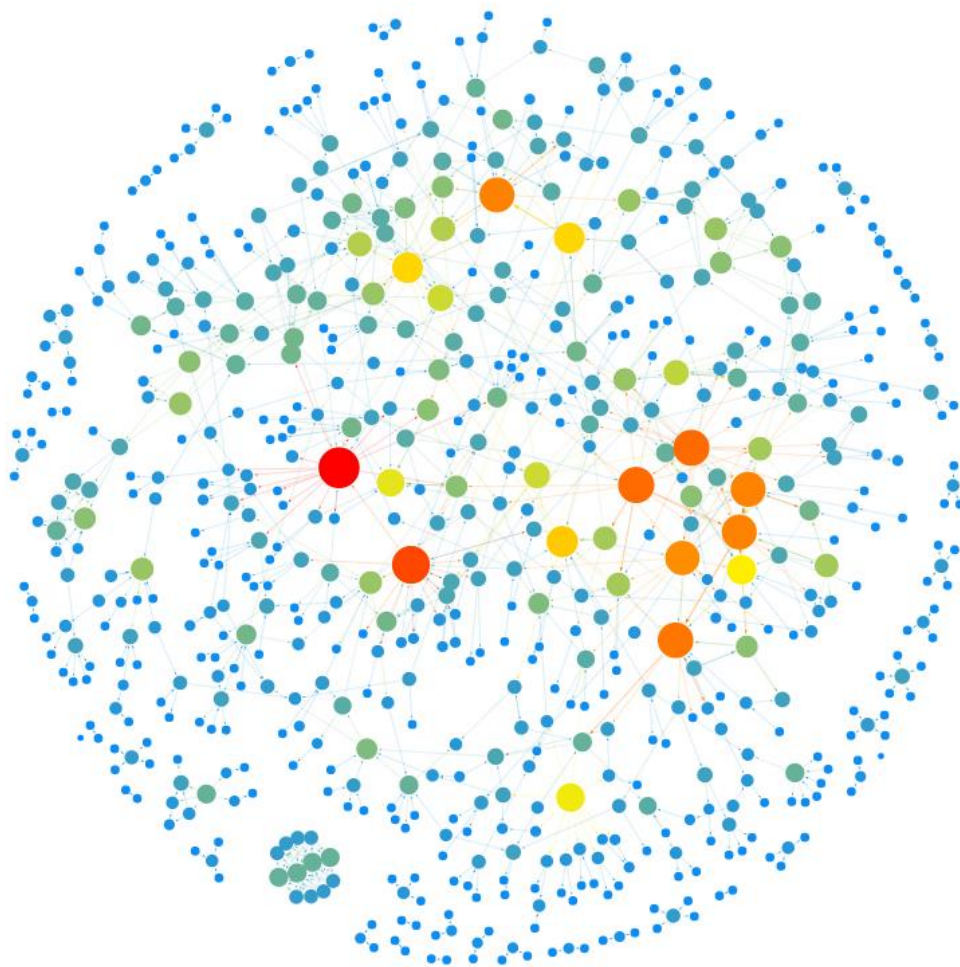




STRATEGIC EVIDENCE OF FUTURE CHANGE

Horizon Scanning evidence and analysis Second report June 2015



Robust decisions in uncertain times 

SAMI Consulting
The Rectory
1 Toomers Wharf Canal Walk
Newbury RG14 1DY



STRATEGIC EVIDENCE OF FUTURE CHANGE

Horizon Scanning evidence and analysis

Second report June 2015

<i>CONTENTS</i>	<i>Page</i>
A. Introduction	4
B. Mapping the landscape	10
C. Clusters of change	12
Greening cities	12
Future food is closer than you would think	15
Invasive species – not all bad?	20
New threats to water quality	22
Citizens are mobilising to drive action	25
D. Emerging signals	29
Energy economics: the world may be entering an era of global energy price deflation	29
Inhibiting pests via hormones can reduce insecticide use	30
Floods and flood defences – living with, rather than fighting, water	31
Environmental regulations need not harm growth	32
Radical new approaches to materials benefiting the environment	33
New ways to use waste show promise	34
New approach to marine reconstruction: ceramic “Lego” helps coral growth	36
Appendix A – Project Overview	37
Appendix B - Methodology	38



STRATEGIC EVIDENCE OF FUTURE CHANGE

Second report June 2015



Department
for Environment
Food & Rural Affairs



Environment
Agency



NATURAL
ENGLAND



Food
Standards
Agency
food.gov.uk



Llywodraeth Cymru
Welsh Government

Further information:

*If you would like further
information on this*

*project, please contact
the project manager*

***huw.williams@samico
nsulting.co.uk***

(07711 107223);

or the Defra head of

Horizon Scanning

***Konrad.Bishop@defra
.gsi.gov.uk***

Overview

This foresight briefing is the second in a series produced for Defra and its Partners intended to help to identify potential strategic threats, risks and opportunities to strategy, policy and operational goals that may need new responses.

The evidence used in this report is a collection of horizon scanning data from published sources gathered by SAMI Fellows and Principals, a team of scanners at Manchester University and trained scanners across the Defra Partnership¹ over April and May 2015. It therefore contains some material which is already known within the Defra Partnership.

The report covers five major clusters of change emerging from the data and a number of emerging signals.

Descriptions of the aims of the project and of the methodology are attached as Appendices.

An Executive Briefing document is produced separately.

The first report in March 2015 was a “scan of scans” assessing the base level of knowledge, and is available at:

<http://www.samiconsulting.co.uk/5reports.php>

Robust decisions in uncertain times



SAMI Consulting

The Rectory
1 Toomers Wharf Canal Walk
Newbury RG14 1DY

Contact: Huw Williams
huw.williams@samiconsulting.co.uk
Direct line: 07711 107223

Disclaimer:

The views expressed in this document are those of the authors, SAMI Consulting Ltd, and do not necessarily reflect those of Defra or its partners.

¹ Defra, Natural England (NE), Environment Agency (EA), Food Standards Agency (FSA), Welsh Government



A. INTRODUCTION

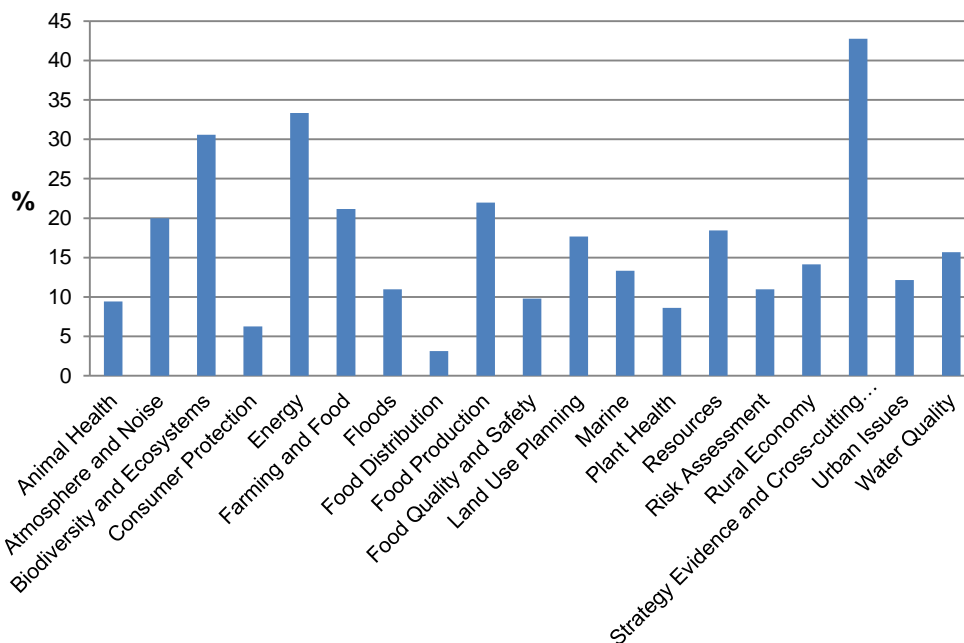
What's in the report - the evidence

This report draws on horizon scanning evidence entered into the Defra Futurescaper database by SAMI Consulting scanners and by Defra Partnership members between April 2nd and 28th May 2015. We have specifically focussed our analysis on these stories¹ as opposed to those entered for the March baseline scan, in order to highlight new clusters of change and emerging signals. The Annual Synthesis report in December will look at the stories over all the year.

In total, 255 stories were entered during this period. A wide range of sources were consulted, from the popular press and online articles to peer-reviewed papers and patent databases. The SAMI scanners in particular looked at the PESTLE² categories to ensure a wider perspective on emerging issues. Each story was coded to refer to one or more "Defra Extended Network Vulnerabilities" or "NEAPs+" categories³.

The chart below shows the % stories referencing each NEAP+ area in the cumulative data.

CUMULATIVE STORIES JUNE 2015 - % referencing each NEAP+



On average each story references 3.2 NEAPs+.

¹ "Stories" are the basic data elements stored in Futurescaper – see Appendix B for explanation

² PESTLE: Political, Economic, Societal, Technological, Legal, Environmental sources of change

³ Network Evidence Action Plans, augmented with some extra categories relating to food – see Appendix B for list.



Compared with the March scan:

- New categories of “Energy”, “Land use planning” and “Urban issues” were added by the Partnership
- “Strategic, Evidence and Cross-cutting issues” was the highest NEAP+ being referenced in over 40% of stories
- The new category “Energy” is also high (33% of stories), and “Biodiversity and Ecosystems” remains quite high (over 30%)
- “Resources” has fallen back a little.

There remain relatively few stories referring to:

- “Consumer protection”
- “Food distribution”.

We would like to acknowledge the contributions of scanners from within the Defra Partnership:

Konrad Bishop, Defra	Helen Doran, Natural England
Nick Dales, Natural England	Marie Fox, Environment Agency
Sarah Bardsley, Environment Agency	Jason Dinsdale, Environment Agency
Becky LeAnstey, Environment Agency	Rachel Gibson, Environment Agency
Patrick Miller, Food Standards Agency	

Appendix A contains a description of the project overall and Appendix B the methodology adopted.

Overview of the Methodology

Sources

The scanners analysed data from a range of sources, from peer-reviewed journals and patent applications to online blogs and articles (see Appendix B for more detail) and used a software tool called Futurescaper to store and analyse them.

Data structure

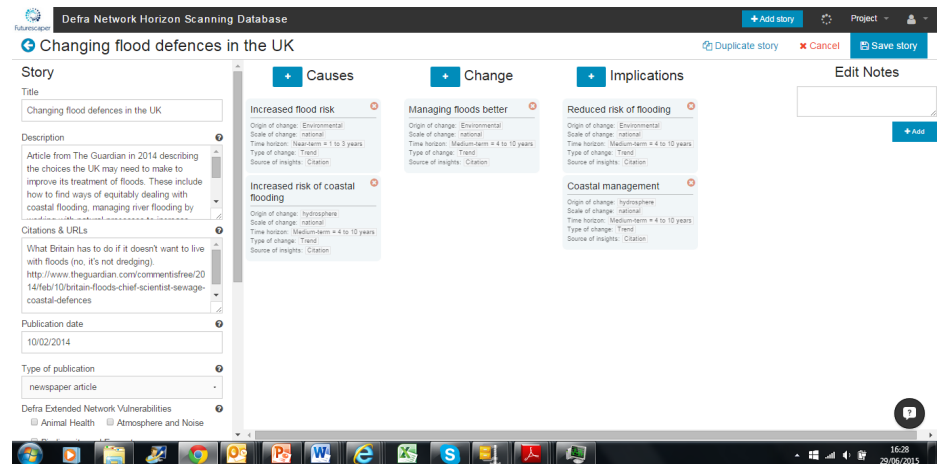
The Futurescaper tool imposes a defined structure on to the scanning which allows us to filter and search the data in a variety of ways. It has its own specific terminology. The key terms used in the report are:

- A “**story**” is an item of interest found by the scanners and stored in the database.
- Stories are structured into “**causes**” (the drivers of change), and **implications** (effects of the change); each of these elements is called a “**factor**”.



- Stories that share the same factors are interlinked. This allows us to produce **“influence maps”** showing the causal relationships between factors.
- In the influence maps, the **“nodes”** correspond to factors and the **“links”** show the cause-effect relationship between them.

Example data entry screen



Along with the content of each story, scanners record several items of “metadata”:

- the source, publication date, type of publication (eg press release, peer reviewed paper)
- The PESTLE origin of change
- an indication of time horizon and geographical scope of the story
- and Defra Extended Network Vulnerabilities or Network Evidence Action Plan areas augmented with some extra categories relating to food (“NEAPs+”)⁴.

See Appendix B for detailed methodological information.

Reading an influence map

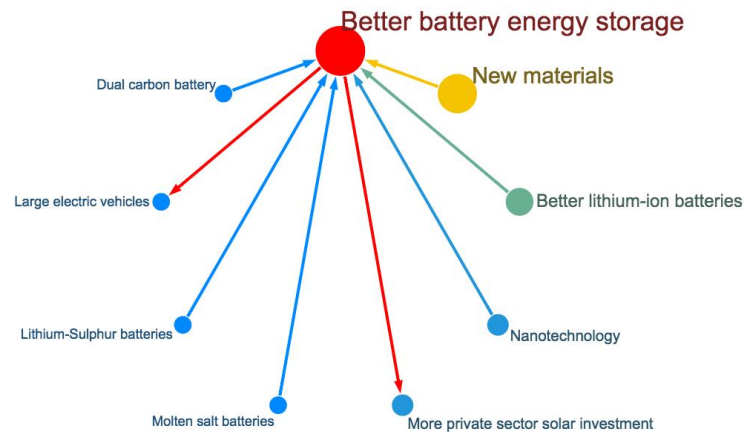
As well as acting as a store for the scanning data, Futurescaper provides a means of analysing the interactions between the different “stories”, with advanced graphics supporting the development of insights.

The linkages between “factors” in various stories form an “influence map” of the overall system. Nodes that are larger and more towards the red end of the spectrum indicate factors that occur relatively frequently in stories in the database, suggesting that they are changing more rapidly; those that are smaller and towards the blue end are relatively infrequent.

⁴ See Appendix B for full list



Example of an influence map



In this extract from the database, the factor “*Better battery energy storage*” appears in a number of stories. “*Better battery energy storage*” is an effect of several other factors: “*New materials*”, “*Nanotechnology*”, “*Dual carbon battery*”, “*Lithium-Sulphur batteries*”, and “*Molten salt batteries*” and is in turn the cause of “*More private sector solar investment*” and “*Large electric vehicles*”.

Because “*Better battery energy storage*” has more links, it appears as a large red circle to make it more prominent; “*New materials*” has the second-most links. Note that this colour/prominence assignment is dynamic. The tool allows us to select by the metadata – e.g. only short term issues – and the colour/prominence is then based on that subset of data.

Selecting the topics for this report

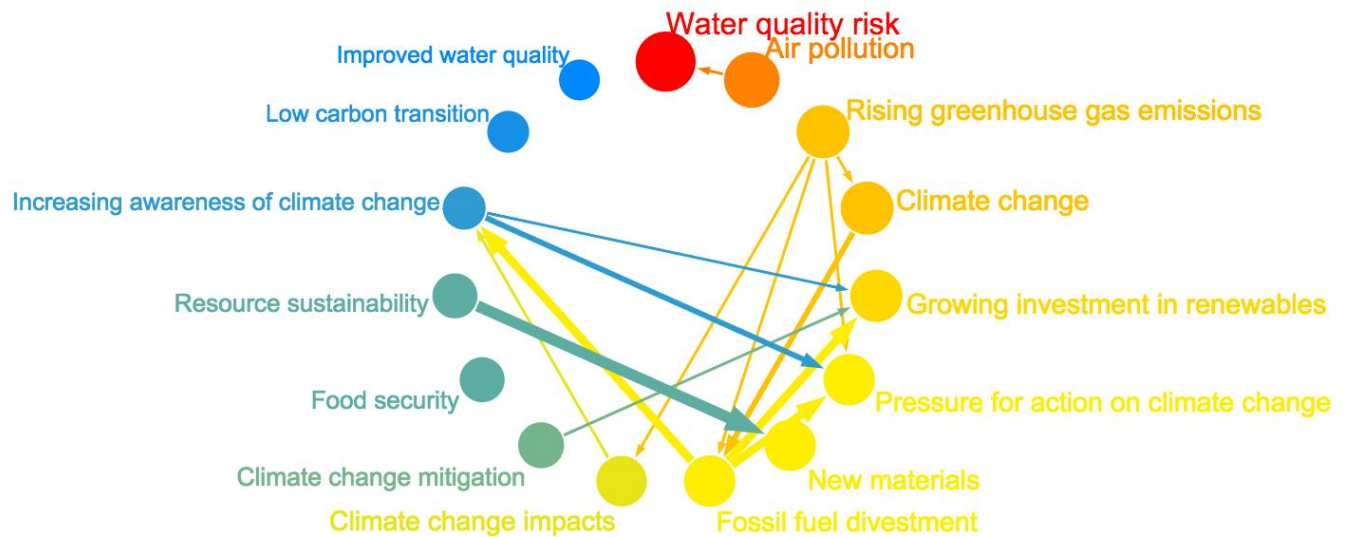
Futurescaper was used to analyse the collected scanning data. First the number of stories for each of the NEAPs+ was calculated (noting that many stories will be linked with more than one NEAP) in order to establish which areas had been reported on most (see overview on next page). From this list, the Core Group determined which of the NEAPs+ areas they wished to prioritise and be examined in detail.

For each of these NEAPs+ we produced a draft text for a long list of topics where there were notable changes over the scanning period. The Core Group then reviewed these topics and selected those to include in the final report. Topics were characterised as either “Clusters of change”, where there were several important stories, or “Emerging Signals” where particularly new and interesting stories were identified.

In the next report in September we intend to look more at the NEAPs+ not covered this time.






Overview – influence map of top 15 factors



Looking overall at the top 15 “factors” in the whole data, we see that there are a number on climate change. These reflect different aspects of the issue as captured in various stories and not an attempt to provide a comprehensive exploration of it.



Structure of the report

Scale of analysis	Selection Criteria	Report section
<p>Large Scale</p>  <p>Mapping the landscape</p>	<p>Change factors that generate the highest number of onward implications; and those changes that have been affected by the greatest number of drivers.</p> <p>The change factors for the April/May data are compared with those in the March report, based on the original “scan of scans”.</p>	<p>Section B: p10</p> <p>Top 15 causes: the big external drivers of change</p> <p>Top 15 effects: the greatest effects.</p>
<p>Medium scale</p>  <p>Clusters of change</p>	<p>Those areas which both have a larger number of stories in the database, and which were regarded by the Core Group as having potentially significant implications.</p>	<p>Section C: p12</p> <p>Greening cities Future food Invasive species Threats to water quality Citizen mobilisation</p>
<p>Individual topics</p>  <p>Emerging signals</p>	<p>Changes that were seen to be of particular interest or importance.</p> <p>We were looking for emerging changes whose impact would be felt soon enough for urgency, but far enough out to offer the option of policy response.</p>	<p>Section D: p28</p> <p>Energy economics Inhibiting pests Floods and flood defences Environmental regulations New materials Waste Marine re-construction</p>



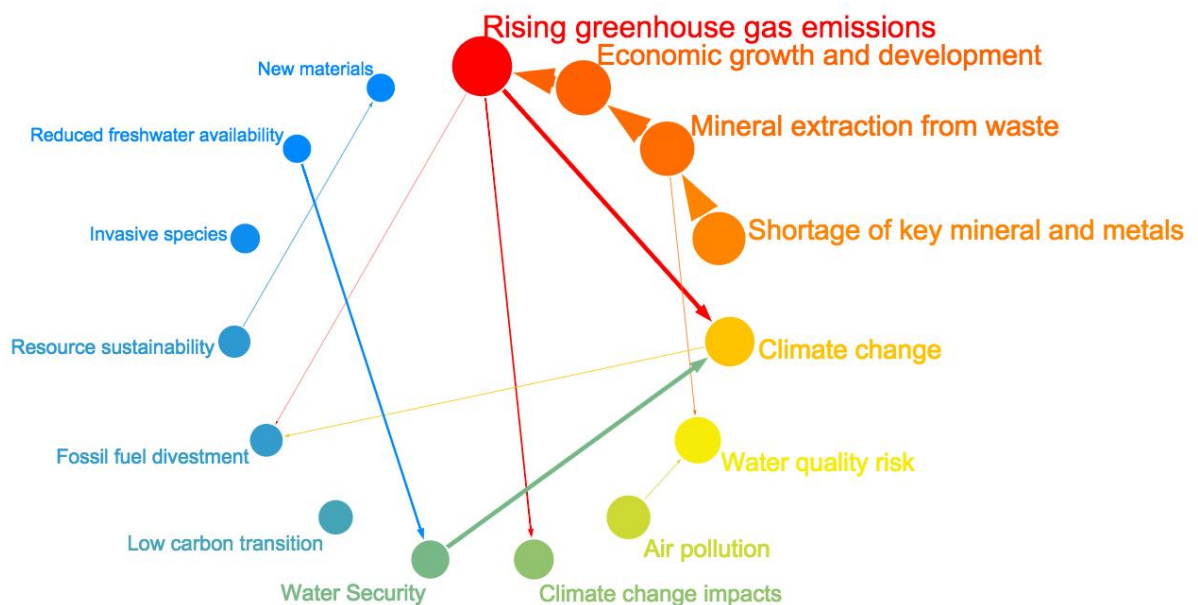


B. MAPPING THE LANDSCAPE

As in our first scanning report, we first identified the “top causes” and “top effects” within the Futurescaper database: i.e. the factors that generate the highest number of onward implications; and those that have been affected by the greatest number of drivers. These factors show, over the scan period, the biggest external drivers of change, and where the greatest impacts could be felt.

Top 15 causes

The April/May 2015 analysis identified the top causes as:



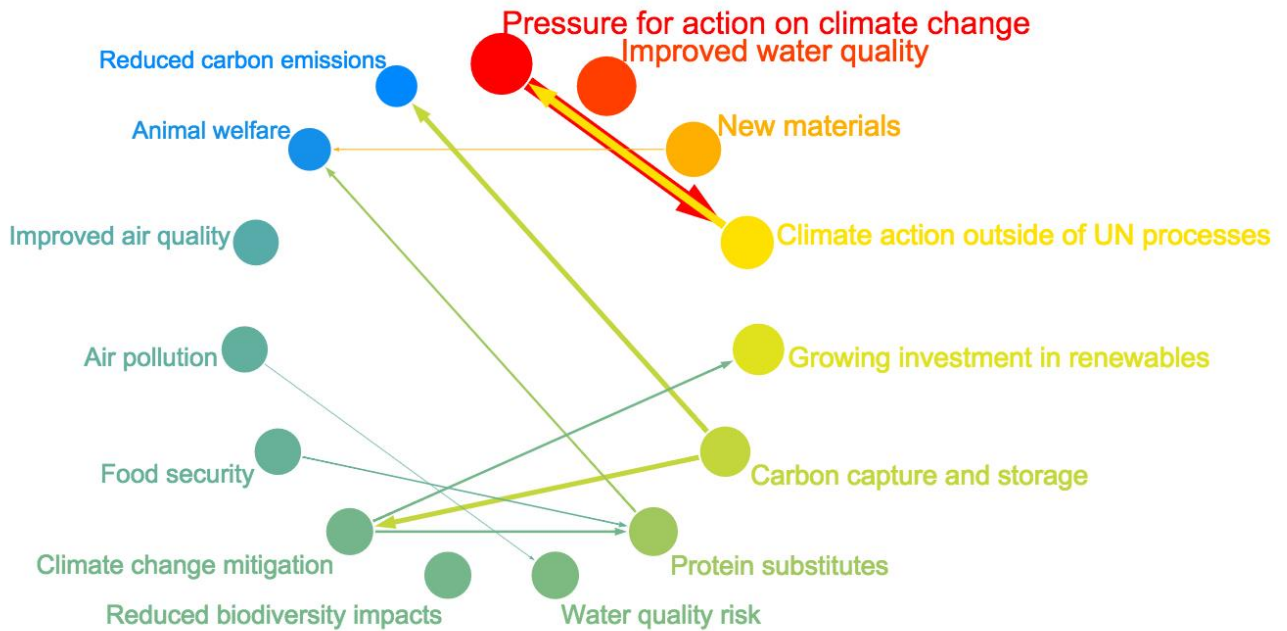
The factors relating to minerals show up strongly as in the data they are more strongly interconnected than many other factors, even though the number of stories related to the topic may not be that large.

Big Data and nano-technology were prominent in the March “scan of scans” analysis, but have not continued to feature as strongly in the more recent data.



Top 15 effects

The April/May 2015 analysis identified the top effects as:



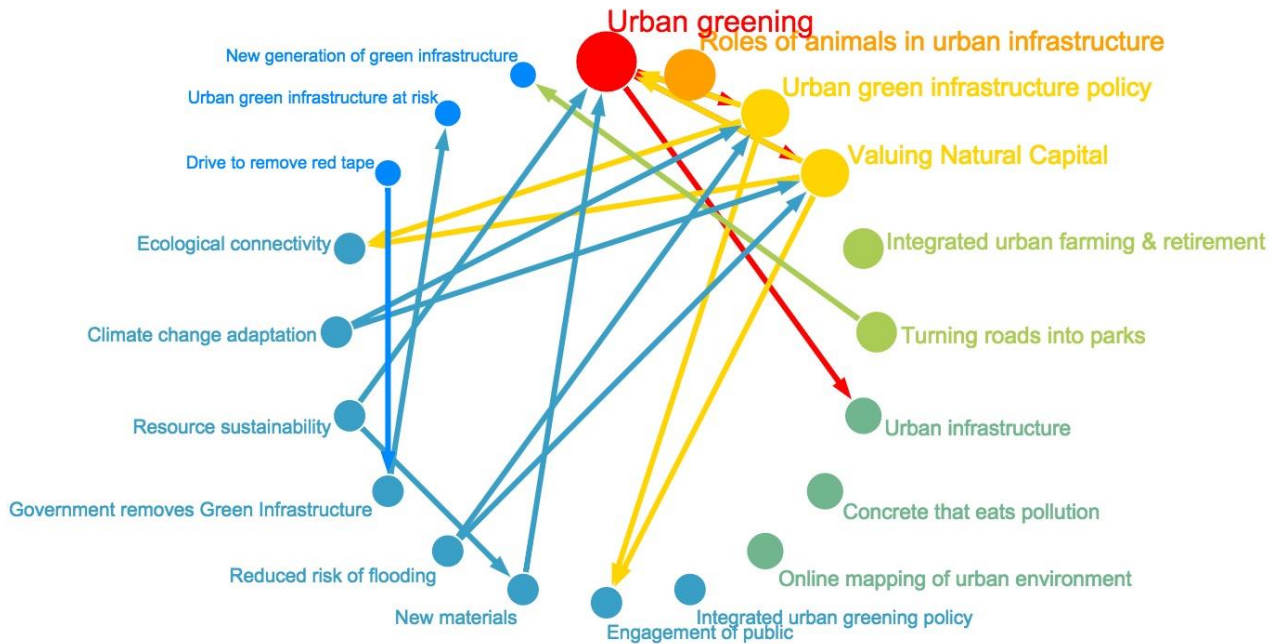
Pressure for action on climate change has become more of an issue, while water quality concerns remain high. Food security and Big Data were major effects in March but feature less strongly in the April/May data.





C. CLUSTERS OF CHANGE

Greening cities



NEAPs+ affected:

- Animal health
- Atmosphere and noise
- Biodiversity and ecosystems
- Floods
- Land use planning
- Resources
- Urban issues
- Water quality

A variety of green infrastructure projects are helping urban areas adapt to future change (including climate change)

Alongside increasing urbanisation there is growing support for ways to embed ecosystem services into our cities to improve their resilience to change. For example, many cities are now using trees, soils and other planting to manage urban water and to improve sustainability of water resources (1).

This scaling up of green infrastructure appears to be an increasing trend globally although there are some counter trends such as the loss of traditional “green” front gardens in Britain and concerns following the removal of the Green Infrastructure Guidance from the National Planning Practice Guidance (NPPG) (2, 3).

Recently a range of projects have been referenced that support this “greening”:

- Hamburg is turning stretches of its Autobahn into a park and is planning to make a large part of the city car-free by 2034. It is building up a "green network" of walkways and cycleways across the city, which should eventually cover 40 per cent of the city (4).



- A vertical urban farm design in Singapore looks to engage active seniors by combining solutions for ageing and health, with urban food production, revitalisation of local economies, and greening of the urban environment (5).
- Birmingham's Green Living Spaces Plan will create access to an impressive network of rivers and streams, making it the basis for a citywide grid of trails and pathways. The city aims to become the first "natural capital city," and is working on a "natural capital metric" to be used to evaluate future development projects (6).
- The winner in an ideas contest run by eVolo Magazine was a high-rise skyscraper containing 11 landscape types which would allow people to experience a range of different natural environments (7).
- The winning scheme in the Wolfson competition which argued for the extension of existing market towns in line with garden city principles has led to new ideas for sustainable communities (8)
- The ability to map online every tree in a large city which may help understand the interplay between different tree species; e.g. New York's 592,000 trees have now been mapped down to the detail of trunk size (9).

Whilst these stories relate more to planning, there is also interest in other ways of making our cities greener and more sustainable:

- The "photocatalytic concrete" that will be used on the Sarajevo Bridge in Barcelona will break down pollutants into neutral substances (10).
- Spanish researchers are developing a new type of concrete that captures rainwater to create living walls of moss and fungi. Unlike existing vertical garden systems, which require complex supporting structures, the new "biological concrete" supports the growth of organisms on its own surface (11).
- UK researchers have found that "urban soils" formed from the demolition of concrete buildings can sequester large amounts of atmospheric carbon dioxide (12).
- Some animals are already used to support urban infrastructure (for example pigs in Egypt to eat waste, and falcons in cities to catch pigeons). Future ideas include genetically modifying animals or insects for specific purposes, for example: insects to recover specific materials from waste; attaching surveillance equipment to birds of prey; insects for deployment in emergency situations, or for environmental monitoring (13).



Questions to consider:

- How can the Defra Partnership promote a green infrastructure led design approach for urban environments that promotes nature as a key driver (14), especially as more power is devolved to cities?
- What further support can the Defra Partnership offer for making our cities greener and more sustainable?
- How might urban species impact on waste disposal and habitat management and what are the possible implications for the environment? How might specific species help solve local urban environmental problems?
- Uptake of novel materials (e.g. “green” concrete) – how might this perform in the UK climate? How can these be tested and experimented with in UK cities? What might the blockers be? Would there be an impact on waste legislation?

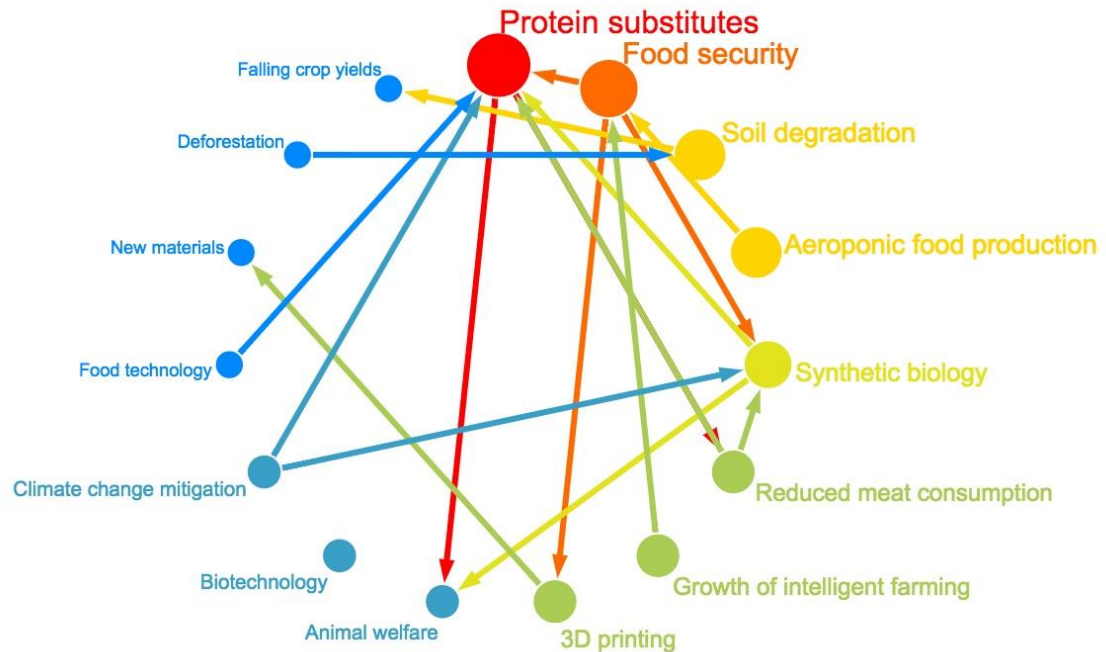
References

- (1) Is green infrastructure the new normal?
thoughts.arup.com/post/details/437/is-green-infra-structure-the-new-normal
- (2) The Decline of the British Front Garden. bbc.co.uk/news/magazine-32780242
- (3) Government removes Green Infrastructure guidance.
theplanner.co.uk/news/government-removes-green-infra-structure-guidance
- (4) So Hamburg is turning its Autobahn into a park. citymetric.com/transport/so-hamburg-turning-its-autobahn-park-653 and Can a city really go car free
www.bbc.com/future/story/20140204-can-a-city-really-go-car-free
- (5) Integrated vertical urban farm. seedstock.com/2015/04/05/singapore-urban-farm-design-looks-to-engage-active-seniors
- (6) Green Living Spaces Plan in Birmingham.
birmingham.gov.uk/greenlivingspaces biophiliccities.org/what-are-biophilic-cities/birmingham
- (7) Conceptual high rise skyscraper containing 11 landscape types.
dezeen.com/2015/04/01/conceptual-high-rise-essence-wins-evolo-skyscraper-competition-2015
- (8) Garden cities revisited. theplanner.co.uk/features/garden-cities-revisited
- (9) Atlas of New York trees. citylab.com/design/2015/04/a-gorgeous-atlas-of-new-york-tree-species/390456
- (10) Barcelona road bridge eats pollution. citymetric.com/skylines/barcelona-covering-road-bridge-concrete-eats-pollution-873
- (11) Researchers develop biological concrete. dezeen.com/2013/01/03/spanish-researchers-develop-biological-concrete-for-moss-covered-walls
- (12) “Urban soils” capture carbon.
endsreport.com/48004/urban-soils-can-rapidly-remove-carbon-from-atmosphere
pubs.acs.org/doi/abs/10.1021/es505476d
- (13) New urbanist: our infrastructure is expanding to include animals.
newscientist.com/article/dn27465-new-urbanist-our-infra-structure-is-expanding-to-include-animals.html
- (14) Cities Alive, ARUP.
http://www.arup.com/Homepage_Cities_Alive.aspx





Future food is closer than you would think



NEAPs+ affected:

- Consumer protection
- Farming and food
- Food distribution
- Food production
- Food quality & safety
- Land use planning
- Plant health
- Resources
- Rural economy

Emerging innovations in agriculture and food production are maturing and interlinking to create the commercial products and food industries of the next decade.

- Indoor farming is scaling up and moving from hydroponics to aeroponics.
- 3D printing of organic materials is getting closer to mimicking the functions and functional aesthetics of live tissue.
- “Better than beef” innovations are creating meat substitutes.

With hydroponics, plants can be grown efficiently indoors with little soil – but lots of water. Aeroponics reduces the water demands considerably by nourishing plant roots with a nutrient-rich water mist. A 21,031 square-metre vertical farm is set to open in Newark, New Jersey in 2015 (1, 2), designed to grow almost a million kilos of pesticide-free produce per year. Aerofarms, the company building the farm, says it requires no soil, 95% less water than traditional farms, creates no run-off, and achieves a full crop cycle in 16 days.

The “killer application” for this pristine, urban-grown food might be as raw



- Strategy, evidence, and cross-cutting issues
- Water quality

ingredients for the Bocusini open-source food printing system (3, 4). It consists of interchangeable cartridges with printable food, a food printer head, and an “intuitive user interface” (your smartphone). The immediate challenge is improve the food textures to make them more palatable. Other researchers are designing new approaches to growing meat “*in vitro*” that should result in healthier products that taste better as well (5). One innovative food design project suggests 3D printing edible substrates for seeds – printing food that grows (6).

Several Silicon Valley start-ups are developing food products using vegetable proteins to mimic more accurately the meaty, cheesy and creamy flavours of food derived from animal proteins (7). These products target the majority of meat-eating consumers, not just committed vegetarians. Using gene editing techniques to insert animal protein genes into food plants offers the prospect of more convincing and delicious plant-based substitutes for animal proteins – “better than beef”.

If successful, these companies would create Silicon Valley-style disruptive innovation across the human food chain, with profound consequences. As the ecological footprint of vegetable products is typically one tenth that of animal-based food, these innovations suggest sustainable future paths to feeding a global population exceeding 10 billion.

A technical innovation can often attract artists who see in it a new medium. Dutch artist Koert Mensvoort (8) has opened a virtual restaurant offering conceptual dishes that could in future be prepared using lab-grown meat, including “knitted mince”, a meat-foam cocktail, and sausages grown from living pets.

Questions to consider:

- How extensively will policies and regulations (food safety, land use change etc) need to be revised to address the new growing regimes and agricultural cycles of aeroponic vertical farms and other emerging forms of urban agriculture? Does indoor/ urban farming make agricultural pollution easier to manage?
- Will 3D food printers become as popular as microwaves, or remain commercial and industrial kitchen appliances?
- Should switching to plant proteins that mimic meat be encouraged by government food and environmental policy?
- How could the environmental costs of these new plant-based food production processes be evaluated?
- What implications do these emerging changes have for long-term global food security?
- How might art and design be used to communicate technical innovation about food to a wider audience?



References

- (1) Dan Nosowitz, "Say Hello to the (Soon To Be) World's Largest Indoor Farm," Modern Farmer, March 17, 2015, modernfarmer.com/2015/03/say-hello-to-the-soon-to-be-worlds-largest-indoor-vertical-farm
- (2) Old New Jersey Factory to House Earth's Largest Vertical Farm, 21 April 2015, weburbanist.com/2015/04/21/old-new-jersey-factory-to-house-earths-largest-vertical-farm
- (3) "Bocusini, The world's first universal Plug & Play 3D food printing platform (video)," 3D Food Printing Conference, 17 April 2015, 3dfoodprintingconference.com/food/bocusini-the-worlds-first-universal-plug-play-3d-food-printing-platform
- (4) "The Bocusini Might Be the First Universal Food 3D Printer to Reach the Market," 3DPrint.com, 24 April 2015 3dprint.com/60365/bocusini-food-3d-printer
- (5) "Green bioprinting: Fabrication of photosynthetic algae- laden hydrogel scaffolds for biotechnological and medical applications," Anja Lode, Felix Krujatz, Sophie Brüggemeier, Mandy Quade, Kathleen Schütz, Sven Knaack, Jost Weber, Thomas Bley, Michael Gelinsky, Engineering in Life Sciences, March, 2015. 10.1002/elsc.201400205 <http://3dprint.com/50379/3d-print-algae-human-cells/>
- (6) "3D-printing with living organisms could 'transform the food industry'", Dezeen and Mini Frontiers, 26/2/2015 <http://www.dezeen.com/2015/02/26/movie-3d-printed-food-living-organisms-chloe-rutzerveld-edible-growth/>
- (7) "Silicon Valley gets a taste for food," Economist Technology Quarterly, 7 Mar 2015, p13. <http://www.economist.com/news/technology-quarterly/21645497-tech-startups-are-moving-food-business-make-sustainable-versions-meat/>
- (8) "Bistro in Vitro is a virtual restaurant serving the artificial meat dishes of the future," Dezeen Magazine, 11 May 2015 dezeen.com/2015/05/11/bistro-in-vitro-virtual-restaurant-artificial-meat-dishes-future



UK may have only 100 harvests left and nutritional levels of many crops are falling – could indigenous plants and precision farming help?

Intensive use and systemic mismanagement is leading to significant soil degradation. The UN Food and Agriculture Organization suggests that if current practices continue, the world has around 60 years left before top soil disappears. Researchers put this figure at 100 harvests remaining for the UK (1). A further area of concern is the decreasing nutritional quality of those harvests. Many fruits and vegetables are less nutrient-dense than they used to be - broccoli now has less than half the calcium it once had.

One suggested response is greater use of less well known, local native fruits and vegetables (2).

Well-designed precision farming strategies could also help ameliorate this nutrient erosion. The precision farming market is set to grow by 13% over the next 7 years (3). More and more farmers and their equipment are connected to advanced earth-based and satellite soil, nutrient, and crop sensors, generating massive amounts of data on how particular farming approaches affect soil and nutrient quality (4). In addition, new tools for modelling and analysis of ecosystems may help soil and nutrient stewardship by forecasting possible effects of specific farming methods or inputs on ecosystem services (5).

Questions to consider:

- Soil degradation is a long standing problem; are there perverse incentives that on the one hand encourage conservation and on the other favour cultivation of crops that expose soils to erosion and degradation?
- How might the UK National Inventory of Plant Genetic Resources for Food and Agriculture contribute to increasing overall nutrient values in UK national food production?
- How might the large-scale data output of precision farming systems contribute to improved soil and nutrient stewardship?
- Do sufficient skills exist in the agri-industry to utilise large data sets?



References

(1) The UK has 100 harvests left

<http://www.fwi.co.uk/news/only-100-harvests-left-in-uk-farm-soils-scientists-warn.htm>

<http://www.scientificamerican.com/article/only-60-years-of-farming-left-if-soil-degradation-continues/>

(2) Indigenous plants, fruits, and vegetables could be key to human nutrition in the future

<http://www.news.com.au/lifestyle/food/indigenous-plants-fruits-and-vegetables-could-be-key-to-human-nutrition-in-the-future/story-fneuz8wn-1227033953259>

(3) AGCO "Farm Forward" The New Economy, spring 2015, pp.34-36

(4) Latest EU Sentinel satellite to track global food crops

<http://www.bbc.co.uk/news/science-environment-33229809>

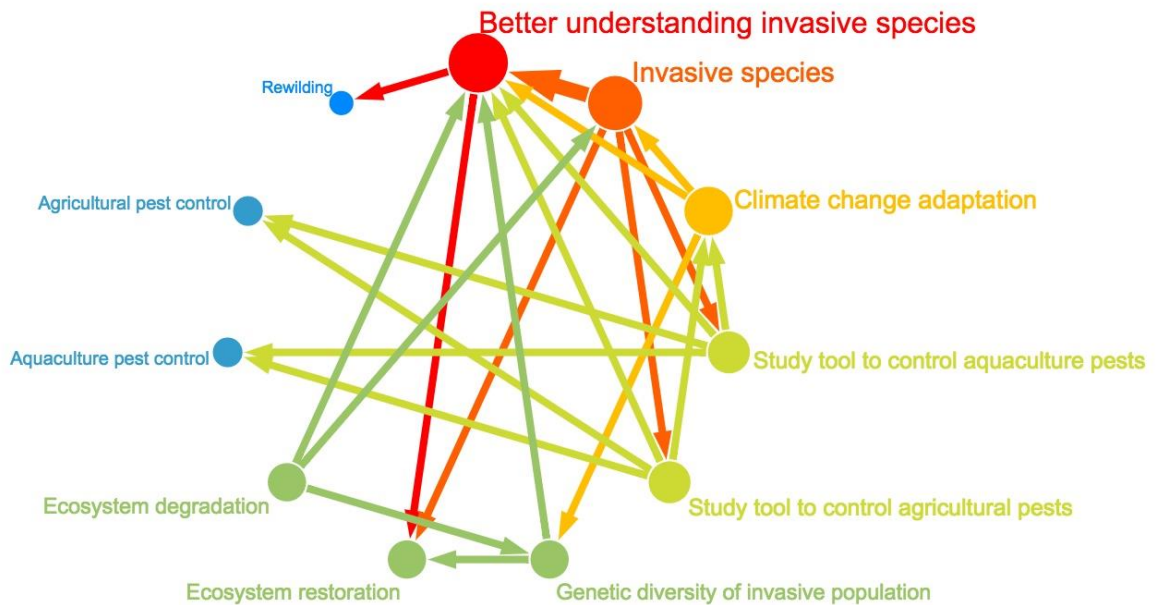
(5) Ecosystems services. ENDS Report 483, May 2015, p. 48 28 April 2015

endsreport.com/48139/ecosystem-services-a-new-way-to-plan





Invasive species - not all bad?



NEAPs+ affected:

- Animal Health
- Bio-diversity and ecosystems
- Farming and Food
- Marine
- Water quality

Potential benefits identified and modelled

Invasive species are generally considered to be damaging to the native environment. However, in a new book, science writer Fred Pearce (1) claims that we benefit from the immigrants' diversity, and from their environmental contributions, and that the instinctive reaction against invasive species amounts to "green xenophobia".

In addition, a review of introduced alien plants shows that they are not as damaging to local ecosystems as is usually supposed, and that they are rarely linked to the national or global extinction of native plant species. The hypothesis that competitive exclusion will eventually enable introduced plants to drive native species extinct receives no support, according to analysis of extensive British data (2).

Other research used genetic data to develop a model of invasion accounting for multiple introductions from a single source (MISS), a previously largely unexplored model. This enables better predictions of the rates of growth of the populations and pest control in both agriculture and aquaculture, over perhaps a 4 to 10 year period (3).

There is no doubt that many invasive species are damaging to the native environment.



However, taken together these insights suggest that a more nuanced approach and better modelling of the impacts could prove valuable.

Consideration needs to be given of whether there is a threshold at which any individual species ceases to be benign and becomes a threat. There may also be considerations around interactions of multiple invasive species.

Questions to consider:

- Should the Defra Partnership be actively examining which species could bring positive environmental contributions?
- What decision tools could help us decide if an invasive species is a “problem” or a “solution”, taking account of where we see range shifts due to climate change?
- Are there new modelling approaches which could be applied to tracking invasive species and how should these be deployed?

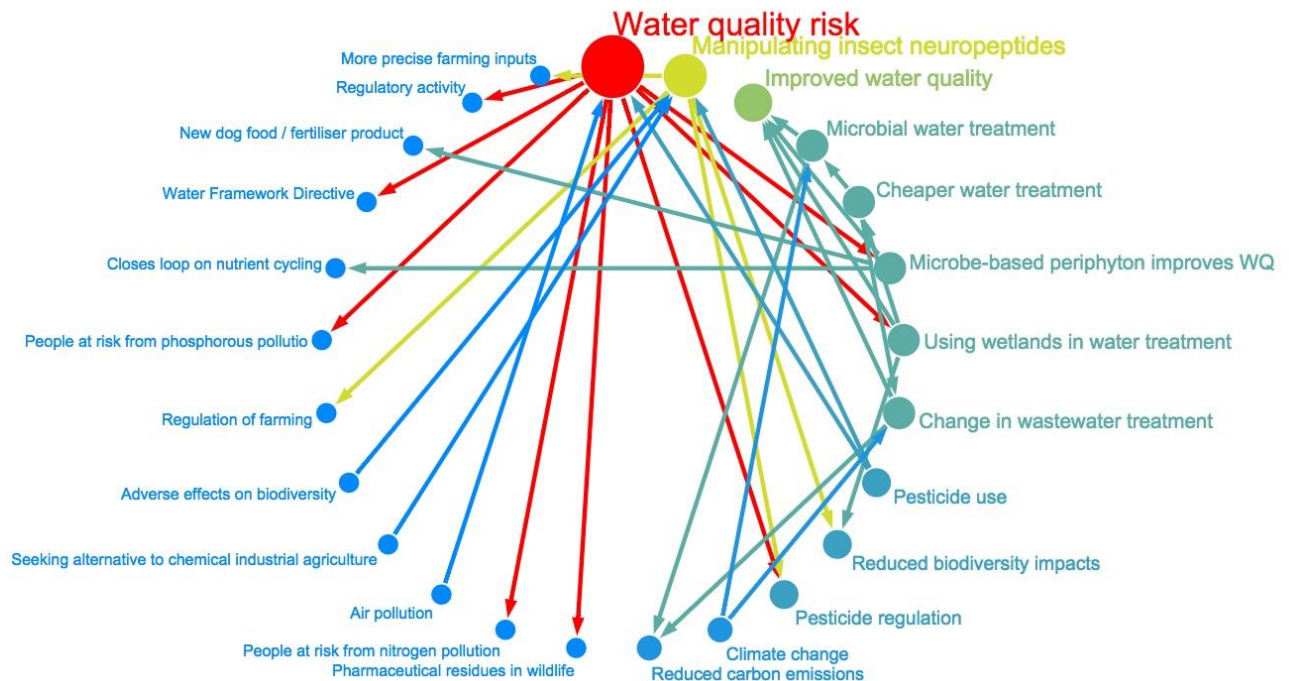
References

- (1) The New Wild: Why Invasive Species Will Be Nature’s Salvation
<http://www.independent.co.uk/environment/nature/tackling-britains-green-xenophobia-over-alien-plants-and-animals-our-ecological-systems-can-be-helped-not-harmed-by-incoming-flora-and-fauna-10174455.html>
- (2) Non-native plants add to the British flora without negative consequences for native diversity; Chris D. Thomas and G. Palmer
<http://www.pnas.org/content/112/14/4387.abstract>
- (3) Study develops new tool to study development of invasive species
<http://www.sciencedaily.com/releases/2015/04/150429101038.htm>
<http://www.ncbi.nlm.nih.gov/pubmed/25920671>





New threats to water quality



NEAPs+ affected:

- Animal health
- Biodiversity and ecosystems
- Energy
- Food production
- Rural Economy
- Urban issues
- Water quality

Threats to water quality are emerging from pharmaceuticals and pesticides; and new responses are also being developed.

The International Food Policy Research Institute (1) highlights that in 2050 up to one in three people globally are going to be exposed to a high risk of water pollution from an increase in amounts of nitrogen and phosphorous.

Pharmaceuticals and pesticides are a continuing threat to water quality. Almost one in four drinking water protected areas are currently at risk from pesticides (2) and concern is growing over the impacts of pharmaceuticals entering rivers via wastewater from sewage treatment plants (3). Water quality may also be affected by harmful concentrations of Bisphenol-A (BPA) entering water supplies from current atmospheric pollution (4).

Novel developments in the use of microbes, enzymes and other artificial molecules could potentially tackle some of these challenges:

- Artificial molecules that resemble neuropeptides could interfere with insect metabolism creating “smart” pesticides – e.g. by impacting on breeding cycles (5).



- Existing waterway microbial populations could be harnessed to break down organic pollutants, and also provide an indication of water quality (6).
- Researchers demonstrated a water purification system using enzymes could be used to neutralise potentially harmful pharmaceuticals – antibiotics, hormones and endocrine disruptors (7).
- A patent describes a method for operating a plant installation for treating or purifying water, using aquatic plants in at least partially closed photo-bioreactors (8).

Man-made “constructed” wetlands that naturally degrade contaminants could offer a way to reduce the impacts of chemicals and pharmaceuticals on the aquatic environment. In a new approach (9), waste water flows through long shallow pools, where bacteria and sunlight work to break down chemical residues, improving the water quality for downstream consumers.

Questions to consider:

- Is the Defra Partnership confident that the emerging threats to water quality are sufficiently well monitored and that the UK will comply with the EU Water Framework Directive?
- Should the Defra Partnership be considering air pollution BPA contamination when planning to improve water quality?
- Is sufficient support being given to research into novel uses of microbial and similar approaches to pollution control?
- Is there scope and value in developing further the creation of man-made wetlands?

References

(1) Global decline in water quality predicted by International Food Policy Research Institute.

<http://www.wwdmag.com/trends-forecasts/study-shows-global-decline-water-quality>

(2) Pesticides putting surface water drinking water protected areas at risk

<http://www.endsreport.com/47902/pesticides-put-one-in-four-drinking-water-protected-areas-at-risk>

(3) Pharmaceuticals in river and drinking water

<http://www.endsreport.com/47683/pharmaceuticals-something-in-the-water>

(4) Atmospheric BPA may reach surface water

http://www.eurekalert.org/pub_releases/2015-05/uom-aro051915.php

(5) New project to develop “smart” pesticides.

http://www.leeds.ac.uk/news/article/3689/new_project_to_develop_smart_pesticides

(6) Scientists discover tiny microbes with potential to cleanse waterways

http://www.eurekalert.org/pub_releases/2015-05/ntu-sdt051715.php



(7) Improving fisheries and water quality

<http://frogenvironmental.co.uk/wp-content/uploads/2015/04/Minnow-Pond-A-Brush-Park-Aquaculture-Study.pdf>

(8) Water treatment method using plant installations

http://worldwide.espacenet.com/publicationDetails/originalDocument?FT=D&date=20131212&DB=EPODOC&locale=en_EP&CC=WO&NR=2013182309A1&KC=A1&ND=4

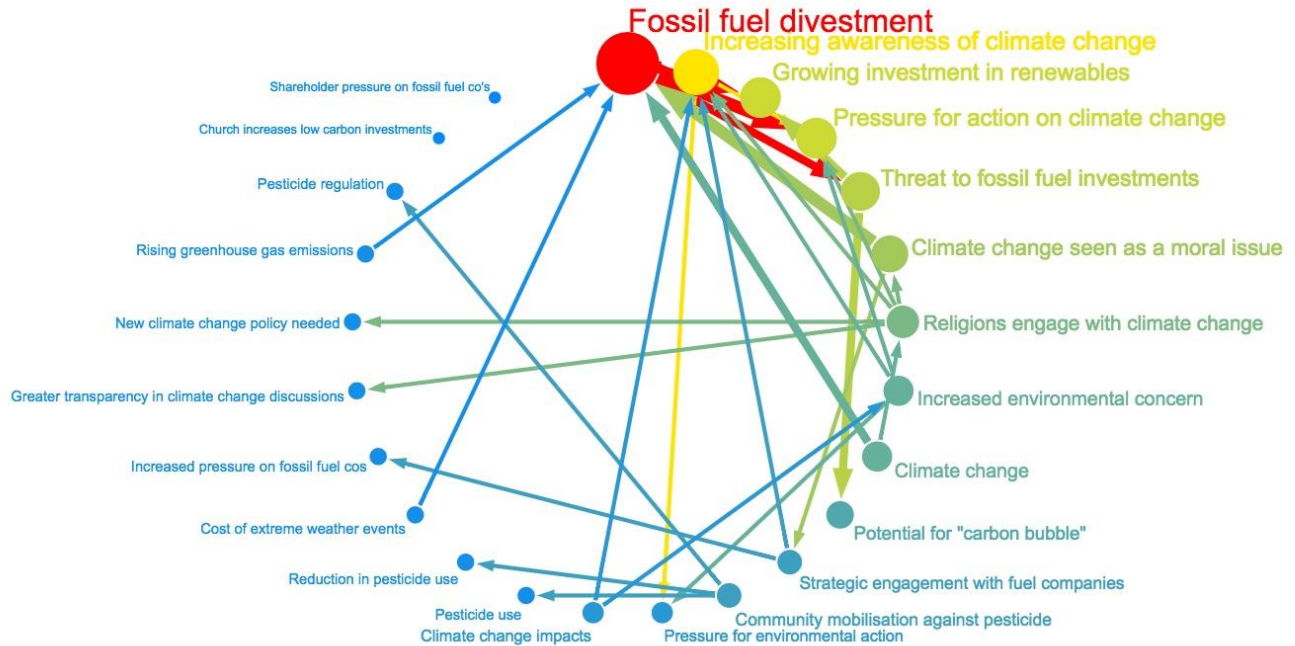
(9) Designing wetlands to remove drugs and chemical pollutants

http://e360.yale.edu/feature/designing_wetlands_to_remove_drugs_and_chemical_pollutants/2856/





Citizens are mobilising to drive action



NEAPs+ affected:

- Atmosphere and Noise
- Biodiversity and ecosystems
- Energy
- Floods
- Food production
- Marine
- Land Use Planning
- Risk Assessment
- Strategy, Evidence and cross-cutting issues

Citizen mobilisation on climate change

The campaign to divest from fossil fuel investments, particularly coal and tar sands, is gathering pace with potential implications for the stock market:

- Rockefeller (1), AXA (2), The Church of England (3) and Oxford University (4) are among those divesting, and the UN Framework Convention on Climate Change (5) has also called for divestment.
- The Bank of England (6) and the G20 (7) have warned of the risks of a fossil fuel “bubble” with companies’ valuations of reserves being over-stated.
- At Shell’s 2015 AGM in The Hague, 98.9% of shareholders supported a call for the company to report on whether its actions are compatible with limiting climate change to 2°C above pre-industrial levels (8).

Churches are highlighting the moral dimension:

- Pope Francis hosted a climate summit in April (9), entitled "Protect the Earth, Dignify Humanity: The Moral Dimensions of Climate Change and Sustainable Development"; an encyclical on the topic was published in June (10).



- Water quality
- Urban Issues
- The Church of England also argued that climate change was a moral issue (3).
- In the US, several faith groups have come together in support of the Pope's appeal (11).

Actions like these by religious groups could mobilise a wider audience than can be reached by environmental lobby groups.

Also, research demonstrates that about 75% of the moderate daily hot extremes over land is attributable to global warming (12) raising the prospect of mobilising public reaction to extreme weather events.

Questions to consider:

- What has changed in the way climate change science is communicated and does the Defra Partnership's own messages take on board new understanding of communications as narratives, visions, empathies etc?
- What opportunities exist to improve the communication of climate science through churches, large companies, trusts and foundations?
- What plans exist to relate extreme weather events with climate change? Should Local Authorities be encouraged to highlight local implications of climate change?
- Is more research required into which groups are sceptical about the need for action on climate change and the reasons behind that? Should scientists engage more with educationalists, psychologists, political scientists and accountants to improve our understanding of this behaviour?

References

- (1) Rockefeller Brothers Fund: it is our moral duty to divest from fossil fuels
<http://www.theguardian.com/environment/2015/mar/27/rockefeller-fund-chairman-moral-duty-divest-fossil-fuels>
- (2) Huge Insurance Company Cites Climate Change As Reason For Divesting From Coal
<http://thinkprogress.org/climate/2015/05/22/3662053/axa-insurance-coal-divestment/>
- (3) Church of England National Investing Bodies and transition to a low carbon economy
[https://www.churchofengland.org/media-centre/news/2015/04/national-investing-bodies-and-transition-to-a-low-carbon-economy.aspx?utm_source=Daily+Media+Digest&utm_campaign=aed53d6cd8-&utm_medium=email&utm_term=0_296e14724b-aed53d6cd8-248606341&ct=t\(\)](https://www.churchofengland.org/media-centre/news/2015/04/national-investing-bodies-and-transition-to-a-low-carbon-economy.aspx?utm_source=Daily+Media+Digest&utm_campaign=aed53d6cd8-&utm_medium=email&utm_term=0_296e14724b-aed53d6cd8-248606341&ct=t())
- (4) Oxford University ends coal and tar sand investment
<http://www.endsreport.com/48342/oxford-university-ends-coal-and-tar-sand-investment>
- (5) UNFCCC backs snowballing divestment movement
<http://www.endsreport.com/48137/unfccc-backs-snowballing-divestment-movement>
- (6) Bank of England warns of huge financial risk from fossil fuel investments



<http://www.bankofengland.co.uk/publications/Pages/speeches/2015/804.aspx>

(7) G20: fossil fuel fears could hammer global financial system

<http://www.telegraph.co.uk/finance/economics/11563768/G20-to-probe-carbon-bubble-risk-to-global-financial-system.html>

(8) Climate change dominates marathon Shell annual general meeting

<http://www.theguardian.com/business/2015/may/19/climate-change-shell-annual-meeting-oil-global-warming-resolution-shareholders>

(9) Pope Francis to Host Major Summit on Climate Change

<http://ecowatch.com/2015/04/16/pope-francis-climate-change-summit/>

(10) Pope's climate change encyclical tells rich nations: pay your debt to the poor

<http://www.theguardian.com/environment/2015/apr/28/vatican-climate-change-summit-to-highlight-moral-duty-for-action>

(11) For Faithful, Social Justice Goals Demand Action on Environment

http://www.nytimes.com/2015/06/21/science/earth/for-faithful-social-justice-goals-demand-action-on-environment.html?_r=0

(12) Anthropogenic contribution to global occurrence of heavy-precipitation and high-temperature extremes

<http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate2617.html>

Campaigns on other environmental and food policies

Citizens are also being mobilised around other environmental issues:

- The Soil Association (1) and 38 Degrees (2) are mobilising people around the issue of bees and neonicotinoids.
- The Pesticide Action Network UK (3) is urging communities to cut the use of pesticides, especially glyphosate. Concerns over links between glyphosate and health issues are leading to increased testing of a range of foodstuffs, despite assurances that glyphosate does not bioaccumulate (4).
- Action Aid is questioning the role of bioenergy in the EU Climate and Energy Policy Post 2020 and recommends limiting the use of biomass in future energy packages (5).
- MEPs have come under criticism as the European Parliament's agricultural committee's Forest Strategy argues that forests should play a greater role in the future energy mix of the EU (6).

Whether the overall level of citizen engagement with environmental issues is increasing or simply changing focus is not clear. Online campaigning groups like 38 Degrees and other social media channels make it easier to mobilise citizens and, as we reported in March, the use of smartphones as environmental sensors is leading to an increase in "citizen science" and greater environmental awareness generally.

Questions to consider:

- Is research needed into whether social media and online campaigns have led to a step-change in citizen engagement?
- Does the Defra Partnership need to review its communication plans to engage more directly with online campaigns?



References

(1) Keep Britain Buzzing

<http://www.soilassociation.org/keepbritainbuzzing>

(2) Ban the pesticides that are killing bees

<http://www.38degrees.org.uk/page/s/ban-the-pesticides-that-are-harming-our-bees>

(3) UK community mobilisation against pesticide use.

endsreport.com/48317/communities-mobilise-against-probably-carcinogenic-pesticides/

(4) Fears over Roundup herbicide residues prompt private testing.

reuters.com/article/2015/04/10/us-food-agriculture-glyphosate-idUSKBN0N029H20150410

(5) Biofuel use needs to be limited to sustainable levels.

actionaid.org/publications/pitfalls-and-potentials-role-bioenergy-eu-climate-and-energy-policy-post-2020

(6) MEP's support role of forests in production of biomass.

endseurope.com/40715/parliament-risks-sending-wrong-signal-on-bio-energy?referrer=channel-energy





D. EMERGING SIGNALS

Energy economics: the world may be entering an era of global energy price deflation.

NEAPs+ affected:

- Biodiversity and ecosystems
- Biodiversity and Ecosystems
- Consumer protection
- Farming and food
- Food distribution,
- Food production
- Resources
- Risk assessment
- Rural economy
- Strategic evidence & cross-cutting issues

Solar photovoltaic cell costs continue to fall substantially, and economies of scale are driving down the cost of onshore wind turbines. Already, the cost of renewable energy has reached grid parity in some parts of the world, and this trend is expected to continue in the long term. The Economist magazine foresees an era of "global energy deflation" (1). With zero marginal cost of production, increased deployment of renewables will have two distinct effects: average prices of electricity will fall, and become much more variable.⁵ This day-to-day variation in prices will put a premium on energy storage technologies. These may have environmental impacts (e.g. old battery packs from electric vehicles being kept in or near people's homes).

The technology road-map of energy production is still very open (2, 3, 4). There will be profound implications for energy supply, and the power grid will need to be restructured. Agri-business is energy and chemical intensive so persistently low energy prices would have an impact (e.g. possible expansion of UK glasshouse production).⁶

Questions to consider:

- What impact would lower energy prices have on the long-term pattern of land use and food production?
- How much is current environmental policy based on an assumption of high energy prices in the future?
- What impacts (both environmental and economic) would highly variable prices for electricity have?
- What will the environmental impact of grid-scale storage be?

References

(1) Global energy price deflation.

The Economist, 17 Jan 2015, Special report "Let there be light", p4.

<http://www.economist.com/news/special-report/21639014-thanks-better-technology-and-improved-efficiency-energy-becoming-cleaner-and-more>

(2) UK coal burning for electricity falls to historic lows in 2014

<http://www.carbonbrief.org/blog/2014/09/uk-coal-power-back-to-historic-lows-as-electricity-demand-continues-to-fall/>

(3) Half of new electricity sources are renewables. New Scientist, 4 Apr 2015.

<http://www.newscientist.com/article/mg22630153.300-asian-solar-spending-helps-drive-renewable-energy-boom.html/>

(4) Tesla batteries to power homes and business.

<http://www.dezeen.com/2015/05/01/elon-musk-launches-tesla-powerwall-battery-replace-fossil-fuels-powerpack/>

⁵ Source: SAMI Consulting analysis.

⁶ Source: expert review





Inhibiting pests via hormones can reduce insecticide use

NEAPs+ affected:

- Animal health
- Biodiversity and ecosystems
- Farming and food
- Food quality & safety
- Plant health
- Risk assessment
- Water quality

An EU-funded project, *nEUROSTRESSPEP* (1), is researching ways to influence the hormone systems of selected insect species using artificial biopeptides. The goal is to create effective, highly targeted pest control that does not damage pest predator species as well as the pests themselves. Traditional pesticides often affect natural predator populations much more severely than the intended targets, as predators exist in fewer numbers than their prey species. A vicious circle develops, with pesticides killing both target species and their usual predators, but killing a greater percentage of the predators. The target pest population can then rebound into even greater numbers as fewer natural predators are left to limit their growth. Using artificial hormones as pest control should avoid that dynamic, although if successful at killing large numbers of the target pest population, some predator die-off due to reduced food supply may occur.

Using artificial biopeptides that disrupt specific hormone paths in a single species also reduces the danger of widespread ecological contamination in either the water systems or the food chain. One issue might be how multiple applications of hormone mimics (e.g. to address a range of pests within one field) could interact and with what effect.

Questions to consider:

- What might be the range of effects on biodiversity, especially on predator-prey balances?
- As these hormone mimics are tailored to specific species, will they be prohibitively expensive – a product only for large-scale, commercial farming?
- What unintended consequences might result from spraying fields with multiple applications of targeted hormone mimics in order to suppress multiple pest species?

References

(1) University of Cologne, “Greener pest control: scientists plan to fight insect pests by turning their own hormones against them”, EurekaAlert!, 27 April 2015, eurekaalert.org/pub_releases/2015-04/uoc-gpc042715.php





NEAPs+ affected:

- Biodiversity and ecosystems
- Farming and food
- Floods
- Food production
- Land use planning
- Marine
- Risk assessment
- Rural Economy
- Strategy, Evidence and Cross Cutting Issues
- Water quality

Floods and flood defences - living with, rather than fighting, water

Recently there have been articles discussing the growing recognition that sea levels may be rising faster than previously thought (1). If this is so then better flood defences will be needed sooner rather than later.

However, there is also a growing view that finding ways to live with water may be a better long-term solution than trying to defend against it, for example the projects taking place in New York following Hurricane Sandy (2), such as stone revetments on Coney Island Creek to prevent “backdoor” flooding and reinforcing beaches in the Rockaways.

On the other side of the USA, the government of California is following that of Arizona in working on ways of incentivising landowners to encourage them to take part in “groundwater banking” schemes. Following other research in the state, they are also looking at changes in flood defences which can allow aquifers to be more readily recharged so improving water availability in times of drought (3,4,5).

Questions to consider:

- Given that the UK has recent experience of being both water stressed and experiencing severe flooding at the same time there may be possible advantages to groundwater banking schemes; how might the Defra Partnership influence, and experiment with, such schemes? Are there water quality issues to consider?
- What are the wider systemic impacts of using specific landowners to assist with flood risk management? How does this affect the flood risk management system?

References

- (1) Economist, 17 Jan 2015, p78. Higher Water Mark.
economist.com/news/science-and-technology/21639442-rise-sea-levels-may-be-accelerating-higher-water-mark
- and New Scientist, 16 May 2015, p18. Apparent slowing of sea level rise is artefact of satellite data
newscientist.com/article/dn27497-apparent-slowing-of-sea-level-rise-is-artefact-of-satellite-data.html
- (2) Water in the Bank: One Solution For Drought-Stricken California.
e360.yale.edu/feature/water_in_the_bank_one_solution_for_drought-stricken_california/2872
- (3) Moving levees can increase groundwater supply.
http://news.ucdavis.edu/search/news_detail.lasso?id=11195





NEAPs+ affected:

- ALL

Environmental regulations need not harm growth

The Economist has reported on OECD research that shows that countries with stringent environmental regulation do not necessarily suffer lower levels of economic productivity as a result. This finding is potentially of great interest to those developing environmental policy within the context of government economic objectives (1). Researchers have created the first comprehensive dataset of the strictness of environmental policies, across the OECD. By comparing the effect of these policies on economic productivity, they were able to conclude that *“a tightening of environmental policies is followed by a temporary increase in productivity growth, leading to an overall improvement in production efficiency for a large share of the manufacturing industries.”*

There are several explanations for this: it may be that the economic cost of strict environmental policies is too small to be visible in the data; or that environmental regulation does as much economic good as it does harm.

But what does seem to matter is whether environmental regulations are broadly market-based, or anti-competitive (2). Factors which matter for economic outcomes include: policy stringency (environmental externalities “prices”); the extent to which policies incentivise continued search for cheaper abatement options; flexibility in the way that an environmental objective is to be achieved; predictability in the future price of environmental externalities; and the competition-friendliness of policies.

Questions to consider:

- Are current policies influenced by an assumption that stringent environmental policies will harm economic growth?
- What evidence do policy makers need to be able to make an informed judgment about the economic impact of environmental regulations?
- Does the development of environmental regulation in the UK pay sufficient attention to impacts on the market and competition?
- The consequences for UK environmental policies could be profound. How robust is this research finding?

References

- (1) Environmental regulations need not harm growth
Economist, 3 Jan 2015, p55. “Free exchange: Green Tape.”
<http://www.economist.com/news/finance-and-economics/21637411-environmental-regulations-may-not-cost-much-governments-and-businesses/>
- (2) Do Environmental Policies Matter for Productivity Growth? Albrizio et al, OECD, 3 Dec 2014. DOI10.1787/5jxrjncjrcxp-en
http://www.oecd-ilibrary.org/economics/do-environmental-policies-matter-for-productivity-growth_5jxrjncjrcxp-en





Radical new approaches to materials benefiting the environment

Several projects and thought exercises have highlighted possible new materials, some genetically modified, which could benefit the environment in the longer term.

NEAPs+ affected:

- Animal health
 - Biodiversity and ecosystems
 - Resources
 - Strategy, evidence and cross cutting Issues
- New techniques are being researched in the US to radically reduce the cost of producing lightweight, strong metals such as aluminium, magnesium and titanium which could benefit the efficiency of wind turbines (1).
 - Adding proteins from the golden orb spider to milk producing genes of transgenic goats to produce human tissues (ligaments) or to boost antibodies in milk to benefit the immune system (2).
 - A writer and designer duo have imagined a scenario where genetically modified bees could be trained to print detailed concrete structures rather than produce honey. The scenario is based on the observations of a number of species that have been genetically engineered to produce useful materials, including bees that produce a cellophane-like plastic (3).

Questions to consider:

- New materials development may require inter-disciplinary thinking; how can this be best supported in the current climate and are there other organisations with whom the Defra Partnership could work?

