Decision Support Methods for Climate Change Adaptation

9

Adaptation Turning Points

Summary of Methods and Case Study Examples from the MEDIATION Project

SEVENTH FRAMEWORK PROGRAMME

Mediation

Key Messages

- Concerned decision makers increasingly ask whether current management is able to cope with climate change or whether alternative strategies are needed. They urgently demand tools to assess and communicate the implications of climate change and opportunities for adaptation.
- The European MEDIATION project has undertaken a detailed review of methods and tools for adaptation, and has tested them in a series of case studies. It has assessed their applicability for adaptation and analysed how they consider uncertainty. The findings are summarised on the MEDIATION Adaptation Platform and in a set of Policy Briefing Notes.
- The method presented in this Policy Briefing Note focuses on the specific situation where climate change induces policy failure and alternative strategies have to be considered. If such a situation is thinkable, there is an imperative to act and climate change becomes particularly relevant to decision makers. We call this situation an '**adaptation turning point'**.
- The assessment of adaptation turning points translates uncertainty about the magnitude of climate impacts into a time range over which it is likely that an unacceptable situation occurs. This time range can be used to adapt.
- Knowledge on adaptation turning points helps to combine potential adaptation measures into adaptation pathways. Adaptation pathways encourage taking short-term actions to sustain the current system, whilst planning longer-term adaptation that may be required in the future.
- Practical experience shows that the assessment of adaptation turning points allows for a meaningful dialogue between stakeholders and scientists about the *amount of change* that is acceptable, *when* conditions could be reached that are unacceptable or more favourable, *how likely* these conditions are and *what adaptation pathways* to consider.
- The main strength of assessing turning points for adaptation is that the approach is highly policy-orientated, and uses scenarios to delineate uncertainties in time. It is also very flexible and can consider a range of objectives, which encourages discussion on acceptable change and critical values. Weaknesses relate to a potential focus on existing objectives, rather than new challenges. In addition, simplicity is lost when thresholds are less-well defined and when turning points have multiple drivers.
- Summarising, an assessment of adaptation turning points focusses on the specific threshold situation that policy becomes untenable due to climate change. The assessment translates uncertainty about climate impacts into a time range that can be used to plan adequate responses. Adaptation pathways offer flexibility by allowing for progressive implementation.

Introduction

Adaptation has become an integral part of climate change policy. The ultimate scale of the challenge will largely be defined by the development of the world's economy and greenhouse gas emissions reductions. Both are uncertain, suggesting that planners may have to respond to rises in global mean temperature of 4°C or more (Parry *et al.*, 2009). Adapting to such conditions would be challenging at best(Smith *et al.*, 2011), and may face practically insurmountable physical limits in many places due to loss of ecosystem services and interacting impacts. Climate change shifts the sustainability challenge from preserving natural resources for future generations to strengthening resilience and adaptive capacity in social-ecological systems. The challenge for policy making and sustainable resources management shifts from conservation to managing change and adaptation.

The European Commission FP7 funded MEDIATION project (Methodology for Effective Decision-making on Impacts and AdaptaTION) is advancing the analysis of adaptation issues through its objectives of analysing impacts, vulnerability and adaptation, and promoting knowledge sharing through a MEDIATION Adaptation Platform (http://www.mediation-project.eu/platform/). To complement the information on the Platform, a series of Policy Briefing Notes have been produced on *Decision Support Methods for Climate Change Adaptation*.

This *Policy Briefing Note (Note 9*) provides a summary of the assessment of **adaptation turning points**. It provides a brief synthesis of the approach, its strengths and weaknesses, the relevance for adaptation, how it considers uncertainty, and presents case study examples. It is stressed that this note only provides an overview: more detailed information is available in MEDIATION deliverables, and sources and links on the MEDIATION Adaptation Platform.

Description of the Method

The assessment of adaptation turning points starts from the perspective that management aims to sustain conditions for society and nature. A critical threshold is reached, the moment that climate change renders policy untenable or results in conditions that society perceives as undesirable. At such a threshold situation, it is not only important to know the extent of the impact, but at least equally important is to know when and how likely it is that this situation occurs. Thus the analysis focusses on the question of whether or not current management is sustainable under a changing climate, and when adjustments are required.

