



# The CLIMSAVE Project

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

Newsletter N° 6, April 2013

### Introduction

CLIMSAVE is a European Union funded research project which is assessing climate change impacts and adaptation strategies across six key sectors in Europe: agriculture, forestry, biodiversity, urban, water and coasts. It is developing an Integrated Assessment Platform that will allow stakeholders to explore and understand the interactions between climate change impacts in different sectors. This will build the capacity of decision-makers to identify cross-sectoral vulnerability to climate change and determine how it might be reduced by various cost-effective adaptation options.

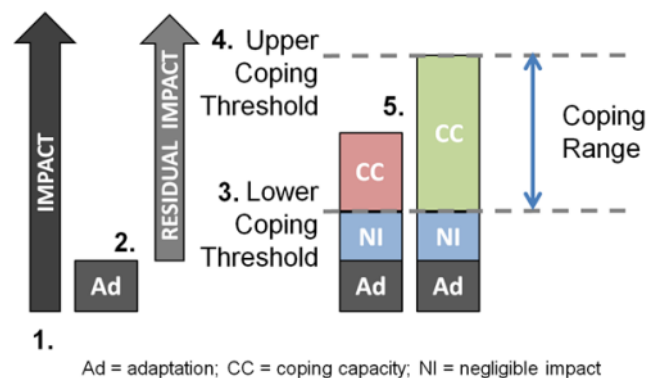
This sixth edition of the CLIMSAVE newsletter focuses on the assessment of vulnerability.

### Vulnerability hotspot assessment

Vulnerability assessment is important in delineating the people, places and ecosystems at risk from environmental and/or human-induced variability and change. Mapping vulnerability enables the underlying causes of vulnerability to be explored and assists in the development of more targeted policy responses when adapting to change. In the CLIMSAVE project, vulnerability is considered with respect to human wellbeing: areas are vulnerable when impacts are greater than the ability of those affected to draw on resources (both tangible and societal) at the time of the crisis to help them cope.

The CLIMSAVE Integrated Assessment Platforms includes a vulnerability screen

which allows users to identify vulnerability hotspots using the methodology summarised in Figure 1.



**Fig. 1: CLIMSAVE vulnerability approach.**

The vulnerability hotspot approach draws on the following key factors (numbers below link to the numbers on Figure 1):

1. **Impact:** The level of impact for a given sector. For example, this could be the area flooded during a 1 in 100 year flood event. The greater the impact, the greater the risk to human wellbeing.
2. **Adaptation and Adaptive Capacity:** This represents the influence that adaptation actions implemented in advance of the event have on the level of impact when the event takes place. For example, the level of flood defences created. As a result of adaptation, the amount of which depends on adaptive capacity, the level of impact is reduced (i.e. the higher the flood defences, the less area flooded). Post-adaptation impact is termed *residual impact*.
3. **Lower Coping Threshold:** There is a level of residual impact below which the impacts on human wellbeing are negligible; this is termed the “lower coping threshold” and

following the flood example reflects very small areas being flooded due to water overtopping flood defences.

4. **Upper Coping Threshold:** Similarly there is a level of residual impact beyond which there is no way that any society, no matter how resource-rich, could cope without impacts on human wellbeing. Areas with impacts above this threshold will therefore always be vulnerable.
5. **Coping capacity:** Between the upper and lower coping thresholds is termed the “*coping range*”. Within this range different regions have different abilities to cope depending on their available resources. Once the lower coping threshold is exceeded, areas with limited resources will find that even small amounts of residual impact have significant impacts on their wellbeing which means that they are vulnerable. Conversely, areas rich in resources will be able to cope with increasingly large residual impacts with little impact on their wellbeing, only becoming vulnerable as residual impacts approach the upper coping threshold.

### Measuring current coping capacity

Actually measuring “resource” availability to develop an index of coping capacity is challenging. There is potentially a very wide range of contributing political, social, economic and technological resources that could contribute to reducing the severity of impacts on human wellbeing. It would be difficult or impossible to measure all of them, or to understand exactly how they combine and interact to determine the capacity to cope with specific impacts. But at a general level, the principal determinant of coping capacity, at whatever geographical or social scale, is access to “resources”, where “resources” are defined broadly to include intangible features such as human knowledge, social networks and the ability to coordinate actions effectively.

Hence, in CLIMSAVE an index of coping capacity has been developed based on four types of resource stocks which we term *capitals*: human, social, financial and manufactured. Societies can draw on these stocks now in order to adapt, but they can

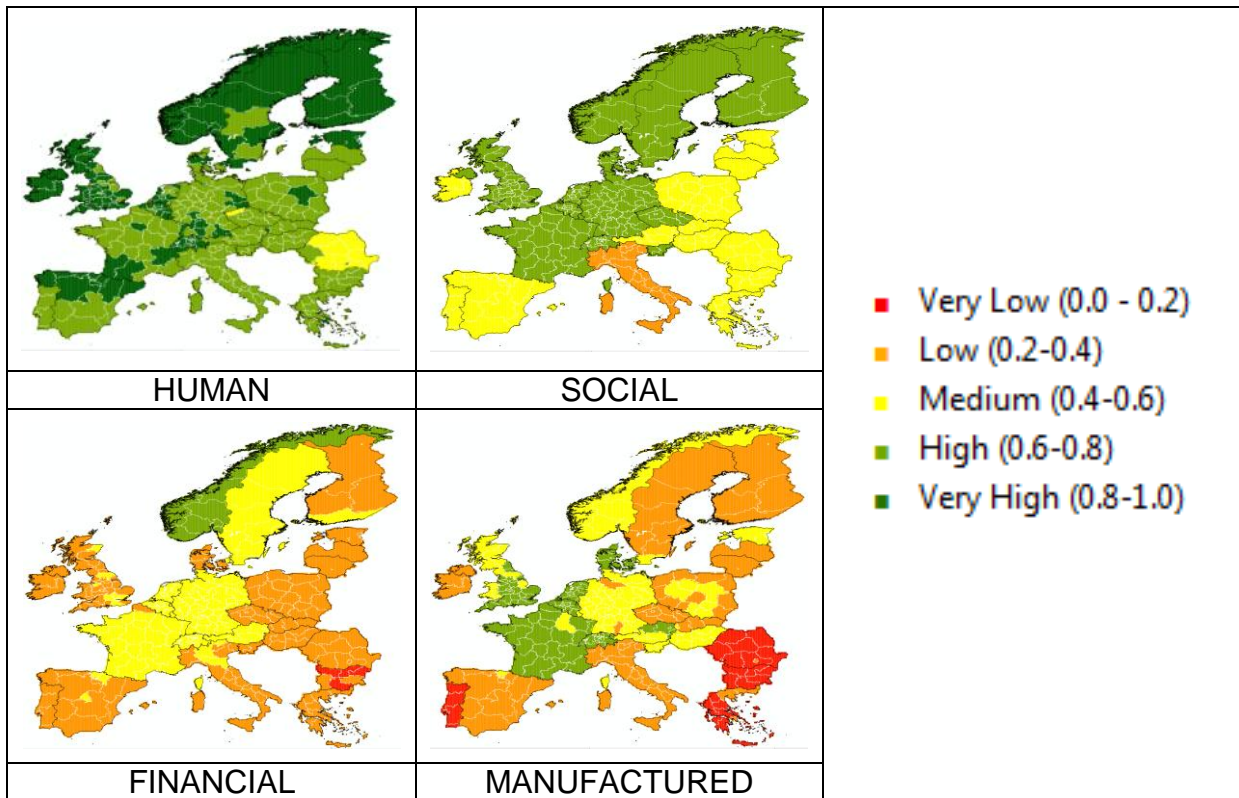
also decide to invest in building up these stocks in order to be better able to cope with future events, reducing future vulnerability. A fifth capital stock, natural capital, is not included in our index because it does not play a strong role in the ability to cope, but rather is used to define the impacts of climate change as modelled within the Integrated Assessment Platform.

To assess the availability of coping capacity, we used a combination of data analysis, stakeholder scenario development and expert judgement. For each capital, two indicators were selected from a long candidate list. Selection was based on the suitability and availability of data that were not strongly correlated. The indicators selected were:

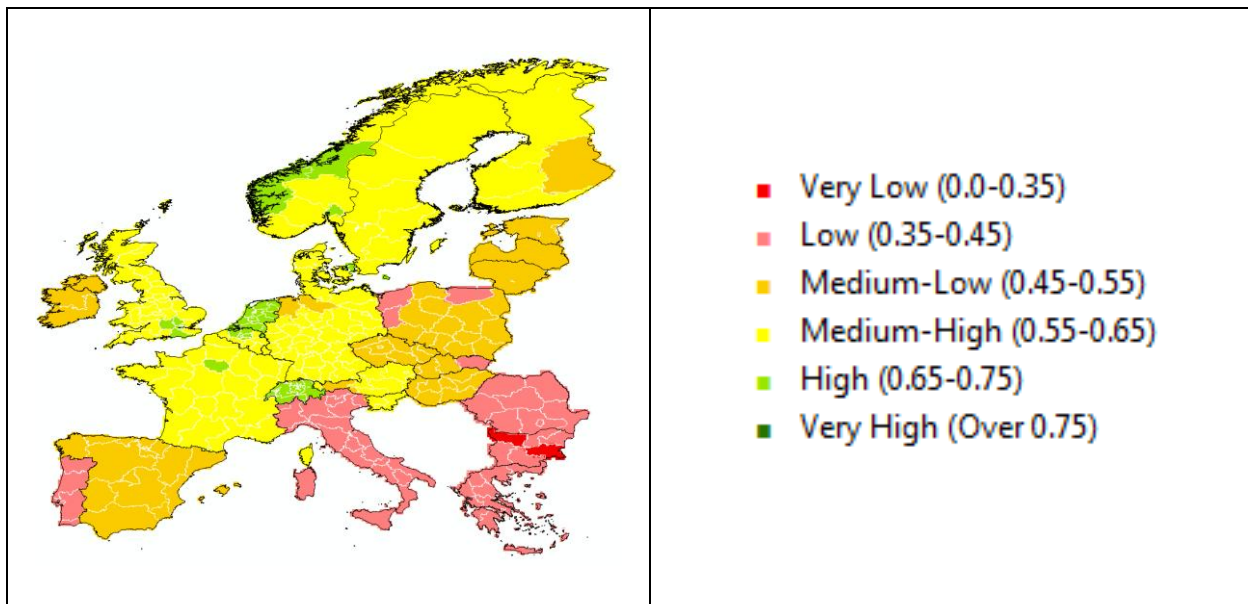
- Human capital (life expectancy; tertiary education);
- Social capital (income inequality; help when threatened or community involvement);
- Financial capital (household income or earnings; savings);
- Manufactured capital (transport or road length; produced capital or capital expenditure).

The indicators were standardised on a 0 to 1 scale by determining 'absolute' maxima and minima based on descriptions of the CLIMSAVE socio-economic scenarios and expert judgement. Different functional forms relating an indicator to its standardised index were used, so that the indices could reflect non-linear relationships with the capitals - for example, moving from 0% to 5% with tertiary education represents a much more significant increase in human capital than moving from 45% to 50%.

To build the capital estimates and the overall coping capacity index, we used equal weights within capital categories and in calculating overall coping capacity. This could easily be altered later, following testing within the Integrated Assessment Platform and user feedback, if it is thought necessary to put more emphasis on a particular capital type, and/or to vary the weights according to the threat faced. The results for Europe are shown in Figures 2 and 3.



**Fig. 2: Baseline capital estimates for Europe.**



**Fig. 3: Baseline coping capacity for Europe.**

The general pattern is of higher coping capacity in the wealthier parts of Europe with advanced infrastructure and strong social institutions. Southern and eastern parts of Europe tend to have lower coping capacity, associated with lower incomes, savings and manufactured capital, and also weaker social institutions.

### **Modelling future coping capacity**

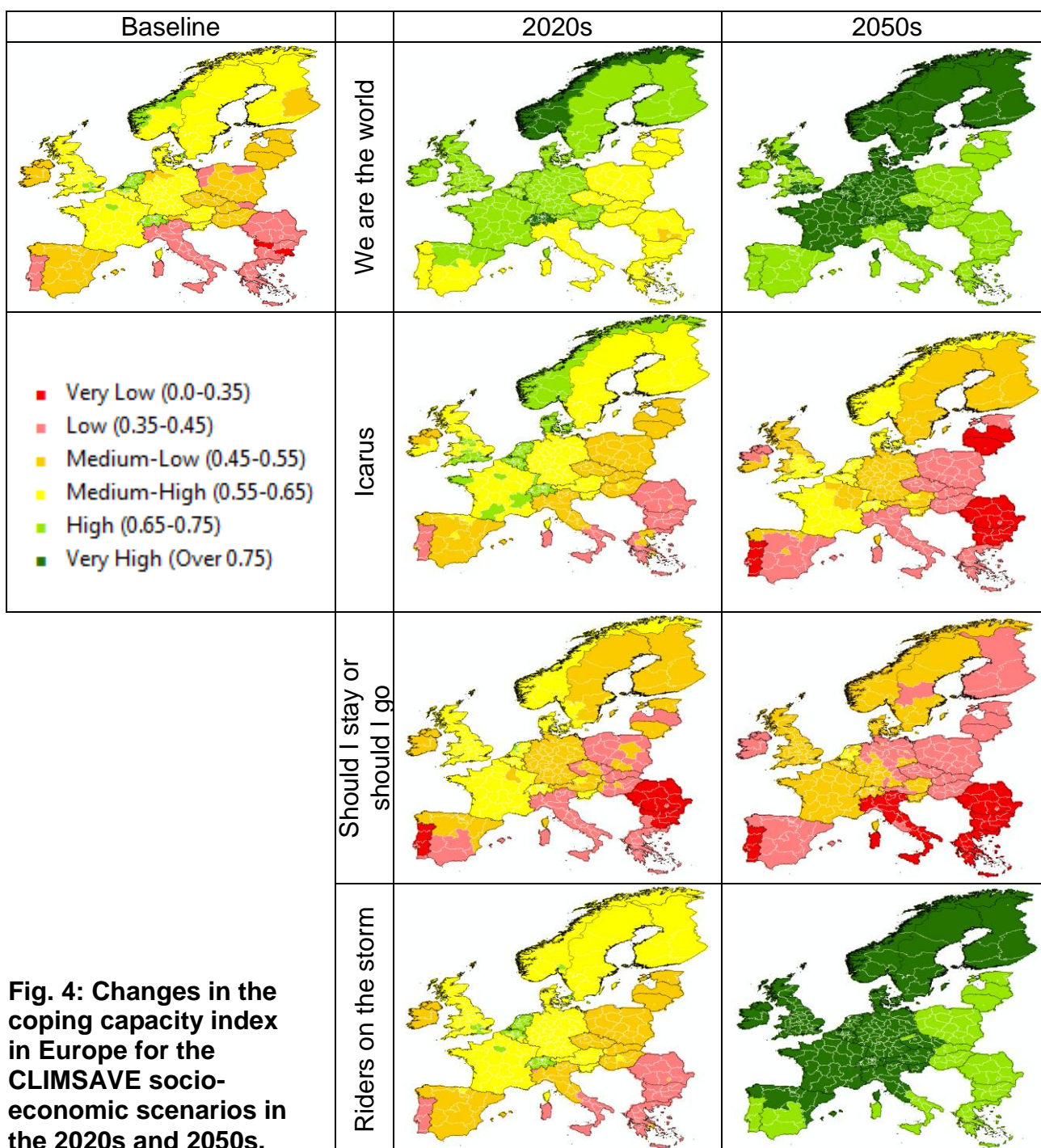
To identify how capital stocks might change in the CLIMSAVE socio-economic scenarios stakeholders at the scenario development workshops were asked to define whether each capital was expected to increase or decrease (with respect to the previous time slice) within the scenario. They were then asked whether that change was “moderate”

or “high”. The results are shown in Table 1 with the more utopian scenarios “We are the world” and “Riders on the storm” showing more positive trends than the dystopian “Icarus” and “Should I stay or should I go”. Further information on the

scenarios and the scenario development process is provided in Newsletter no. 3. These changes were applied to the baseline maps of available capitals to compute coping capacity for the 2020s and 2050s time slices in each scenario (Figure 4).

**Table 1: Changes in capital stocks estimated by stakeholders at the socio-economic scenario workshops. “H” = high and “M” = moderate “+” = positive and “-” = negative.**

Capital	We are the world		Icarus		Should I stay or should I go		Riders on the storm	
	2020s	2050s	2020s	2050s	2020s	2050s	2020s	2050s
Human	M+	H+	0	H-	0	M-	M+	H+
Social	H+	M+	M-	0	M-	M+	M+	M+
Financial	M-	M-	M+	M-	M-	M-	M-	M+
Manufactured	M+	M+	0	M-	M-	M-	M-	M+



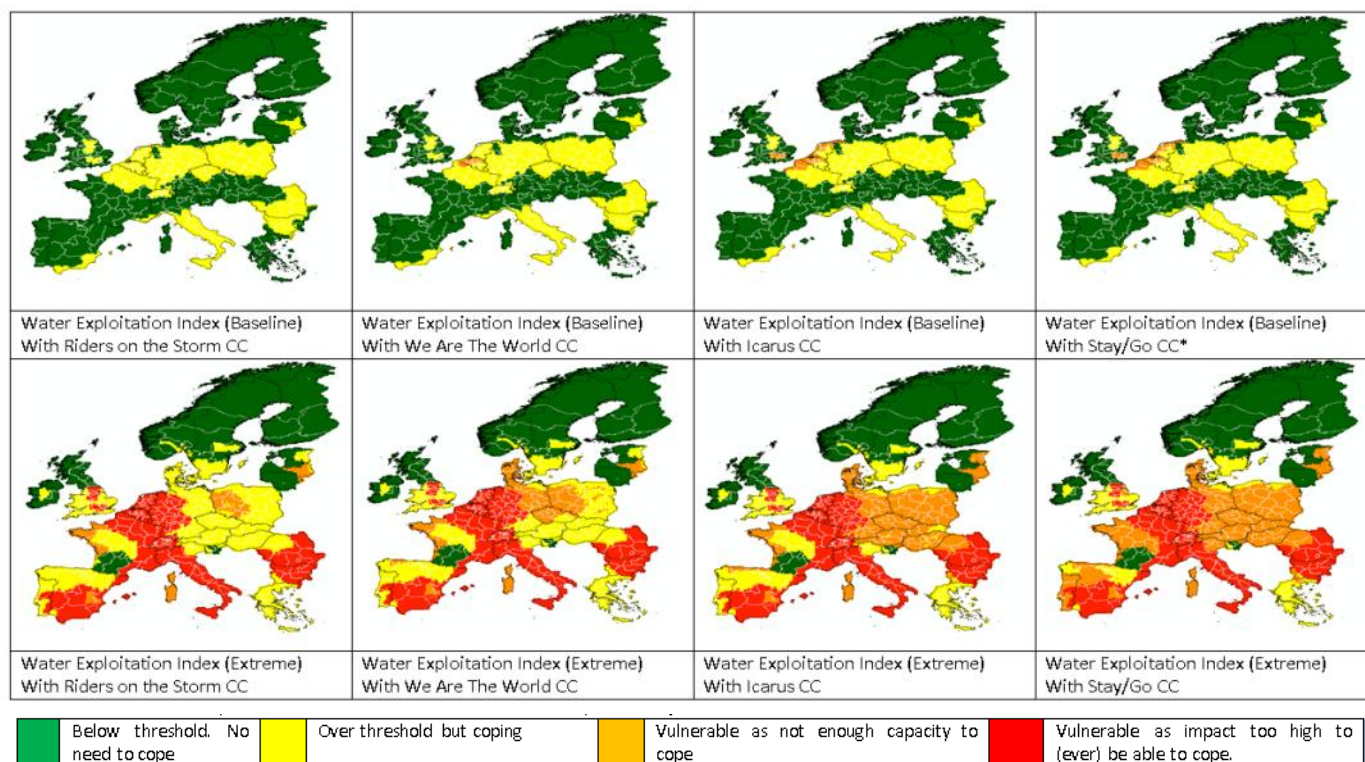
**Fig. 4: Changes in the coping capacity index in Europe for the CLIMSAVE socio-economic scenarios in the 2020s and 2050s.**

There is a clear split between the level of coping capacity within the scenarios. Two scenarios ('Riders on the storm' and 'We are the World' 2050s scenarios) build up high levels of coping capacity, leading the whole continent to a strong position for coping with the residual impacts of climate change. On the other hand, the 'Icarus' and especially the 'Should I stay or should I go' scenarios show a generalised decline in the ability to cope, and a worsening of existing imbalances leading to very low coping capacity, in particular in southern and eastern parts of Europe.

### Modelling vulnerability hotspots

Expert interpretation was used to determine upper and lower coping thresholds for indicators from each of the six sectors modelled in CLIMSAVE (agriculture, forestry, water, biodiversity, coasts and urban). These were then combined with the coping capacity index and the level of impact for any pre-defined or user selected scenario which is run on the Integrated Assessment Platform to produce maps of vulnerability hotspots (Figure 5).

The maps separate vulnerability into four classes. The first class identifies areas where residual impacts are lower than the lower coping threshold (green in Figure 5). In these areas there is no need for society to "cope" as the risks to human wellbeing are non-existent, either because there is no "impact" or adaptation options are sufficient to ensure that residual impacts are negligible. The second and third classes are identified where the residual impact is between the upper and lower threshold, i.e. within the coping range. The difference between the two classes is governed by the coping capacity of that area. In the second class (yellow in Figure 5), there is a notable residual impact, but the coping capacity within the region is sufficient that the impacts on human wellbeing are nullified. In the third class (orange in Figure 5), the residual impact is greater than the available coping capacity, and as such human wellbeing is negatively affected. The final class (red in Figure 5) maps areas where the residual impact is greater than the upper coping threshold. In these areas the impact is so severe that no amount of coping capacity will be sufficient to protect human wellbeing.



**Fig. 5: Vulnerability hotspots for water availability for baseline and an extreme sensitivity test with +6°C temperature and -50% rainfall combined with the CLIMSAVE socio-economic scenarios. "CC" refers to coping capacity.**

## Concluding remarks

The CLIMSAVE vulnerability methodology is a relatively simple, systematic process that allows the CLIMSAVE Integrated Assessment Platform (IAP) to move beyond mapping impact and adaptation to identify vulnerability hotspots. The method has been implemented within the “Vulnerability” screen of the IAP which allow the user to map vulnerability hotspots for seven indicators: (1) Water Availability; (2) Flooding; (3) Food Security; (4) Timber Supply; (5) Land Use Intensification; (6) Landscape Diversity / Multi-functionality; and (7) Biodiversity. The user can also choose between mapping vulnerability hotspots for individual sectors or ecosystem services or aggregated across multiple indicators. Whilst European data are presented here, the method has also been applied to the Scottish IAP where it is derived from Scottish datasets.

## Other project activities

The project held its final set of stakeholder workshops on 3-4 December 2013 in Edinburgh. 27 stakeholders attended the workshops where they familiarised themselves with the scenarios they had developed and the adaptation options they had defined in previous workshops. They then worked with the Integrated Assessment Platform and project scientists to evaluate the robustness of adaptation options across scenarios. The workshops for the European and Scottish case studies were held in parallel with some joint sessions. The joint sessions enabled the stakeholders to compare their resulting scenarios and their learning experiences. Both the Scottish and European stakeholders were very positive about meeting each other and the workshop overall with more than 72% of the participants rating it as very good.

The project held its third Steering Committee meeting on 12-13 September 2012 in Kassel, Germany and its fourth General Assembly meeting on 26-28 February 2013 in Vienna, Austria. Progress was reported on all aspects of the project and workplans were updated in order to deliver the outcomes of the project. The project has negotiated a four month extension with the European Commission and will now finish on 31 October 2013. This will ensure that there is sufficient time to thoroughly de-bug and quality control the final version of the Integrated Assessment Platform before it is publically released on the CLIMSAVE ([www.climsave.eu](http://www.climsave.eu)) and Climate-Adapt ([www.climate-adapt.eea.europa.eu](http://www.climate-adapt.eea.europa.eu)) websites.

CLIMSAVE co-organised the recent European Climate Change Adaptation conference held in Hamburg on 18-20 March 2013 where the project gave nine scientific presentations and organised a practitioner symposium involving the Scottish and European stakeholders from the CLIMSAVE workshops. CLIMSAVE results have been presented at numerous other conferences including the Nordic International Conference on Climate Change Adaptation (Helsinki, August 2012), the CIRCLE2 workshop on Uncertainty and Climate Change Adaptation (Lisbon, November 2012) and the Conference on Ecosystem Services and Ecosystem Markets (Fort Lauderdale, December 2012).

A number of CLIMSAVE outputs are available from the “Outputs” page of the project website ([www.climsave.eu](http://www.climsave.eu)). These include reports on the stakeholder workshops, scenario development, adaptive capacity, vulnerability, adaptation policy and governance, and the specification of the Integrated Assessment Platform and the sectoral meta-models within it. Further information can be obtained from the website or the Project Co-ordinator: Paula Harrison ([paharriso@aol.com](mailto:paharriso@aol.com)).



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