References

- (1) "Heavy metal so last year", New Scientist 28 Feb 2015, <http://www.sciencedirect.com/science/article/pii/S0262407915603979>
- (2) Mixing Spider DNA and Goat Embryos Produces Milk With a Side of Silk takepart.com/article/2014/04/10/gmo-goats
- (3) Bees could 3D print concrete honey
de zeen magazine dezeen.com/2014/07/27/bees-3d-printing-concrete-geoff-manaugh-john-becker





NEAPs+ affected:

- Biodiversity and ecosystems
- Food quality and safety
- Plant health
- Resources
- Water quality

New ways to use waste show promise

A variety of factors affect waste and waste disposal, from the drop in oil prices making new polymers more price competitive compared with recycled ones (1) to projects highlighting the amount of waste produced by electronic goods (radioactive vases used as visual representations of toxic waste (2)).

- UK e-waste is increasing as sales of electronic goods rise and the amount produced by each UK resident is now estimated to produce 15.2kg, just slightly below the per capita figure for Europe. This waste stream contains valuable components and, although much is recycled, there is still a percentage that is not (3).
- The UK export of refuse-derived fuel (RDF) - shredded, dehydrated and baled residual waste – has increased exponentially over the past five years and is forecast to stabilise at around 2.5Mt annually in the next five years (4).

Innovative projects demonstrating new ways of using waste are becoming more common; for example a method of air blasting paper pulp onto the network of twine-covered columns to create a Pulp Pavilion for a festival (5).

Researchers from the US Geological Survey (USGS) (6) identified gold in waste from American sewage treatment plants at levels which if found in rock could be worth mining. Extracting metals from the waste could also help curb the release of toxic substances into the environment. In addition to gold and silver, human waste also contains amounts of rare earth metals such as palladium and vanadium.

The team uses leachates which are already used in commercial mining where they have a reputation for environmental damage. But proper regulated use in a closed system could pave the way for commercial sewage outflow mineral extraction.

Questions to consider:

- Are there new ways of monetising waste disposal like the paper pulp example? What would be the regulatory implications?
- Should the Defra Partnership be encouraging metal extraction from waste because of the potential to reduce toxic contamination?



References

- (1) Oil prices affect business models for UK plastics recyclers
endsreport.com/48288/new-business-models-needed-for-uk-plastics-recyclers
- (2) de zeen magazine dezeen.com/2015/04/28/radioactive-ming-vases-toxic-smartphone-waste-mud-unknown-fields-division-kevin-callaghan
- (3) UNU Global E-Waste Monitor 2014
i.unu.edu/media/unu.edu/news/52624/UNU-1stGlobal-E-Waste-Monitor-2014-small.pdf
- (4) Growth in refuse-derived fuel exports
endsreport.com/48145/infographic-will-the-meteoric-rise-of-rdf-exports-come-to-an-end
- (5) dezeen.com/2015/05/09/pavilion-paper-pulp-ball-nogues-studio-orange-purple-sinuuous-coachella-music-festival
- (6) Gold in faeces “worth millions”.
<http://www.acs.org/content/acs/en/pressroom/newsreleases/2015/march/sewage-yes-poop-could-be-a-source-of-valuable-metals-and-critical-elements.html>





NEAPs+ affected:

- Biodiversity and ecosystems
- Marine

New approach to marine re-construction: ceramic “Lego” helps coral grow

Australian designer Alex Goad has created a system of modular ceramic components for forming structures that can help rebuild diminished coral reef environment that have been damaged by weather or blasting. The “lego” bricks rapidly attract fish and plants and aid new coral growth (1).

In the past a number of techniques for artificial reef stimulation have been examined, both in the UK and elsewhere. These include stabilised coal-ash, scrap tyres and large sand filled geotextile containers.

A broad evaluation on the alternatives already adopted around the UK might inform the value of new alternatives.

Questions to consider:

- Does the value of artificial reefs for nearshore fisheries need re-assessment?
- Should the environmental and social costs and benefits of artificial reefs be compared with those of aquaculture to decide how future investment in fisheries might be distributed?

Story from the scanning database

(1) Lego-inspired ceramic reefs help restore damaged coral reefs

<http://www.dezeen.com/2015/03/06/alex-goad-mars-modular-artificial-reef-structure-restore-damaged-coral-reefs/>



APPENDIX A – PROJECT OVERVIEW

Horizon scanning

SAMI Consulting has been commissioned by Defra to undertake Horizon Scanning to provide strategic evidence of future change for the Defra Partnership, for a three year period starting in December 2014. The project is managed by a Core Group of representatives from the five Partner organisations. This report is the second in a sequence of reports on the strategic evidence of future change.



Further information:

If you would like further information on this

project, please contact the project manager

huw.williams@samicoconsulting.co.uk

(07711 107223);

or the Defra head of Horizon Scanning

Konrad.Bishop@defra.gsi.gov.uk.

Horizon Scanning is the “systematic examination of information to identify potential threats, risks, emerging issues and opportunities, beyond the Parliamentary term, allowing for better preparedness and the incorporation of mitigation and exploitation into the policy making process.” (Definition from Jon Day Review of cross-government horizon scanning.)

Defra and its Partners have used Horizon Scanning for a number of years, to help ensure that policies, strategies and delivery approaches are more robust, adaptable and resilient over time. The techniques enable the Partnership to anticipate and prepare for events that may happen in coming decades which are highly uncertain and/or beyond their control. This project follows on from the 2011-2014 Cranfield University Institute for Health, Environment, Risks and Futures horizon scanning and futures project.

The purpose of this project is to deliver foresight and insight to help Defra and its partners identify potential threats, risks and opportunities in order to achieve strategy, policy and operational goals.

The project will also support futures capacity within the Defra Partnership and help develop the skills and knowledge required to use Horizon Scanning and futures techniques and to use the outputs to enhance strategy, policy and delivery.



APPENDIX B - METHODOLOGY

Scanning

The Horizon Scanning is being carried out by three distinct groups:

- The Defra Partnership itself: there are many existing scanning activities conducted within the partnership, though the degree of formality varies between the different organisations. The Partnership scanners will be covering the more specialist areas for input into the scanning database.
- SAMI Consultants focus on the broader PESTLE (Politics, Economics, Society, Technology, Legal and Environmental) categories.
- Academics at Manchester University, who have been sub-contracted to provide focussed scanning on specific environmental issues.

The scanners have been trained in the use of the software tool, Futurescaper. This acts both as a scanning database and a means of analysing the interactions between the different “stories”, with advanced graphics supporting the development of clusters of change. Each “story” contains links between the change identified and both causes and implications of the change and a range of other metadata.

The screenshot displays the 'Defra Network Horizon Scanning Database' interface. The main window shows a story titled 'Changing flood defences in the UK'. The story details include a description, citations, and publication information. The interface is divided into sections for 'Causes', 'Change', and 'Implications', each containing specific insights and metadata such as origin of change, scale of change, time horizon, and source of insights.

Section	Item	Origin of change	Scale of change	Time horizon	Type of change	Source of insights
Causes	Increased flood risk	Environmental	National	Near-term = 1 to 3 years	Trend	Citation
	Increased risk of coastal flooding	Hydrosphere	National	Medium-term = 4 to 10 years	Trend	Citation
Change	Managing floods better	Environmental	National	Medium-term = 4 to 10 years	Trend	Citation
	Coastal management	Hydrosphere	National	Medium-term = 4 to 10 years	Trend	Citation
Implications	Reduced risk of flooding	Environmental	National	Medium-term = 4 to 10 years	Trend	Citation
	Coastal management	Hydrosphere	National	Medium-term = 4 to 10 years	Trend	Citation

Along with the content of each story, scanners record the source, publication date, type of publication (eg press release, peer reviewed paper), an indication of time horizon and scope of the story, and Defra



Extended Network Vulnerabilities or Network Evidence Action Plan areas augmented with some extra categories relating to food (“NEAPs+”).

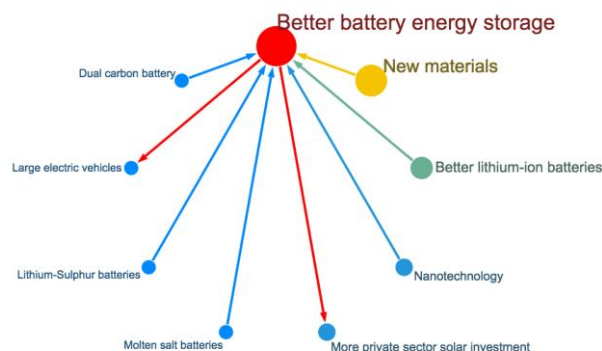
The NEAPs+ categories are:

- Animal Health
- Atmosphere and noise
- Biodiversity and eco-systems
- Consumer protection
- Energy
- Farming and food
- Floods
- Food distribution
- Food production
- Food quality and safety
- Land use planning
- Marine
- Plant health
- Resources
- Risk assessment
- Rural economy
- Strategy, evidence and cross-cutting issues
- Urban issues
- Water quality

Reading an influence map

The linkages between “factors” in various stories form an “influence map” of the overall system. Nodes that are larger and more towards the red end of the spectrum indicate factors that occur relatively frequently in stories in the database; those that are smaller and towards the blue end are relatively infrequent.

Example



In this extract from the database, the factor “*Better battery energy storage*” appears in a number of stories. “*Better battery energy storage*” is an effect of several other factors: “*New materials*”, “*Nanotechnology*”, “*Dual carbon battery*”, “*Lithium-Sulphur batteries*”, and “*Molten salt batteries*” and is in turn the cause of “*More private sector solar investment*” and “*Large electric vehicles*”.

Because “*Better battery energy storage*” has more links, it appears as a large red circle to make it more prominent; “*New materials*” has the second-most links. Note that this colour/prominence assignment is dynamic. The tool allows us to select by the metadata – e.g. only short term issues – and the colour/prominence is then based on that subset of data.

Analysis

The steps in the analysis process were:

- Futurescaper is used to analyse the collected scanning data. First the number of stories for each of the NEAPs+ was calculated (noting that many stories will be in more than one NEAP).
- The Core Group were then asked which of these they wished to prioritise and which SAMI Consulting should examine in detail.
- Then for each of these NEAPs+, the main topics were written up in a draft report.
- The Core Group then reviewed these topics and selected those to include in the final report.
- The Expert Panel at Manchester University in parallel assessed the topics, providing input on both the science and the policy implications.
- Final revisions to the report were then made.

Topics were characterised as either “Clusters of change”, where there were several important stories, or “Emerging Signals” where particularly new and interesting stories were identified.

Produced by
SAMI Consulting
The Rectory
1 Toomers Wharf Canal Walk
Newbury RG14 1DY