Assessing climate impacts in terms of the finiteness of policy objectives has the important consequence that it invites to elicit and discuss the thresholds that society should not transgress. Ultimately, this question is a normative one – how much change and risk is society willing to accept? Many studies of adaptation view the legal and political system as boundary conditions. Yet, by focusing on those boundaries and how to move them, greater realisation of adaptation can be achieved (c.f. Cosens and Williams, 2012; Adger *et al.*, 2013). The focus on thresholds highlights that adaptation operates at two distinct levels: changes to the physical environment, and changes to the decision environment, including policy objectives. An often overlooked strategy in adaptation planning is for actors to accept changes and adjust policy objectives accordingly.

Starting from the threshold situation where the current management strategy can no longer meet its objectives, the concept of 'adaptation tipping points' was advanced for a policy study of long-term water management in the Netherlands (Kwadijk *et al.*, 2010). It has proven successful in assessing and communicating water related risks, and it has become one of the scientific concepts underpinning the Dutch long-term water strategy (Haasnoot *et al.*, 2013). A similar planning approach was developed and tested for flood risk in the Thames estuary (Lavery and Donovan, 2005; Smith *et al.*, 2011). Reported studies so far have focused on hydrological and technical thresholds for policy success (Kwadijk *et al.*, 2010; Reeder and

Ranger, 2011; Lempert, 2013). More recently, cases with social-ecologically defined policy objectives have become available (Bölscher *et al.*, 2013; Werners *et al.*, 2013b).

- Although the studies differ methodologically, they address at least the following questions:
- What defines unacceptable change: which targets and thresholds exist for different actors?
- Under which climatic conditions are thresholds reached?
- When are thresholds reached (including capturing uncertainty in a time range)?
- When and how to respond?

To avoid confusion with the popular term 'tipping point' that people tend to associate with major change in biophysical systems, MEDIATION uses 'adaptation turning point' for the situation in which a social-political threshold is reached due to climate change. Social-political thresholds include formal policy objectives as well as informal societal preferences, stakes and interests, such as willingness to invest and protection of cultural identity (Werners *et al.*, 2013a). Importantly, reaching a turning point can be due to a biophysical tipping point, but not necessarily so. Essentially, an adaptation turning point signifies a moment in time at which a threshold of concern is likely to be exceeded. Figure 1a illustrates that an adaptation turning point does not mean that management is impossible and that catastrophic consequences are to be faced. Yet, it implies progressive failure of the current management (*the "rocky road*"), such that actors may wish to turn to alternative strategies *(the "unexplored land")*. Figure 1b illustrates how scenario uncertainty can be translated into a time range in which the adaptation turning point is likely to occur.

The Application to Adaptation

This section shows how the assessment of adaptation turning points can help to plan adequate responses. In the face of threshold behaviour and uncertainty, authors have called for a shift in perspective from the aspiration to control change in a system assumed stable, to sustain and generate desirable pathways for societal development (Downing, 2012; Weaver *et al.*, 2013). Given the uncertain changing conditions that many decision-makers face nowadays, a sustainable plan is not only one that is able to achieve objectives related to society, economy, and environment, but a sustainable plan should

Illustration of an adaptation turning point

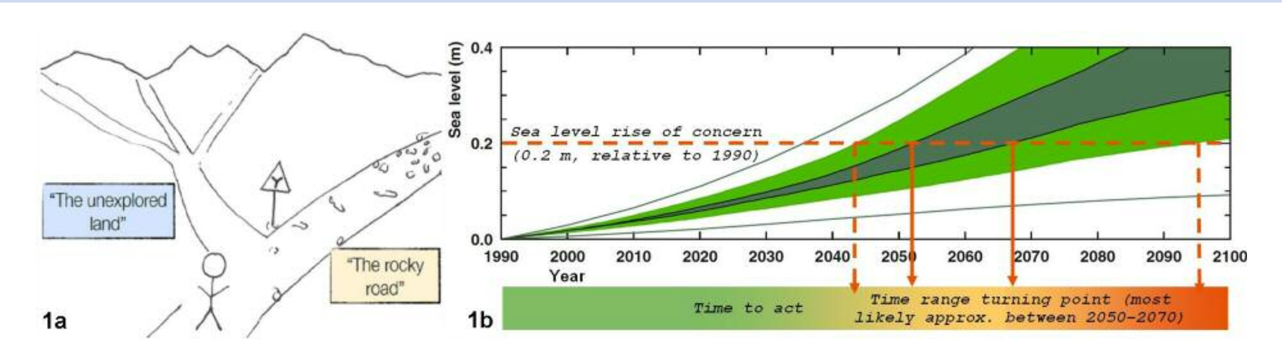

Figure 1: a) the current direction is becoming unattractive in time (the "rocky road") and a turn to alternative routes is for consideration (the "unexplored land"), b) a threshold (here: failing safety standards at a sea level rise of 0.2 m relative to 1990) is translated into a time range in which it is likely to be reached. The figure uses projected global-averaged sea-level rise for the 21st century from the IPCC assessment report (2001) (the dark shading is the model average envelope for all IPCC SRES greenhouse gas scenarios, the light shading is the envelope for all models and all SRES scenarios, and the outer lines include an allowance for an additional land-ice uncertainty (Church et al., 2008))

also be robust, meaning that it performs satisfactorily under a wide variety of futures, and adaptive, meaning that it can be adapted to changing (unforeseen) future conditions.

Much of the traditional scientific work has been built on the supposition that the uncertainties result from a lack of information. This has led to an emphasis on uncertainty reduction through ever-increasing information seeking and processing. However, most strategic planning problems face uncertainties that cannot be reduced by gathering more information and are not statistical in nature (Hallegatte *et al.*, 2012).

These deep uncertainties are unknowable at present, and will only dissolve as time unfolds. This is particularly problematic for planning long-lived and costly investments (Hallegatte, 2009). Here it is recommended to incorporate flexibility by designing so-called adaptation route-maps and pathways that sequence measures over time and allow for progressive implementation depending on when pre-identified thresholds are reached (Reeder and Ranger, 2011; Haasnoot *et al.*, 2013).

Route-maps stimulate planners to explicitly think about decision lifetime and taking short-term actions, while keeping options open and avoiding lock-ins. Thus, the inevitable changes become part of a recognized process and corrective actions can be taken based on monitoring and as new information becomes available.

