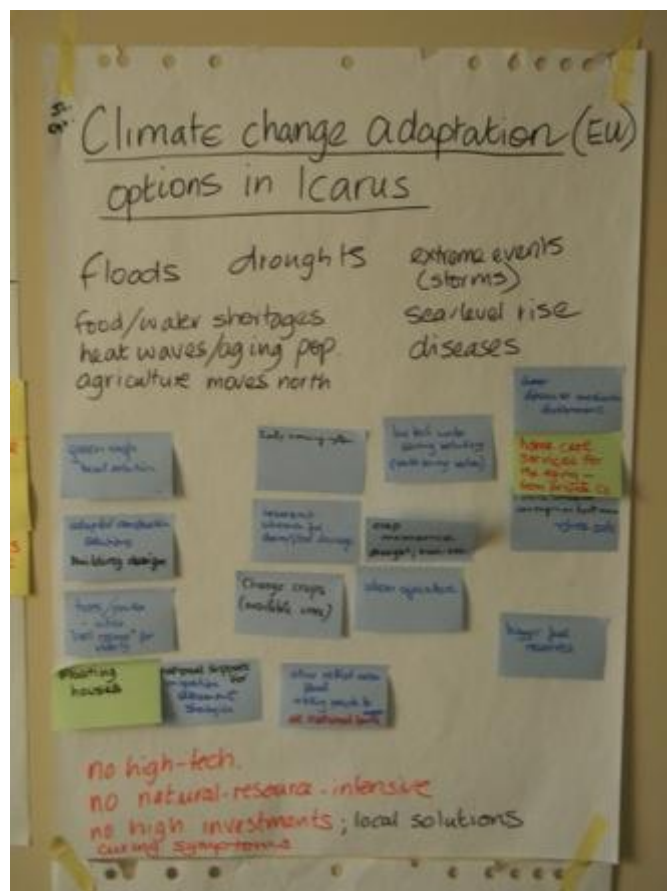
Original flipcharts with adaptation options for the We are the World scenario:



Original flipchart of the Icarus scenario dynamics:



Original flipchart with adaptation options for the Icarus scenario:



Original flipchart of the Should I Stay or Should I Go scenario dynamics:

Rollerco: SHOULD I STAY OR SHOULD I GO **addon**

Rollercoaster to Armageddon is characterized by a rollercoaster of economic development and ineffective solutions by innovation to the depletion of natural resources.

Scenario dynamics

No specific scenario dynamics was provided for the Rollercoaster to Armageddon scenario by the stakeholders, but a number of graphs were drawn by the stakeholders.

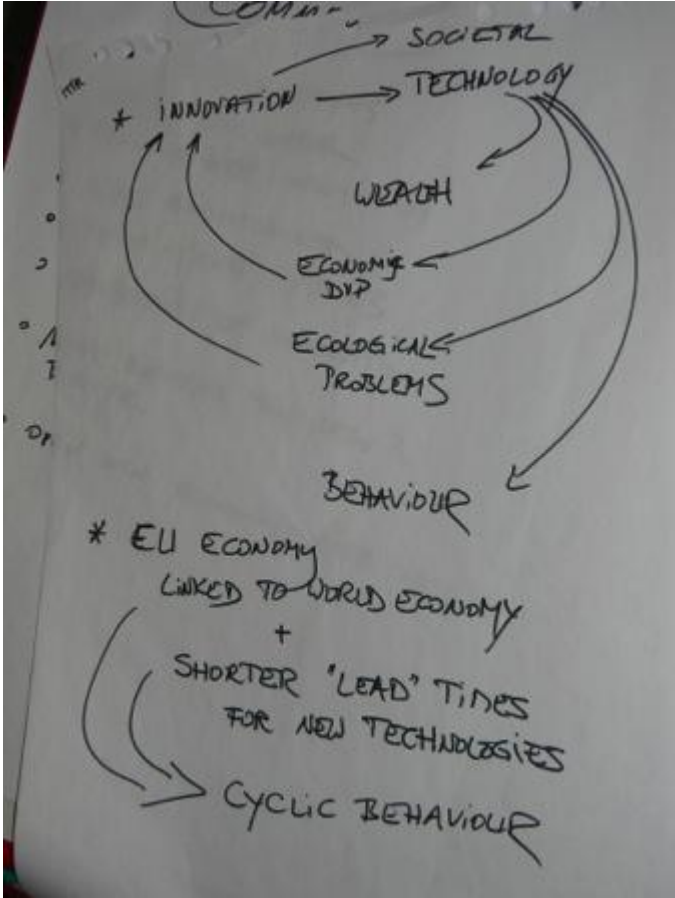
Second European CLM&AT stakeholder workshop - 6-8 February 2015, Prague

Rollercoaster to Armageddon 1

www.impact.eu

ETA

Original flipchart of the Riders on the Storm scenario dynamics:



Original flipcharts with adaptation options for the Riders on the Storm scenario:

