South Shropshire Climate Action

southshropshireclimateaction.org
info@southshropshireclimateaction.org

"Next steps"

CLIMATE ACTION PLAN

For the Ludlow Constituency to reach Net Zero by 2030

Land & Biodiversity

Transport

Energy & Buildings

Communities & Education

South Shropshire Climate Action (SSCA)

"Next Steps"
Climate Action Plan
for the Ludlow Constituency to reach Net Zero by 2030

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Executive Summary

We are living beyond our planet's resources, not only in South Shropshire, but also in many developed countries. In the last 50 years some national populations have become accustomed to unprecedented levels of convenience, comfort and consumption. At the same time significant numbers of animals, birds, insect and some plant species fall. In South Shropshire common species such as hedgehogs and curlews are so severely reduced in number they are in danger of going extinct; year on year the bee population fails to thrive. The Covid pandemic has demonstrated quite how keenly humans depend for their mental and physical well being on their relationship with nature.

Goods, including food, are moved across continents by land, air and sea and so are a cause of greenhouse gas emissions. Waste emissions from the fossil fuels used to power our vehicles and homes have been accumulating in the atmosphere, causing global warming since the Industrial Revolution which itself began in Ironbridge, in our own county of Shropshire. These impacts have accelerated all over the world in the last 50 to 60 years. In this period, industrial practices have been applied to agriculture and in developed countries we buy rather than make or grow what we need. It is a characteristic of humans, perhaps, to not always distinguish between "need" and "want."

As there is often a complex chain of events as well as distance in time and space between the origin of the goods or our food, the true cost of our consumption often remains hidden from the purchaser.

Now that technology enables us to communicate directly across time and distance many people can see and so understand consequences with their own eyes. Changes are needed as Greta Thunberg, Extinction Rebellion and School Strikes all over the world have demanded. Many community groups throughout Shropshire, and beyond, have been working on these very issues over a long period, unrewarded by significant political development either locally or nationally. This Report has been written to show the many ways we can - if we choose - create a better future. The limited geographical focus on the Ludlow constituency was chosen to scrutinise the How rather than the Why. Our proposals are intended to be transferable. We believe this Report is an important contribution to the international debate about tackling climate change which most often focuses on urban settings.

This Report has been conceived, researched and written by a large number of volunteers, often with expertise and curiosity in other fields as well as their own specialisms. The task of finding ways to achieve Net Zero Greenhouse Gas emissions by 2030 developed without pre-conceived outcomes and without self-interest.

Many hours have been given to this Report to ensure that it is evidence-based with practical and transferable ideas.

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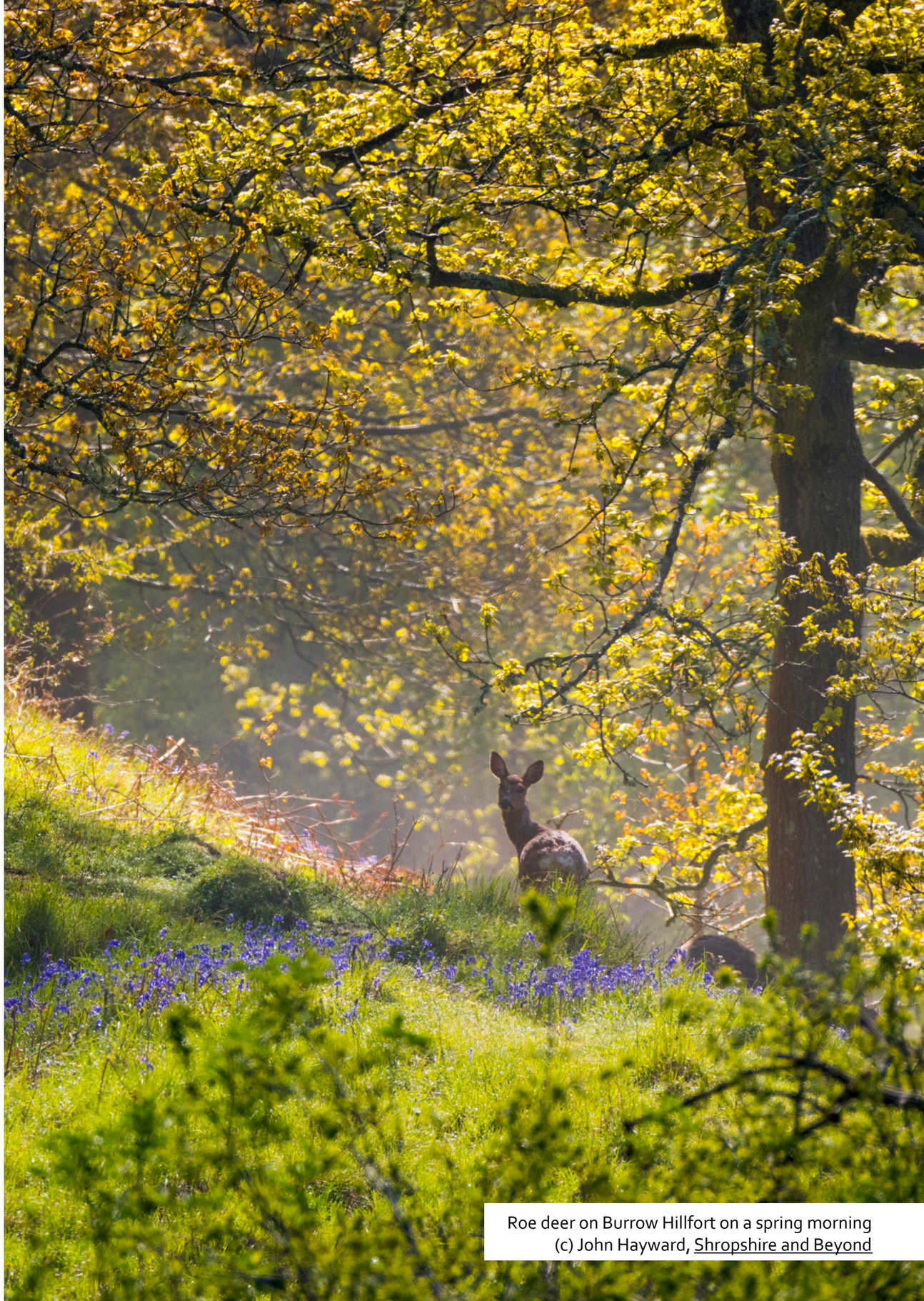

Roe deer on Burrow Hillfort on a spring morning
(c) John Hayward, Shropshire and Beyond

Our Key Findings:

- We are living beyond the resources of our planet and must change our ways – fast.

- Every action of every individual and each community affects everyone else. We do not always immediately see those effects. To help us we need direction, intention and funding from national policies designed to meet the climate emergency for the good of all.

- We are living at a time of great opportunity: in our choices we can improve life, creating an inclusive and fair society for all, sharing resources equally and respecting differences – or turn our backs on our children's and their children's future.

- All the solutions for our current problems exist but there is presently a lack of will to put them into action.

- We recognise training is needed to close the skills gap in creating new, 'green' employment.

- In telling the truth about the Climate Emergency, we acknowledge that the future is uncertain, difficult and dangerous, but also full of opportunity and hope.

- Cathedrals were built for future generations. Forests were planted by people who would never see the trees mature. This Report is our cathedral and our forest.

Land and Biodiversity recommendations:

- Work with local stakeholders to generate and deliver local solutions.

- Ensure that farmers are rewarded for the quality of the food they produce and for delivering public benefits.

- Enable policy to support a low carbon and high biodiversity trajectory.

- Link those areas of habitat that are in favourable condition and restore those, including peatlands, to create a Nature Recovery Network.

- Naturalise existing watercourses, create more diverse riverine habitats and employ natural approaches to flood alleviation. Ensure raw sewage and other effluents are no longer discharged into waterways.

- Manage soils to improve soil health and fertility.

Energy and Buildings recommendations:

- The move to Net Zero Carbon will require a very substantial improvement in the supply of energy generated by fossil-free energy sources.

- Housing needs to be supplied with carbon free heating systems supported by insulation and smart management and storage systems.

- Co-ordination between local authorities, householders, businesses and community welfare agencies is an essential component in all developments towards the Net Zero target.

Transport recommendations:

- Transport is responsible for 37% of the area's direct carbon emissions.

- Transport is a largely private matter in South Shropshire as public transport is extremely limited. This creates significant difficulty for many while maximising pollution and danger.

- An efficient public transport system could transform our roads to make them safe for active travel (cycling and walking).

- A Net Zero carbon transport future gives all income groups and those with disabilities and health problems greater choice in accessing hospitals, schools, colleges and shops.

Communities and Education recommendations:

- We are stronger when we cooperate and work together.

- Community Action takes different forms, and there are a large number of different starting places; getting going is the key as much else follows on. There is support available from South Shropshire Climate Action.

- The Climate Emergency should be underpinning every decision made by individuals, communities, councils, businesses and governments.

Finally, bear in mind:

- This Report only covers four main themes; there are many more essential topics, Waste and Consumption being one such major issue (discussed in detail by Zero Carbon Shropshire).

- The longer we delay, the harder it will become to take effective action to achieve Net Zero Carbon Emissions by 2030. We note that on 20th April 2021, the government announced a target of a 78% reduction by 2035 (compared to 1990 levels). Both dates require huge changes in local and national life.

- Clear requirements must also be laid down in law for such steps to have any chance of success. It is important for individuals and groups to lobby government and specific departments so that clear, regular and consistent messages are raised with central Government, especially in this year of the international climate conference in Glasgow, COP 26, which is a unique opportunity and pressure point.

- Continuous and consistent lobbying of industry, corporations, land managers and business is also vital. Try to share answers.

- Individuals and groups need to take time to keep up to date with scientific and social developments. Individuals and groups inform and inspire each other.

"Optimism is not the result of achieving a task we have set for ourselves. That is celebration. Optimism is the necessary input to meeting a challenge"

Christina Figueres

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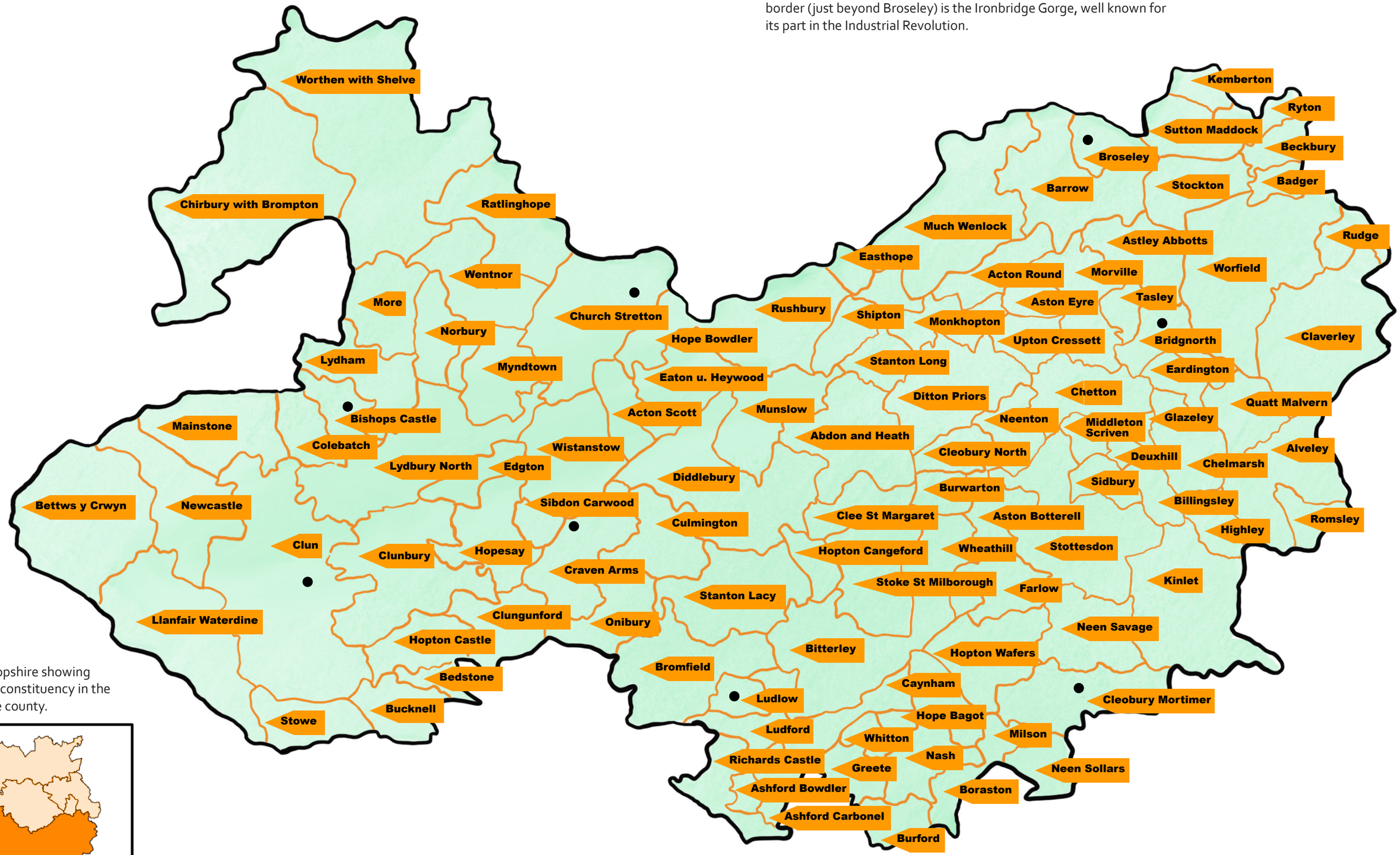
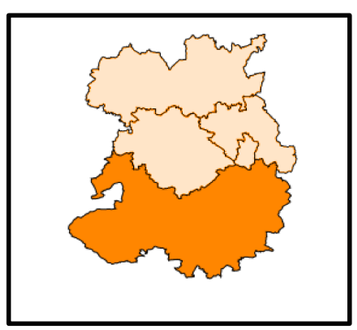
A late summer grasshopper
(c) Sarah Jameson

Ludlow constituency map

The Ludlow constituency, covered by this Plan, covers a large, very rural area (600 square miles) in the south of Shropshire with a population of 85,112 (source: Who shall I vote for). The main market towns are Ludlow and Bridgnorth (populations of 10,000+) and towns with less than 5,000 include Bishops Castle, Broseley, Church Stretton, Cleobury Mortimer, Clun, Craven Arms and Much Wenlock. On the north east border (just beyond Broseley) is the Ironbridge Gorge, well known for its part in the Industrial Revolution.



Map of Shropshire showing the Ludlow constituency in the south of the county.



Foreword: Dr Ken Addison

The weather is one of our most popular opening conversation lines and we can experience two or three different 'seasons' in one day, due to Britain's location in the path of capricious Atlantic atmospheric and ocean currents. Climate is the average weather from real seasons to seasons and year to year. Both undergo change - a reason given by citizens and politicians sceptical, or downright dismissive, of Anthropogenic (human-induced) Climate Change. Going further, proud in their knowledge of a recent Ice Age - with mammoths roaming the Shropshire Hills just 12,000 years ago - they claim there is nothing unusual about unseasonal weather and climate today!

However, Earth's natural scientists make fundamental distinctions between 'natural variability' and Anthropogenic Climate Change, evidenced from deep ocean, ice sheet & land-based sediments and atmospheric gases. These show that Greenhouse Gases (GHGs) - permitting sunlight to reach Earth's surface whilst slowing outgoing radiation - have increased from natural long-term peaks of 285 ppm to 419 ppm today, or 457 ppm CO_2 equivalents (CO_2e) with other GHGs such as methane, in just the past 150 years. Earth's atmosphere is 3° C warmer than at any time in the past 3 million years - before the Ice Age and when our African ancestors began to walk upright in response to Climate Change.

Scientists are virtually unanimous: Climate Change and impacts in the past 150 years of global industrialisation, intensive farming, land use changes and population growth, now occur scores or hundreds of times faster than anything in previous Earth history. We experience more intense rainfall, flood frequency, wildfires, coastal storm surges, abnormal weather etc.

After the first Assessment Report (AR) of the Intergovernmental Panel on Climate Change (IPCC) in 1990, the evidence convinced 154 national governments (now 192) to sign the United Nations Framework Convention on Climate Change in 1992, binding members to *"Act in the interests of human safety, even in the face of scientific uncertainty, and seek the stabilization of greenhouse gas (GHG) concentrations in the atmosphere at a level that would prevent Dangerous Climate Change."*

Since then, 4 more ARs - with the 6th due this year - demonstrate that GHG emissions continue to increase exponentially, slowing briefly after the 2008 financial crisis and the 2020-21 Covid-19 pandemic. Earth is now within 1.5 - 2.0° C of Dangerous Climate Change, projected by 2034, with catastrophic and irreversible consequences. SSCA Report authors, members and many of its readers, are familiar with this evidence-based science, which we should continue to defend against groundless counter-arguments.

What is crucial now is what we do about it. The road between 1992-2021 is littered with insufficient international action - the original 1997 Kyoto Protocol to reduce GHG emissions was not fully enacted until 2007, the 2009 Copenhagen Conference of national Parties (COP 15) failed to agree a Kyoto 2 intended for 2012, and the much-vaunted 2016 Paris Accord (COP 21) only 'succeeded' by allowing countries to set their own Nationally Determined Contributions (NDCs). Current signed-up commitments will only limit Global Warming to +4° C!

Reasons include international governments' failure to grasp the real risks, reluctance to lose competitive advantage by acting faster than others and downright

disbelief. Donald Trump's withdrawal of USA (second largest GHG source) from the Paris Agreement is the prime example but even in the UK, Margaret Thatcher's Secretary of State for the Environment's firm grasp of *"The principle of sustainable development, to which the United Kingdom is committed, faces possibly its greatest challenge in man-made Climate Change ...."* became, in a more recent Environment Secretary's opinion, that *"People get very emotional about this subject and I think we should just accept that the climate has been changing for centuries."*

Huge responsibility now rests on the 2021 COP 26 in Glasgow, with governments outbidding each other with extravagant emissions reductions targets but insufficient direct leverage to deliver. Targets are easy - delivery more difficult. Many excellent technical developments mitigate (reduce) GHG emissions. Renewable energy and carbon sequestration by the biosphere lead the way, but others such as carbon capture and hydrogen fuel lag behind. We must accelerate Net Zero Carbon targets, balancing emissions with sequestration, with truly Sustainable Management of Natural Resources (SMNR) and Nature-Based Solutions essential to avert Dangerous Climate Change. Less success will require more adaptation to counter Climate Changes already in hand and yet to come, at considerable expense and with human life and socio-economic costs. That depends on our adaptive capacity and resilience to respond and rebuild after environmental, social and economic damage.

So how can we in Shropshire make any impact on global emissions through mitigation and adaptation when the UK contributes only 1.1% global GHGs. Are international targets enough ? - possibly; will they be achieved ? - probably not. Doing nothing is no option, and if we don't act why should anyone else ? At no time has the epithet *Think global - Act local* been more pertinent and our response to Covid 19 shows the way. Lockdown and vaccination don't just safeguard individuals but also communities. The same citizen response is essential now, acting to reduce our GHG footprint and lobbying not only government but our industries, corporations and land managers continuously until they get the message fully and act to deliver these vital objectives. Moreover, our dedication will help inspire other communities.

This is why this *Next Steps* Report is so important - an excellent, detailed, well-thought-out and essential road-map of what we can do over four main themes - and I commend it to you.

Dr Ken Addison
Emeritus Fellow in Earth & Climate System Science, St. Peter's College, Oxford University and South Shropshire Resident

I leave you with this stark summary from *Global Catastrophic Risks**

"The science of Climate Change is complex. But it is simple compared to the economic and political challenge of responding to it. The market failure that leads to global warming [like the global financial crises] poses a challenge for two reasons."

"Both crises have the same cause: those who exploit the resource demand impossible rates of return and invoke debts that can never be repaid ~ and live in collective denial over their likely consequences. Both crises also feed each other through the application of common rules ~ unsustainable resource extraction at rates beyond those of replenishment causes eventual stock collapse."

(*Edited by Nick Bostrom & Milan M. Ćirković, Oxford University Press, 2008)

Introduction

South Shropshire Climate Action (SSCA) began in the House of Commons when in June 2019 Shropshire residents responded to a national lobby of MPs on the Climate Emergency organised by a group aptly called 'The Time Is Now'. Meeting Philip Dunne, MP for Ludlow, acted as a mass introduction with David Luckhurst suggesting a follow up meeting in Shropshire.

After much discussion and many further conversations a public meeting took place in Craven Arms in November 2019. Over 170 people attended and heard a panel speak on the topics of Climate Change as it related to Land, Transport, Energy and Buildings. The event was popular and motivating. A follow up event was suggested with more time for discussion: there was also a desire for practical, focused action.

The group then set about making plans for a major conference, just as the Covid situation was developing in the spring of 2020. We staggered from "waiting to see what might happen" to gradually realising that any meeting would simply have to take place online. Zoom seemed a very daunting prospect at that point. By now the group was meeting regularly, at first in person and by early summer, online.

We were, and are still, a small group of volunteers without any formal organisation, but we have a history and we have a purpose. Our name resolved into South Shropshire Climate Action.

In Shropshire there are many active environmental groups, each has a particular focus, identity and purpose. There is a great deal of cooperation between groups, with many people active in several such as Stretton Climate Care, Lightfoot Enterprises and Ludlow 21, all of whom have been fighting this cause for many years. We also work closely with Shropshire Climate Action Partnership (SCAP).

SSCA's second event, the climate conference, took place online on 26th September 2020 using Zoom and with 119 participants. We gave much thought to whether we should write a plan, a route map, a pathway or a manual and what we launch today, this "Next Steps" Report, is a combination of all these.

The reason for choosing the Ludlow constituency as our geographical reference is that it is a clearly defined area, represented in parliament by one MP. As nearly all of the group are residents of the constituency this seemed both a large and a small area and one that we could look at and make plans for. The constituency boundary includes more than 100 parishes: this presents a marvellous opportunity. Many parishes are already very active. The county has many highly motivated people of all ages and persuasions. This is a great advantage given the challenges we face. This Report is not intended to be narrow or exclusive to South Shropshire in any way, but the definition offers a possible area where change can really happen. Ideas successfully developed or piloted here could be adapted elsewhere.

Last September, our main purpose was to recruit volunteers to working groups to research then write a 'Net Zero by 2030' plan for this area. We have now completed this initial task, thanks to our many dedicated volunteers who have spent much of the 20/21 winter and spring researching, collaborating and writing, having countless meetings and conversations over Zoom to develop our Report. Our huge thanks to everyone involved!

This Report is presented with four themes: Land, Buildings, Transport and Community and running through, under, below, above and truly beyond all these is Nature, which at the moment is in crisis.

We are not trying to invent the old pre-Covid normal but instead offer a route to a greener, calmer, diverse, fair and flourishing Net Zero new normal.

Whatever your worldview, what sort of planet do you want to leave to future generations?

Jane Cullen
Chair, South Shropshire Climate Action
May 2021

Walking on the Long Mynd
(c) Paul Weston / Alamy Stock Photo

Land Management for Climate and Nature

Introduction

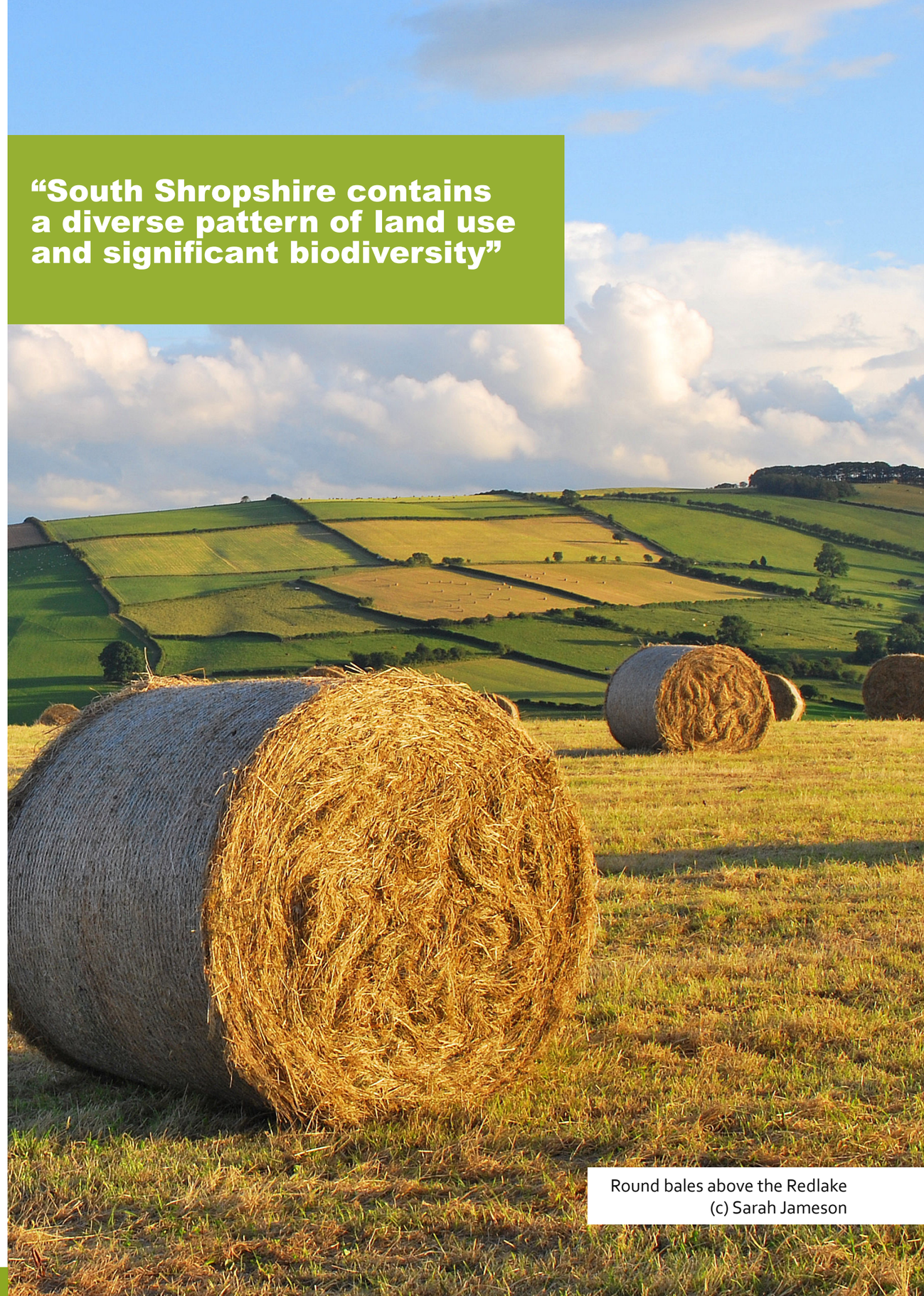
Decades of Government policy, both domestic and European, have created our current land management practices through support payments, incentivised schemes and legislative safeguards.

However, the policy landscape has been unable to keep pace with the challenges presented by Climate Change and whilst it may have prevented the most damaging environmental practices and supported the protection and management of some habitats, it has fallen short in preventing either the climate or ecological crises we face. If we are to achieve the fundamental change in land management practices required to significantly reduce Greenhouse Gas (GHG) emissions and significantly improve ecological health, we need policies and resources that can support that transition.

The economic viability of our land-based industries must be ensured alongside the development of skills and management techniques that enable both the security of our food supply and the delivery of the wider "public goods" that result from land management, especially carbon sequestration and biodiversity. We will not achieve Net Zero across the UK economy without the contribution that farming, forestry and the green infrastructure can make to carbon sequestration and Shropshire's land use will be required to support national goals, but it must be resourced appropriately.

Post-Brexit land use policy includes the Environmental Land Management Scheme (ELMS) and Nature Recovery Networks. The initial proposals for ELMS were ambitious and far reaching, aspiring to deliver multiple public goods. However, there is growing concern first, that the final product will lack the urgency and ambition required and secondly, that ELMS will not address whole farm systems and will not be accompanied by adequate advisory support. Local experience shows that farmers respond to advice from trusted

"South Shropshire contains a diverse pattern of land use and significant biodiversity"



Round bales above the Redlake
(c) Sarah Jameson

advisers provided the advice is tailored to their situation and properly integrated, balancing agriculture, the environment and economic viability.

In this Report we are arguing for a greater focus on environmentally positive farming systems - those based on ecological and agricultural integration, such as organic, pasture-fed and Regenerative - rather than continuing to view food production objectives and environmental gain as being in opposition to each other and land being segregated accordingly. In the local context these systems are characterised by mixed farming, the use of legumes to fix nitrogen, high biodiversity for soil nutrient cycling and pest control, effective recycling of nutrients, lower inputs, minimal or no use of pesticides and avoidance of over-stocking – systems which already integrate production and ecological objectives. We are building on this in advocating a fundamental shift in the way we value and manage land through the adoption of high Nature value farming systems.

An agroecological, multi-functional, land management approach will deliver multiple public goods: food, fibre, timber, wildlife, recreation, rural jobs, reduced GHGs and improved water quality and flow.

Furthermore, local farmers have indicated they are willing to deliver these; consultations conducted via Land, Life and Livelihoods in the Clun Forest have shown significant support for food production in ways that lead to environmental gain. But farmers need the resources to support this transition, both financial and advisory, and they will also need public support. If we want to arrest Climate Change and loss of biodiversity, we all have a part to play, through our roles as customers, consumers and advocates for change.

In writing this Report we have taken account of the major national debates affecting land use and food: for example, land sparing or land sharing, the role of ruminants, the impact of our dietary choices on food production. We are also aware that predicting the impacts of different land management techniques on either Climate Change or biodiversity is subject to wide margins of accuracy and is often a contested, rather than an exact, science. See for example, Garnett et al, 2017 and Sustainable Food Trust, 2021

Our approach, therefore, is to suggest a menu of opportunities rather than a blueprint, taking into account the unique location that is South Shropshire.

We support our approach with available evidence. We are not anticipating that everyone will agree with everything we have written (within the drafting group we had a broad spectrum of opinions). However, we hope to stimulate debate without being doctrinaire and that our discussions will lead to practical local actions that make a difference.

Our thinking is presented in four sections:

A. Land management and the local economy – the factors that have influenced local land use, and the significance of land management practices.

B. Policy drivers for change – how future policy may impact on local activity, and what policies need to address.

C. Land management for climate and biodiversity – practical measures to reduce emissions and produce food in environmentally friendly ways.

D. The impact of food and food waste – the link between local land use and consumer demand, exploring how communities can support a transition to local procurement and environmentally friendly food production.

Land Management: Our Key Messages

♦ Work with local stakeholders to generate and deliver local solutions.

♦ Do no harm, protect our existing fauna and flora, trees, woodland, rivers and hedges.

♦ Recognise that Nature exists everywhere and that all land is a habitat for some form of life.

♦ Provide help and advice to all land managers wanting to care and conserve.

♦ Stop emissions from modified peatlands, and reverse this into becoming a carbon sink by rewetting these soils.

♦ Link those areas of habitat that are in favourable condition and restore those that have deteriorated to create a Nature Recovery Network.

♦ Reduce emissions from energy use in farming, including in vehicles, buildings, use of materials and bought in resources.

♦ Improve the biology of local soils by reducing compaction and soil run-off, manage soils to improve soil health and fertility.

♦ Reduce Greenhouse Gas (GHG) emissions from methane and nitrous oxides, through management of livestock, manures and fertilisers.

♦ Increase carbon sequestration by increasing soil organic content, and tree and woodland cover in ways appropriate for the local landscape.

♦ Naturalise existing watercourses, create more diverse riverine habitats and employ natural approaches to support flood alleviation. Be prepared to reverse some past drainage.

♦ Ensure that farmers are rewarded for the quality of the food they produce and for delivering public benefits, enable policy drivers to support a low carbon and high biodiversity trajectory.

♦ Improve people's access to, and connectivity with, their local natural environment to improve health and well-being and generate local support for farming-led initiatives.

(c) Energy Diary, Lightfoot Enterprises (Angela Martin)

A. Land management and the local economy

Land management is an important economic activity. 2018 data for Shropshire showed:

- Accommodation and food, agriculture, forestry and fishing accounted for 10.35% of employment, though this will be higher in South Shropshire.

- Agriculture, forestry and fishing accounted for 21.5% of Shropshire's businesses.

- There were 3,719 registered holdings (a 7% increase from 2013). A holding is a place where livestock are kept or handled in pursuit of an agricultural activity including farms, markets, abattoirs or showground. It is not the same as, but is indicative of, the number of farms.

- The area of farmed land had declined by 2% since 2013 to 264,325 ha.

- 9,731 people worked in agriculture, a rise of 5% since 2013 mainly due to increasing numbers of part time farms, casual workers, and regular part-time workers though overall the workforce had declined by 31% since 1985.

Agriculture provides a significant source of demand for businesses in the wider economy including wholesalers, energy supply, fertiliser and plant protection products, vehicles, construction, haulage, veterinary products and financial and professional services, estimated to be worth £15.3bn to the UK in 2015 (NFU, 2017).

South Shropshire contains a diverse pattern of land use and significant biodiversity. Of the 27 landscape types recognised within the Shropshire Landscape Typology, 18 are found in the Ludlow constituency (Shropshire Council, 2006). Landscape character is composed of elements that reflect natural features and processes:

- **Geology** – Shropshire is the most diverse county for geology, no other area of equivalent size in the UK exhibits the same degree of geological variation.

- **Landform** – largely determined by geology as older, harder rocks, tend to be more resistant to erosion and form areas of more prominent and dramatic topography, whilst younger, softer rocks tend to underline areas of lower ground.

- **Soils** – formed by the weathering and breakdown of underlying rocks and drift deposits. Soil chemistry (fertility and acidity), depth and drainage are key attributes determining what vegetation soils may support. In common with the rest of the UK, Shropshire's peatlands are a valuable carbon sink.

Landscape character is also affected by cultural activity, how humans have impacted:

- **Settlement** – dispersed or nucleated.

- **Woodland and tree cover.**

- **Land use** – reflecting the physical factors affecting agricultural productivity, leisure, the built environment, biodiversity, carbon sequestration, soil type and relief.

The landscape is strongly influenced by socio-economic factors as it is a product of human agency, formed in response to cultural, economic and technical drivers. These are important considerations when addressing Climate Change and biodiversity because some targeted approaches (eg doubling woodland cover) or more radical suggestions for land use (eg removing all grazing animals) would significantly affect the landscape and the values that people attach to it, and impact on local economic viability. Locally, the ecosystem depended on limited numbers of native herbivores, plus predators and scavengers and, in a largely farmed landscape, the proxy for these native herbivores are domesticated livestock.

England is divided into 159 National Character Areas (NCA) based on the combination of landscape, biodiversity, geodiversity and economic activity, following natural rather than administrative boundaries. South Shropshire contains elements of 4 NCAs (Table 1). The South Shropshire landscape(s) exist today because of how they have been farmed. There is room and need for improvement to address both climate and Nature, but it is largely a designated "beautiful" landscape on the back of generations of human endeavour. The west of the area is classed as a Less Favoured Area (LFA - see Table 2), shaped in part by traditional family farming systems based on mixed (cattle, sheep and crops) farming practices. A sustainable land use strategy must recognise the inheritance of stewardship that has generated such a diverse and beautiful landscape.

Parts of the area are protected through legislation or schemes which promote management practices (Table 2). What these designations indicate is that farming is taking place within some of the most valuable environmental settings, but often in challenging physical conditions, and that options for change must be considered within the parameters of what the natural environment can accommodate without further harm.

Our priority must be to value what already exists and enable a transition to more effective ways of reducing GHG emissions whilst protecting and enhancing biodiversity.

Lleyn sheep above Mainstone (c) Sarah Jameson

Table 1: National Character Area profiles for South Shropshire

Shropshire Hills NCA	A landscape of rugged and mostly bare-topped hills, contrasting with mixed agriculture in intervening valleys and dales. A tranquil landscape of national importance flowing into the neighbouring hills of Clun and North West Herefordshire Hills to the south, but contrasting markedly with the flat and lowly undulating Shropshire, Cheshire and Staffordshire Plain NCA to the north. It stands above and overlooks a complementary landscape of rolling landform, intricate field patterns, and the parklands and numerous woodlands of the Mid-Severn Sandstone Plateau to the east. It is characterised by relatively wild hills and ridges.
Mid Severn Sandstone Plateau NCA	Located in the central catchment of the Severn and the lower Stour rivers, a national watershed between the north-easterly flowing River Trent and the south-westerly flowing River Severn. Predominantly rural and important regionally for food production, with large arable fields in the central and eastern areas, and remnant areas of characteristic lowland heathland. Parklands provide an estate character in places. Drained by fast-flowing tributaries of the Worfe and Stour resulting in many steep-sided, wooded dingles throughout the NCA. The main river is the fast-flowing Severn.
Clun & North West Herefordshire Hills NCA	An undulating, tranquil, rural and sparsely populated area, divided by the river valleys of the Clun and Teme. Higher land is typically wind-swept heath and grassland bordered by areas of small-scale, irregular enclosure and slopes down to the Herefordshire Lowlands NCA to the south-east, typically with plantation and native woodland on the hill tops and upper valley slopes. Valley heads are narrow and deeply incised, with woodland on the steepest slopes. The River Teme is an SSSI* for its important flora, fish and invertebrate fauna and includes the River Clun SAC, designated for freshwater pearl mussels.
Teme Valley NCA	Primarily in northwest Worcestershire it extends into Shropshire. The River Teme (see above) is nationally important for Nature conservation. The area is a mosaic of mixed agriculture, cultivated in places but less improved on the steeper slopes.

** For descriptions of SSSI and SAC see Table 2*

Nordy Bank looking back across Corvedale
(c) Craig Cooper (Unsplash)

Up on the Stiperstones (c) Sarah Jameson

Land Management

Table 2: Statutory land-use designations in South Shropshire

Area of Outstanding Natural Beauty (AONB) The Shropshire Hills AONB is the only designated AONB in the county, covering 23% of Shropshire and over half of the Ludlow constituency.
National Nature Reserve (NNR) The Stiperstones is one of three NNRs in Shropshire. Comprising the major part of the Stiperstones Ridge, it is noted for its heathland, upland oak woodland, acid grassland, hay meadows, mire and swamp, providing a variety of upland habitats and refuges for many upland species at the edge of their range.
Special Areas of Conservation (SAC) SACs are European designations and form a network of sites containing habitats and species listed within the European Habitats Directive. SACs in South Shropshire include the River Clun, The Stiperstones and The Hollies
Natura 2000 Sites Natura 2000 consists of a network of sites selected to ensure the long-term survival of Europe's most valuable and threatened species and habitats.
Sites of Special Scientific Interest (SSSI) South Shropshire contains more than 50% of Shropshire's SSSIs, designated in UK law because they provide habitats for rare or endangered species.
Less Favoured Area (LFA) A significant area to the north east and west of Bishop's Castle has LFA status. Introduced by the European Union in 1975 to support farming where production conditions were difficult; mainly upland areas where the natural characteristics (geology, altitude. climate) make it more difficult for farmers to compete and which are generally suitable only for extensive livestock production and for growing of crops for livestock feed. LFAs are subdivided into Disadvantaged and Severely Disadvantaged.
The Moorland Line The Moorland Line was established in 1995 as a means of establishing eligibility for a European subsidy concerning livestock extensification. Moorland is defined in terms of the vegetation present, which must be predominantly semi-natural upland vegetation, or predominantly made up of rock outcrops and semi-natural vegetation and is used primarily for rough grazing. It includes both open moors and enclosed land on the margins of uplands.
Nitrate Vulnerable Zones (NVZ) Three small areas, to the west of Munslow, close to Much Wenlock and west of Meadowtown, are designated as NVZs, which are areas deemed to be at risk from agricultural nitrate pollution. Within these zones there are rules concerning the use of inorganic nitrogen fertiliser and the storage and use of organic manures.
Drinking Water Safeguard Zones Land to the south and east of Bishop's Castle is designated as a Drinking Water Safeguard Zone for surface water, in which the use of certain substances (principally pesticides) must be carefully managed to prevent pollution of raw water sources that are used to provide drinking water.

(continued from p 25) Some locations have multiple designations, such as SAC, Natura 2000, SSSI etc. More detailed assessments of the local landscape and its natural capital (see below) are found in the Shropshire Landscape Typology (Shropshire Council, 2006) and the Natural Capital Atlas. The latter applies national indicators to the distribution and condition of natural assets to inform local decision-making. See also the interactive websites:

- https://magic.defra.gov.uk
- https://environment.data.gov.uk/farmers

Although legal protections are in place, these have not been influential enough to arrest overall decline in biodiversity. English targets for protected sites, such as SSSIs, were that 50% should be in "favourable" condition by 2020 and at least 95% in "favourable" or "recovering" condition (Defra, 2011), in practice there has been a net decrease, from 44% of SSSIs in "favourable" condition in 2003 down to 38.9% in March 2020.

Much of post war agricultural policy was understandably focused on increasing food production, though with little reference to biodiversity and the lack of protection outside of designated areas has led to significant decline in what were once common native species. In recent decades this gradually changed with, for example: the introduction of the Environmentally Sensitive Areas (ESA) Scheme in 1987 which offered incentives to encourage farmers to adopt agricultural practices that would safeguard and enhance areas of particularly high landscape, wildlife or historic value; and agri-environment payments as part of the Agenda 2000 CAP reforms (referred to as Pillar 2). These have been significant in South West Shropshire which hosted an ESA pilot in 1987, followed by 10-year agreements in the Clun and the Shropshire Hills, and then Countryside Stewardship schemes a decade later. This is reflected in the species records, which are richest for the Clun Forest area. However, many farms across South Shropshire were not beneficiaries of these targeted approaches.

The UK Government's commissioned report on the economics of biodiversity (Dasgupta, 2021) makes the following points:

- Our economies, livelihoods and well-being all depend on our most precious asset: Nature.

- We have collectively failed to engage with Nature sustainably, to the extent that our demands far exceed its capacity to supply us with the goods and services we all rely on.

- Our unsustainable engagement with Nature is endangering the prosperity of current and future generations.

A greater emphasis on the links between food production and environmental quality is set to continue with post Brexit land management policies (see below).

Nature Recovery Networks

Nature Recovery Networks are being proposed by Government to reverse the general decline in biodiversity that has occurred. The Defra 25 Year Environment Plan (Defra, 2018A) provides a vision for a national Nature Recovery Network:

"The concept for the Nature Recovery Network is simple. Our existing protected sites constitute our best areas for wildlife and provide many other economic and social benefits. They should form the core of any

future network. However, for Nature to recover we have to also look beyond protected sites and take action to extend and link our existing sites, both to support wildlife and to recover the range of economic and social benefits that Nature provides."

The ecological principles for restoring resilient habitat networks were set out in the Lawton Report, published over a decade ago (Lawton et al, 2010).

"The essence of what needs to be done to enhance the resilience and coherence of England's ecological network can be summarised in four words: ***more, bigger, better and joined.*** *There are five key approaches which encompass these, and also take account of the land around the ecological network. We need to:*

- *Improve the quality of current sites by better habitat management.*

- *Increase the size of current wildlife sites.*

- *Enhance connections between, or join up, sites, either through physical corridors, or through 'stepping stones'.*

- *Create new sites.*

- *Reduce the pressures on wildlife by improving the wider environment, including through buffering wildlife sites."*

The debate has largely focused on the designation, protection and enhancement of wildlife sites. Whilst some of these are in public ownership, most are on private land (particularly farmland) and rely on their owners to manage them sympathetically. The debate has sometimes been characterised as a dichotomy between:

- **Land sparing** where productive land is intensively farmed to maximise output, allowing other land to be left to Nature, or:

- **Land sharing** where farmland is used for food production but with environmental objectives built in.

However, developing Nature Recovery Networks requires both approaches: where land available for Nature is linked by areas in which food production takes place integrated with Nature. It is important that we do not perpetuate the idea that wildlife of any value only exists within specially designated sites - and that we promote wildlife on all possible land.

A survey involving four farmer groups from four different countries, but with the UK participants consisting of livestock farmers belonging to Land, Life and Livelihoods in the Clun Forest (see Appendix A) confirm that the majority of local farmers wish to farm in ways that also benefit Nature (UK Farmer Group Discussion Network, 2021). To quote from the report:

"Land sparing is a dangerous road. It will give licence to intensification/further habitats and species losses in the farmed areas. Dead agricultural landscapes will be the acceptable price for wilderness areas.

Nature in farming is good for farming too. It is more resilient. Fewer pesticides (are needed) if we use natural pest predators. Crops will be less prone to infection, not more.

It is critically important to have policies that encourage including Nature in farming."

The creation of an effective Nature Recovery Network affects all land management: farming, forestry, hedgerow maintenance, roadside verges, urban green infrastructure, and gardens. Good habitat

on many upland farms will often be the rough corners, dingles, wet areas, banks and "awkward" bits of land. A focus on production has often led to these either being agriculturally improved for grazing or being left and neglected. However, these are key parts of habitat networks on a farm-scale and "improving" them needs to be viewed through the lens of their asset value as natural capital. This may require protecting them from nutrient run-off or dumping, or relaxing production pressure on the marginal areas to allow them to develop into bigger, better and more connected habitats. These may be a mix of wetland, rough grassland, tall vegetation, scrub, scattered trees or woodland.

Management should be aimed at reinforcing the natural pattern of wildlife habitat rather than imposing something artificial (retaining and enhancing a boggy area with rough grassland and scrub might be better than digging an artificial pond). In most locations natural succession will gradually build up denser vegetation, unless slowed by cutting or grazing.

If more areas were allowed to develop by natural succession across the uplands, especially along stream corridors, it could help create habitat networks and healthier ecosystems. Where open habitats are valuable, such as heathland and grassland, continued grazing will be beneficial, but it should aim to allow variety and structure in the vegetation rather than uniform, short-grazed swards.

The farming practices on the mainly productive areas of the farm will therefore affect the marginal areas, and environmental performance and Nature Recovery Networks require looking at the whole farm operation and not just the "unproductive" parts.

To achieve enhanced biodiversity therefore requires a range of mechanisms to be implemented, all of which will be required to address the ecological crisis:

- Sustainable planning decisions and enforcement action to prevent further harm from occurring.
- Sustainable land-use management practices.
- Government support for conservation with robust incentivisation and advice.
- Linking up key sites with the wider landscape to create wildlife corridors and critical mass of habitat and species.
- Projects that restore and recreate habitats.
- Grassroots action and support from local communities.

Two curlews flying, Stiperstones, from *Upland* (c) Andrew Fusek Peters

Table 3: Priority Habitats in the Shropshire Hills AONB

Habitat	Area (ha)	Habitat	Area (ha)
Upland heathland	3,537.8	Purple moor grass and rush pastures	246.1
Priority Habitat Inventory Other*	2,380.9	Lowland heathland	231.2
Ancient woodland	1,853.0	Upland flushes, fens and swamps	173.1
Lowland dry acid grassland	719.8	Traditional orchard	110.7
Rivers	596.9	Lowland fens	105.2
Wood pasture and parkland	583.6	Lowland calcareous grassland	33.3
Lowland meadows	420.3	Lakes	18.3
Upland hay meadows	7.2	Blanket bog	0.1
Upland calcareous grassland	0.7		

** mainly semi-improved grassland*

South Shropshire is in a good position to begin this process. 13.7% of the Shropshire Hills AONB is characterised as a "priority habitat" (Table 3). However, apart from some large blocks of heathland these are spatially fragmented. Species which are at the margins of their ecological range are threatened by Climate Change, which is driving them northwards and upwards by up to 5km pa within the northern hemisphere as the habitat changes. Therefore, more joined up mosaics (the "network" within a Nature Recovery Network) are required to ensure that species are able to relocate successfully (Rewilding Britain 2020).

High Nature Value Farming systems

An important component of a Nature Recovery Network is the relationship between food production and ecology. To many people they are thought of as mutually incompatible, land is either for food production or for nature conservation. However, in the 1980s organic farming developed integrated farming and conservation systems and standards, and in the early 1990s the concept of High Nature Value (HNV) farming developed, recognising that food production and ecology could be mutually beneficial. As an illustration, traditional hay meadows are a species-rich habitat which have arisen from

the way they have been farmed. They are part of a farming system, not ancillary to it, as are wet, rushy pastures in the uplands, moorland, hedgerows etc. Historically, farm conservation advisers have supported land managers to manage these systems and maintain a balance between the needs of agriculture, environment, economics and animal and human welfare.

In practice, the successful conservation and enhancement of biodiversity depends upon the continuation of these low intensity farming systems, encouraging nature throughout and providing wildlife corridors and networks between areas of particularly high biodiversity, unique habitats or protected species. HNV systems may also effectively provide other public goods such as carbon sequestration and water quality.

The land management lexicon has had a recent addition with "re-wilding". It is, perhaps, an unfortunate term fuelled by media associations with the reintroduction of apex predators across large upland areas. The basic premise, however, is that land management is based on the reinstatement of natural processes and, where appropriate, reintroducing species to create nature-based communities (Rewilding Britain, 2019, 2020). Re-wilding is primarily a form of ecological restoration where the emphasis is on humans stepping back and leaving an area to Nature, as opposed to the more active forms of natural resource management found in most farming and woodland systems.

The term "agroecological" farming is now widely used in policy and research to encompass more ecologically based farming systems including organic, integrated pest management, pasture-fed and regenerative (FFCC, 2020). Organic farming, for example, is a system based on biological processes and management instead of the use of agrochemical inputs. It relies on legumes for nitrogen supply, recycling of manures, mechanical weed control, encouraging natural predators for pest control, and high standards of animal welfare with minimal use of medicines. For further information on agroecological principles consult Agricology, 2021.

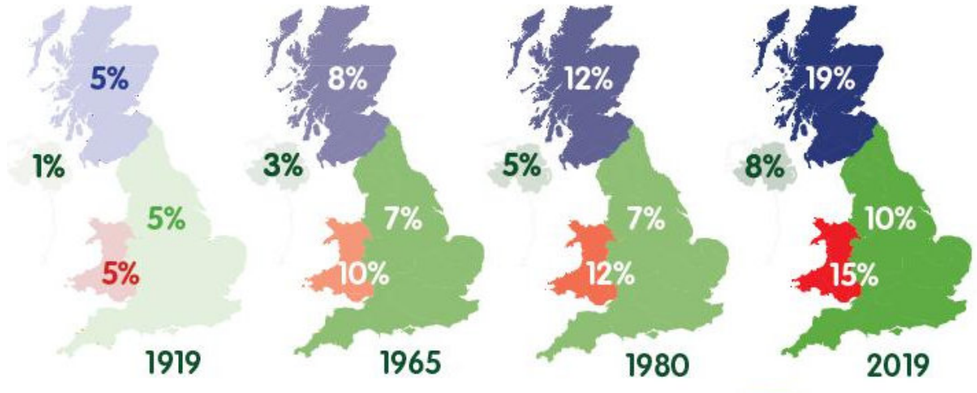
However, agroecological farming is not achieved through introducing a few basic techniques. To be properly implemented it requires a change in the whole management system, in crop rotations, livestock husbandry, the avoidance of damaging inputs, and in increasing diversity and greater reliance on the farms' ecology.

"Agroecology is based on applying ecological principles to optimise the relationships between plants, animals, humans and the environment. Through building these relationships, agroecology supports food production, food security and nutrition, while restoring the ecosystems and biodiversity that are essential for sustainable agriculture. Agroecology can play an important role in mitigating and adapting to Climate Change." (FAO, 2018).

The balance of land uses will need to encompass sustainable food production, habitat protection and restoration, ecological processes, and carbon sequestration. Farmland which has high environmental value will need to be maintained as such by continuing low intensity or sustainably intense farming methods. To achieve this also requires public support, both financially and through social acceptance of what is being proposed, so that farming methods remain both socially and economically viable.

There is growing momentum for supporting an agroecological approach. The pan-European IDDRI study (Poux et al, 2018), Project Drawdown (Project Drawdown, 2020) and "Farming for Change" (Campbell, 2021) all argue for a

Fig 1: Increases in woodland area in the UK over time



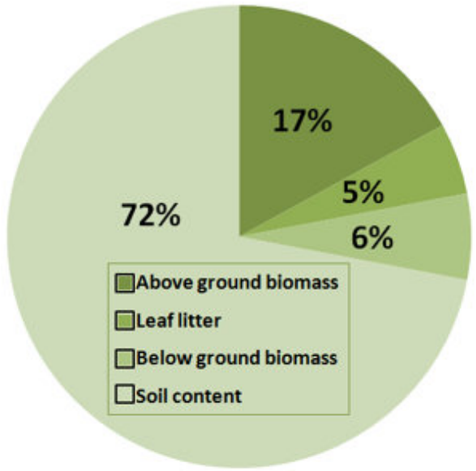
vision that connects food, health, Nature and climate and demonstrate how, with the right enabling conditions, we can grow enough food for a future population, release land for more flexible uses such as recreation and biodiversity and reduce GHG emissions. As a farming case study, the National Trust Estate at Wimpole, in Cambridgeshire, is a lowland arable farm which is being farmed using these approaches (National Trust, 2020).

Woodland in South Shropshire

In the UK it is not possible to grow enough trees to directly offset our carbon footprint, but the contribution of trees and woodlands are important (Committee on Climate Change, 2019, Matthews *et al*, 2020). Of equal or greater significance is the contribution and potential of trees and woodland in the protection, restoration and enhancement of biodiversity (Natural England, 2020, Broadmeadow & Matthews, 2003, The Wildlife Trusts, 2020, NFU, 2019) and in underpinning the resilience of our rural and urban landscapes and habitats against Climate Change.

In 2020, the 3.2 million hectares of woodland in the UK represented 13% of the total land area, comprising 10% in England, 15% in Wales, 19% in Scotland and 9% in Northern Ireland (Forestry Research, 2020). Forestry Commission statistics for Shropshire (Shropshire & Telford & Wrekin Local Authorities) published in 2016 (Forest Research, 2016) gave the county's woodland cover as 9.3% (32,461ha), however this was essentially a measure of

Fig 2: UK forest carbon stock (Kevin Stannard, FC)



woodland > 0.1ha in size and did not account for smaller woodland stands, linear groups and individual trees. The Forest Research urban canopy cover project (Forest Research, 2021), using 35,181 random survey points, indicates a canopy cover of 15.13% (53,221ha) demonstrating the significance of individual and small groups of trees outside woodland.

For South Shropshire, The Woodland Trust have calculated the woodland cover to be approximately 17.6%, broadly corroborated by the Shropshire Council Tree Team's use of the Forest Research project data, this is significantly above the national average but reflects the influences of the topography and landscape characteristics of the area.

This resource is a significant carbon store above ground but even more significantly below ground in woodland soils (Natural England, 2012, West, 2011). Where woodland is managed following good practice (Forestry Commission, 2017, Broadmeadow & Matthews, 2003) it will continue to be a significant carbon sink (Matthews, *et al*, 2020).

Of equal importance is the multifaceted contribution of trees and woodlands to Natural Capital (Defra, 2020A, ONS, 2020) and ecosystem services (Defra, 2018) through providing biodiversity, habitat mosaics and continuity and landscape character, whilst also contributing to the local economy (forestry, agroforestry & tourism) and agroecology (Food, Farming & Countryside Commission, 2012, NFU, 2019). These factors have direct and positive implications for the area's resilience to Climate Change and biodiversity loss and/or net gain, but also to food production (Burgess *et al*, 2019), flood mitigation (Environment Agency, 2017B) and drought resistance.

Different habitats have different potential to store carbon, but woodland offers the greatest potential to increase storage by new planting. In all habitats, soils represent the most significant permanent carbon store. Therefore, whilst planting trees will affect the carbon balance, woodland management is crucial to ensure soil stability and re-planting when trees die.

Woodland creation and management

Although South Shropshire currently has higher tree cover than the national and county average, we support the broader aspirations for significant increases in both the area and functionality of trees and woodlands locally (Confor 2019, Shropshire Wildlife Trust *et al*, 2020). However, given the existing area of woodland in South Shropshire this may best be achieved through extensive but smaller scale woodland creation that complements the existing woodland and land use mosaic, seeking to merge, buffer and improve the existing infrastructure of stepping-stones, habitat corridors and Nature Recovery Networks, with particular consideration for important habitats such as ancient woodland and wetlands. There needs to be emphasis on the integration of woodland, wood pasture, trees and hedges into farmland; this mutually beneficial approach is more likely to be adopted by farmers, for example creating shelter and providing browsing for animals.

This will require greater incentivisation and uptake of these incentives for farm woodlands (Food, Farming & Countryside Commission, 2021, Defra, 2018), agroforestry and agroecology. To ensure that new woodland creation is sustainable it should adopt the principles of "the right tree in the right place" (Forestry Commission, 2017, Forest Research, 2021, Forestry Commission, 2020, Burgess *et al*, 2019, Forest Research, 2018, Whittet *et al*, 2019).

Young trees on Park Hill, Treverward (c) Sarah Jameson

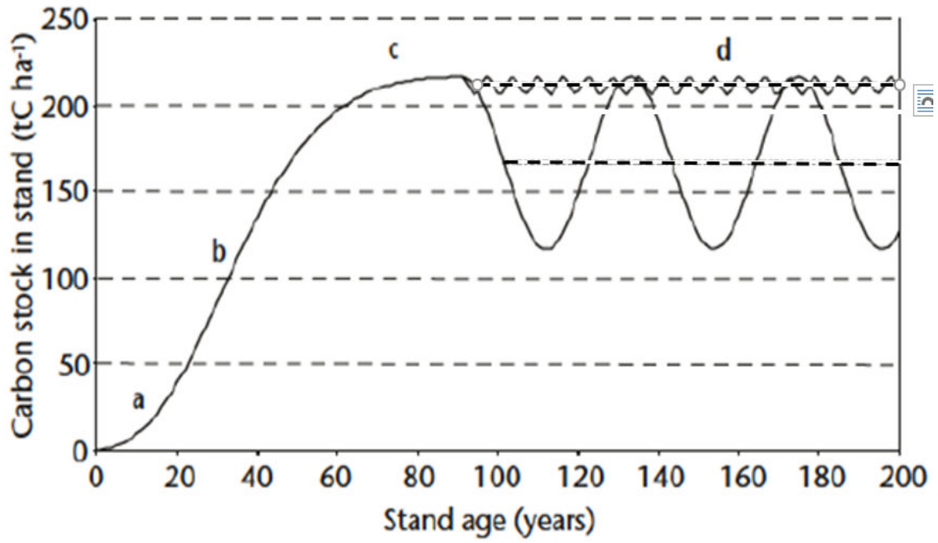
Table 4: Carbon stocks average estimates by broad habitat

Habitats	Carbon stock in soils (t Cha^{-1})	Carbon stock in vegetation (t Cha^{-1})
Dwarf shrub heath	88	2
Acid grassland	87	1
Fen, marsh and swamp	76	?
Bog	74	2
Coniferous woodland	70	70
Broad leaf, mixed and yew woodland	63	70
Neutral grassland	60	1
Improved grassland	59	1
Arable and horticulture	43	1
Coastal margins (UK)	48	?

There is no similar data for marine habitats in England or the UK. Data on terrestrial habitats soils from CS2007 in England (Note: CS2007 figures are from 15cm depth soil samples); on coastal and marine habitats from NEA 2011 UK-level; on vegetation from Ostle et al 2009, except for woodlands which comes from Broadmeadow and Matthews 2003 and it is an average for 50 years rotations. Source: Natural England (2012) NERR043 table 7

The benefits of tree and woodland management on biodiversity, GHG offsetting and carbon sequestration are variable, and not necessarily subject to constant growth. They are affected by a range of natural influences and cycles of growth and decline, and the effects of commercial rotations. Whilst a large portion of South Shropshire's woodlands are in some form of formal management, a significant percentage are not (Hemery *et al*, 2020), meaning that measuring or assessing the quality of woodland's contribution to Climate Change and biodiversity is imprecise. Whilst minimal or non-intervention management might be beneficial for biodiversity initially, unmanaged woodlands eventually reach a state where the above ground carbon stock reaches an equilibrium due to natural cycles of growth and decline. The same is true of managed woodland where carbon stock is removed and regrown on a regular rotation (Broadmeadow & Matthews, 2003). The capacity of a site to support trees coupled with the specific growth rate and density of the stock affects the speed with which mean annual growth increment per hectare can be accrued. Therefore, finding appropriate site-specific management practices can maximise both

Fig 3: An example of carbon accumulated in a newly created stand of trees



*Four phases of growth or carbon sequestration can be seen: **a**: establishment phase: **b**: full-vigour phase; **c:** mature phase; **d**: old growth phase. Looking over several decades it is evident that, following an increase in carbon stock on the ground due to the initial establishment of stand, carbon stocks neither increase nor decrease because accumulation of carbon in growing trees is balanced by losses due to natural disturbances and decay of wood on site. Two examples of carbon dynamics with differing degrees of natural disturbance and thus long-term equilibrium carbon stocks are illustrated. The long-term average stock, as based on the two disturbance scenarios (dashed lines) is estimated to lie in the range 170 to 220 tCha^{-1}. The estimates up to the age of 80 are representative of a stand of general yield class 12 Sitka spruce and have been made using the CARBINE Carbon accounting model. Source: (Broadmeadow & Matthews, 2003)*

Wood Anenomes
(c) Sarah Jameson

Traditional hedge-laying
(c) Sarah Jameson

the rate of carbon sequestered (timber production) and biodiversity.

Aspirations set out in the Government's policies and guidance (Defra, 2020, Defra, 2018, BEIS, 2018, Forestry Commission 2005, 2019, 2020) on resilience and biodiversity seek for appropriate and sustainable management that maximises the benefits of the natural capital provided by trees and woodland. The primary guide for sustainable woodland management is The UK Forest Standard (UKFS) (Forestry Commission, 2017). Increased management in compliance or compatible with the UKFS should be encouraged through example and through accessible incentives, training and guidance to managers of woodland of all sizes and through the support and creation of sustainable markets for UK provenance woodland products. This in turn will improve access to woodlands, opportunities for relevant education and employment opportunities in rural areas like South Shropshire (Hemery *et al*, 2020, Defra, 2005, CONFOR 2019, FCCWG, 2018).

The significance of hedgerows

A hedgerow is defined as any boundary line of trees or shrubs over 20m long and less than 5m wide, and where any gaps between the trees or shrub species are less than 20m wide (JNCC, 2011). The hedgerow habitat includes any trees within it and the herbaceous vegetation up to 2m from its centre. Hedgerows are an integral part of the landscape character of the area, and with the exception of woodland it is only in the upland areas of the Clees, Stretton Hills, Stiperstones and Clun Forest that they give way to open landscapes. Unfortunately, encouraged initially by Government grants in the '50s and 60s, hedgerows have been removed at a faster rate than they have been created and in some parts of the UK 50% have gone or are so badly managed that their value to wildlife is significantly reduced (RSPB, 2021).

In South Shropshire the retention rate has been higher than other parts of the county, even so hedge management is variable. Hedge management is difficult, skilled work and can be done well or badly. The value attached to hedgerows also varies; on livestock farms they form crucial stock barriers, provide shelter and thereby support animal health. On arable farms they can be viewed as impediments to economies of scale, though they contribute to reducing wind erosion and provide habitat for beneficial species that aid pollination or disease control.

In the Clun Valley and the Shropshire Hills Environmentally Sensitive Area (ESA) past grant schemes have aided hedge retention and encouraged high standards of hedge management. However, changing management objectives has seen a reduction in the value placed on hedgerows by many landowners and where there is no consideration for long-term hedgerow restoration, rejuvenation or retention, there can be a detrimental impact on the resilience of this green infrastructure (Drewitt, 2020). Nevertheless, hedgerows are important for landscape (visual and historical), biodiversity and Climate Change mitigation (Wolton, 2007, Hedgelink, 2013, CFE 2021, Campbell, 2021, NFU, 2019, 2020). They have a vital role in supporting the complex ecological webs that bind together countryside habitats. This role is recognised and underpinned through the 1997 Hedgerows Regulations (GOV.UK, 1997) their designation as priority habitats (JNCC, 2011) and by encouraging good management through adherence to "cross-compliance" regulations for those wishing to avail themselves of European payments

(RPA, 2020). Rural hedgerows are a priority habitat with 135 associated priority species listed in the UK Biodiversity Framework (JNCC, 2018).

The capacity of hedgerows as carbon stores is estimated at a range (for above-ground biomass) of 15 tonnes of carbon per hectare (tC/ha) for short hedges (up to 1.5m high) and 30-40 tC/ha for tall hedges (up to 2.7m), with a similar amount of carbon in below-ground biomass. A crude calculation value is that UK hedgerows store about 4.8 million tonnes of carbon (NFU, 2020).

Farming and conservation groups offer evidence, guidance and incentives on the financial and environmental benefits of pro-active hedgerow management. This may include allowing hedgerows to grow out, or rotation management that enables sections of a hedgerow to thicken out, flower and set fruit for the benefit of Nature and the surrounding countryside (Hugill, 2020).

Information is available from:

- Nature Friendly Farming Network
- Farm Wildlife
- Championing the Farmed Environment
- Hedgelink UK
- People's Trust for Endangered Species

Water management

Good soil management maintains and enhances water quality and regulates water flow. Soils facilitate the infiltration of water and water storage, thereby influencing the rate of surface run-off and times to peak flow. Conversely, excessive run-off from degraded or compacted soils leads to erosion of topsoil and soil organic matter and depletes valuable nutrients, with negative impacts on soil fertility and water quality. Many of the threats to water quality arise from poor land use practices, whilst effective land management can build resilience against flooding and drought. The Severn Trent Environmental Protection Scheme (STEPS) works with landowners and farmers in priority catchments to improve water quality and enhance water availability (Severn Trent, 2020).

The Flood and Water Management Act 2010 promotes the idea of working with natural processes to reduce flood risk and the development of Catchment Flood Management Plans (CFMPs) incorporates the idea into a policy framework for each river catchment. Natural Flood Management (NFM) is the name given to using natural processes to reduce the risk of flooding and erosion. In many cases these protect, restore and emulate the natural functions of catchments, floodplains and rivers. Examples include river restoration projects, planting woodlands to manage water flow, and soil and water management (Environment Agency, 2017A).

In flood management, NFM is often complementary to, rather than a complete replacement for, built water storage or engineered defences, but it can significantly alter the cost-benefit ratios of planning for floods. NFM operates on a catchment or sub-catchment scale and generally implements three mechanisms:

- Increasing filtration, eg by reducing soil compaction or improving soil quality.
- Storing water, eg by restoring functioning floodplains or retention ponds.
- Slowing flows, eg by creating woodland buffer strips or woody material dams.

Working with Nature also offers considerable opportunity to realise additional benefits such as improvement in water quality, increased resilience to Climate Change, enhanced biodiversity and carbon storage (Scottish Environment Protection Agency, 2015). Local "Slow the Flow" initiatives by the Environment Agency, Shropshire Council and Shropshire Wildlife Trust reduce flood risk by slowing water flow in the headwaters of river catchments hence protecting development downstream (Shropshire Council).

Green infrastructure and gardens

Natural England's People and Nature Survey revealed that almost 9 out of 10 adults reported that the protection of the environment was important to them personally, and almost three quarters were concerned about biodiversity loss (Natural England, 2020).

The nation's gardens, parks, woodlands and rivers played a huge part in helping us during the Covid pandemic, with almost nine in 10 of adults in England reporting that being in Nature made them very happy. Four in 10 adults reported spending more time in Nature than before the pandemic, with health and wellbeing being amongst the main reasons for getting outside. The research also showed how important local parks and green spaces were to the nation's mental and physical wellbeing, with urban green space (such as a park, field or playground) being the most frequently visited natural environment.

However, socio-economic status is related to access to natural spaces – you were less likely to have visited a natural space if you were living in an area of high deprivation, had a low income, a low level of education, or were unemployed. Older people, those from minority ethnic groups or with a long-term illness or condition were also less likely to have visited a natural space.

SOUTH SHROPSHIRE CLIMATE ACTION

Top tips for gardening

In ten tips for gardening in a changing climate, RHS recommends:

- Greening your living space.
- Planting a diverse range of plants, ideally a variety of pollinator friendly plants with different flowering times.
- Adopting new ways of growing, such as green roofs and walls, and reducing the use of petrol-powered tools.
- Attending to water use and management, such as water butts with a larger than standard capacity and selecting plants better suited to the environmental conditions.
- Avoid using peat.
- Compost garden and kitchen waste.
- Adopt the 4 Rs (reduce, reuse, recycle, reinvest).
- Avoid, wherever possible, the use of chemicals and, if required, use chemicals with a low carbon footprint.
- Practice integrated pest management (IPM) ie combinations of good plant biosecurity, biological, cultural and chemical controls to minimise the spread of pests and diseases.
- Ensure that cultivated plants remain in the garden and don't become invasive species.

See also Garden Organic.

The West Midlands had the lowest incidence of people benefiting from visits to the natural environment (52%).

The Royal Horticultural Society (RHS) stress the multifunctional benefits of gardens as: *"multifunctional spaces, important to health and social well-being whilst also supporting the natural environment by helping to sustain wildlife. Gardens also provide important ecosystem services, such as mitigating urban flooding, urban cooling, building insulation, pollutant capture and carbon sequestration."* (Webster, 2017)

Gardens are important, positively because they can provide migration corridors for local species needing to move as the temperature increases due to Climate Change; negatively because non-native species may become invasive and pose a threat to human health, the economy or biodiversity, and because gardens can inadvertently be vectors of pests and diseases.

B. Policy drivers for change

Land use is not only the product of individual farming decisions; it is also influenced by market forces and Government policy. Europe remains the most significant export market for agricultural products accounting for approximately two thirds of the exports by value. The EU's Farm2Fork strategy has recently set targets of a 50% reduction in pesticides and antibiotic use and a minimum 20% cut in nitrogen fertiliser use by 2030, while stating that 25% of European farmland should be organic (European Commission, 2020). The UK is yet to adopt similarly ambitious targets, but it will need to if it is to compete with Europe on environmental ambitions. Domestically, the Agriculture Act 2020 represents a major shift towards the integration of environment and food production. However, there are other policy drivers being developed which will come on stream months, or years, in the future. They include:

- An Environment Act, expected later in 2021

- A National Food Strategy - part 1 has been published, part 2 is expected later in 2021

These policy drivers will bring into greater focus the concepts of:

- **"Public Goods" -** land use providing public benefits for which it is considered appropriate to receive public funding in support, compared to the production of commodities paid for by the market. Public goods may include biodiversity, carbon sequestration, clean water etc.

- **"Natural Capital" -** the analogy is that as you have capital that allows you to purchase things or invest, so the environment provide us with "Natural Capital" and services of benefit to our human existence (clean water, fertile soil etc), referred to as "ecosystem services".

Public Goods and Natural Capital have an economic value. Research commissioned in 2016 to assess the value of Natural Capital within the Marches (Shropshire, Telford & Wrekin and Herefordshire) concluded that the monetised Natural Capital for the area (what you would have to pay to obtain the products that Nature contributed to economic growth) was equivalent to the entire Gross Value Added (GVA) of all the businesses and industry within the area (approximately £15 billion) (Hölzinger, 2016).

In addition to Government policy and the land designations outlined in Table 2, there is a bewildering array of other policies, strategies and schemes that affect local land management decisions, including:

- Recommendations from national advisory bodies on how to achieve Net Zero (Climate Change Committee, 2018, 2020).

- Targets and strategies set by key land use organisations, such as the National Farmers Union Zero Carbon strategy (NFU, 2019).

- The impact of the existing regulatory framework, including planning law, affecting land use infrastructure and practices.

- Local management strategies, delivery plans and targets. For example, the Shropshire Hills AONB and Stiperstones National Nature Reserve have their own management plans, and the Marches Woodland Strategy has set a local target of doubling woodland cover (Shropshire Wildlife Trust, 2020).

- Land-use advisory projects, such as Catchment Sensitive Farming and the Shropshire Pond Creation Scheme.

- Documents and campaigns that may influence public opinion and consumer practices such as dietary choices (Willett, 2019, Blake, 2014).

There is also a considerable amount of activity already taking place within South Shropshire (Appendix A) that both informs the local context and provides a range of essential stakeholders to be involved with delivery. Public perceptions, consumer choices and local community action are important drivers to influence change.

Finally, we must take account of the impacts of Brexit. Land use change will occur because of the changes to farm support taking place as we leave the Common Agricultural Policy (CAP). Nationally, 41% of farms depend on the CAP payments for their economic viability and locally that proportion will be higher given the types of farming and farm sizes. Defra is designing a successor to the CAP known as the Environmental Land Management Scheme (ELMS), due to come into effect in 2024 and transitional arrangements from the EU-based to post Brexit domestic schemes have been announced (Defra, 2020).

Whilst we await the details of ELMS, the general direction of travel is known:

"By the end of 2024 we will roll out our new policy which will be open to all. We envisage three components to Environmental Land Management. Firstly, there will be a sustainable farming incentive which will be open to any farmer and will incentivise participation in farm level measures such as integrated pest management, sensitive hedgerow management and soil health. Secondly, there will be a local environment tier which will incentivise interventions including the creation of habitats, improving biodiversity, tree planting, and natural flood management. And finally, there will be a landscape scale tier which will support woodland creation, peatland restoration and other potential land use changes" (George Eustice NFU AGM, 2020).

The aim is to provide income streams which incentivise more sympathetic and sustainable land use and rebuild the land's ability to provide ecosystem services and proposals include payments to conserve and increase soil carbon storage. Test and trial pilots are informing the design of ELMS, including some within South Shropshire such as the Upper Onny Farmers Group (Appendix A). However, as we stated in the introduction to this section there is growing concern that ELMS will not be as ambitious as it needs to be,

nor that it will be supported by sufficient advisory outputs.

Furthermore, national policy should not be viewed as a panacea. First, however beneficial ELMS may turn out to be, it will be targeted, focused on specific outcomes, and less generous overall than the CAP payments have been. Secondly, simply having policies or legislation in place is no guarantee that this will achieve the desired outcomes, unless there are sufficient resources to back them up. Biodiversity has generally declined throughout the UK and that is in spite of years of statutory designations and schemes.

Many of the statutory protections that exist are poorly enforced. If we take hedgerows as a case study they are, theoretically, protected by the 1997 Hedgerows Regulations (GOV.UK, 1997), their designation as a priority habitat (JNCC, 2011) and the need for good hedgerow management as part of the CAP's cross compliance regulations (RPA, 2019). However, a lack of resources in advisory support, poor levels of enforcement, and changes to land management practices have generally contributed to a significant deterioration in the quality of UK hedgerows.

