



The **CLIMSAVE** Project

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

Report on the second CLIMSAVE regional stakeholder workshop

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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 was 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. In order to safeguard continuity the same group of stakeholders was invited to the second workshop. The group of participants who participated in 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 regional CLIMSAVE workshop. The workshop was organised in Edinburgh on 27-28 February 2012.

1. Overview of the workshop

This section provides a summary of the activities that took place during the second workshop for the regional 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. Marc Metzger, University of Edinburgh;
- Reintroduction to the scenario development process by 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. After lunch the participants went through the list of main drivers and uncertainties that was created in the first workshop. This activity helped them to expand the storylines. Afterwards each group presented their storyline to the rest of the stakeholder panel and the CLIMSAVE research team.

At the end of the day participants received more information on the IA Platform during a presentation by Dr. Ian Holman (University of Cranfield) and Benjamin Stuch (University of Kassel).

DAY 2:

On day two the stakeholders reviewed the quantified values for a set of predetermined socio-economic variables for the IA Platform within their scenario group. Later on stakeholders were asked to determine specific adaptation options for their scenario. Then they visited the other scenarios in order to add further options to the other scenarios.

After lunch, participants were back in their own scenario. They discussed the contributions from their colleagues and finalised the set of adaptation options for their own scenario. As a final step all the stakeholders determined the importance within their scenario of a predetermined set of 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 regional case study participants developed four scenarios:

- *Tartan Spring* is characterised by a disparate well-being and lifestyle and a resource surplus.
- *Mad Max* is characterised by a disparate well-being and lifestyle and a resource deficit.
- *The Scottish Play* is characterised by an equitable well-being and lifestyle and a resource deficit.
- *Mactopia* is characterised by an equitable well-being and lifestyle and a resource surplus.

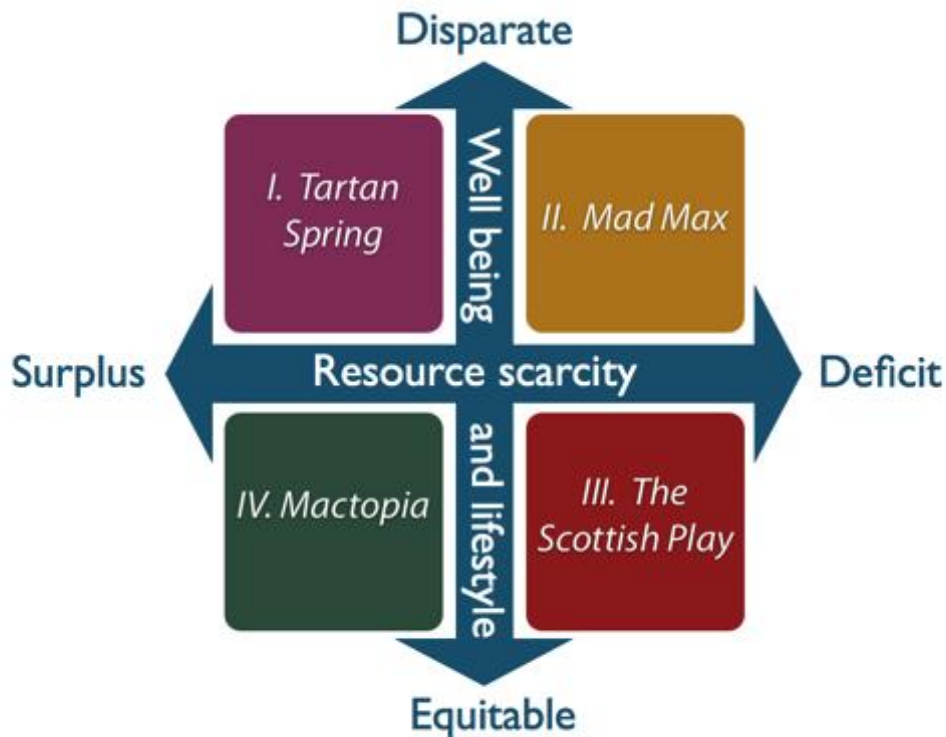


Figure 1: Scenario logic, with the name of each scenario in the respective quadrant.

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:





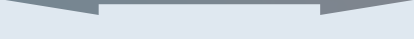



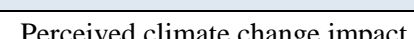


- The participants reviewed the storylines and identified gaps and inconsistencies;
- The groups answered specific questions in order to fill in these gaps and expand the storylines:
 - Tartan Spring:
 - In this scenario, what does disparate mean? 20% rich and 80% poor? What about the middle class?
 - What happens in the surroundings of Scotland?
 - What are the effects of innovation?
 - Mad Max:
 - What is the ratio of 'haves', 'have-nots' and/or 'middle class' people in your scenario?
 - How do 'haves' and 'have-nots' organise themselves internally?
 - What elements make people come to a turning point around 2045?

- The Scottish Play:
 - Good education is a pillar of Scottish society, but what jobs do Scots have? At what employment levels?
 - How is the countryside affected by population growth and more agriculture?
 - What international framework are we in (trade, politics, military)?
 - Mactopia:
 - How does the move to an equitable development come about? What does it build on?
 - What kind of trade agreements are made by Scotland? What is the relation to the EU?
 - Who are the winners and losers in this scenario? What do they do?
- 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. Tartan Spring

2.3.1. Driving forces and uncertainties

Polarity	Uncertainty	Polarity	In YOUR scenario
Individualised	 Social behaviour	Collectivised	Collective – individual – collective: Individualised is driven by privatisation
Gradual	 Economic growth	Rollercoaster	Gradual – wealth goes away
Surplus	 Resource scarcity	Deficit	Surplus
Pervasive	 Adoption of technological innovation	Patchy	Pervasive technology for exploitation of natural resources
Integrated	 Environmental regulation	Sectoral	Sectoral – weak Governance weak No EU
Out-migration	 Population/migration	In-migration	2020: in-migration of low- and high-skilled 2050: out – high-skilled Scottish; in-migration of economic migrants
High	 Threat of war, crime and violence	Low	Internal: increases (less police) External: trade wars, not peaceful
Accepted limits	 Consumption	No limits	No limits: driven by necessity
Equitable	 Well-being and lifestyle	Disparate	Disparate
High	 Perceived climate change impact on human society	Low	Low – only by external
Local	 Power level of decision-making	Central	External: driven by multinationals – does not matter whether it is central or local

2.3.2. Tartan Spring scenario dynamics

The stakeholders did not provide an influence diagram to illustrate the dynamics of the Tartan Spring scenario.

2.3.3. Tartan Spring storyline

Towards the 2020s

After 2012, Scotland continues to be a prosperous country with a strong socio-economic middle class. All layers of the Scottish society enjoy the benefits of a strong government-led management of its (natural) resources, of which it has a large surplus. This surplus fosters prosperity in the short term and also boosts technological innovation, which ensures prosperity over the long term. Technological innovation leads to more efficient use of resources, the exploration of new stocks, and the possibility to turn previously low value resources into valuable ones.¹

The thriving engines behind this technological development are excellent schools and science centres on the one hand, and the private sector on the other hand. **A whole new generation of highly educated young people takes the lead.**² Because of this high degree of prosperity, Scotland is increasingly seen as a good place to live. Young people immigrate to Scotland and the domestic birth rate goes up, as does life expectancy. **On the other hand, elderly people migrate to Scotland for their retirement. This causes an overall ageing population. The new flock of retirees cannot join the workforce, but weighs on public finance.**

Through innovation there is a massive increase in recycling activities and the use of natural resources is optimised. Also, hydrogen fuel cells are being developed successfully. As a result, Scotland meets 100% of its renewable energy targets by 2015. Moreover, a major gas find in the Atlantic helps to secure growth in Scotland for the years to come. To capture the full potential of all these technological developments the Scottish government decides to open resource access to the private sector and establish liberal market structures. As a result, by 2020 the influence of the private sector in Scotland has become very strong.

Scotland can export part of its resource surplus. Electricity is exported to Europe, while China is mainly interested in the minerals hidden under Scottish soils, such as uranium from the Shetlands. The ties with neighbouring countries that are also rich in resources are strengthened and Scotland has formal contracts with the Scandinavian countries and North America. Private companies are equally driven by cooperation.

The whole Scottish economy is essentially resource based and has a low dependence on financial resources. Human capital has become very high, and apart from its resources Scotland also exports knowledge. Multinationals invest strongly in Scotland, which is beneficial for the economy. But the other side of the coin, however, is that the Scottish government no longer has control of its resources. The multinationals have slowly become the controlling force.

Following the first immigration wave of high-skilled professionals, comes a wave of lower-skilled labourers. They strengthen the workforce and become an essential part of the Scottish economy. Meanwhile, the prosperity of Scotland influences the voting behaviour of the Scottish people for the 2014 referendum on independence. The fact that Scotland is a successful country with abundant resources convinces people to vote for independence. The Scottish people believe independence is the best way to safeguard their wealth. Resource

¹ Text in black is the original first draft of the storyline, as established during the first workshop.

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

security thus fosters independence. However, Scottish independence does not happen overnight. The outcome of the 2014 referendum sets in motion an incremental process leading to full independence by 2030.

Towards the 2050s

In the period after the referendum and before full independence, the private sector further increases its grip on society. As the private sector is already very large, it is a small step for private enterprises to offer health care plans for employees. Public and welfare state related services are also being privatised. However, the privatisation process is poorly regulated and thus safeguards are not put in place for those not able to benefit from such privately organised schemes. By 2025-2030, the welfare state ceases to exist and it is estimated that Scotland is now run by ten private enterprises controlling the main assets of the country. Because increasingly more people depend on the private sector and the services of major international companies, the social fabric erodes and the influence of the local, community level decreases.

Together with independence in 2030, a new government comes into power. From this moment the full effects of developments since the vote for independence start to pan out. The power of the private sector, together with its independence, now makes it possible for Scotland to become a major player on the global market. Scotland signs trade agreements with China on the use of critical minerals and becomes the world's major producer of uranium. It also exports water to southeast England. ~~By 2040, Scotland spends 30% of its GDP on overseas conflicts to secure ownership of access to resources.~~³

On a global level, the scarcity of resources leads to an energy crisis. Prices for energy become high worldwide. Scotland, with its resource surplus feels strong enough to step out of the EU. A national currency is created, the McKrona. In the meantime, the government of Scotland attempts to face the multinationals, because the market driven society has had a number of unintended, negative consequences. Therefore liaisons are established with other resource rich countries, such as Canada, Norway, Iceland and even Russia. The EU still exists, but is not seen as a strong business partner due to its lack of resources.

The disparity between the poor and the wealthy in Scotland is more pronounced. This disparity largely arises because technological innovation makes it possible to eliminate jobs and manpower. Those that have a job still benefit from privately organised health care schemes, but a large part of the workforce services the super rich and has only limited social security, barely enough for a decent life. ~~In addition to this, the relative prosperity of Scotland compared to the rest of Europe attracts refugees and job-seekers. For every job there are hundreds of candidates, so salaries tend to be low.~~ Some commentators speak of a modern slave economy. As such, most people cannot sustain their standard of living. Standards in education and science cannot be sustained either. Unemployment rates increase, while social welfare decreases rapidly as there is no social safety net for those that are unemployed. A class of poor citizens emerges.

The wealthy move into eco-communities and the top 10% of Scottish multi-millionaires start living in multi-millionaire ghettos. Scotland also becomes a new tax heaven. The poor start to feel the burden of no longer being able to benefit from the welfare state. The government (unsuccessfully) tries to regain a grip on society, but fails to do so because long lasting

³ Strike-out text (eg. ~~example~~) are lines of thought that have been taken out of the storyline.

contracts and agreements on tax cuts for the private sector are deemed legally binding. The poorly regulated privatisation operation in the 2020s has left the Scottish treasury empty, and there are very few public resources available.

Only the wealthy can still afford to travel and access certain services. This also stimulates a large black market, run by the Scottish mafia. People are unhappy and at each election a landslide takes place. But, the Scottish Government fails to have an impact. By now, business districts with labour housing have been created by the multinationals. Nevertheless there is still pressure on the housing market, because Scotland continues to attract migrants due its resource surplus. Therefore the unemployed and new immigrants are forced to move to condensed housing surrounding the cities and main towns.

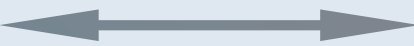


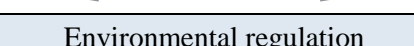
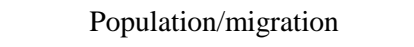
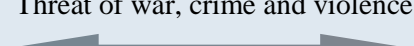
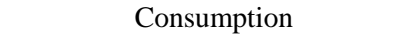
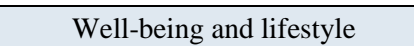
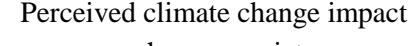
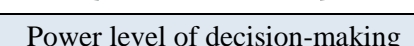

Although the country has an enormous resource surplus, there is a scarcity of food. The worldwide energy crisis has led to increasing food prices. Scotland does not produce nearly enough food to feed its ever-growing population. Together with financial pressures, social pressures rise to unseen levels. As a reaction agriculture is promoted. The poor are urged to move to the countryside to build up new rural communities.

The effects of this disparity become seriously visible by 2040. A record number of Scottish families live below the poverty line and as a result the life expectancy of the bottom 50% of Scots is around 50 years. Scottish society is characterised by an increasing wave of migration and increasing birth and mortality rates. People die from diseases that were thought to be extinct. The divide between poor and rich is 80:20, where it used to be 20:80 only 30 years ago. A Scottish middle-class is non-existent.

Initially, the poor were not upset because they were told they lived in a very successful country, no matter at what level they are. But this changes towards 2050 when continuous strikes and protests by the dispossessed paralyse the country. The population is heavily disappointed by the lack of sustainability and accountability of governance. In the private sector strikes and uprisings are also prevalent. The underpaid workforce is more than fed up with the dictatorship of the multinationals. In 2051, insecurity ends up in a “Tartan spring” revolution. The Scottish government is overthrown by the dispossessed. Scotland enters turbulent times.

2.4. Mad Max

2.4.1. Driving forces and uncertainties

Polarity	Uncertainty	Polarity	In YOUR scenario
Individualised	 Social behaviour	Collectivised	Early on individualised, later collective within strata
Gradual	 Economic growth	Rollercoaster	Rollercoaster - volatile
Surplus	 Resource scarcity	Deficit	Deficit
Pervasive	 Adoption of technological innovation	Patchy	Patchy and stratified
Integrated	 Environmental regulation	Sectoral	Not relevant
Out-migration	 Population/migration	In-migration	Strictly outwards
High	 Threat of war, crime and violence	Low	High: general social unrest
Accepted limits	 Consumption	No limits	No limits: - Haves don't care - Not relevant for have-nots
Equitable	 Well-being and lifestyle	Disparate	Disparate
High	 Perceived climate change impact on human society	Low	High, but only cause/effect
Local	 Power level of decision-making	Central	Corporate HR Trumptower vs. community strata

2.4.2. Mad Max scenario dynamics

The stakeholders did not provide an influence diagram to illustrate the dynamics of the Tartan Spring scenario. However, a drawing by the participants is provided in Annex 3.

2.4.3. *Mad Max storyline*

Towards the 2020s

The financial and economic crisis hits Scotland in 2012, but in a more severe way than it hit Ireland a few years ago. On top of this, Scotland is confronted with a series of extreme weather events causing a poor harvest. This mix of financial crisis and extreme weather events hits the agricultural sector hard.⁴ **This Perfect Storm causes⁵** a shortage in agricultural resources and volatile financial markets. Commodity speculation takes place, notably on food, land and housing. The price of a patch of land goes up, which forces landowners towards intensive land cultivation. This has an upward effect on the wheat price. The markets become very volatile, with the energy market being the most volatile market of them all. **Blackouts are taking place on a weekly basis and the entire utility distribution network no longer functions. Water and food become scarce.**

Increasingly more people have problems buying food and water. A hunger march is organised in Edinburgh and a few days later there is a riot in a local market over the cost of potatoes as farmers abandon the price control agreement. These commodity speculations and riots demonstrate that it is every man for himself. Because of the financial crisis and difficult economic conditions, solidarity with others is not a priority. The aim of most people is to safeguard their lifestyles at the expense of others in society during these torrid times. The cooperative system collapses, which illustrates the new self-centred paradigm of Scottish society. Some characterise this as a return to the feudal system. The steady increase in the use of private cars over public transportation reinforces this paradigm.

Energy becomes an increasingly valuable resource. In order to maximise those resources the Scottish Government sells energy to the highest bidder. As such, multinationals increase their grip on society. **They own large portions of land, control the scarce water and food supplies and determine the consistently high pricing of essential goods and commodities. These multinationals do not respect labour laws and abolish trade unions, but the government does not respond. These ruthless companies are the only ones that keep the remainder of the Scottish economy going. With them gone, unemployment rates would soar even more.**

The self-centred, profit-driven system leads to a disparity between the “haves” and the “have-nots”, the rich and the poor. The “haves” have access to drinking water, health care services, energy and are able to buy patches of land, while the “have-nots” are deprived of most essential services. The “have-nots” start squatting in order to find shelter and poaching increases due to a lack of access to food. **Fragmentation of society leads to more sectarianism. Conflicts between Catholics and Protestants are rampant, especially in the small mining communities in the highlands.**

The whole European Union suffers from social unrest and an economic and energy crisis. Resource deficit and disparity in society are not only Scottish issues. Independence is no longer an issue in Scottish society, because there are other priorities now. Also, a Scotland that has to rely solely on its own economy and resources is destined to deteriorate even more.

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.

By 2025, the “have-nots” organise themselves in communities of interest. They attempt to voice their grievances and hope to find protection among people facing the same challenges and suffering the same fate. Black markets for food, water, clothes and jobs are sprouting all over Scotland and cheap labour is the only sort of employment.

Towards the 2050s

By 2030, people are looting the limited water supplies. The whole system is now characterised by short-term thinking. People have the idea that things could change overnight, so why invest in long-term solutions. A survival from day-to-day, “getting the sandbags out” type of mentality prevails over a long-term structural approach, especially for the have-nots. The haves on the other hand are preoccupied with securing the few remaining resources and fortune.

The policy of the Scottish government is also based on this “just-in-time” approach. This makes it more of a crisis management team than a stable government with a long-term vision for the future of Scotland. A lack of long-term (public) investments also makes this society vulnerable to new shocks, such as energy blackouts. The health care system that was built on the principles of solidarity goes through a crisis. This is not just a Scottish problem, but a European one. Only the emerging economies, such as India and China, seem to be doing well, mostly since they have a large, cheap and eager labour force. Multinationals from Asia take hold of Scotland’s remaining resources. These multinationals do not see the benefits of being sustainable. When resources run out, they just move on and exploit the next town or county.

The rich are the most resilient to shocks as they have the financial resources to adapt to crises. As a result they increase their grip on society. The rich have private health care and protest against the introduction of a national publicly financed health service. But even the rich cannot escape the volatility of Scottish society completely. Asset stripping becomes common practice amongst those on the management boards of major multinationals.

In the meantime, the pressure on the poor increases further as rising house prices force some of them to live on houseboats. Ghettos of poor people living on boats emerge just off the Scottish coast. Initially, the social cohesion in these ghettos is low, but over time religion, faith and spiritualism bring the poorer Scots closer together. Poor people also leave the central belts and move to the highlands. They look for the scarce resources so they can be self-sufficient, or they move to the areas owned by the “Haves” and the multinationals, who have reinstated a feudal system reminiscent of the Middle Ages. Multinationals own all the land suitable for mining, agriculture or forestry. Their forests and gated communities are guarded by security personnel that do not shy away from violence to keep desperate Have-nots out. Decision-making is in the hands of multinationals and landowners, since governance remains weak. The poor have to pay or work for the landowners to safeguard their water supply. But at least they can get access to some clean water. The poor that are left behind in the decayed cities are worse off. The network of water distribution does not exist anymore and potable water is scarce.

There is also an increased resistance to allow people to move into the region. Immigration is strongly discouraged. Both the Haves and Have-nots realise they have to organise themselves: the Haves to protect themselves and their property, the Have-nots to survive. These unions originate out of necessity. However, conflict within these groups is also common. The have-nots for example are also subdivided into different strata. The worse the situation, the more

this sectarianism based on culture, religion and dialect becomes. ‘Clans’ are ruling Scotland again, just like they did in earlier times. Some of these clans specialise themselves in organised crime and the black market is thriving.

The image of a split country is reported to the rest of the world and causes a crisis in the tourism sector. Tourists are afraid of being robbed and stay away. Scotland is also facing external pressure from the EU to restore its budget deficit and to ensure a proper functioning parliamentary democracy, which does not solely serve the short-term interests of multinationals. The EU even warns Scotland to think about leaving if these issues are not properly addressed.

As of 2035 both the “haves” and “have-nots” get used to this system and learn to live with instability, albeit both in very different ways. The “haves” and “have-nots” organise themselves internally. Within each strata of society the overall situation starts to improve as the cooperatives are reinstated and a sufficient degree of innovation ensures survival. By the same token, Scotland remains inequitable and real fundamental problems between the different strata continue to exist. There is no, or very limited contact between the different strata. The poorer Scots work for the richer Scots, but that is the only interaction between them.












In 2045 a small part of the Scottish social elite comes to realise that Scotland can no longer continue to live like this. It has already missed its emission targets by 30% and the water price is over 50 pounds sterling per cubic metre. A small movement of the Scottish social elite reconsiders the historic concept of “sustainability”. The movement advocates a sustainable society in which poor and rich can live in harmony with one another. ~~Initially, the idea is not well received by the poor, nor the rich. The poor have lost their faith in any solution coming from the rich, while the rich are not eager to invest into a transition to a sustainable Scotland. In 2050, part of the Scottish elite starts to fund NGOs to promote sustainable initiatives. A small minority of “have-nots” do welcome this and also increasingly more of the “haves” start to see the potential of a more sustainable development of the Scottish economy. Despite efforts to decrease the gap between both groups, inequality remains a problem because the government is not powerful enough to put measures in place to ensure a sustainable Scottish society.~~⁶ However, most “Haves” are determined to sustain their position. That is why a decrease in the gap between both groups remains implausible. The multinationals adopt a Victorian approach to eliminate social unrest. They provide their work force with a better quality of life, simply because a happy workforce tends to work harder.

By 2050, the Scottish economy and society have somewhat stabilised. The poor are creative and earn a living by providing services to the “Haves”. There is a strong demand for security guards and lawnmowers. “Have-nots” shop on the black market and bartering becomes popular. Decision-making happens on two levels: on the corporate level and on the local/clan level. The national level is still very weak and the First Minister of Scotland has almost become a ceremonial function.

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

2.5. The Scottish Play

2.5.1. Driving forces and uncertainties

Polarity	Uncertainty	Polarity	In YOUR scenario
Individualised	 Social behaviour	Collectivised	Collectivised: working together, not individually
Gradual	 Economic growth	Rollercoaster	Gradual with blips. Is there sustainable controlled growth?
Surplus	 Resource scarcity	Deficit	Deficit
Pervasive	 Adoption of technological innovation	Patchy	Not pervasive, but widespread. Public – universities; MIT model - energy
Integrated	 Environmental regulation	Sectoral	Integrated – not always controlled by Scotland. Trade-offs inherent in the system - priorities
Out-migration	 Population/migration	In-migration	Both ways: respect for other cultures – focus on education
High	 Threat of war, crime and violence	Low	Stable – equality, national service, no war
Accepted limits	 Consumption	No limits	Accepted limits: less money, repair rather than buy new, tax
Equitable	 Well-being and lifestyle	Disparate	Equitable
High	 Perceived climate change impact on human society	Low	High: we have options, adaptive capacity. De-carbonising the economy
Local	 Power level of decision-making	Central	Coordination - subsidiarity

2.5.2. The Scottish Play scenario dynamics

The stakeholders did not provide an influence diagram to illustrate the dynamics of the Tartan Spring scenario. However, a drawing by the participants is provided in Annex 3.

2.5.3. The Scottish Play storyline

Towards the 2020s

Like many other countries in Europe, Scotland feels the effects of the financial crisis and climate variability. Extreme weather events cause a number of poor harvests. The government bails out the agricultural sector by investing more money in climate change mitigation. As a result, the Scottish Government is forced to significantly cut down on public spending. Several health care programmes take budget cuts and funds for climate change adaptation are also low. At the same time, the oil price peaks, increasing the revenues for Scotland. The Scottish Government decides not to cut down on subsidies for education and invests a lot of the oil revenues in educating children, including teaching about healthy lifestyles and eating habits. Despite the crisis, all children are able to enjoy free education, while the Scottish people still have access to affordable health care.⁷

In spite of these difficult times, the economy is still growing marginally by 2020. Scotland has some advantages over the rest of Europe. Its population is smaller, which means it still has some options regarding land use. It can partially produce its own energy. The country also has a mature economy with a focus on intellectual capacities and innovative technologies. Last but not least, the Scots take pride in their country. The response to the resource crisis and the equitability of Scottish society attracts a fair number of immigrants.⁸

The Scottish are very supportive of the government approach and the subsidies for the agricultural sector. Agriculture is ~~the backbone~~⁹ the growing core of the Scottish economy. Without barley the whisky industry would cease to exist. Moreover, the majority of the Scottish people believe in the government priorities of not cutting spending for education. A good farming education is developed with a focus on innovation and sustainability. On the other hand the agricultural sector also gives back to society by supporting industries. In the face of these difficult times the Scottish people come together to take on the challenges as a whole. The traditional Scottish values of getting on with it, no desire for excess, and sense of solidarity take the upper hand. Long-term thinking is promoted and citizens with a vision are appreciated. An absolute majority votes 'yes' in a referendum for autonomy. The young Scottish state is very much focused on its own strengths and looks at the Nordic countries as an example. The bond between Scandinavia and Scotland becomes stronger and they exchange best practices.

By 2018, the crisis starts to affect the fishery industry and further crop failures occur due to droughts. Because of slow economic growth, Scotland has not invested a lot in renewable energy sources and struggles with the high cost of energy. This cost weighs on normal household budgets across the country. In spite of all this, the Scottish people manage to adapt quite well to problems in the food chain and high energy prices. Some people move to the countryside seeking a better quality of life and cheaper living costs. Self-sufficiency and farmer markets break the reign of the large supermarkets. There is a growing consumption of local produce. Life in Scotland remains attractive, mainly because the rest of the world is suffering from more severe problems.

⁷ Text in black is the original first draft of the storyline, as established during the first workshop.

⁸ Text in red are new additions to the storyline during workshop 2.

⁹ Strike-out text (eg. ~~example~~) are lines of thought that have been taken out of the storyline.

Towards the 2050s

The key to making the Scottish people resilient lies in the education system. The decision not to cut education budgets in 2012 now pays off. People have strong confidence in the education system and the education system teaches the Scottish how to cope with changing conditions. Courses on recycling and food habits feature in the curriculum of most schools by 2025. All strata of society bear the fruit of the investments in the education system. Specific programmes focus on elevating children from poverty through education.

The education system stimulates innovation and creativity in the domains in which Scotland has been struggling for the last 15 years. New techniques are being used to provide fish farms with food, while newly graduated agronomists now manage to cultivate land which was previously uncultivated due to climate change. Because of the education system the Scottish make better use of what they have and try to adjust to things they don't have. Car owners trade in their cars for free bus passes for the entire family. Health care services are restrained, but because people are better educated they live healthier lifestyles, which reduces demands on the health system. People also live longer. Immigration into Scotland means that the population is growing. *The equitable Scottish mindset does not expect people to assimilate, but to integrate. The right of immigrants to celebrate their traditions makes them a relatively happy, productive workforce.*

By 2035, pretty much all Scots have learned to cope with difficult and quickly changing living conditions. By now they know that a modest approach, together with a strong social fabric, will help them through the toughest of times. Only a handful of Scots defect from this and still have an unhealthy lifestyle and drive powerful 4x4s. *The Scottish consumption pattern has changed due to the growth of "Factor 4" economies. The amount of waste is reduced, because things are now built to last. The three 'R's' – Reduce, Re-use, Recycle – have become the motto of the Scottish economy. The economy has developed into an example for the rest of Europe. It is a service-driven and resource protective economy, focused mainly on the export of high-value products and services.*

After 10 years of relative sustainable growth, extreme weather events lead again to resource shortages and crop failure. Again people need to adjust their diets. By now Scots are used to the state of flux and adapt quite easily. Deliveries of fossil fuels through pipelines are no longer taking place on a daily basis. Despite a strong emphasis on recycling and renewables, these renewables (notably solar energy and hydro power) have not lived up to the expectations sufficiently. *The renewable energy sector grows, but energy remains expensive and its distribution limited.* The Scottish government now pins all its hope on wind power. But wind power also fails to deliver.

By 2050 the Scots have learned to adapt to changing situations. Communities are coming together in the face of recurring economic troubles, natural hazards or extreme weather events. Economically there might be losses, but a strong degree of social capital mitigates this effect. *There is a reinstatement of the national service. People are enthusiastic about giving something back to society. They have received an excellent free education and feel the need to serve their country in return. This national service is not focused on the military, but includes volunteering in homes for the elderly, engineering, construction, etc.*








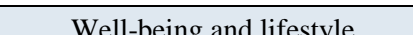
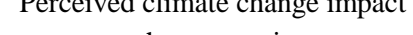
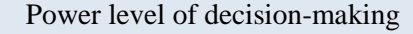

National service is inherently linked to the pride the Scottish feel in their country. However, this pride does not translate into independence for Scotland, but rather into regional autonomy

within Scotland. It is now subdivided into 'Clantons', with the Swiss model of governance as an example. These 'Clantons' are in effect structured communities. They function through the idea of collectiveness, however they are not always democratic. The referendum is not as common in Scottish decision-making as it is in Swiss decision-making. Even though the 'Clantons' have a decent amount of autonomy, decision-making in domains such as education or technology remains exclusively at the national level.

Outside of Scotland, countries lack the necessary flexibility to deal with natural hazards. This leads to political unrest in some European countries. In contrast, the adaptability of its population and the focus on education and innovation have made Scotland one of the better places to live. Education, research and agriculture are three of the main areas of employment. But Scots also excel in engineering, marketing and services. The Scottish population may be poorer than a few decades ago, but they are also greener and happier.

2.6. Mactopia

2.6.1. Driving forces and uncertainties

Polarity	Uncertainty	Polarity	In YOUR scenario
Individualised	 Social behaviour	Collectivised	Collectivised: not absolute, not all nationalised; yet strong societal approach with shared benefits
Gradual	 Economic growth	Rollercoaster	Scotland: gradual World: first gradual, then also rollercoaster with little effect on Scotland
Surplus	 Resource scarcity	Deficit	Surplus
Pervasive	 Adoption of technological innovation	Patchy	Pervasive – there is a strong social contract that people take up technological innovation
Integrated	 Environmental regulation	Sectoral	Integrated regulatory framework
Out-migration	 Population/migration	In-migration	In-migration, but comes to halt when Scotland decides it is full; more rural than now
High	 Threat of war, crime and violence	Low	Low in Scotland, medium elsewhere
Accepted limits	 Consumption	No limits	Individual accepted limits, sustainable as a country
Equitable	 Well-being and lifestyle	Disparate	Equitable
High	 Perceived climate change impact on human society	Low	Very high danger, very low (mainly positive) impact
Local	 Power level of decision-making	Central	Strong center + high community empowerment

2.6.2. Mactopia scenario dynamics¹⁰



2.6.3. Mactopia Storyline

Towards the 2020s

In 2012, Scotland takes a conscious decision to embrace the concept of equitable development. To live up to this commitment Scotland makes some important and big decisions to make the concept work for the Scottish people. At the Inverness conversations, which gather representatives from all layers of society, it is decided that oil will be phased out as an energy source in Scotland in favour of renewable energy resources such as hydropower. Moreover, a plan to give all Scottish citizens broadband internet is approved in the Scottish Parliament. **There is a strong social contract with the Scottish people to take up such technological innovations.** This plan creates the possibility for teleworking and increases the level of information for all citizens of Scotland.¹¹

Many of the transitions towards an equitable and sustainable society require strong regulation from the government. But because the whole of society is behind the transition to an equitable

¹⁰ This scenario dynamic is a result from workshop one and was not updated during workshop 2.

¹¹ Text in black is the original first draft of the storyline, as established during the first workshop.

society, it is widely supported and local communities also contribute to the transition. By the same token, harsh penalties are attributed to those households not switching to renewable energy sources. Some pockets of the population do not agree with this lack of choice, but most primarily see the advantages of strong government policies. The number of poor people goes down year after year and a large and solid middle class is the driver of the economy. Even though the rich are taxed severely, most of them decide to stay in Scotland. They also realise that a more equitable society is a safer society. Scots also perceive climate change as having a positive impact on their lives, thanks to strong mitigation and adaption actions.¹²

This evolution towards equity comes at the backdrop of positive economic development and a further political separation from the UK. The few years of economic and financial turmoil are now firmly behind Scotland and thus resources become available to make this transition possible. Further¹³ Strong devolution from the UK gives Scotland the autonomy it needs to make the transition towards an equitable society possible. The legal system becomes more European over time. This leads to planners no longer allowing people to build houses in flood risk zones in Scotland, since the planner can be sued if a newly built house gets flooded. This additional personal liability is extended to all levels of society, including Ministers.

Social justice has become a key term in law in the same way as accountability has become a key term in government. Scotland also puts the payment of flood risk subsidies to London on hold. The Scottish remain strongly linked with the European Union, but meanwhile they also strengthen the connection with the Scandinavian countries. By 2020 Scotland has joined the Nordic Council and best practices are exchanged between the different countries which have similar economies and a similar philosophy with regard to equity.

Additional incomes are generated by the Scottish government from the selling of resources such as water, of which Scotland has a surplus. Because of its comparative advantage over others in the field of water, it can obtain good trade agreements with other countries on innovative resources such as information technology. Trade agreements are made between Scotland, Brazil and the other BRICs without British interference.

For small and medium businesses the costs tend to increase, but these are more than outweighed by the benefits of a resource surplus. More and more companies are encouraged by the government to relocate to Scotland. Since the Scottish economy is one of the healthiest worldwide and innovative companies make Scotland their stomping ground, highly educated Scots no longer emigrate. On the contrary, many Scottish ex-pats return to their home country. The industry is focused on innovation and technology. There is government support for research, development and innovation. The long-term investments in education are also paying off and Scotland becomes a frontrunner in trading resources as well as the intellectual property surrounding it.

The strong economy and equitable lifestyle of Scotland attracts many immigrants from throughout the European Union and beyond. Unlike the previous wave of immigration, they now also move into rural areas of Scotland and immigration is not limited to the larger cities. This has a positive effect on small town economies, but the influx also puts pressure on local communities, which leads to some nationalistic attitudes in the years to come. In some parts

¹² Text in red are new additions to the storyline during workshop 2.

¹³ Strike-out text (eg. ~~example~~) are lines of thought that have been taken out of the storyline.

of Scotland the Scottish and immigrant communities are fairly divided, but there also more cosmopolitan areas.

Towards the 2050s

The export of water and other products increases the global role of Scotland. A part of the profit of selling the resource surplus is invested in a Sovereign Scotland fund. This fund gives Scotland on the one hand the possibility to ensure the well-being of its population, regardless of its social status, and on the other hand the resources to invest in innovation and other sustainable investments such as a reforestation programme, which would cover 25% of Scotland by 2025, a very extensive railway network by 2030 and research programmes to boost innovation in the field of renewable energy and IT.

Scotland begins to play an important role in services worldwide, diversifying away from natural resources because the government realises that these can run out. Therefore a lot of investment goes into education and innovation to secure a stable economy for the decades to come. There is also a boom in small and medium sized enterprises. Scotland becomes a frontrunner in IT, life sciences, green technology and finance.

Resource abundance, and its benefits, bring about the realisation that it would be good to be an independent country, as it would help Scotland to grow even more in the future. A further step is its own currency, which is linked to the Norwegian Krona. Scotland has by now developed strong independent links with other EU countries. It attempts to play an important role in decision-making on the European level and provides key personnel for the different EU bodies. One of its biggest achievements in the political arena is the EU Environmental Framework Directive, which was advocated by Scotland to ensure an integrated regulatory system for land and water management.

From the 2030s all new buildings have to be energy neutral and all households have to be on smart grids. This green push does have some disadvantages. Scotland has become highly dependent on renewable energy and transmission systems, since oil and gas are phased out as an energy source and nuclear power is also largely abandoned. This makes Scotland vulnerable and solar storms are feared. Tax evasion also increases in a heavily taxed Scotland, as do illegal activities such as the smuggling of water outside of Scotland to other parts of the world.

Climate change, however, also has a number of positive effects on Scotland. The share of land for agriculture in eastern Scotland increases due to a warmer climate. The warmer climate also attracts more tourists to Scotland. The Sovereign Scotland fund now bears fruit, by buffering down turns in the global economy.

By 2035, Scotland attracts even larger numbers of immigrants, notably coming from England. They are encouraged to settle in the west and in rural locations to perform cheap labour. Strong assimilation measures for immigrants are taken. In some parts of Scotland Gaelic language courses are compulsory in school, also for immigrants. They are not forced to speak Gaelic, but they are educated in Scottish tradition. Scotland also works together with the other countries in the Nordic Council to obtain exceptions from the EU freedom of movement. A minority of Scots feel threatened by this wave of immigration and the media reports on nationalist terrorists attacking immigrants.

The – often highly educated – immigrants may not always receive a warm welcome, but they prove to be extremely valuable. They help to reinvigorate the communities they move to in West and Central Scotland. This fuels further development and enhances the health of the local population. Due to this move to rural areas, many villages become larger rural towns over time with more facilities. The local communities are so strong that a new type of governance is adopted: communitarianism. The Scottish identify themselves strongly with their local community. They expect much from it, but also give back.

In 2040, Scotland is shocked when a Scottish water tanker is hijacked on the way to the Mediterranean to deliver drinking water. This event plus a resource war in Africa and South America leads Scotland to rethink its national security strategy in view of the ever more visible threats from countries which have a resource deficit. The strategy aims to protect all the resources Scotland has; not only commodities, but also its biodiversity and variety of species. But because Scotland is firmly attached to values such as equity and solidarity the protection of its resources does not happen by having an inwards/protective attitude. Establishing healthy trade relationships with rich countries, as well as helping with the (economic) development of poor countries should enable those countries to develop sufficient resources themselves and to keep them at bay.

By 2050, this protective stance has a number of unintended effects. Some remote communities do not buy into this way of life. They like the feudal or clan system and don't want to change. At the other end of the spectrum, some Scots are fed up with the highly regulated society and the fact they are no longer able to live their hedonistic lifestyle. **Satellite Scottish hedonistic communities move to the wide-open spaces and forestland of Eastern Europe, where they can enjoy their alternative lifestyle in peace.** At the same time tax exiles move to London or other major European cities. Although there is some discontent, these are all events at the fringes of Scottish society. By 2055 the Scottish population peaks at 7.5 million, but homelessness hits zero. **The rich may have become slightly less rich, but poverty is almost eradicated and a powerful middle class now takes the lead in Scotland.**

3. Quantification of selected key variables

3.1. Quantification exercise explained

After finalising the scenarios, each scenario group specified values for key drivers which are inputs 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 variables¹⁴ 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. 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?

¹⁴ 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

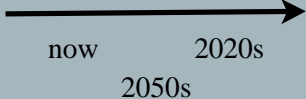

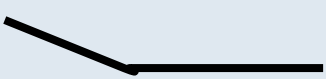


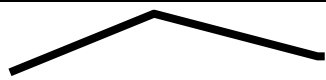

For the questions on the capitals, labour costs and electricity production the following value categories were used:

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

3.1.2. Tartan Spring scenario

Variable	In our scenario: 2020s	In our scenario: 2050s	Graph <div> <div>now</div> <div>2020s</div> <div>2050s</div> </div>
1. GDP	h	m	
2. Population	m (5.5 million)	l/m (6 million)	
3. Food imports	m	vl	
4. Arable land for biofuels	vl	vl	
5. Oil price	h (scarcity and global instability)	vh	
6. Household size	l/m	vh	
7. Natural capital	h+	0	
8. Human capital	h+	m- until 2040, h- afterwards	
9. Social capital	0/m+	h- (towards 2050 m+)	
10. Manufactured capital	h+	m+	
11. Financial capital	0	m-	
12. Labour costs	m+ until 2015; afterwards 0	m- until 2035, afterwards h-	
13. Electricity production	h-	Stops. Hardly any needed.	

3.1.3. Mad Max scenario

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

3.1.4. The Scottish Play scenario

Variable	In our scenario: 2020s	In our scenario: 2050s	Graph
1. GDP	l	m	
2. Population	l	m	
3. Food imports	l	vl	
4. Arable land for biofuels	vl	vl	
5. Oil price	h	vh	
6. Household size	l	m	
7. Natural capital	m+	m+	
8. Human capital	m+	h+	
9. Social capital	h+	m+	
10. Manufactured capital	m+	0	
11. Financial capital	h-	m-	
12. Labour costs	m+	0	
13. Electricity production	h-	h-	

3.1.5. Mactopia scenario

Variable	In our scenario: 2020s	In our scenario: 2050s	Graph <div> <div>now</div> <div>2020s</div> <div>2050s</div> </div>
1. GDP	vh	m	
2. Population	m first, high later at end of 2020s	h (to 2050), l at very end	
3. Food imports	l – m (slight increase, the group estimated 33%)	h	
4. Arable land for biofuels	l	vl	
5. Oil price	h	vh	
6. Household size	l – m (stable, 2.22 same as now)	m	
7. Natural capital	h+	m+	
8. Human capital	h+	h+	
9. Social capital	h+	0	
10. Manufactured capital	h+	m+	
11. Financial capital	m+	h+	
12. Labour costs	m+	m+	
13. Electricity production	m-	h-	

4. Adaptation options

4.1. Adaptation options identified

4.1.1. *Tartan Spring scenario*

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

- Reinforce electricity grid
- Energy conservation – localised production
- Electricity storage capacity
- Maximise surplus

- Alter harbours to accommodate sea level rise – may enable larger vessels - opportunity
- Trans-shipment point for water exports

- Reduce transport need through IT so it is not disrupted if there is an extreme weather event
- Cooling for machinery

- Insurance
- *Weather derivatives*

- Green infrastructure (trees etc.)
- Public-private initiatives in agriculture (e.g. biomass)
- New crops + livestock better suited to climate
- Agricultural improvement through non-fossil fuel means / efficiencies
- Maximising newly available land
- Small scale renewables

- Water ... to regulate water consumption??¹⁵
- Water resource management (dams, pipeline)

- All houses to have rainwater harvesting meters by legislation to maximise a surplus
- Buildings adapted to extreme weather
- Move settlements away from low-lying coastal zones
- Defence barriers to maximise profit
- Avoid building on floodplains
- Housing fit for purpose: that don't overheat in summer and aren't damp in winter

- Increasing skills
- Innovative technology / human systems
- Viable carbon accounting system
- Community allotments
- Governance set at the appropriate level
- Regulation

¹⁵ Post-it is partly illegible.

- Incentives
- Reduce – re-use – recycle
- Awareness-raising of climate change issues and consequences
- *Micro-adaptation options towards 2050 – volunteers*
- Private sector provides, public sector pays + still has risk of failure
- Hydro public private partnership: water storage + electricity
- Community energy schemes when public resources are limited
- *Flood defence scheme that make profits*
- *Private micro adaptation + consultancy*
- *Private-public partnerships*

4.1.2. Mad Max scenario

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

- Haves building adaptive capacity: leadership/CSR (corporate social responsibility), demonstrate benefits – survival / profit
- Have-nots: using social capital / community building through engagement, building peer-peer relationships
- Conservation of some SPP (Scottish Planning Policy?) for ‘sport’
- Water management: reservoirs, abstraction control, pumping to areas of demand
- Efficiencies in resource management to maximise profit
- Technologies, GMO, transport
- GMO for crops/biofuel: climate resilience, maximise yield
- ‘Haves’ – cultivation of marginal land with lots of fertilizer
- *Production efforts go up*
- *New crop types*
- *Clonal forestry*
- Basic environmental safeguards for big business
- Food storage for times of hardship
- *Insurance¹⁶*
- *Gated communities: self-sufficiency in water and energy*
- *Short lifespan materials*
- *Wooden construction goes up¹⁷*
- Structural defence for critical infrastructure (ports, resources)
- Large emergency response labour force to respond to extreme events
- Stockpiling of food and water as a buffer against volatility
- *Rainwater harvesting*
- *Irrigation*

¹⁶ Group did not agree.

¹⁷ Group did not agree.

- *Remove gully pots for health reasons*
- *Composting toilets (save water resources + homemade fertilizer)*
- Prioritise primary education
- Development of local energy by have-nots: peat, micro-hydro, wind, etc.
- Cooperative local energy production by have-nots
- Allotments in urban areas
- Minimum sized areas for food protection (allotments)
- Low input sustainable agriculture (permaculture) + nut trees
- *Community woodlands: coppicing, charcoal¹⁸*
- *More crofting*
- *Sheep farming; hunting and gathering*
- *Alternative industries (e.g. fishing); rural, not just mountains*
- *Less meat consumption*

4.1.3. The Scottish Play scenario

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

- Renewable energy
- Energy production responds positively from high tides and wind
- Smart electrical grid redirects to avoid wind damage
- *Midges for biofuel*
- *Energy efficiency*
- *Planned energy blackouts*
- *Use larders, not fridges*
- Irrigation balanced against urban demand and tourism to avoid drought consequences
- Promote reduced water use (climate resilience)
- Harness / capture water when plentiful
- Transfer water from plentiful to scarce areas
- *Rainwater harvesting*
- *Composting toilets*
- Adapt urban fabric (buildings/infrastructure) for changing patterns of temperature/precipitation
- Improve building ventilation / cooling standards for hot summers
- *Raised buildings*
- *Greening cities*
- *Hospitals: ventilation can be problem*
- *Live upstairs*
- *Relocate capital city to higher ground (attract business to safer areas)*
- *Rammed earth or straw bale buildings*
- Managed retreat – buffer areas
- Buffer zones – coastal and riverine

¹⁸ Group did not agree.

- Shoreline management: planning for changing coasts and sea level rise
- Improve flood management (rivers)
- *Catchments: natural flood management*
- *Multifunctional land use strategy (max. benefits from limited land-based resources)*
- *Reconnect floodplains*

- Consider new crops from the south
- Upstream planting to capture water that would result in downstream flooding
- Crop diversity for irrigation / flood / drought resilience
- Optimise agriculture according to changing pattern of temperature / precipitation
- Agronomy – nutrient use efficiency + resilience to disease / weather conditions
- Increase mobile venison stock
- *Use of animal waste as fertilizer*

- Factor 4 framework induces resilient real capital
- *Adaptive economic management*

- Self-sufficiency makes transport damage less serious
- Limiting transport of goods
- *Use of wind in water based transport*

- Climate change adaptation R&D
- Develop climate change adaptation governance
- *Mainstreaming adaptation*
- *Training – e.g. what to do in a flood? – flood warning systems*
- Make the most of warning systems – extreme weather
- Spend more as small % of budget on preventative action
- More investment in climate change adaptation options
- *Risk – raise the acceptance levels, don't bother with insurance*

- Clantons provide social support for affected families
- Encourage more voluntary work
- De-centralise
- Social service provides repair services
- *Governmental climate emergency service*
- *Telephone trees*¹⁹
- Support focuses on very young, not very old
- Mass society participation: might not agree with climate change, but idea of better quality of environment could be sold
- Increase resilience
- Publish public sector recycling performance
- More efficient use of resources
- Self-sufficiency
- Reduce, re-use, recycle
- Spend more on maintenance
- *Introduce midge burgers*
- *Optimise or need for flexibility*
- *Lowering maintenance costs*

¹⁹ Telephone trees are networks of people organized to quickly spread information.

- *Resource rationing*
- *Aim for flexibility*

4.1.4. Mactopia scenario

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

- Sovereign Scotland fund
- *Integrated policies*
- *Ministry of/for adaptation + agency*
- *Compulsory strong regulation on impact assessment + environmental sound adaptation*
- *Strengthening Scottish natural heritage*
- *Marketing Scotland as new summer vacation spot*
- Development of new methods of coastal protection for urban centers (not sea walls)
- Switch to waterless sewage system
- Undertake sustainable land management in all catchments
- *Flood defence walls increase size + height*
- *Give up parts of land in order to avoid flooding*
- Cottage industry for creative adaptation
- Exchange programs with other countries / cultures
- Programs for outward looking cultural + creative development
- Twinning for adaptation
- *Pressure from local communities on individuals not complying*
- *Develop behavioural awareness campaign to involve all individuals*
- Bring back flags: flood liaison + advice groups
- Sharing community knowledge about resilience options
- Re-organisation of education system to take advantage of innovation
- Effective information systems to help reduce transport disruption
- *Support networks for adversity*
- Manage land use to take advantage of larger area of high-grade agricultural land
- Genetic technology produces crop varieties which are more resilient and more productive
- Ban organic crops to reduce pathogens²⁰
- Agricultural methods adapt to changing climate
- Develop water export facilities
- *Strong defence*²¹
- *Advice + support services to other countries*
- *Strong diplomatic capability*

²⁰ No agreement within the scenario group.

²¹ Group did not agree.

- Redistributing wealth to vulnerable households on benefits (e.g. compulsory purchase of insurance)
- *Insurance on climate change risks for all sectors*
- *Compensation payment schemes*

- More remote working – use of IT
- Co-ordinated transport modes to facilitate easy public transport use
- Shared transport modes common
- *More transport links that can cope with all weather conditions (e.g. landing during fog)*
- *Free transport*

- Infrastructure development is multi-sectoral: takes account of flood risk management and energy transmission etc. – shared service
- *Enlarge and protect harbours*

- Hard surfaces in gardens not allowed
- Rainwater / greywater systems for all buildings
- House and urban design planning takes account of increased rainfall and resource efficiency
- All homes to be fitted with remote control systems to control all lighting, heating, etc.
- Resilient building regulations
- Retrospective building regulations after flood / storm
- All buildings fitted with appropriate on-site renewable generation
- Promote micro-hydro + tidal power (very small scale renewable energy generation)
- *Greening cities*
- *More parkland also in cities, green belts*
- *Increase density of settlements*

- Fossil fuel free electricity generation
- Fossil fuel free heat generation
- Fossil fuel free transport
- Back-up systems for potential disruptions of ICT systems
- Coppicing (woodland management)
- Build resilience of energy transmission system to storm events (e.g. reduce vulnerability of (wood-pole) electricity distribution networks to wind)
- Crofting to maintain rural populations (disagreement), broadband means more people willing to lead a crofting lifestyle
- Combined heat + power for waste disposal instead of landfill
- *Smart grids?*

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. Tartan Spring scenario

Option group	Low, medium or high importance?	Extra comments
1. Spatial planning	Low	May be high only in 2020s
2. Limit coastal development	Low	
3. Improve flood defences	Medium	
4. Reduce water demand	High	
5. Reduce water use	First medium, then low	
6. Prioritise water demand	Low	If shortage then priority to industry
7. Change irrigation water cost	Low	
8. Improve irrigation efficiency	Low	
9. Yield improvement	High	
10. Change in dietary preference	Low	
11. Wetland creation	Low	
12. Reduce flood impact	Medium	
13. Set-aside of land	Low	
14. Forest management	High	Only when aimed at improving timber production
15. Enlarge existing protected areas	Low	Low for species, high when it has to do with resources
16. Increase number of protected areas	Low	

4.2.2. *Mad Max scenario*

Option group	Low, medium or high importance?	Extra comments
1. Spatial planning	High	Corporate strategy
2. Limit coastal development	Low	
3. Improve flood defences	Medium	Patchy
4. Reduce water demand	Low	
5. Reduce water use	Low	Not by education or training. Use goes down because water is limited anyway
6. Prioritise water demand	High	Corporate decision: for food and industry
7. Change irrigation water cost	Low	
8. Improve irrigation efficiency	High	
9. Yield improvement	High	Including forestry
10. Change in dietary preference	Low	Adaptive capacity limited
11. Wetland creation	Low	Formed by negligence, not managed
12. Reduce flood impact	Low	
13. Set-aside of land	Low	
14. Forest management	Low	For opposite reason: profit
15. Enlarge existing protected areas	Low	Private estates/reserves
16. Increase number of protected areas	Low	

4.2.3. The Scottish Play scenario

Option group	Low, medium or high importance?	Extra comments
1. Spatial planning	High	Low-cost, regulation, non-controversial
2. Limit coastal development	High	Localised, not relevant in some areas
3. Improve flood defences	Low	Response = non-engineering
4. Reduce water demand	Medium	Low-cost technologies
5. Reduce water use	High	
6. Prioritise water demand	Medium	Lots of natural storage, food
7. Change irrigation water cost	Low	Public good
8. Improve irrigation efficiency	High	
9. Yield improvement	High	
10. Change in dietary preference	Low	Promotion of healthy living rather than adaptation option
11. Wetland creation	Low	Already done
12. Reduce flood impact	High	
13. Set-aside of land	Low	Single land use outmoded, cannot afford set-aside
14. Forest management	Medium	
15. Enlarge existing protected areas	Low	Coastal; if land use allows
16. Increase number of protected areas	Medium	

4.2.4. Mactopia scenario

Option group	Low, medium or high importance?	Extra comments
1. Spatial planning	High	Very important for compact development
2. Limit coastal development	High	Discourage development on soft coasts, harbour development to be focused on hard coasts
3. Improve flood defences	Medium	Both hard and soft defences would be important
4. Reduce water demand	High	
5. Reduce water use	Medium	Not essential, but in our economic interest + overall ethos of society
6. Prioritise water demand	Low	Not an issue as resource rich
7. Change irrigation water cost	Low	Not a priority, but fits with the heavily regulated society
8. Improve irrigation efficiency	Medium	Not short of water but importance increases over time due to global food availability down and population up
9. Yield improvement	High	Due to warmer climate (pests, diseases), increasing food demand and invasive species
10. Change in dietary preference	Medium	Fits general ethos. Not through regulation but social pressures
11. Wetland creation	High	Buy-out and relocation schemes
12. Reduce flood impact	High	Very important in equitable society. Needs primary regulation.
13. Set-aside of land	High	For tourism and environmental goals. Agreement on long-term set-aside
14. Forest management	Medium	Mixed management fits the scenario ethos, but not essential
15. Enlarge existing protected areas	Low	Focus on making landscape more permeable rather than fixed PA's
16. Increase number of protected areas	High	Creating corridors + make landscape more permeable for biodiversity

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:

- ‘Fantastic facilitation, great venue – good organisation’
- ‘Helpful to review and refine scenarios, for example with regard to private - public partnerships’
- ‘Event-booking software was not always user-friendly, and the e-mail notification was not very clear.’
- ‘Interesting and fun workshop.’

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:

11 Very good 1 Good ☐ OK ☐ Bad ☐ Very bad

Comments: ‘Very intensive, but achievable due to quality of support and facilitation.’ - ‘Excellent’ – ‘Excellent facilitation and enjoyable’

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

Please mark:

9 Very good 3 Good ☐ OK ☐ Bad ☐ Very bad

Comments: ‘Central venue’ – ‘Very well organised’ – ‘Lovely venue, catering excellent and company good’

3. How do you rate the introductory presentations?

Please mark:

8 Very good 3 Good ☐ OK ☐ Bad ☐ Very bad

Comments: ‘Excellent catch-up from 1st workshop’ – ‘Very useful reminder’

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

Please mark:

12 Very good ☐ Good ☐ OK ☐ Bad ☐ Very bad

Comments: ‘Excellent’ – ‘Interesting and fun’ – ‘Helped to bring the group together’

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

Please write: 'Good to refine scenarios' – 'New to me, but can see the logic and the value. Heavily dependent however on baseline factors – axes.' – 'Good refinement process and good to have the opportunity to challenge other scenarios.' – 'Tendency to go to centre rather than being too extreme.' – 'They seem to be developing well and I am looking forward to the write-up' – 'The review of the scenarios allowed time for reflection and consideration of new ideas.' – 'Good idea to refine scenarios. Good to see end point (lacking from last workshop)' – 'Good to refine original ideas and have input from other groups' – 'Stimulating and produced new ideas as the scenarios were refined.'

6. What are your views on the quantification session? – Please leave this field open if you did not attend this session

Please write: 'Difficult to quantify, but done in a good way' – 'It would have been easier with more information on how our answers would be used in the modelling process.' – 'Perhaps the questions could have been made more specific in relation to each of the scenarios.' – 'Would have been beneficial to understand more about how the tool will be used.' – 'Challenging' – 'Difficult to apply quantification to theoretical scenarios, but useful and interesting to attempt.' – 'This was an important part of the process and helped towards the consideration of trade-offs and priorities.' – 'Highly enjoyable, but might need further expert input.'

7. Any further comments?

Please write: 'Excellent facilitation and organisation. Good fun.' – 'The team did a fantastic job.' – 'Timing and breaks worked well. An overall interesting and stimulating workshop.' – 'Overall a very productive and interesting workshop' – 'Looking forward to the next one.'

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 European stakeholder workshop.

During this workshop the stakeholders will receive feedback from the IA Platform on the adaptation 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 27 February 2012

10:00 Registration

WELCOME & REVIEW OF SCENARIO STORYLINES

10:30 Welcome and re-introduction to CLIMSAVE - Dr. Marc Metzger
(University of Edinburgh)

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

11:10 Scenario storyline review

12:30 Lunch

SPECIFYING STORYLINES

13:30 Specifying uncertainties and expanding storylines

15:30 Coffee / Tea

16:00 Presentation & discussion

LINKING TO MODELLING

17:15 Presentation of results from the modelling and the IA Platform - Dr. Ian Holman
(University of Cranfield) and Dr Benjamin Stuch (University of Kassel)

17:35 Discussion

18:00 End of day's work / reception

19:30 Group dinner

Tuesday 28 February 2012

09:00 Overview of the day

09:10 Review of modelling / input to modelling per scenario

11:00 Coffee / Tea

IDENTIFICATION OF ADAPTATION OPTIONS

11:30 First identification of options

12:00 Second identification of options

- 13:00 Lunch
- 14:00 Consolidation of options
- 14:30 Reviewing options from the IAP: Integrated Assessment Platform
- 15:30 Plenary review

WRAP-UP AND CLOSURE

- 16:00 From here to the final workshop
- 16:10 Wrap-up and evaluation
- 16:30 End of workshop

ANNEX 2: List of participants

Participants:

Baarda	Phil	Scottish Natural Heritage (SNH)
Brown	Iain	The James Hutton Institute
Buckingham	Sarah	Scottish Agricultural College (SAC)
Crichton	David	AON Benfield Hazard Research Centre
Densham	Jim	Royal Society for the Protection of Birds (RSPB)
Dlugolecki	Andrew	Andlug Consulting
Edmond	Graham	Transport Scotland
Esson	Graham	Perth and Kinross Council
Hagg	Joe	Adaptation Scotland
Harding	Andrew	CXC
Jacques-Turner	Miranda	Scottish Water
Kerr	Andy	Edinburgh Centre for Climate Change
Kosciewicz-Fleming	Linda	The Scottish Government
Ormiston	David	North Lanarkshire Council
Singleton	Peter	Scottish Environment Protection Agency (SEPA)
Smith	Mike	Forest Research
Street	Roger	UK Climate Impacts Programme (UKCIP)
Villegas	Ailsa	Highlands Council
Wolstenholme	Ruth	SNIFFER

Scientific advisors:

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

Process facilitators:

Gramberger	Marc	Prospex bvba	Lead facilitator
Watson	Martin	Prospex bvba	Facilitator
Chiamparino	Tommaso	Prospex bvba	Facilitator
Rakers	Peter	Prospex bvba	Facilitator
Maes	Marjan	Prospex bvba	Reporter

ANNEX 3: Selection of original workshop outputs

Original flipchart of the new Tartan Spring storyline:



Original flipcharts with adaptation options for the Tartan Spring scenario:



Original flipchart of the Mad Max scenario worldview:



Original flipchart with adaptation options for the Mad Max scenario:



Original flipcharts with adaptation options for the Scottish Play scenario:



