Tayplan: Strategic Land Use Change 2035-2050

Phase 1 Report
e-ANNEX
Document Summaries

Universities of Dundee, Abertay and St Andrews

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Authors

1. Title: Adapting to climate change: a Greater Manchester policy perspective. Ecocities project

Author(s) Jeremy Carter and Angela Connelly
Institution (agency or university) Manchester University
Date of publication 2012
Availability (URL or Publisher) http://www.adaptingmanchester.co.uk/documents/one-city-multiple-futures-two-scenarios-exploring-future-greater-manchester

Summary of research undertaken
Working paper which maps out the policy landscape on climate change adaptation, focusing on the implications for progress on adaptation in Greater Manchester. Although policy framework can rapidly shift, this review offers a snapshot into key pieces of legislation and implications as it stands in 2012. The paper begins at supra-national level before concentrating on national policy and then strategies influencing growth and development.

Key conclusions
The conclusion draws together the major implications of the review adaptation policy, and considers how this may define the scope of partnership working towards ensuring that Manchester is a ‘well-adapted’ city. Cities are the ‘engines’ of economies plus centres of learning and cultural exchange, and the competition between them are the key forces for driving future changes. Making cities more sustainable and resilient to environmental, economic and social challenges is a key policy issue. Adapting to climate change is one aspect of such a holistic response to fitting cities for 21st Century and being one of the ‘first movers’ to reacting / adapting to that challenge will provide significant benefits such as boosting their competitiveness over other urban areas by demonstrating proactive responses (links to economic competitiveness / economic opportunities / private sector investment / increase demand for households and businesses etc). Redesign of urban fabric will be associated with investment and job creation (lower end of skills spectrum plus environmental consultancy and urban planning and design for ex). It’s about creating healthy and agreeable places where people want to live – liveability.

Areas/questions for future research
Highlights gaps for future research. Adaptation agenda includes ‘green growth’ and low carbon economy – look at building retrofit and urban planning / design. Encourage property owners and businesses to take the initiative to adapt / enhance their own resilience to climate change (Abertay Lo-Cal-Net) ideally supported by a framework of guidance and action plans. Key challenges for realising adaptation include social justice, reducing climate risk to vulnerable groups, enhancing quality of life via green spaces / infrastructure. Develop policy frameworks which are integrated with other policy issues that promote long term growth and development in a holistic / multifaceted way which are achievable / deliverable.

Potential linkages to other research
Cross cutting research so several links with other research

Relevance
This parallels with TAYplan. Feeds into TAYplan strategic planning process and provides significant parallels for TAYplan aspirations and forward planning.
2. Title: Land use change scenarios for Greater Manchester: analysis and implications for climate change adaptation

Author(s) Jeremy Carter  
Institution (agency or university) Manchester University  
Date of publication 2012  
Availability (URL or Publisher) http://www.adaptingmanchester.co.uk/documents/land-use-change-scenarios-greater-manchester-analysis-and-implications-climate-change

Summary of research undertaken  
The EcoCities scenarios, ‘long descent’ and ‘upward spiral’, draw different narratives of how Greater Manchester may develop over the coming decades based on ten ‘drivers of change’. This paper reports on the outcomes of a linked research task focused on exploring future land use change over Greater Manchester, using the EcoCities scenarios as a framework. The team focused on this issue because evolving land use patterns will influence how the conurbation is impacted on by, and will adapt to, the changing climate.

The research uses Metronamica, a spatial decision support tool designed to assist planners, decision makers and researchers in understanding future land use change. It provides a platform for simulating and assessing potential land use change up to fifty years into the future. Using the EcoCities scenarios as a framework, Metronamica offers a projection of possible land use change in the conurbation. The research is scenario-based, acknowledging that we cannot predict future land use with any degree of accuracy. There are simply too many variables that could influence land use patterns in Greater Manchester over the coming decades.

Key conclusions  
Results indicate that different land use futures will have contrasting effects on climate change impacts and adaptation responses in Greater Manchester. This demonstrates that when considering adaptation responses, it is vital that attention is paid not just to the changing climate but also to land use change. These observations can assist the development of adaptation policies and strategies attuned to the importance of current and potential future land use across Greater Manchester.

Areas/questions for future research  
Metronamica (Dutch designed spatial decision support system) – designed with the non-modeller in mind to support spatial planning decisions at different scales – is this really the case? Is it transferable / are we doing something similar? Is it something that TAYplan stakeholders would be interested in? 3 key drivers of change which include economic growth (and decline), demographic change and politics – what research with these 3 key drivers is available pre-TAYplan – local demographic change and political drivers research?

Potential linkages to other research  
James Hutton Institute GIS modelling / Abertay interactive visualisation platform based on games technology (John Isaacs etc).

Relevance
Covers multiple drivers of change and is strategic in nature. Link to Metronamica brochure - http://www.riks.nl/resources/Metronamica_brochure_web.pdf
3. **Title:** Adapting to Climate Change – a Greater Manchester Policy Perspective

**Author(s)** Jeremy Carter and Angela Connelly  
**Institution (agency or university)** Manchester University  
**Date of publication** 2012  

**Summary of research undertaken**  
Supportive adaptation policies and strategies can help to equip cities and urban areas for changing climate patterns, which looks set to influence their future growth and competitiveness. However, much existing policy effort is targeted at mitigation; that is the reduction of the greenhouse gas emissions that are principally responsible for observed and projected future changes in climate. Adaptation remains the poor relation in policy terms, yet there is some evidence of increasing adaptation activity within policy communities, stimulated in part by the recognition of the unavoidable impacts of climate change.

**Key conclusions**  
The report maps out the policy landscape on climate change adaptation, focusing particularly on its implications for progressing the agenda in Greater Manchester. Although policy frameworks can rapidly shift, this review offers a snapshot into key pieces of legislation and their implementation as it stands at the beginning of 2012. The paper begins at supra-national level before concentrating on national policy and then strategies directly influencing the growth and development of Greater Manchester. The conclusion draws together the major implications of the review of adaptation policy, and considers how this may define the scope of partnership working towards ensuring that Manchester is a ‘well-adapted’ city.

**Areas/questions for future research**  
Has this been undertaken for Scottish, and TAYplan regional and local levels? i.e. have they all been brought together in one document? This is important to assist with identifying potential future changes etc.

**Potential linkages to other research**

**Relevance**  
Adaptation strategies for climate change based on policy landscape. Scenario based modelling relevant to strategic planning process.
4. Title: Strategic Flood Risk Assessment

Author(s) SEPA / SNIFFER / Tayplan
Institution (agency or university) TAYplan
Date of publication May 2011
Availability (URL or Publisher)

Summary of research undertaken

First Draft Level 1 - Strategic Flood Risk Assessment: A ‘living’ document. SFRA developed to address some of the challenges associated with delivering growth in urban areas, building sustainable communities, restoring degraded environments and providing high quality development that is economically and environmentally sustainable. One of the key objectives of TAYplan is to bring sustainable economic development to the region which will involve the delivery of 2,170 new homes a year for the next 20 years. For future development in the region to be considered sustainable, consideration of the impacts of flood risk is required and how to manage that risk. The primary aim of Strategic Flood Risk Management is to avoid locating new development in areas of flood risk. Flooding is a natural process which provides both opportunities (e.g. strong links to green infrastructure) as well as a challenge to building sustainable communities and this SFRA provides an evidence base to inform proposed TAYplan by identifying: Where flood risk is likely to be important; How much of the area is defended; Where new development is likely to add risk; Where flood risk may need to be assessed in further detail.

Key conclusions

- The region is exposed to flood risk from a number of sources
- Flooding from the sea, due to extreme tides, is the predominant source of coastal flood risk, due to the location of some of the region’s most populated areas on low lying coastlines
- The region is protected from flooding from the sea by defences along the some of its coastal frontages. The level of protection afforded by the defences along each frontage varies considerably
- Climate change poses a significant risk to the region. Predicted sea-level rise and increased rainfall over the coming century will reduce the level of protection provided by most of the region’s flood defences and may result in the inundation of larger areas by extreme tidal floods. In addition, increasing intensity of rainfall of storm events is predicted which could result in increased river and groundwater flood events. In addition, sufficient flood storage is needed to adapt to future climatic conditions. Failing to take action and plan for the future could increase risk and incur higher costs as the climate changes, and remedial maintenance and renewal is required
- In addition it is clear that poorly-designed developments in unsuitable places can damage the quality of life in a community and increase greenhouse gas emissions. It is also vital to recognise that places which are suitable now for habitation and development may become unsuitable in the future as a result of the changing climate. Therefore it is in our interest to act now to find sustainable solutions that allow for climate change and adopt ‘no regret’ solutions, which will deliver benefits whatever the extent of climate change, such as avoiding development in areas of flood risk or planting trees that will thrive in current and future climate conditions and assist in managing surface water run-off.
Regional Conclusions (assessing the feasibility of allocating 43,400 houses within the TAYplan region as a whole):

- Scottish planning policy Risk Framework satisfied re location of new housing.
- However, high urban allocation presents a problem as the study was not able to assess issues with sewer / surface water runoff related flooding (SUDS should alleviate the problem...)
- Current flood defence / mitigation measures may prove to be unsustainable in the longer term then a managed relocation strategy for existing populations at risk may need to be considered in the longer term.

Recommendations:

- Review SFRA when significant new updates / guidance become available (anticipated that this will be 2012 as SFRA based on data available pre-2009).
- Proposed Plan should contain policies to ensure that new development is not at risk of being affected by flooding, or might increase flood risk elsewhere.
- Detailed site specific flood risk assessments are needed to accompany planning apps for proposed developments or site specific allocations in LDPs.
- Potentially higher defence standards may be required in light of climate change forecasts – these should include consideration of wider social and economic factors alongside SFRA outputs.
- SFRA should be used to guide LPAs when developing polices for LDPs to ensure future development is sustainable in relation to flood risk and climate change impacts to ensure that the provision and maintenance of flood management infrastructure can be secured as planning conditions for new development sites.

Areas/questions for future research

There have been several severe flooding incidents since 2009 – should update flood risk register and ultimately this SFRA. Pluvial flooding not really considered as Scottish Water do not appear to have shared data. This data should exist and can be obtained if possible to provide a more accurate picture. Huge missed opportunity at Riverside regeneration – surface water pumping station (and underground storage) as a solution is NOT sustainable – why no plans to incorporate green infrastructure and SUDS instead? Was it thought that this would be a cheaper option? False economy as pumping costs can only rise as will carbon footprint etc. Other regeneration areas should not copy this example and look at more sustainable solutions linked in with green infrastructure – green roof experiments for commercial developments etc.

Potential linkages to other research

Detailed-site specific FRA’s. Look at GSDP and London 2012, Newcastle / Gateshead, Greater Dublin SWMPs.

Relevance

Strategic document for future decision making – but needs to provide accurate information. More research required linking green infrastructure and more sustainable solutions with placemaking / liveability etc.
5. **Title: Strategic Environmental Assessment**

**Author(s)** Perth and Kinross Council  
**Institution (agency or university)** TAYplan  
**Date of publication** 2009  
**Availability (URL or Publisher)**  

**Summary of research undertaken**  
The Strategic Environmental Assessment for the TAYplan area interacts with a Main Issues Report which is borne of several iterations of environmental assessment reports. Strategic Environmental Assessment scope is based on environmental topics specified in EA (Scotland) Act 2005, plus issues identified in the baseline study prepared as part of the earlier Scoping Report plus the range of matters that the Strategic Development Plan (SDP) is likely to cover in The TAYplan area. Key TAYplan SEA topics: Biodiversity, Population and Human Health; Soil and Land; Water; Air; Climate factors; Material assets; Cultural heritage; Landscape. Development of the SEA is a 5 phased approach – framework and evidence base development; undertaking environmental assessment; final report preparation; consulting on the report; monitoring the adopted Strategic Development Plan including environmental impacts. The SDP has 5 key main issues (environment and settlements, people, consumption and use of resources, infrastructure, economy) with 13 objectives P15, Fig2 (these align with most of the ‘drivers’ for change...). Assessment and Conclusions of TAYplan Vision and Framework (pp47-49) considers the inter-compatibility of the MIR objectives and MIR compatibility with the SEA objectives to achieve the Vision. Achievement of the Vision is also dependant on the spatial allocation of development.

**Key conclusions**  
SDP is likely to have both significant positive and negative environmental effects.

The assessment and conclusions of TAYplan Vision and Framework has identified some areas where additional measures should be incorporated into the plan that will allow for the overarching Vision to be achieved. Examples: There are tensions relating to the provision of infrastructure and services, and land use provision when considering the inter-compatibility of the MIR objectives and; when considering MIR compatibility with SEA objectives to achieve the Vision there are areas which need to be strengthened such as the objective that aims to 'Protect and enhance the quality of the area’s natural and built environment, biodiversity and natural resources' where TAYplan need to ensure that there is a mechanism in place that will protect and enhance the TAYplan's water environment.

Section 6 of the report - Comparative analysis of strategy’s A and B identified the potential environmental effects on an area-basis reflecting proposals in the spatial strategy’s settlement hierarchy. The assessments considered positive/negative, cumulative and synergistic, and short/medium/long term effects of development within each of the area i.e. this section considers the overall environmental effects of the proposed strategies on a regional basis. Strategy A is best environmental option for all cases: A strategy that focuses development in the regions core areas will still have environmental impacts and implications for the whole region including increased emissions, increased mineral extraction, resource use, and waste production; however Strategy A is considered the preferred option for the SDP in terms of least environmental impact.
In order to enhance the proposals in the MIR, and to mitigate the potential impacts identified in the assessment, section 9 suggests a number of actions (based on cumulative effects with other plans such as Tay Management Plan, Tay Forest District Strategic Plan, NPF2) that could be included in the SDP to improve its environmental sustainability. Iterations of the SEA process resulted in the tightening and reshaping of summary main issues and associated objectives to provide a framework that could be assessed, and proposing a number of enhancements to the framework. This can be achieved by operationalising the objectives, attaching required actions and/or guidance for policy frameworks in lower tiers of the planning system. P103, Table 9.1 identifies 3 objectives (Protect & enhance the natural & built environment, biodiversity & natural resources', Ensure land use promotes sustainable food security', 'Provide new or improved infrastructure capable of supporting a low/zero carbon economy and zero waste') of the Vision Framework that require associated operational guidance, and the corresponding potential environmental issues relating to the spatial strategy. This highlights the necessity to enhance the proposals in the Vision to ensure that adequate mitigation of the potential impacts of the spatial strategy can be achieved. Proposed mitigation measures are also defined for each environmental issue.

Areas/questions for future research
PP 31-39 provide an overview of main environmental issues derived from baseline data, TAYplan region existing / predicted changes and data gaps and could help inform prioritisation of future research areas. Assessment and Conclusions (pp47-49) should be considered when BI writing the review report. Proposed mitigation measures and monitoring proposals defined for each environmental issue should also be considered (pp 105-111).

Potential linkages to other research
Links to all areas.

Relevance
The SDP has 5 key main issues with 13 objectives which align with most of the ‘drivers’ for change.
6. **Title: Scotland National Visitor Survey**

*Author(s)*: Insights Dept  
*Institution (agency or university)*: Visit Scotland  
*Date of publication*: Jan 2012  
*Availability (URL or Publisher)*: [http://www.visitscotland.org/research_and_statistics/visitor_research/all_markets.aspx](http://www.visitscotland.org/research_and_statistics/visitor_research/all_markets.aspx)

**Summary of research undertaken**
Highlights key results from the Scotland Visitor Survey which can be used by businesses to help understand Scotland’s visitors and to aid business planning.

**Key conclusions**
Domestic tourism has been increasing, countered by a decline in visits from overseas visitors: there has been a gradual decline in domestic holidays as a result of the increasing popularity of “staycation” holidays substituting overseas trips for domestic holiday due to affordability and localisation of holidays - Scots holidaying in Scotland. UK visitors particularly prominent in Argyll and Isles, Fife and Borders. Edinburgh and Glasgow had the highest proportion of Overseas visitors. Fife had 77% UK visitors (23% overseas).  
Demographics by region – Fife has lowest figures for all age groups except 55-64 year olds, Cairngorms, Fife and Highlands have highest figures in 25-44 year olds. First time visitors are more likely in the city destinations (Edinburgh / Glasgow) with Highlands next. Key motivations for visiting Scotland - Scenery, history and previous experience are big draws for all visitors to Scotland. Amongst Overseas visitors, recommendations and Scotland’s reputation for friendly people also add to the appeal. Highlands and Cairngorms have highest score for scenery motivator, Fife the lowest. Historical motivator – Highlands, then Fife but Cairngorms low. Particular attraction motivator – Fife highest, then Cairngorms, then Highlands. Specific activities motivator – Cairngorms the highest, then Highlands and Fife lowest. Tourist Board brochure motivator – Fife was the 2nd lowest overall.  
Accommodation deal motivator – Fife was the lowest alongside Edinburgh. Fife motivators - Scenery (27%), 19% were familiar with the area. St Andrews was a particular attraction and higher proportion of family connections compared to other regions (15%). Highlands motivators - Predominately scenery (57%); history of area (23%), recommendations (22%), know the area (20%), particular attractions included Loch Ness and the whisky distilleries. Cairngorms motivators - predominately scenery (45%), many already familiar with the area (26%), specific activities (23%) included cycling, hiking and walking. Other influencers for visiting Scotland - finances continue to be a consideration in decision making: Economic influences such as ‘Scotland offers good value for money’ and is ‘less expensive than other destinations’; Environmental influences such as ‘Scotland has a good reputation in sustainable tourism’ and carbon footprint reduction. Various statistics around booking accommodation and travel. Touring countryside trips the most popular. Stays in the Countryside more prevalent amongst UK visitors. Fife - 33% Touring, 19% City plus visit to countryside. Travel from overseas is predominantly by plane, whereas UK visitors are more likely to drive. Train, Bus and Car hire higher amongst overseas visitors. Fife activities - Trying local food 50%, Shopping 48%, Short walk/ stroll 44%, Visited a beach 40%, Sightseeing by car 37%, Centre based walking 36%, Visited religious building 36%, Visited a historic house 33%, Visited a country park 25%, Long walk, hike 24%. Fife accommodation - friends / family 26%, Self catering 18%, B&B / Guest House 15%, Hotel (3 star) 12%, Caravanning 10%, Camping 8%, Hotel (4 star) 4%, Second home 3%, Hostel 2%, Hotel (5 star/ luxury) 2%, Hotel (1-2 star) 1%. New media (flikr, facebook, twitter etc) - photo sharing and facebook updates is particularly prevalent amongst the younger and overseas visitors.
**Areas/questions for future research**

Look at demographics in more detail and how to attract different age groups via brochures / internet advertising etc. Recommendations are a key motivator for visiting so encouraging visitors to ‘pass on their experiences’ through recommendations on facebook and sharing experiences both during and after the trip has the potential to access a wide number of prospective visitors. Many visitors are proud to have some kind of connection with Scotland - whether this be through family or otherwise does not seem to matter, so promoting the idea of finding a connection may be advantageous. Internet is becoming increasingly important for sharing trip experiences but also for other stages of the trip (booking accommodation / trips etc). From an industry perspective, accommodations offering proficient online booking will benefit the most, particularly amongst overseas visitors. Travellers are confident to book trips on their own – tailored experiences may offer an opportunity to differentiate from other providers. In addition, being able to access local information via Smartphone or laptop would be useful to many. Budget concerns and value for money continues to be themes at the planning stage, and as well as throughout the trip. Particular experiences of expensive accommodations, attractions and eating out are all areas that are memorable amongst some visitors and experiences that are likely to be shared with others. Opportunities for discounts/deals, particularly for attractions may be worthwhile. Offering/promoting more choice of budget accommodation, but not necessarily hostels, particularly in Edinburgh and Fife.

**Potential linkages to other research** National Tourism plan and St Andrews Tourism destination plan 2012-2016. Six destinations study.

**Relevance**

Eco-tourism and promoting tourism in general.
Title: National Tourism Plan

Author(s) Scottish Tourism Alliance
Institution (agency or university) Tourism Leadership Group
Date of publication 2012
Availability (URL or Publisher) http://scottishtourismalliance.co.uk/national-strategy-2/

Summary of research undertaken
New tourism strategy for Scotland. ‘Recent years have seen Scotland’s tourism industry maintain its position as a key contributor to the nation’s economy, generating an annual visitor spend in excess of £4.5bn and accounting for over 200,000 jobs. However, visitor expectations grow ever more sophisticated with a shift away from individual tourism attractions towards more rounded experiences. The opportunity for Scotland, if we’re to accelerate growth is to up our game collectively and turn our nation’s many tourism assets into quality, authentic visitor experiences’, Tourism Scotland 2020. “Tourism Scotland 2020 is a strategy for the industry, by the industry. It’s the product of extensive consultation, led by the Tourism Leadership Group (TLG), and it is the means by which the Scottish Tourism Alliance (STA) will lead businesses and stakeholders to deliver one common goal for 2020 and beyond.

Key conclusions
This is an ambitious but realistic strategy based on input by private and public sectors through research into consumer trends, Scottish tourism industry and international tourism destinations; and careful analysis of the best available market forecasts. Driven by the need to adapt to a changing industry and uncertain economic climate, it provides a snapshot of where Scotland currently stands, the step changes needed in order to fully capitalise on assets, potential financial rewards and the priorities for action. At the heart of the strategy is growth via quality, authentic visitor experiences. In other words, highlighting those aspects of our assets that are uniquely Scottish, be they contemporary Scotland or more traditional.

Much has been done in recent years to make more of Scotland’s tourism assets at a local level through destination groups and with the support of local authorities. We need to build on this as a collective, sharing experiences and good practice more widely across destinations and we need the support of Scottish Government and public sector agencies too, aligning their tourism activities with our industry strategy. The report outlines Scotland’s special appeal (see national visitor survey report) with the inclusion of business tourism and also covers areas where we could do better – accommodation, eating out, travelling to and around Scotland and internet and mobile phone coverage. International research shows that competitor destinations have been quick to respond, integrating efforts across respective industries to offer experiences tailored to visitors’ personal interests.

Growth markets - Forecasts indicate that three main pillars will account for most of the visitor spend in 2020, just as they do now: Home turf (UK), Near neighbours (Europe) and Distant Cousins (USA, Australia, Canada) with emerging markets including India, China, Russia and Brasil possibly accounting for £70-83M in 2020 (from £33M in 2011). Assets are identified (golf tourism £220M) and the need to build local and national networks and capacities in key areas such as collaboration, marketing and sustainable tourism.

Areas/questions for future research
Are strategies / research included to encourage / grow Eco-tourism potential? Measures of success are crucial (monitor, report and act) – how will TAYplan provide this information?
**Potential linkages to other research**
Visitor survey and ‘Next Generation Broadband by Farr Point.

**Relevance**
Eco-tourism
8. Title: St Andrews Tourism Destination Plan 2012-2016

**Author(s)** Scottish Enterprise

**Institution (agency or university)** Scottish Enterprise

**Date of publication** 2012


**Summary of research undertaken**
St Andrews is one of the UK’s leading visitor destinations only one of a handful of places in Scotland which is genuinely world renowned (international home of golf, leading centre of learning, historic importance, award winning beach) but this has not come about as a result of any coordinated tourism plan or collaborative efforts. St Andrews now faces the challenges of: economic downturn; growing competition from rival and increasingly-better organised destinations; the globalisation of consumer culture (better-informed customers with higher expectations). Even with its strengths, it is unlikely to enjoy the same levels of success or growth without improved levels of coordination and collaboration. If St Andrews hopes to enjoy continued support from public agencies (SE, FC and VS) it has to provide compelling evidence of measurable results and benefits, and show that the tourism sector is working together with shared objectives. The destination plan is a holistic approach which aims to improve the visitor experience. The plan concludes with an action plan to deliver a ‘St Andrews Brand’.

**Key conclusions**
2010 saw the development of a St Andrews official portal website [www.standrews.co.uk](http://www.standrews.co.uk) and social media channels (up to 27,000 visits per week and ranked as one of the world’s top 25 most influential online travel sites). The site aims to complement the existing business association websites and drive more traffic to them. The St Andrews Skills Academy (which concluded its initial three-year pilot in 2011) has delivered training courses for many hundreds of staff and also introduced the innovative ‘St Andrews Standard’ - a customer care qualification with a local dimension. Investment is needed in the town’s visitor infrastructure and amenities. Particular weak points include: dated quality and style of visitor orientation and interpretation materials; no information in other languages; poor provision of public toilets; Lack of ‘animation’ in the town centre (ad hoc small-scale events, music etc); Insufficient visitor car parking; visitor accommodation range. The ‘Brighter St Andrews’ visitor voluntary donation scheme aims to raise money to pay for a wide range of smaller-scale upgrades and improvements to the visitor experience. Room for improvement includes business growth and development by becoming more aware of how to present itself in different international arenas and how to better look after visitors from different countries and cultures and developing a more innovative culture to compete with others and secure customers.

**Areas/questions for future research**
What do other TAYplan areas do to promote tourism?

**Potential linkages to other research**
National visitor survey and tourism plan.

**Relevance**
Combines a strategy with research information although specific to St Andrews.
9. Title Combating climate change – a role for UK forests

Author(s) D.J. Read et al
Institution (agency or university) Forestry Commission
Date of publication 2009
Availability (URL or Publisher) www.forestry.gov.uk/climatechange

Summary of research undertaken
The full report costs £30. Free synthesis report reviewed. The report was commissioned by the Forestry Commission to examine the potential of the UK’s trees and woodlands to mitigate and adapt to a changing climate. It forms part of the UK response to the IPCC 4th Assessment Report (2007) which provided authoritative evidence of how planting and managing woodland, avoiding deforestation, and replacing fossil fuels and carbon-intensive products with wood can make a major contribution to mitigating the effects of climate change. It also examined the impacts of climate change on forests, and the importance of adaptation to make forest ecosystems more resilient.

The report aims to provide a better understanding of how UK forestry can adapt to and improve its contribution to mitigation of climate change, with the following objectives:
- review and synthesise existing knowledge on the impacts of climate change on UK trees, woodlands and forests;
- provide a baseline of the current potential of different mitigation and adaptation actions;
- identify gaps and weaknesses to help determine research priorities for the next five years.

The report provides background information on UK forests, the policy framework, current/projected climate trends, relationships with trees and greenhouse gases, assesses evidence on impacts, how UK forests can mitigate climate change, and undertakes scenario analysis for woodland creation and management including cost of mitigating carbon. It also reviews the scope to adapt woodland resources and examines the role of trees in helping society adapt to climate change impacts through land use, sustainable development concepts, economic perspectives and behavioural change. Woodland creation provides cost-effective and achievable abatement of GHG emissions when compared with options across other sectors. The Committee on Climate Change considered that abatement costing less than £100 per tonne of CO2 was cost-effective. The UK has the lowest forest cover in Europe - 12% (Spain 36%, Finland 74%).

Key conclusions
UK forests and trees have the potential to play an important role in the nation’s response to the challenges of climate change by abatement of GHG and to adaptation, so ensuring that the multiple benefits of sustainable forestry continue to be provided in the UK. An enhanced woodland creation programme would help to reverse the decline in the rate of atmospheric CO2 uptake by forests. New woodland would also deliver a range of co-benefits but would need to respect a range of other land-use objectives including biodiversity, food security, landscape and water supply.

Part of the current failure to accept wood products for use in construction arises from conservatism in the construction industry. Outmoded attitudes need to be challenged by drawing on the evidence and promoting the technical properties of wood. Further scientific and socio-economic analysis is required to enable the UK to achieve the full adaptation and mitigation potential of forestry that is identified in this first national ecosystem assessment. Clear, robust, research programmes are needed to underpin the changes of forestry policy and practice.
Areas/questions for future research
Is this being addressed in TAYplan areas?

Potential linkages to other research
National Ecosystem services assessment.

Relevance
Economy, sustainable development.
10. **Title:** The state of the natural environment land use and the future of forestry

**Author(s)** Andy J Moffat, Chris P Quine & Helen McKay

**Institution (agency or university)** Centre for Forestry and Climate Change

**Date of publication** 2009

**Availability (URL or Publisher)** http://www.bis.gov.uk/assets/foresight/docs/land-use/jlup/er32_the_state_of_the_natural_environmenty_land_use_and_forestry.pdf

**Summary of research undertaken**
The review discusses possible changes to land covered by trees. It looks at the primary uses of forested landscapes and how this may change over the next decades and the drivers for change (uncertain and controversial views included) in order to promote discussion and explore policy options. Forestry policy has evolved from one primarily focused on home-grown timber production to one that incorporates multiple objectives. Today it is centred on the principle of ‘Sustainable Forest Management’. A consequence of devolution has been the development of forestry Strategies for England, Scotland and Wales which set out distinctly different priorities and programmes for developing and implementing forestry policy over the next few decades, reflecting the nature of each country’s woodland and forests. The current state of forestry - there has been a major expansion of woodland cover due to planting programmes during most of the past century but the rate of planting has declined substantially in recent years, mainly due to taxation changes, but also because of the influence of biodiversity and landscape conservation lobbies.

Forestry and the environment - forests provide a wide range of ecosystem goods and services: provisioning services (timber / biofuel source, non-timber products); regulating services (pollution control, soil protection, flood / water protection, carbon sequestration, climate stress mitigation); cultural services (social cohesion, meaningful places – education / arts, recreation and tourism, cultural); supporting services (nutrient and water cycling, oxygen production and biodiversity). Forestry for people - forests are now regarded as important for delivering on many government agendas, such as improving quality of life, tackling social exclusion, and promoting sustainable lifestyles. Increasing urbanisation and the impact of Community Forests have brought the public benefits of forests into sharp focus in recent years, and this trend is likely to continue. Principle future drivers include climate change adaptation

**Key conclusions**
Devolved country forestry strategies point to the need to instil confidence in both producers and industrial consumers, by means of the development of a long-term vision. It is also recognised that agricultural and forestry policy should be brought closer together, and that funding and incentive schemes need to be more integrated.

The forestry sector has suffered from being much smaller than agriculture in both the UK and in most of continental Europe, and its political profile has been comparatively low. The importance of woods and forests in supplying a wide range of ecosystem services relevant to national and European agendas for climate change adaptation and mitigation suggests that there is a real opportunity over the next few decades to improve this position.

**Areas/questions for future research**
Do these opportunities exist and provide enough benefits in TAYplan area to warrant further research?
Potential linkages to other research
Combating climate change – a role for UK forest

Relevance
Forestry / economic development.
11. Title: Land use and the state of the natural environment

Author(s) Potschin M
Institution (agency or university) University of Nottingham
Date of publication 2009
Availability (URL or Publisher) http://www.bis.gov.uk/assets/foresight/docs/land-use/jlup/20_land_use_and_the_state_of_the_natural_environment.pdf

Summary of research undertaken
The review explores the range of measures that have been applied in the UK at national, regional and local scales, and their sensitivity to particular drivers of change. The key aim is to examine the different ways in which land use indicators are being used to inform environmental management and policy. The extent to which the indicators are important properties in themselves or are surrogates for wider environmental qualities is also considered. Examples: The Millennium Ecosystem Assessment shows that at global scales the conversion of ecosystems through human activities has adversely affected not only biodiversity but a range of ecosystem services including regulation of climate, air and water quality, soil formation, and the regulation of flooding and other natural hazards. At more local scales, land use has been employed to predict the output of ecosystem services and to value different types of land parcel in relation to both market and non-market (relationships between particular land cover and land use types, and the way in which their condition and management impact upon different aspects of the natural environment such as woodlands both biodiversity and water management, impacts of agricultural intensification on ecologically valuable habitats and the impacts of land cover and land use change on carbon storage in soils). The discussion focuses on evolving frameworks used to analyse relationships between land use and the state of the natural environment. The limitations and strengths of the OECD DPSIR (cause – effect) reporting and analytical framework were explored where they resulted in the importance of land use being under-represented in national debates because it was not easy to translate environmental issues into other dimensions of sustainability.

Key conclusions
Recent approaches to the assessment of the impacts of future land use change on the natural environment using model-based scenario methods were examined, and the need to develop new types of aggregate measure of land use function was identified. For the land use science community, the challenge is to evolve more sophisticated tools to help explore the complexities arising out of the positive and negative feedbacks between different activities, economic and social mechanisms, and the fact that policy responses may have multiple effects. There is also a pressing need to link assessments of trends to the analysis of sustainability thresholds or limits. It is concluded that the concept of a socio-ecological system offers a more fruitful approach to the analysis of the relationships between land use and the state of the natural environment than the simplistic cause–effect models that have been used in the past. Indicators can be then identified at appropriate spatial and temporal scales, and system dynamics and societal responses properly captured and represented more fully if the principles that lie behind the ecosystem approach are to become embedded in decision making.

Areas/questions for future research /Potential linkages to other research

Relevance
Monitoring and indicators.
12.  Title: Possible Opportunities for Future Forest Development in Scotland: A scoping study

Author(s) W. Towers, G. Schwarz, R. Burton, D. Ray, L. Sing, R.V. Birnie
Institution (agency or university) Macaulay Institute and Forest Research
Date of publication 2006
Availability (URL or Publisher) www.forestry.gov.uk/website/forestry.nsf/byunique/infd-6mgfky

Summary of research undertaken
The Scottish Forestry Strategy states that “our objective should be to increase Scotland’s forests and woodlands towards one quarter of our land area by the middle of this century”. The main purpose of this study was to provide a solid foundation for assumptions about the proportion of Scotland that might reasonably be afforested over the next 40-50 years. It aims to complement the development of the Scottish Forestry Strategy by determining the practical constraints on the expansion and distribution of woodland cover and assessing expansion potential and distribution relative to a range of policy objectives and factors that might influence uptake.

Key conclusions
The most suitable extensive areas for woodland expansion are in the western parts of the Central Belt, the eastern Border hills, the area around Dumfries, SE Sutherland and in parts of Orkney. Key findings evaluated: Timber production potential (economic plus recreation benefits important for rural development) - mainly arable / grassland which is free from land use planning restrictions; climate change mitigation strategies (soil carbon storage) – eastern lowlands and NE Scotland present large opportunities. The potential for biomass cropping viewed in terms of “whole system effect” as benefits are likely to be in terms of displaced uses of fossil fuels so there is need for further research on whole system carbon auditing; Biodiversity - building upon the existing core areas of semi-natural native woodlands but there are limitations and biogenetic biodiversity should be considered (habitat poverty areas); Social objective forestry should favour areas closest to large towns and cities, particularly where there are high values for income, health and other deprivation indices – central Scotland provides greatest opportunities and should be undertaken in partnership with other agencies and communities, as part of a wider social programme.

The greatest potential land bank for future woodland expansion is currently under agricultural land management (arable and grassland) with potential only if woodland planting intersects with existing interests (e.g. sporting cover, uses of poorer ground, amenity purposes etc). Energy cropping may be exception; however, energy crops for biofuels (oilseed rape) will be preferred over biomass crops (rotation coppice).

The most likely opportunity to increase woodland cover in arable landscapes is through development of small woodlands and linear features like shelter belts. These could be valuable in terms of developing habitat networks which provide significant landscape effects in the longer term. Some potential for silvo-pastoral systems in hill and upland settings but a cultural change in attitudes towards trees is required. Large landowner groups (including overseas buyers) are motivated by economic objectives and with the right incentive structures they may continue to provide security of future feedstock supply to the downstream forest industry. Forestry commission role should be considered also as it has an important role in influencing forestry policy.
Areas/questions for future research
Have all the above been explored / considered for potential land use change?

Potential linkages to other research
Land use and the state of the natural environment. Impacts of climate change on forestry in Scotland

Relevance
Factors for woodland expansion in relevant TAYplan areas.
Title: Impacts of climate change on forestry in Scotland – a synopsis of spatial modelling research

Author(s) Duncan Ray
Institution (agency or university) Forest Research
Date of publication 2008
Availability (URL or Publisher) http://www.forestry.gov.uk/pdf/fcrn101.pdf

Summary of research undertaken
Predictive research albeit which represents an initial exploration of climate change impacts and the consequent opportunities and threats for forestry in Scotland using using the decision-support tool Ecological Site Classification (ESC). The maps are indicative and use coarse-resolution soil data with future climate variables derived from climate change scenarios published by UKCIP at 5 km resolution. The maps infer trends only - forest planning for the future climate cannot be applied reliably to individual sites.

Key conclusions
Climate change will create many challenges and opportunities for Scotland’s forest industry. Productivity will increase in some areas and a wider selection of species will become suitable. However, there are also potential threats, including drought, increased insect and disease damage, and wind damage, hence new techniques to combat these will be necessary. A key basis for risk planning and management is diversification; from broadening the choice of genetic material, mixing tree species in stands, to varying management systems and the timing of operations. Scotland’s aspiration to expand woodland from 17% to 25% of land area by 2050 provides an opportunity to target reforestation within habitat networks. This will reduce woodland fragmentation and thereby help improve the resilience of woodland ecosystems to climate change. Emerging recommendations: Low-impact silvicultural systems (LISS) and the use of mixtures could provide the basis for adaptation strategies; a wider range of species and a broader range of genetic material within a species will increase stand resilience in a changing climate; Natural colonisation of woodlands by some non-native tree species may be a valid adaptation strategy (but limitations where conservation is a major objective); Forest nurseries in eastern Scotland will have to adapt to the drier summers (more irrigation) and to wetter winters (avoiding soil damage); Contingency plans for increasing risks of catastrophic wind damage, fire, and pest or disease outbreaks. Future outputs from this research programme will be used in policy development and best practice guidance. This will help Scotland to adapt best forestry practice to suit the needs of the environment and maintain a strong, viable, sustainable and carbon-efficient forest industry.

Areas/questions for future research
Have all the above been incorporated into potential land use changes?

Potential linkages to other research
Land use and the state of the natural environment. Possible Opportunities for Future Forest Development in Scotland. The evidence supporting the use of continuous cover forestry in adapting Scotland’s forests to the risks of climate change.

Relevance
Factors for woodland expansion in relevant TAYplan areas.
14. Title: The evidence supporting the use of continuous cover forestry in adapting Scotland’s forests to the risks of climate change

Author(s) Dr Victoria Stokes and Dr Gary Kerr
Institution (agency or university) Forest Research
Date of publication 2009
Availability (URL or Publisher) www.forestry.gov.uk/pdf/CCF_and_ClimateChange_Report.pdf

Summary of research undertaken
The aim of the report was to answer the question: what evidence exists to support the use of Continuous Cover Forestry as part of the strategy to adapt Scotland’s forests to the risks of climate change? The main method of conducting the review was to examine literature and then discuss the main findings with a range of experts in Forest Research. Continuous Cover Forestry (CCF) is an approach to forest management that results in diverse forests. CCF cannot easily be compared with even-aged management, (main silvicultural system presently used to manage forests). The risks posed by climate change to Scottish forests can be categorised into primary risks (directly from future climate and extreme weather) and secondary risks (biological interactions, ecological responses etc).

Key conclusions
The report has identified 5 primary risks and of these 3 could be mitigated using CCF. A further 9 secondary risks were considered and again 3 could be mitigated through the use of CCF. There are still many gaps in knowledge about the responses of trees, forests and ecosystems to climate change. This is true for even-aged management and also, to a greater extent, for CCF. The review was not able to find many direct scientific comparisons of the benefits of CCF and even-aged management for many of the risks considered. Detailed consideration for each factor will be important when making site specific decisions. At the strategic level, CCF should be viewed as an approach to forest management that seeks to create more diverse forests, both structurally and in terms of species composition. Development of more diverse forests is a sensible way to reduce the risks posed by future changes in the climate. However, this could be achieved using both even-aged management and CCF. In terms of positioning Scotland’s forest estate to minimise the risks of future climate change the best way forward is to use an appropriate combination of even-aged management and CCF. This is likely to result in a patchy distribution of the use of CCF in the short to medium term. In terms of mitigating the risks of climate change a more even distribution of uptake is required and a revised FC policy about CCF may be required to achieve this.

Areas/questions for future research

Potential linkages to other research
Land use and the state of the natural environment. Possible Opportunities for Future Forest Development in Scotland.

Relevance
Relevant in relation to TAYplan areas.
Title: Potential impact of drought and disease on forestry in Scotland

Author(s) Dr Sarah Green and Duncan Ray
Institution (agency or university) Forest Research
Date of publication 2010
Availability (URL or Publisher) www.forestry.gov.uk/pdf/fcrn004.pdf/$FILE/fcrn004.pdf

Summary of research undertaken
In predictions of future changes in climate, drought is expected to become a more important factor affecting the health of trees, including areas of Scotland. Drought may cause direct physiological damage to trees as well as increase their susceptibility to a range of fungal diseases. This study used GIS-based modelling to develop ‘drought-risk maps’ to identify forest sites and tree species in Scotland most at risk by combining past and predicted climatic variables with a range of soils data. Sitka spruce, Scots pine, larch, Norway spruce, mixed broadleaves and Douglas fir were found to be species of drought-prone forest sites in eastern Scotland. Results from the modelling study focused a literature review of the potential risks to these species from drought related fungal diseases.

Key conclusions
This review identified a number of diseases likely to increase in frequency and severity on drought-prone forest and woodland trees in Scotland. In addition to good silvicultural practice, it is concluded that the potential of damage to trees from pathogens must be factored into future climate change adaptation strategies.

Areas/questions for future research
Has this research been factored into the strategy (increasing forest cover as part of future land use changes)?

Potential linkages to other research
The evidence supporting the use of continuous cover forestry in adapting Scotland’s forests to the risks of climate change. Land use and the state of the natural environment. Possible Opportunities for Future Forest Development in Scotland.

Relevance
In relevant TAYplan areas
16. Title: Woodland Expansion GIS project

Author(s) Towers et al
Institution (agency or university) FCS
Date of publication 2011
Availability (URL or Publisher) http://www.forestry.gov.uk/website/forestry.nsf/byunique/infd-8meebv

Summary of research undertaken
The main purpose of this study was to determine the impact of various constraints on the availability of land for woodland expansion. It is intended to inform the Woodland Expansion Advisory Group which has been tasked with taking forward Proposal 7 of the Scottish Land Use Strategy: to “identify more closely which types of land are best for tree planting in the context of other land-based objectives...” The report is divided into three sections, describing: land that is predominantly not available for woodland expansion; land that is affected by national designations/policies which impose constraint on woodland expansion; land not included in the first two categories and therefore most likely to have potential for woodland expansion.

Key conclusions
Category one land (46% of Scotland) - the only opportunities for woodland expansion will be small in scale – i.e. small woods on farms, riparian woodlands, urban woodlands. Category two land (20% of Scotland) - most woodland establishment is likely to be native woodland which is carefully designed and sited to fit with existing conservation and landscape features. Opportunities are likely to be greatest within some of the National Scenic Areas, where existing woodland is a key element of the landscape. Opportunities for establishing productive softwood plantations of any significant size are likely to be very limited. Category three land (34% of Scotland) – although likely to have fewer ‘formal’ constraints than categories 1 and 2 there still remain many constraints, for example, agricultural considerations on the better ground and protecting soil carbon stocks on the poorer ground. Combining these constraints spatially shows that woodland expansion on about half of the Phase 3 area could face quite serious barriers.

Areas/questions for future research
Has this research been factored into the strategy and is it of enough importance (increasing forest cover as part of future land use changes)?

Potential linkages to other research The evidence supporting the use of continuous cover forestry in adapting Scotland’s forests to the risks of climate change. Land use and the state of the natural environment. Possible Opportunities for Future Forest Development in Scotland. Potential impact of drought and disease on forestry in Scotland

Relevance
17. **Title:** Scottish Enterprise Six Destinations Study (Tourism Destination Development Interim Evaluation & Assessment of Future Growth Potential)

**Author(s)** James Adam and Iain Macfarlane. (EKOS Ltd in partnership with Tourism Resources Company).

**Institution (agency or university)** Scottish Enterprise

**Date of publication** 2010

**Availability (URL or Publisher)**
http://www.evaluationsonline.org.uk/evaluations/Search.do?ui=basic&action=show&id=459

**Summary of research undertaken**
The SE Tourism Destination Development Strategy aims to maximise the contribution that the six key tourism destinations in the SE area can make to the 50% revenue growth target set out in the tourism industry strategy. For TAYplan St Andrews and Highland Perthshire are included. Central to the strategy is the “Competent Destination” approach which was adopted to ensure that market failure and engaging with industry and partners effectively was addressed. The study was commissioned to evaluate the success of the approach to date and where appropriate offer recommendations to help ensure future success.

**Key conclusions**
Key conclusions resulting in 15 recommendations for future development and implementation of the destination approach which can be implemented in other parts of Scotland that have evolving destinations. The recommendations cover management issues, funding mechanisms, visitor research, best practice, monitoring and evaluation, equity and equality.

Highland Perthshire conclusions: took a long time for the concept of a composite ‘destination’ forward amongst partners and has a business plan for 2010-2013 with SE expenditure approval only for development of the partnership with project management being underwritten by SE in the first instance. The group is in its infancy but strong but will need some early ‘wins’ to hold everyone together. Vision is generic rather than prescriptive and still needs ‘form’: it is based around green and adventure tourism. No branding strategy at time of writing. No projects yet but an audit of existing is underway to fill in gaps, and no specific policy to encourage private sector investment. Links created between differing tourism associations encouraging collaboration. No formal M&E process agreed but the submitted DMO business plan does include performance measurement. Key strengths include a competent destination approach bringing the different interested parties together and opening of dialogue across the wider area helped by public consultation etc and strengthened the ‘voice’ of the local industry with the Council and SE. Key weaknesses include the length of time for the process, local politics causing issues, fragile partnership, need for outside facilitation to pull the business plan together. Key lessons include taking care when mentioning; private sector investments to avoid misrepresentation; and public sector finance as this builds up expectations that SE will support funding bids.

St Andrews conclusions: clearly defined geographic area a strong offer around several of SE’s existing key product areas (golf and food) and emergent products (heritage and wellness), and a newly revitalised destination management group, offers the opportunity for it to build upon its role as an essential part of the Scottish tourism offer. SE are working with the St Andrews Partnership to deliver step change activities around their key remits of product development, innovation, quality and service, delivering the optimum value to support capital investments driven by the private sector and Fife Council. The new partnership had as its core starting point the need to engage with the community and bring benefits to those
living and working in St Andrews as well as those visiting and a well defined delivery model. The Board has set up a small number of sub-groups with specific areas of responsibility highlighting its inclusivity. Albeit in its infancy this particular partnership appears to be commencing its facilitation and delivery roles strongly and is considered to be vibrant, go ahead and instilling enthusiasm amongst those involved. Partnership is both industry led and tourism focused. The partnership is primarily supported and funded by Scottish Enterprise (FC provides some funding) for project management and project funding for various activities identified in the Action Plan until March 2011. A key issue is resolving issues regarding charitable status. Funding has been secured from VisitScotland growth fund. Other funding possibilities are: visitor levy; student levy; sponsorship model (successful employed by the St Andrews Links Trust); paid parking scheme from ‘adopted road’. The concern is that the organisation continues to exist in the future but because of poor funding is ineffective in delivering results. The three themes in the strategy are Community, Environment and Economy and it is much broader than delivering a destination strategy. However, it has excluded a number of community relevant topics where organisations/delivery mechanisms already exist e.g. health, education and housing. Specific market research was not undertaken to inform the vision and strategy (used inherent knowledge of the local organisations and businesses) but a number of studies were undertaken that helped to inform the strategy (such as visitor surveying and postcard feedback systems and Social Media exercises). The issue of ‘branding’ has not been considered yet and consideration is being given to target domestic and international markets. A holistic approach in general but some feel that there is too much emphasis on golf and that there are opportunities offered by events, the university and culture/heritage etc. There are a number of actions that the partnership plans to take forward as facilitators / signposting as opposed to delivering / funding but some early wins are needed to demonstrate that it is an effective organisation and engender confidence. The Partnership is looking at potential sources of private sector investment to support the organisation, beyond this they see their role as a facilitator by providing research and evidence of opportunities, branding unification, signposting to grant assistance, encouraging them to invest in skills, etc. Open and inclusive approach has led to stronger linkages between and within the public and private sectors. M&E activities robust with monthly reporting but there is no formal process yet. Many key strengths and several weaknesses with key lessons being: importance of early involvement of the wider community to achieve buy-in; local leaders / champions in the partnership and being open to public scrutiny.

Potential linkages to other research

Areas/questions for future research
Extensive research – no gaps for the destinations identified. Can this be transferred to other TAPlan key areas – Dundee?

Relevance
Links to economic and place quality drivers of change
The intention of EFSOS II is to help policy makers and other actors to make well informed choices, by providing them with objective analysis on which they can base these choices. Allowing policy makers to see the possible consequences of their choices, presented in a structured and objective way, should help them to make more informed, and presumably better, decisions. EFSOS II focuses on seven major challenges, which could all have significant consequences and could interact with each other. They are complex, international, and long term in nature and issues include: mitigating climate change; supplying renewable energy; adapting to climate change and protecting forests; protecting and enhancing biodiversity; protecting and enhancing biodiversity; supplying renewable and competitive forest products; achieving and demonstrating sustainability and; developing appropriate policies and institutions. EFSOS II is based on scenario analysis. A reference scenario and four policy scenarios have been prepared for the European forest sector between 2010 and 2030, covering the forest resource (area, increment, harvest, silviculture) and forest products (consumption, production, trade). The reference scenario provides a picture of a future without major changes from the past. The four policy scenarios help policy makers gain insights into the consequences of certain policy choices and not meant to give predictions of what will happen in the future, but to give insights into the behaviour of the system and how it could be influenced. They are: maximising biomass carbon; priority to biological biodiversity; promoting wood energy; fostering innovation and competitiveness.

Key conclusions
In North Europe, productive functions develop positively, especially in the Promoting wood energy scenario, but criteria on health and vitality, and on biodiversity require attention. There is a considerable proportion of mature forests, with stands in the range of 60-100 years old, which increase wind vulnerability. At the same time, stands over 100 years of age are felled and regenerated at a faster pace, leading to lower biodiversity values. Maintaining adequate levels of deadwood also requires attention. The report provides recommendations for policy makers, international organisations and for research.

Areas/questions for future research
Although on a national (European scale), this is the most up-to-date research available and it would be worth checking recommendations against any planned strategy for TAYplan forest areas.

Potential linkages to other research

Relevance
Forestry / land use change forecasts / strategies.
19. **Title:** UK National Ecosystem Assessment  

**Author(s)** Coordination Lead Authors Robert Watson and Steve Albon  
**Institution (agency or university)** Defra  
**Date of publication** 2011  
**Availability (URL or Publisher)** uknea.unep-wcmc.org  

**Summary of research undertaken**  
The UK National Ecosystem Assessment (UK NEA) was the first analysis of the UK’s natural environment in terms of the benefits it provides to society and continuing economic prosperity. This is an extensive report which covers all aspects of ES. There is a chapter on ‘status and changes to ecosystems and their services to society: Scotland’ which highlights specific benefits, pressure points and changes during the last 70 years.

**Key conclusions**  
The habitats of Scotland provide a diverse and important suite of ecosystem services. The diversity of services and their interdependence on ecosystem condition and management suggests that management for multiple objectives is necessary. Many approaches for achieving multiple objectives exist; the ecosystem approach is one that is gaining in popularity and relevance as it combines a place-based approach with a systematic and integrative approach to environmental management and links communities with decision making.

The Scottish Government is actively developing Acts and policies that encourage the enhancement of Scotland’s environment while using the many ecosystem services to promote the health and well-being of Scotland’s population. The Climate Change (Scotland) 2009 and Marine (Scotland) Act 2010 are recent Acts of importance for developing an integrated approach to the many pressures and demands placed on Scotland’s ecosystems from environmental change and human activity.

**Areas/questions for future research**  
Has this been attempted at the TAYplan level (using this document as a guideline)? If not – this could fill in gaps in the local situation and be a future research proposal.

**Potential linkages to other research**  

**Relevance**  
Links land use change with social and economic drivers.
Title: Trends of change in coastal landforms and processes

Author(s) McManus, J.
Institution (agency or university) SNH and University of St Andrews
Date of publication 2009
Availability (URL or Publisher) http://www.dpea.scotland.gov.uk/Documents/qJ13769/J211150.pdf

Summary of research undertaken
The study collates all available reports on coastal change in Scotland and attempts to identify trends within the data.

Key conclusions
Main findings are on pp 1-2 of the summary. Findings of significance to TAYplan include: Major growing coastal landforms are Tentsmuir, Forvie, most of the western parts of the southern Moray Firth coast and at Morrich More in the Dornoch Firth where histories of long-term change are well documented.

Areas/questions for future research
Further studies are needed on the direct impacts of wind on the coastal system as there is much hearsay evidence of sands being driven inland by wind action but there are few well-documented accounts of wind-induced change. Is this of importance to Tayplan

Potential linkages to other research

Relevance
Primarily TAYplan beaches, protected areas etc on the coast.
21. **Title:** Report 420 Strategic assessment of the value and state of Scotland’s geodiversity: an assessment of potential approaches to the economic and social evaluation of geodiversity

**Author(s)** Myall, D., Birch, J. and Knapman, D.
**Institution (agency or university)** SNH
**Date of publication** 2011
**Availability (URL or Publisher)** http://www.snh.org.uk/pdfs/publications/commissioned_reports/420.pdf

**Summary of research undertaken**
This report outlines the wider values of geodiversity and summarises its contribution to ecosystem services. It then presents a comprehensive and objective review of the techniques for valuing environmental goods and services and an assessment of their potential applicability to geodiversity. The report contributes to a wider study by SNH and BGS to develop an evidence base to inform the development of a national framework for geodiversity in Scotland. Geodiversity is commonly defined as “the natural range (diversity) of geological (rocks, minerals, fossils), geomorphological (landform and processes), and soil features. It includes their assemblages, relationships, properties, interpretations and systems” (Gray, 2004). Geodiversity is starting to be recognised as an integral component of the environment, having strong links with landscape, biodiversity and economic activities. Moreover, an understanding of geomorphological processes is increasingly becoming recognised as being critical to the management of river catchments, the coast and climate change adaptation. The key findings were that geodiversity contributes widely to ecosystem services and delivers demonstrable benefits to the Scottish economy, environment and society however credible wholesale monetary valuation could not be drawn from existing literature, either directly or through a process of value transfer as they are difficult to define. While much work is being done to improve the quality of monetary valuations and the process of value transfer they have not reached a point where values are credible or robust, or suited for use outside the academic sphere and although progress is being made, the process is still at a very early stage.

**Key conclusions**
The case for geodiversity should continue to be made on a combination of economic and non-economic grounds. The recognition that geodiversity contributes significantly to broader ecosystem services provides a powerful argument in favour of developing a better understanding as well as showing that protection of the natural environment helps to preserve geodiversity’s more obviously beneficial features. Given that there are other robust and accessible non-economic arguments (such as the qualitative evaluation of the contribution of geodiversity to ecosystems services and the benefit of those contributions to society) which can be deployed, it is recommended that these be employed until monetary valuation techniques have been more rigorously tested, and shown to be effective. Economic arguments used to support the policy-making process, but should be limited to broad principles rather than monetary value estimates.

**Areas/questions for future research**

**Potential linkages to other research**
UK National Ecosystem Assessment

**Relevance**

Author(s) SNH
Institution (agency or university) SNH
Date of publication 2011
Availability (URL or Publisher)

Summary of research undertaken
The emerging policy context for the integration of urban green networks into spatial planning (e.g. National Planning Framework 2, Planning Policy Guidance 17) provides an opportunity to improve the planning and management of urban Scotland and people’s quality of life. The concept of green networks seeks to recognise the importance of greenspaces and associated green networks as an essential component of more sustainable urban environments. The review examines current approaches to assessing green networks and green infrastructure and examines how these can support planning and management. Many approaches to greenspace provision may have application for developing multifunctional green networks. Thus the principal aim of the ‘Green Networks and People’ project is to examine how a range of data sets and analytical tools can be applied to the development of new approaches to support the planning and management of multifunctional green networks. Evidence for the key functions and issues affecting use of green networks is presented, focussing upon: green networks and health; active travel; accessibility and barriers; and understanding social values.

Key conclusions
The development of Green Networks for People has highlighted the lack of spatially referenced social data on how people use green networks. Priorities for research to address these issues are: How people move through the landscape and how they use green networks; Motivations for using (or not using) green networks; How to balance competing needs, interests and priorities for different user groups; M&E of effectiveness of green network improvements.

Areas/questions for future research
What are TAYplan’s aspirations for improving quality of life through greenspace provision etc? This is being dealt with in other areas of Scotland – Glasgow and Clyde Valley Green Network etc and should be applied in the TAYplan areas especially Dundee, Perth and the larger towns.

Potential linkages to other research

Relevance
This is an important for TAYplan where regeneration / redevelopment is planned.
Title: Report 488: An assessment of the impacts of climate change on Scottish landscapes and their contribution to quality of life: Final report

**Author(s)** Land Use Consultants

**Institution (agency or university)** SNH in collaboration with the University of Sheffield, and University of Oxford Environmental Change Institute.

**Date of publication** 2011


**Summary of research undertaken**
Climate change will have implications for Scottish landscapes and the social, economic and environmental benefits they provide. Bringing together current research on the effects of climate change across a range of sectors, including forestry, agriculture, ecology and the built environment, the study explored how these changes could interact and alter Scottish landscapes and townscapes, and their benefits to people. Due to uncertainty surrounding climate change landscape impacts the research focused on potential scenarios and overall directions of change rather than predictions. The study represents Phase 1 of a 2 stage research process. The 2nd stage will explore ways of communicating the key messages, thereby influencing climate change policy and practice to take account of landscape and quality of life concerns such as raising awareness and engaging with stakeholders and communities to develop practical approaches to managing climate change impacts on the landscape and to influence decision making and practice in development planning.

**Key conclusions**
Landscape change will result from the direct impacts of a changing climate as well as from indirect impacts of human attempts to slow climate change (mitigation) and the way that we respond to a changing climate (adaptation). Overall, mitigation and adaptation measures are likely to have a more significant influence on landscape character than the direct effects of climate change, i.e. UKCP09 probabilistic projections suggests that changes associated with temperature are, all other things being equal, more likely to occur than those associated with rainfall. The combined influence of direct, mitigation and adaptation effects are likely to be greatest in lowland and coastal landscapes reflecting the dominance of land management, settlement and land use in shaping landscape character, and the likely impacts of changing sea levels. In the uplands landform is a more dominant factor. Here, with the exception of developments such as windfarms and related infrastructure, change may be gradual and subtle. Using the framework of ecosystem services at a local level, the study revealed a mixed pattern of effects on quality of life, broadly reflecting the pattern of landscape change, although cultural heritage values were affected across the local study area. Specific conclusions are provided for the Strathmore, Firth of Tay and Perth (pp 7-9 of the final report).

**Areas/questions for future research**
Communication and policy development could be a focus for future research.

**Potential linkages to other research**

**Relevance**
Communicating / developing landscape change strategies
24. **Title:** Report 398: Assessing the value of nature based tourism in Scotland  

**Institution (agency or university)** SNH  
**Date of publication** 2010  
**Availability (URL or Publisher)**  

**Summary of research undertaken**  
The primary aim of the study was to establish an estimate of the economic contribution of Scotland’s environment to the nation’s tourism economy based on existing studies which were used to calculate standardised impact assessments. It was the first report to provide the total current value of economic output/activity generated by nature based tourism activities, or quantified the level of jobs in the nature based tourism industry.

**Key conclusions**  
Overall it is estimated that total visitor spending attributable to nature-based tourism per year (rounded and after displacement is deducted) is £1.4 billion with 39,000 associated FTE jobs (indicative figures). Economic and employment impacts are also calculated for the activities and interests given in the typology: wildlife watching, field sports, walking/mountaineering, snow sports, cycling, water sports, horse riding, adventure activities, conservation work, other specialist interests, and scenery. However, there is much less confidence in the accuracy of some of these than of the overall figure due to the difficulty of accurately ascribing a specific motivation for any individual trip.

**Areas/questions for future research**  
This work has been followed up by the studies listed below on cross-linkages to other research. There are several recommendations for further research and analysis on pp 88-90: Improve data collection and analysis; Establish norms and consistent methodologies; Improve the estimation of net employment impact; Establish impacts for particular types of locations (places most associated with nature based tourist activities include forests, the coast, lochs and rivers, mountains and other spectacular scenery. Many of these areas qualify for agricultural and land use support, with incentives and payments linked to maintaining rural ‘public goods’ such as scenery, biodiversity and wildness in good condition); assess nature based tourism values for different types of location.

**Potential linkages to other research**  

**Relevance**  
Developing nature based tourism in strategic TAYPlan areas to assist with management planning.
25. **Title: Report 398: Sustainable building guidance**

**Author(s)** Sust
**Institution (agency or university)** ADS
**Date of publication** Various
**Availability (URL or Publisher)** [http://www.ads.org.uk/sust/guidance/sust-guidance](http://www.ads.org.uk/sust/guidance/sust-guidance)

**Summary of research undertaken**
Sust is a programme of A+DS that is dedicated to sustainable design in architecture and the built environment. Sust aims to raise public awareness of sustainable design and the contribution it can make in delivering a sustainable future, and improve an understanding of sustainable design for those commissioning new buildings. Sust. is working with a number of organisations to assist those responsible for delivering the aspirations of government, from NGO’s to pressure groups and others, with the application of policy and guidance in this area. It is hoped that this will influence future legislation. The link is to several design and guidance documents: Energy Heritage Guide; Visionary Planning; Design & Detailing for Deconstruction; Design & Detailing for Airtightness; Sustainable Housing Design Guide for Scotland; Design & Detailing for Toxic Chemical Reduction.

The Visionary Planning report (a response to the need to mainstream sustainable housing in Scotland) although published in 2006 provides some good insights into opportunities to ensure that the next generation of new homes are built to high sustainability standards. LAs which were part of the study include City of Edinburgh, Fife, East Lothian, Midlothian, and Scottish Borders.

**Key conclusions**
The Visionary Planning report - The message comes through loud and clear that, while LAs have the will to act, they are keen to have support in determining the shape of this action. This is particularly acute in terms of exploring exactly what a change of culture towards more sustainable development would require in terms of day-to-day working practices. The feeling that there is no time to explore alternative working practices is acute. Support to incentivise the development of alternative processes of housing development is urgently needed.

**Areas/questions for future research**
One area for future research – TAYplan plans to promote sustainable homes and culture change studies?

**Potential linkages to other research**

**Relevance**
Sustainable building and design and cultural changes (internal and external) to support sustainable developments.
26. **Title:** Climate change burdens

**Author(s)** Thirdwave  
**Institution (agency or university)** ADS  
**Date of publication**  

**Summary of research undertaken**
Our uses of land and buildings are directly responsible for the release of a huge percentage of GHG emissions. Changing the way assets are used holds some of the most important keys for evolving a low carbon society. The Climate Change Burden (CCB), as part of the Climate Change (Scotland) Act 2009, provides a legal mechanism to ensure that future development meets defined requirements for greenhouse gas reduction. A Burden is included with title deeds to a property and is binding on both current owners and their successors.

**Key conclusions**
This is guidance which provides an overview of the purpose and function of the newly established Climate Change Burden. It offers practical support to those wishing to attach these to assets they control or may wish to influence how development will take place in the future. A Climate Change Burden could impose positive obligations such as: renewable energy system; include passive measures such as making use of natural light, stack ventilation or an efficient use of water; focus on opportunities for carbon sequestration through expansion of suitable forestry or conservation of peat lands.

**Areas/questions for future research**
Is CCB mechanism included in future TAYplan strategy for encouraging a low carbon society?

**Potential linkages to other research** Adapting to climate change Manchester studies.

**Relevance**
Low carbon societies / sustainability.
Summary of research undertaken
A mapping exercise based on Northern Ireland’s strategy for responding to current service changes was undertaken to explore the effect of local development planning approaches on the healthcare estate. Using Inverness as an example, the paper models the potential effect on the number and nature of healthcare facilities required to serve the changing City. The study looks at the changing strategies for healthcare provision, the potential infrastructure needed to support this and how that might map onto three ‘city scenarios’ considered during the City Visioning and Local Development Plan process, to help understand the impact on public sector service provision (and the public purse) of different development planning strategies. Although the mapping relates solely to healthcare facilities, similar effects might be anticipated in relation to other public service infrastructure. The population/service mapping criteria used in the study are based on Northern Ireland’s strategy for responding to current service changes. Scenario 1: historic development pattern continues. Scenario 2: polycentric development. Scenario 3: public sector led development. Consequential public sector risk/ opportunities are outlined following each scenario as mapped for Inverness.

Key conclusions
Several conclusions based on each scenario with public sector led development most favourable.

Areas/questions for future research
Useful strategic change reference study for future critical infrastructure planning / redevelopment – may be useful to commission similar research for the cities / larger towns.

Potential linkages to other research
Possibly SMaSH NHS research due in 2013.

Relevance
Alignment of future critical infrastructure / service provision with local development planning approaches.
28. Title: Education, buildings, places

Author(s) ADS
Institution (agency or university) ADS
Date of publication Various
Availability (URL or Publisher) http://www.ads.org.uk/smarterplaces/features

Summary of research undertaken
ADS Schools design programme web page with links to features / case studies / design studies (national and international) / reflections /

Key conclusions
Sense of place Learning: Towns initiative is a good study – it is designed specifically to deliver Curriculum for Excellence in the places we live by focusing on the two principles at the heart of building better schools in Scotland – participation and collaboration. With five other partners, ADS have collaboratively built developed an imaginative range of design concepts. In particular they imagined how communities might create ‘Learning Towns’ — whole places contributing to learning. ‘Learning Towns’ uses design to imagine different ways of doing things, and takes a pragmatic approach to the pursuit of excellence. It also delivers economies of benefits i.e. doing more with whatever we have.

Areas/questions for future research
Consolidate case study findings on all case studies, including Learning Towns (if not already underway) and develop (TAYplan) guidance for implementation / improvements based on hindsight.

Potential linkages to other research
Other ADS studies.

Relevance
Placemaking / liveability.
Summary of research undertaken
Covered in Title 60 (education, buildings, places). The Curriculum for Excellence model encourages, recognises and fosters learning wherever this takes place. It recognises opportunities for learning beyond the school walls. Five designers have developed concepts, based on conversations with pupils, which highlight possibilities for learning to be a catalyst and a driver for better communities – building on investment in education to release the wider economic potential of a place. What could a Learning Town offer, and what might a scale-free school day look like?

Key conclusions
The Senses of Place project showed what can be sparked by really talking to pupils and letting them inspire talented designers who know how to really listen. Senses of Place: Learning Towns results range from toolkits to creating learning spaces and show how design starts with the people who live within places. It recognises opportunities for learning beyond the school walls – and the potential of whole communities as places for learning. This initiative has shown that learning is an effective catalyst for innovation and action. Local Authorities in Scotland are already doing this. Whether it involves talking to pupils, or collaborating with other agencies, or exploring possibilities with designers, the important message is the need to engage before building.

Areas/questions for future research
Consolidate this and TAYplan evidenced research findings and develop (TAYplan) guidance for implementation / improvements based on hindsight.

Potential linkages to other research
Other ADS studies.

Relevance
Placemaking / liveability.
Title: Masterplans: lessons learned from design review

Author(s) ADS
Institution (agency or university) ADS
Date of publication 2009
Availability (URL or Publisher)

Summary of research undertaken
Design Reviews aim to offer helpful and useful advice to the various parties involved in the development process. Design is a challenging progression; it requires considered analysis of the key issues, a careful appreciation of context, and an assured grasp of competing elements. The booklet articulates the lessons A+DS believes can be learnt from masterplans that have been assessed through various Design Review processes between Sep 2005 - Dec 2009.

Key conclusions
Masterplanning sets the context for making buildings and public spaces in an integrated and co-ordinate. The term ‘masterplan’, and the air of assurance that it implies, can be misunderstood or misleading. The quality of projects is variable and, when first seen, not every ‘masterplan’ is as good as it could be. The Design Review process seeks to guide those projects that are less successful towards a more positive outcome. In general, the most successful projects are where skilled and talented professionals negotiate and develop a design in a creative way in response to specific circumstances. Masterplans will have an important role to play in assisting Scotland’s modernised planning system to provide clearer guidance about what goes where and why. When adopted as supplementary planning guidance (SPG), masterplans will translate policy ambitions into three dimensional spatial visions that are capable of being delivered, reducing risk and uncertainty and providing greater clarity in order to help to deliver sustainable economic growth. Masterplans should deliver places where people want to be. PP 8-28 – lessons learned recommendations.

Areas/questions for future research
Consolidate ADS findings with TAYplan masterplanning findings to provide guidelines for future plans.

Potential linkages to other research
Other ADS studies such as Working together to deliver better Masterplans’ workshop (Report 63)

Relevance
Placemaking and liveability.
Title: Masterplans: Working together to deliver better masterplans

Author(s) ADS
Institution (agency or university) ADS
Date of publication 2011/12
Availability (URL or Publisher) http://www.ads.org.uk/designforum/features/working-together-to-achieve-better-masterplans

Summary of research undertaken
ADS in response to requests for masterplanning training delivered ‘Working together to deliver better masterplans’ workshops in Glasgow (2011), Edinburgh (2012) and Dundee (2012). Report available for 2011 workshop with outputs intended to form the basis of a learning resource pack which also comprises the presentation, practitioner presentation and film links to relevant agency publications, case studies and other good practice.

Key conclusions
Key points raised include: vision should be authentically embedded in, and arise from, an understanding of the unique qualities of a place; masterplan can exercise spheres of influence across a wider area, to maximise the potential of what lies both within and beyond the site; masterplanning may not require a ‘big idea’ – ‘lots of small’ can be an authentic response; the purpose behind masterplanning is to enable people to live better lives – we therefore need to consider the experience of what is being proposed; what will the place look and feel like, how will it function, and how are people’s lives made better?

Areas/questions for future research
Institutional cultural / mindset change. Build on this work if deemed important to TAYplan.

Potential linkages to other research
Masterplans: lessons learned from design review (Report 62).

Relevance
Placemaking and liveability.
Title: Urban placemaking/leadership

Author(s) ADS + Geddes Institute for Urban Research, University of Dundee
Institution (agency or university) ADS + University of Dundee
Date of publication Various
Availability (URL or Publisher) http://www.ads.org.uk/urbanism/features

Summary of research undertaken
The link takes you to ADS Urbanism features web page with links to synthesis reports for various Conferences / symposiums / workshops. An example symposium hosted by Dundee University and ADS, Oct 2012 - Master Planning Process Under Current Conditions - three drivers of change in settlements: Public life The desire to create places where people want to be, that are enjoyable and sustainable - this is key to wealth, equalities and sustainability. Efficiencies The resources available to implement change are finite but we are challenged by the current economic climate for achieving great places - how does the masterplanning process respond to these challenges? Collaboration The masterplanning process is a design route to move through the complex urban landscape, guiding people and agendas towards a consensus on what needs to be done; where and why to achieve mutually beneficial impacts.

An example of Scotland’s Towns Conference Sept 2012: Creating New Stories for Scotland’s Towns. The aims of the Scottish Government’s National Review of Town Centres is to scope out potential solutions to the issues faced by Scotland’s town centres and to enable a measured, long-term approach to town centre regeneration by targeting these issues.

Key conclusions
Dundee Master Planning Process Under Current Conditions Symposium. Ninety-four per cent of masterplans fail. We need to learn how to make the most of what is still one of the most powerful concepts in urban design. Scotland’s Towns Conference - co-creation, co-design and co-delivery of better quality towns and places is needed.

Areas/questions for future research

Potential linkages to other research
Other ADS work

Relevance
Placemaking, town centres and liveability.
Summary of research undertaken
Study was commissioned to contribute to strategic guidance on areas where the impact of offshore wind energy development on Scottish seascapes are likely to be of least significance.

Key conclusions
Higher relative capacity generally present on east mainland coasts; review of SNH policy revealed gaps and potential conflicts between strategic consideration of offshore wind energy and current guidance and policy; Specific windfarm development proposals will require detailed environmental assessment. This is a new and evolving area of work. The assessment methodology was developed specifically for the study, and is not necessarily recommended by SNH.

East Fife: Medium Sensitivity. Forces for Change - Considerable development pressure on coastal fringes within and on the edge of settlements. As built development is a key characteristic of much of the unit, sensitivity is unlikely to alter.

Tay Estuary: Medium Sensitivity. Forces for Change - Some development pressure on coastal fringes within and on the edge of settlements. As built development is a key characteristic of much of the unit, sensitivity is unlikely to alter.

North East Coast: Low – Medium Sensitivity. Forces for Change - Potential pressure for onshore wind energy development within Grampian Hills and this may increase sensitivity should cumulative impacts become an issue. Possible development of coastal trail (Nortrail) from Aberdeen along the Moray coastline.

Areas/questions for future research
Recommendations include incorporating visibility issues in future policies; considering the discrepancies of scale between onshore and offshore windfarms; balancing the economic needs of remote communities with natural heritage protection; and addressing the potential cumulative impacts. Factors such as population, recreation and tourist routes, iconic sites, viewpoints, were beyond the scope of the study.

Potential linkages to other research
Placemaking / Tourism studies / climate change impacts research.

Relevance
Placemaking / Local economy
Title: Processing Planning Applications for National and Major Developments

Author(s) Liz Shiel, Nicola Hudson and Francesca Richards
Institution (agency or university) Tribal Consulting for Scottish Govt.
Date of publication 2009
Availability (URL or Publisher) http://www.scotland.gov.uk/Resource/Doc/260282/0077466.pdf

Summary of research undertaken
The 2005 White Paper, Modernising the Planning System, recognised the need to achieve greater efficiency in the handling of planning applications and advocated the use of processing agreements to facilitate this. In England, the use of processing agreements, although still not widespread, has helped promote more robust project management in handling large-scale applications. The research suggested that this approach, which has been piloted by some authorities in Scotland, could have benefits. Tribal Consulting was commissioned to carry out research into best practice in the efficient handling of planning applications for national and major developments. This included reviewing the potential benefits of using processing agreements and also the potential for an advisory service to support those involved in dealing with major planning applications. The research focused on identifying successful approaches to streamlining the processing of major applications, taking into consideration the resource implications and the impact on effectiveness and efficiency of different approaches. The research included review of existing practice within Scotland as well as review of the English system and, in particular, the service provided by the Advisory Team for Large Applications (ATLAS).

Key conclusions
The processing agreement approach may not suit all circumstances, but other less formal approaches may deliver benefits. A project management approach would benefit all major planning applications, as would more formal pre-application discussions with statutory consultees. The Proposal of Application notice required by the Planning etc. (Scotland) Act 2006 establishes a defined 12 week pre-application period prior to the submission of all major and national planning applications. This creates an opportunity to make the pre-application stage more productive and effective – including setting up a processing agreement or project management plan for all major developments. Engaging effectively with statutory consultees is a major issue for those involved in processing national and major planning applications. There is a need for better communication between all parties involved in the process in order to support informed and timely decision-making. Engaging effectively with elected members is also a major issue. It is difficult for applicants to predict the decisions of members. While the issues which inhibit early comment by elected members cannot be wholly resolved, there is scope for applicants to be given earlier indications of the policies and issues which are likely to be important in determining the application. The ATLAS advisory service has been positively received in England and a similar service in Scotland could benefit the system by providing ready access to expertise in the handling of large-scale applications at no cost to the user. A service for Scotland might involve an annual cost of around £350,000 - 500,000, depending on the number of staff employed.

Areas/questions for future research
The research findings support a range of recommendations aimed at improving efficiency in the handling of national and major planning applications. Short-term actions (within 6-12 months): Pilot the use of processing agreements more extensively across Scotland;
Encourage local authorities to adopt a more structured, project management approach in the handling of all national and major planning applications; Encourage local authorities and statutory consultees to adopt a more formal approach to pre-application discussions; Encourage local authorities to prepare regular briefings for elected members on national and major planning applications. Medium-term actions (12-18 months): Consider a charging structure that would better reflect the timing and scale of local authority and statutory consultee inputs; Develop better guidance on the role of elected members in the planning process; Set up an advisory service for those involved in large-scale planning applications, based on the ATLAS model.

**Potential linkages to other research**

**Relevance**
Placemaking – assisting the planning application process for large developments. Research completed – is this of benefit to implementing TAYplan strategic plan?
35. Title: Urban Networks For People and Biodiversity – Form and Function

Author(s) SNIFER
Institution (agency or university) SNIFER
Date of publication 2008
Availability (URL or Publisher)

Summary of research undertaken
Development of habitat networks can be a mechanism for reversing effects of fragmentation on biodiversity as well as delivering a range of other social and environmental benefits. Existing tools that address habitat fragmentation exist and there is a growing interest to apply these tools to planning and management of peri-urban and urban areas. Encouraging people to link with greenspace by identifying and protecting green spaces for people to use may address some of the existing social policy objectives. Enhanced engagement can contribute to transformation in environmental quality (real and perceived) and achieve renewal of run down areas. Incorporation and consideration of habitat networks into integrated long-term spatial planning is evolving. The research question in this study was: “Is it possible to integrate the needs of people and wildlife in green networks within urban environments, in other words to deliver multifunctional green networks.”

Key conclusions:
1. Multifunctional green networks should be used within the planning process to ensure that green space creation and management is spatially targeted to achieve optimum gains for economic, environmental and economic development.
2. A least cost focal species model should be used to integrate people as focal species with biodiversity classes.
3. Further research is required to investigate how to implement multifunctional green networks to maximise visual enhancement and usability.
4. Green space needs to be more accessible both physically and socially. Requirement to raise awareness of the benefits of greenspace to low user groups.
5. There is a need to develop social datasets about the use of urban greenspace e.g. motivations and patterns of use.
6. GIS format seems to be the way that social and environmental dataset are collected.

Areas/questions for future research
Can the habitat fragmentation model developed above be combined with some of the other more visual and interactive approaches to spatial planning. This may also address 3) above.

Potential linkages to other research
Links to work on sustainability assessment and stakeholder engagement. Enhanced public engagement through the communication of the complex issues through visualisation

Relevance
Links to placemaking and liveability agendas
Place making - Greenspace including how use of this space may change and the quality,
Place quality including importance of quality. Biodiversity including change over time -
Biodiversity impacts of building/planning.
Title: Ecological Networks and River Basin Management Planning: Clyde Pilot Study

Author(s) SEPA
Institution (agency or university) SEPA
Date of publication 2010
Availability (URL or Publisher) http://www.sepa.org.uk/science_and_research/publications.aspx

Summary of research undertaken
The project was initiated by SEPA and GCVGN to investigate opportunities for achieving multiple benefits through the River Basin Management Planning (RBMP) process. The project looks for opportunities to create or enhance areas of habitat and habitat connectivity, whilst also achieving improvements that contribute towards RBMP objectives (for example improvements in water quality or the physical structure of rivers). Project presents a framework to support effective decision making, inform investment and achieve maximum environmental, social and economic benefits.

Key conclusions
A screening methodology has been devised to identify areas with the opportunity to achieve multiple benefits in restoration and/or development.

Areas/questions for future
Application to larger areas/regions - The screening methodology has been designed to be able to be applied elsewhere and in a variety of situations or with different interests. With the considerable amount of work being (and required to be) undertaken for the WFD, it is hoped that the use of this process, and the ideas contained therein, will contribute to a holistic and streamlined approach to achieving WFD objectives across Scotland, with benefit for the wider environment.

Potential cross-linkages to other research being carried
Links to work on sustainability assessment and stakeholder engagement.

Relevance
Climate change - Biodiversity including change over time, Availability and use of natural resources. The screening methodology presented provides opportunities to present river basin planning objectives as climate change adaptation, ecological quality, improvements to the water environment, and green networks, together in a cohesive and cost effective approach.
37. **Title:** Economic Contribution Study: An Approach to the Economic assessment of Arts and Creative Industries in Scotland

**Author(s):** DC Research  
**Institution (agency or university):** Commissioned by Creative Scotland and Scottish Enterprise  
**Date of publication:** June 2011  

**Summary of research undertaken**
The purpose of the research was to obtain a comprehensive picture of the contribution of the Arts and Creative Industries to the Scottish economy. Using data from published sources it focuses on 16 industries and identifies impact in terms of direct employment, Gross Value Added and Adjusted GVA. It also looks at wider and associated impacts. It was difficult to look at historic trends in AC&I due to changes in the SIC in mid 2000s.

**Key conclusions**
Controlling for population, the major Scottish cities are show higher than average AC&I employment intensity but London is by far the major centre of AC&I in the UK. Dundee accounts for 4.2% of total employment. Scotland has relatively few AC&I businesses but they are typically larger than elsewhere. AC&I performance has been more cyclical than the wider economy. Role and contribution of AC&I to tourism widely recognised including both direct and indirect influence with the strongest being in Heritage and the Performing Arts.

**Areas/questions for future research**
This report does not look forward in terms of the implications for the future of AC&I in Scotland or the UK.

**Potential cross-linkages to other research**

**Relevance**
The research relates to the economic drivers and shows that AC&I are important in the TAYplan area with Dundee in particular having employment above the Scottish average when adjusted for population size. The economic impact, both directly and indirectly via tourism and links to HE, are important. Caution is needed re the future potential of the computer games industry which seemed to be less significant than anticipated by other studies. It may be possible to look at the potential of A&CI as a driver of economic development in the Tayplan area.
38. Title: High Rise Hope: The social implications of energy efficiency retrofit in large multi-storey tower blocks

Author(s) Bates K, Lane L and Power A
Institution (agency or university) LSE Housing and Communities and Rockwool UK
Date of publication 2012
Availability (URL or Publisher) http://www.rockwool.co.uk/files/RW-UK/site%20images/facade/High%20Rise%20Hope-Full%20Report.pdf

Summary of research undertaken
This is a study of the social impact of energy efficiency retrofit to an estate in west London. A ‘whole buildings’ approach was taken to the upgrade of the high rise blocks located within the Edward Woods Estate, a socially disadvantaged area. Residents experienced difficulties in meeting fuel costs and in heating their homes. Environmentally this work is important given the large contribution that buildings make to energy consumption and greenhouse gas emissions and there are also potential social and health benefits. The work was part of a wider regeneration initiative. The researchers interviewed a sample of residents to ask their views on their homes, the estate, energy costs, social interaction, engagement if local affairs etc. Initial findings were: high levels of satisfaction with homes although concerns re change; many residents felt positively about the estate although problems were identified; some ties to neighbours but not strong involvement in local groups and activities; most residents felt safe in their homes; variations between interviewees in terms of energy and bills; most were tolerant of the on-going regeneration work. There was a general lack of awareness of the thermal insulation work which might undermine its effectiveness as residents need to change their behaviour to maximise savings.

Key conclusions
The research concludes that there can be major benefits from this type of large scale retrofit project in terms of improving homes and saving energy. Wider benefits depend on building good relationships with residents. A number of lessons are highlighted which focus on communicating with residents and the methods used to engage all sectors of society.

Areas/questions for future research
The social impacts can only be assessed after completion of the project and a follow up study will be undertaken.

Potential cross-linkages to other research

Relevance
A significant proportion of the buildings in the Tayplan area today will remain in thirty years time so work on retrofitting is important. This study suggests that implementing such schemes depends not only on the use of appropriate technology but also effective interaction with householders. Although a study of a specific estate, this work has wider significance.
39. Title: Scotland’s Digital Future Strategy for Scotland

Author(s) Scottish Government
Institution (agency or university) Scottish Government
Date of publication 2011
Availability (URL or Publisher) http://www.scotland.gov.uk/Resource/Doc/981/0114237.pdf

Summary of research undertaken
This document is the Scottish Government’s strategy for improving the delivery of public services in future years through the use of digital technology. It is not a research document as such but it highlights the issues of importance to Scottish Government at the present time and the ways in which digital technologies could enhance productivity, drive innovation and help deliver sustainable economic growth.

The document highlights, for example, the role that digital technologies can play in the transition to a low carbon economy by (1) replacing goods and services with virtual equivalents, (2) allowing more efficient use of energy (3) offering virtual technologies for shopping, teleworking and on-line services. It notes that “The Digital Agenda is one of the flagship initiatives of the EU 2020 Strategy. Its overall aim is, by 2020, to deliver sustainable economic and social benefits from a digital single market, based on next generation broadband networks and fully integrated ICT”.

Key conclusions
The document presents a strategy for building digital connectivity, enhancing opportunities for digital learning, and delivering services digitally.

Areas/questions for future research

Potential cross-linkages to other research
There are strong links to the research that has been carried out for Scottish Government on digital participation in Scotland (Myant, 2011) as well as work on the potential of smart cities.

Relevance
The relevance lies in the way in which the expansion of digital technologies will impact on how future generations will live their lives, impacting on the way people work, shop, learn and access other services. While not a research document, it contains useful insights of use to Tayplan.
Six challenges were identified:

1. Global demographic and societal challenges – population growth, changing family structures and lifestyles, generational shifts in expectations for work and lifestyles

2. Energy and natural resource security and efficiency, environment and climate change – concerns both about energy security and resource security (land, food, water, raw materials), paradigm shift needed to respond to climate change in relation to energy saving solutions for cities, need for systematic governance of innovation

3. Economy and technology prospects – shift towards Asia in terms of economic growth, ageing population, increasing global connectivity via technology, intelligent machines

4. Geopolitics and governance: EU frontiers, integration and role on the global scale - influence of global markets, reframing of growth in terms of quality not quantity eg well-being, income stability, environmental quality and social mobility, changing forms of politics and democracy as a result of e-Action

5. Territorial and mobility dynamics – basic elements of territorial dynamics include: the urban settlement system (hierarchy and networks), the semi-urban areas (suburban, peri-urban, diffuse city patterns), the more rural areas (including also areas with a high natural heritage value), systems of transport and communication networks; importance of transport shits towards electric and hybrid vehicles, mass transit and embedded intelligence.

6. Research, education and innovation – need to fill the innovation gap.

Three scenarios considered each of which responds to the six global trends discussed above.

Nobody cares and Europe just muddles along with no clear vision or direction. This scenario assumes lower economic growth than the leading nations, a failure to exploit the potential for innovation, and a loss of EU position in terms of economic competitiveness,

EU under threat. This scenario assumes global economic decline with resulting national protectionism. There will be food and fuel crises, EU GDP will decline significantly, with resulting fragmentation.

European Renaissance. This scenario is more positive, describing a future where the EU enlarges, strengthens and integrates politically, financially and militarily. Research and innovation will play a key role with impacts on to economic and social development.

Key conclusions
A series of ‘key messages’ are outlined:
(1) the increasing importance of science in shaping policy
(2) Europe needs to regain cognitive leadership by reinvigorating its capacity to invent the future.
(3) need for new forms of entrepreneurialism focused on learning and education
(4) mobilise financial resources to invest in knowledge
(5) importance of long term visions in stimulating innovation eg decarbonisation of energy

Only the Renaissance scenario is convincing in addressing challenges facing the EU – bold, ambitious and coordinated policy actions are needed.

Areas/questions for future research
How do the challenges identified at European level impact on the Tayplan area?

Potential cross-linkages to other research
Similar challenges identified in other documents such as The Futures Report (148) and Wellington Towards 2040 (144).

Relevance
This report addresses current global challenges and possible future responses. It provides an excellent analysis of the implications of different scenarios to 2050 building on current data. It sets the background context which is extremely relevant to Tayplan although it does so at a very broad level. More work is needed to interpret the significance of these finding to Scotland and to regions within Scotland.
41. **Title:** Creating strong communities: how to measure the social sustainability of new housing

**Author(s):** Social Life and Tim Dixon  
**Institution:** (agency or university)  
**Date of publication:** 2012  
**Availability (URL or Publisher):**  
http://www.berkeleygroup.co.uk/media/pdf/k/o/9441_002_BG_Socail_Sus_essay_LR.pdf

**Summary of research undertaken**

This study begins from the premise that although strides have been made in improving the environmental performance and design of new housing development in recent times and in understanding the impacts of design on social behaviour and people’s sense of place, there remain questions about what constitutes a strong community and what can be done to build them. The study adopts the concept of ‘social sustainability’ as a framework to help develop such understanding and as the basis for measuring factors that influence quality of life and strength of community.

Building on work carried out for the HCA, two categories of factors influencing quality of life are identified: physical (including decent affordable housing, quality public services, quality public realm, good transport links); and non-physical (including safety, social inclusion, sense of belonging, well-being). A measurement framework is created drawing on these factors. It contains 4 core dimensions: social and cultural life, voice and influence, amenities and infrastructure, and change in the neighbourhood; and a set of indicators are developed for each. The researchers tested 3 or the 4 core dimensions in four developments in the south east of England using both published data and surveys to allow comparison of these developments against the national averages. The results were analysed and presented using a RAG (red/yellow/green) system.

**Key conclusions**

The authors make it clear that the main purpose of the framework is to help ‘illuminate emerging patterns by enabling broad-brush comparisons with appropriate benchmarks for comparable places’ - a practical tool that can be used over time. The report assesses the methodology and discusses the strengths and weaknesses of the approach. They highlight the importance of the concept of social sustainability to future policy makers and suggest that using the framework can help those planning or developing new housing to “identify where interventions and investments in services, support for social life, or design improvements, are most needed or can be most effective”.

**Areas/questions for future research**

It is recognised that more work is needed on developing the framework, refining both the components and questions. It is useful in combining the physical and non-physical components of placemaking.

**Potential cross-linkages to other research**

Links to work in developing the SuBET (Sustainable Built Environment Tool)

**Relevance**

The main relevance is the study’s use of the concept of social sustainability and the exploration of the relationship between the different dimensions of placemaking. In this report the findings are presented at the level of individual housing developments and it is
therefore more local than strategic in character but work is on-going to link it into the wider factors of change.
42. Title: If you want a city of the future, ditch yesterday’s rules

Author(s) Tim Horton
Institution (agency or university)
Date of publication 2012
Availability (URL or Publisher) New Start, Sep, p10-13

Summary of research undertaken
This paper starts from the assertion that Australian cities are some of the most liveable settlements in the world. In the late 2000’s forecasts of substantial population growth (from 23 to 36 million by 2050) started a debate about the country’s ability to ‘house, feed and employ’ its citizens in the future. The paper then describes national criteria for the future strategic planning of Australia’s main cities. States are required to develop 30 year strategic plans to determine investment on infrastructure. In Adelaide, their plan identified a ‘polycentric urban form around 14 transit-oriented developments’. The focus was on creating walkable neighbourhoods with a shift from urban fringe, greenfield developments to central infill or brownfield sites with the latter making up 70% of new development over the lifetime of the plan.

Key conclusions
A design or problem solving approach was taken making the link between creating a vision of a more sustainable future and building the governance arrangements to deliver it. One of the key actions has been the creation of a new integrated agency, the Integrated Design Commission SA, drawing together government, state and city agencies, and subsequently the development of an Integrated Design Strategy for Inner Adelaide. The strategy, known as 5000+, is portrayed as a new approach to engaging people in ideas about their futures using an open source approach and digital technologies. It is concluded that people want more integrated decision-making.

Areas/questions for future research
Recognises that the model is not perfect and that there needs to be multiple drivers in order to create momentum.

Potential cross-linkages to other research
Similarities to some of the Ecocities work including Greater Manchester.

Relevance
Provides a comparative model of integrated design–led planning operating at a strategic level in an international context.
Summary of research undertaken

While health in WHO European continues to improve, differences remain between regions linked to social disadvantage and the situation is complicated by the current global economic downturn. Participant cities in WHO Healthy Cities Network, established in the late 1980s, recognise the importance of social, economic, environmental as well as personal factors on health and make a political commitment to improving citizen health by implementing strategies at a local level. With increasing focus on the ‘social model’ of health, the role of local government is seen as vital given it has responsibility for services impacting on health including education, transport, housing and urban planning and can be in a good position to facilitate partnership and local decision making.

The built and natural environments are important determinants of health, especially for disadvantaged and excluded groups with fewer choices open to them. There are numerous studies recording the coincidence of spatial disadvantage and poor environmental quality, often described as environmental injustice:

**Transport:** low income families often have limited access to transport but are at risk from the impacts of transport such as air and noise pollution and congestion.

**Air pollution:** Low income families are at greater risk from respiratory diseases linked to high levels of air pollution.

**Road safety:** while varying across socioeconomic groups, there are links between disadvantage and high levels of road accidents.

**Neighbourhood and facilities:** The distribution of land uses in an area has an important impact the activity levels of residents, while access to local facilities, such as school, health centres and recreation is important for health and well-being. Where the environment is poor, people are less likely to go out.

**Housing and urban planning:** Poor quality housing is typically more difficult and expensive to heat, and with rising fuel prices many families in deprived areas suffer fuel poverty, and these factors are linked to poor health.

**Greenspace:** There is increasing evidence of the benefits of greenspace to both physical and mental health.

**Crime:** Crime or fear of crimes has a negative impact particularly on mental health and social isolation.

**Urban environment and climate change:** Rising temperatures and risk of flooding are both likely to affect disadvantaged populations disproportionately.

“Strategic decisions determining urban form affect the proximity of facilities, access to employment and income, access to high-quality green spaces and viable modes of transport and hence determine where people live and work and their mental well-being and physical health”.


The report reviewed action being taken at the level of local government across Europe. One relevant issue explored was the growing interest in creating healthy and sustainable communities. Projects highlighted in clued walking and cycling initiatives, measures to reduce air pollution such as use of tunnels to segregate traffic. However, there was a sense that health as a subject was not given a high priority within spatial plans.

**Key conclusions**
Local government has an important role to play including “promoting safe and sustainable places and communities, undertaking health equity impact assessment in urban planning and place shaping to inform new design and the regeneration of existing neighbourhoods”.

Key issues in implementation: the level of intersectoral cooperation, policy coherence, the strength and communication of the evidence base, capacity, managing the political context and knowledge transfer.

**Areas/questions for future research**
Opportunity to explore the relationship between health and the built environment in a Scottish context.

**Potential cross-linkages to other research**

**Relevance**
This report sets out evidence regarding current understanding of the social determinants of health and examples of action drawn from across Europe. It reinforces the need for an integrated approach to creating sustainable communities, a key part of the Tayplan vision.
44. Title: Low carbon cities can kickstart the economy

Author(s) Burton M
Institution (agency or university)
Date of publication 2012
Availability (URL or Publisher) Local Government News 34-7 pp10-11

Summary of research undertaken
This article reports on research carried out on the potential of the low carbon sector to create new jobs in the Leeds City Region of England. The low carbon sector is seen as one of two sectors where jobs growth is possible, the other being healthcare. Globally, the low carbon and environmental goods and service sector is worth £3.2 trillion per annum and will continue to grow. It is argued that future demand in this sector will come from China and other countries with growing populations as they seek to reduce their energy costs and carbon footprints as well as from investing in energy efficiency within the region itself.

Leeds City Region commissioned the Centre for Low Carbon Futures to undertake research into the economics of low carbon cities, recognising that a significant proportion of GDP is lost to the region every year through high energy bills. The report, published in January 2012, considers alternative way of decarbonising cities. It reviews the available low carbon options, considers the opportunities to develop these in the domestic, industrial and transport sectors within the region and the wider potential impact on the regional economy. It calculated that investment opportunities amounted to almost £4 bn.

Key conclusions
The report considers that while there are opportunities within LCR to reduce the use energy in a way that is cost neutral to the area, action is needed to realise these opportunities both in terms of building political, social and financial capital. Substantial levels of investment would be needed together with new investment mechanisms and delivery vehicles.

Areas/questions for future research
The report focuses mainly on the economics of a low carbon region and it is acknowledged that further work is needed to explore the extent to which actions would be acceptable both politically and socially as well as work on future proofing in relation to carbon reduction targets beyond 2022.

Potential cross-linkages to other research

Relevance
The research on which this article draws, looks at the options for a low carbon future for a major UK city region. While larger in scale than the Tayplan area with a population of 3 million people, the methodology and many of the conclusions are relevant.
Summary of research undertaken
The results of The Foresight Land Use Futures Project were published in 2010: Land Use Futures: Making the most of land in the 21st century. This research was co-sponsored by DEFRA and CLG. Its aims were to examine the key challenges and opportunities for land use over the next 50 years, to consider how land could be managed more sustainable and provide benefit to both people and the economy. After reviewing past changes, the report examined land uses by sector and then considered how the challenges facing them interrelated.

Over the next fifty years, three main sources of pressure on land were identified: a growing and ageing population with more people living alone; the rise of the low carbon agenda; and rising expectations associated with growing incomes, such as the demand for more space for living and better transport. In order to assess future uncertainty and risk, three scenarios well generated; these were concentration of people and economic activity, adaption to environmental change and resistance to change.

An important conclusion of the 2010 report was the value of considering ways in which land in the future can deliver multiple benefits and it set out guidance on developing strategies to address future pressures.

Key conclusions
One year after the LUF report was published its conclusions have fed into a range of policy across UK government in a number of ways including a recognition of the importance of the planning system to achieving informed and integrated decision making, directing new development away from areas of high flood risk and the adoption of an ecosystems services approach. The impact in Scotland has been less significant given the focus of the 2010 report on England but Scottish Government is taking account of its wider significance.

Areas/questions for future research
Potential cross-linkages to other research
Relevance
The original study (2010) is extensive and draws together research from across a range of experts in a diverse array of fields. Its overall findings are pertinent to Tayplan, both in terms of the key drivers of change and the material on individual land uses. Adopting a multifunctional approach is a key message.
Summary of research undertaken
The Welsh Government set up the task force in late 2011 to consider evidence for establishing city regions in Wales as drivers of economic growth and to identify potential city regions. The study considered global urban growth and the potential role of medium sized cities in terms of growth and equity. The Core Cities Partnership (2010) Report, Driving Economic Recovery, identified key factors in achieving future economic growth in the UK including Wales – addressing skills gaps, investment in infrastructure and innovation. City regions are considered as a policy response. City regions are defined as “a core city or network of urban communities linked by functional economic and social ties to a hinterland”. Their characteristics and use are examined. The main drivers behind city regions are improving the planning system; improving connectivity; driving investment. Other drivers include economic drivers – agglomeration advantages, links to political arrangements, and leadership. The report then considers the arguments for city regions in Wales and sets out recommendations for the future in Wales.

Key conclusions
The task group concluded that adopting a city regional approach in Wales could deliver larger and more efficient labour markets, larger markets for goods and services and greater knowledge exchange and innovation. Examples from elsewhere demonstrate the importance of funding, investment and partnership. In the absence of change, weak economic performance will continue.

Areas/questions for future research

Potential cross-linkages to other research

Relevance
City regional planning is in place via Tayplan although highlights the need for funding and investment at the regional scale.
Title: Smart Cities in Europe

Author(s) Caragliu A, Bo CD, Nijkamp P

Institution (agency or university)

Date of publication: 2011

Availability (URL or Publisher): Journal of Urban Technology, 18, 2, pp65-82

Summary of research undertaken
Discusses the concept of the ‘smart city’ and reviews evidence in practice across cities in the EU. The starting point is the growth in urban populations globally and urban size. The smart city is a fuzzy concept but the authors highlight that it goes beyond the availability and quality of ICT networks highlighting six characteristics: utilization of networked infrastructure to improve economic and political efficiency and social and cultural urban development; emphasis on business-led urban development; focus on social inclusion of residents; stress on the role of creative industries; role of social and relational capital and the context of learning; social and environmental sustainability. “We believe a city to be smart when investment in human and social capital and traditional and modern communications infrastructure fuel sustainable economic growth and a high quality of life with a wise management of natural resources with participative governance”.

Based on the review of evidence, the paper allows analysis of the performance of smart cities. EU cities are analysed on the basis of data for 250 indicators for the period 2003-6. Aberdeen, Glasgow and Edinburgh were part of the study but not Dundee.

Key conclusions
Findings suggest that the existence of a creative class, the quality of the urban environment, the level of education and the accessibility and use of ICT are all positively correlated to urban wealth. The variables can be seen as stocks of social capital than can grow or decay over time and therefore need to be supported over the long term. The authors state that these findings point to a new strategic agenda for European cities that will allow them to achieve sustainable urban development and a better urban landscape.

Areas/questions for future research

Potential cross-linkages to other research
Dundee City Council EU project.

Relevance:
All of these characteristics are evident in the Tayplan region and there may be lessons to be learnt from other such cities.
48. Title: Creating smart-er cities: an overview

Author(s) Allwinkle S and Cruikshank P
Institution (agency or university) 
Date of publication: 2011
Availability (URL or Publisher) Journal of Urban Technology, 18,2, pp1-16

Summary of research undertaken
Overview of the concept of smart cities taken from 6 papers presented at the Creating Smart(er) Cities Conference in March 2009. It looks at the claim that such declarations by cities may be more to do with marketing campaigns than the social intelligence needed to make them smart. According to Hollands, being smart goes beyond the use of ICTs. Highlights 2 examples: Amsterdam Smart City (business, government and community project focused on energy saving) and Edinburgh’s Smart City Vision (focuses on e-government infrastructure to improve service delivery while supporting access and participation). Hollands argues for a more neo-liberal approach to smart cities – the use of networked infrastructure to enable social, environmental, economic and cultural development. Stresses the critical factor is a city’s people and how they interact.

Hollands labels Southampton as the first smart city as it developed a portal to support the use of smart card applications (transport, recreation, leisure transactions) developed under the triple helix model (university, industry, government). Halperns understands ICT to be a form of social capital with the potential to support networked communities within specific places and to boost norms, rules and values. Examines the ‘smart’ regeneration programme in communities. Wester Hailes, Edinburgh as an example. Describes ICT-enabled network, Myedinburgh.org, as going beyond previous use to include a community portal for learning. It allows citizens access to learn about planning, design and development and to participate in shaping their areas.

Key conclusions
Shift from emphasis from the promotion and administration of services to the democratic governance of their application – to improve the quality of life of communities.

Areas/questions for future research

Potential cross-linkages to other research
Range of other studies on smart cities.

Relevance
This work offers the vision of smart cities based on primary research being carried out today. It considers the impact of ICT on the delivery of services with knock-on impacts on the pattern of urban development.
Summary of research undertaken:
The starting point of this paper is the concept of ‘smart growth’ - a form of city development based on three broad principles: compact high density development, a mix of land uses. It is argued, however, that proponents of smart growth often ignore the implications of economic development, most notable the premise that low-density development is more economically desirable. The paper examines the possible connections between the theory of smart growth and the location requirements of high tech firms and seeks to demonstrate that connecting alternative development patterns and economic development objectives is not only possible but can be mutually beneficial. Discussion of links between smart growth and economic development: drawing on the work of Richard Florida, the importance of the quality of place in attracting the so-called creative classes; the link between proximity (the smart growth characteristics of compactness and density) and economic competitiveness; the link between proximity, knowledge spill-overs and knowledge transfers and competitiveness.

Research was undertaken in two localities in Vancouver, Canada, to determine the feature important to high-tech firms concerning location. For those in Yaletown, a centrally located, mixed use, high density neighbourhood, ‘intangible qualities’ were the most important locality factors ie ‘lively’, ‘attractive streetscape’, ‘diverse amenities’, ‘good access to transit connections’ and these were linked to the recruitment of staff, as well as the proximity of similar firms. Price did play a role in some firms’ decisions, however. Those interviewed in Crestwood, a low density office park, also referred to the importance of recruiting quality staff but cited other locational factors such as large buildings with floorspace and room to expand; plentiful, cheap car parking; and low rental rates although amenities and centrality were also seen as important.

Key conclusions
The paper concludes that there are positive connections between economic development and sustainable forms of urban development such as smart growth, based around aspects of amenity, centrality and proximity.

Areas/questions for future research
Research is needed that demonstrates which firms have a legitimate need to be separated from other areas of cities and on how to accommodate such firms while helping the city to maintain sustainable land-use patterns.

Potential cross-linkages to other research
Important links to the study undertaken by Creative Scotland and Scottish Enterprise on the role of Arts and creative Industries.

Relevance
This paper highlights the wider implications of smart growth with a particular focus on economic development and place quality.
Summary of research undertaken:
The paper looks at how the triple helix model (university, industry, government) can be used to study the knowledge base of an urban economy in terms of civil society’s support for innovation. It identifies three dynamics: intellectual capacity of universities; the wealth creation of industries; and the democratic government of civil society and suggests that the interaction across these spheres, creates dynamic spaces where knowledge can be exploited for the benefit of regional innovation. It draws on the triple helix model to account for the ongoing reconstruction of Montreal and Edinburgh as smart cities.

Key conclusions:
Paper provides evidence to show that entrepreneurship-based and market-dependent representations of knowledge are being replaced by communities of policy markers and others working in alliances with the opportunity to move towards a process of reinvention that allows cities to become smarter.

Areas/questions for future research

Potential cross-linkages to other research
Other studies on smart cities

Relevance
The three components of the triple helix (university, industry, government) are strongly interlinked in the Tayplan area and provide the basis for future innovation.
51. **Title:** The Future of Sustainable Cities

**Author(s)** Cosgrove E

**Institution (agency or university)** ARUP

**Date of publication** 2012

**Availability (URL or Publisher)** Sustain March/April pp30-32

**Summary of research undertaken**

This paper considers the range of interconnected factors that together underpin successful sustainable cities. Factors such as health, education, transport, the environment and new technologies all impact on quality of life. There is a balancing act required, with the citizens’ need for energy, water, waster management, transport shelter and public health all to be considered in the context of social welfare, economic prosperity and political acceptance. The focus is on cities, home to the majority of the world’s population and the source of most of the global green house gas emissions. Recognition the all cities are distinctive and there is a need to translate sustainability principles into context specific actions. Arguing that the future starts here, it is pointed out that more than half of the existing housing stock will still exist in 2050 and as a result retrofitting is a possible answer. It is the view of ARUP that technology and ICT have a key part to play in finding sustainable solutions. New technologies are changing both how we live and how we take decisions. The introduction of smart grids, which optimise the energy network are given as an example. Reference is made to an ARUP report, Information Marketplaces – the New Economics of Cities, innovative technologies create jobs and support citizens as they use and enjoy cities. Smart 2020 Report estimated the level of C02 emission savings that could be made through the use of ICT.

The author argues that the full potential of ICT has yet to be realised. ARUP has been supporting the C40 Cities Climate Leadership Group including work on an Urban Life ICT strategy for Melbourne to change behaviour. Four projects were developed: transport, green infrastructure, urban information architecture and transparent buildings. Reviews examples of work by ARUP in Sitra, Helsinki and Musheireb, Qatar

**Key conclusions**

While cities are all different key trends can be identified now. Decisions taken now will set the framework for the future so sustainability principles should underpin our investments in the future.

**Areas/questions for future research**

Possible application in Tayplan area?

**Potential cross-linkages to other research**

This paper has synergies with the various projects and papers that has been carried out on ‘smart cities’ and High Rise Hope re retrofitting of existing buildings.

**Relevance**

This piece reinforces more general thinking about the potential impact of technology and ICT on the shape of future cities and hence is relevant to Dundee and Perth.
52. Title: Climate Ready Clyde

Author(s)  
Institution (agency or university) Adaptation Scotland  
Date of publication 2012  
Availability (URL or Publisher) http://www.adaptationscotland.org.uk/4/110/0/Area-based-project--Climate-Ready-Clyde.aspx

Summary of research undertaken
This project aims to bring together a range of agencies and other stakeholders including businesses and other organisations to create a strategic regional approach to the development of Glasgow and the Clyde Valley. The purpose is to develop a climate ready vision and adaptation strategy. To date there have been three project workshops facilitated by Adaptation Scotland and a scoping report has been published. It has been agreed that GCV approach would be similar to that used by London, which begins with a general overview of climate change issues, provides details of projections for the region and responsibilities before seeking answers to key local concerns. Local concerns identified include flooding, drought, overheating, high winds and snow. Other issues discussed to date relate to timescales, leadership, coordination and barriers. Scotland’s Climate Change Declaration provides the wider context.

Key conclusions
Agreed on the approach but not yet taken the strategy forward. Consultants have recommended the next steps to take the process forward including identifying a vision, reviewing the evidence base, agreeing vulnerabilities and priorities, identifying adaptation work underway, establishing mechanisms for engaging stakeholders and preparing an action plan.

Areas/questions for future research
The project involves a review of relevant activity – similar to this study.

Potential cross-linkages to other research
Similar to Ecocities project for Manchester.

Relevance
This project is comparable with the work being undertaken for Tayplan and addresses very similar issues. Some barriers and constraints were found to taking this approach forward but there has now been general agreement reached amongst the main agencies involved. Initial material is available but the project is on-going.
53. Title: Adapting to Climate Change in Health and Social Care: Mapping Future Hazards, Vulnerabilities and Risks

Author(s) BIOPICCC
Institution (agency or university) BIOPICCC - University of Durham
Date of publication 2012
Availability (URL or Publisher) https://www.dur.ac.uk/geography/research/researchprojects/biopiccc/

Summary of research undertaken
This is a report of a dissemination event organised in 2012 as part of BIOPICCC, a 3-year research project funded by the EPSRC as part of a major research network on Adaptation and Resilience in a Changing Climate. The project aims to develop strategies to help ensure that the infrastructures and systems supporting the health and social care for older people (aged 65 and over) will be sufficiently resilient to withstand harmful impacts of climate change in the future, up to 2050.

The workshop looked at the ways in which outputs from a number of research projects can be used to inform future strategies, both in climate change adaptation and health and wellbeing. A number of themes were discussed.

(1) What are the challenges facing local level resilience planning, and how are authorities responding? Key points included: the importance of focusing on the vulnerability of the population and built environment as well as climate change hazards; the fact that while older people are vulnerable to extreme weather they can also be resilient, with an ability to contribute both in advance of and after disasters; JRF study has produced vulnerability maps for the UK, drawing on a range of data including ethnic origin and deprivation. BIOPICCC has produced vulnerability maps for projected populations for England adjusted for age. There are difficulties regarding vulnerability statistics at local level as these are held by multiple organisations.

(2) Climate change mitigation and adaptation. Differences were noted in relation to the responses to climate change being taken by the health sector and social care sector. The former has tended to focus on mitigation, reducing CO2 emissions by its organisations while the latter has focused more on adaptation. While climate change is being considered by local authorities, it can be in conflict with short term requirements to deliver services.

(3) Organisational challenges. Recognised the need for a joint response to climate change across agencies, sectors and geographic areas. It was suggested that a new mechanism was needed for this. Highlighted the need for better guidance and improved communication.

(4) Communicating climate change with the wider public. Feeling that mitigation is better understood than adaptation. Felt useful to look at strategies for both such as urban greening.

(5) Mapping tools (hazards, vulnerability, flood modelling). A number being developed eg BIOPICCC and CREW have produced hazard risk mapping tools and these are important but the challenge is to roll out. Some problems in using these tools at local levels.
Key conclusions
Importance of cross-sector working; a broad approach to understanding social vulnerability; local approaches involving the public are important; different tools are being developed.

Areas/questions for future research
The application of the research and tools mentioned beyond initial case study areas. How to make connections between different forms of mapping to that it can help inform climate change mitigation and adaptation strategies.

Potential cross-linkages to other research

Relevance
There is a clear link here between the character of the future population of the Tayplan area and its potential vulnerability to climate change. Are the tools being developed in this work being used in the Tayplan area or Scottish context?
Summary of research undertaken
This paper considers the growth in electric vehicles and hybrids and their contribution to reducing levels of greenhouse gas emissions, as well as helping address related issues such as energy security and dependency, and local health and environmental problems. At present, there are government subsidies in place to stimulate this market but other factors are also important in stimulating the uptake of these vehicles. The paper explores these factors to develop a model of the long term growth of EVs to 2050. There are three main parts to the model: a fleet turnover model, a discrete choice model of car purchase decisions; and a technology diffusion process. Factors considered included subsidies, purchase price, operating costs, maximum speed, fuel availability, emissions ratings, and range. The model was tested in relation to different market scenarios.

Key conclusions
The paper highlights the complexity of factors impacting on the future market for EVs and the sensitivity of projected uptake depending on a range of market conditions including subsidies. There remains a real question about whether the EV market is sustainable without the continuation of subsidies. At present it appears that subsidies are not having a significant impact on sales.

Areas/questions for future research

Potential cross-linkages to other research

Relevance
While this is a rather technical paper, it is useful in highlighting some of the factors likely to affect future growth of EV and plug-in hybrids including on-going government policy.
Title: Imagining city futures: the use of prospective through scenarios in urban planning

Author(s) Ratcliff and Krawczyk
Institution (agency or university)
Date of publication 2011
Availability (URL or Publisher) Futures 43(7) 642-653

Summary of research undertaken
At a time of rapid urbanisation and significant changes to the global environment, the authors argue that a future-oriented approach is needed in order to resolve many of the challenges facing society in the 21st century. Major challenges facing current planners and policy makers are highlighted including population growth, conflict over resources, new technologies etc. Following a critique of contemporary approaches to planning, a futures approach is advocated. Some of the benefits of adopting a scenario approach are outlined; extending thinking beyond the conventional, helping identify assumptions about the future that might need tested; encouraging people to think about positive opportunities as well as current threats; making more intelligent decisions today about the future by focusing on the most important issues; preparing for and managing change by enhancing the capacity to learn; making response times to actual future events shorter and more relevant; and fostering active participation and strategic thinking leading to decision making.

The paper then draws on the experiences of ten city futures exercises to highlight a number of lessons or themes for the next 30 years.

(1) The importance of changing value systems.
(2) The importance of arriving at a shared vision (not just policy makers) which can create momentum for change
(3) The importance of leadership of the process and stewardship.

Key conclusions
The authors advocate a futures approach as the way to tackling the challenges of the century.

Areas/questions for future research

Potential cross-linkages to other research
Links to the work of ADS and the Ecocities Project applied to greater Manchester.

Relevance
This paper deals more with the process of future planning rather than the drivers of change. It is relevant nonetheless in the respect that it supports important trends in society, notably the environmental challenges of climate change and resource depletion and the shift in power from the centre to the wider civil society.
Title: Pluvial (rain-related) flooding in urban areas: the invisible hazard

Author(s) Houston D, Geddes A, Werrity A, Bassett D, Hoolavhan A, MacMillan M
Institution (agency or university) Joseph Rowntree Foundation
Date of publication 2011
Availability (URL or Publisher) http://www.jrf.org.uk/sites/files/jrf/urban-flood-risk-full.pdf

Summary of research undertaken
This study considers the extent to which people living in urban areas are at risk from pluvial flooding (surface water flooding resulting from intense rainfall). Such floods are extremely difficult to predict leading to problems in providing warnings and managing the risks. Much recent research has focused on understanding science of flooding and its potential economic impact: this study looks beyond this to consider social vulnerability, resilience and adaptation to flooding and flood risk at individual, institutional and national levels.

The study reviews current estimates of pluvial flood risk across the UK with some 15,000 properties estimated to be at pluvial flood risk in Scotland (SEPA, 2011). The estimates vary in different parts of the UK and this is seen as a reflection of different methods and highlights the problem of estimating this type of flood risk. The study discusses the concepts vulnerability and resilience and considers the influences on flood risk (hazard; vulnerability and exposure). Vulnerability to pluvial flooding can be reduced by public actions to reduce exposure, such as upgrading drainage systems, and actions by individuals to minimise losses. Insurance companies take responsibility for the financial risk of flooding.

(1) The impact of climate change on pluvial flood hazard. It is predicted (UKCP09 projections) that winters in the UK will be wetter and warmer (particularly in the north and west) and summers will be hotter and drier (particularly in south and east). The impact on pluvial flooding is likely to be greatest in absolute terms in the north and west but larger in percentage terms in the south and east.

(2) The urban population vulnerability to pluvial flooding. This varies between regions from 2.6 per cent in Scotland and Wales to 3.7 per cent in the North West and West Midlands and risk relates to the proportion of the population living in urban settings and the proportion living above street level. There is an over representation of vulnerable populations in areas at high flood risk. The extent of exposure is likely to increase significantly by 2050, with population growth more significant in increasing risk than climate change.

(3) Current responses to pluvial flood risk. Planning and flood risk management regimes have the potential to influence the numbers at risk from pluvial folding, eg via avoiding high risk sites, upgrading drainage systems, flood proofing new buildings, and use of green and blue corridors. Partnership approaches can be effective in responding to flood risk. While new urban development can mitigate the worst impacts of flooding, existing building will continue to pose problems.

Key conclusions
The number of people at risk from pluvial flooding is likely to increase by 1.2 million across the UK by 2050, linked primarily to growth in population and as well as to climate change. The impact will vary across the UK. In the short and medium term, forces other than climate change will have the greatest impact. Vulnerable groups are at a slightly higher risk as many socially deprived neighbourhoods are located in low lying areas. Recent changes in legislation have helped in tackling pluvial flooding but governance issues remain. Action can be taken to reduce risks in new development, challenges remain in existing built up areas.
Areas/questions for future research
The report highlights several areas for further work: predicting future extreme rainfall; probabilities in relation to different scenarios of climate change; assessments of development patterns and water management regimes in risk areas; assessment of housing market responses to flood risk, including changing insurance premiums.

Potential cross-linkages to other research
Links to work on vulnerability and flood insurance provision.

Relevance
This is an important study in relation to future land use development in the Tayplan area, highlighting the significance of pressures of population growth on flood risk.
57. Title: Flood Insurance Provision and Affordability: Beyond the Statement of Principles: Implications for Scotland

Author(s) Ball, T, Werrity, A, Geddes A, Black A, Easton
Institution (agency or university) CREW; Scottish Government
Date of publication 2012
Availability (URL or Publisher) http://www.scotland.gov.uk/Resource/0039/00397678.pdf

Summary of research undertaken
Since 2008, an agreement has been in place between Scottish Government and the Association of British Insurers (Scottish Statement of Principles on the provision of Flood Insurance) that standard flood risk cover would be provided to domestic properties built before 2009 as long as flood risk was not ‘significant’ (no worse than a 1 in 75 annual probability of flooding). This study was commissioned to look at the social implications of the end of this agreement after 2013. The research considered the current price of flood insurance in high risk flood areas and assessed the likely impact of a change in approach after 2013, including those communities and households most likely to be affected. It involved use of questionnaires, GIS analysis of flood risk areas, focus groups and interviews.

Key issues in relation to future flood insurance provision are considered including (1) availability and likely changes to the cover given in high risk areas and high risk properties (2) affordability, the potential large increases for those at high risk and associated ways of responding such as subsidies (3) other issues such as the need for greater transparency on flood defence measures, the industry emphasis on engineered defence structures, and resistance and resilience measures.

Key conclusions
The existing arrangement means that there is extensive cross-subsidy of insurance although this is not visible to the general public. As more information becomes publically available, eg SEPA flood maps, transparency will increase. The main groups likely to be most affected by increases in flood insurance are: households on low incomes (below £16,000); the elderly; and non-homeowner households (particularly those in social rented accommodation). Beyond 2013, cover will continue to those in high risk areas but on a different basis reflecting the true risks. While socially deprived households (using SIMD) are under-represented in flood risk zones, 41,000 individuals are at risk. An issue amongst homeowners was the impact on changes in the insurance regime on the ability to gain mortgages for properties.

Areas/questions for future research

Potential cross-linkages to other research
This links to pluvial flooding study.

Relevance
This study raises some important issues which may affect the future patterns of housing demand, if, as is predicted, premiums for house insurance rise significantly in high risk areas.
58. Title: A delphi survey of immigration to the UK to 2060 with particular reference to environmental mobility

Author(s) Findlay A et al
Institution (agency or university) St Andrews University
Date of publication 2012
Availability (URL or Publisher) http://cpc.geodata.soton.ac.uk/publications/2012_A_delphi_survey_of_immigration_to_the_UK_WP28_Findlay_et_al.pdf

Summary of research undertaken
This paper considers the potential levels of migration to UK in the next 50 years as a possible response to challenges associated with climate change, seeking to provide quantitative estimates. It is part of wider research being undertaken within a Government Office for Science Foresight project. It draws on the views of 27 experts in the field using a Delphi Survey approach, within comprised an initial questionnaire on current and future trends followed by a discussion of the aggregate responses. Survey topics included estimated gross immigration by 2030 and 2060, current and future levels of immigration related to environmental change, demographic and economic drivers of immigration to the UK and return migration to the UK due to adverse environmental change.

Key conclusions
Those engaged in the survey believed that migration to the UK associated with environmental change was likely to rise over the next 50 years set against a predicted slight decline in overall immigration. There remained great uncertainty, however, about the actual levels. It was suggested from the survey that only a minority of environmental migrants were likely to arrive in the UK as ‘displacement movers’, with most being influenced by other factors (demographic, social, political and economic).

It was thought that Mediterranean Europe was the most likely source of migrants in this category, not because of clime change factors per se but because of freedom of movement with in Europe.

Areas/questions for future research
This paper looked at the UK as a whole. Will the same conclusions apply to Scotland?

Potential cross-linkages to other research

Relevance
This type of work can contribute to understanding of forecasts of future population within the Tayplan area. It is unclear, however, the extent to which the factors identified operate at a regional as opposed to national level.
Title: The Contribution of Green and Open Space in Public Health and Wellbeing (Green Health Project)

Author(s) Ward Thompson C, Roe J, Aspinell P, Zuin A, Bell S
Institution (agency or university) James Hutton Institute
Date of publication RERAD
Availability (URL or Publisher) http://www.openspace.eca.ac.uk/researchprojects_openspacecontributionpublichealth.php

Summary of research undertaken
This is a four year research project (2008-2012) for RERAD which aims to quantify the relationship between the quantity and quality of green and blue space, its proximity and use, and associated health outcomes as well as seeking better understanding of the mechanism involved. Environment factors, both actual and in terms of people’s perceptions, which are related to health and wellbeing are being tested and the results will inform public policy assessments in relation to the role and benefits of green space.

Key conclusions
Despite reference to an interim report, no final report appears to have been published to date.

Areas/questions for future research

Potential cross-linkages to other research

Relevance
The topic is of relevance but it will be excluded due to the lack of published output.
60. Title: Community green: using local spaces to tackle inequality and improve health

Author(s) Ward Thompson C, Roe J, Aspinell P, Zuin A, Travlou P, Bell S
Institution (agency or university) CABE
Date of publication 2010
Availability (URL or Publisher)
http://www.openspace.eca.ac.uk/researchprojects_Not_so_green_and_pleasant.php

Summary of research undertaken
This study built on an earlier piece of work for CABE, Urban green nation, which found that people living in deprived inner-city neighbourhoods have much more limited access to quality green space than residents of more affluent neighbourhoods and furthermore that this situation is further exacerbated for ethnic minority communities. It examines the impact of quality green space on health and wellbeing in six socially deprived neighbourhoods in London, the West Midlands and Greater Manchester, with particular focus on understanding the ways in which green space, ethnicity, deprivation and health are interlinked. The research included a review of over 150 published documents and a survey of over 500 residents living in these areas.

There were 4 main findings: (1) Green space is a public resource with a proven track record in improving people’s health, but too many local green spaces remain unused (2) People’s concerns about safety affect their use of local green space and this concern varies by ethnicity (3) improving the quality of spaces will encourage more active use and exercise (4) Local people are best placed to know what they want from green space.

Key conclusions
The research found that the provision of quality green space has strong benefits in addressing inequality. Interviewees felt that providing green space was a key component of improving the liveability of a neighbourhood, providing opportunities to play and relax and spaces to meet friends and neighbours. The authors conclude that there was a virtuous circle linking quality green space and better health and wellbeing and that this in turn was reinforced by ethnicity. Findings from the literature review indicate that green space can help ease tensions between ethnic groups by helping to being communities together. Barriers to use are linked to quality, safety fears and lack of facilities. The researchers highlight the role that communities themselves can play in improving green space by getting involved in managing a local park of other facility as well as landowners and local authorities.

Areas/questions for future research

Potential cross-linkages to other research
Links to Green Health Project

Relevance
The researchers concluded that their findings were applicable across localities irrespective of levels of deprivation or ethnicity. It makes links across the drivers of change including greenspace, health and place quality.
Summary of research undertaken

Protecting people’s health, particularly the over 60s, from the impacts of climate change is of growing importance as the proportion of older people in the population rises. Drawing on work which maps variations in hazards, vulnerability and risk across England, the paper identifies locations where the built infrastructure essential to older people might be affected and where there is a need to plan for adaptation and resilience in public policy responses.

The starting point was a review of the academic literature on the links between climate change and wellbeing amongst older people and this review was used to develop operational definitions. Particular attention was paid to heatwaves, coldwaves and floods. These in turn were related to climate change projections for 2030 and beyond from the UK Climate Impacts Programme (UKCP09), river and coastal flooding projections from the 2004 UK Government’s Foresight Flood and Coastal Defence Project (Environment Agency, 2004) and demographic projections from the Office for National Statistics.

Key conclusions
The paper talks of the complexity in assessing future hazards and vulnerability and identifies a number of challenges: the definition of climate change hazards; the interpretation of the socio-demographic conditions, such as housing conditions, that contribute to vulnerability; and the approach to combining spatial variation of hazards with vulnerability in order to identify local level risk. In substantive terms, the paper concludes that older people in more rural and coastal parts of England are potentially vulnerable to a range of extreme weather events.

Areas/questions for future research
The authors talk of further work to consider the application of this type of mapping as part of consultation and planning mechanisms in different contexts. It may also be useful to consider how information about local hazards and vulnerability impact on the built infrastructure.

Potential cross-linkages to other research
Links to a number of other climate change studies.

Relevance
This research relates specifically to England but it highlights the particular vulnerability of older people to future weather related hazards and the possible potential of a mapped based approach.
Title: The influence of seasonal weather and climate variability on crop yields in Scotland

Author(s) Bell Iain
Institution (agency or university) James Hutton Institute and ClimateXChange
Date of publication 2012
Availability (URL or Publisher) http://link.springer.com/article/10.1007/s00484-012-0588-9

Summary of research undertaken
The potential impact of climate change on agriculture is widely recognised and analysing the sensitivity of agriculture to past variations in weather can aid understanding of the potential impact of future climate change on regional food production alongside other factors such as market forces and technological advances. This research considers the connections between agricultural yields and bioclimatic factors, such as the length of the growing season and soil moisture, in arable cropping areas of Scotland. Using yield data for the period 1963 to 2005, the climatic sensitivity of four crops, wheat, barley, oats and potatoes, is examined. Data was analysed statistically showing that relationships between yield and climate vary by crop and month. Two factors are highlighted; sun duration (positive correlation) and precipitation (negative correlation).

Key conclusions
The results suggest that for specific months in the year, key indicators of the influence of climate on yields are the length of sunshine and precipitation, while key bioclimatic metrics are soil moisture deficit and cumulative sunshine. Temperature appears to be less significant as an indicator. The author indicates that the sensitivity to soil moisture deficits appears to have increased for wheat and barley. Sun in the spring followed by a dry and sunny summer is likely to result in high national yields. It is concluded that “a long-term trend to drier summers may therefore be good for national crop productivity in Scotland (with the caveat that this may require additional irrigation water)“.

Areas/questions for future research
This study has explored Scottish data and it is suggested further work is needed to assess regional sensitivity.

Potential cross-linkages to other research
This research complements the work into climate change, drought risk and land capability.

Relevance
This relates to two of the drivers, climate change and agriculture and highlights potential long-term impacts of climate change.
63. Title: Climate change, drought risk and land capability for agriculture: implications for land use in Scotland

Author(s) Brown I, Poggio, L, Gimona, A.; Castellazzi, M.S
Institution (agency or university)
Date of publication 2011
Availability (URL or Publisher) Regional Environmental Change 11,2, pp 503-518

Summary of research undertaken
Safeguarding quality land for agriculture has becoming increasingly important to policy makers in the context of food security but must also be seen within the wider commitment to achieving multi-functional landscapes. Improved understanding of the capacity of land to deliver a range of functions is thus needed. Land capability classifications provide a way for experts and policy makers to share knowledge and understanding of the biophysical factors impacting on land use and thus the potential effects of climate change. The study explored the relationships between soil and climate using a case study of drought risk for agriculture in Scotland.

Key conclusions
The findings indicate that drought risk is likely to be a more significant factor influencing Scottish land use in the future than at present. If this were to occur, it could potentially limit the range of crops that could be grown and as a result reduce land capability in some locations. Strategic action could be taken to address this, such as integrating land use and water resources.

Areas/questions for future research

Potential cross-linkages to other research
Links to work on climate variability and crop yields.

Relevance
This research provides insights into the significance of changing climate on agriculture.
64. **Title:** Estimating carbon price from a closed emissions trading scheme in the agricultural sector

**Author(s)** Bakam I, Pajot G, Matthews RB  
**Institution (agency or university)** James Hutton Institute  
**Date of publication** 2011  
**Availability (URL or Publisher)** Journal of Land Use Science, 7, 2

**Summary of research undertaken**  
Greenhouse gas emissions from agriculture account for 12% of the Scottish total and as a result there is increasing attention being given to mitigation approaches and costs available to the sector. The paper focuses on emissions trading within the agriculture sector in Scotland and considers the way in which reduction targets and strategies influence carbon price and emissions reduction. It uses an agent-based approach to model different variables.

**Key conclusions**  
The results of the analysis find that there is a positive relationship between increases in carbon price and increases in emission reduction targets. Operating in closed carbon emissions trading schemes, those farmers who adopt on-farm reduction measures and sell surplus credits will benefit financially.

**Areas/questions for future research**

**Potential cross-linkages to other research**

**Relevance**  
This work contributes to understanding of the carbon pricing as a driver of change.
Title: Developing carbon budgets for UK agriculture, land-use, land-use change and forestry out to 2022

Author(s) Moran D, MacLeod M, Wall E, Eory V, McVittie A, Barnes A, Rees RM, Topp C, Pajot G, Matthews R, Smith P, and Moxey A

Date of publication 2011

Availability (URL or Publisher) Climatic Change, 105, pp529 - 553

Summary of research undertaken
At a UK level greenhouse gas emissions from agriculture, land use, land use change and forestry (ALULUCF) amount to 8% of the total and given climate change targets this issue is under scrutiny. It is accepted by the Committee on Climate Change that reductions in emissions must be achieved in an economically efficient way. This research considers a notional future carbon budget for ALULUCF. Each sector is considered in some detail to identify potential abatement measures, eg crops and soils: includes reducing nitrogen fertilisers and improving land drainage, livestock: a range of animal and manure management measures, and forestry: afforestation and rotation. Scenarios for the adoption of mitigation measures at five year intervals to 2022 are projected and the budget is derived from these based on a marginal abatement cost curves.

Key conclusions
The modelling process suggests that there is potential for abatement in relation to crops, soils and livestock management measures but limited opportunities in relation to land use change. The estimated total abatement for ALULUCF is particularly sensitive to action takes in relation to forestry, such as the use of timber products in place of carbon intensive construction materials. According to the authors, the study “adds to a growing evidence base on agricultural mitigation cost-effectiveness” (p549). Methodological problems are acknowledged making to difficult to compare results with other sectors but it provides an “initial route map” of future abatement measures within UK agriculture.

Areas/questions for future research

Potential cross-linkages to other research

Relevance
The study highlights the kind of CO2 abatement measures that may be employed within agriculture and forestry, both significant land uses within the TAYplan area, in the next decade and the potential effectiveness of these measures in reducing GHG emissions.
66. Title: Building sustainability assessment methods

Author(s) AlWaer H and Kirk D
Institution (agency or university) University of Dundee
Date of publication 2011
Availability (URL or Publisher) Journal of Engineering Sustainability; Proceedings of the Institution of Civil Engineers; http://dx.doi.org/10.1680/ensu.10.00058

Summary of research undertaken
A range of new tools for assessing the sustainability of buildings and the wider built environment have been developed in recent years linked to concerns about future global resource use and the wellbeing of future generations. This paper reviews a subset of these tools, namely sustainable building rating systems, with particular focus on the scope of the assessment and the extent to which they relate to sustainable development objectives, and the robustness of the assessment process. Twenty-three systems from across the globe were assessed. The authors identify features of an assessment system in relation to the achieving the goal of sustainable development: hopeful, holistic, protective, harmonious, participatory and habit forming; and those of an objective assessment process: scope, a conceptual framework, reliable indicators, transparency, effective communication, informative, and capable of enhancement. These were combined to create a set of key characteristics.

Key conclusions
Overall, the tools examined proved generally satisfactory in terms of their approach and objectivity. They were up-to-date and methods were transparent. Differences between tools were evident in the weighting given to different factors and their reporting practices. The authors are more critical however of the scope of assessments and the extent to which the tools assess social and economic dimensions as well as the environmental dimension of sustainable development. More consideration is need to the qualitative data for example relating to the value that users place on buildings to complement quantitative data, as well as to place specific information.

Areas/questions for future research
The paper concludes that there remains scope to develop building assessment tools further so that they allow better assessment of the role of buildings in wellbeing and can include qualitative information. A more participatory approach to assessment is advocated.

Potential cross-linkages to other research
Links to work in developing the SuBET (Sustainable Built Environment Tool)

Relevance
This paper provides useful insights into the range of sustainability assessment methods which are being applied to the built environment. It is a methodology and process paper rather than a substantive one.
Title: The application of visual environmental economics in the study of public preference and urban greenspace

Author(s) Laing, R.; Davies, A.M.; Miller, D.R.; Conniff, A.; Scott, S.; Morrice, J.G

Institution (agency or university)

Date of publication 2009

Availability (URL or Publisher) Environment and Planning B, 36, pp355-375

Summary of research undertaken
There is increasing recognition of the importance of greenspace to the health and wellbeing of local people and also calls for more effective community engagement in the preparation of plans and policies. Those planning and designing future greenspace need new and innovative approaches to public involvement in order to deliver greenspace which is both socially sustainable and valued by user groups. The aim of the research was to explore the way in which different physical and non-physical characteristics of greenspace such as lighting, season, time of day, and weather, impacted on user perceptions including safety and quality. It sought to bring together methods from environmental economics with visualisation technologies. Contingent rating was used to establish the values associated with greenspace.

Three case study sites were selected in Aberdeen from a wider inventory, reflecting different types of greenspace in terms of location, design, content and development pressure. The CR survey, based on computer-generated visualisations, and focus group discussions considered the attributes that residents felt were important as well as suggestions for change. Alternative designs were generated and respondents were asked to assess six of these. The CR survey provided a framework for assessing the impact of different characteristics of greenspace on people’s perceptions.

Key conclusions
The study provided interesting results in relation to the links between change in greenspace and user perception. It also provided feedback on the use of visualisations with some users highlighting differences between the images and the ‘real thing’ and inconsistencies eg in dress. The authors suggest that combining contingent rating and visualisation methods has potential that can be further developed allowing trade offs between attributes to be explored.

Areas/questions for future research
An area for further research highlighted is the relationship between landscape design and a perception of lack of safety.

Potential cross-linkages to other research
This work was undertaken by some of the key researchers involved in the Green heath project.

Relevance
This is a detailed study into the links between greenspace, health and wellbeing but it is useful in highlighting some of the mechanisms involved. The use of visualisation techniques is innovative but more appropriate to the local development plan level.
Title: Increasing the Resilience of Vulnerable Citizens to Natural Hazards and Disasters

Author(s) Hall E, Kroll T, and Dawson S

Institution (agency or university) University of Dundee

Date of publication 2012

Availability (URL or Publisher) CECHR Briefing Paper

Summary of research undertaken
This paper reports on a knowledge exchange event held in Dundee in 2011 in order to explore the challenges of natural hazards and disasters for the vulnerable, particularly the elderly, people with disabilities mental health and other illnesses.

The issues discussed at the event included: defining ‘vulnerability’ and identifying who and where is ‘vulnerable’; the roles and responsibilities of the different agencies and organisations; the role of communities, families and individual; accessing and sharing information; prioritising action in natural disaster events; after the event: managing recovery, building resilience and identifying best practice. Drawing on the academic literature, researchers now questioned the use of broad generalisations such as vulnerable communities highlighting the importance of setting the risk in its specific cultural and context. The discussion highlighted the fact that vulnerability is not just linked to personal capacity but also the support or lack of it available. There is often a lack of up-to-date data on those at risk in a form that can be shared in a disaster situation. While difficulties exist to coping with those affected after a natural disaster, more attention needs to be given to finding ways “to improve the design of environments and systems, and to enhance community working and local partnerships, to make a place and a community more adaptable to future events”. The concept of resilience is often associated with the ability to ‘bounce back’ from challenging situations but the experts felt it could also be seen as a chance to ‘bounce forward’, a process of on-going learning, so that questions of resilience are considered routinely in planning for the future.

Key conclusions
In relation to vulnerability, a key conclusion is to conceptualise vulnerability as a pathway or process, shaped by spatial and temporal contexts rather than as something associated with particular groups. It is important that the elderly, disabled and others are empowered to identify their own needs and capacities, possibly via a process of community mapping. This in turn could help inform planning in the medium term, through the planning system including Community Planning Partnerships. Opportunities exist to learn from the experiences of other countries.

Areas/questions for future research
The debate raises questions about responsibility and the different roles expected of agencies and the wider community and this was raised as an area for further research.

Potential cross-linkages to other research
Links to work on flooding and vulnerability (Houston and Geddes)
**Relevance** This event highlighted the importance of thinking about resilience as a theme of long-term planning, not just in relation to short-term events such as flooding or periods of extreme cold.
69. **Title:** Energy 2050 Pathways Analysis

**Author(s):** Department of Energy and Climate Change  
**Institution (agency or university):** UK Government  
**Date of publication:** 2010  
**Availability (URL or Publisher):**  

**Summary of research undertaken**
The UK government is committed to reducing greenhouse gas emissions by at least 80% by 2050 (compared to 1990 levels) while safeguarding energy supply and enabling sustainable economic growth. This study considers a range of different ways to achieve this target and, by presenting a number of different pathways, it provides the basis for discussion of the options amongst policy makers, the energy industry and the wider population. Four possible trajectories are explored for different sectors of the economy (energy supply sectors, energy demand sectors and non-energy sectors). The trajectories range from taking limited action to reduce emissions or save energy at one end, to pursuing ambitious options at the limits of physical or technical knowledge at the other. Other change factors taken into account were: behaviour and lifestyle change; technological improvements; different fuel choices; and possible structural change in the economy.

A computer model was developed, the 2050 Pathways Calculator, which allows different options to be combined in order to achieve the 80% reduction in GHG emissions. Uncertainties and risks are inherent in these scenarios, such as the likely impact of new technologies, as are the need to make trade offs. A number of assumptions regarding the model are explained including the role of the economy in the trajectories, the UK focus, timeframes, and the absence of policy decisions.

Different pathways are outlined to illustrate different ways of moving to the 2050 goal.  
(1) Pathway Alpha: a balanced approach including a reduction in energy demand, an increase in low carbon energy sources and an increase in bioenergy  
(2) Pathway Beta: a scenario where carbon capture and storage is not achievable  
(3) Pathway Gamma: no additional nuclear power stations  
(4) Pathway Delta: limited additional renewable generation capacity  
(5) Pathway Epsilon: limited supplies of bioenergy  
(6) Pathway Zeta: a scenario where behaviour change is not achieved.

**Key conclusions**
The report identifies a number of common themes:  
(1) The importance of reducing demand for energy, particularly where there are barriers to the provision of low carbon energy  
(2) Significant electrification is required for heating, transport, and industry  
(3) Increasing levels of electricity from renewable sources presents challenges in balancing the electricity grid  
(4) In sectors where increasing electrification is impractical (eg aviation), sustainable bioenergy has a key part to play  
(5) There will remain a need for fossil fuels as part of the energy mix, the extent of which may depend on the success of carbon capture and storage schemes  
(6) At present, emissions from agriculture, waste, industry and international transport make up a small part of the total, but if these are not addressed they will be very significant by 2050.
Areas/questions for future research
On-going need to refine and develop the calculator

Potential cross-linkages to other research

Relevance
This work has been carried out at a UK level although drawing on inputs from across the country including Scotland. It is valuable in highlighting a range of possible scenarios that could deliver the Government’s objectives although it does not present these as policy choices.
70. Title: Energy 2020 A strategy for competitive, sustainable and secure energy

Author(s) DG Energy
Institution (agency or university) European Union
Date of publication 2011
Availability (URL or Publisher) http://ec.europa.eu/energy/strategies/2010/2020_en.htm

Summary of research undertaken
The EU has common goals in relation to energy policy, notably security of energy supply, competitiveness and sustainability, set out in the Lisbon Treaty and also has ambitious carbon reduction targets to 2050 but it is considered unlikely that the existing strategy will meet 2020 targets. There is a need for the EU to agree new tools to enable Europe to move forward in a more competitive, secure and sustainable direction.

Key conclusions
The report outlines a new EU framework for energy policy, drawing on extensive consultation. Rather than look at future scenarios, which are discussed elsewhere, this sets out a framework for meeting the objectives for 2020. The framework is based around five priorities:

(1) Delivering energy savings to complement increasing use of renewables: actions include prioritising savings in buildings and transport; reinforcing industrial competitiveness by making industry more efficient and making the most of National Energy Efficiency Action Plans

(2) Creating an integrated EU energy market is a priority through pan-European infrastructure: actions include timely and accurate implementation of the internal market legislation; identification of priority infrastructure to 2030; streamlining procedures and market rules for infrastructure

(3) Empowering citizens and delivering high levels of quality, safety and security in production, distribution and use of energy: actions include making the energy market more customer friendly; improvement in safety and security legislation

(4) Ensuring continued leadership in terms of research and innovation: actions include implementation of the Strategic Energy Technology (SET) Plan; new EU large-scale energy projects; new initiatives to help ensure long term energy competitiveness.

(5) Exploiting the EU’s geopolitical strength in the global energy market: actions include implementation of integrated energy markets and frameworks; building the requirements for a low carbon future into future partnerships beyond the EU.

Areas/questions for future research
The document recognises that changes made now may not be sufficient to transition to a low carbon EU by 2020 and indicates that this strategy will be followed by a roadmap to 2050 which sets this strategy in a longer term context.

Potential cross-linkages to other research
Links with Energy 2050: Pathways Analysis

Relevance
This is a strategy document rather than a research one, but it is relevant due to its overarching nature and medium term view.
Summary of research undertaken

URBAN-NEXUS is an EU funded project which aims to stimulate dialogue and develop partnership approaches to sustainable urban development. This report on urban climate resilience was prepared to inform a dialogue café event in Glasgow in May 2012. The report provides an overview of urban resilience to climate change highlighting the critical role for cities in relation to reducing GHG emissions and in adaptation. This section includes discussion of the concepts of vulnerability and resilience in this context. This is followed by summaries of current research in relation to four topics:

1. The range of uncertainties associated with climate change modelling at different geographic scales, including data collection
2. The need for new approaches to governance as a result of climate change based on partnership and integration both vertically and horizontally
3. The ability of individuals to respond to climate change is not solely determined by geography or personal characteristics but also by a range of social factors such as mobility, perceptions etc
4. Climate change impacts on place include flooding, landslides, drought etc and these will have important consequences for the life and activities of cities. “The design and use of urban space and infrastructure is a fundamental driver in how resilient our cities are to climate change”.

Key conclusions

Key findings are presented:

- “There is a wealth of scientific and business research on climate change but a relative dearth of coordinated studies that adopt an integrated, i.e. multi-sector and multi-governance, urban perspective
- The majority of urban climate change research, policy and practice appears to be concerned with mitigation, energy efficiency, new developments, etc
- There is a potentially confusing array of “urban sustainability models”, many of which omit any climate resilience consider
- It is important to integrate the social sciences into cross-disciplinary research on urban climate resilience
- There appears to be more emphasis on research and technological measures for flood prevention, than on drought alleviation and associated risks from lower rainfall such as subsidence and wildfires
- Just as the climate and climatic projections are changing, improving resilience must be understood as a continually evolving process
- Building resilience at the city scale requires more partnership working and collaborative approaches”.

Areas/questions for future research

There are opportunities of research which takes an integrated approach (cross sector and multi disciplinary).
Potential cross-linkages to other research

Relevance
This report cuts across a number of the drivers of change of relevance to Tayplan including impacts of climate change on place, land use and flooding. It also highlights the importance of developing partnerships to building resilience to climate change in urban areas.
Title: Scottish Energy 2020? Improving the world through engineering

Author(s) Fox T
Institution (agency or university) IME
Date of publication 2011
Availability (URL or Publisher) CECHR Briefing Paper

Summary of research undertaken
Report undertaken in response to Scottish Government’s 2020 target that 20% of energy would come from renewable sources (since risen to 30%). This report examines the implications of these targets from an engineering viewpoint. It highlights the fact that figures for energy and electricity are often confused, although energy also encompassing factors such as heat and transport. It suggests, as a result that the current focus of energy policy on electricity is misplaced and that even if Scotland’s electricity was all generated from renewables it would only just meet the 20% target. Recent investments in renewables in Scotland have focused primarily on wind and solar sources and as these can be unpredictable investment would be needed in waste-to-energy and biomass to achieve a balanced supply.

It is suggested that the current approach builds on what is seen as an optimistic estimate that between 60% and 143% of Scotland’s projected annual electricity demand could be met from renewable sources, noting that these estimates were not backed by detailed studies of infrastructure and did not take account of the need for backup supplies. It is suggested that the greenhouse gas emissions of this backup supply have not been taken in into account in setting GHG emission targets. The report introduced the Energy Hierarchy – an assumption that any energy policy will start with energy reduction, followed by improving efficiency, before looking different sources of supply. It is argued that current Scottish energy policy fails to follow this approach. The report considers practical barriers to achieving the 2020 targets. These include technological issues, such as development needs in the marine sector, the requirements for substantial investment in the National Grid, a potential lack of skilled engineers, the need for investment in new manufacturing against competition from other parts of the globe, and current difficulties in accessing investment funding. It is felt unlikely that the 2016 target of zero fuel poverty in Scotland can be met.

Key conclusions
IME sets out recommendations to assist in reaching the country’s targets. These are: the need to clarify and set out clearer targets; create an engineering-based plan which recognises the practical issues involved; create effective policies to tackle fuel poverty.

Areas/questions for future research

Potential cross-linkages to other research

Relevance
This document is based on data and research regarding the energy sector in Scotland but its main focus is a critique of current Government policy. It highlights some of the practical issues that may affect the delivery of current energy policy.
Summary of research undertaken
This report is part of the wider project Good Places, Better Health, with a focus on practice at both national and local levels. It begins from a position that the physical environment is vital to health and wellbeing outcomes and that it is important to go beyond previous concerns with reducing environmental risks to create and implement strategies to create places that foster health and wellbeing.

Its main objective is to review policy and practice relating to environmental interventions in Scotland and in particular in four Scottish cities (Glasgow, Edinburgh, Aberdeen and Inverness) which are designed to improve child health, in respect of asthma, obesity, mental health and wellbeing, and unintentional injuries. The report uses secondary material, including from websites, supported by questionnaires and interviews.

A number of national level strategies are reviewed including Design Streets: A Policy Statement for Scotland. It is considered to be relevant to increasing physical activity and road safety. National and local environmental interventions are then considered by health category although no attempt is made to assess effectiveness.

Key conclusions
This study highlights an array of environmental interventions related to child health, both government and non-government at the present time in Scotland. It concludes that there are “areas that are strongly supported in terms of legislation and national charities, such as asthma, and those with particularly strong policy backing, such as obesity and mental health and wellbeing” (page 48).

Areas/questions for future research
This is largely a mapping exercise to highlight current practice. Further work on the effectiveness of interventions would be helpful in shaping future policy.

Potential cross-linkages to other research
Linkages to some of the place-making reports and studies.

Relevance
This is a review of current policy and practice in relation to environmental interventions and health rather than research but it contains some interesting insights for Tayplan.
Title: i-Age: e-inclusion in ageing Europe

Author(s) Gilmour D et al
Institution (agency or university) University of Abertay and Partners – EU
Date of publication 2012
Availability (URL or Publisher) http://www.iageproject.eu/

Summary of research undertaken
iAge is an EU project concerned with the improvement of regional development in areas of decline affected by an ageing population. It involves eighteen partners from the ten North Sea regions collaborating on new approaches to service delivery and economic development through ICT innovation. The project promotes the use of ICT to combat social exclusion, improve employment opportunities, quality of life and community participation. Its main objectives are:
(1) Increase active participation and productivity of the elderly in relation to the labour market;
(2) Increase and promote the use and accessibility of ICT in relation to lifelong living;
(3) Implement transnational strategies, demonstration pilots and concrete actions to increase the economic and social e-inclusion of the ageing population;
(4) Communicate the iAge project and its outcomes to other ageing communities in and beyond the North Sea region.

The project is developing an ICT toolbox, a transnational framework which consists of training material and software applications, and wikiAge, a web based encyclopedia of age related ICT knowledge, with automatically updates through mailing lists, twitter, and facebook.

Key conclusions
This EU project is still in its early stages although progress has been made in relation to the ICT developments above (set out in a 2012 update). Current activities include: a review of the current literature on the state of play in mobile usability, accessibility and inclusive design and a literature review to find a scientific foundation for the development of a research plan on Independent living and ICT and the needs of 50+ in this regard.

Areas/questions for future research
Research in this area is on-going, dynamic and innovative.

Potential cross-linkages to other research
This links to other work on ICT and its application ion delivery of services.

Relevance
This project could be of relevance particularly in relation to ICT innovation in relation to economic development but its outputs at present are limited.
Title: Animated Virtual Agents to Cue User Attention

Author(s) Martinez, S., Sloan, R., Szymkowiak, A. & Scott-Brown, K.
Institution (agency or university) University of Abertay, Dundee
Date of publication 2011
Availability (URL or Publisher) Published in Think Mind, International Journal on Advances in Intellegent Thinking, 4, 34, 299-308

Summary of research undertaken
This article reports on research into human-computer interfaces. Increasingly organisations and companies are using ‘virtual agents’, graphic representations of someone from the organisation, as a way of assisting users to undertake an on-line task, such as buying a product or booking a ticket. Advances in graphics associated with the computer games development, now allows high resolution motion virtual agents. This study draws on psychological research, associated for example with cue-gazing, the way in which people respond to the changes in facial expressions and eye movements of others, and considers the potential to apply this understanding to virtual agents. It involves two experiments: the first captured the eye-gaze of participants in response to the animated agent; and the second recorded the responses made on a touch screen to the same cues from the virtual agent.

Key conclusions
The first experiment found that users speeded up considerably (42-35% faster) in actions taken in response to the virtual agent in comparison to static or 2 image cues. In the second experiment, response times also improved although not to the same extent. The authors conclude that the “results inform techniques aimed at engaging users’ attention in complex scenes such as computer games and digital transactions within public or social interaction contexts by demonstrating the benefits of dynamic gaze and head cueing directly on the users’ eye movements and touch responses” (p299).

Areas/questions for future research
Potential cross-linkages to other research
Links to research on ICT and smart cities.

Relevance
This work demonstrates some of the on-going progress that is being made in furthering aspects of the ‘smart city’, enhancing the way in which organisations and the public interact. It has process implications, as more of the stakeholder engagement for Tayplan goes on-line.
Title: SUDS and Green Infrastructure

Author(s) Duffy A, Dowie D and Dalrymple J
Institution (agency or university) University of Abertay, Dundee; Greenleaf
Date of publication 2012
Availability (URL or Publisher) http://sudsnet.abertay.ac.uk/presentations/National%20Conf%202012/SUDSnet_2012_Conference_Book_web.pdf

Summary of research undertaken
This conference paper on SUDS and Trees was presented at the SUDSnet International Conference - Multiple Benefits from Surface Water Management, September 2012 Coventry.

Trees, as an important part of green infrastructure, provide a range of benefits in urban areas including: regulating microclimates, filtering of rainwater, attenuating noise, improving air quality, carbon sequestration, and enhance biodiversity, and yet the number of urban trees in the UK is in decline. Greenleaf is a company that was set up in the 1990s to both research issues associated with trees in urban areas and develop product solutions, including the integration of trees and SUDS. One of its most recent product developments is in an urban drainage system, Aberflow, which is a tree pit system which aims to increase attenuation as trees grow, reduce the SUDS footprint which is important in restricted sites, and aid carbon retention.

The work, involving, Greenleaf, the University of Abertay and Dundee City Council, was concerned with testing a demonstration system that was put in place in a car park at a new development within a regeneration area in Dundee. A cross-disciplinary approach was taken involving landscape architects, engineers, planners, product designers and SUDS experts and the design was adapted through the process. The tree species used was the London plane which is tolerant to urban conditions. A control tree was planted in nearby open space for comparison purposes. A monitoring regime has been put in place covering both aspects of water quality and tree growth and vigour.

Key conclusions
The project results of the project will only emerge over time as the trees are monitored but the project is described as ‘innovative’ both in terms of the produce and the cross-disciplinary approach. If successful it is hoped that it may result in a review of the design specifications for SUDS schemes and may be replicated in other urban locations.

Areas/questions for future research

Potential cross-linkages to other research
Links to other work on green infrastructure and urban water management

Relevance
This is a small scale project which shows the potential for cross disciplinary working, linking urban trees, SUDS, and the planning system. It is a practical example of ecosystems services thinking although it is perhaps of more relevance at the local development plan scale than the strategic one.
Summary of research undertaken
The Wellington 2040 Project is concerned with the future development of the city over the next three decades. One of the main strands of the work was research into the main trends which could have an impact on the city’s development. Six megatrends were highlighted and discussed. These were:

1. **Place is everything**: people will have higher expectations of places in a more globalised world. With changes in technology, increasing skills development and concern about lifestyle, people will have increasing ability to chose where they want to live in the world (amenity migration).

2. **i-City**: public interactions and personal exchanges will be mediated by new technology. The growth and development of personal handheld devices, social networking, and other new technologies etc and the impact this will have on service delivery in both the public and private sectors. This can challenge how cities work.

3. **It’s not easy being green**: our response to climate change and environmental degradation. Widening impact of environmental concerns, shift of response from government to individuals; more localised responses (local not central governments); challenges to network infrastructure. Cities will be more scrutinised for their green credentials.

4. **Older and bolder**: demographic changes will require cities to adapt to new lifestyle demands. Population trends suggest the future population will be older but healthier; this in turn may lead to increased demands for services and people moving to places with good health care facilities; increasing influence of baby boomer generation

5. **Basic commodities as scarce resources**: as populations grow, demand for basic resources – food, water and energy – will put pressures on cities. Global population growth will continue but it will become more difficult to grow food in some parts of the world; decline in oil production, increasing demand for resources from growing economies such as China.

6. **Big cities, big growth**: big cities dominate growth given their dense networks of knowledge and economic activity. Increasing concentration of economic development in major cities, with the advantages of clustering giving such cities an economic advantage, reinforcing upward cycle of growth.

Key conclusions
The subsequent vision to emerge is based around four goals: a people centred city; a connected city; an eco-city; and a dynamic central city. These goals were then developed in the form of a future strategy for Wellington with a number of supporting projects.

Areas/questions for future research

Potential cross-linkages to other research
Links to other work in New Zealand such as the Magnetic South consultation on the future of Christchurch.
Relevance
Some of these trends are global and relevant to Scotland while some are more specific to New Zealand. There is a challenge to interpret these changes in a Scottish and Tayplan context. The work provides insights into a number of drivers for change and also provides a useful comparator on plan-making processes.
Summary of research undertaken

New strategy for Auckland based on an assessment of current sustainability challenges and opportunities for the next 100 years. These are identified as:

1. responding to climate change: predicted more extreme weather and sea level rises causing flooding and coastal erosion; higher temperatures may lead to public health issues (diseases) and ecological issues; displacement of people affected by climate change may lead to pressure for immigration; possible opportunities to reshape agriculture production to capitalise on climate change.

2. doing more with less: rising global population; loss of global forests and topsoil; oil production likely to peak in 2050; expanding world demand for energy by more than 50% by 2030; loss of world fish populations; major challenge is to reduce material consumption and use resources efficiently.

3. capitalising on global economic change: New Zealand currently is vulnerable to global economic change due to its small size and distance from markets; need to develop a niche market role

4. managing population growth and demographic change: 1.5% to 2.0% population growth expected; this puts pressure on the region’s environmental quality, rural land, open space and physical infrastructure; rapid change to communities’ ethnic and cultural composition

5. addressing disadvantage: by 2025 there will be more people over 65 than people aged 16 years and under; an aging population is predicted to affect demand for health and aged-care services, labour supply and housing social, cultural, economic and environmental outcomes.

The Auckland Sustainability Framework is centred on 8 inter-related long term, sustainable development goals together with shifts needed to achieve them.

Key conclusions

It is recognised that the strategy is built on a number of assumptions and that these will need to be closely monitored as changes could alter the nature of the challenges and the responses to them.

Areas/questions for future research

The need for scenario planning to identify changes in drivers of change that might indicate a review is required is highlighted. Thresholds are identified for key indicators relating to different scenarios.

Potential cross-linkages to other research

Relevance

This report combines research into future change drivers with a strategy to deliver long-term sustainable goals.
Summary of research undertaken
This is an on-line discussion game which allows people to think about options and possibilities for the future of their city and to explore how the city can respond to future challenges. It was used in June 2012 to discuss the future of Christchurch, New Zealand, following the 2011 earthquake and 850 people took part from all over the world playing 8889 cards.

The types of questions being considered were: What will Christchurch be like in 2040? How will business be done? How will we want to get around? How will people want to live? Participants take part in conversations in response to imagination cards of Christchurch in the future.

Key conclusions
The resulting conversations are tracked and have been categorised as positive imagination forecasts (optimistic) and dark imagination forecasts (pessimistic). These feed into the plan-making process

Areas/questions for future research

Potential cross-linkages to other research

Relevance
This is an innovative use of ICT in the preparation of strategic plans. It is a process document, however, rather than a research one.
80. Title: Development of Deep Geothermal Resources in the UK

Author(s) Younger PL, Gluyas JG and Stephens WE
Institution (agency or university)
Date of publication 2012
Availability (URL or Publisher) Proceedings of the Institute of Civil Engineers Energy 165, p19-32

Summary of research undertaken
This paper reports on recent work connected with the potential exploitation of ‘deep geothermal energy’, which the paper defines as “natural heat encountered at depths in excess of 300 metres” (p19). There is the potential for this type of heat to be used either directly or as a source of electricity. While recognised for many decades, exploiting heat primarily from sites of volcanic activity, the fact that geothermal sources can provide constant and low carbon energy has made its exploitation more attractive and has led governments to incentivise its development.

Exploration in the 1980s targeted ‘hot dry rocks’ and economic assessments at that time were generally pessimistic about the commercial prospects for deep geothermal energy in the UK including in Scotland. More recent exploration which has focused on granites with high natural permeability derived from fault zones, for example in Durham, and this has been more encouraging. The authors report that attention has now turned back to Cornwall and there is also interest in the exploring potential resources in Scotland and Northern Ireland. Interest in exploiting geothermal hot brines, which are co-produced with hydrocarbons in oilfields, is also highlighted

Key conclusions
The paper concludes that recent advances in technology, affecting drilling, reservoir simulation and power generation mean that deep geothermal energy is now “a realistic target for full-scale development in the UK”.

Areas/questions for future research
Scottish Government have commissioned some new research into deep geothermal potential in Scotland as well as the policy and planning implications of this.

Potential cross-linkages to other research
Current government policy on renewables is strongly influenced by its 2050 Pathways Analysis and this estimated the UK geothermal resource as capable of producing “the equivalent of up to 35 TWh of electricity per year for around 50 years down to a depth of 6km”. Most of this resource was considered to be located in Cornwall although “granite basements ... in North East Scotland” were explicitly mentioned

Relevance
Areas of deep geothermal potential lie in the Grampians, on the edge of the Tayplan area. Development of this form of energy can make a positive contribution to Scotland’s renewable sector but may also have knock-on implications for other renewables.
Title: The Futures Report

Author(s) Global Futures and Foresight
Institution (agency or university) Steria
Date of publication 2012
Availability (URL or Publisher) http://www.thegff.com/Groups/175830/Global_Futures_and/Reports/The_Future_report/The_Future_report.aspx

Summary of research undertaken
This report was commissioned by Steria and considers the drivers of future global change. Drawing on an analysis of over 150 published sources it looks at the change over the next forty years:

- Populations: over the next 40 years the global population will grow by more than 2 billion people
- Economies: It is estimated that over the same time period the global economy will triple in size with the greatest growth coming from emerging economies such as Brazil, China and India.
- Political authority: the economic shift will be accompanied by a shift in political power and in values and beliefs from the USA and Europe to Asia.
- Middle classes: As populations and economies grow, an increasing proportion of people will become more affluent, particularly in the emerging economies.
- Cities: Global urbanisation will continue and it is forecast that 60% of the world’s population will live in cities by 2030 and 70% by 2050.
- Infrastructure: Increasing urbanisation will require massive investment to be made in infrastructure as well as innovative solutions to provide food, water, waste management and other services.
- Resources: Rising energy use is predicted, particularly by China, and much of this will need to come from renewable sources if the worst affects of climate change are to be avoided. New innovative responses are needed which could lead to a growth in clean technology.
- Food: The growing population will mean an increasing demand for food. This could lead to a change in the pattern of food with less meat consumption.
- Technology: The internet is expected to reach 5 billion people by 2050. Continuing move to empower people with own mobile technologies.
- Control: Firms will allow their employees greater control via new technologies.
- Social Media: Use of social media will continue with positive impacts on innovation, creativity and collaboration.
- Work: New types of work are being created linked to city growth, technological development, globalisation and climate change. It is anticipated that service based jobs and those in hospitality in the UK will continue to grow with an increasingly diverse workforce.
- Government: Increasing use of public services will be delivered online. EU is setting an agenda for car free cities by 2050.

Key conclusions
This is a time of great change offering both opportunities and threats.

Areas/questions for future research /Potential cross-linkages to other research

Relevance
This looks at global trends but many apply at a regional level.
Summary of research undertaken
This research seeks to address the challenging issue of enabling stakeholders including the public to make a contribution to decisions about the future of the urban environment through the use of 3D interactive and immersive technologies. While a range of computer based tools are available to assist decision makers, the authors argue that these are often dominated by ‘experts’ and are technically oriented and concerned with choices between options. A prototype tool (S-City VT) was developed which sought to incorporate measurable indicators of sustainability into the decision making process while also facilitating more effective engagement of stakeholders through a process which visualises alternatives and allows trade-offs to be made between them. The tool, which is embedded into a sustainability enhancement framework, builds on technologies developed for the computer games industry. The researchers worked in collaboration with Dundee City Council and its partners to use the tool as part of the decision-making processes for the Dundee Waterfront Project, a multi-million pound regeneration scheme for the city. Sustainable development indicators for the Project were developed with key stakeholders with the following characteristics: comprehensibility, tractability, transparency and practicality. An analytic network process (ANP) methodology, a multi-criteria decision making approach, was used as the basis of the model. In the visualisation process, each development element was assigned a sustainability value based on a range of selected indicators and these onto a colour scale. The model was tested by two groups of Abertay students on the basis of different sustainability scenarios and the results suggested that the tool allowed the participants to distinguish the relative sustainability of alternative schemes.

Key conclusions
The paper concludes that visualisation tools of this kind can be effective both in conveying information about the sustainability characteristics of development options to stakeholders and in opening up the process beyond the expert to include the public. The tool has potential to be adapted to incorporate a greater range of factors such as demographic change.

Areas/questions for future research
At the time of this paper, only pilot testing has been carried out with students. More testing of the Waterfront proposals with a range of stakeholders included local people seems to be the next step.

Potential cross-linkages to other research
Relevance
This work is valuable in thinking about how to engage stakeholders in the decision-making processes of Tayplan in the future. Can this type of visualisation be used at a strategic level, such as the city-region, and thereby address some of the current problems in engaging the public in strategic level planning?
83. Title: Calculating carbon budgets of wind farms on Scottish peatlands

Author(s) Nayak, DR, Miller D, Nolan A, Smith P and Smith JU
Institution (agency or university) University of Aberdeen and Macaulay Institute
Date of publication 2010
Availability (URL or Publisher) Mires and Peat, 4, pp1-23
http://www.mires-and-peat.net/map04/map_04_09.pdf

Summary of research undertaken
Organic soils can both absorb and release CO2 depending on land management practices. In Scotland, it is believed that the soils absorb more CO2 than they release but there are some uncertainties surrounding this assumption. Set against the background of Scottish Government’s policy commitment to increase the proportion of energy produced from renewable sources, the research considered a methodology for calculating the carbon emission savings that can be achieved from the development of wind farms on peatlands. Peatlands are seen as potentially attractive sites for windfarms because they are less likely to be in productive agricultural use than other soils, and they are frequently found on exposed locations where there is high wind potential. Calculations of potential carbon emission savings from prospective projects are important for informing planning decisions.

The paper identifies the factors to be considered when estimating carbon saving. The starting point is an estimate of the emissions from the source of power than is replaced. This is balanced against the loss of carbon from a range of activities and factors including (1) the production, transport, erection and operation of the wind farm (2) back up power generation (3) carbon released from peatlands and forest (4) carbon fixing potential if the development did not occur; plus carbon savings from habitat improvement. While many of these carbon losses are a result of national factors, some are more localised and be influenced by the selection of the site and the extent of drainage. The paper shows that these localised factors can have a significant impact on the potential overall carbon savings of new windfarms (up to three quarters of the gross carbon savings) and while most windarms are likely to result in savings, with poor site location the new benefits could be quite small.

Key conclusions
The authors recognise the role of wind farm development in meeting government renewable targets but also stress the importance of ensuring that decision makers have information on the carbon savings arising from such developments that can inform the decision making process. A workable method of making such calculations has been produced which makes use of readily available data and incorporates impacts relating to the use and management of peat soils. Carbon losses from development on peatlands have been identified but it is concluded that these can be reduced through site selection and by paying attention to land management.

Areas/questions for future research / Potential cross-linkages to other research

Relevance
This work has relevance to decision makers considering planning applications for new wind farm developments. It is perhaps of more specific relevance to local development plans, where detailed policies are need on wind farm development but is of some wider interest at the strategic level.
84. **Title:** Sustainable development indicators for major infrastructure projects

**Author(s)** Gilmour D, Blackwood D, Banks L and Wilson F

**Institution (agency or university)**

**Date of publication** 2011

**Availability (URL or Publisher)** Proceedings of ICE – Municipal Engineer, 164,1, pp15-24

**Summary of research undertaken**

This paper considers work being undertaken to create a sustainability framework for the Dundee Waterfront project, a 30 year regeneration initiative in Dundee. While a methodology based on sustainable development principles has been developed and used as part of the Waterfront Project, it is hoped to have wider applicability in other contexts.

The approach taken was to map the various different levels of decision making associated with a project of this kind as well as the stakeholders involved at different levels. Indicators of sustainable development were then identified drawing on published work at international, national and Scottish levels and these were then tested through a series of interviews with the key stakeholders in the Waterfront Project culminating in a sustainability enhancement framework. Problems associated with the collection of some of the data needed to monitor the indicators were identified and as a result it was felt inappropriate to aggregate data into a single measure of the sustainability of the development.

**Key conclusions**

The research aimed to create a sustainability enhancement framework which would assist those engaged in the Waterfront Project in arriving at both individual and collective decisions related to the project. The approach adopted means that the framework is well aligned to the decision making processes suggesting that it can help guide future decisions.

**Areas/questions for future research**

This was a scoping study with ongoing work to analyse the impact of the framework at the implementation stage of the Waterfront project over the following three years.

**Potential cross-linkages to other research**

This is linked to other studies on assessment such as the SUBET tool.

**Relevance**

The Waterfront Project is a key component of the future strategy for Dundee and the wider region. This research is important in understanding the likely impacts of the projects which will influence the shape of the city for decades to come. This paper reports on the initial part of the work and its value will be clearer once the second phase research has been carried out.
Summary of research undertaken
The starting point of this work is recognition of the importance of taking a long term and integrated approach to the sustainable design of cities which moves beyond ticking boxes and which addresses socio-economic and cultural factors as well as planning and design. The SuBET tool was designed to be used as part of a masterplanning process in order to deliver high standards of sustainable urban design.

The SuBET tool provides a framework of sustainability indicators which can be used by stakeholders to assess the sustainability of a proposed masterplan against the project’s priorities. The 80 indicators, with linked weightings, cover effective environmental stewardship (eg transport, land use, ecology, water conservation, energy efficiency) social diversity (eg community mix, availability of public spaces and amenities) cultural identity (community involvement and cohesion) economic vision (job creation, business focus, creation of technology ‘hubs’). It has a much wider scope than other systems, such as BREEAM, ensuring that it goes beyond ‘green design and energy efficiency’.

Key conclusions
The tool has been used in two international projects, in Milan and in Saudi Arabia. It has help make potential factors in the design process more visible to stakeholders early in the design process, such as the impact on local jobs or on social cohesion. The authors argue that the tool can be used at different scales from local to national.

Areas/questions for future research

Potential cross-linkages to other research
Part of a series of assessment tools

Relevance
This work focuses on the process of sustainable plan making rather than drivers of change.
Key performance indicators (KPIs) and priority setting in using the multi-attribute approach for assessing sustainable intelligent buildings

Title: Key performance indicators (KPIs) and priority setting in using the multi-attribute approach for assessing sustainable intelligent buildings

Author(s) Alwaer H and Clements Croome D
Institution (agency or university)
Date of publication 2010
Availability (URL or Publisher) Building and Environment, 45, pp799–807

Summary of research undertaken
This paper focuses on the assessment of the performance of sustainable, intelligent buildings, moving beyond a focus on green aspects such as energy use, ventilation etc to consider whether social, economic and cultural factors, on the basis that sustainable building is a subset of sustainable development. The paper reports on research which began by identifying the main issues associated with sustainable intelligent buildings, a conceptual model was then developed to assist in the identification of key performance indicators, and these were informed and changed through a process of engagement with stakeholders. Indicators were selected focusing on ‘the three ‘p’s; people, products and processes. A new consensus-based model was produced, the Sustainable Built Environment Tool –SuBET, incorporating the indicators which can operate at different levels: micro; meso; macro and global. The tool involves a process of weighting of indicators.

Key conclusions
The authors present SuBET as a tool to help those involved in designing and planning understand the multiple dimensions of sustainable development as they are reflected in decisions being taken in shaping the future environment. They see its use as part of an ongoing learning process. The fact that the tool can be applied at different scales is seen as a strength as is its flexibility and adaptability in different contexts. It is recognised that more development work is needed on the tool particularly in aggregating performance scores. Rather than using this tool to deliver firm conclusions about the sustainability of a building or masterplan, the authors see it as a discussion tool between stakeholders.

Areas/questions for future research
More research is needed in relation to the social and economic aspects of the tool. Its application was taken forward by Hilson Moran.

Potential cross-linkages to other research

Relevance
This is a process tool but it does give insights into thinking about future sustainable design.
Summary of research undertaken
This paper looks at a change in thinking from concerns with ecological modernisation to resilient cities, using Manchester as a case study. While civic leaders dream of green futures, it is argued that this will only be achieved with greater resilience.

In response to the challenges of a changing climate, it is argued that city-regions are ‘leading the way’. The author uses the Manchester city region to explore this shift. The region includes a number of individual local authorities but they have collaborated through a number of mechanisms and in 2009 it became a pilot for a new form of city regional governance. An Executive Board is advised by a number of commissions one of which was charged with developing a spatial strategy for Greater Manchester. The strategy committed the region to improving productivity and tackling inequality in a sustainable way. It was also recognised that adapting to climate change and boosting resilience were key. The value of taking a city-regional perspective to problems was highlighted, for example in having shared policies on waste disposal and minerals. The fact that the city region acts as a functional economic area is important as is the existence of institutional arrangements at this level.

A mini-Sterne Report was prepared for Greater Manchester by consultants (2008) and the approach taken was to focus on economic drivers of change, the need to create a low carbon economy and deliver infrastructure that would reduce the need to travel. The report identified the potential economic losses of failing to respond to climate change and the gains that could be made from innovating and developing new technologies. The author sees this as an example of an ecological modernisation approach. Others took a different approach around the development of Green Infrastructure (GI). A report on the economic benefits of GI was commission and this subsequently argued that GI is vital to economic growth. It also highlighted resilience associated with GI together with objectives related to biodiversity and flooding.

This led to the Ecocities Project, a collaboration with Manchester University, where climate change thinking was embedded and resilience was stressed. The author uses the response to flooding as an example of this. At a time of changing responsibility for flooding and flood risk, it was agreed to collaborate across councils in the city region and with the Environment Agency and local water company. Strategic planning was done at the city regional level with action taken at the more local level by the local authorities.

In relation to a low carbon economy, there has been a change from an approach linked to the reduction of green house gases to one focuses on reducing external energy flows, looking at localised sources of energy such as combined heat and power, windfarms etc and how these relate to local development.

Key conclusions
The author highlights the positive nature of collaboration across the city region in terms of future planning. A mechanism has been put in place to deliver the Greater Manchester Strategy which prioritises sustainability. This will require some agreement over budgets eg
to fund extensions to tram network, applications to other funding sources such as Europe and use of embedded capacity within the existing agencies. The author concludes that the shift towards a ‘resilient city’ approach has happened partly as a result of the regions institutions which have encouraged a focus on resilience. He sees it as a positive shift because the focus on resilience rather than economic modernisation has long term benefits to all sections of society including the poorest who may suffer most from climate change.

Areas/questions for future research

Potential cross-linkages to other research
Links to Ecocities study, as well as work in Leeds, Wellington and Auckland.

Relevance
The focus on taking action at a strategic, city regional level is very relevant to Tayplan. There are obvious lessons from the Greater Manchester – the theme of resilience in particular.
88. **Title:** Holding the future together: towards a theorisation of the spaces and times of transition

**Author(s)** Brown G, Kraftl P, Pickerill J, and Upton C  
**Institution (agency or university)** University of Leicester  
**Date of publication** 2012  
**Availability (URL or Publisher)** Planning and Environment A, 44-7, pp1607-1623

**Summary of research undertaken**

This paper explores the concept of ‘transition’ as currently debated within social science discourse. The concept is commonly understood as a process of change over time from one state to another. It is acknowledged that transition processes may involve people, groups or states either as active participants or as passive recipients. Contrasting transition with transformation, it is suggested that the latter is understood as a sudden shift or break taken to achieve a clear goal, the former involves “iterative, incremental processes of change, towards uncertain futures” (p1608).

Much current governmental planning uses projections of alternatives futures as a way of responding to current threats such as climate change and obesity. Present and possible threats become the basis for taking action now. Futures are envisaged by considering ‘styles’ that is vision statements, ‘practices’ or predictions of calculations of human activity, and ‘logics’ that is formalised strategies for action. The authors argue that the concept of ‘transition’ is becoming more varied but that it is becoming central to thinking about the future.

The authors question the extent to which different forms of transition (individual behaviour, technological change, socio-political or environmental) are being seen holistically in responding to future threats. They argue that transition needs to be theorised, particularly the place of individual life course transitions. A major aim of the paper is to formulate a theory of transition.

The authors explore two examples of environmentally-focused transitions (UK Government low-carbon transitions and Transition Towns movement) which they suggest try ‘to hold the future together’ – broadly accepting the neoliberal capitalism, mobilising diverse social groups to change behaviour in response to environmental threats.

The UK Government’s Low Carbon Transition Plan talked about the changes needed to respond to the challenges of peak oil, energy security and recession using the concept of transition which linked together different policies strategies from energy to housing. It was seen as prospectus for change that all sections of society could contribute to from individuals to business, but one which recognised the need to look for new responses to problems within a capitalist framework. What is often absent in future scenarios is any effort to analyse the consequences of trends or the social impacts across society.

The Transition Towns movement is a community-led response to the challenges of peak oil, resource degradation and climate change which seeks future happiness through low carbon living. It is characterised as responsive, localised, and adaptable to context. It is argued by some that the movement fails to tackle the underlying causes of future threats but put s coping mechanisms in place. This view of transition is based on some key assumptions; that energy decent is inevitable, that existing communities lack resilience, collective action is needed today; and that by working together solutions can be found. An overarching view is
held together by the message of an inevitable threat (peak oil and climate change), the value in taking local responsibility thus increasing resilience, and the benefits of working collaboratively to address the future.

The authors contend that there are tensions within the TT movement between imminent threats, such as climate change and economic non-productivity, which weigh heavily on the present and its possible futures, and redirecting these futures in ways which might better hold together diverse social groups, communities and places.

**Key conclusions**
The paper concludes that the concept of transition is powerful partly because it allows different approaches, policies and actions which often sit in tension with each other (individual/collective; active/passive) to exist together. In this way transition is used as a tool to manage future collective problems by focusing different philosophies and energies reinforced by a message of pressing need if the challenges of the future are to be faced now and that this can be best achieved at a local level.

**Areas/questions for future research**

**Potential cross-linkages to other research**

**Relevance**
This paper is quite theoretical but it does raises questions about the way in which we think of the future and highlights some of the underlying assumptions involved in a ‘transition’ approach.
Title: SWITCH Policy Briefing 4: Managing the Transition of Urban Water Systems

Author(s) Fisher J.

Institution (agency or university)

Date of publication 2010

Availability (URL or Publisher) http://www.switchurbanwater.eu/outputs/pdfs/WP1-3_GEN_PBN_Managing_the_transition_of_urban_water_systems.pdf

Summary of research undertaken

SWITCH (Sustainable Water Improves Tomorrow’s Cities Health) was an EU project funded under the FP6 programme. The main goal of SWITCH was to change the way that urban water systems were managed in the future (30-50 years from now) and promote a more integrated and coherent approach.

The project adopted an approach based on transition theory. “A transition is a structural change in the way in which society operates. In simple terms it is a process whereby culture, markets, networks, institutions policies, individual behaviours and trends evolve together from one relatively stable system state to another” (p1). There are four phases in the transition process: (1) pre-development phase involving innovation and experimentation with new technologies (2) take-off phase when new technologies begin to be accepted (3) acceleration phase where there is structural change as a result of decision making processes that take account of institutional, cultural, ecological and economic factors (4) stabilisation phase when there is acceptance of the new approach and integrated and sustainable urban water management becomes the norm.

SWITCH was concerned with deepening understanding of integrated and sustainable urban water management and, based on the assumption that transition is needed, it considered how this shift. The new systems involve the physical networks, the management systems and the wider contextual landscapes. The SWITCH approach assumes that stakeholders and policy makers wish to improve the management of urban water and create a Learning Alliance to identify the appropriate local objectives. Where the transition is bottom up it will focus on local or niche innovation, establishing good practice projects. A more top down approach may result in more major technological solutions which are harder to adapt over time. The transition to sustainable urban water management is in the take-off phase. The project aimed to process transition to the acceleration phase by sharing experiences of good practice. Barriers to transition were identified including: limitations of existing support infrastructure; financial consequences of change; disruption to existing societies.

Key conclusions

At present there is a lack of political commitment in relation to the transition to integrated and sustainable urban water management as well as a lack of the necessary strategic planning mechanisms in place to take advantage of new technologies. There is a requirement to build capacity of managers and operators and to raise wider awareness of the benefits of transition through the media.

Areas/questions for future research

Where on the transition pathway is the Tayplan area? What are the barriers here to driving this agenda forwards and how might they be overcome.

Potential cross-linkages to other research

Relevance
Pursuing integrated and sustainable urban water management aligns with the vision of Tayplan. New and innovative approaches are already in place in some parts of the area. The SWITCH manual suggests a way forward in driving the transition in the Tayplan area.
Summary of research undertaken
This manual is one of the outputs of the SWITCH project (Sustainable Water Improves Tomorrow’s Cities Health) funded under FP6. The project sought to guide transition in urban water systems, moving from ‘conventional socio-technical systems to next generation urban water systems’. It is argued that to ensure the adoption of such systems, it is important that new schemes not only produce cost savings and improved efficiency but must also deliver environmental benefits. The conventional approach to urban water management was developed to address the needs of developing societies. Change is being driven by a number of factors including: ageing infrastructure, rising energy costs, availability of new technologies, depleted ground water, pollution and urbanisation, migration, climate change and rising costs.

Features of urban water management practices that might characterise future cities include; storage and local reuse of water; green buildings with efficient energy use; decentralised water management; reductions in travel and enhanced public transport; energy recovery; better use of treated water; life-cycle assessment; better community connections to water in the local environment.

Key conclusions
The manual provides a methodology for stakeholders and policy makers seeking to adopt more integrated and sustainable urban water management in order to deliver quality, safe water supplies and attractive environments free from flooding. There is guidance for stakeholders at different scales: strategic guidance relating to visions and the creation of strategic plans and strategies; tactical guidance about creating Learning Alliances to evaluate options; and operational guidance concerned with generating innovations and putting experiments in place. Seven sections are contained in the manual: (1) Background to Transitioning (2) The transition framework explained (3) Transition management cycle (4) Strategic niche management – demonstrations (5) Transitioning stories (4 examples) (6) example tools and (7) Further information.

The manual highlights a number of cities where transition has occurred in relation to urban water management including Accra, Alexandria, Lodz and Belo Horizonte.

Areas/questions for future research

Potential cross-linkages to other research
This project is summarised in the SWITCH Briefing Note.

Relevance
There are two major stands of this that are relevant to Tayplan. Firstly, the manual provides an excellent illustration of an integrated strategic planning approach to complex urban issues. The concept of transition is one that can help inform the future approach of the strategic planning agencies in the Tayplan area. Secondly, the practical examples highlighted in the manual demonstrate innovative thinking in urban water management.
Summary of research undertaken
This paper considers the interrelationship between place, understood as “space enriched by the assignment of meaning” (Pocock and Hudson, 1978) and ‘smart’ information and communication technologies (ICT). The author starts from the view that developments in ICT, such as sophisticated information portals and digitally enabled platforms for e-learning, e-governance, community participation and decision making, are likely to continue to change both the way in which people use space for work, home and leisure, and their perceptions of it with far greater tele-servicing although the manner in which this occurs remains unclear. ICT developments could potentially result in “themed environments devoid of place-specific design” (p199).

As long ago as 1964 Webber argued that technological advances, at that time the car, were making traditional streets and neighbourhoods irrelevant and similar arguments are being made today in relation to current ICT technologies. Others have suggested that with greater ability to choose where to live, the character of place becomes more important in the choices made. Florida’s work on the creative classes talks of amenity migration to attractive locations. An ideal might be to combine what Walter’s calls “ICT-infused urbanity” (virtual spaces of e-learning portals and digital platforms) with a distinctive local identity based on the unique qualities of history, geography and culture and, as in the example of transition towns, by a concern for localised sustainable lifestyles. This vision of the future is not without problems, however, as ICT may in fact reinforce existing social divisions within society. It is suggested that deliberative public policy initiatives are needed in order to address possible problems in relation to housing affordability, job opportunities and social cohesion.

Key conclusions
It is argued that there is a key role for those managing cities to combine physical, place based planning and design with the positive aspects of virtual or ‘smart’ advances to enhance the distinctiveness of individual localities. It is suggested that public forums are needed to discuss place-specific futures. Features of smart and sustainable planning have been identified (Walters and Brown, 2004) as compact, mixed use, walkable cities, with good public transport, an accessible public realm, and energy efficient and adaptable buildings. Design codes are seen as a way of delivering the tele-serviced and place specific agenda by embedding design principles in e-governance structures (combining physical and virtual worlds).

The paper then explores the history of design coding linked to New Urbanism and the work of Andres Duany. It highlights that the approach recognises the importance of those living in a place contributing to its future planning and considers the possible impact of changes in planning policy in England following the last UK election. The article then looks at the experience of Beaufort in the USA which has gone through a process of change over the past
few years. It has put an electronic planning portal in place, with neighbourhood plans and
design codes produced through a process of electronically enhanced participation events
and easily accessible information. The conclusion was drawn in this case that combining
electronic media and place based design had been important in bonding the community
around a new vision for the city. ICT has enhanced the planning and design process both in
terms of the information and opportunities for engagement.

Areas/questions for future research

Potential cross-linkages to other research
Clear links to other work on smart cities

Relevance
There are two issues of relevance within this paper. The first relates to the need to continue
to focus on place as development in ICT make populations more mobile in terms of the
places they want to live and work. It highlights the need to link place-based policies with ICT
infused urbandity and that these two dimensions of the future are linked together.

The second thread is more process related and the opportunities that ICT and e-governance
provide local populations to have a greater say in shaping the future of the region.
Summary of research undertaken
This work was undertaken for Scottish Enterprise to enable the calculation of figures for futures energy scenarios in order to inform debates policy debates about energy markets and potential opportunities. The time period covered by the reckoner is 2011 to 2020. It distinguishes between ‘supported’ investments which relate to existing investments which may require additional support of which could be expanded, and ‘created’ investments which are new and emerging opportunities. Development of the reckoner drew on reviews of the literature, extensive discussions with experts and public bodies, and the company’s own expertise.

Investment in energy development at a global level is typically unaffected by changes in the business cycle but the depth of current global problems is likely to have an effect for some decades. There are two main challenges facing the world: maintaining a supply of energy which is both reliable and affordable, while at the same time moving to energy supplies which are low-carbon, efficient and environmentally. The authors conclude that current global trends in both the supply and use of energy are ‘unsustainable’ and yet there is not international agreement on the way ahead. In the UK, the gap between the supply and consumption is widening with the availability from the four main sources (oil, gas, coal and nuclear) declining. Renewables still account for only a small proportion of supply. The UK’s current energy gap is “now about 60 mn tonnes growing at about 7 mn tonnes of oil equivalent per year. At current oil prices and exchange rates the gap would be valued at £20 bn per year, growing at £2.4 bn per year”. In relation to the UK electricity, the main factors driving change are the fact that many of the country’s power stations are reaching the end of their life and that the cost of investing in greener sources of supply will have to be included in fuel costs.

The report considers future trends in each of the sources of energy: North Sea oil and gas, including decommissioning which it is anticipated will be serviced from Aberdeen; nuclear energy which is politically unclear but is thought to be unlikely that it will go beyond the replacement of existing power stations, coal including the possibilities of carbon capture, and renewables. The report considers different scenarios for future wind generation: one developed around onshore wind in Scotland, one covering offshore wind around Scotland and two relating to offshore developments for the UK. For hydro power, the main opportunities are thought to be in the growth of small schemes, averaging 150Kw, mainly in Highland, Strathclyde and Tayside although financial viability of these will depend on the level of feed-in tariffs. Scotland is well situated in relation to wave energy potential and is leading in terms of investment and development interest. Six future scenarios are developed. The consideration of biomass energy highlights its potential but that given the impact of transport coat, it suggests potential will be for small plants close to forests or locations on the coast.
Key conclusions
The report concludes that opportunities still exist in Scotland across all fuel sources: the ongoing exploration and development of North Sea oil and gas; decommissioning of nuclear power stations; the development of carbon capture and storage; and offshore wind.

Areas/questions for future research

Potential cross-linkages to other research

Relevance
The report includes an analysis of strategic trends affecting the energy industry and this analysis is relevant to Tayplan. It sets out the range of opportunities available over the next decade and highlights that these include the development of existing technologies (oil, gas, carbon capture and storage from coal) as well as further development of renewables. Opportunities for small scale hydro schemes in Tayside are specifically mentioned. While the shift to low carbon technologies is part of a global trend, the political dimension is a major factor in shaping future developments.
Summary of research undertaken
This article considers the value of using the census as a tool for investigating Scottish population change, both comparing one census to the next and making connections to other data sources. It draws on the work of the recently established Centre for Population Change, a joint ESRC centre involving both Dundee and St Andrews Universities as well as other UK institutions. Three case studies are presented in the chapter, one relating to health, migration and employment and the other two to population change over time.

The life expectancy of Scotland’s population is lower than elsewhere in the UK and Europe despite year on year improvements. One explanation put forward for this difference in the past has been Scotland’s relatively high levels of poverty and unemployment compared with elsewhere. This appeared to have declined in significance in relation to the 1991 and 2001 censuses leaving an element of unexplained excess deaths named the ‘Scottish effect’. Reasons for the Scottish effect include the possible long-term impact of poverty over a lifetime, meaning that current levels of deprivation do not capture past life experiences and there is some evidence to support this theory. Past research into the Scottish effect has tended to use death rates but an alternative is to consider levels of poor health and examining the link to socio-economic circumstances and country of birth. Using Samples of Anonymised Records (SARs) almost a total of almost nine hundred thousand records were analysed from both Scotland and England with approximately 9% reporting poor health, and after adjustments, those born and living in Scotland were found to be more likely to report poor health. However, the differences between countries could be explained by reference to economic factors suggesting no evidence of a Scottish effect. It is thought that self-assessment of health reflects current health rather than life-time health. The authors suggest that decreasing deprivation in Scotland thus could mean improving health of the population.

The second study used the Census to try and understand in-migration to Scotland including return migration, this latter group making up almost 30% of migrants to Scotland in the year prior to the 2001 Census. The study used longitudinal data to explore the characteristics of return migrants between 1991 and 2001 although this may not identify all migrants. In terms of characteristics, return migrants (excluding students) were more likely female than male, were of a relatively young age, and have a favourable educational profile and likely to be in managerial or professional jobs. They were more likely to be upwardly mobile than other groups and are not as commonly thought of retirement age. Explanations that have been advanced stress that “that migration is a positively selective process engaging the better educated and better qualified elements of the population, with similar positive selectivity amongst in-migrants to Scotland”. Thus return migrants can have a positive impact on population and economic growth. It is suggested that this kind of analysis could be repeated for the 2011 census, particularly to consider if the recent recession has made a difference to returners.
The third study considered issues of health and wellbeing. Some recent policies particularly in community regeneration assume health and well being benefits can be gained from living in socio-economically mixed communities. This study looks at the neighbourhood effects on the life chances of residents, building on suggestions of a causal link on employment prospects. It addressed the question: “to what extent does 1991 neighbourhood tenure mix influence the probability that those who are unemployed in 1991 have a job in 2001?”

Three regression models were used in the study. The first, incorporating tenure mix and employment status, showed that the higher the level of social renting in the neighbourhood in 1991, the less likely an individual was to be in employment in 2001, although this took no account of other factors. The second model widened the factors to include measures of neighbourhood deprivation and found that that the more deprived the neighbourhood of residence in 1991, the less likely people were to be in employment in 2001, with deprivation being more important than tenure mix. However, when individual characteristics were added, these were found to be the most important factors, ie that there is no evidence of neighbourhood causal factors.

Key conclusions
The three studies are used to illustrate the potential benefits to be gained from using the census for research purposes and it is suggested that the 2011 census could be used to further such understanding.

Areas/questions for future research

Potential cross-linkages to other research

Relevance
Understanding demographic change in the Tayplan area is central to the strategic planning process and this work shows the opportunities for tailored research using the 2011 census.
94. Title: The role of map-based environmental information in supporting integration between river basin planning and spatial planning

Author(s): Smith H.M., Wall G. and Blackstock K.L.
Institution (agency or university): James Hutton Institute & University of Aberdeen
Date of publication: 2012
Availability (URL or publisher): http://www.sciencedirect.com/science/article/pii/S1462901112001141

Summary of research undertaken
The paper examined the emerging relationship between river basin planning and spatial planning in Scotland with emphasis on communication mechanisms. The latter includes formal written consultation responses, as well as more informal opportunities for discussion and dialogue. However the paper focusses on the use of map-based tools to convey information relating to the ecological condition of water bodies.

The results presented a considerable emphasis on developing map-based tools to communicate complex information, in a simplified format, as a means of being easily understood by all stakeholders. These tools have an undoubted value as a means of visualising and communicating environmental information. It is suggested that the reliance on such tools may serve to downplay the need for broader discussion and dialogue. However, there were indications from interviews that part of the rationale for producing these maps is to reduce the need for additional dialogue and discussion between SEPA and local authorities.

These maps are considered to be ‘screening tools’ which could indicate, through colour coding (RAG assessment of red, amber and green), where new development should (or should not) be located, based on the predicted impact from nearby water bodies. Additionally, mitigation measures could also be identified in these maps where there are many predicted impacts.

Key conclusions
If greater integration between river basin planning and spatial planning is to be achieved, GIS-based communication tools are the agreed means of addressing this need. Map-based models are seen as tools to support decision-making which simplify complexity to some degree. McDonnell (2008) points out that GIS tools cannot effectively represent social and political values. While map-based tools can provide quick and succinct information over time-consuming discussion, there often needs to be discursive interaction around the interpretation of maps. Ultimately, such map-based tools should be situated within and complement, rather than replace, a meaningful discursive context.

Areas/questions for future research
- The effectiveness of map-based tools to visualise ideas and concepts against conventional text-based reports and diagrams
- The changing format of public participation over the next 40 years in an increasing ‘virtual’ world.

Potential cross-linkages to other research
Immersive and non-immersive 3D virtual cities as decision support tools for urban sustainability carried out by the University of Abertay (http://www.itcon.org/data/works/att/2011_10.content.05914.pdf)
Ecological Urbanism App that predicts the future of cities based on data input by Harvard School of Design
Betaville software as a 3D map-based public participation tool by University of Applied Sciences, Bremen

Relevance
General practical lessons can be learnt from this paper. In modernising planning practice, the use of map-based tools can increase accessibility and efficiency by creating maps which can be easily understood by all, visualise key concepts or findings, aid in decision-making. The use of GIS-based tools to support formal and informal discussion, in an increasingly technologic society, could lead to increased effective communication to all members of society and bring about more efficient decision-making.
95. Title: Coastal Flooding in Scotland

Author(s): Werritty, A. and Duck R.W.

Institution (agency or university): Centre of Expertise for Waters (CREW), The James Hutton Institute and the Scottish Government

Date of publication: 2012


Summary of research undertaken
This piece of research highlights key legislation which determines the management of coastal flood risk in Scotland: Flood Risk Management (Scotland) Act 2009 (FRM Act), Marine (Scotland) Act 2010, Coast Protection Act 1949 and the EU Flood Directive (2007/60/EC). Under the FRM Act, all 32 local authorities are divided into 14 local plan districts, each with a lead local authority, which reflect the configuration of river basins in Scotland. A Flood Risk Management Plan covers each Local Plan District. These Plans include a SEPA Flood Risk Management Strategy and the lead authority Local Flood Risk Management Plan. To deliver sustainable flood risk management, authorities should work holistically in designated river basin or appropriate units for coastal areas, work in partnership with each other and relevant stakeholders and seek multiple benefits from the actions taken.

It is understood that focus needs to be diverted from hard-engineering solutions, which can potentially increase the severity of damage, towards a range of measures which collectively reduce flood risk (i.e. flood warnings, property-level resilience, community action, robust spatial planning, use of natural features to store water and reduce flood flows, etc.). Ultimately there is a view towards increasing individual resilience at the community level rather than total dependency on the State. A timetable is given, from June 2012 to December 2015 and beyond, on the delivery of Flood Risk Management Strategies.

Key conclusions
Collectively, the legislation addresses the need to create flood risk management systems in relation to both inland and coastal flooding. In 2011, 243 potentially vulnerable areas have been identified across the 14 local plan districts. Considering the increasing number of natural disasters due to climatic factors, public funding should be given to protect these more vulnerable areas in a proactive manner.

Areas/questions for future research
The first Scottish national Marine Plan is still to be launched with consultations being held in 2011. It is envisaged that the boundaries for the associated Scottish Marine regions have yet to be announced but it is unlikely that they will coincide with the boundaries for the Local Plan Districts. The paper reflects that there is a risk that spatial planning for Regional Marine Plans may not give due regard for flood risk management. It is to be hoped that appropriate guidance to local authorities will emerge to ensure that flood risk management is sufficiently covered.

Potential cross-linkages to other research
A water vision for Johnstone by the University of Abertay and Renfrewshire Council (http://web.sbe.hw.ac.uk/staffprofiles/bdgsa/11th_International_Conference_on_Urban_Drainage_CD/ICUD08/pdfs/611.pdf)
Relevance
The TAYplan area comprises of undeveloped coastland as well as many riverside settlements. Due to increasing climatic variables, and as required by the EU Floods Directive, flood hazard and risk maps are required to be created by 2013 and a flood management strategy by 2015. It is also in the interests of Tayplan, according to the SDP to:

- Build-in resilience to climate change and increased risk from sea level rise.
- Settlements and land will see changes resulting from a mixture of natural processes, such as flooding and rising sea level impacts of climate change
- Ensuring effective resource management – Enhancing networks (i.e. watercourses) within and between the region’s settlements to reduce flood risk
- The Plan is informed by a range of assessments including the Strategic Flood Risk Assessment
- Policy 2A – Ensure that climate change resilience is built into the natural and built environments (i.e. mitigation and management measures to flood risk)
- Policy 3 – Identifying and safeguarding parts of the undeveloped coastline and identifying areas at risk from flooding and sea level rise
Title: A decade of delivering sustainable coastal zone management: The Tay Estuary Forum, a voluntary local coastal partnership in Scotland

Author(s): Booth, L.M. and Duck, R.W.
Institution (agency or university): The Tay Estuary Forum & University of Dundee
Date of publication: 2012
Availability (URL or publisher): http://www.dundee.ac.uk/crsem/TEF/TEF%20Littoral%202010%20Paper%20BoothDuck.pdf

Summary of research undertaken
Compared with other UK estuaries, the Tay estuary is relatively undeveloped, its south shore remaining predominantly rural. The Tay estuary is an area of exceptional environmental quality and is widely regarded as one of Europe’s least polluted estuaries (Duck, 2005). The aim of the Tay Estuary Forum (TEF) is to promote the wise and sustainable use of the Tay Estuary and adjacent coastline of east-central Scotland through multiple stakeholder cooperation (including, amongst others, the four local authorities within Tayplan). This paper reflects the achievements, developments and changes to the partnership over the past decade and outlines the on-going challenges it still faces.

In April 2009, the TEF launched a five year Management Plan. The Plan is a non-statutory document, aimed at promoting future sustainable management in the Tay Estuary and along the adjacent coastline. A list of Actions was agreed upon. By continually reviewing the document, the TEF will ensure that Actions are implemented as efficiently as possible. With the emergence of Scotland’s Marine Act, the future of the Local Coastal Partnerships in their current form may be uncertain.

Key conclusions
The TEF is an adaptive Partnership and despite irregular funding contributions and comparatively fewer resources than other Local Coastal Partnerships in Scotland, it still continues to deliver, setting itself achievable targets and evolving to meet the changing needs of its coastline and population. Through necessity, limited funding had made the Partnerships resourceful and efficient in delivering coastal zone management, on a budget. Strong relationships between individual Steering Group members have made it easier to facilitate information exchange and build trust between key organisations between business, government and knowledge centres.

Areas/questions for future research

Potential cross-linkages to other research

Relevance
The Tay Estuary is a key asset to Tayplan in terms of environmental quality, business opportunities and undeveloped coastline to be safeguarded. The networking capability of TEF can be utilised and promoted. It is also in the interests of Tayplan, according to the SDP to:

- Policy 2A: ensure that climate change resilience is built into the natural and built environments through: a presumption against development in areas vulnerable to coastal erosion, flood risk and rising sea levels; including the undeveloped coast.
- Managing Tayplan’s assets: Identifying environmentally sensitive areas and important natural and historic assets where no or very limited development would be permitted, such as some coastal areas.
Title: The Low Carbon Land Use Innovation Network (LoCal-Net)

Author(s): The University of Abertay Dundee
Institution (agency or university): The University of Abertay Dundee
Date of publication: 2012
Availability (URL or publisher): http://localnet.abertay.ac.uk/

Summary of research undertaken
A new programme, the Low Carbon Land Use Innovation Network (LoCal-Net), spearheaded by the University of Abertay aims to coordinate research and development opportunities for the small and medium enterprise (SME) business sector, to innovate low carbon activities, products and services. There is an emphasis on the agriculture, food and rural industries sectors which present opportunities in low carbon innovation.

The project is a cross-organisational effort across Scotland which involves local authorities within the TAYplan area, the Forestry Commission in Scotland, Scottish Enterprise, Scottish Renewables, Scottish and Southern Energy in addition to like-minded bodies which aim to develop a low carbon future such as SEGEc (Scottish European Green Energy Centre), Binn Eco Park and the Scottish Alliance for Geoscience, Environment and Society. It is aimed that the transition to a low carbon economy will be supported by a knowledge exchange in order to effectively engage SMEs to move forward, to take account of key stakeholders, form new alliances and to grow organically beyond the duration of the project.

Key conclusions
LoCal-Net will support individual SMEs by assisting with the conversion of research ideas into potential products and services which includes scoping studies for these products and services, identifying sources of funding and assisting with the application of research ideas to low carbon products or services. Supported by knowledge exchange partnerships, the objective is to reduce greenhouse gas (GHG) emissions, reduce energy demand, reduce waste, increase renewable energy provision, improve job retention and increase job creation in addition to intelligent land use.

Areas/questions for future research
As LoCal-Net is a new programme, there is scope to identify current projects to demonstrate the processes involved in transferring to a low carbon economy through products and services. Once established there may be an opportunity to include larger business and industry.

Potential cross-linkages to other research
Relevance
As mentioned, there is emphasis on the agriculture, food and rural industries sectors in the LoCal-Net programme. It is relevant for Tayplan as a large percentage of land within Tayplan’s jurisdiction is agricultural and rural land. Where rural land is intended to be developed, the LoCal-Net programme can help ensure SMEs are low carbon to zero carbon in their activities. It is also in the interests of Tayplan, according to the SDP to:

- Supporting growth in renewable energy industry
- Offering opportunities for business to operate within environmental limits
- Supporting sustainable economic development (i.e. low carbon technology sectors, with a view towards supporting advanced and competitive European and global market, both at rural local service level as well as main economic driver level)
• Policy 2D – waste management solutions contributing to Scotland’s Zero Waste Plan
• Policy 2E – Use of low and zero carbon energy generating technologies to reduce carbon emissions and energy consumption
• Policy 6 – deliver a low/zero carbon future and contribute to meeting Scottish Government energy and waste targets
Title: The macroeconomic benefits of investment in offshore wind

Author(s): Centre for Economics and Business Research (CEBR) Ltd

Institution (agency or university): Mainstream Renewable Power

Date of publication: 2012

Availability (URL or publisher):
http://www.mainstreamrp.com/content/reports/benefits-of-offshore-wind.pdf

Summary of research undertaken
As a whole, the research project provides a comprehensive, integrated analysis of the prospects for long-term development of offshore wind resources and presents evidence suggesting that the UK should rely on a substantial contribution from offshore wind in the medium to long term.

“In 2010 the Offshore Valuation Group set out to measure the value of the UK’s offshore renewable energy resource. The Group concluded that, by harnessing less than a third of that resource, the UK could, by 2050: Generate the electricity equivalent of 1bn barrels of oil a year; reduce its CO2 emissions by 1bn tonnes; and create over 145,000 new jobs. By 2015, CEBR expects the impact of planned investment in offshore wind electricity generation in the UK to increase UK GDP by 0.2% and create 45,000 full time jobs; by 2020, to double GDP to 0.4% and 97,000 employed; and by 2030 increasing to 0.6% GDP and creating 173,000 jobs. CEBR investigated the economic impact of investment in offshore wind capacity through a scenario-based assessment using foreign trade multiplier (FTM) analysis. A table is provided from which key conclusions are based. Under an accelerated growth scenario, FTMs suggest that offshore wind investment impacts can be expected to be higher by 2020 than those suggested by the domestic multipliers. By 2030, FTMs are shown to be increasing which reflects the declining reliance on imports and the growth in the export capabilities of the UK supply chain as it matures. The FTM estimates are consistently lower in 2015, due to the greater reliance on imports in the offshore wind investment supply chain. Whereas the domestic multiplier framework suggests that, by 2020, investment in offshore wind will generate £8.4 billion of GVA, the (combined Leontief/Keynesian) FTM framework suggests that this could be as high as £10.5 billion. Likewise, whereas the domestic multiplier suggests that offshore wind investments would support 185,000 jobs by 2020, the FTM framework suggests that this estimate could exceed 200,000.”

Key conclusions
From the point of view of growing the economy in the 21st century, the research shows that offshore wind provides an attractive opportunity for the UK to take a leadership role, expand output and promote regional and global exports in a sector that is destined to play an increasingly important part in the global economy. CEBR’s investigations point to three positive conclusions driven by assumptions about reduced fossil fuel imports and offshore wind electricity exports as a result of greater offshore wind capacity: an increasing contribution to GDP is expected to double with from 2020 to 2040; increased employment generation; an increase in net exports to plug by 2030 to plug the UK trade deficit.

Areas/questions for future research
Investment in offshore wind while within a recession? Social implications of off-shore wind?

Potential cross-linkages to other research
Relevance
It is in the interests of Tayplan, according to the SDP to:
• The region has significant potential to support growth in the renewable energy industry, particularly through the growth of Dundee and Montrose ports to support offshore renewable energy
• Strengthen the economic base to support the renewable energy and low carbon technology sectors
• The National Renewables Infrastructure Plan identifies the strong potential to grow the offshore renewable energy sector and its supply chain in this region
• Opportunities to grow the renewable energy and waste/resource management sector as a whole within the TAYplan region.
• Policy 6: To deliver a low/zero carbon future
99. Title: Immersive and non-immersive 3D virtual city: Decision support tool for urban sustainability

Author(s): Isaacs, J.P., Gilmour, D.J., Blackwood, D.J. and Falconer, R.E.
Institution (agency or university): The University of Abertay Dundee
Date of publication: 2011

Summary of research undertaken
The paper outlines the opportunity for immersive (3D) and non-immersive (2D) map-based tools, combing computer game techniques and the modelling of economic, social and environmental indicators to provide an interface that presents a 3D interactive virtual city with sustainability information overlain. Advocating the importance of visualisation during the early stages of the planning process, real-time rendering of 3D graphics is highlighted to aid interaction and communication between stakeholders including the general public.

Levy (1995) notes that the ability to visualise part of the city that is undergoing the development or regeneration within the wider city context is likely to improve engagement with the communication tool and bring a greater level of involvement from all participants in the planning process. Pettifer and West (1997) supports the use of immersive and non-immersive 3D graphical representations of the urban development, useful for collaborative sustainable urban design as it has the ability to engage fully the user’s perceptual and spatial faculties and aid processing of complex information.

The paper, by example, makes reference to the Dundee Waterfront development with a 3D representation of the proposed development within the wider city context. Further reference is made to the comparison capability of the software to aid decision-making in, for instance, the choice of building materials to best fit the building and its surrounds. Multivariate sustainability information can be overlain onto physical models and the results can represent the best sustainable option depending on the indicators used.

Key conclusions
Pilot tests of the virtual environment involving a wide variety of stakeholder groups have demonstrated that it is a useful medium to communicate the interdependent nature of sustainability indicators and to compare and contrast opposing planning scenarios. The participants (100%) were able to recognise which scenarios were the most sustainable when presented with the tests. The paper concludes by saying that, as a decision-making tool, the use of immersive and non-immersive tools is limited by the reliability and quality of the underlying data used in the models. However, the models can be replaced by better models and the criteria for sustainability assessment can also be refined. In this sense, it is a dynamic process requiring contextual input.

Areas/questions for future research
By using immersive and non-immersive environment map-based tools, can this improve the planning process in terms of clarity, transparency, efficiency and effectiveness when communicating to stakeholders and all forms of the general public? In the next 40 years, can we see an increased use in immersive and non-immersive virtual 3D environments instead of current conventional GIS software packages?
Potential cross-linkages to other research
The role of map-based environmental information in supporting integration between river basin planning and spatial planning, with particular interest in the use of map-based tools, by the University of Aberdeen and the James Hutton Institute (http://www.sciencedirect.com/science/article/pii/S1462901112001141)


Betaville software as a 3D map-based public participation tool by University of Applied Sciences, Bremen (http://www.bbc.co.uk/news/technology-19753721)

Relevance
General practical lessons can be learnt from this paper. In modernising planning practice, the use of map-based tools can increase accessibility and efficiency by creating maps which can be easily understood by all, visualise key concepts or findings, aid in decision-making. The use of immersive and non-immersive 3D environment tools to support formal and informal discussion, in an increasingly technologic society, could lead to increased effective communication to all members of society and bring about more efficient decision-making.

There is no specific reference made to Tayplan with the exception of Dundee Waterfront being used as an example of 3D virtual environment. This technology was part of the community participation event for the V&A museum.
Summary of research undertaken
The Water Vision is based on ideas from The Netherlands which promote communication with the public on key water related issues in a local authority area. The paper outlines the development of a Water Vision for Johnstone, selected for having number water related problems. It was investigated that, for an extreme event, 50 properties would be flooded from local rivers, whereas around 1000 were at risk from local runoff from small streams or surface water drains.

The Vision endeavours to strike an appropriate balance between protecting the water environment and allowing people to use that environment. It also assists in permitting development and encouraging regeneration of the water network and regeneration of the economic prospects of the area through the planning process. It addresses vulnerability and exposure to potential hazards from flood waters and outlines various strategies, for example, for introducing biodiversity plans or expanding green corridors and watercourses in urban areas. The Vision aims to provide more sustainable and cost effective solutions that improve quality of life and offer additional benefits for the whole community. Such a document is viewed as critical in assisting not just water concerns and realistic solutions, but also social, environmental and economic issues for all stakeholders at an easily accessible but also detailed level.

The Water Vision is now one of three documents for development plans which effectively form a sustainable flood management plan (SFM) core. The development plans include the Water Vision for the relevant catchment, flood hazard reduction zoning maps and Dainage Assessment Guidelines (Renfrewshire Council 2006). In contrast to the Netherlands, the final step for this Water Vision is to consult with the public as public consultation is a vital step to providing solutions that benefit all that live and work in the area.

Key conclusions
The paper has shown the development of a ‘Water Vision’ process for an urban development in Scotland which may be applied to any urban development in the UK. It is a proactive document which identifies the risks but provides a positive vision of the future for those that work and live in the locality. The process endeavours to improve the transparency of and public engagement in decision making processes by providing information at a level that is understood by all stakeholders.

Areas/questions for future research

Potential cross-linkages to other research
Selling Sustainability in SKINT (SSIS) relating to the relationship between land use planning and the management of surface and groundwater systems by Interreg IVB North Sea Region Programme
(http://www.skintwater.eu/documents/upload/SKINT_Waterseries_SSIS_120925.pdf)
The role of map-based environmental information in supporting integration between river basin planning and spatial planning by the James Hutton Institute and University of Aberdeen
(http://www.sciencedirect.com/science/article/pii/S1462901112001141)

Relevance
This paper realise the importance of exchanging ideas between authorities, not just at home but within Europe and potentially elsewhere, and utilising working examples in practice. It also highlights the importance of reinforcing partnerships in the North Sea Region. The Water Vision for Johnstone is a prime example of transferring a working framework from elsewhere, understanding the new context and applying best solutions to address, fix and coordinate water-related issues. Due to the varying climatic instances, water visions for could support each SDP and LDP in reaching sustainable goals while engaging communities. It is also in the interests of Tayplan, according to the SDP to:

- Enhance the condition and connectivity of the networks of green spaces and watercourses within and between the region’s settlements to reduce flood risk
- Protect and enhance the quality of the TAYplan area’s built and water environments
- Policy 2A: ensure that climate change resilience is built into the natural and built environments
- Policy 6C: Anticipated effects of construction and operation on surface and ground water pollution
Summary of research undertaken
The objectives of the paper were to identify the main spatial challenges related to demographic change for the North Sea Region; to explain which challenges might be usefully subject to transnational co-operation; to set out who should participate in such co-operation (including partners outside the North Sea Region); to recommend what activities and investments should be undertaken; and to suggest how the demographics theme might be formulated in a future territorial cooperation programme.

The paper concentrates on demographic issues which affect planning matters. For instance, a reported ageing population creates changing needs in relation to accessibility and transport, housing, environmental quality, services and infrastructure. Planning policy also needs to address its potential contribution to raising fertility levels, increasing economic productivity, stabilising internal migration, attracting qualified immigrants, pressure on greenfield land as well as depopulation.

Planning policy and practice need to compensate for increasing fertility rates, an ageing population, migration and immigration through the provision of appropriate and affordable housing and relevant infrastructure. It is suggested that co-operation within the NSR can assist these issues through the exchange of experience and comparison of good and weak practice in policies that influence demographic change.

Key conclusions
Many demographic issues and trends are shared issues across the North Sea Region. Demographic trends are critical for the future social and economic development of the EU and the North Sea Region, especially low fertility rates, the ageing of population, tendencies to polarisation of growth and increasing international immigration. The implications of demographic change have led to increasing interest through studies and policy documents at the EU level.

NSR co-operation should be encouraged to build understanding of spatial development impacts of demographic trends and to share experience with other external regions with similar experiences and make full use of the flexibility to include regions outside the NSR in its projects. Whilst there is considerable potential for the sharing of experience in tackling the spatial impacts of demographic trends, there is very little support for a separate element of a future co-operation programme based on demographic change.

Areas/questions for future research
• No mention any increase or decrease in the male to female demographic (impossible to ascertain?) – planning for/with men vs planning for/with women.
• The impact of greenfield land development for immigrants to increase housing stock

Potential cross-linkages to other research
Relevance
At the national level, Scotland is part of the North Sea Region and therefore the country plays an important role in delivering positive demographic change as identified in this paper. The Tayplan SDPA alongside the other three SPDAs all should acknowledge the changing demographics of the NSR. In particular with Tayplan, the SDP aims to support an advanced, thriving and diverse economy occupying a competitive position within European and World Markets. There is no direct mention of the NSR within the SDP. This is before 2008.
Summary of research undertaken
The Scottish Climate Change Act (2009) targets an 80% cut in GHG emissions in Scotland by 2050. The Greenhouse Gas Regional Inventory Protocol (GRIP) scenario process uses a scenario tool that is manipulated solely by stakeholders to form CO2 emission orientated energy scenarios for a given area, in this case the Tayplan SDPA. The process was used to explore how the Tayplan SDPA may reduce its emissions by 2050 across four key emissions sectors: energy, industrial processes, waste and agriculture. The scenarios can evolve dynamically as participating stakeholders’ knowledge, beliefs and attitudes change.

The aim of these scenario sessions was to explore how the SDPA might achieve a reduction in CO2 emissions of at least 80%. Each scenario session achieved exactly an 80% emissions reduction and was in excess of existing emissions reductions in Scotland. The approach to how to reduce emissions varied between the scenarios.

The report suggests: a series of sector based targets for each SDPA from 2015 to and beyond 2050, follow up sessions using the GRIP tool to communicate changes to local stakeholders, recognising climate modelling uncertainty in adaptation plans, trained individuals and planning application decisions take account of the long term total emission impacts.

Key conclusions
The GRIP scenario process was previously applied in an RTPI award-winning project with the Glasgow and the Clyde Valley SDPA and has also been applied in 12 European countries. This emphasises the positive effect GRIP has had. What this analysis highlights is that, whilst Scotland has indeed reduced its emissions under this established methodology, it is not clear whether the reductions are due to adopting reduction policies or through economic and industrial change. Each sector would contribute differing amounts to the overall emissions reduction however some sectors emissions are potentially harder to mitigate than others.

SDPAs may need to work together to ensure cohesion in policy and look towards specifications that go beyond what is a legal requirement today. These decisions and others will then help to mitigate emissions in the short, medium and long term. The need to consider what climatic impacts, and potential areas of risk, may be associated with a world that may be two, three or four degrees Celsius or more warmer in the future is also key to planning.

Areas/questions for future research

Potential cross-linkages to other research
The macroeconomic benefits of investment in offshore wind by CEBR (http://www.mainstreamrp.com/content/reports/benefits-of-offshore-wind.pdf)
Relevance
GRIP has already had positive effects elsewhere and there is a strong opportunity for Tayplan to use GRIP in order to contribute to reach Scotland’s Climate Change Act (2009) targets of 42% by 2020 and 80% by 2050. It is also in the interests of Tayplan, according to the SDP, with:

- The Plan will be instrumental in driving up standards for resource consumption in development to contribute to meeting Scottish Government targets to reduce greenhouse gas emissions, energy consumption and waste
- Policy 2E: ensure that high resource efficiency is incorporated within development through the orientation and design of buildings, the choice of materials and the use of low and zero carbon energy generating technologies to reduce carbon emissions and energy consumption to meet the Scottish Government’s standards
- Policy 6: Anticipated effects of construction and operation on emissions
Title: Planning our electric future: a White Paper for secure, affordable and low-carbon electricity

Author(s): UK Government
Institution (agency or university):
Date of publication: 2011

Summary of research undertaken
This White Paper sets out the Government’s commitment to transform the UK’s electricity system to ensure that our future electricity supply is secure, low-carbon and affordable. The package of outlined reforms will mean that by 2030 we will have: a flexible, smart and responsive electricity system, powered by a diverse and secure range of low-carbon sources of electricity, with a full part played by demand management, storage and interconnection; competition between low-carbon technologies that will help to keep costs down; a network that will be able to meet the increasing demand that will result from the electrification of our transport and heating systems; and a transition made at the least cost to the consumer.

At the heart of the strategy is a framework that broadly consists of: long-term contracts for both low-carbon energy and capacity in the form of Feed-in Tariffs with Contracts for Difference (FiT CfD), providing clear, stable and predictable revenue streams for investors in low-carbon electricity generation; institutional arrangements to support this contracting approach which are best placed to take on this delivery role, including appropriate levels of accountability, independence, credit-worthiness, skills and value for money; supporting the principle of no retrospective change to low-carbon policy incentives, within a clear and rational planning cycle; and ensuring a liquid market that allows existing energy companies and new entrants to compete on fair terms.

To decarbonise electricity generation, the introduction of a Carbon Price Floor (CPF) and an Emissions Performance Standard (EPS) is envisaged. The introduction of the ‘Green Deal’ will enable homes and businesses to improve energy efficiency with no upfront cost. This will be complemented by a programme where every home in Great Britain has smart electricity and gas meters, with businesses and public sector users have energy metering suited to their needs. The first of these assessments will be in 2016 and will also consider whether the new contract structure for low carbon is delivering all the benefits, especially for consumers, and improvements over the existing Renewables Obligation and to consider any amendments to the future approach that may be required.

Key conclusions
The measures outlined in this White Paper to contract for low-carbon electricity generation will have the effect of making our electricity supply more secure by encouraging a diverse range of new generation capacity and reducing reliance on energy imports. New capacity will include renewables, CCS (carbon capture and storage) on gas and coal and new nuclear stations. The White Paper commits to: encouraging investment in proven low-carbon generation technologies, but also allow new technologies such as CCS to get off the ground and allow them to become cost-effective and compete without support; boosting competition within the market for independent generators and new investors and the ability of new entrants to come to the market; lead to competition within and between different low-carbon generation technologies; introduce an appropriate policy framework in the electricity sector; and aims to be at least cost to the consumer. It is aimed that the
measures will provide a more efficient and stable framework for investors, ensuring that the cost of capital required for new low-carbon generation capacity is lower and thus potentially saving £2.5 billion over the period to 2030.

Together, outlined policies will ensure secure low-carbon energy supplies, at least cost, and help delivery to become the greenest government ever. These need to be implemented effectively and efficiently. Therefore there needs to be a smooth transition from existing policies, working closely and collaboratively with the Devolved Administrations to develop and deliver a coherent and seamless package of reform measures in each part of the UK, and ensuring that reforms are consistent with EU law. The legislation will reach the statute book by spring 2013 so that the first low-carbon projects can be supported under its provisions in 2014.

Areas/questions for future research

Potential cross-linkages to other research

Relevance
The White Paper serves as an advisory document. There is no direct relevance to the SDP. Notwithstanding, targets set within the White Paper and measures to achieve a low carbon to zero carbon society should not be disregarded.
Title: Towards a zero carbon vision for UK transport

Author(s): Whitelegg, J., Haq, G., Cambridge, H. and Vallack, H.
Institution (agency or university): Stockholm Environment Institute
Date of publication: 2010
Availability (URL or publisher):

Summary of research undertaken
The aim of this study is to quantify and assess the contributions that different CO2 emission reduction measures can make in assisting the UK to move towards a zero carbon transport sector by 2050. Existing published reports, academic papers and official statistical data have been used to estimate CO2 emissions from the transport sector in 2050 according to two scenarios: a business-as-usual (BAU) scenario and a Maximum Impact (MI) Scenario in which all feasible interventions for achieving a ‘near zero carbon’ UK transport sector are applied. The MI Scenario represents a radically different Britain by 2050, where the UK transport sector emits close to zero CO2. A wide range of measures known to reduce CO2 emissions from transport were examined to see the extent to which these measures can have a maximum impact on the transport sector and realise the vision of a zero carbon transport sector in the UK.

Key conclusions
The paper lists a series of measures and interventions needed to achieve the emissions targets across spatial planning (e.g. doubling urban density to reduce urban car travel and designing housing areas where people can move around and access services), fiscal matters (e.g. parking cash-out, adjusting UK spending on walking, cycling, public transport, shared space and urban design), behavioural change (e.g. attractive deals for bus and rail fares, workplace and education travel plans) and technology (e.g. electrified lines, vehicle conversion to PEV (Plug-in Electric Vehicle) or hydrogen fuel cell).

The report provides a table outlining a policy implementation framework of most of the spatial, fiscal and behavioural measures to move towards a zero carbon transport systems in the UK. Implementation of the MI Scenario outlined measures could deliver a 76 per cent CO2 reduction compared with the 2050 BAU Scenario (or a 68 per cent reduction on the BAU baseline year emissions). The speed of implementation is also important to achieve targets set for 2050. Equally, providing technological solutions alone will not deliver the required reductions. It must also be emphasised that additional policy interventions would be required to produce the 100 per cent carbon neutral UK electricity power generation sector on which zero CO2 emissions for the road and rail transport sectors will totally depend.

Areas/questions for future research
- Investigation into the cost-benefit analyses of the various CO2 emissions reduction measures.
- Analysis of policy pathways leading to such a decarbonised electricity supply in the UK.

Potential cross-linkages to other research
Exploring public attitudes to climate change and travel choices by the Department of Transport
Planning our electric future: a White Paper for secure, affordable and low-carbon electricity by the UK Government

The macroeconomic benefits of investment in offshore wind by CEBR

Relevance
The report relates to Britain as a whole therefore there is no mention of Scotland or Tayplan however the emission targets and measures can relate to the Climate Change (Scotland) Act 2009 and can be applied to not just the Tayplan SDPA but all four SDPAs in Scotland. It is in the interests of Tayplan, according to the SDP to:

- Shift to a low carbon and zero waste economy by using our land and resources more efficiently
- Support the switch to a low carbon and zero waste economy by providing for appropriate infrastructure and improvements in our resilience to climate change and other potential risks
- Policy 2D: ensure that waste management solutions are incorporated into development to allow users/occupants to contribute to the aims of the Scottish Government’s Zero Waste Plan
- Policy 2E: ensure that high resource efficiency is incorporated within development through the use of low and zero carbon energy generating technologies to reduce carbon emissions and energy consumption to meet the Scottish Government’s standards
- Policy 6: To deliver a low/zero carbon future and contribute to meeting Scottish Government energy and waste targets
Summary of research undertaken
The report presents the findings from an 18 month deliberative study that has explored public attitudes to climate change and how this relates to their personal travel choices. There were three primary aims from the study: i) to provide a greater insight into public understanding of climate change and how it relates to personal travel behaviours, ii) explore the barriers and motivations for travel behaviour change, and iii) to consider the role of information in increasing public awareness and understanding of the issues.

Key conclusions
Climate change is a known fact however the understanding of both transport as a source of climate change emissions and the contribution of different transport modes was limited. The negative impacts of climate change are considered to be too distant to have concern about demonstrating a cultural shift and change in social understanding is needed. It was felt that individual contribution is outweighed by the industry sector and other countries’ emissions.

From a sense of personal responsibility, most people feel more willing and able to reduce their domestic CO2 emissions compared with those from transport use. Although it is felt that there is no social pressure to actually reduce carbon consumption from travel choices. Many people felt more able to make adjustments to their trip patterns (e.g. by trip chaining, shopping locally), or driving behaviours (e.g. ‘smarter driving’, keeping tyres at correct pressure) than changing the mode of transport they use – which are not significant enough to elicit CO2 savings.

Encouraging more significant travel behaviour change will require greater consideration of identified barriers as they relate to individual journey types. These observed barriers include attitudinal and emotional barriers (e.g. habit), information barriers, lifestyle barriers, and practical issues (e.g. whether transporting items/children). Behaviour change activities have a range of benefits to individuals including financial, time, health and environmental and are perceived by participants as easy to incorporate within existing lifestyles.

Provision of information was shown to increase understanding and engagement and did increase levels of reported concern. Opportunity to deliberate with this information also increased feelings of personal responsibility and ability to act; both were identified as linked with intentions to change behaviour. Information provision, engaging all members of society, is clearly a necessary and potentially effective step in increasing public engagement.

Areas/questions for future research
Investigation into travel to work areas within the SDPA and the impacts these have on our climate?
Potential cross-linkages to other research
Towards a zero carbon vision for UK transport by the Stockholm Environment Institute

Relevance
A significant percentage of workers travel to work to other towns and cities within the Tayplan area. It is therefore vitally important that, with an increasing demand on resources and social desires to own and drive a vehicle, to work or otherwise, presents an increasing impact on our environment. By studying past and current travel to work areas and the volume of traffic between towns and cities, this can help Tayplan identify key areas for improvement. Particularly, it is in the interests of Tayplan, according to the SDP to:

- Reduce the need to travel and support a shift from car and road-based freight transport in favour of more sustainable modes and travel behaviour.
- Promote transport linkages, infrastructure improvements and network improvements; and, support the delivery of infrastructure that promotes a shift towards non-car travel and transporting freight by rail and sea.
- Reduce resource consumption and reduce the need to travel by car
- Policy 2C: ensure the integration of transport and land use to reduce the need to travel and improve accessibility by foot, cycle and public transport; and, support land use and transport development by transport assessments/appraisals and travel plans where appropriate
Summary of research undertaken
The overall aim of SKINT has been to provide professionals and decision makers with procedures and tools to demonstrate the need for, and benefits of, adopting more sustainable solutions to a wider public. The paper makes reference to the Green City index which defines a number of criteria that helps to contextualise how green and sustainable a city will be. These include: governance; holistic approach; the importance of wealth; civic engagement; technology; a green and brown agenda; and dealing with informal settlements. This report considers the approach within the context of selling sustainability in SKINT (SSIS) and proposes a method for this by facilitating the demonstration of the multi-value benefits of flood and water management techniques, coupled with urban land use planning and urban design, expressed in monetary terms.

A matrix of benefits have been adapted for SSIS and developed jointly with the CNT (Centre for Neighbourhood Technology) and GINW (Green Infrastructure North West) beneficiaries is categorised in terms of: Protection of air/water/planet; Flexibility and adaptability to climate change; Contribution to local/global economy; Life cycle costs; Affordability; Risks; Public/professional engagement; Amenity provision; Acceptability; Media influence; Attention to cultural heritage; Energy use. The matrix may be used to support communication, conversations, discourse and for illustrative purposes and also to develop detailed analyses of benefit value in monetary terms. The matrix also identifies whether or not a more detailed physical, chemical, biological, social and environmental analysis is possible and dependant on data availability. A tick-based evaluation finalises whether or not financial or economic assessments are likely to be possible. Case studies from the UK and Europe are presented to visualise the matrix results through colour coding (Red for low benefit, Blue for medium benefit and Green for high benefit).

Key conclusions
There are clear differences in interpretation as to what the criteria mean and how they should be considered in the evaluation process. By illustrating the matrix this cannot be used as a stand-alone tool to inform stakeholders. Nevertheless, the matrix has proven useful in ensuring that each potential benefit is considered during option selection.

The framing and visions surrounding the sustainability discourse are perhaps the most useful aspects of the concept, as they allow partnerships, stakeholders and those participating in decision processes to set their values and points of view in a “vision” that is both shared and separate. The way in which the matrix presented here has been variously interpreted and used to retrospectively analyse the case studies demonstrates that even a collectively agreed-upon list of criteria can be understood in different ways by different users in different contexts. The idea of presenting the benefits of options to decision-makers, ideally monetised, offers the best possibility to get options adopted that are as sustainable as possible.

Areas/questions for future research
Potential cross-linkages to other research
The role of map-based environmental information in supporting integration between river basin planning and spatial planning, with particular interest in the use of map-based tools, by the University of Aberdeen and the James Hutton Institute (http://www.sciencedirect.com/science/article/pii/S1462901112001141

Relevance
General practice can be learnt from this paper. The practical use of matrices to visually represent a bunch of selected criteria has proven to be successful through case studies and such practice can be applied to the Tayplan SDPA. There is no specific reference to SDPAs however one of the case studies was based in Scotland (Drainage Improvement to Facilitate Expansion of Eastern Dunfermline).
Summary of research undertaken.
The objective of SEWeb project is to develop a website to bring together information on Scotland's environment in one place so that environmental data and reports from known and trusted sources can be accessed and looked at in combination. Ultimately, the site will provide straightforward descriptions of the state of Scotland's environment and key messages that highlight our progress in protecting it. The Web site is also intended to induce behavior change.

Abertay have been commissioned as part of the SEWeb development processes. This research project will create a vision of the possible future development of the SEWeb web presence, incorporating the SEWeb LIFE objectives and committed actions. The project will produce a number of blueprints detailing how the SEWeb site and overall web presence can be expanded and enhanced through the use of novel web and mobile technologies to efficiently confer the information on Scotland's environment and to attract and retain a wider range of users. This will be achieved via a two step process, requirements analysis which will determine stakeholders, project members and target user requirements, and solution design, which will define blueprints for possible future development.

Key conclusions.
To be provided to SEPA February 2013.

Areas/questions for future research.
Best way to communicate TAYplan issues and to source supporting data for planning

Potential cross-linkages to other research
Cross cutting research links to the dissemination of research and Tayplan output.

Relevance
Education including how delivery of education may change, Lifestyles including reducing environmental footprint
Title: AGILE Interface for 'No-Learning nor Experience required' Interaction

Author(s) Martinez, S. Carrillo, A.L., Scott-Brown, K. and Falgueras, J.
Institution (agency or university): University of Abertay Dundee.
Date of publication: Forthcoming 2013.
Availability (URL or Publisher): No

Summary of research undertaken:
The wide variety of novel technological devices, such as tablets and phone applications, is a
barrier to their satisfactory usage. Different types of interface element distribution and
dissimilarities of their functionalities, even in the same category of products under the same
brand, can steepen the learning curve to effective device operation. Based on an inclusive
paradigm, this research aims to improve the usability, accessibility and satisfiability of the
interface for a specific group of users, such as novice elderly, to benefit all types of users in
their daily lives. HCI user models have not traditionally considered the user with specific
requirements in the same classification where able-bodied users were commonly described.
Whether these users are described, they belong to differentiated and separated set. While it
is true that they do not share the same characteristics of able-bodied users, usage may
coincide in terms of goals. From an Inclusive Design perspective, we accept that all users
have needs. The issue is to find those needs that can be covered and solved by the design of
an effective interface. We argue that a true usability and accessibility approach for a specific
subset of users is thus transferable to all users. The improvement can be appreciated by
target users but also for those outside the scope originally considered (i.e., able-bodied with
no experience nor time to learn, cognitive mild impairments, etc).

Key conclusions:
A new interaction style has been described, ideally conceived for users with no IT experience
nor time to learn, the AGILE interaction style focused to adapt to the idiosyncrasy of a non-
archetypical user, in this case the novice elderly user.
Assistance has been implemented in a virtual agent, in charge of guiding the user in the
current goal achievement, and in lecturing how to perform operations on the interface by
simple and effective animations.
The most valuable features of AGILE are: the simplicity and clarity, guidance and error-
minimized that the AGILE interface presented during the whole interaction process.

Areas/questions for future research:
To assess how technological support to non-experienced users can help facilitate lifestyle
changes in the future, in particular to support aging and less-able members of our
communities.

Potential cross-linkages to other research: Links to transition concepts that are required
to introduce technological change in the TAYplan region and links to the need to support and
communicate with a range of stakeholders.

Relevance
Lifestyles including reducing environmental footprint
Summary of research undertaken
This paper reports on what was then the only study in the UK where actual costs of constructing and maintaining SUDS have been compared to an equivalent traditional drainage solution. Capital and maintenance costs of underground storage chambers of analogous storage volumes were estimated. A whole life costing methodology was then applied to data gathered. The cost analysis is supportive of SUDS and indicates that well designed and maintained SUDS are more cost effective to construct, and cost less to maintain than traditional drainage solutions which are unable to meet the environmental requirements of current legislation.

Key conclusions
The cost analysis is supportive of SUDS and indicates that well designed and maintained SUDS are more cost effective to construct, and cost less to maintain than traditional drainage solutions which are unable to meet the environmental requirements of current legislation.

Areas/questions for future research
The work is quite conclusive and policy in Scotland requires the use of SUDS systems. There may be more research required into the impact of this requirement on the viability of new developments, particularly in the light of the robustness of design guides in the changing climatic conditions. 
There is a need to explore Carbon costing of SUDS systems in more detail.

Potential cross-linkages to other research: Role of SUDS in pollution reduction and amenity creation (Place).

Relevance
This work links to several change drivers including sustainable development, infrastructure and its climate resilience, risk of river and coastal flooding
110. **Title:** Making Asset Investment Decisions for Wastewater Systems that include Sustainability.

**Author(s):** Ashley R, Blackwood D, Butler D, Jowitt P, Davies J, Smith H, Gilmour D, and Oltean-Dumbrava C.

**Institution (agency or university):** Universities: Abertay Dundee, Imperial College London, Heriot Watt, Coventry, Sheffield.

**Date of publication:** 2008

**Availability (URL or Publisher):** [http://ascelibrary.org/doi/abs/10.1061/%28ASCE%290733-9372%282008%29134%3A3%28200%29?journalCode=joeedu](http://ascelibrary.org/doi/abs/10.1061/%28ASCE%290733-9372%282008%29134%3A3%28200%29?journalCode=joeedu)

**Summary of research undertaken:**
This paper considers two main case studies used in the development of the asset management decision support system: sustainable water industry asset resource decisions – SWARD- and, in particular, the way in which sustainability has been included in the decisions regarding investments using a multi-criteria approach based on environmental, social, technical, and economic supporting indicators. The work involved exploring the difficulties that the water service providers’ were facing when making asset investment decisions, particularly the way in which sustainability considerations were included in these processes. The primary objective of the project was to provide a means whereby water service providers could include the principles of sustainability within the decision-making processes in an effective and transparent manner, and which could fit with contemporary decision-making processes. The multidisciplinary SWARD team comprised researchers from five United Kingdom universities, with collaborators from the Scottish Water, English water companies, and water professionals from Romania and Australia.

**Key conclusions**
The research has:

- shown that the selection of options is still generally too prescriptive, and current governance, institutional, legislative, regulatory, risk, technological, and economic paradigms tend to constrain most water service providers into adopting well-tried and tested technologies. The problems are compounded by a very variable commitment to the inclusion of sustainability issues in water service provision across organizations and internal staff turnover
- presented a set of criteria that will ensure that the main elements of sustainability are included in water asset related decision making
- shown that it is possible to incorporate social criteria more fully in the decision making process and to involve the perceptions of a wide range of stakeholders in sustainability assessment

**Areas/questions for future research**
The applicability of this to other areas particularly the approach of monitoring sustainability in a way that can incorporate social criteria and engage decision makers.

**Potential cross-linkages to other research**
Links to more recent research on the application of these process to the built environment and to the communication of the complex issues through visualisation.

**Relevance**
Cross Cutting: Monitoring the plan and stakeholder engagement. Water resources.
Title: Implications of land use and climate change for the water balance in Scotland

Author(s) Iain Brown, Sarah Dunn, Laura Poggio, Marie Castellazzi, Alessandro Gimona, James Sample, Willie Towers

Institution (agency or university): The James Hutton Institute, Aberdeen, Scotland. UK

Date of publication: 2012

Availability (URL or Publisher): No URL From: IWA World Congress on Water Climate and Energy

Summary of research undertaken:
Scotland is generally considered to have abundant water resources. In reality, resources are rather unevenly distributed and when considered against patterns of water use, the picture is more complex. In addition, climate change will act to modify both the supply and demand for water. Future projections indicate that summers will be warmer and are most likely to be drier than present. The objective of this study was to use future climate projections and scenarios of land use change to (i) assess the national water balance, (ii) highlight ‘hotspot’ areas, (iii) consider implications for sustainable resource management.

Key conclusions:
Scotland presently has limited inter-basin water transfers and it would take many years to establish the infrastructure to expand this network for agricultural production. The alternatives include (i) changing land use to new crops or varieties with improved drought-resistance, although this may reduce overall yields, (ii) a planned shift towards a more coordinated use of water resources amongst land managers, which would require improved co-operation and water-sharing (iii) stricter regulation and enforcement of abstraction limits to implement a precautionary approach to environmental protection.

Areas/questions for future research:
Impacts of climate change will be manifest through both direct effects on water supply but also through more complex impacts on water demand that may be compounded by other drivers of land use change (e.g. globalisation of trade). Better understanding of these interlinkages is crucial in developing sustainable adaptive management systems for water resources.

Potential cross-linkages to other research
Supports research in land use and crop change patterns and water resource management.

Relevance
Agriculture, including land availability for crop growth and future crop types, Lifestyles including reducing environmental footprint.
112. **Title:** Sustainable Coastal Management in Practice.

**Author(s)** Gilmour et al

**Institution (agency or university)** EU Interreg. Lead Beneficiary Province of North-Holland, The Netherlands with a contribution by University of Abertay Dundee

**Date of publication** Web contains a useful paper on transportation in North Sea Region. [http://northseapapers.northsearegion.eu/](http://northseapapers.northsearegion.eu/). Further publications are forthcoming

**Availability (URL or Publisher) (Main Project Website)**

**Summary of research undertaken**
This project aims to develop an innovative Integrated Coastal Zone Management (ICZM) ‘assistant’. The ICZM approach has been explored in several parts of the NSR and often the focus of these interventions has often been for public safety. Although these interventions have offered opportunities to realise the full development potential of the areas concerned, in practice a fully integrated, holistic approach has rarely been taken and this is regrettable because coastal potentials are not fully utilised.

SUSCOD brings together partners to produce, through a well coordinated transnational team approach, a practical web based tool which will allow coastal development practitioners to fully realise coastal potentials: economical, social and environmental.

**Key conclusions**
Useful overview on transportation issues, if with no clear conclusions on the report above. Other outputs to be delivered in 2013.

**Areas/questions for future research:**
Sustainability assessment i.e. the assessment of social economic and environmental and social issues.

**Potential cross-linkages to other research:**
Links to sustainability assessment work.

**Relevance**
Cross Cutting: Integration of Sustainability Assessment on ICZM, Water resources.
Investigating Factors Affecting Anaerobic Digestion of Ascophyllum Nodosum Species of Seaweed

J.C. Akunna and B. Kwiatkowska

University of Abertay Dundee.


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Summary of research undertaken:
Marine biomass such as seaweed is regarded as a potentially important source of feedstock for the production of bioenergy through anaerobic digestion. However, seaweed salinity has been reported as an impediment to effective digestion. This study investigated factors affecting anaerobic digestion of a seaweed species, *Ascophyllum nodosum*. Results showed that the effectiveness of digestion depends on feedstock salinity. The choice of appropriate system configurations and operational conditions for anaerobic digestion is strongly dictated by the characteristics of the feedstock. The aim of the present work was to determine the effects of salinity and reactor configuration on the effectiveness of seaweed anaerobic digestion. Two types of reactor configurations, single and two-stage mesophilic reactor systems were used for the study, and their performances were compared using the same operational conditions. *Ascophyllum nodosum* was used as a substrate for the study because of its availability and abundance in many regions of the world.

Key conclusions:
The results of this study have shown that the effectiveness of seaweed digestion depends on feedstock salinity. The greater the substrate salinity content the greater the process inhibition. Methanogenesis has been shown to be more sensitive to the inhibitory effects of salinity than hydrolysis and acidogenesis, hence effective acclimatisation of methanogens to salinity is the most important step towards process optimisation. Two-stage system offers greater process stability than the single-stage system. This may due to the fact that acclimatisation of methanogens to salinity can be more effective in phased systems than in single-stage systems. Since, acidogens seem to be more tolerant to salinity than methanogens, accumulation of volatile fatty acids may be a good indicator of the level of acclimatisation of methanogens to salinity.

Areas/questions for future research:
Further research is required on the viability of gas production and hence energy production from seaweed in two stage reactors.

Potential cross-linkages to other research:
Links to other studies on the use of Anaerobic digestion technologies as an energy production/waste management technology in the region.

Relevance
Availability and use of natural resources; Lifestyles including reducing environmental footprint.
Title: International Review of Behaviour Change Initiatives

Author(s): Southerton D, McMeekin A and Evans D

Institution (agency or university): University of Manchester

Date of publication: 2012.

Availability (URL or Publisher):
http://www.scotland.gov.uk/Publications/2011/02/01104638/0

Summary of research undertaken:
This study was commissioned by Scottish Government and consists of a review of international projects which involve behaviour change in relation to resource consumption with resulting impacts on carbon lifestyles. It presents a framework for analysis, drawing on the academic literature, which links behaviour change mechanisms with different contexts. Three contexts are identified: the individual context, the social context and the material context. The individual context is concerned with encouraging more sustainable lifestyles by altering peoples’ attitudes and choices. Examples include increasing the costs of activities which damage the environment, improving the provision of environmental information, and developing low carbon alternatives. The social context is concerned with altering wider social norms and customs, which may be promoted, for example via educational programmes. The material context covers objects, infrastructure and technologies in so far as they impact on how people act. It is suggested, for example that the design of goods and services can “nudge” behaviours towards desired goals.

Following a review of available reports, thirty case studies were selected and analysed in relation to different mechanisms, geographic locations and scales, sectors and forms of implementation. More detailed analysis is presented for six of these case studies, including a social marketing campaign was employed to bring about a reduction in residential water use; a community based programme which encouraged individuals to find alternatives to private car use; introduction of a law that requires residential buildings to meet certain energy and water efficiency requirements; a bicycle hire scheme; a report which set out a blueprint for a sustainable food system; and a co-operatively owned offshore wind farm.

Key conclusions
The analysis of the thirty cases found a predominance of information-based campaigns which aimed to shift individual attitudes and thereby change behaviour with less consideration given to the wider social context. Developments in infrastructure and technology were found to impact on behaviour particularly in relation to the delivery of energy, water and travel.

Three lessons were drawn from the study:
(1) Initiatives to change behaviour have more chance of success if they target multiple contexts, that is including the social and material dimensions as well as the individual, focus on the times in people’s lives when their lifestyles are changing, or are linked to moments of institutional or infrastructural transition.
(2) There is the potential to develop frameworks for coordinating action across sectors based on a coherent and shared vision.
(3) It may be possible to use “less visible” mechanisms to promote the desired behaviour change, for example by altering the provision of goods and services.

In addition, four other conclusions were highlighted: the need for robust evaluation methods so that the costs and outcomes of initiatives can be identified; recognition that
behaviour change initiatives may be context specific presenting challenges for policy transfer; the importance of institutional leadership to outcomes; and the fact that more radical approaches may be needed if governments are to meet their GHG targets.

Areas/questions for future research
The report acknowledges that data on behaviour change is currently poor and this suggests a need for more comprehensive and rigorous research and evaluation of behaviour change initiatives.

Potential cross-linkages to other research

Relevance
This report highlights the interconnected nature of behaviour change including the importance of linking action on infrastructure and technology (such as investing in improved public transport) to approaches focused on shifting individual attitudes (better travel information).
Title: Mitigating Transport’s Climate Change Impact in Scotland: Assessment of Policy Options

Author(s): Atkins, University of Aberdeen

Institution (agency or university):

Date of publication: 2009

Availability (URL or Publisher):
http://www.scotland.gov.uk/Publications/2009/08/26141950/0

Summary of research undertaken:
This research is concerned with ways in which emissions from transport can be reduced in order to meet Scottish Government long-term emission reduction targets. The authors were asked “to identify, analyse and report on the policy options available”. The methodology involved identifying an extended range of policy options including policy ownership which were then filtered and reduced. A total of 22 options were considered grouped under 7 headings: technology; driving style; car demand management fiscal and infrastructure; can demand management smart measures; freight; land use planning; aviation. Scottish and UK transport use was identified and compared. Following an assessment of the emissions from a ‘business as usual’ scenario, the other policy options were assessed. Two more integrated scenarios were then created and assessed.

Key Conclusions
The annual abatement potential of each policy options was assessed although the results are vary depending on the assumptions made regarding factors such as the timescales and rate of implementation. The authors identified some broad patterns; it was suggested that the greatest potential to reduce emissions was by Car Demand Management Smart Measures (eg work place travel plans, individual travel marketing); Car Demand Management Fiscal and Infrastructure also has significant abatement potential although this relates more to the fiscal measures rather than infrastructure ones; options relating to public transport investment offered more limited abatement gains. The cost effectiveness of abatement options for the two broader scenarios over the next 20 years was also estimated. While the overall effects were broadly similar the contributions from different measures varied eg over time the gains from more efficient driving may decline with the growth of electric and hybrid vehicles, while the impact of land use measures may become more significant.

Areas/questions for future research

Potential cross-linkages to other research

Relevance
This report helps to demonstrate the complex nature of meeting future carbon reduction targets from transport and the potential impact of different policy choices. It is not area specific but assesses a range of options individually and in combinations. It highlights the importance of land use decisions particularly over the longer term.
Summary of research undertaken
This report builds on a number of previous policy and research reports on reducing emissions in the fields of energy, transport, rural land use and waste. It highlights the nature of future change needed in order to meet the Scottish Government’s 2050 targets, as set out in the Climate Change delivery Plan, 2009, including a largely decarbonised electricity generation sector by 2030, a decarbonised heat sector by 2050, decarbonisation of road transport by 2050 and a comprehensive approach to ensure that carbon is taken into account in rural land use decisions at both strategic and local levels.

Key conclusions
The main purpose of the report is to set out the range of measures required across sectors in order to meet government targets by 2022. The cost and benefits of different measures are also considered. In terms of the delivery of measures, these will vary by sector but common issues are identified such as the opportunities that exist to deliver multiple benefits across sectors and the risks associated with implementation.

Areas/questions for future research

Potential cross-linkages to other research

Relevance
This is a policy document rather than a research one but is clearly of relevance to Tayplan.
Agriculture and Climate Change: Evidence on Influencing Farmer Behaviours

Author(s): Hallam A, Bowden A and Kasprzyk K
Institution (agency or university): Scottish Government
Date of publication: 2012

Summary of research undertaken:
Agriculture has an important role to play in achieving reductions in GHG emissions for two reasons; firstly, agricultural activities currently contribute an estimated 20% of Scotland’s emissions and secondly, agriculture can act as a carbon sink fixing carbon in the soil. While substantial research has been undertaken on factors influencing behaviour change generally, less has been done in relation to farmers and their particular social, environmental and cultural context. The methodology in this study involved a literature review of existing evidence relating to farmer attitudes and behaviours in relation to climate change and interviews with key farming opinion formers (agricultural consultants, lobby groups, NDPBs). The report highlights 4 sets of factors from the literature which impact on farmer behaviour:
1. External factors including the extent to which change is possible linked to the farming environment, size of units, demographics
2. Economic factors such as levels of subsidy, market volatility, costs
3. Internal factors including habit, personal values. The importance of ‘moments of change’ is noted
4. Social factors such as community values, commitment, wider sector decisions

The report considers a range of issues raised in the literature, tests the findings with the key opinion formers and considers the implications for policy makers.

Key conclusions:
It is concluded that behaviour change is possible and that a variety of policy measures are needed which take account of regional and farm specific circumstances. Uptake relates to many factors including values and motivations but there are key times when uptake is likely to be greater. It is suggested that the uptake of measures can be helped in a number of ways: increasing awareness of examples of environmental stewardship; supporting early innovators; encouraging demonstrations. A balance may be needed between mandatory and voluntary approaches. Some evidence of the need for collective action for some measures eg renewables. Importance of working with those in the industry to build trust.

Areas of future research
Several references are made to further research; the need for further research of approaches and successes in changing farmer behaviours towards climate change elsewhere in the world; and the need for further work on engagement with farmers around the climate change agenda.

Potential cross-linkages to other research
International Review of Behaviour Change Initiatives

Relevance
Indirectly relevant. Changing farmer behaviour is important in responding to climate change but the key factors highlighted in this study lie beyond the scope of strategic land use planning.
Title: Impact of Workbased Initiatives on Low Carbon Behaviours

Author(s) Cox, A., Higgins, T., Gloster, R., Foley, B. and Darnton, A.
Institution (agency or university): Institute for Employment Studies and AD Research & Analysis
Date of publication: 2012
Availability (URL or Publisher): http://www.scotland.gov.uk/Resource/0039/00390309.pdf

Summary of research undertaken:
The main aims of this research were to explore the extent of activity encouraging low-carbon behaviour in workplaces; to identify which measures and programmes are successful and consider their impact; to understand why these interventions work; and to find evidence of the impact of work-based schemes on behaviour beyond the workplace. A multi-method approach was used including a literature review, interviews, and case studies.

Employers appear to find it easiest to focus on energy saving measures and recycling of waste. Fewer organisations attempt to influence travel behaviour as it is more complicated despite the more major impact on emissions. There are opportunities to increase levels of employee activity which currently fall below 50%.

Employers recognise the knock-on benefits of seeking low-carbon behaviours such as building organisational reputation, being seen as a pro-environmental brand, reducing operating costs and meeting regulatory requirements. Some examples of work-place change influencing wider behaviour was found, mainly relating to recycling and travel. The size of organisations did not affect the ability to promote low-carbon behaviour programmes.

The research identifies a number of critical success factors in starting schemes: perceptions of costs and benefits for employees; minimise initial perceptions of inconvenience; embed shared values; access to expertise. Advice to staff leading schemes includes involve staff, provide information and advice, set up green teams, and encourage behaviour to be seen as part of the job. Using formal organisational frameworks can help but there needs to be a balance between carrot and stick. Recognition that change can be promoted at key moments eg launching new products, relocation of activities etc.

Key conclusions
The authors advocate combining educational activities with policies to encourage a new organisational culture and shared values in support of low-carbon behaviour if there is to be long-term success. Energy saving and waste recycling are easy first steps and can act as catalysts for more major measures.

Areas for further research

Potential cross-linkages to other research
Other Scottish Government behaviour change work.

Relevance
Limited specific relevance
Title: Digital Participation in Scotland: A Review of the Evidence

Author(s) Myant K
Institution (agency or university): Culture Analytical Team, Scottish Government
Date of publication: 2011
Availability (URL or Publisher): http://www.scotland.gov.uk/Publications/2011/12/22155754/0

Summary of research undertaken
Digital participation is defined as “people's ability to gain access to digital technology, and understand how to use it creatively”. It is recognised that increasing levels of digital participation can have positive impacts in terms of economic growth, quality of Government’s digital strategy, work was undertaken to identify and evaluate existing data on digital participation in Scotland and to identify the main barriers that prevent digital uptake. The main sources of existing data are the Ofcom Communications Market Report, the Scottish Household Survey, Oxford Internet Survey, Labour Force Survey and the Opinions Survey. The main area where further data is needed is in relation to the extent or depth of use.

Key conclusions
Factors affecting digital use include age (younger people are more likely to use the internet); income (higher incomes are linked to increased use); educational qualifications (higher level of qualifications is linked to greater participation); working status (greater participation for those in work); disability (lower for those with a disability or long term illness); little difference in participation levels between urban and rural areas. Reasons given for not accessing the internet: lack of need or desire; lack of knowledge; cost.

Areas for future research
Need for monitoring of participation data to enable non-users to be identified. Further work needed on the reasons for low digital participation in Scotland. Qualitative research is recommended to explore possible ways of promoting digital participation.

Potential cross-linkages to other research
Clear links to a range of work around smart cities and the use of ICT.

Relevance
Relevance only in as much as it demonstrates that more needs to be done to promote the use of digital technologies in Scotland. Moving to a digital future will impact on different sectors of society differently.
Title: Trends in Economic Performance of European Regions 2000-2006

Author(s)
Institution (agency or university): ESPON 2013 Programme
Date of publication: 2010
Availability (URL or Publisher):

Summary of research undertaken:
This is the third report produced under the ESPON 2013 Programme linked to the EU 2020 agenda of achieving smart, sustainable and inclusive growth. This report gives information on the comparative status of European regions in relation to the 2020 agenda based on indicators. Data presented mainly dates for 2006.

Key conclusions:
In order to measure progress towards the EU goal of becoming the most competitive and dynamic knowledge based economy in the world, indicators have been agreed covering employment, innovation and research, economic reform, social cohesion, and the environment. The territorial patterns found include: strengthening regions in the West and North of Europe, best educated labour forces in northern EU, existing disadvantaged regions have lost ground in terms of competitiveness, capital cities have grown in influence. The economic downturn has had uneven impacts across regions. The report also tracks variations in unemployment and R and D investments. In general northern regions are out performing those in the south. A number of newer indicators are used in relation to the development of greener economic development such as tertiary education levels and renewable energy consumption and potential.

Areas for further research:

Potential cross-linkages to other research:

Relevance:
Limited specific relevance. This is a comparative high level study and the information is quite dated.
121. Title: Development of a methodology for predicting the impact of demographic change and urban development on biodiversity

Author(s) SNIFFER
Institution (agency or university) SEPA
Date of publication 2008
Availability (URL or Publisher)

Summary of research undertaken
Project aim was to develop a methodology which predicted the impact of demographic change and urban development on biodiversity. This was achieved by quantifying and linking datasets of current and future land use, and biodiversity value of key habitats and networks in an urbanised area of Scotland (City of Edinburgh and birds chosen for the biodiversity component). Analytical techniques were then developed which could assess the potential impacts of urban development on biodiversity.

Key conclusions
Using the three stage process outlined above a sound methodology was developed but it required a high level of expertise in GIS and modelling software which generally satisfied project objectives however several modifications are desirable to help refine the approach to deliver future enhanced outputs and broaden its applicability.

Areas/questions for future research
Has the model been modified to enable useability etc?

Potential cross-linkages to other research being carried out
Green networks and people / climate change adaptation studies / land use change scenarios etc

Relevance to Tayplan
Potential useful tool for Tayplan to assist in promoting green infrastructure / networks for future developments providing the skillset was available.
Title: Tactran Transport Carbon Assessment (Stage 1 Report)

Author(s) Aitkins
Institution (agency or university) Commissioned by Tactran
Date of publication 2012
Availability (URL or Publisher) http://www.tactran.gov.uk/documents/121211Item6ClimateChangeDutiesAppendixA.pdf

Summary of research undertaken
Aitkins were commissioned by Tactran to produce and analyse estimates of future surface transport CO2 emissions relating to both the Tactran and TAYplan areas. A Stage 1 Report was issued in November 2012. The estimates produced for this study built and expanded on earlier work covering the whole of Scotland undertaken for Scottish Government in 2009. Two scenarios, based on different sets of assumptions, were used as the basis for developing forecasts of transport emission levels.

The first scenario, called the “do-minimum scenario” assumed that existing measures to reduce CO2 levels, such as those designed to meet European new car emission targets, would continue to 2020 but that there no additional measures introduced beyond that date. The second scenario, called the “Committee on Climate Change (CCC) Carbon Budget Recommendations scenario”, assumed that there would be on-going measures to address climate change, in line with the recommendations of the Committee on Climate Change, including improvements in vehicle efficiency and a shift towards the use of electric vehicles. This scenario also included additional assumptions relating to changes in behaviour (smarter choices and eco driving) as well as adjustments to vehicles emissions requirements.

Key conclusions
The results for the ‘do-minimum’ scenario showed that the majority of surface transport emissions for both areas under investigation (95%) were linked to private vehicle use. While growth of CO2 emissions was forecast in the period to 2022, this growth is expected to be off-set to some extent by on-going improvements in vehicle efficiency. Beyond 2022, however, it is anticipated that the rate of emissions will then increase as traffic levels rise.

The results for the ‘CCC Carbon Budget Recommendations’ scenario, suggested a small decline in emissions (3%) in the period to 2022, and a slightly larger decline (10%) by 2032. The authors state that the main factor in this decline, compared with the do-minimum scenario, is the assumption that the efficiency of private vehicles will continue to improve throughout the period and that this will be achieved as a result of greater uptake of electric vehicles and improvements to the efficiency of commercial road vehicles. As the cost of driving by car is reduced with increasing use of electric vehicles, however, there could be a rebound effect, i.e. further increases in traffic levels.

On the basis of the analysis, the report recommends consideration of a new framework for monitoring progress on climate change mitigation for Tactran, covering the take-up of low carbon vehicles, fuel consumption, shifts in modal share, and reduction in travel need. It highlights current measures that are being taken to reduce transport sector emissions and potential additional interventions.

Areas/questions for future research
Next steps identified in the report include: monitoring existing transport measures to assess actual impact on emissions; analyse outcomes of behaviour change initiatives; research the
potential impact of policy changes, including planning policy; and review climate change risks with regard to the area’s transport system.

**Potential cross-linkages to other research being carried out**

Links to research into behaviour change (generally and in respect of travel) as well as the development of electric vehicles.

**Relevance to Tayplan**

This research was designed to inform Tactran both in relation to its own remit and its inter-relationship with TAYplan. While it is recognised in the report that land use and planning related measures have a part to play in reducing future transport emissions, such measures are only one of a number of responses to this challenge. The scale of the contribution that might be made by reducing the need travel via land use change is not explored in this report.