

CRITICAL REVIEW OF THE APPLICATION OF THE UKCIP SOCIOECONOMIC SCENARIOS: LESSONS LEARNT AND FUTURE DIRECTIONS

FINAL REPORT

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FOREWORD

By Megan Gawith and Alastair Brown, UKCIP

1. What are socioeconomic scenarios (SES) and why do we need them?

UKCIP was established in 1997 to help UK organisations assess how they might be affected by climate change so they could plan how to adapt. We provide tools, guidance and advice to researchers and stakeholders throughout the climate adaptation process, and help communicate and disseminate findings to a wide and varied audience. Core tools provided by the Programme include a set of climate change scenarios (currently UKCIP02), a set of socio-economic scenarios, a risk, uncertainty and decision making framework, and a methodology to cost the impacts of climate change.

Climate variability and change will not occur in isolation of social and economic factors. Our vulnerability to climatic changes and the way in which we choose to respond to it will be influenced to a large extent by the nature of the economic, social and technological world in which we live. In recognition of the importance of these socio-economic factors a set of socio-economic scenarios was produced by UKCIP in 2001 for use in regional and sector-specific impacts assessments to help users consider the nature of possible future societies and their likely effects on the severity of climate impacts.

2. Why was this critical review commissioned?

A 2005 review of UKCIP studies completed to date showed that only a handful had used the socioeconomic scenarios. Critically, where they had been applied, they were shown to have had a major effect on study results (West and Gawith, 2005). Recognising the importance of future socio-economic conditions in influencing vulnerability to future climate change, UKCIP resolved in its current work programme to reinvigorate interest in the socio-economic scenarios amongst stakeholders and researchers.

The socioeconomic scenarios are now also several years old. UKCIP sought advice from key experts in May 2007 on the validity and utility of its scenarios before embarking on this reinvigoration exercise. The meeting concluded that:

1. The axes on which UKCIP's socioeconomic scenarios are based remain valid and useful.
2. There is no obvious alternative to our scenarios.
3. Our scenarios should be refreshed, and be made relevant for climate vulnerability and adaptation assessments.
4. Any refreshment must be informed by an assessment of current gaps and user requirements.
5. Better guidance is required on how to use the scenarios.

UKCIP decided to continue to use the existing scenarios for the foreseeable future. However, we recognise there is a need to better understand how the existing scenarios have and haven't been used, and to identify difficulties that arose in their application. It was therefore agreed that we should:

- Conduct a critical review of the application of UKCIP's socio-economic scenarios
- Identify specific difficulties experienced in their application and make recommendations on how these difficulties could be overcome
- Identify reasons for limited use and identify options for promoting uptake
- Consider the type and form of socio-economic information that might be most useful for climate change vulnerability and adaptations assessments in future.

The present review was commissioned to provide some answers to these questions.

3. What's happening next?

The report is publically available from the UKCIP website. All contributors have also received individual copies.

UKCIP is revising the guidance it offers users on the application of socio-economic scenarios in the light of the report's findings, and considering its implications for the application and development of other UKCIP tools. The implications of these findings will be discussed with Defra.

We welcome any comments or insights you may wish to share on this work. To do so, please contact: alastair.brown@ukcip.org.uk or megan.gawith@ukcip.org.uk.

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EXECUTIVE SUMMARY

By Nick Hughes, KCL

1. Background to scenarios

Scenarios – internally consistent visions of the future - have been formally employed as tools for analysing the robustness of current plans and strategies, in a variety of formats and by a variety of users, since at least the early 1960s. A review of such studies reveals some important insights.

Scenarios can be used 'reactively'- allowing the user to prepare and be robust against possible external events which may be beyond their control. They can also be used 'proactively' allowing the user to identify opportunities to influence the future and shape it to be closer to their own priorities.

Effective scenarios clearly define the actors relevant to the system under study, their different intentions and their potential to influence the system in the future. This includes defining the actor who is the main user of the study, and that actor's own ability to effect change in the system, as this will influence the extent to which the scenarios can be used to assist with 'proactive' or 'reactive' decisions.

If scenarios are to consider the future effectively they must also be 'grounded' in present realities, and trace forward a plausible sequence of events from the present into the future. This grounding in presently evident factors ensures plausibility, and increases the likelihood of scenarios being accepted by potential users.

Scenarios can challenge pre-conceived ideas about the future; they can also help to re-build shared ideas about the future, improving understanding and communication between diverse actors.

2. Criticisms of the UKCIP SES

The existing UKCIP SES are based on a 2x2 axis which contrasts consumerist with community values, and autonomous with interdependent governance. Though this grid is effective in producing contrasting visions of the future, there are some drawbacks. First, ensuring a wide number of parameters fit within each scenario 'value space' results in slightly

caricatured visions of the future. Second, the scenarios are defined by high level drivers, but do not adequately define the activities and influence of different actors, making it less clear what role potential scenario users could play in the future. Third, the scenarios are not adequately 'grounded' in presently evident factors, in particular those policy and regulatory development frameworks which will be of great relevance to local authorities and other regional actors who are potential users of the scenarios.

The UKCIP guidance on the use of the SES provides a convincing account of how socioeconomic factors may change over the coming decades, and how these factors may interact with climate change impacts. However, it is not made completely clear what the exact purpose of using the scenarios is. One way of clarifying their purpose would be to define a 'focal question' which expresses the key question the scenarios were intended to help answer. A key dimension of this would be to define the extent to which the scenarios are intended to help users inform their own policies (ie those over which they have some control) with a view to making their activities more robust to the impacts of future climate changes.

The guidance also appears to exhibit some uncertainty on key aspects of scenario use. These include:

- whether to standardise all studies based on UKCIP supplied data to enhance opportunities for integrating results, or to allow or encourage regionally-specific elaboration;
- the extent to which adaptation should be considered;
- how important it is to use the full set – as opposed to a selected subset - of scenarios;
- how to integrate the SES with UKCIP's climate change scenarios.

These issues were largely unresolved in the SES report. However, with the benefit of several years experience in the application of the SES, it would now seem appropriate for UKCIP to provide more definitive guidance on these issues in future updates, in accordance with its main priorities.

3. Review of studies

A review of some of the studies which have used the SES, as well as some of those which did not, was conducted to analyse the role and effectiveness of the SES as an analytical tool within studies. This literature review was supplemented by a number of interviews with authors of some of the studies being reviewed. The key insights from both of these processes are combined and summarised here.

3.1 Benefits of using the SES

It emerged from the review that socioeconomic factors are widely understood to be highly relevant when considering future climate impacts, and that in many cases the promotion and use of the SES has encouraged and facilitated such considerations. One of the important socioeconomic issues to emerge from the studies, for instance, is the need for coordination between numerous regulatory bodies and actors, as the impacts of climate change will be felt across sectors and regulatory jurisdictions.

However, comparing studies which did and didn't use the SES, it appears that the extent of pre-existing interest and enthusiasm for scenarios within project teams, and in some cases the presence of UKCIP on the steering committees, were significant factors affecting whether or not the SES were actually used. This suggests that the SES have not yet proved themselves objectively to a wider audience.

Moreover, it is also the case that socioeconomic factors were considered in most of the studies that did not use the UKCIP SES, many of them delivering clear and practical policy recommendations with reference to key procedures such as Local Development Frameworks. Hence, while the SES seem in general to have contributed to raising awareness about the socioeconomic aspects of climate impacts, it is not clear that their actual use greatly improved the quality and relevance of the socioeconomic and policy output.

3.2 Difficulties of use and barriers to uptake

The lack of clarity about the precise function of the SES within the guidance document is reflected in several of the reports' which also lack clarity as to the precise function of scenarios. Few reports seem to have been able to derive practical insights from scenario work, as practical policy recommendations were rarely discussed in the context of the scenarios.

Several stakeholders observed that the scenarios did not appear to have a strong link to their own concerns, leading some to suggest that they were simply 'dreamt up' and with little relation to the 'real world'.

Another significant barrier was the perceived resource intensiveness of including socioeconomic scenarios, the added complications, and resulting distraction from project aims. For this reason several stakeholders wished to see 'off the shelf' scenarios which they could take and apply with minimal resources. A related reason given for not using the SES was that users considered them to be insufficiently regionally disaggregated to be relevant.

These comments suggests there is a tension to be resolved between providing 'off the shelf' scenarios, in which all data is available at a detailed regional scale, and providing higher level scenarios which users need to adapt to meet their own specific needs. UKCIP needs to establish where the balance between these tensions should lie, and clearly communicate its thinking in future publications.

3.3 Scales: national vs regional

Though the UKCIP scenario matrix includes an axis running between 'autonomy' and 'interdependence', the implications of these alternatives are not well explored by most studies. However, perhaps the biggest political impact on the options available to regional actors in developing their future strategies will be the extent to which various decision making areas become increasingly devolved, or return to the national government level. This will affect the agency of regional actors to take action to form and influence their futures.

Several of the studies undertook significant work in 'downscaling' and regionalising the scenarios to their own context, adding significant regional detail- but usually losing the representation of national level dynamics and the effect these could have on the regional level. These detailed studies also raise a further question for UKCIP- where they have added so much in terms of regionalisation to the initial scenarios, the value of what UKCIP has originally provided becomes less and less clear.

3.4 Values: community vs consumerism

The reduced emphasis on the governance axis tends to result in scenarios which are primarily contrasted along the values axis, which can result in an overly stereotypical contrast between 'green' and 'growth' archetypes. This has resulted in problems with the plausibility of the scenarios, as a natural response is that the future will contain elements of both, as does the present. Deriving scenarios from such high-level generic values can also miss the important step of 'grounding' the scenarios in presently existent and evident factors and policy trajectories.

3.5 Relationship of socioeconomic to climate change scenarios

UKCIP provided guidance on how to relate the socioeconomic scenarios to their climate change scenarios to help study teams use both sets of scenarios in their climate impacts assessments. However, the business of mapping one set of scenarios on to the other is complicated by the different levels of agency operating at global and local levels: regional actors may be able to take very influential action within their own regional context, but are less likely on their own to have a critical influence on the trajectory of global emissions. There is thus no self-evident or intrinsic link between actions taken at the regional level and at the global level. More specific guidance is therefore needed from UKCIP on how to link the socioeconomic and climate change scenarios. The approach to be taken could be clarified through the formulation of a clear 'focal question'.

3.6 Quantification

Most of the studies made some use of the quantitative information provided with the socioeconomic scenarios. Some used this information to compare economic impacts of different scenarios. This approach is potentially problematic as it attempts to combine a variety of different effects within a single figure – a figure which in itself is also highly dependent on a (somewhat speculative) projection of future GDP. Such precise cost figures may give a misleading impression of their accuracy (ie. they may appear to be more accurate than they really are) and draw the focus away from other less quantified but possibly more robust insights. A common complaint amongst studies that both did and didn't use the SES was that the quantitative data was not sufficiently regionally disaggregated. The BESEECH project did develop regionalised data but this has not yet been used sufficiently widely to evaluate whether this data was more useful.

3.7 Vulnerability, adaptation, agency

While the question of adaptation had not been explicitly part of the original aims for the SES, it is nonetheless evident that different socioeconomic scenarios show themselves to be more or less robust or vulnerable to future climate impacts than others. It would be possible to develop scenarios that explored the potential of decisions taken by regional users to increase or reduce their vulnerability to climate change. If this were a desired output of the scenario process, rather than just an observation of interest, the agency of different actors- and scenario users should be clearly defined.

3.8 Influence on outcomes

A combination of most of the above factors meant that on the whole the scenarios did not seem to influence the final policy recommendations of the study reports in any substantial way; in several of the scoping study reports, the socio-economic scenarios were not explicitly mentioned at all. This was not necessarily for want of pertinent policy recommendations in the reports in general; rather it seemed to be unclear how to use scenarios as strategic decision making tools linked into practical recommendations.

It was also notable that there was significant interest from interviewed stakeholders in approaches designed to identify actions which would enable users to adapt and be more robust to future climate change. However there was also some frustration that the scenarios did not seem to be providing a particularly useful way of achieving these practical aims, with some interviewees disclosing that although scenarios were used at the early stages of the project, their use had been discontinued by the final stages of the project.

4. Recommendations

On the basis of the review of a number of climate change impacts scoping studies, and interviews with study authors, this report makes the following recommendations:

4.1 Clearly define the aim of the process

A central recommendation from this review is that the aims and purpose for which UKCIP intends the SES to be used, should be more clearly and definitively articulated. A lack of clarity in the purpose of scenarios in general, and the UKCIP SES in particular, is a weakness of the guidance document. This has led to imprecise usage of the scenarios within regional studies. It may be useful to agree upon a clear 'focal question' to be the central purpose of scenario studies.

4.2 A stronger and more definitive guidance document

As well as defining more clearly the central aim of the scenario process, UKCIP should move towards clarifying certain methodological aspects of the guidance document which were left somewhat open in the 2000 version. The areas in which UKCIP will have to decide on its approach and give greater clarity are listed below.

Centrally driven consistency through added detail or user-devolved regionalisation

UKCIP should be clear about the extent to which it wishes to develop increased standardisation across studies for the purpose of integration and comparison, and the extent to which this will require UKCIP to provide more regionalised data. Alternatively it may be considered preferable to encourage users to regionalise the scenarios themselves- in which case this should be made explicit, and the required resource commitment from users emphasised (ie these would not be 'off the shelf' scenarios).

Quantification

The clarified aims, and decisions on the extent of standardisation and regionalisation within the scenarios, would determine which quantitative data would be most relevant to include in the UKCIP guidance. The data parameters should be carefully selected, with any parameters not strictly relevant to the refined aims and approaches being stripped out to improve methodological clarity.

Vulnerability, adaptation and agency

The extent to which highlighting policies of regional adaptation to future climate change is a key aim of the UKCIP SES also needs clarification. If this is taken to be a key aim, the

scenarios would significantly increase their usefulness with clear delineation of what elements of the future lie potentially within, or outside of the regional users' control.

Selection of scenarios and their relationship with the climate change scenarios

Greater clarity is required by users on whether it is acceptable to select a sub-set of the SES and how to combine these with the climate change scenarios. A clearer understanding of what factors are potentially within or outside of the users' control would again assist this, as regional users may have the potential to influence some socioeconomic factors, but their position in relation to globally driven climate change could be entirely reactive.

4.3 Supporting activities

More support should be made available to help users apply scenarios, particularly where they find the process somewhat complex and unfamiliar. A variety of support should be offered, and could include a 'best practice' study or training workshops.

4.4 Longer term possibilities

This report has observed certain weaknesses in the design of the current set of UKCIP socioeconomic scenarios. The most notable of these is that the 2x2 axis tends to produce an unrealistic polarisation of values within scenarios, and that is hard to 'ground' scenarios constrained by such axes to the kinds of policy concerns and other dynamics which stakeholders are conscious of in their current environment. At worst this approach results in the unfortunate assumption that the scenarios have very little to do with reality as it is perceived by stakeholders.

UKCIP may therefore wish to consider a more fundamental review and recast of the scenario set at some future point. Should it do so, wide stakeholder engagement would be a necessary part of the process to ensure the resultant scenarios are fully 'grounded' in the concerns of their prospective users.

Critical review of the application of the UKCIP socioeconomic scenarios: lessons learnt and future directions

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1. Introduction

The UK Climate Impacts Programme (UKCIP) commissioned King's College, London (KCL) to undertake a critical review of the application of the UKCIP Socioeconomic Scenarios (SES). The purpose of this review was to answer the following questions:

1. How were the UKCIP SES used in those studies that used them, and what lessons emerged through their application?
2. What specific difficulties were experienced in their application and how might such difficulties be overcome?
3. Why was there limited uptake of the scenarios, and how could greater uptake be encouraged?
4. What type of socioeconomic information and support should be available in future to support user-led climate change vulnerability and adaptation assessments?

As indicated in the project team's proposal to UKCIP, the work towards answering these questions was delivered in the following three stages.

1. A literature review of the studies listed in the Specification, resulting in an Interim Report, consequent to which the project team produced, in consultation with UKCIP, a questionnaire and list of interviewees (see Appendices A1 and A2), to address issues 2, 3 and 4 above.
2. A number of interviews with those who did, and did not, use the UKCIP SES.
3. A final Report integrating the insights from the literature review with the interview findings.

This document is the final report which integrates all stages in the process. Section 2 reviews briefly the historical background and context to the use of socioeconomic scenarios. Section 3 explores the aims and purpose of the UKCIP SES, while Section 4 critically reviews this scenario set and the accompanying guidance provided by UKCIP. Section 5 presents a review of several regional climate impact studies, comparing those that used the UKCIP SES with those that did not. Common themes emerging from the study analysis are discussed and analysed in Section 6. Section 7 introduces the interview process and presents a themed analysis of the findings. Section 8 draws out and integrates key points from both the interviews and the literature review and Section 9 offers some recommendations and suggestions for future directions.

2. Background to the use of socioeconomic scenarios

The use of scenarios as strategic planning tools has a long history, and the range of approaches and methodologies which have been used is extremely varied. This is undoubtedly a result of the range of different actors who have used a scenarios approach to guide their decision making, the range of objectives they have had in producing scenarios, as well as the very different kinds of resources available to them. Several authors have tried to impose order on this 'methodological chaos' (Martelli, 2001) by arranging the variety of approaches into scenario typologies (see for example McDowall and Eames, 2006; Bradfield *et al*, 2005). There is not space within this report to engage in such a detailed discussion and taxonomy. Nonetheless, even a very high level overview of previous scenario approaches does reveal some important common principles to the successful use of scenarios, which is what this section aims to deliver.

The imaginative depiction of an alternative society as a tool for critiquing present trends and problems is a feature of utopian literature (Plato's Republic, More's Utopia) as well as dystopian literature (Orwell's 1984, Huxley's Brave New World, Atwood's Handmaid's Tale). Such utopian and dystopian tendencies are also discernible in more academic scenario studies which are based on the extrapolation of presently discernible trends or problems to their 'logical conclusion'. However, as shown by the radically contrasting visions produced by studies such as the Club of Rome's Limits to Growth (Meadows *et al*, 1972), compared to for example Herman Kahn's The Next 200 Years (Kahn *et al*, 1977), the end point of such scenario exercises can be heavily influenced by the pre-existing world views or values, of those writing the scenarios.

A field with a very well established tradition of scenario planning is that of military strategy, where 'war games' are developed to simulate a range of possible situations and enemy strategies, in order to consider the robustness of resources and plans in a full range of possible situations- to be 'prepared for everything'. Herman Kahn took this approach into the civilian realm by publishing in 1960 On Thermonuclear War, a book which took a scenarios approach to the possibility of nuclear conflict, arguing that it was the responsibility of society to explore the various ways in which a nuclear conflict could come about, in order to be fully prepared for its outcomes- and that by having gone through this process society would be better prepared to mitigate those effects (Kahn, 1960).

Kahn was an influence on Pierre Wack, who whilst working within the planning department of Shell, was a key figure in one of the most well known and acclaimed scenario processes, through which the company negotiated the turbulent period of oil shocks during the 1970s (Wack, 1985a; Wack, 1985b). Wack used scenarios to highlight major approaching discontinuities which were not being acknowledged by company managers- thus for Wack a major function of scenarios was to challenge

the preconceptions, and broaden the 'mind maps' of managers, to enable them to achieve 'strategic insights beyond their previous minds' reach' (Wack, 1985a).

At the same time, a contrasting school of scenario studies had been in development in France, known as La Prospective. This interpreted the use of scenarios not only in a protective or reactive sense, but in proactive, normative sense. For Bertrand de Jouvenel, one of the movement's founders, the principle reason for studying the future is to bring 'the probable closer to the desirable' (de Jouvenel, 1967). La Prospective's approach has therefore been employed at national planning level, for the French government, as well as at the individual company level.

A more detailed discussion of all of the above approaches can be found in Bradfield *et al* (2005), Kleiner (1996) and Raskin (2008), which help to identify the differences in approach and philosophy between the various schools. For the purpose of the current report, however, it will suffice to highlight some key insights which are strongly reinforced across almost all scenario techniques.

First, it is clear that scenarios can be used in two ways- to take a proactive attitude to the future, or a reactive, protective approach to it. As Pierre Wack puts it, 'Scenarios serve two main purposes. The first is protective: anticipating and understanding risk. The second is entrepreneurial: discovering strategic options of which you were previously unaware.' (Wack, 1985b). It is entirely possible that a scenario set may be used in both ways- it may highlight things against which we must make ourselves robust, as well opportunities which we may act on if we so choose.

Second, crucial to understanding the balance and interplay between these two factors, is an understanding of the role of the various actors who through their own interests and motivations may influence the future. Michel Godet stresses that 'the actual future will be the outcome of the interplay between the various protagonists in a given situation and their various intentions' (Godet, 1987), and Pierre Wack emphasises that the strategic power of the early Shell scenarios came from understanding the evolving motivations of the key actors in the system: 'We began to study the characters on the stage and how they would behave as the drama unfolded' (Wack 1985a). Particularly crucial is understanding the role and location within the social system under study, of the actor who is the recipient and user of the scenario set. This actor has been quite different in the range of scenario studies- governments for Kahn and La Prospective, a company for Wack. A particularly important strategic benefit of defining very clearly the role and location of the scenario user, and its relations to other actors, is to understand which elements of a potential future are within or outside of the scenario user's control. Bertrand de Jouvenel divided elements of the future into those over which an actor had control ('masterable') and those over which the actor had no control ('dominating')- he also crucially pointed out that whether an element is dominating or masterable depends on the status of the actor

from whose perspective the future is being considered, and the other actors upon which it can exert influence. The clear definition of the motivations and inter-relationships of the various actors in the system is not only crucial to a plausible understanding of the potential dynamic evolution of the system, it is also vital to determining to what extent the scenario prompts 'reactive' or 'proactive' decision making from the scenario user in respect of the future.

Third, while it is frequently emphasised that scenarios are concerned with accounting for the numerous uncertainties of an unknowable future, the most successful scenario processes make it clear that a strategically useful view of the future is grounded in a detailed understanding of the present. From such a detailed understanding, including of existing actor relationships, and events already in motion, and through a logical exploration of their necessary consequences, it is possible to attain greater certainty about the future than is achieved by a process which focusses from the outset on a distant time horizon, and considers virtually everything to be possible. Whilst much of the future is uncertain, there are almost inevitably events which have taken place and are taking place now, which will have inevitable future consequences, to which we are therefore irrevocably committed. Wack compared this to someone who witnesses a heavy rainfall in the foothills of the Himalayas, near the source of the Ganges. 'With little doubt you know that something extraordinary will happen within two days at Rishikesh in the foothills of the Himalyas... You derive that knowledge not from gazing into a crystal ball but from simply recognising the future implications of a rainfall that has already occurred' (Wack, 1985a). This relation of the future scenario to the observed present also aided the acceptance of the scenarios by potential users. Wack found that persuading managers to take on board the insights of scenarios, particularly when they jarred with their established world views, was extremely challenging. However, he discovered that the process of 'grounding' the scenarios in aspects of the present which the managers knew and understood well, was a vital part of gaining their acceptance of the scenarios. Following this, the various different ways in which these aspects might develop into the future could be explored more freely. In general, Wack found it was vital to construct scenarios such that they appealed to managers' deepest concerns (Wack, 1985a).

Fourth, having broken down and challenged previous pre-conceptions, scenarios can also act as re-building tools. World views or mind maps are supported by a vocabulary which supports and reinforces belief in them. In order to assist the process of breaking down the old world view, a new set of terms, concepts and images is required. Scenarios can provide this, and sow the seeds of new, but commonly understood ways of looking at the world, which are vital to fostering understanding and cooperation between diverse and distributed actors (Wack, 1985b).

3. The aims and purpose of the UKCIP SES

While the relevance of socioeconomic factors to climate impacts, as well as the general usefulness of scenario approaches in considering future uncertainties, are discussed in some detail in the UKCIP SES guidance document (UKCIP, 2000), what is missing is a clear statement of purpose for the UKCIP SES themselves, with a precise elucidation of their aims and the kinds of questions they are intended to answer. This section represents the *current authors'* views on what the aims of the UKCIP SES *could be*, based on their understanding of the concerns elaborated within the UKCIP guidance document.

The UKCIP SES are designed to be a tool for use by authors of regional climate impact studies, as an additional input into these studies. The need for the consideration of socioeconomic factors in assessing potential future climate impact is explained by the assertion that 'different social and economic structures will affect sensitivity to climate change, as they affect the potential for response and adaptation' (UKCIP, 2000: ii). Therefore, 'studies to assess climate impacts suffer from serious weakness if by default they merely assume that the projected future climates will take place in a world with a society and economy similar to today' (UKCIP, 2000: i). In other words, the assertion is that climate impact studies need to consider socioeconomic factors, because if they do not the scope of the study will be limited and the results therefore incomplete or misleading. So the SES are intended as a supporting input - and, if the strength of the above assertions carries, a crucial one - into regional climate impact studies.

Some examples of the relevance of socioeconomic factors on climate impacts are given. They include the observations that:

- Flooding events may be worse if there is a larger population living on the flood plain as a result of planning decisions
- The effect of climate change on crop yields will depend on how many farmers have planted the crops, whether their farm income is dependent on that crop, in turn depending on agricultural subsidies, access to technology and so on. (UKCIP, 2000: ii)

These examples imply a range of different questions which could be the focus of a scenario-based investigation. The first implies a question relating to how changes in socioeconomic factors (in this case housing developments) will exacerbate any physical climate change related impacts that are expected to occur. The second involves a similar question of how farmers' practices will exacerbate climate impacts on crops; but also in return on how the impacts will affect crop yield, which becomes again a socioeconomic issue. Thus, these examples imply an interest both in how socioeconomics

affect climate impacts, and how climate impacts affect socioeconomics. The examples also imply questions about adaptation- the agricultural example raises the possibility of available technologies reducing impact; the socioeconomic context will have affected how many of these technologies are developed (whether society has allowed the development of GM crops, for example). The flooding example indicates that while the socioeconomic aggravator could increase the damage of the climate impact, it therefore follows that different kinds of socioeconomic development (presciently or otherwise) may *reduce* the damage experienced from climate impacts.

The above examples alone present at least four possible kinds of question:

1. How will socioeconomic factors exacerbate or reduce the regional impacts of climate change?
2. How will socioeconomic factors affect the adaptive capability of society to certain climate impacts?
3. How will climate impacts affect socioeconomic conditions?
4. What appropriate measures might be taken to bring about socioeconomic conditions that are less vulnerable and / or have a greater adaptive capacity?

All of these are quite different questions, which could imply quite different uses for socioeconomic scenarios and therefore different approaches in developing and generating them, as indicated by the range of different approaches briefly reviewed in Section 2. Any of these contrasting questions could be interpreted as being the main purpose of a SES-based exercise, yet none are *explicitly identified* as such within the UKCIP guidance document. This may lead to a lack of clarity as to the precise function and purpose of the scenarios.

3.1 The Focal Question

The scenario approach developed by Shell suggests that it can be useful to define a 'focal question' for a scenario process (Shell, 2003). This has the advantage of clarifying exactly what question the process is intended to try to answer. It is often also important in that it identifies the scenario user- the person or actors that are using the scenarios as an aid to answering the question. Understanding with clarity the identity of the 'scenario user' can become particularly relevant if scenarios are to be used to inform proactive decision making, as well as reactive capability. This is because if an actor is considered to be able to influence the future in any way it is vital to understand what factors will be inside and outside of that actor's control, in different future contexts. For example, the agency of a local authority will be quite different to that of a national level regulatory body, and would vary depending on assumptions relating to the extent of its powers in different future scenarios.

The UKCIP SES guidance document explores in some detail the characteristics both of socioeconomic scenarios themselves, and of the extent of uncertainty pertaining to considering the future evolution of socioeconomic factors. It also makes the case that the impacts of future climate change will be experienced by a different socioeconomic system to the present one, and that therefore crucial to understanding the extent of possible future climate change related impacts, is understanding the range of possible socioeconomic conditions in which they could take place. Depending on how these impacts were measured, these could be purely a question of how socioeconomic factors exacerbate physical stresses (if they are measured in terms of expected physical impacts), or they could also be considered in terms of how physical impacts rebound onto socioeconomic conditions (if damages are measured in terms of economic losses). There is also an apparent interest in how different socioeconomic conditions would affect the ability of society in general to respond and adapt to climate change (because of available technology, wealth or generic behavioural aspects), as well as how different socioeconomic conditions would affect the ability of specific regional actors to respond and adapt to climate change (because of different regional governance arrangements, or extents to which power is devolved from central government).

The above discussion suggests four possible focal questions which could be expressed in respect of the use of the UKCIP SES:

1. How are the impacts of climate change different across the socioeconomic scenarios, measured in terms of:
 - a. (exacerbated) physical impacts on the environment?
 - b. 'rebounded' effects of these physical impacts upon the economy?
2. How do the different socioeconomic contexts of the scenarios affect the general ability of society to respond to the physical impacts of climate change?
3. How do the different socioeconomic contexts expressed by the scenarios affect the ability of specific regional actors ('scenario users') to respond to physical impacts?
4. How might the different scenarios affect the kind of decisions regional actors should be taking now, in order to plan for and potentially influence the future?

The questions expressed here become increasingly complex, particularly as they imply several points of potential feedback, where one possible change drives another. Nonetheless, all of these issues are present in the suggestions of the UKCIP guidance as to why scenarios might be useful. Sections 5, 6, and 7, through reviewing studies that have used the scenarios and reporting interviews with study authors, will identify which issues were in fact explored within the studies, and which kinds of issues users and authors would be interested in exploring in the future.

4. Generation, structure and presentation of the UKCIP SES

Before reviewing the regional climate impact studies that have used the UKCIP SES, as well as those that chose not to, a brief review of the UKCIP SES themselves will be conducted, and some issues raised based on the insights from the broader review of the scenarios literature in Section 2. First, a brief recapitulation will be made of the origins of the UKCIP SES and the scenario-generating techniques on which they are based. Following this, some broad and high level comments are made on the structure and presentation of the scenarios, with suggestions as to why certain aspects of this may cause problems to potential scenario users, and barriers to uptake.

As acknowledged in the publication itself, the UKCIP SES have a clear lineage from the IPCC's Special Report on Emissions Scenarios (SRES) (IPCC, 2000), and those developed under the DTI's Foresight Programme (OST-DTI, 2001). The IPCC's Emissions Scenarios were produced in order to provide coherent and consistent inputs to climate impact models. It was acknowledged that future levels of Greenhouse Gas emissions will be highly dependent on the character and extent of human industrial activity. Thus scenarios were developed which characterised future socioeconomic structures, and hypothesised the emissions levels that would be associated with them. The scenarios therefore allow the uncertainty ranges inherent in modelling future climate impacts to be grouped to a certain extent according to the kinds of societies which may be associated with producing them, which may be interpreted as departures or otherwise from current trends. It should be acknowledged therefore that the intentions of this scenario process are somewhat specific. The future societies are taken as 'given'- they are assumed to have evolved in order to generate a contrasting set of emissions outputs. Significantly less attention is given to how these societies might plausibly evolve from current conditions, as this is clearly not their focus.

The SRES derives its key scenario drivers from the functional relationships of the KAYA identity¹, which identifies the key drivers to emissions as population, economic growth, and technological development. A 2x2 axis is derived in order to accommodate different permutations of these key drivers, which results in the axis of 'economic-environmental' being contrasted with 'global-regional' (IPCC, 2000). The approach combines the two sets of variables and essentially derives scenarios by combining the extreme ends of the axes.

The Foresight scenario set inherits a similar approach to structuring its scenarios. A 2x2 axis is created from the contrasting drivers of autonomous vs. interdependent governance, and consumerist vs. community values. This creates four 'value spaces'- these are spaces defined by the combinations of two sets of values, which create a unifying 'world view' which each aspect in the scenario must

¹ CO2 emissions = Population * GDP/capita * Energy/GDP * CO2 emissions/unit energy

reflect. While these scenarios are understood to have evolved from the present, there is still fairly minimal attention to understanding how this could plausibly happen. Rather each scenario is constructed to fit into this predefined 'value space', which is assumed to be dominant and all pervasive at some given point in the future.

The UKCIP SES are very close cousins of the Foresight scenarios: they exist within the same value spaces on the same 2x2 axis, and are indeed known by the same names. The additional aspects of the UKCIP SES are that the implications of the value space of each scenario have been followed through to be interpreted at the regional scale, in terms of biodiversity, housing, transport infrastructure, water management, and other physically visible components of the regional scale. Also, the UKCIP SES are accompanied by a fairly extensive set of quantitative indicators- these interpret the potential impacts of the four value spaces on GDP, population, planning, land use, water use, biodiversity, and coastal zone management. These indicators are derived using intuitive judgements about the extent to which the four value spaces would imply deviation from current trends in each of the areas considered.

4.1 Critique of the structure of the UKCIP SES

The UKCIP SES are effective in providing contrasting, yet internally consistent archetypes of future societies, which help to challenge conventional wisdom, or default expectations that future societies will be much like the present, and to stimulate imaginative thinking about the different kinds of socioeconomic factors which could alter the effects of climate impacts. However, in the context of the wider scenario tradition, reviewed in Section 2, and bearing in mind the full range of possible focal questions identified in Section 3.1, possible criticisms could be raised relating to the usefulness of the scenario set for strategic policy planning. Whether such criticisms are felt to be valid depends on the aim of the scenarios which are ultimately decided upon. The criticisms fall into three areas.

First, the broad value spaces which provide the underpinning for each scenario, whilst seeming to offer plausible and coherent backdrops for storylines about future societies, risk falling into slightly caricatured visions of the future. The idea of using a combination of values to make a description of the future 'coherent' must be balanced against a recognition that the world is never a particularly coherent place, and a variety of actors could always act in quite conflicting ways with contrasting motivations for doing so. Thus the frequent reference in National Enterprise to private education and low welfare provision is not an inherently necessary outcome of the combination of autonomy and consumerism, and neither is the universal public funded education and high welfare provision in Global Sustainability and Local Stewardship a necessary outcome of the relevant drivers in each case. Rather than these possible futures growing out of trends which can be already perceived, they are arguably constructed to fit into predetermined utopian or dystopian paradigms.

Second, they are derived at a high level, but as they consider the values on which they are defined to be 'all pervasive' throughout the society, they do not adequately define levels and respective spheres of agency of the various actors. The responsibilities of management of regional issues are not explored. These can sometimes be extremely complex and involve many different actors. For example management of coastal areas may involve in different ways, the Local Authority, the Environment Agency, the Department for Transport, BERR, Defra, and Natural England. In the UKCIP scenarios, a society is constructed to fit in with a unifying, guiding ethos, rather than by understanding the combinations of dynamic actor interactions by which events and situations are brought about. In reality the world is a mass of conflicting actor motivations. We are not united by shared values, rather we must negotiate and live with conflicting ones.

Third, they do not emerge from currently evident forces, which are of relevance to the scenario users. This misses an opportunity to 'ground' the scenarios in the kinds of aspects which are perceived to be of greatest concern and relevance to regional actors. For example, the UKCIP document observes that the Regional Planning Guidance (RPG) framework will be playing out over a time frame similar to that of the scenarios (UKCIP, 2000: 76). It is therefore suggested that it could be used to produce an additional 'conventional wisdom' scenario. However, this is the kind of driver which could usefully be a fundamental aspect of *each* of the scenarios- with each one taking a different view as to how the framework could develop, and what kinds of different implications it might have for regional actors. This would 'root' the scenarios within processes the local actors could more instinctively relate to, encourage engagement and create a better understanding of the kind of implications that they might derive from the scenarios.

4.2 Critique of UKCIP's guidance on how to use the SES

This section in the UKCIP SES report aims to provide some guidance on the use of the scenarios. The discussion addresses a debate about the balance between the need for consistency between different regional studies, and the extent to which users will need to adapt the scenarios to make them relevant to their own situation. UKCIP was established to provide an integrated assessment of the impacts of climate change on the UK. Common sets of socioeconomic and climate information were provided to ensure that regionally focussed studies can be comparable over a common set of assumptions, in order that the various regional studies can be brought together to provide, as a whole, coherent pictures of how the UK will be affected by future climate changes. It was recognised that each regional or sectoral study will have its own particular area of interest, so the factors which are focussed on in most detail may be quite different between the studies. The SES guidance states:

The research team carrying out a sectoral or regional study, by virtue of its expertise, will be best placed to develop detailed scenarios... the framework scenarios should not be used as a blueprint, but as a starting point to promote consistency across a range of climate impact studies and provide the basis for synthesising the results. (UKCIP, 2000: 67)

There is thus a delicate balance to be struck between ensuring comparability between scenarios, and allowing for the fact that in order to be effective and informative in their right, individual studies must be allowed (and encouraged) to develop scenarios which reflect their own interests and concerns. A comment from the Wales team emphasises that each study needs to identify elements of the future which are most relevant to its particular concerns:

In the case of agriculture the trajectory of changes to the CAP, consumers attitudes to GMOs and organic farming are likely to affect their response to climate change much more than economic growth or income distributional issues. (UKCIP, 2000: 69)

The guidance reports that some studies have found the scenarios good for sparking discussion on broad 'macro level' issues, but less good for more detailed regional work.

It may be that if the various regional studies were to prioritise their attention on the aspects of most relevance to them in this way, that the resulting studies would lose something of the overall comparability which is one of the main priorities of UKCIP. It is worth noting however that many scenario practitioners would argue that in order to be strategically useful, scenarios must have a point of view: that is, they must identify the key priorities of the scenario 'user', and identify the potential room for manoeuvre of that particular actor within various future contexts. The balance between these two potentially competing imperatives may be difficult to strike, but it is likely to be an issue over which UKCIP will have to take a more definite position for the sake of the clarity of guidance it gives to users.

This also relates to quantification. The document describes the substantial effort put into developing a set of quantitative indicators to be applied to the scenarios, and to serve as an additional unifying basis within regional studies. However, the guidance notes that for some users the quantitative indicators are obstacles to engagement with the 'more important' qualitative elements of the scenarios. It also notes that additional quantitative indicator needs may be highly specific to certain regional scenarios, before acknowledging:

From the perspective of UKCIP, ideally one set of indicators should be provided and be available for studies. This approach is clearly impracticable, and therefore it is vital that there is transparency and

openness in the derivation of the indicator values so that when studies are integrated, the possible causes for variation in results can be seen. (UKCIP, 2001: 72)

It should also be noted however, that the prospects both for comparing the quantitative outputs of a range of studies, as well as providing a generically applicable set of indicators, are potentially hampered by the absence of a clear central purpose for all studies. For example, referring again to the focal questions outlined in Section 3.1, it is clear that a study based on question 1a, would be quite different in terms of its quantitative indicator requirements as well as its quantitative outputs, to one based on question 1b.

The question of adaptation is also discussed; although once again while the complexity of the issues is emphasised, a clear approach is not made apparent. The section starts with a clear statement that adaptation should not be a factor considered within the scenarios:

In order to identify what the impacts of climate change might be, it is not appropriate to take account of response to climate change within the socioeconomic scenarios (UKCIP, 2001: 75)

However in the following paragraph this is immediately demonstrated to be a somewhat artificial separation. The scenarios are inevitably full of socioeconomic developments which have significant effects on the adaptability of the environment to climate impacts, thus any development which reduces impact would correctly be viewed, if it was on that basis adopted as policy, as an adaptive measure. The process of creating socioeconomic scenarios which are expected to demonstrate societies which have different degrees of vulnerability to climate impacts is in this way inherently linked to the question of adaptation- the scenarios immediately suggest adaptive measures.

The guidance also includes a section on selection of scenarios. It accepts that if both socioeconomic and climate scenarios, to timeframes of both 2020 and 2050, are combined without selection, they could result in an unmanageable number (32) of scenarios. It also accepts that resources available for developing the SES may be limited. In the event that it is not possible for resource reasons to develop all four SES to some extent, the report suggests selecting two diagonally opposed (in the context of the 2x2 grid) scenarios. The possibility of selection of just two of the four scenarios is clearly problematic. First, it means that the analysis will not cover the full 'possibility space' (UKCIP, 2001: 19), and may risk scenarios that are overly contrasted by means of one of the axes, rather than both. Second, once again it compromises UKCIP's stated aim of encouraging reports which are comparable in that they are based on common sets of information. Again, the guidance might be faulted for over-emphasising the potential complexity of the issues, without providing decisive messages as to UKCIP's chosen approach.

The question of integrating the socioeconomic with the climate scenarios is also explored, with possible combinations for 'consistent' or 'sensitivity analysis' approaches detailed in table 3.2 (UKCIP, 2001: 75). This issue is again complex, as the socioeconomic scenarios are intended to penetrate to a specific regional level, whereas greenhouse gas emissions are the result of activities aggregated at the global level. It is entirely plausible that activities at the two scales could be entirely contrasting. Again, the guidance is not definitive; however it may be that with the benefit of experience a more definitive UKCIP policy could be arrived at, for the benefit of consistency across studies.

In general, this guidance section provides an exploratory discussion of the problems and challenges experienced with early attempts to apply the scenarios. It emphasises the considerable complexities involved, however it does little to provide clear and definitive guidance to potential users on how such complexities should be resolved- which it would be thought would be a crucial step towards achieving the required level of standardisation and cross-comparability which is one of UKCIP's main objectives. The exploratory nature of the discussion is understandable given that at the time this guidance was written, the SES programme was still in its early stages. However, with the benefit of the experience of several years of application of the SES, it would seem appropriate for any new publication in which the scenarios were featured to be somewhat more conclusive where questions of application arise. This would be likely to be of greater use to potential scenario users, and promote greater consistency and comparability across studies.

5. Critical review of selected UKCIP studies

5.1 Critical review of studies which used the UKCIP SES

This section reviews those regional climate impact studies which made some use of, or reference to, the UKCIP SES. Studies included in the review are listed in Table 1 below. A more detailed analysis of common issues emerging from analysis of the study reports is reserved for Section 6.

Table 1: List of studies reviewed which have used the UKCIP SES

<i>Title</i>	<i>Reference</i>	<i>Sponsor</i>
REGIS: Regional Climate Impact and Response Studies in East Anglia and North West England	Holman <i>et al</i> (2002)	DEFRA / DETR / UK Water Research Ltd / UKCIP
Simulating the effects of future climate and socio-economic change in East Anglia and North West England: the RegIS2 Project	Holman <i>et al</i> (2007)	DEFRA / UK Water Research Ltd / UKCIP
Climate proofing rural resource protection policies and strategies in Wales	Edwards-Jones <i>et al</i> (2007)	Environment Agency
Defra Research Contract: Climate Change Impacts and Adaptation- Cross Regional Research Programme (Project C- Water)	Wade <i>et al</i> (2006)	DEFRA
London's warming : The impacts of Climate Change on London	ENTEC (2002)	The London Climate Change Partnership
The Potential Impact of Climate Change in the West Midlands	ENTEC (2003)	Sustainability West Midlands
The Isle of Man Climate Change Scoping Study	Metroeconomica (2006a; 2006b)	The Government of the Isle of Man
Foresight Future Flooding	Foresight (2004)	Office of Science and Technology
Climate Change and its Effects on Small Businesses in the UK	Crichton (2006)	Axa Insurance
Climate change and the visitor economy	McEvoy <i>et al</i> (2006)	Sustainability North West and UKCIP
Building Economic and Social Information for Examining the Effects of Climate Change (BESEECH)	Dahlström and Salmons (2005)	UKCIP / EPSRC

The first step in the Regis approach is to reduce the four UKCIP SES into two scenarios which combine socioeconomic aspects with levels of climate change. The two socioeconomic scenarios selected are 'Regional Enterprise' and 'Global Sustainability'. This selection results in a contrast between a world view which has high environmental priorities and 'community' social values, and one which is individualistic and market driven. It is assumed that the former involves more regulation, while the latter is more 'laissez faire' in this respect. This selection of scenarios therefore results in the principle contrast being about dominant social values, which make legislation and regulation to protect resources, more or less publically acceptable. The different kinds of possible governance structures, such as national level led compared with devolved administrations, are less clearly explored. The two scenarios are also associated with an 'appropriate' range of greenhouse gas emissions- Regional Enterprise with high emissions; Global Sustainability with low emissions.

The UKCIP climate scenarios are used to identify the possible physical climate impacts applying to the region under different extents of emissions. The different socioeconomic contexts are then applied, considering how these will exacerbate or improve the problems. For example under Regional Enterprise, in East Anglia significant growth drives development around urban centres, increasing pressure on water abstraction in these areas. By contrast under Global Sustainability, the more environmentally aware society is assumed to be better at conserving water and using it more efficiently. In the North West under this scenario low intensity farming and subsidies preserve the special landscape character of scenic landscapes, whereas under Regional Enterprise more of these landscapes would be lost as the economic focus of the region shifts to the southern industrial areas.

This approach provides some means to adding socioeconomic stresses to those derived from climate change. The majority of the impacts discussed however can be described as either climate or socioeconomic impacts, rather than the one seen through the lens of the other. Some useful information on the potential extent of coastal and river flooding, as well as impacts on agriculture, are derived from the climate scenarios. The socioeconomic impacts are related to changes in cropping patterns due to the expected decline in competitiveness of dairy farming (under both scenarios)- but these are not apparently linked to climate change impacts. Similarly biodiversity impacts are considered to be primarily a function of the scenarios' contrasting attitudes to the natural environment, as are approaches to coastal management. Whilst this seems intuitive, it might be argued that the avoidance of the question of regional-actor agency makes the scenarios seem somewhat fatalistic. It may be possible to imagine futures in which such attitudes are on average more or less prevalent, the responsibility for conservation of Sites of Special Scientific Interest or coastlines, lies with a number of local and national level agencies. In a time of average national apathy to biodiversity, it might still

be possible for a local authority to make its position much more active. Scenarios which generalise some notion of the average commitment to such issues therefore diminish the agency of local actors, who dependent on the extent of their devolved powers, may have the ability to make their own judgements on such issues.

The integration with socioeconomic factors takes place with an assessment of the potential cost of damages from flooding- £580 million per year in the North West, £950 million per year in East Anglia, in the Regional Enterprise scenario. These figures are derived in part from the assumption of increased urban development under this scenario, but also simply from the fact that RE is a high emissions scenario.

Regis 2 provides a 'user friendly tool' for the use of the climate and socioeconomic scenarios. It reinstates all four UKCIP SES, though with National Enterprise remaining renamed as Regional Enterprise, and Local Stewardship renamed as Regional Stewardship. Although both scenarios are at the 'autonomy' end of the governance axis, it must be acknowledged that this renaming removes quite an important distinction between the two original scenarios, that between a dominant, top down national level government, and a more devolved system with a greater power for regions and local authorities. As World markets becomes Global Markets, presumably to provide a greater symmetry with the final scenario, Global Sustainability, which retains its original name, this scenario set seems to move more towards a contrast of two pairs, which are split most fundamentally along the 'values' axis, in their approaches to conservation and social welfare, compared to market based growth, rather than a comparison of four equally contrasting scenarios. This 'pairing' becomes evident in the discussion of the scenarios' impacts on various sectors, as impacts and drivers are frequently discussed as pertaining in equal measure to 'Regional Enterprise and Global Markets' scenarios, or to 'Global Sustainability and Regional Stewardship' scenarios.

The Regis 2 tool is able to combine socioeconomic indicators with different levels of climate impacts, through assumed extrapolations of key indicators such as economic and population growth, energy and water demand, based on deviating one way or another from a 'business as usual' trend. In so doing it acknowledges that it may not necessarily be justified to associate a regional socioeconomic scenario with a particular globally driven climate change scenario, and enables the user to match up different socioeconomic outcomes with the range of climate impacts.

The study raises some important issues about competition for scarce resources under different future scenarios with different priorities. For example, although water demand for human populations is reduced under Global Sustainability and Regional Stewardship, because of the high environmental

values of these scenarios, abstraction is restricted to protect the river ecology, leading to a water deficit still being present in these scenarios.

Climate proofing rural resource protection policies and strategies in Wales (Edwards-Jones et al, 2007)

As it suggests, the intention of this report is to consider the robustness of six sets of policies and strategies to increasing climate change as it will be manifested in Wales. The report is highly detailed in its consideration of the natural impacts of a changing climate in these policy areas, using data from the UKCIP climate scenarios to model processes at a very high resolution. For example, in its discussion of policies relating to Sites of Special Scientific Interest (SSSIs) the report investigates specific kinds of natural habitats which may become unsupportable of certain species yet more amenable to others, and considers habitat management through means such as corridors, stepping stones and islands. It concludes that SSSI policy is currently too fixed in its classification of sites and species, and will need to take a more flexible view of the natural environment in Wales, as habitats become irrevocably altered. A significant policy recommendation is that 'it will be necessary for the EU, governments, society, experts and the public to move away from valuing certain characteristic species above all else, and start to learn to value collections of species characteristic of certain habitats. Such a shift in policy and public attitude is unlikely to occur to quickly or easily' (Edwards-Jones *et al*, 2007: 52). What is perhaps interesting for the current review is that this insight is not set against or interpreted within the context of the socioeconomic scenarios, particularly as this is precisely the kind of iterative social and political process of change which scenarios are well placed to explore, and to understand the pathways towards.

The socioeconomic aspects of the scenarios are included usually in terms of how different practices may or may not exacerbate the physical effects of climate change. For example, 'under the scenario of National Enterprise lowland raised bogs have a high vulnerability as they are likely to decrease in abundance across Wales, and at the same time they are highly vulnerable to summer drought and changes in nutrient dynamics' (Edwards-Jones *et al*, 2007: 42). Similarly, in a future situation 'where society decides that it would rather have more land in production than in conservation... habitats like broadleaved woodland and lowland meadows, which in themselves may not be under great threat from climate change, would become vulnerable to conversion to other land uses...' (Edwards-Jones *et al*, 2007: 56).

While the logic of such hypothetical speculations is essentially sound, given the stated assumptions, it is unclear what policy recommendations would fall out of them. This kind of approach considers climate and socioeconomic dynamics as separate consecutive impacts upon the environment, the

presence of one exacerbating the impact of the other on any given environmental 'receptor'. This model however portrays both factors as equally autonomous and uncontrollable. However, the element of regional actor agency is significantly different in relation to each variable, and this makes a crucial difference in the interpretation of the scenarios. Rather than a purely exogenous element, the socioeconomic context could be seen as something which has the potential to be actively moulded precisely in order to mitigate, rather than exacerbate, the physical effects of climate change. Elements such as the extent to which 'society' will wish to preserve lowland raised bogs, or to which it will adapt to a more flexible valuation of 'collections of species', rather than certain 'characteristic species', are not impending trends which will be imposed exogenously. Rather these are choices which will be made as a result of the combination of actions of a number of relevant actors, of which the potential users of scenario studies such as those reviewed in this paper, would be not least. This aspect of agency is somewhat different to that of globally driven climate change, which from the point of view of regional actors, would reasonably be seen as an exogenously driven impending trend, over which no control can be exercised.

The report makes strong recommendations regarding the importance of coordination of numerous actors from different levels as a means to responding to climate impacts, emphasising the need for 'integrating nature conservation, spatial planning, forestry and agricultural policy together as an integrated land use and landscape policy' (Edwards-Jones *et al*, 2007: 59), and for corresponding dialogue between 'stakeholders and institutions from within the UK and across the EU' (Edwards-Jones *et al*, 2007: 62). The final section on Policy Interactions and Recommendations states that 'Responses to climate change and sustainable development require a greater integration of policies and more joined-up government. However, it may be difficult to bring about real change in policy development and implementation if existing institutions do not have the power or the will to bring about change' (Edwards-Jones *et al*, 2007: 176).

What is notable about these highly pertinent points is that they are not set in the context of the scenarios, neither are the scenarios used to interpret their plausibility. There seems to be a disconnect between the use of scenarios as vehicles of hypothetical speculation as to the impacts of a number of simultaneous factors, and any process of practical policy recommendations and action.

Defra Research Contract: Climate Change Impacts and Adaptation- Cross Regional Research Programme (Project C- Water) (Wade et al, 2006)

This report focusses on whether socioeconomic factors will add additional stress to the natural system, most notably in terms of their effect on a potential 'water deficit', where demand overtakes supply. This is largely interpreted in terms of how socioeconomic drivers could increase water

demand: 'Depending on the choice of scenario, socioeconomic change may result in large increases or large decreases in the demand for water due to changes in population, Gross Domestic Product (GDP), uptake of water saving technology, leakage control and social attitudes towards water use and the environment' (Wade *et al*, 2006: 3). The translation of these factors into quantitative indicators appropriate to each scenario gives water demand profiles, which can be combined with availability profiles based on climate impact data. This produces a number of alternative scenarios in which the stress on water supply is more or less acute.

Recommendations from this study are mainly of a technical nature- concerning metering, efficiency, improvements in technology, water harvesting, etc. These suggestions are all clearly driven by the potential stresses identified in the combined socioeconomic and climate impact scenario work. The socioeconomic scenarios are used to provide a plausible basis for hypothesising the extent to which water demand could grow, in the context of what are considered consistent climate change scenarios. Thus the scenarios provide a range of possible water deficits for which planners should be prepared. Recommendations do not however suggest whether aspects inherent within any of the scenarios, being particularly conducive to water saving, should be pursued as a policy objective.

London's warming : The impacts of Climate Change on London (ENTEC, 2002)

This study again provides significant and detailed descriptions of potential physical impacts on the study region, relating to the UKCIP climate scenarios. The use of socioeconomic scenarios in this project proceeds from the set of four adapted by the Regis 2 project. It then chooses two of them, Global Markets and Regional Sustainability, for further analysis. This selection of two scenarios provides clear contrasting socioeconomic contexts within which to consider future climate impacts. This is in many ways a strength, as it allows a highly detailed exploration of the different aspects which each kind of future could involve. For example, in the built environment GM sees greater air conditioning demand and more high rise buildings, whereas RS sees more green spaces; in the domestic sector flood risk is greater under GM due to increased development; lifestyle differences see greater energy consumption in general under GM. The intention to contextual detail is so great that for some indicators it is not always entirely clear whether a strong link to climate adaptation is intended- for example it is indicated that in GM there will be more private funding of education.

Whilst the detailed exploration of a number of varied socioeconomic factors is a strength of this study, it might be argued that the selection of just two scenarios results in a tendency to characterise them according to a somewhat simplistic contrast between 'green' and 'growth'. The issue of different spatial levels of governance, represented by the vertical axis in the 2x2 grid, is less well explored.

The possible drawbacks of scenarios which are defined by such diametrically opposing values are noted within the report itself. It was found that during workshops, stakeholders instinctively showed a 'proclivity to brand GM as 'bad' and RS as 'good" (ENTEC, 2002: 100). Further, a later discussion in the report identifies that elements which might be associated with both GM and RS are already present within the Draft London Plan. It is clear that the priorities of London's policy makers would be for a combination of the two scenarios. This raises a question as to how useful such 'polarised' scenarios are, if their emphasis on contrast does not appear to take account of factors which are already under development.

The Potential Impact of Climate Change in the West Midlands (ENTEC, 2003)

This study, also carried out by the consultancy ENTEC, is of a very similar structure and approach to the London's Warming study. It also selects two scenarios for analysis, though it selects the equivalents from the original UKCIP grid, Local Stewardship and World Markets. A similar comparison is made between these two scenarios and existing draft policies pertaining to the West Midlands, with the observation that a combination of LS style factors such as regeneration, environmental protection and locally based trading, with WM type objectives such as international competitiveness, private sector delivery of social services, and increased mobility, are all present in the draft Regional Planning Guidance.

The report uses the different socioeconomic indicators associated with the scenarios to generate ranges of impacts, for example the different extents of flooding damage which might be expected under different extents of development. However, the report does not proceed to derive recommendations as to how the more favourable socioeconomic conditions may be achieved as policy objectives. This ultimately means that insights from the process of using socioeconomic scenarios do not make a significant appearance in the final policy recommendations.

The Isle of Man Climate Change Scoping Study (Metroeconomica, 2006a; 2006b)

This study consists of twelve technical papers of which two have direct relevance to the use of socioeconomic scenarios.

Technical paper 6 (Metroeconomica, 2006a) describes each of the four UKCIP SES. Using the regionally disaggregated data from the BESEECH project it then derives quantitative indicators for demographics, GDP, and sectoral economic contribution, as would pertain to the Isle of Man under each SES for the 2020s and 2050s.

Technical Paper 7 (Metroeconomica, 2006b) then uses data from three historical weather events (historical analogues) to assess what the potential cost of future weather events would be under different socioeconomic and climate scenarios.

Two of the scenarios are selected, Global Sustainability and World Markets, and are associated with "low" and "high" emissions respectively. The potential costs of various types of weather event under each scenario, bringing together inputs from high and low-emission climate scenarios with the regionalised socioeconomic data, were then assessed. Whilst such an approach is highly transparent, and quantitatively detailed, there is arguably a problem with focussing on just two scenarios, in which both climate and socioeconomic factors are varied. It is difficult to differentiate the socioeconomic effects which may be reducing damages under the 'Global Sustainability' socioeconomic framework, when the fact that it is also a "low" emissions scenario clearly will be having a huge impact on those costs. In essence, this study provides what some might define as a 'worst' and 'best' case climate impacts scenario, through contrasting lowest emission levels with highest general sustainability, and vice versa, thus giving a wide range of potential climate impacts. This is effective in giving an impression of the potential ranges of impacts which may have to be prepared for; however, in comparing the scenarios it is less easy to identify how different socioeconomic contexts are more or less robust under a given level of climate change.

Foresight Future Flooding (Foresight, 2004) uses the Foresight scenarios from which the UKCIP SES were developed, to assess flood risks in the UK, in terms of numbers of properties at risk, costs of damage and management. The four Foresight scenarios are mapped against the IPCC emissions scenario set, in order to apply to each one an emissions level ranging from low (Global Sustainability) to high (World Markets). This enables outputs describing levels of damage in the 2080s for each scenario, relating to the urban environment, coastal erosion, risks to people. In general the extent of damages flows, logically, in order from World Markets (highest emissions) to Global Sustainability (lowest emissions). However there are some exceptions to this relating to socioeconomic factors. For example, when considering the annual costs of damage to urban areas, Local Stewardship has a lower cost than Global Sustainability, despite having higher emissions. This is presumably as the significantly lower annual GDP growth means that the damaged property is valued less. Whilst this approach is again transparent, it has a similar possible drawback to the previous study. Although this study uses four scenarios rather than two, nonetheless different climate scenarios are imposed upon each socioeconomic scenario. This means that, although a range of potential impacts are given, it is not possible to see what mitigating effect different socioeconomic contexts might have on a given level of climate change.

Both the Isle of Man and Foresight Future Flooding studies communicate the extent of impacts under each scenario in terms of economic costs; hence they are oriented towards a 1b-type focal question, in the terms of the analysis of Section 3.1 of this report. Possible problems with this approach might be felt to be: the possible controversy of 'monetising' physical impacts; the fact that in these socio-economic scenarios, the extent of monetised damage is influenced by the total value of the economy, hence may obscure the extent of physical damage; the fact that of the quantitative indicators, the GDP or GVA indicators may be considered to be amongst the most speculative in the way they are derived.

Climate Change and its Effects on Small Businesses in the UK (Crichton, 2006) uses the Foresight scenarios and the data derived from them relating to flooding in the previously reviewed report, thus basing its estimations of costs to small businesses and implications for the insurance industry on this data.

It is in many ways a very practically oriented report, emphasising the importance of encouraging local authorities and small businesses not to build on flood plains, to build flood proof buildings, and to take out adequate insurance. It also stresses the need for the insurance industry to develop a partnership with the government to ensure appropriate planning.

Its reference to the socioeconomic scenarios, apart from producing a range of possible impacts, is principally to suggest that the Scottish approach to flood planning, with its strict control of property development, is closest to the Local Stewardship scenario (that with the lowest impacts), whereas the English approach where priority for economic growth forces development in flood plains, resembles more the World Markets Scenario, that with the highest impacts. The report concludes that 'arguably, England seems to be on track for the worst case scenario while Scotland is on track for the best case scenario'. This assertion may not necessarily be entirely firm, if comparisons of all Scottish and English policies and social trends are made. Moreover, the assumption that Local Stewardship is the best possible world for flood management is not necessarily the case- in the Foresight study the low financial impacts accruing to Local Stewardship were as much due to its low GDP and the relatively low global emissions attributed to it, as to do with the inherently appropriate nature of its flood management policies, emphasising once again the practical difficulties of producing policy recommendations from scenarios which attempt to incorporate so many different level drivers within a coherent 'world view'.

Nevertheless the approach of trying to tie in scenarios to a basis in presently existing policies and trends is in general a promising one. This approach attempts to use scenarios to evaluate current policies and where they are likely to take us, with a view to reconsidering and possibly recasting policies in a way which will have a better chance of leading to a more desirable outcome. This report

presents a range of practical suggestions, including greater cooperation between government and the private sector, which it believes would ameliorate future flooding stress, and attempts to interpret them within a scenario framework in order to understand whether currently existing policies and trends are likely to bring them about, or not.

Climate Change and the Visitor Economy (McEvoy *et al*, 2006) chooses two of the Regis scenarios to apply to the North-West region, 'Regional Enterprise' and 'Regional Stewardship'. The scenarios were expanded in significant qualitative and quantitative detail in a working paper entitled 'Visioning a Future North West Economy' (McEvoy, 2005). This uses a range of data sources to quantify aspects of each scenario, including BESEECH, the Office of National Statistics, Regis, and the Regional Economic Forecasting Panel. It considers a number of relevant policy documents, including the North West Development Agency's Regional Development Strategy, and considers the possible outcomes of already 'pre-determined' events, such as the spin-off effects of Liverpool's role as European Capital of Culture in 2008. However, the socioeconomic scenarios are not directly referenced in the final summary report, which instead focusses on detailing the potential physical impacts of future climate changes on specific areas and heritage sites. This appears to indicate that the project was not able to find a coherent way of joining up the SES with the climate scenarios.

Building Economic and Social Information for Examining the Effects of Climate Change (BESEECH) (Dahlström and Salmons, 2005), developed the UKCIP scenarios for further use in regional contexts. The main contribution of this project was to further develop the regional quantification of the UKCIP scenarios. Quantification of the scenarios includes detailed breakdowns of demographics, contributions of economic sectors, household types and spatial distribution, as well the Gross Value Added (GVA) broken down into twelve UK regions for each scenario. This data appears to have been used by several of the scenarios reviewed in this section

BESEECH adds further qualitative characterisation to the UKCIP scenarios, which draws on cultural theory to assess the adaptive capacity of the different scenarios, that is the extent to which the different levels of technology, institutions, human capital, as well as economic resources in each case, will render that society as a whole more capable of responding and adapting to a changing climate. This attention to 'adaptive capacity'- which moves towards the second focal question identified in section 3.1- is somewhat unique in the studies reviewed in this section.

5.2 Critical review of studies that did not use the UKCIP SES

UKCIP studies which did not, but which might have, made use of UKCIP's SES are listed in Table 2 and critically analysed in this section.

Table 2: UKCIP studies reviewed which have not used the UKCIP SES

<i>Title</i>	<i>Reference</i>	<i>Sponsor</i>
The Potential Impacts of Climate Change in the East Midlands	ENTEC (2000)	East Midlands Sustainable Development Round Table
Warming Up the Region: Yorkshire and Humber Climate Change Impact Scoping Study	WS Atkins <i>et al</i> (2002)	Yokshire Forward / Yorkshire and Humber Regional Assembly
And the Weather Today Is... Climate Change in the North East	North East Assembly / Sustainability North East (2002)	North East Assembly / Sustainability North East
Warming to the Idea: Meeting the Challenge of Climate Change in the South West	CCLIF <i>et al</i> (2003)	The South West Climate Impacts Partnership
Living with Climate Change in the East of England	Land Use Consultants (2003)	East of England Regional Assembly
Preparing for Climate Change in Northern Ireland	WS Atkins (2007)	Scotland and Northern Ireland Forum for Environmental Research
Climate Change: Adaption by Design	Shaw <i>et al</i> (2007)	Town and Country Planning Association
Wales: Changing Climate, Challenging Choices	Farrar and Vaze, eds (2000)	National Assembly of Wales

Those studies that chose not to use the UKCIP socioeconomic scenarios focused on the physical impacts of climate change. All referred to the UKCIP02 climate scenarios (e.g. low, low-medium, medium-high, and high emissions).

Most studies that did not use the UKCIP SES acknowledged the importance of the socioeconomic context. In the Yorkshire and Humber study (WS Atkins *et al*, 2002), for example, the assessment of the regional impacts of climate change were “based on understanding the sensitivity of environmental processes to both climate variation and other factors, for example socioeconomic change”, however, it is not obvious from the report how such ‘other factors’ had been considered.

Some of the studies specified why the SES had not been used: the authors of the East of England study (Land Use Consultants, 2003) argued that the socioeconomic impacts on the region had been covered in another report (REGIS) and that they therefore did not need to be explored again. On the other hand, the Northern Ireland study acknowledged the importance of socioeconomic factors on climate change impacts, but argued that a lack of SES specific to the region meant that the socioeconomic impacts on adaptation to climate change could not be considered in depth, and made an early recommendation that “the government develop SES specific to Northern Ireland” (WS Atkins, 2007: 29). Similarly, Wales: Changing Climate, Challenging Choices, mentions the UKCIP SES, but states, 'Unfortunately these scenarios have not been disaggregated below the level of the UK so no projections are available for Wales' (Farrar and Vaze, eds, 2000: 58), and therefore does not use them. It is clear from the above that the intention of UKCIP that the SES should be taken on by regional users and applied to their own circumstances, is not always transmitted. Nevertheless a need for socioeconomic scenarios is perceived, as the Wales report recommends 'Socioeconomic scenarios need to be developed for Wales...' (Farrar and Vaze, eds, 2000: 58).

The Yorkshire and Humber study (WS Atkins *et al*, 2002) proposes that outputs from its study should be used to influence the formation of socioeconomic policy, calling for “a new, more sustainable approach to socioeconomic development” but it is not clear from the report what such an approach would entail.

The South West study (CCLIF *et al*, 2003) acknowledged that lifestyle “will both influence and be influenced by climate change” but argued that “such changes are elusive and there is little literature on the subject”.

Amongst these studies then it is possible to discern three quite different reasons why the SES were not used. First that socioeconomic factors are considered in other reports, therefore there is no need to focus on them (implying that integration of socioeconomic and physical analysis is not needed); second, that no socioeconomic studies exist which are appropriate to the region; third, that no relevant socioeconomic literature exists at all. Each would imply different remedial responses from UKCIP: to argue for the merits of interdisciplinary analysis; to argue and explain the potential usefulness and applicability of the UKCIP SES to regional contexts; to raise awareness of the SES themselves.

It is also possible that any of these reasons may be exacerbated by more practical concerns, which are less easy to state candidly in formal reports. Most obviously, organisations with the skills and resources to carry out detailed assessments of physical impacts of climate change may well consider that they do not have the resources or skills to carry out socioeconomic analysis. Creating formal

collaborations with other organisations who do have that capacity may be considered beyond the scope of the report.

It is perhaps worth observing that the East Midlands study (ENTEC, 2000), being published in 2000, was probably too early to be able to incorporate the SES; but that the lead author and consultancy involved in producing this report were also authors of subsequent reports, London's Warming and The Potential Impacts of Climate Change in the West Midlands, which did use the SES and are reviewed in Section 5.

It is also an important observation that most of these studies engaged with regional stakeholders at some level, providing in several cases a very firm grounding for the study within the current socioeconomic context. For example, the East Midlands study (ENTEC, 2000) assesses the perspectives of key stakeholders on the impacts of climate change, views on local government emissions targets and how they will respond to emissions measures. The South West study (CCLIF *et al*, 2003) makes significant use of stakeholder views, and acknowledges that local authorities have a key role to play in adapting to climate change, through policies and regional planning. The East of England study (Land Use Consultants, 2003) explicitly refers to potential actors such as the Regional Assembly, Local Authorities, businesses and universities and suggests actions which they may take. It also deals in some detail with areas of very significant potential socioeconomic variability, such as the effects of the possible expansion of regional airports, and potential for decentralisation of certain currently London-focussed business sectors. Climate Change, Adaptation by Design (Shaw *et al*, 2007), identifies key national and international political processes of relevance, and brings these together with various technological solutions for building design, to consider the potential for action at three scales: catchment, neighbourhood and building, emphasising the need for partnerships between the various actors that operate at those different levels. It identifies key implementing tools such as the Regional Spatial Strategies, and Local Development Frameworks.

Therefore, while these studies do not explicitly follow a scenario approach, by considering available policy and technological options, the various relevant actors, the different scales at which they operate, and the available policy frameworks at each scale, they in fact identify most of the key building blocks for creating strategically useful scenarios based on plausible extrapolation of presently evident trends and actors.

Many of the above reports do have a very intuitive and practical understanding of the kind of socioeconomic factors which could improve or complicate adaptations to climate change, with a particular reference, of course, to their own region. It seems however that there is not always such an intuitive sense of how to apply the UKCIP SES to these concerns. It may be that the SES are seen as

being too speculative- rather the authors prefer to proceed directly to seeking current stakeholder views, as this seems to provide a more useful view about what policies or actions will be acceptable.

It might finally be observed however that the preference for this approach by the authors of the above studies is by no means incompatible with the process of producing scenarios. Indeed, some would say it is a fundamental aspect of scenario writing. There may be a lesson in Pierre Wack's experience that to his scenarios were never accepted by Shell's managers unless they were grounded in their 'deepest concerns' (Wack, 1985a). He later pointed out that a common problem with attempts at scenario planning was that 'the interface of scenarios and decision makers is ignored or neglected. By interface, I mean the point at which the scenario really touches a chord in the manager's mind- the moment at which it has real meaning for him or her.' It may be that, at least at a first reading, the UKCIP SES lack this fundamental connection with the deepest concerns of their potential users.

6. Common themes emerging from study analysis

Once the studies had been reviewed they were compared and analysed, and overarching key themes identified. The studies are discussed as body of work under these key themes, below.

6.1 Benefits of using the SES

It has emerged strongly from the review of regional climate impact studies that socioeconomic factors are widely understood to be highly relevant when considering future climate impacts, and that this perception is reflected in discussions and conclusions in many of the studies. It is clear that in many instances, the use of the UKCIP SES has encouraged and facilitated the consideration of future socioeconomic development.

One of the most important issues to emerge in studies which used the SES is the need for coordination between numerous regulatory bodies and actors. The impacts of a changing climate in the UK will be felt across sectors and regulatory jurisdictions, and thus are likely to require significantly increased coordination between what have until now been relatively distinct policy areas. The required degree of coordination between different policy sectors, including conservation, spatial planning, forestry and agriculture, and between different governance levels, including regional, UK, and EU levels is likely to increase. It may also be the case that potential conflicts between the needs of different policy areas may arise- for example, biodiversity policies may demand the restriction of water extraction from ecologically sensitive areas, which may conflict with growing demands for water services in lower rainfall-futures.

The process of setting socioeconomic indicators alongside climate change impact assessments raise some controversial issues about the valuing of future impacts or avoided impacts. Economic valuation may appear to have the attraction of providing a means to comparing widely different kinds of impact, however it is clear that any economic value is highly contingent both on the overall GDP of the country and the value which, for various reasons, is attached to the particular threatened resource. For example, in some studies it seems clear that lower impacts in certain scenarios were more a result of the perceived economic value of the resource than the physical extent of the impact. This of course raises interesting issues and highlights the point that an acceptable way of comparing and trading off economic with ecological value will need to be developed in future policy relating to climate change in the UK.

However, it is also the case that socioeconomic factors were considered in most of the studies that did not explicitly use the UKCIP SES. These studies used stakeholder engagement to elicit views on the effect of local government environmental targets and policies, the roles of key local actors such as

RDA, businesses and universities, the effect of major infrastructure development projects, and of changes in economic activity within the region. These studies make practical policy recommendations with reference to key procedures such as regional spatial strategies and Local Development Frameworks. Hence, while the existence of the UKCIP SES has probably raised awareness of the importance of considering socioeconomic issues, it is not clear that their actual use greatly improves the quality and relevance of the socioeconomic and policy output.

The possible reasons for this, and how they may be addressed through improved construction and use of the scenarios, are explored in the following section.

6.2 Difficulties of use and barriers to uptake

In general the studies do not seem to be absolutely clear of what the purpose is of using socioeconomic scenarios. This is reflected in the general lack of scenario-related insights in the conclusions. In some cases insights from the climate change scenarios are preferred. Frequently, even in studies which devoted resources to developing the SES, virtually no reference is made to them in the final project report.

The lack of clarity about the precise function of the SES is also reflected in some of the reports' own descriptions of the function and purpose of scenarios. Interestingly, such explanations tend to downplay the likelihood of any of the scenarios coming about in the exact form in which they are represented, some even implying that to ask if any of the scenarios will actually come about would be to miss the point. In analogical explanations, scenarios are compared to vague and distant thoughts, rather than strategic and useful plans. The general disconnection between the scenarios and practical strategy making is emphasised by the fact that whenever policy recommendations appear, they are rarely discussed in the context of the scenarios.

Amongst the studies that did not use the SES, a common reason for this lack of use seems to have been that the scenarios were not considered disaggregated enough. This is often illustrated with reference to the quantitative indicators which are not considered specific enough. However, the point is made in the UKCIP guidance that in order for the scenarios to be useful and relevant at the regional level, it is necessary for study authors and stakeholders to adapt and apply the high-level scenario storylines to their own regional context- in other words, a fairly significant additional amount of scenario-based work needs to be done by the regional users in order to make them fit for purpose for the regional context. It is not clear that all potential scenario users are ready for this challenge, in part, possibly because of lack of funding or expertise within the organisation.

As discussed in Section 4, one of the intentions behind developing a high level set of scenarios was comparability between regional studies, in order to be able to match up the various studies and ultimately develop an integrated UK level view but with nested regional detail. Through increasing the regional detail within the high level SES, UKCIP may be able to tempt more regional stakeholders to use them, as well as ensuring a certain standardisation which could be useful to ensure comparability. On the other hand, the more resources which are dedicated by regional users to developing regionally focussed scenarios which are grounded on the concerns of their own stakeholders, the more strategically useful they are likely to be. There is a potential conflict between these two imperatives, and striking the balance between them and communicating that balance clearly, will be an important future objective for UKCIP.

6.3 Scales: National vs. Regional

In the original UKCIP scenario matrix, the vertical 'governance' axis describes a contrast between 'autonomy' and 'interdependence'. When this is perceived as relating to issues of globalisation, or conversely a strengthening of the political independence of the nation state, it becomes hard to see what relevance this has to socioeconomic scenarios with a sub-national, regional focus. Hence, most of the scenarios do not consider this axis in great detail; several, because of its perceived irrelevance, drop it altogether and concentrate on two scenarios contrasted along the values axis.

However, the level and location of governance is in fact an issue of great significance to local actors when considering potential socioeconomic futures. It relates very strongly to the crucial question of the varying potential of the scenario users to exert agency within the different scenarios. If governing power is centred very strongly at the national or supra-national level, local actors will have fewer areas in which they can intervene and shape their own socioeconomic futures. By contrast, if devolution centres increasing amounts of governing power at the regional level, regional actors will have a much greater opportunity to form and influence their future. The consideration of these different possibilities is therefore highly relevant to regional socioeconomic scenarios.

6.4 Values: Community vs. Consumerism

The tendency to diminish the importance of the governance axis results in scenarios which are primarily contrasted along the values axis, which can risk leading to an overly stereotypical contrast between 'green' and 'growth' archetypes, in which every actor in society is understood to be entirely motivated by either of these paradigms. In constructing scenarios there is, perhaps inevitably, a tendency to define each characteristic within the scenario in its most extreme and all-pervasive incarnation, rather than opting for 'middle of the road' views. This is in some ways advantageous as it ensures that the futures developed are adequately contrasting, avoiding a set of scenarios with very

little to choose between them, and all looking much like today. However, it is also problematic in that the scenarios may be considered extreme, caricatured and overly monolithic. Some projects found that stakeholders would immediately tend to assume that the scenarios represented 'good' and 'bad' futures. Both stakeholders and project reports consistently acknowledged that present reality already contained elements of both, and that it was almost certain that the future would too.

The implication from this, that due to their one-sidedness there is something of a gulf between the scenarios and 'reality', is particularly problematic in terms of trying to understand how the scenarios may be put to some kind of practical use. It is very difficult to see either type of scenario as a plausible evolution from the present when even present documents, such as Regional Planning Guidance and economic development strategies, highlight the simplifications inherent in this polarisation.

It seems that the mainstreaming of the sustainable development agenda has meant that, at least in the long term intentions of local authorities, economic development is prioritised alongside, but not at the expense of environmental and 'community' values. This kind of 'multi-objective' planning is not reflected in the UKCIP scenario grid, which implicitly assumes that societies will be singular in the kind of objectives and values they hold.

The UKCIP scenario development process begins from 'high level' drivers and works down. However, experience from the historical literature on scenarios suggests that there are important advantages in grounding scenarios in presently existing and evident factors. Through such a process, scenarios become more strategically informative for near term decision making. Also, and perhaps even more importantly, they are more likely to be recognised and accepted by stakeholders who can see in them their own current and real concerns, which are then plausibly traced through future developments.

There is a tendency in all reports to consider key regional documents such as the Regional Planning Guidance as a reference for ex post comparison to the scenarios. An alternative approach would be for such documents to be key inputs into the development of scenarios. Whilst the goals and targets set out in such plans may not be considered set in stone, they nevertheless give an indication of the intentions of certain important actors, which can then be compared to and set against the interests and motivations of other actors, in considering how the future might plausibly evolve from the present, as a result of these multiple interactions.

6.5 Relationship of socioeconomic to climate change scenarios

As discussed in Section 4.2, the UKCIP SES guidance document suggests two approaches for mapping the socioeconomic scenarios on to the climate change scenarios, thereby producing

combined scenarios which describe socioeconomic developments at the same time as developments in the changing climate (UKCIP, 2000: 75; Table 3.2). The mapping approach responds to a need to link the climate change to the socioeconomic scenarios, and is also derived from a reasonable concern that considering all socioeconomic scenarios in the context of all climate scenarios would result in an unmanageable number of combined scenarios.

The guidance acknowledges that some socioeconomic futures are compatible with more than one climate future. However, arguably the number of feasible combinations is even greater than that suggested in the document (which for example appears to rule out the possibility of Local Stewardship occurring with either Low or High emissions), particularly as the socioeconomic contexts in the scenarios are focussed at the regional level. Socioeconomic contexts are formed by international developments, by national policies, but also to a large extent by actions of regional actors. The extent of climate change is related to the globally aggregated level of greenhouse gas emissions, from human and other sources. It should be clear that regional actors therefore have significantly increased agency with regard to their own socioeconomic context than with regard to the trajectory of global greenhouse gas emissions. It follows from this that there is not a necessarily strong correlation between the two areas, as one cannot be significantly influenced by regional agency, whereas the other could be. In other words, it is perfectly conceivable that actions at UK or sub-UK regional level may be at odds with the actions of other global level actors- this is indeed acknowledged in several of the studies.

Interpretative problems stem from this difference in agency. Outcomes of future scenarios are taken to be aggregated from the combined effects of climate and socioeconomic factors. This is of course in itself an accurate assumption. However, when comparing across scenarios in which both the socioeconomic and climate drivers are changing, it becomes difficult to see what is the true effect of a change in either. It may be of interest to see the change in final impact from a *given* level of climate change as a result of *different* socioeconomic contexts, as these are the contexts which the scenario users may potentially have the opportunity to influence; hence the identification of a socioeconomic context which appears to have a mitigating effect on climate impacts may lead to policy recommendations aimed at bringing that context about. If however, it is not clear to what extent the reduced impacts are more a result simply of an assumed lower emissions climate scenario, then any potential for transforming the consideration of different socioeconomic futures into practical policy recommendations, is lost.

Some studies assess in financial terms the extent of damage under the different scenarios. Again the simultaneous varying of socioeconomic and climate changes creates problems. It seems clear in some cases that lower economic costs of damages is related to the lower land values as a result of lower

GDP in these scenarios. In other words, the impacts are measured as less because the resulting damage is valued lower.

Whilst it may seem reasonably transparent to link regional socioeconomic progress to wider and more global political and cultural developments, and to associate these with global emissions levels, the clear drawback of such an approach is that it is not easy for a policy maker to draw strategic insights when various elements of a scenario imply quite different levels of agency for the decision maker. These scenarios advocate preparedness for a range of outcomes and costs- but give little strategic insight into how integrated planning and preparation might reduce those costs.

6.6 Quantification

Most of the studies made some use of the quantitative indicators provided with the SES. Many of the studies used economic indicators in order to compare the scenarios in terms of expected monetised costs of damages. While this in one sense provides a relatively transparent and easily comparable way of looking at the scenarios, as has been discussed it is also potentially problematic in that it draws in a variety of very different effects into a single figure, thus possibly obscuring a more rounded understanding of what is actually going on in that scenario. It is also arguably the case that the extrapolation of metrics such as GDP for each scenario in terms of a percentage divergence from a projected business as usual, is at best approximate and at worst arbitrary- therefore to convert these generic trends into precise cost figures gives a misleading impression of accuracy. It might be considered more appropriate to treat these indicators as general trends rather than hard data inputs.

Some of the studies felt that the national level indicators provided by UKCIP were not appropriate to regional use, indeed some studies which did not use the SES cited this as a barrier. A few studies used the BESEECH regionalised data, though these were not widely used. Several studies added more data to their scenarios from other national and regional data repositories. Overall, it certainly appears that UKCIP's initial ideal of the various studies using a common set of data and thus being highly comparable has not been achieved- indeed given the individual nature of each study it seems highly unlikely that it could be achieved.

6.7 Vulnerability, adaptation, agency

The question of adaptation was discussed in Section 4.2, where it was established that it had not been the intention of UKCIP to explicitly include adaptation measures within the scenarios. However, it was also acknowledged that in practice it is not possible to remove all aspects which might be seen as adaptive from scenarios which produce different levels of climate impact, and therefore at least by implication contain elements which may be considered more or less adaptive.

The question of adaptation would appear less complex if the question of agency was more explicitly considered within the scenarios. The set of values which define the futures tend to be considered as all pervasive and 'given'. This produces scenarios which are in one sense unified, but which ignore the fact that futures are brought about by the conflicting motivations of multiple actors- thus it diminishes the role of all actors, and in particular the actors who are to be the main users of the scenarios (the stakeholders themselves) do not have a very clear role within the scenarios. This makes it unclear how the stakeholders could affect the future if they wished to, and thus reduces any sense of agency on their part when considering the scenarios.

While it is clear that there are some elements of the future over which regional stakeholders will have very little or no influence, undoubtedly some aspects of the future which are described in the scenarios would be very much within the remit of regional stakeholders to take decisions on- for example choices of whether to build new houses in certain areas, construct new infrastructure, or attempt to attract certain kinds of businesses. As has been described above, the extent of influence over some of these aspects could vary in different futures, depending on the extent of devolution, and this is another important aspect for scenarios to consider. Moreover, depending on the extent of devolution of local power, it is by no means impossible that decisions which can be taken autonomously at the regional level could run counter to the general trend of decisions taken at the national or global level, rather than, as is implied by the homogeneously defined scenarios, values being uniform at every spatial and governance level. For example, in a time of average national apathy to biodiversity, it might still be possible for a local authority to make its position much more active. Scenarios which generalise some notion of the average commitment to such issues therefore diminish the agency of local actors, who dependent on the extent of their devolved powers, may have the ability to make their own judgements on such issues.

6.8 Influence on outcomes

All of these factors mean that policies are not directly represented in the scenario discussions, meaning that in many of the studies reviewed, the SES receive no explicit mention in the final output reports, despite having sometimes received significant resources during the project itself. Notably, however, this is often not for want of pertinent policy recommendations within the studies as a whole, which advise the importance of the increased interaction of numerous actors from different governance levels, the greater integration of policy agendas and more 'joined up government'. However, these insights are not set against or interpreted within the context of the scenarios, neither are the scenarios used to interpret their plausibility. There seems to be a disconnect between the use of scenarios as vehicles of hypothetical speculation as to the impacts of a number of simultaneous factors, and any process of practical policy recommendations and action. Whilst it seems that the

scenarios may have had some effect in terms of generally raising the importance of considering socioeconomic issues in climate impact assessment, the scenarios in general are not feeding through as strategic tools having a direct impact on outcomes and recommendations.

7. The interview process

The second component of the review consisted of interviews with researchers who had, and had not, used the socioeconomic scenarios in their studies. The interviews were used to investigate researchers' perceptions and experiences with the socioeconomic scenarios, as well as to explore in more depth issues that emerged during the interim review.

An initial list of interviewees was drawn up by UKCIP and all suggested interviewees contacted. Additional contacts that were identified or recommended during interviews were followed up as appropriate by the project team. A total of 11 face-to-face and telephone interviews were held over a two week period; one set of written comments was also received. Detailed notes were taken in all interviews, and where possible the interviews were also digitally recorded. The interviews were then transcribed and interpreted. All comments by interviewees have been anonymised.

Researchers who were interviewed consisted both of those who had worked on the projects or were involved indirectly through steering committees. Interviewees came from both consultancy and academic backgrounds. Appendix A1 lists all those who participated in this review, along with the studies they worked on.

Semi-structured interviews were used to enable the discussion to stay focused whilst allowing new lines of enquiry to be followed up. An initial list of questions, structured around several themes to provide a framework for discussion, was generated prior to the interviews. The questions were based on the interim review and discussion amongst the research team. They were then commented on by UKCIP and revised appropriately; Appendix A2 contains the final interview questions. The themes explored in the interviews were:

- General value of the socioeconomic scenarios;
- Use of the socioeconomic scenarios within the studies;
- Value and influence;
- Guidance and support; and
- Future efforts.

The following sections report the interview responses, with the analysis grouped to reflect the structure of the previous literature review section. An additional section summarises interviewees views on future directions for the SES.

7.1 Benefits of, and experience in, using the SES

Overall, researchers felt that the socioeconomic scenarios were a useful tool that aided them (and in some studies their stakeholders) to envisage possible futures within which the impacts of, and adaptation to, climate change might occur. Many researchers stated that they enjoyed using the scenarios, which provided them with a useful framework for thinking about future socioeconomic contexts. One interviewee argued that the concept of socioeconomic scenarios was essential to any climate impact and adaptation study, and that to not consider the role of people and their behaviours within such studies would fail to provide a true reflection of impacts.

“We found socioeconomic scenarios to be fundamental to the work we were doing. Indeed, the idea of not incorporating socioeconomic factors in any impact or adaptation study is verging on the indefensible.”

For many, the key strength of the socioeconomic scenarios was that they provide a common framework for visioning alternative socioeconomic futures within which climate change would occur. The framework enabled systematic thinking about possible futures and was considered vital for incorporating socioeconomic factors into climate impact and adaptation studies. The mapping of the time horizons and storylines onto SRES was for some another strength that enabled the linkages between the climate and socioeconomic scenarios to be more easily made. Other strengths included a more robust outcome, and the inclusion of ‘negative’ futures which encouraged stakeholders to imagine futures that were fundamentally different from their usual approach.

Researchers also commented on the growing acceptance in some sectors of the need to consider socioeconomic scenarios in impact and adaptation studies. The water sector was highlighted by interviewees as being particularly advanced in their acceptance of the socioeconomic scenarios and their ‘sophisticated understanding’ of the need to consider socioeconomic factors when developing strategies. However, it was also commented that this may be due to sector specific characteristics, and awareness of other sectoral studies which have used socioeconomic scenarios. Two studies that were frequently mentioned in the interviews were the Environment Agency’s scenario approach to water demand forecasting (Environment Agency, 2001) and Foresight Flooding (Foresight, 2004).

7.1.1 The project brief and commissioning process

For some projects, such as ReGIS and BESEECH, the use of the socioeconomic scenarios was an integral part of the project brief. However, for the majority of the studies the use of the socioeconomic scenarios was non-essential. For those studies where the use of the socioeconomic scenarios was not a formal project requirement, there appeared to be two key factors that influenced

whether they were used or not. The first was the interest and enthusiasm of the project team for the scenarios and the second, and perhaps more important factor, was stakeholder acceptance of the need to consider socioeconomic factors. The presence of UKCIP on the steering committee, who promoted the use of the socioeconomic scenarios, was another reason that they were used.

7.1.2 Guidance and support

All interviewees were aware of the guidance and support that was available to them, in part due to the presence of UKCIP on project steering committees. Their presence on steering committees meant that awareness of the socioeconomic scenarios was high and support and guidance for their use was provided through this role. Even without a presence on steering committees, interviewees commented that they felt they would be able to approach UKCIP for advice. It was commented that the scenarios were not easy to pick up and use and that the guidance document probably did not tell the user what they needed to know in order to use them. There was agreement that the guidance document needed bringing up to date.

7.2 Difficulties of use and barriers to uptake

A key barrier to the uptake of the socioeconomic scenarios was the lack of buy-in from stakeholders. Even though the socioeconomic scenarios were shaped by expert opinion, it was hard for researchers to sell their qualitative nature to policy-makers and people making decisions in the ‘real world’. The scenarios were often viewed as ‘airy fairy’ and ‘dreamt up’ by some stakeholders, and it was difficult for researchers to persuade them otherwise.

For some studies, and particularly earlier ones, project teams felt that funders were only just beginning to consider the impacts of climate change and that adding socioeconomic factors added complexity to what was already an innovative and ground-breaking study. In later studies it was felt that the funders’ focus was on the impacts of climate change on the sector or region and that to consider the socioeconomic scenarios would be a ‘distraction’ from the project aims. In some studies there was less emphasis on participation and bottom-up processes, as a result the use of top-down approaches, such as climate scenarios, was better understood by stakeholders.

Interpreting and communicating the implications of the scenarios was also viewed as a major difficulty by some users. Communication by the user community was felt to be quite poor as was understanding of the receiving community. Many stakeholders had difficulties with envisioning a world that was fundamentally different to their way of thinking or own vision for their region or sector; it was mentioned that their use was hindered by short-term thinking at the local and regional level. A lack of evidence of their successful use also made it difficult for researchers to promote their

use to stakeholders. Similarly, researchers were unable to provide examples of where the scenarios had proved useful in other studies, and where their use had influenced policy.

The resource implication of using the socioeconomic scenarios was also seen by some interviewees as a deficiency. Researchers argued that when tendering for a project, the cost of the project was as important as quality. The resource intensive nature of the socioeconomic scenarios, and the considerable work required with stakeholders in order to translate the scenarios, meant that the cost of using the socioeconomic scenarios in projects with small, limited budgets was prohibitive. The lack of emphasis given to the scenarios by funders more interested in climate impacts also restricted their use. A lack of skills or capacity within the team to use the socioeconomic scenarios was not regarded as a barrier to their use by any of the interviewees.

One interviewee argued that to adequately use the socioeconomic scenarios in the studies required a great deal of effort, and that if this was not possible then it was not worth incorporating the scenarios into the study.

7.3 Scales: National vs. Regional

The issue of scale, and the disparity between what is happening at a global level versus at the local level, was commented on by researchers. It was argued that while the world might be following a World Markets future, there was evidence of Local Sustainability policies at the local level and that this disparity was not reflected in the scenarios. Stakeholders also recognised that current development in their region or sector contained elements of all futures, therefore the axes were viewed by some as arbitrary.

In projects where the use of the SES was an explicit part of the study aims the project teams were able to adapt, downscale or re-present the scenarios. Their ability to adapt the scenarios was partly due to the integral role the SES played in the studies, which ensured that resources were explicitly directed to developing the scenarios. The downscaled and re-presented socioeconomic scenarios developed by the ReGIS and BESEECH have since been used in other projects, such as London's Warming and ASCCUE. Researchers found these scenarios more useful for their studies as they provided additional information, such as determinants of adaptive capacity, more detailed quantitative indicators, or provided scenarios that reflected stakeholder concerns. For example, the adaptation of National Enterprise to Regional Enterprise in ReGIS reflected stakeholder concerns about the lack of a regional focus in the original scenarios, as well as a lack of buy-in to a future that stakeholders felt was unlikely.

However, for projects where the use of the socioeconomic scenarios was not a primary objective of the study, their lack of temporal and regional specificity proved to be a barrier for many users. Although the SES provided a useful higher level context for envisaging possible futures, they were not usable by the research teams until they had been downscaled and adapted for use in the study. For many teams without the resources this was simply not possible. One interviewee felt that UKCIP should develop a set of downscaled, regionally specific socioeconomic scenarios, which can then be set in context alongside climate change scenarios.

7.4 Values: Community vs. Consumerism

Some of the scenarios were unacceptable to stakeholders, which led to a ‘cherry picking’ of futures. One interviewee argued that a key problem with the scenarios was enabling users and stakeholders to view them neutrally:

“Planners understand policy intervention and are therefore more accepting of the community axis of the scenarios. Therefore, how can we enable people to use them neutrally, rather than having a perception that ‘community’ is better than ‘consumer’? They are difficult to use neutrally, but this may be good if it helps decision-makers to think through the first steps that need to be taken towards a particular future”.

7.5 Relationship of socioeconomic to climate change scenarios

While some users thought the linkages between climate and socioeconomic scenarios were easy to make, for others the lack of explicit linkages between climate and socioeconomic scenarios was a key difficulty for their use. Interviewees wanted to know how the scenarios fit together, how they were supposed to feed into one another, and how users were supposed to demonstrate to stakeholders which combinations of socioeconomic and climate change scenarios were feasible, and which were not. As a result some studies used all of the scenarios, while others focused on using a couple of the scenarios to provide two ‘extreme’ visions of the future.

Researchers expressed the need for a more explicit understanding of the connections between the scenarios. The matrix on p.75 of the UKCIP guidance document was referred to as one possible way of combining the scenarios. However, the matrix also raised questions about how two scenario sets are to be used: do users need to understand the underlying principles? Are there some scenarios which cannot be linked? With four socioeconomic scenarios, four climate change scenarios and different regions to study, resource limitations meant that ultimately decisions had to be taken about which scenarios to use. Where a greater number of scenarios were used, researchers mentioned the difficulty of interpreting and presenting the results.

7.6 Quantification

Whether the quantitative indicators were used was dependent on the type of study being undertaken. Not all studies used the indicators; some who used the qualitative descriptions commented that they had found the indicators ‘adequate’, while for others they were simply ‘too deep’ for the scoping studies. However, for quantitative studies that developed models the indicators were widely regarded as inadequate.

For those studies that used the quantitative indicators, the key weakness was that the national, high level indicators provided in the guidance document were difficult to use as most studies were sectorally or regionally specific.

“The national parameters were fairly high level indicators. [UKCIP] might have given us populations whereas what we wanted was household size, housing density, price of crops, per capita demand- all of the quantitative information that could then be used to drive the physical and numerical understanding of impacts and adaptation.”

“I think that one of the drawbacks of the socioeconomic scenarios, that yes, okay there was contextual stuff but the numbers weren’t there in quite the level of detail that was required”.

7.7 Vulnerability, adaptation, agency

An aim of the UKCIP socioeconomic scenarios was to provide insights into the vulnerability of different types of future societies to the impacts of climate change. However, there was a lack of consensus amongst interviewees about whether this tool enabled users to assess vulnerability. Some interviewees felt that the scenarios did facilitate thinking about vulnerability, providing ‘colour and flavour’ to the assessment of climate impacts. For example, when thinking about crime and adaptation the use of the scenarios in London’s Warming highlighted the strong social dimensions that differentiated between the two scenarios used in the study: Global Markets (GM) and Regional Sustainability (RS). An adaptation measure in non-air conditioned buildings will be natural ventilation i.e. leaving windows and doors open. However, under a GM future higher crime rates may mean that householders do not feel safe using natural ventilation; this would particularly affect poorer households. The socioeconomic scenarios also helped to assess the spatial implications of vulnerable groups. The tool allowed not only the growth of vulnerable groups such as the elderly to be determined but also where such groups were likely to be located in future years.

On the other hand, some researchers felt that the scenarios were too top-down to provide insights into vulnerability. It was argued that in order to understand vulnerability studies needed to take place at the local level. It was suggested that:

“In order to understand the vulnerability of different social groups to climate change, vulnerability should be built into national scenarios so that you’re not just assessing populations, but also providing an indication of social vulnerability measures”.

7.8 Influence on outcomes

It was argued that many stakeholders felt that the socioeconomic scenarios added an extra level of complexity to what was an already complex subject. Because the aims of most of the studies were primarily to explore impacts of climate change, and more recently adaptation, as a result the use of the socioeconomic scenarios was felt to ‘muddy the water’ both in terms of the research being undertaken and communicating the results.

“It’s a lot easier if [the socioeconomic scenarios] are not included, and clearer messages can be provided.”

Many interviewees argued that funders were coming from a more fundamental starting point, one of ‘what will climate change mean for us and what can we do to adapt’? The use of the socioeconomic scenarios was viewed as a distraction by many funders more interested in the predicted impacts of climate change; as a result the use of the socioeconomic scenarios rarely informed the outcomes.

For those studies that used an integrated approach i.e. used quantitative modelling, qualitative analysis and participatory techniques, the socioeconomic scenarios were a fundamental part of the project outcomes. A key insight from the socioeconomic scenarios was that for many sectors the socioeconomic factors were shown to be as or more important than climatic factors. For many researchers this insight was empowering, highlighting that the use of the scenarios could make the difference between the impacts being positive or negative:

“The importance of the socioeconomic factors shows that it is the choices that society makes that determine the future, and not just the climate. [The study] showed that the future isn’t entirely preordained.”

For other studies, the insights from the scenarios were not used to feed into the final reports and recommendations but rather were used to emphasise that there were other factors and issues that need to be thought about when considering adaptation and future development in the region or sector.

The use of the socioeconomic scenarios also helped to identify more efficient policy responses in some studies. In ReGIS, for example, under a GM future the model showed that the amount of water used in the agricultural sector was very price sensitive. However, under a RS future, where the agriculture sector was well supported, price changes had little impact on water use. Under this future,

a more efficient policy response was to focus on licence controls on metric restrictions. Similarly, in studies that explored the impacts of climate change on the water sector, the socioeconomic scenarios had a large impact on the results. However, in other studies the scenarios had little impact in terms of providing insights into practical decision-making.

One interviewee argued that project teams would begin using the scenarios but that after a point, generally the introductory phase, their use was discontinued. Therefore, the results of this initial phase of the project were not followed through nor included in the summary report.

“The results and insights provided by the socioeconomic scenarios were not followed through into the results and recommendations. While they helped to raise awareness of the socioeconomic issues, at that time there was little reflection about the implications of the socioeconomic scenarios.”

“There is little debate or follow on to explore the implications [of the socioeconomic scenarios] in more detail. In general, the insights from the scenarios don’t get followed up in the recommendations and don’t lead to concrete actions.”

A lack of priority given to this tool by stakeholders and the project teams was one reason that the insights from the scenarios did not feed into the results and recommendations. Another reason was resource limitations, which for some users meant that although the scenarios had influenced the results, the impacts on the outcomes were not explored in depth.

BESEECH had quite distinct aims and objectives from other studies considered in this review. The aim of BESEECH was to adapt and enhance the UKCIP socioeconomic scenarios for use in the Building Knowledge for a Changing Climate programme (BKCC). The re-presented qualitative storylines and detailed quantitative indicators have since been used in other BKCC studies, such as ASCCUE and GENESIS. One criticism of this research was that the outcomes have not been promoted to the right user communities, which has limited their uptake.

7.8.1 Use of other socioeconomic information

For those studies that did not use the socioeconomic scenarios, researchers were asked whether other socioeconomic information had been used in the study, and whether such information had influenced the study results.

One interviewee stated that only information about climate change had been used in their study. It was argued that this was a reasonable assumption as for some trends, such as changes in natural systems, it might be possible that the domain would not be affected by socioeconomic changes. When pressed it emerged that this study had however referred to regional development plans, and thus

that some socioeconomic changes had been accounted for. Other socioeconomic information used in other studies included planning documents, regional spatial strategies, information provided by developers and projections of future populations. Researchers commented that while this information had been useful for setting the context, whether this information had informed the results of the study was uncertain and would be difficult to prove.

It is important to note that a participatory, user-led approach was at the heart of many of the studies that did not use the socioeconomic scenarios. As a result the stakeholder workshops may have influenced the project outcomes although, once more, it would be difficult to show whether such workshops had any influence on the outcomes.

7.9 Future efforts

The final section of this analysis concentrates on where researchers felt that UKCIP should focus its future efforts in providing and supporting the socioeconomic scenarios for climate change vulnerability and adaptation assessments. Two key areas emerged from discussions: the first relates to increasing understanding and acceptance of the socioeconomic scenarios, and the second on the provision of guidance and support by UKCIP.

7.9.1 Opportunities for further development, and wider promotion of SES

In general, researchers felt that there was a need for a better understanding of futures thinking amongst both user and stakeholder communities. It was suggested that UKCIP need to be more aware of other traditions of scenarios building, and how such tools have been used in other research. Some interviewees argued that a large literature on socioeconomic scenarios had been largely overlooked by UKCIP, which had led to a narrow thinking about socioeconomic change. One interviewee contended that UKCIP or a professional social science organisation should take the lead on developing a new set of stakeholder-led, bottom-up socioeconomic scenarios. However, it is important to stress that most researchers thought the UKCIP scenarios were a good starting point for thinking systematically about possible futures within which adaptation to climate change could occur.

“Even if the tool’s not perfect, or the document’s not comprehensive, it is more about how [socioeconomic information] can be used, and how you can go about developing your own set of socioeconomic scenarios for your own context.”

Ensuring that the socioeconomic scenarios are used in all vulnerability and adaptation studies was suggested as one way of raising awareness and increasing understanding. It was suggested that using the scenarios in such studies should be a compulsory, integral part of the commissioning process.

After all, as one interviewee commented, it will only be through the experience of using the scenarios that the awareness of the importance of socioeconomic factors is raised. Wider use of the socioeconomic scenarios would also encourage funders to recognise that socioeconomic changes would affect their region or sector, and to highlight that for some domains the socioeconomic factors will be as if not more important than climatic changes. Promoting the use of the scenarios in other policy tools, such as Strategic Environmental Assessment and Sustainability Assessment, was a key priority for one user in order to improve their robustness and resilience. However, it was commented that specific guidance on how the scenarios should be incorporated in other policy tools is urgently needed.

7.9.2 Stakeholder 'ownership', regional specificity

While it was acknowledged that users need to have socioeconomic scenarios at a general, national level, a more careful assessment of users' needs is required. The lack of regional and sectoral specificity was commented upon by all interviewees. Similarly, the socioeconomic changes for urban areas need to be elaborated, as urban areas will have unique spatial and temporal implications for vulnerability and adaptation to climate change.

Encouraging stakeholders to 'own' the scenarios was also considered important for increasing acceptability and buy-in. The scenarios need to be mapped on to, and be directly relevant to, stakeholder needs.

“The methodological underpinnings suggest the socioeconomic scenarios should be stakeholder driven, but we need more information on how to involve stakeholders and how to downscale the socioeconomic scenarios”

It was acknowledged that stakeholders, as well as aspiring to certain futures, exert influence over the future. The addition of a normative dimension, which would enable users to incorporate stakeholders' aspirations for the futures, was also encouraged. It was argued that this would enable a greater understanding of how the choices and decisions that stakeholders take today influence the development paths followed.

Other suggested changes to the UKCIP socioeconomic scenarios included the addition of a political component, which would incorporate recent changes such as rising oil prices and stagnating economies, greater elaboration of the role of the state and policy style in the qualitative storylines, and the addition of time frames.

7.9.3 The quantitative indicators

Interviewees felt that UKCIP needed to make it easier for people to use the quantitative indicators, such as through the provision of targeted information. It was recognised that this would be challenging and researchers questioned the feasibility of producing a large range of indicators that would meet the requirements of all sectors and regions. However, it was argued that by doing the work for people and making the indicators easier to use, their uptake would be increased. The provision of detailed quantitative indicators was considered a fundamental part of the climate scenarios in order to make them ‘real’ for users.

“The advantage of the climate scenarios is that people can look at their region or sector and find quantitative indicators, but this information isn’t available for the socioeconomic scenarios.”

The lack of information in the guidance document that would help users to parameterise their models was also commented upon. The provision of quantitative uncertainty ranges, which would allow co-evolutionary change, was suggested by one interviewee. It was argued that there is currently very little to constrain people in how they interpret the numeric quantities, and that some constraining of the uncertainty range would be helpful. This would enable users to constrain futures in a way that was defensible while ensuring that these constraints were consistent with the qualitative storylines. Many researchers commented that the specific indicators developed by BESEECH had proved very useful, particularly for regional and urban studies. It was suggested that these indicators should be promoted more widely, especially as some users felt that BESEECH had had little impact outside the academic community. One interviewee argued that specific indicators for metropolitan areas should also be elaborated, using BESEECH to demonstrate how this had been done at the regional level.

7.9.4 Guidance and support

Overwhelmingly, researchers argued that UKCIP needs to increase the usability and relevance of the socioeconomic scenarios.

“Stakeholders have too much to think about already without also having to think about the socioeconomic context. If they struggle to implement statutory requirements, how are you going to persuade them to use an optional tool whose relevance they are not convinced by?”

In order to increase their use, the socioeconomic scenarios need to be usable ‘off the shelf’: after all, the easier the scenarios are to use the more they will be applied. It was argued that UKCIP need to focus on demonstrating that the socioeconomic scenarios are relevant to stakeholders and that they have practical uses. Interviewees highlighted two ways that UKCIP could do this: firstly, by

revamping the scenarios so that they are more closely aligned to the needs of the users and secondly, by providing exemplars of their successful application.

“Users need more examples of successful use of the socioeconomic scenarios. This may require more resources to fund a ‘best practice’ case study or more research into what’s already out there, but it needs to demonstrate the benefits of using the scenarios i.e. how the scenarios fed into and informed the study results and recommendations.”

UKCIP should also provide guidance on how to communicate the results in the light of the scenarios. Only in a few studies did the results of the socioeconomic scenarios feed into the analysis or recommendations; therefore, UKCIP need to demonstrate how the scenarios have influenced project outcomes. Once more, the provision of exemplars, to show how the scenarios had benefitted the outcomes of a study, was stressed as a way of demonstrating their influence.

Another suggestion for promoting the use of the socioeconomic scenarios was the provision of training workshops, similar to those provided for the risk assessment and cost methodology tools.

“UKCIP have put a lot of effort into the climate scenarios, but what about some workshops on how to integrate the socioeconomic scenarios with other climate tools?”

Users also wanted further guidance on how to link the socioeconomic and climate scenarios; this was particularly important in the light of the forthcoming release of the UKCIP08 climate scenarios. Holding skills training workshops that would provide guidance on how to integrate socioeconomic factors with other tools for assessing impacts and adaptation to climate change was suggested by several users.

Finally, interviewees pointed out that the publication of the UKCIP08 scenarios for climate change being published at the end of the year provides an ideal opportunity for UKCIP to promote and encourage the use of other tools in studies that assess vulnerability and adaptation to climate change.

“UKCIP08 will be published at the end of the year and that’s a real opportunity to say ‘don’t forget about the socioeconomic scenarios, climate’s not the only thing that’s going to change’. It’s a good opportunity to promote other tools.”

7.9.5 UKCIP: the right place for the SES?

There was a general perception that while UKCIP had been very good at getting researchers to use the climate scenarios it had been far less successful in encouraging the use of the socioeconomic scenarios.

“There’s a perception that [UKCIP] are the UK climate providers, they’re not the socioeconomic futures providers”.

There was concern about lack of specific expertise and specialisation within UKCIP, due to the organisation’s focus on climate change scenarios. The disparity between the resources invested in the development of the climate scenarios, compared to that spent on the socioeconomic scenarios was commented on by several researchers. However, there was disagreement about whether UKCIP was the right place for the socioeconomic scenarios. Some users argued that it was, as the organisation had established links and the background in promoting the use of the scenarios. Others suggested that there ought to be a special body to take the lead on use of the socioeconomic scenarios, such as a professional social science organisation.

“Socioeconomic scenarios are a complex and difficult subject. [UKCIP] need to bring in different perspectives to the scenarios in order to agree on wording for best practice, and to open up the debate. Currently, the CIP socioeconomic scenarios masquerade as the sum total of social science thinking on the subject. What is needed is an institutional process for being able to assess how good they are”.

8. Key issues

Overall, this review has shown that the UKCIP SES have been valuable as a mechanism for ensuring that socioeconomic factors are considered in climate impact studies. The contrasting alternative worlds represented by the scenarios are useful in stimulating thought about the different factors which could increase or reduce stresses on the environment deriving from climate change, ranging from social attitudes to resource consumption, to political devolution and regulatory structures.

However, it is also clear that aside from their role on stimulating broader thought relating to climate impacts, the scenarios themselves have in general not become fundamental to the analysis of the studies in a way which communicates itself strongly in the final conclusions. Indeed, there is a sense running through both the studies themselves as well as the interviews, of some uncertainty about the precise function and purpose of constructing socioeconomic scenarios. The interviews also reveal some uncertainty about key points in the process of using the SES.

8.1 Lack of clear purpose of scenario process

Some of the reason for the lack of clarity on the part of study authors and interviewees may stem from the fact that the UKCIP guidance document is reticent in providing a clear statement of purpose, and directly relating the practice of using scenarios to this. The document is somewhat focussed on emphasising the extent of uncertainty relating to any consideration of the future, and the resultant problems and difficulties of constructing scenarios- rather than providing a clear and convincing case for the use of scenarios in this instance. It also emerged in the interviews that users felt the document did not tell them what they needed to know to use the scenarios.

The process of breaking down the various possible aims and interests of the SES into 'focal questions' as undertaken in Section 3.1 may be a useful mechanism in achieving this clarity. Though this particular set of possible focal questions need not necessarily be considered definitive by UKCIP- as an organisation it will need to consider carefully its intended aims for the use of the SES- nonetheless for the purposes of this report they have highlighted some interesting issues. For example, most of the studies reviewed focussed in their use of the SES on focal question 1; however, within the reports themselves as well as in interviews with study authors, there was some interest in a use of scenarios which would be more in line with answering focal question 4, and informing up-coming policy decisions of regional actors. The split between focal questions 1a and 1b is also pertinent. Studies have distributed their investigations quite evenly across both; however it has been noted that the process of quantifying and monetising economic impacts under 1b steps into an area of considerable difficulty and controversy, as well as admitting a number of additional external uncertainties (such as global economic growth) which are hard to irrefutably align within the framework of a scenario which

is focussed on the regional level. It might be argued that any answer to focal question 1b will be misleading in its apparent precision.

The support provided by UKCIP in the use and interpretation of the scenarios was widely found useful, however increasing resources put into supporting the SES process would be welcomed, including supplementary events such as workshops.

8.2 Role of agency and adaptation

The UKCIP SES were initially envisaged not to consider adaptation. However, it has emerged throughout this review that attempting not to consider adaptation is a somewhat artificial objective, given that some scenarios inevitably contain elements which lessen the impacts of climate change, and which thus may be considered adaptive measures. Rather than trying to avoid this question on the grounds that it increases complexity, it may in fact be that to address the issue fully and consider analytically how it should be represented in scenarios would reduce the perception of complexity, and improve the strategic value of the scenarios to users. The historical literature on scenarios is rich with guidance on this aspect. For example, a common approach is to divide the future into those elements, which from the point of view of the scenario user, are 'dominating' and 'masterable'. Scenarios should enable the user to consider the range of possible 'dominating' circumstances which could come about- that is circumstances which lie beyond their control and which they must accept and adapt to. However, it would not be logical to assume that every other actor may do as they choose, whereas the scenario user is the only actor in society who does not act at all. Hence scenarios should also, in fairness, consider the 'masterable' elements from the point of view of the user. Of course, both masterable and dominating elements are already present in most of the scenarios reviewed- the elements are simply not attributed to the actions of distinct actors, but rather subsumed under generic 'value landscapes'. Being precise about the role of distinct actors, and the extent of agency of the scenario user, would greatly clarify the question of adaptation, and reduce its perceived complexity.

The four possible questions explored in Section 3.1 identify different ways in which the agency of the scenario user may be represented in the scenario, ranging from purely reactive to increasingly proactive decision making opportunities. Whilst most of the studies viewed the scenarios as describing possible future states of the world, that the users would have no role in influencing but would simply have to react to, some of the studies were clearly interested in trying to identify policy decisions that could be taken now to increase the likelihood in bringing about certain socioeconomic contexts- though frequently such insights were not directly interpreted within the scenario context. In the interviews, a strong interest emerged in being able to use the scenarios to highlight choices and decisions which could be made by stakeholders now, to influence the future direction of travel for

their region, in a positive way. Acknowledging that, for regional actors considering socioeconomic futures in the context of global climate change, the future will contain both elements which are beyond their control as well as elements which they might more realistically influence, a focal question which combines a consideration of both 'reactive' and 'proactive' decisions, may be considered appropriate. An example is given in which the pronoun 'we' is used to refer to the local authority or other regional 'user', employing the scenarios to improve long term strategic decision making in the face of climate change impacts:

'What actions can we take to both *influence* and *respond* to the range of potential future *socioeconomic contexts*, in order to *prepare for* and make ourselves *robust* to the range of possible future *climate impacts*?'

Inherent in this question are a number of actor levels, at which the local or regional level actor, that is the user of the scenarios, has differing levels of agency. It will be observed that the emphasised words relate to either proactive or reactive use of the scenarios, depending on the level of the activity and the role of the scenario user as an actor at that level. At the regional level, the actor may have relatively high levels of agency in developing its own economic priorities, its own strategies on biodiversity, housing, tourism, etc. However, the extent of agency at this level is also dependent on higher level processes, particularly the extent to which in the future such processes become devolved to the regional level. Other higher level processes, such as national and EU level policies on agriculture, transport, and industry, will impact on the regional level regardless of the extent of devolution. At such a level the local actor may be considered to have some agency, through the process of dialogue and lobbying to influence higher level outcomes, but its agency is much reduced. Finally, the process of global climate change may be assumed to be one over which the regional actor has virtually no agency at all. While it may be argued that progressive regions may have some wider influence as beacons of sustainable technology use and behaviour, it must be admitted that on its own the influence of such activity on the trajectory of global emissions could only be so small as to be negligible, and that thus the extent of global climate change to a local actor must be an element of the future towards which only reactive, not proactive action is relevant.

8.3 The current scenarios and their structure

Much of this report has discussed in some way the structure of the scenarios, which derives from the 2x2 grid with which they were designed. It has been suggested that the polarisation of the values axis leads to 'extreme' scenarios which as a result lack credibility and stakeholder 'buy-in'. It has also been suggested that the governance axis is important and has in general not been considered as thoroughly

as it should be, as it crucially affects what kinds of decisions a regional actor will be able to make in the future.

The extent to which it may be relevant to alter the scenarios in light of these concerns, depends in part on the future purpose that is decided for the scenarios. If it is acceptable that the scenarios should remain primarily as generators of ideas, then it may not be considered worthwhile to radically alter their structure. If it is intended to make the scenarios more useful as strategic decision making tools for actors who can both influence and react to the future, then characterising them both with a set of values which can plausibly be demonstrated to evolve from present concerns, as well as to explore the effects of governance structure on decision making capabilities of scenario actors, will be vital points of development.

8.4 The relationship of socioeconomic to climate scenarios

An early observation in this review was the complexity of attempts to link climate impacts to socioeconomic factors, and to map socioeconomic scenarios on to climate impact scenarios. This is due to the number of different levels of activity and related spheres of influence which could be associated with them. Regional actors may be able to have significant influence on forming the socioeconomic conditions around them. These actors are however essentially powerless when it comes to influencing levels of global climate change.

The interviews also raised the point that while wider global developments may be following, for example, a World Markets route, it would be possible for one particular region to have developed social structures more akin to Local Sustainability- hence, when considering socioeconomic scenarios at a regional level, the logic for aligning them with 'comparable' global emissions levels is really very weak indeed.

This of course raises the problem which has been acknowledged at every stage, of the potentially unmanageable number of scenarios resulting from an unselective combination of SES and climate change scenarios. UKCIP will also have to consider in this context how much it wishes to dictate a standard scenario combination for the sake of having regional studies which can be more easily compared with each other.

It has been mentioned that studies which change both the socioeconomic and climate drivers in each scenario provide less clear conclusions, because it is not possible to see if any of the socioeconomic contexts are having a mitigating effect. A possible option might be to advise users to test the socioeconomic scenarios against a single climate change scenario; or alternatively to streamline the

socioeconomic scenarios down to two, and test both of these against a 'high' and 'low' emissions climate scenario, resulting in four combined scenarios.

The preferred approach would again depend greatly on the perceived purpose of the scenarios, emphasising again the need to be particularly clear about this.

8.5 'Off the shelf' or high level scenarios

The review of the UKCIP guidance highlighted a primary objective that the SES should provide a common framework to ensure that regional studies should be comparable, in order ultimately to build up a picture of potential climate impacts across the UK. It was also acknowledged, however, that individual sectoral and regional studies would have quite different concerns, and that they would therefore have to be developed on this basis by the particular study authors and users. This was confirmed by the literature review and interviews; what has emerged is a highly diverse body of work, involving different combinations or modifications of the original scenario set, supplemented by additional regional or sectorally specific descriptions or data inputs. It has emerged that UKCIP will have to decide, and communicate clearly, where the balance should lie between standardisation and regional specificity.

A further issue emerged from the interviews and literature review, which while related to the above discussion, has a slightly different perspective. It is clear that engaging in a detailed development and adaption of the high-level scenarios to the specific regional context of the study, is potentially an involved and labour intensive process. Several study authors perceived this, and noted it as a barrier to uptake. There was a significant sense emerging both in studies and interviews, that users would like to see the UKCIP scenarios developed to a much more detailed regional level, in both qualitative and quantitative terms. Some interviewees explicitly called for 'off the shelf' scenarios, which users could take and immediately apply to their regional contexts.

However, other interviewees were more sanguine in acknowledging that given the diversity of regional and sectoral contexts being addressed by the studies, such a goal was probably unrealistic. It is also worth noting that other interview comments emphasised the importance of stakeholder 'ownership' of the scenarios, and that they should be directly relevant to stakeholder needs. This reflects points made in the literature review, as well as the historical analysis, relating to the importance of 'grounding' scenarios in present concerns of stakeholders, both as a means to increasing the plausibility and strategic power of the scenarios, and increasing their acceptance by stakeholders. It is an important point that there is potentially a contradiction between a UKCIP led drive to increase the detail of the high-level SES with a view to providing 'off the shelf' solutions for regional users,

and promoting an approach where it is the users themselves who have to put in the bulk of the work towards 'regionalising' the scenarios, with the possible benefits of greater relevance and perceived stakeholder 'ownership'. Again, the balance between these approaches is something UKCIP will have to decide upon based on its priorities for the SES, and then communicate its preferred approach clearly. If the latter approach is favoured, it would be helpfully accompanied by guidance emphasising the appropriate level of resources which should be dedicated to the task of regionalising the SES.

It is also worth noting that once the aims and purpose of the SES have been more clearly expressed, this will give a strong steer to the kind of detail it may be worth developing, as well as areas which would not. For example, the quantitative indicators currently cover a wide range of areas including economic growth, demographics, land use and planning, and biodiversity. It is sometimes the case that detail across a wide breadth of areas can be less than helpful, as it can create confusion as to what the focus of the socioeconomic work should be. This may also have contributed to the widely held sense that the socioeconomic aspect was an additional layer of complexity which was unviable. Providing more focussed use of detail, for example in the quantitative indicator set, may also help to reinforce the aims and purpose decided on by UKCIP, as the types of indicators provided will suggest clear methodological boundaries for the analysis.

9. Recommendations

Since their inception, the UKCIP SES have played a valuable role in raising awareness of the importance of considering socioeconomic issues in climate impact assessment. They have shown themselves to be highly effective in stimulating exploratory thinking across a much greater range of socioeconomic areas, and the consideration of a wider scope of possible future contexts, than would otherwise have been considered. Those who used the SES in their studies were in general convinced of the importance of considering socioeconomic issues in climate impact assessment, and endorsed the SES as being useful aids to thought in this area. However the SES have not tended to deliver specific insights which follow through strongly into final recommendations of the studies. Indeed, in many of the final reports the SES receive very little mention. It seems that while the SES are considered useful for raising awareness and stimulating thought about socioeconomic issues in the early stages of a study, they are not currently adding significantly to the studies as specific, policy-related or strategic decision making tools.

This section contains some recommendations towards improving the tractability of the UKCIP SES as strategically useful tools for regional actors considering the uncertainties within possible climate and socioeconomic futures. It should be emphasised that, as shown in Section 2 of this report, there is no

objectively 'ideal' scenario process- the appropriate approach should be dictated by the needs and priorities of those using the scenarios. This means that the appropriate way of taking forward the SES needs largely to be determined by UKCIP in light of its own priorities, objectives and resources, and its detailed understanding of the needs and priorities of the stakeholders who will use the scenarios. Hence, this section does not try to offer recommendations which comprehensively trace a series of steps through which UKCIP will end up with a definitively 'better' SES set. Rather, it focuses on the current areas of uncertainty which the authors of this report feel to be problematic, and suggests perspectives from which to reappraise them in an ongoing process. It also describes how, once these issues are clarified, presentation within the guidance document may be improved and ongoing support may be provided to users. However, exactly how these problematic issues will be resolved ultimately remains a question for UKCIP to address based on what it decides should be the primary purpose of the scenarios.

Most of the following section is written with the assumption that the current UKCIP SES will, at least in the short term, broadly remain in place, though with the possibility of some re-focussing, greater elaboration of certain aspects, and more specific guidance. However, the very final section also indicates possible reasons why a more fundamental overhaul of the scenarios might be considered appropriate in the longer term.

9.1 Clearly define the aim of the process

A central recommendation from this review is that the aims and purpose for which UKCIP intends the SES to be used, are more clearly and definitively articulated. This may in fact be that the SES should remain primarily as stimulants to imaginative thought about socioeconomic futures for use in the early stages of the project; or a more strategic function may be envisaged. The existing UKCIP guidance document provides suggestions of the possible reasons why socioeconomic scenarios may be important, however as the discussion in Section 3 shows, the complexity of the area is such that a number of quite contrasting study aims could be derived from this, each implying different questions and different methodologies. This is reflected in the range of approaches followed within the studies themselves, as well as by a certain lack of clarity in their own explanations as to the precise purpose of scenario analysis.

Perhaps an important starting point in this process would be to clarify the extent to which the SES are intended to support assessments purely of climate change impacts, or whether the questions of effective adaptation to, or reduction of vulnerability to climate change are also to be considered. As described in Section 8.2 the current configuration of the scenario descriptions restricts their suitability for being used to consider opportunities for reducing vulnerability or adapting to impacts. This is due

to the dominance of generic 'value landscapes', which do not adequately differentiate the different extents of agency of different actors, and hence do not clearly identify which aspects of the future could be within or outside of the scenario users' power to directly influence. Nonetheless, the scenarios do all contain aspects which might be considered 'dominating' or 'masterable' from a regional user's perspective- they are simply not explicitly differentiated as such. Hence it would be possible to 'refocus' the existing set to give greater attention to the role of different actors in bringing the different futures about, thereby attracting attention to actions the scenario users themselves may take to positively influence the future (which in this instance would mean, affect their local socioeconomic conditions so that they are less vulnerable to climate change impacts).

The definition of a 'focal question' is presented in this report as a useful way of clarifying the precise intention of the scenario process. Section 3.1 hypothesises four focal questions which could define the intention of the UKCIP SES, which vary in the extent to which they are focussed on purely assessing climate impacts and the extent to which they would interact with different socioeconomic contexts, or assessing the opportunities for the user to plan for and affect different future socioeconomic contexts in a conscious attempt to lessen the regional impacts of future climate change. Of course, as the future to any one actor consists of elements which may potentially be controlled, as well as those which cannot be, it is likely that a scenario process will also be used with both perspectives in mind. This would lead to a more integrated focal question, which aims to consider both 'reactive' and 'proactive' actions, such as the one set out in Section 8.2.

9.2 A stronger and more definitive guidance document

Following on from this, and indeed strongly aided by it, would be an updating of the guidance itself. Whilst it is understandable given the early stage at which the guidance was published, that the discussion should be somewhat exploratory regarding the complex series of choices that have to be made in scenario analysis, users have found this document difficult to extract clear direction from, and requested more specific guidance. With the benefit of some experience of several years of the application of the SES, the time is now right for UKCIP to make some clear judgements on the areas which were to a certain extent left open to question in the original document, in a way which reinforces the overall programme aims. A number of areas of complexity were identified in Section 4.2 as requiring greater guidance within the document. The subsequent discussion in Sections 5-8 explored these issues and the potential trade-offs relating to them. The key areas are listed again below. In each case it will be up to UKCIP to decide what steer to give, depending on its programme priorities, and the more precise definition of the aims and purposes of the SES.

Centrally driven consistency through added detail or user-devolved regionalisation

UKCIP should be clear about the extent to which it wishes to increase standardisation across studies for the sake of comparability, and the extent to which this will require the development of further detail and regionalisation in the scenarios. Alternatively, if it sees a more devolved process as appropriate, where the regionalisation of the high level scenarios is conducted by regional users, it should make this clear in the information it provides, as well as stressing the resource commitment this requires from regional users.

Quantification

The clarified aims, as well as the decisions taken with regard to the extent of standardisation, will affect which kinds of quantitative data would most usefully be supplied with the scenarios. The quantitative data should be seen less as trying to capture a broad sweep of indicators, and more as a way of supporting and directing the methodologies of the studies in a way which is conducive to UKCIP's overall aims for the SES.

Vulnerability, adaptation and agency

The extent to which this aspect should be emphasised again depends on the aims of UKCIP. However, an interest was expressed in the interviews in the use of scenarios to inform near term decisions of stakeholders. This kind of use could be promoted and assisted with a greater delineation within the scenarios of 'masterable' and 'dominating' future elements, from the perspective of a regional user.

Selection of scenarios, and the link of SES to climate change scenarios

The UKCIP guidance is unprescriptive about the process of selecting scenarios from the total possible set, though it does offer some suggestions. If UKCIP chooses to prioritise standardisation for the sake of comparability, it will be necessary to become more prescriptive about this. In any case, from the user perspective, it appears that some users would themselves welcome more specific guidance. The rationale for linking socioeconomic to climate scenarios is complex, but this in itself is likely to be a reason for stronger guidance from UKCIP, rather than the opposite. Again, the approach depends in large part on UKCIP's overall aims, but possible options might be to instruct users to set all four SES against a single climate change scenario, or to condense the SES to two scenarios, for setting against two climate scenarios.

9.3 Supporting activities

As well as a clearer and more definitive guidance document, significant additional help and support should be provided by UKCIP to guide users through this highly complex process, the like of which many users will have had little previous experience. If UKCIP wishes the SES to be more widely used it would be likely that committed and detailed engagement with users throughout the process will be necessary to overcome barriers of unfamiliarity. User suggestions for further support included the funding of a 'best practice' study for general reference, and the staging of training workshops.

Most of the studies reviewed which didn't use the SES, nonetheless did take account of socioeconomic issues. Though socioeconomic factors are increasingly widely accepted as being of relevance to climate impact assessment, it may not be clear to all potential users that scenarios are necessarily an important tool in considering this. If UKCIP believes that the SES are a crucial, rather than optional, tool for considering socioeconomic factors, it must continue to work at communicating the specific importance of a scenario approach to this area. It must also work at communicating that this is a viable and understandable approach, which can be logically integrated with climate models, without adding impossible layers of complexity.

9.4 Longer term possibilities

The above suggestions are made with a short term perspective, with the assumption that the basic scenario set will essentially remain in place. With a longer term perspective however, UKCIP may wish to assess whether this basic set still serves the purpose for which it was designed.

A frequent observation within this review has been that the current 2x2 axis structure results in a certain polarisation, particularly along the 'values' axis between 'community' and 'consumerism'. Responses evident in reports as well as in interviews indicates that stakeholders and users feel that the division is slightly artificial, as aspects of both are evident in current contexts as well as future plans. This can be divisive, as it tends to produce a perceived separation of the scenarios from what stakeholders understand as 'reality', meaning that the scenarios' potential for use as strategic planning tools is highly constrained.

If this problem is felt to be significant and insurmountable UKCIP may at some point wish to consider a more fundamental review and recast of the scenario set. At such a point, wide stakeholder engagement would be preferable to a purely literature review based scanning activity. The priority would be to identify the issues that are of interest and concern to the stakeholders who are likely to be the main potential users of the scenarios, and to ground the scenarios in these concerns, hence providing for any future visions which are developed, a plausible link to present realities.

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Appendices

A1. Researchers interviewed

Contact	Study Title	Year of study	Geographical Scale	SES used
Ian Holman; Simon Shackley	RegIS 1: Simulating the effects of future climate and socio-economic change in East Anglia and North West England	1999 - 2002	Regional	Yes
Ian Holman; Simon Shackley	RegIS 2	2002- 05	Regional	Yes
Darren McEvoy	Climate Change and the Visitor Economy: the challenges and opportunities for England's Northwest	2006	Regional	Yes
Richenda Connell	Isle of Man scoping study	2006	Regional	Yes
Jim Kersey	The potential impacts of climate change in the West Midlands	2004	Regional	No
Jim Kersey	The potential impacts of climate change in the East Midlands	2000	Regional	No
Matthew Hunt	North East Climate Change Adaptation Study	2007- 08	Regional	No
Matthew Hunt	Yorkshire and Humber II	2008 - 09	Regional	Planned
Gerry Metcalf	Warming to the idea: meeting the challenge of climate change in the South West.	2003	Regional	No
Steven Wade	Warming up the region: Yorkshire and Humber	2002	Regional	No
Geoff Darch	Preparing for a changing climate in Northern Ireland	2005	Regional	No
Jim Kersey; Richenda Connell	London's Warming: the impacts of climate change on London	2002	Regional	Yes
Richenda Connell; Michelle Colley	Climate change adaptation by design	2007	UK wide	No
Roger Salmons	Building Economic and Social information for Examining the Effects of Climate Change (BESEECH)	2004 - 07	UK wide	Yes
Elizabeth Wilson	Adaptation Strategies for Climate Change in the Built Environment (ASCCUE)	2004 - 07	Local	Yes
Elizabeth Wilson	Defra Cross Regional Project A: Adaptation responses to climate change for new development in growth areas	2004 - 06	Local	No

Contact	Study Title	Year of study	Geographical Scale	SES used
Steven Wade	Defra Cross Regional Project C: Water	2004 - 06	Regional	Yes

A2. Interview questions

Theme	Aim(s)	Questions
General value of the scenarios	To understand the interviewee's perceptions of the scenarios, their applicability to the study context, and appropriateness for the study.	<p>Did you find the SES a useful tool for envisaging the socioeconomic context within which climate change impacts and adaptation might occur?</p> <p>Did the separation of the SES from climate change impacts help or hinder the use of the SES?</p> <p>What were the key strengths and weaknesses of the SES?</p>
Use of the SES within the study	<p>To understand the interviewee's experiences of using the SES and the quantitative indicators.</p> <p>Where the SES were not used, to understand why they were not.</p>	<p>Was the use of the SES an objective of the study when the research was commissioned?</p> <p>Could you briefly describe how the SES were used in the report?</p> <p>Was it intuitive how the SES could be applied?</p> <p>Did you experience any difficulties with using the SES?</p> <p>Were you aware of the use of the SES in other reports? Did this influence your own study?</p> <p>Were the quantitative indicators used in the study? How might they have been more useful?</p> <p>Did the SES provide insights into the vulnerability of different types of future societies to the impacts of climate change?</p> <p>If the SES were not used, are you familiar with the SES?</p> <p>Did you consider using the SES in the study? Why not?</p>
Guidance and support	To investigate specific difficulties that were experienced in the use of the SES, and how such difficulties might be overcome.	<p>Were you aware of the guidance on using the SES that was supplied by UKCIP? Did you follow the guidance? If so, did you find the guidance adequate? If not, why not?</p> <p>What support and guidance could you have been provided with that might have enabled you to use the SES?</p>

Value and influence	<p>To explore perceived value of using the SES and what, if any, influence their use had on the study results.</p> <p>To explore the usefulness of the scenarios in informing the policy recommendations and conclusions.</p>	<p>Was it easy to locate regional policy processes and trends within the scenario framework?</p> <p>Did the SES enable you to scope the interactions that would enable actors to affect the socioeconomic context?</p> <p>What benefits did using the SES bring to the study?</p> <p>How did the use of the SES influence the study results?</p> <p>If you did not use the SES, what other socioeconomic information did you use? Was it helpful? Did this information influence your results?</p>
Future efforts	<p>To investigate where interviewees felt UKCIP should focus future efforts in using the SES.</p>	<p>Where should UKCIP focus its future efforts in providing and supporting SES for climate change vulnerability and adaptation assessments?</p> <p>If UKCIP were to replace or update the SES, what kind of information would be more valuable, and what kind of support would you like to see?</p>
Additional thoughts and comments	<p>To give the interviewee an opportunity to mention anything that they felt was important but had not yet been discussed.</p>	