Adaptation route-map

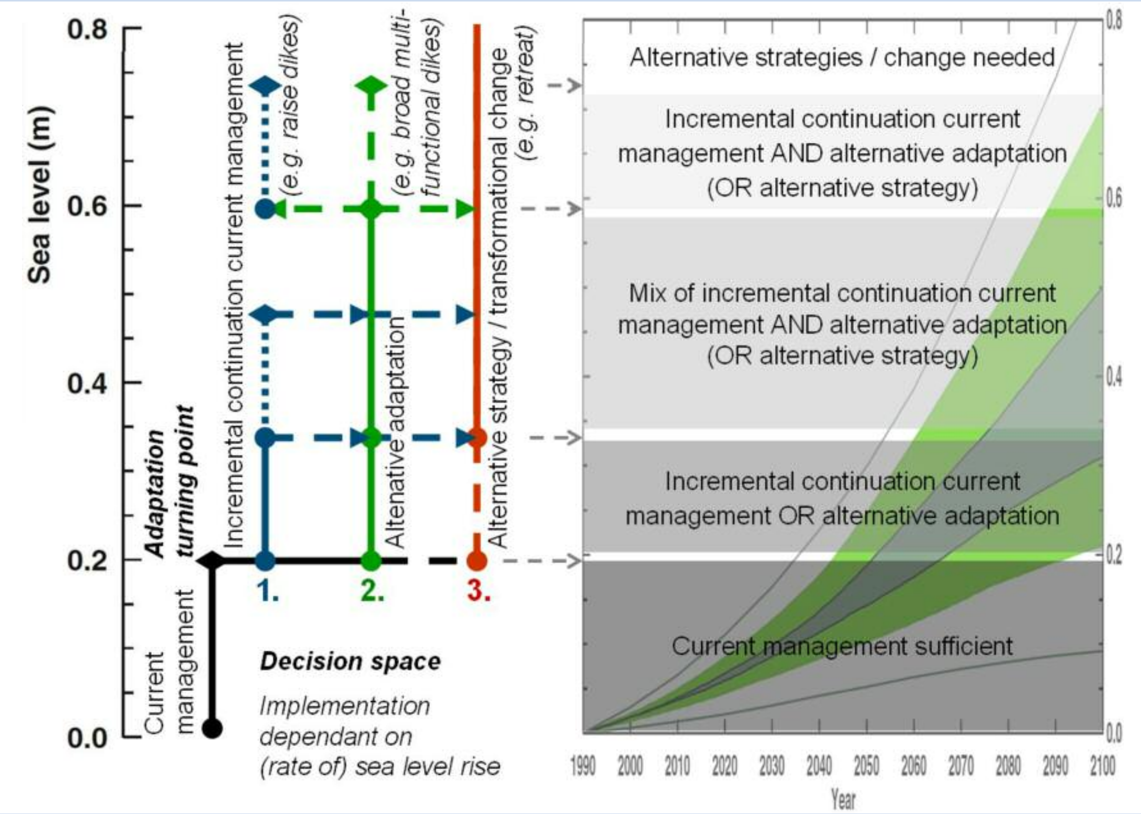

Figure 2: Adaptation route-map illustrating how different adaptation options (here: raise dikes (blue), broaden dikes (green) and retreat (red)) are combined into adaptation pathways (for adaptation turning point and scenario information see Figure 1. For adaptation pathways see (Reeder and Ranger, 2011; Haasnoot et al., 2013))

Figure 2 illustrates how potential adaptation options can be combined into adaptation pathways. This is particularly useful for adaptation options with a longer decision and implementation lifetime (c.f. Smith *et al.*, 2011). In Figure 2 each option is effective for a distinctive range of sea level rise after which a shift to another option is needed (indicated by arrows). Pathways are implemented depending on observed climate change or improved projections. The possibility to switch between adaptation options in response to new information is a measure of flexibility.

Strengths and Weaknesses

A key part of the MEDIATION project has been to identify the strengths and weaknesses of different approaches for adaptation. Table 1 lists strengths and weaknesses of an assessment of adaptation turning points.

A strength is that the focus on conditions that society perceives as undesirable helps to identify stakeholders, policy plans and the spatial and temporal boundaries of the assessment. Starting the assessment from an existing policy process facilitates the engagement of actors and provide an well-communicable starting point. Yet a comprehensive analysis of climate change impacts and possible adaptation turning points may require putting this policy process in a wider perspective, including the exploration of the various ways stakeholders frame the issues to be addressed. Another strength is that assessment of adaptation turning points allows for nesting adaptation options within a longer time frame. The concept can also be used to assess thresholds in taking adaptive action.

A weakness is that policy goals are not always clearly defined, especially with respect to potential impacts of climate change on ecosystems. Turning points for engineered systems (like a coast protected by dikes) are relatively well delimited by norms and standards. For ecological systems it often is more difficult to formulate thresholds. Thresholds that have been included in policy (such as water temperature ranges) may ultimately not be indicative for ecological success or failure (e.g. as in the case study for salmon on the next page). In any case, a statement about whether an adaptation turning point will be reached will always have to indicate clearly with respect to which set of policy objectives and societal preferences.

Table 1: Strengths and weaknesses of the adaptation turning point assessments

Key strengths	Potential weaknesses
• Can synthesize available information for the prioritization of research and adaptation planning. • Is more policy-oriented and stakeholder motivated than typical impact and vulnerability assessments. Actors define stakes to be considered. • Is flexible in considering a range of social-economic objectives. • Uses scenarios not to predict the future, but to delineate uncertainties. • Encourages discussion with society about (un)acceptable change and definition of critical indicator values.	• Focuses on existing management objectives. Unknown impacts and new challenges may be overlooked. • Gains complexity with multiple drivers where there is an indirect link with climate change. At present only relatively simple / driver thresholds have been identified with sufficient certainty for policy support. • Requires identification of social-political thresholds that are often ill-defined. • Loses simplicity for communication when thresholds are less-well defined and when turning points have multiple drivers.

Case Studies

The MEDIATION study has assessed adaptation turning points in different adaptation case studies. Two of these case studies are summarised below.

Case Study 1: Turning points for salmon restoration programmes, Rhine river basin

Social-political thresholds of interest

This case study investigates whether climate change could render the policy to reintroduce the salmon in the River Rhine untenable. Thus the case offers an adaptation turning point assessment for nature policies. Atlantic salmon was a common anadromous fish species in the Rhine that went extinct in the 1950s. Reintroduction started when the Rhine state governments accepted the Rhine Action Plan in 1987. Not only the Rhine national governments, but also regional authorities and NGOs are involved in the implementation effort. Bringing back the salmon is therefore not only an abstract water policy objective, but also an inspiration for many small scale public and private initiatives along the Rhine streams and rivers.

In 2001 the Rhine ministers adopted the 'Rhine 2020 – Programme on the sustainable development of the Rhine' (ICPR, 2001), which resulted in an action plan 'Rhine Salmon 2020' (ICPR, 2004). The main objective is the re-establishment of a self-sustaining, wild Atlantic salmon population in the Rhine by 2020. As such it contributes to policy efforts to enable fish migration in the Rhine river basin and improve habitat conditions. In total, investments of €528 million for the adaptation of infrastructure (weirs, dams) and habitat restoration are planned until 2015.

Climatic conditions for reaching thresholds

These programs do not consider climate change. However, some of the factors that salmon depends on are projected to be affected by climate change (Bölscher *et al.*, 2013). The most direct link between climate change and the success of the reintroduction programme is through water temperature, which affects the propagation and spawning migration of the salmon. In theory water discharge also influences migration, yet in larger rivers, like the Rhine, it is not physically limiting (Todd *et al.*, 2010).

Literature reports diverse thermal boundary conditions for Atlantic salmon (for an overview see Table 2 in Bölscher *et al.* (2013)). Two boundary conditions have been identified from literature and expert interviews as particularly relevant for threatening the reintroduction of the salmon: 1) Short but regularly occurring periods with potentially lethal temperatures between 25°C and 33°C, 2) Long periods with mean water temperatures higher than 23°C. In the latter case the time window for salmon to migrate from the sea into the Rhine may become too small.

Following the inventory of critical climate conditions, it is concluded that a water temperature of 23°C is a meaningful threshold value for the success of the reintroduction program. However, it is largely unknown how migration depends on the duration and timing of the period of time that water temperatures are above this threshold. Thus, the finiteness of policy success can only be approximated. Summarizing, the likeliness of an adaptation turning point increases with the number of days that the water temperature is above 23°C.

Adaptation turning points and lessons

To identify turning points associated with the number of days that the water temperature exceeds 23°C, model results were used of van Vliet *et al.* (2013). Figure 3 shows a distinct increase in this number of days at Lobith, where the Rhine enters the Netherlands from Germany. The figure illustrates the adaptation turning point, assuming that the reintroduction of salmon becomes problematic at a doubling of the number of days with temperature above 23°C from the current 20 days to 40 days.

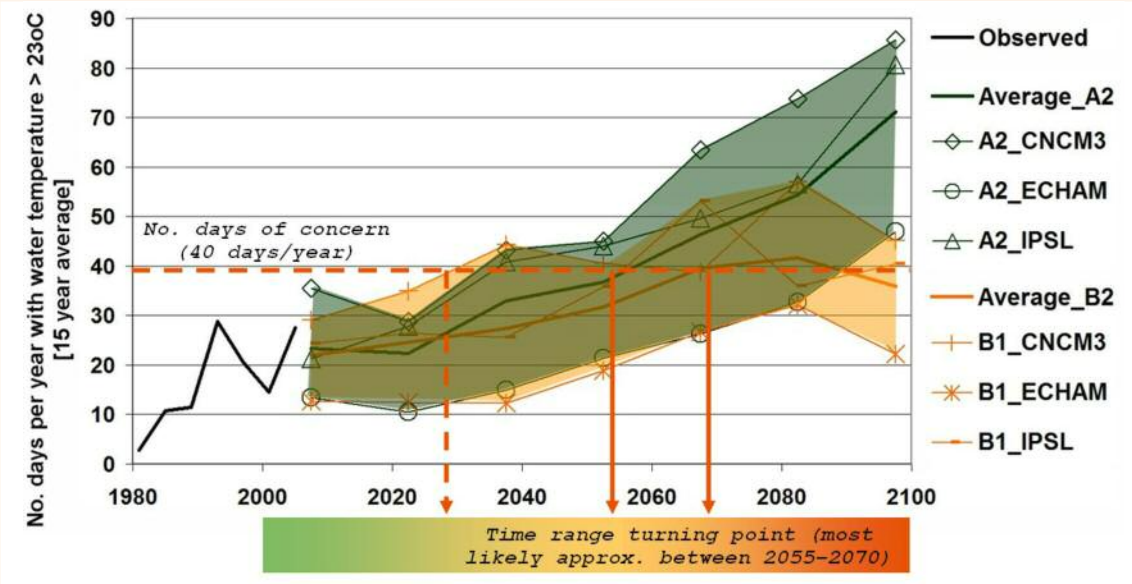

Figure 3: Adaptation turning point for the reintroduction of Salmon. The figure shows number of days with daily water temperatures exceeding 23°C at Lobith for 1980-2099 (15 year average). Thin lines show individual results for three climate models (CNCM3, ECHAM and IPSL model), coloured polygons show the range in results across the models and thick line shows the average result from the models for the SRES A2 and B1 climate change scenario (2000-2099).

This implies the need to rethink salmon policies and consider adaptive action. At the European and national scale, already temperature standards for cooling water discharge have been defined that ought to safeguard the ecological status of the river. It is questionable to what extend these standard can warrant policy success as in practice the standards prove to be the result of negotiations in which social-economic considerations have the lead and increasingly administrators can make reasoned deviations in implementation, for example during extreme weather events.

An adaptation option relevant for smaller river branches is replanting of trees and creation of shade. Another notable adaptation option mentioned by stakeholders is to change objectives. For instance, to give up reintroduction of the salmon and decide to take another species as an indicator for ecological improvements. Here the sturgeon could be an example.

Summarising, exposure increases to long periods with mean water temperatures higher than 23°C. Thus, the time window for salmon to migrate upstream may become too small to re-establish a sustainable population. The timing of a turning point for salmon policy remains uncertain due to a.o. climate variability, local water temperature differences and the adaptive capacity of Atlantic salmon. These uncertainties can direct future research.

Source: Bölscher et al. (2013)

Case Study 2: Turning points for wine production in Tuscany, Italy

Social-political thresholds of interest

This case study explores wine production in Tuscany, Italy under climate change. Wine production in the region is progressively changing from mixed farming system to specialized viticulture. Part of this change is the rediscovery and improvement of traditional and autochthonous vines and a switch to quality production with lower yields, less chemicals and increased value of produced wine. The number of vine-growing farms has been reduced by half over the last 20 years, while average farm size has increased. Significantly, more than half of the total regional vineyard surface is labelled as Designation of Origin (DO).

The associations and unions in the region offer incentives in support of the above mentioned specialisation. Regione Toscana encourages the renewal of old vineyards, on the basis of farmers application and selection. Associations also create awareness that agriculture has created a unique landscape in Tuscany that is both productive and internationally recognised for its beauty. The image of the vineyard, surrounded by the classic, quiet and clean Tuscan landscape, offers a competitive advantage for the wine that is produced there. Thus, agriculture has both an economic, and environmental and landscape value in Tuscany. At the same time the strict landscape conservation and production rules can limit adaptation.

Farmers in Tuscany already observe consequences of climate change and express an increasing interest in adaptation. A key question is whether climate change will make farmers change grape varieties, move to other locations or switch to other livelihoods. Here it is feared that changes in viniculture could have detrimental effects on the landscape, and therefore on tourism and quality of living. After stakeholder consultation the main questions and thresholds of interest are:

- (when) does wine production in its current form become unviable in the region?
- (when) does adaptation become attractive?

Farmers expressed an immediate interest in two adaption strategies: moving production to higher elevations and changing to new varieties. These adaptive actions have a response time of at least 4-10 years (the time it takes for a new wine yard to become productive). Farmers and government representatives stress the crucial importance of assessing wine quality, rather than the more typically modelled production quantity, as the survival of Tuscan viticulture is strictly linked to its high-quality wines.

Climatic conditions for reaching thresholds

Farmers already observe a strong relationship between an increase in temperature and the reduction of the vegetative cycle of the vine. The grapes are ripening earlier compared to twenty years ago, with consequent advance of harvest operations. Literature finds improvement of wine quality with rising temperature at first, yet falling beyond a certain threshold, depending on variety. This corresponds with a shift in the area best suitable for grapevine cultivation either to higher elevations or to higher latitudes.

Adaptation turning points and lessons

A farmer reaches an adaptation turning point the moment that wine quality drops below a desired quality or wine of a higher quality can be produced at a higher elevation. To assess whether and when this may happen the study used a modelling framework for investigating climate change impacts on viticulture in the Tuscany region (Moriondo *et al.*, 2011). Downscaled climate data (temperature, precipitation and CO_2 level from observations and the IPCC SRES scenarios A2 and B2 from different climate models) are input to a vintage quality model for climate change impact assessment. The vintage quality model uses a multi-regressive approach and vintage ratings obtained from the most recently published Sotheby's vintage ratings. The ratings are on a scale from 0 to 100, with the general categories of 0–39 disastrous, 40–59 very bad, 60–69 disappointing, 70–79 average to good, 80–89 good to very good, 90–100 excellent to superb.

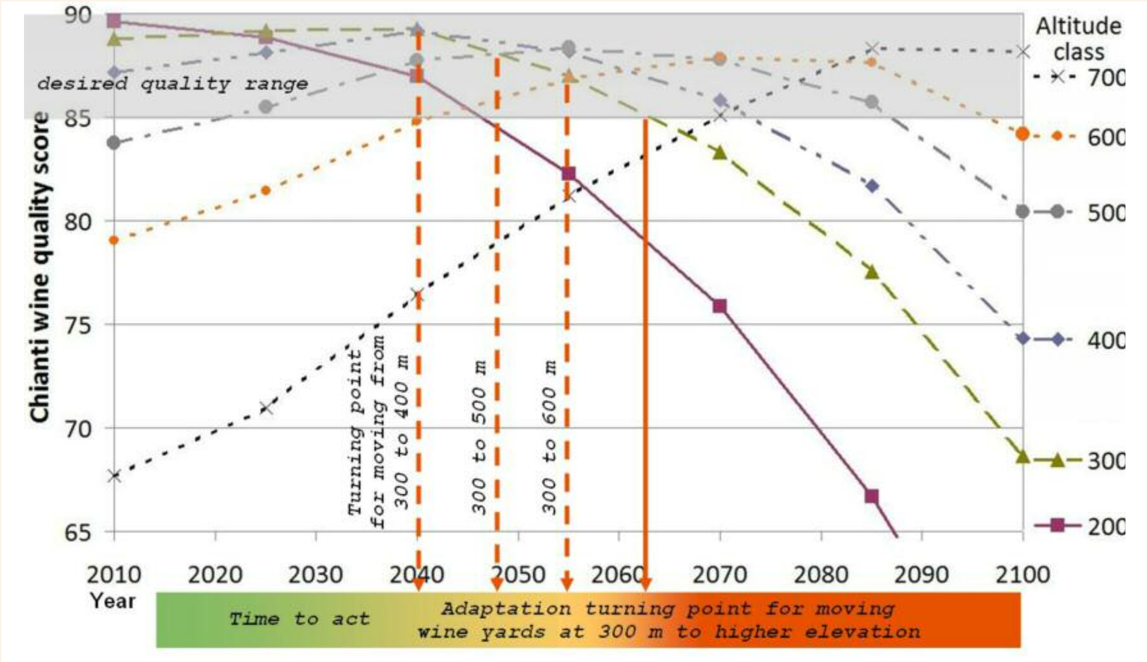

Figure 4: Adaptation turning point for Chianti production in Tuscany. The figure shows quality scores in different elevation classes (average of four climate models (DMI-HIRHAM, ETHZ-CLM, MPI-M-REMO, SMHIRCA) for SRES scenario A2)).

Figure 4 shows that in the coming century the quality at higher altitudes is likely to surpass that of the lower altitudes. Best-quality grapevine production areas are projected to gradually move upwards. For the coming two decades the entire area between 200 and 500 m above sea level is projected to be viable for best-quality wine production above 85. Beyond 2045, grapevines in the lower altitude classes progressively move out of the desired quality range of 85, whilst grapevines above 500 m show an excellent quality score.

Figure 4 can also be used to identify turning points for viniculture to move to a higher altitude. For the altitude class of 300 m the figure shows that around 2040 it becomes attractive to move 100 m upwards. Higher altitudes become attractive progressively. Beyond 2060 quality at 300 m may drop below the desired quality score of 85, accentuating the need for adaptation .

The Tuscan analysis shows that turning points in wine cultivation may well occur in the second half of this century, depending on the location of the vineyards. Around the same time that present production may start to become unviable, the production at higher elevation becomes more attractive, opening up an avenue of adaptive action. Such an adaptive pathway will not be taken lightly and the decision will have to be studied in the light of many factors, including the existence of other options to adapt. Changing management practices can reduce the risk and postpone the time by which an adaptation turning point is reached. Yet, there is no guarantee that turning points can be avoided ultimately.

Concluding, the turning points studied for Tuscany were stakeholders motivated. The assessment and the illustrations produces were useful as a discussion tool, both for scientist trying to communicate their insights, and for decision-makers to explore an adaptation strategy.

Source: Moriondo et al (2011),
Werners et al (2012)

Discussion and Applicability

This section discusses how a focus on thresholds and turning points can meet information needs for policy making. The traditional view within science has often been that scientists should deliver their best possible projections to the decision process as detached specialist (c.f. Ravetz, 2006). This is reflected in the more typical process of adaptation planning, which begins with the generation of climate projections, then an analysis of their impacts and finally the design and assessment of options to adapt to those impacts. Many researchers consider this mode of science-policy interaction outdated. Recent studies have suggested that the process should be inverted and start from the adaptation problem in its decision context in order to satisfy information needs of decision-makers in the face of uncertainty (Cash *et al.*, 2006; Kwadijk *et al.*, 2010; Brown, 2011; Reeder and Ranger, 2011; Hanger *et al.*, 2013).

Tailoring scientific information to the problems to which it will be applied implies an exchange between information providers and users with the aim to support governance decisions. For information to be useful, it must have three broad characteristics (Cash *et al.*, 2003): salience, credibility and legitimacy. Salience means that the information is context-specific and relevant for the decision at hand. It entails ensuring that information provided is needed by those taking actions on it, and in a form that is understandable and can be acted on a timely manner. Credibility means that users perceive the information to be accurate, dependable and of high quality, while legitimacy means that the producers of information are seen to be politically unbiased and that they keep the users' interests in mind. Decision support for sustainability under climate change has the further difficulty of communicating deep uncertainty (Hallegatte *et al.*, 2012). This arises not only from uncertainty in scientific models or incomplete understanding of particular natural or societal processes, but also from the presence of multiple valid, and sometimes conflicting, ways of framing a problem.

The assessment of thresholds and adaptation turning points can produce information that is legitimate, salient and credible for decision-making. Salience is derived from focussing on actor concerns and in particular what actors define as unacceptable change. This allows actors to reframe and understand climate change in terms of pre-existing interests or policy competences (c.f. Termeer *et al.*, 2011). Salience is also supported by the work on adaptation pathways, which shows that the information is actionable and appropriate (even) in the face of deep uncertainty. Legitimacy stems from the central position that the concerns and values of actors take in the assessment. In addition legitimacy results from facilitating the discourse around potential changes in objectives and responsibilities (c.f. Adger *et al.*, 2013). Adaptation governance has an important role to play in the definition and renegotiation of rules and policy objectives untenable under climate change. Credibility results from combining bottom-up elicited social-political preferences with top-down impact projections to assess when and how likely it is that unacceptable conditions occur. It is also aided by the intensified efforts of researchers and policy-makers to coproduce knowledge that includes values and criteria from both communities (c.f. Cash *et al.*, 2006; Hanger *et al.*, 2013). Making this link between actor values, policy objectives and projections of global change is one of the most challenging aspects of the assessment (c.f. Offermans *et al.*, 2011) as multiple links often have to be considered and transient scenario runs at an appropriate scale are scarce. Thus there may be a trade-off between the complexity of the social-political concern (salience) and the accuracy and scientific rigor that can be achieved (credibility) as presently the impact of climate change on more complex social-ecological systems and policy objectives is poorly understood. Here the study of thresholds and adaptation turning points can help set the research agenda.

Conclusions

Climate change requires long-term planning in the face of uncertainty where conservation may no longer be the sustainable option. Thus, decision making has to shift its attention to adaptation and strengthening resilience in social-ecological systems.

Climate change becomes particularly relevant to decision makers in the specific situation where climate change induces policy failure and alternative strategies have to be considered. We call this situation an ‘adaptation turning point’.

The assessment of adaptation turning points provides an important entry point for a dialogue between science and policy about why people care, how much stress a system can absorb before an unacceptable situation is reached, when this is likely to happen, and what can be done. After projecting an adaptation turning point, actors need to search for new options.

The identification of turning points helps in mapping practical adaptation pathways that pull together information on available options and path-dependencies. These encourage taking the necessary short-term actions to sustain the current system, whilst keeping options open for planning longer-term activities and more fundamental system change that may be required depending on how time unfolds.

It is the combination of scientific underpinning and practical application that makes an assessment of adaptation turning points and adaptation pathways attractive for furthering adaptation.

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To find out more about the MEDIATION project, please visit:
http://mediation-project.eu/

For further information on the MEDIATION project: contact Rob Swart at
rob.swart@wur.nl

For further information on adaptation turning points: contact Saskia Werners at
saskia.werners@wur.nl

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