Therefore, in addition to new policy, it is important to evaluate existing safeguards and ascertain whether they are fit for purpose. Specific proposals regarding hedgerows might include:

- Updating the Hedgerow Regulations 1997 so they reflect the presumption that all hedgerows are important unless there is clear public benefit from their removal.

- Better guidance to land managers on the merits of hedgerows to the farming economy and biodiversity, to encourage better maintenance.

C. Land management for climate and biodiversity

Land use is a significant source of Greenhouse Gases, though what makes it different from other industries is the type of GHGs produced. The sum of all activities that make up the global food system are estimated to contribute some 20-30% of all human Greenhouse Gas (GHG) emissions. In general, most emissions occur at the agricultural production end of the food chain with more than twice the GHG outputs compared to after the food has been produced (ie for processing, storage, transport). Livestock are the most significant contributor to food related GHG emissions though the magnitude and nature of these contributions varies substantially with animal species and location. In general, the foods with the highest overall GHG impacts are ruminant, followed by other meat (including seafood) and animal products (eggs, milk) with plant-based foods having the lowest impacts (see also section D) (Garnett, 2012).

Agriculture accounts for approximately 10% of England's total GHG emissions, equivalent to 45.6m tonnes of CO_{2e} in 2017. However, less than 10% was carbon dioxide (5.6m tonnes) whilst 31% (14.3m t) was nitrous oxide (N_2O) and 56% (25.7m t) was methane (CH_4). Therefore, agriculture requires a different range of interventions than other industrial sectors. Land use is also integral to achieving Net Zero Carbon overall, as the UK national economy will not attain Net Zero Carbon without the contribution that land use can make to carbon capture and storage within vegetation and, especially, the soil.

Approximately 80% of the total carbon found in terrestrial ecosystems is in the soil and the soil's carbon sink (its ability to store carbon) is three times that of the atmosphere, and second only to the oceans. Protecting and managing our soils to increase soil organic content is a critical part of any Climate Change strategy. This was recognised internationally by the Paris Agreement, which launched the 4p1000 initiative - an international commitment to try and increase soil carbon stocks by 0.4% (4 parts per thousand) year on year. The UK Government was a signatory to that agreement.

Good soil is alive, containing bacteria, fungi, algae, protozoa, nematodes and other creatures. These are essential to soil health and crop production. However, they require organic matter to survive, whether other creatures, residues or exudates. There is a necessary cycle in which organic matter added to the soil, for example by photosynthesising plants, will be utilised by these living organisms, leading to the release of carbon dioxide back into the atmosphere. The goal of carbon sequestration, therefore, is not just to add carbon to the soil - which will be consumed by soil organisms and released as CO_2 - but to create the conditions in which a surplus of carbon is retained in a stable form. For example, humus is a form of carbon that can remain stable for years, even centuries,

Soil showing excellent structure as a result of long term pasture management (c) Mark Measures

comprising complex molecules which contain carbon, but which are not easily broken down by soil organisms (Kittredge, 2015).

Studies trying to assess the rate at which agricultural practices can build up the residue of stable soil carbon have to account for large numbers of variables (soil type, climate, agronomic practice etc) and unsurprisingly show diverse ranges. Nevertheless, there are clear directions of travel:

- Perennial growing systems can restore more carbon than most other agricultural methods, and within these pasture-based trials tend to dominate. Grazing of ruminants can improve soil organic levels since grazing promotes the growth, then the sloughing off, of grass roots and animal manures provide both a carbon and microbial source. However, there is a very important balancing act with the stocking density of grazing ruminants since they also generate Greenhouse Gases. Natural England recommend light to moderate grazing levels, both in semi natural habitats and intensive holdings.

- The use of synthetic chemical fertilisers, especially nitrogen and phosphorus, can seriously reduce or even eliminate soil carbon build up. Appropriate use of manures and composts does not do this.

- Bare soil oxidises carbon whilst plants protect it, forming a barrier between the air and the soil and slowing the process of carbon emission.

- Breaking up the soil through tillage or erosion releases large amounts of carbon and can also destroy mycorrhizal fungi (and most tillage requires equipment using fossil fuels). Therefore, we should reduce the disturbance and erosion of terrestrial soils.

- Maintaining and restoring biodiverse native habitats is preferable to (re)creating them (Kittredge 2015, Natural England, 2012).

Agronomic practices such as cover cropping or under sowing crops (to ensure the soil remains covered by plants) and reduced or zero tillage (to minimise soils being broken up and releasing carbon) should assist with carbon sequestration. The photosynthesis of any cover crop is an important source of soil carbon, whilst living, and their biomass becomes available after they die. Legumes are important constituents as are deep rooted plants that interact with the soil at depth. Humus tends to form at depth where clay and mineral deposits exist where soil carbon can become bound and thereby resist oxidation. Reduced or zero tillage is more difficult to achieve because tillage is often a component of weed control and zero or minimum tillage techniques can therefore require increased herbicide usage.

The accumulation of carbon in the soil from crop residues, manures and green manures, may be more important than the negative affect of cultivations on maintaining and improving soil organic matter.

Given the degree of variability involved in managing land, we are suggesting a direction of travel rather than a blueprint, predicated on the belief that the twin challenges of Nature recovery and Climate Change can both be addressed by complementary management practices.

One size does not fit all, and all land management is designed to achieve multi-functional objectives. There are, however, core principles (Table 5) that will enable the integrated management of the whole farming system and not just *ad hoc* practices, encompassing the land in the field, as well as field edges, non-farmed margins, habitats and other areas.

Table 5: Principles of land management strategies for Climate Change and Nature recovery

1.	**Value and safeguard what we already have** before making significant changes. In addition to new woodland, restore existing woodland, maintain tree cover and allow hedgerows to thrive. Expand tree cover in Nature-friendly ways, mimicking natural patterns and using native species.
2.	**Survey for existing conservation interest first** when planning new planting. Consider the suitability of steep banks, upland gullies and streams, field corners, hedges, agro-forestry and wood pasture.
3.	**Avoid simplistic assessments**, land-use is not one-dimensional. Whilst livestock contribute to GHG emissions, they are also important grazing managers and income earners. Existing permanent pasture is a carbon store that needs active management, so consider alternatives such as lower stocking densities, small areas of market gardening etc.
4.	**Prioritise the role of agro-ecological farming systems** based on ecology, diversity, integration of farming and wildlife, and soil biological activity.
5.	**Consider the whole life cycle and effects of the farming system**. Cattle housed indoors may offer better management of GHG emissions, but this may ignore environmental such as inputs, soil and water management, and biodiversity - for which grazing systems may be essential – as well as the emissions generated in producing the inputs used.
6.	**Recognise the importance of economically viable food production**. This may lead to areas being utilised to produce "sustainable intensification" (raising yields), so that other land is available for biodiversity and carbon storage.
7.	Wherever possible, **ensure that multiple uses or values of land overlie in the same place**. Avoid thinking of land as arable, pasture, or woodland, but look at the benefits or "ecosystem services" that come from intact ecosystems on all land.
8.	Riverine management is important for flood management and biodiversity. Where possible, **re-naturalise rivers and enhance river corridors** with tree and shrub cover, which may also involve controlling stock access and restoring floodplain wetlands.
9.	**Maximise community interest in South Shropshire's natural environmental factors** so that people value what it contains and will be encouraged to make behavioural changes to lower carbon emissions. It will require the combined impact of the public, private and voluntary sectors to effectively tackle Net Zero and Nature recovery in the next decade.

A toolkit for change

To provide support for those contemplating specific land use decisions, we have adopted a traffic light approach (based on supporting evidence) in which proposed actions are categorised according to their potential impact. We present our suggestions in summary form in this Report (Tables 6 and 7), and as an online toolkit for use by land managers when assessing the potential of their actions.

Table 6: Summary of proposed actions and their impact - Farmed land

●	Lead to certain high positive gain
●	Lead to some positive gain
○	Are unlikely to have any (or only minimal) impact
●	Lead to a negative impact

		Impact on GHG emissions	Impact on biodiversity
Farming systems	Overall importance	VERY HIGH	VERY HIGH
	Organic/Agroecological	●	●
	IPM/LEAF (a)	●	●
	Mixed farming (livestock and crops) (b)	●	●
	Diverse rotations (c)	●	●
	Agroforestry and woodland integration	●	●
	Intensive livestock (d)	●	●
Soil management	Overall importance	VERY HIGH	VERY HIGH
	Soil health	●	●
	Routine soil analysis (C and nutrients)	●	●
	Nutrient budgeting (e)	●	●
	Carbon sequestration (f)	●	●
Fertiliser management	Overall importance	VERY HIGH	VERY HIGH
	Improving synthetic nitrogen use	●	●
	Controlled release fertilisers	●	●
	Precision fertiliser application	●	●
	Urea replacement/inhibitors	●	○

Table 6: Summary of proposed actions and their impact (continued)

		Impact on GHG emissions	Impact on biodiversity
Fertiliser management	Phosphate fertiliser reduction (g)	●	●
	Better organic nitrogen planning	●	●
	Low emission spreading	●	●
	No nitrogen fertiliser use	●	●
	Optimise soil pH (h)	●	○
Manure management	Use of solid manure	●	●
	Efficient recycling on and off farm	●	●
	Manure management plan timing etc (i)	●	●
	Spring manure application	●	●
	Autumn or winter application	●	●
	Slurry store covering	●	○
	Slurry acidification	●	○
	Slurry aeration	●	○
	Manure store cover	●	○
	Composting of manure (if appropriate)	●	○
Cultivations	Zero tillage (j)	●	●
	Shallow tillage/ploughing	●	○
	Reduced soil compaction (k)	●	○
	Good drainage	●	○
Cropping and pastures	Catch and cover crops (l)	●	●
	Reduced N fertiliser: - Improved N use varieties	●	●
	- Arable legumes in rotation	●	●
	- Legumes in grassland	●	●
	Beetle banks	●	●

Table 6: Summary of proposed actions and their impact - Farmed land (continued)

		Impact on GHG emissions	Impact on biodiversity
Cropping and pastures (cont)	Diverse leys (m)	●	●
	Use of peat in growing media	●	●
	Cultivation of permanent pasture or flood plain	●	●
	Reduced or zero pesticides (n)	●	●
	Reversion of arable land to pasture	●	●
	Grassland cutting dates (o)	○	●
Energy Use	Overall importance	VERY HIGH	
	Fuel use efficiency	●	○
	Low energy crop drying and storage	●	○
	Electric vehicles	●	○
Livestock feeding	Improved ruminent nutrition	●	○
	Probiotic feed additives	●	○
	Nitrate feed additives	●	○
	High fat (lipid) diet	●	○
	NOP feed additive (p)	●	○
	Improved animal health	●	●
	Feed diverse herbal pastures (q)	●	●
	Forage feeding of ruminants (min 60%)	●	○
	Forage feeding of ruminants (min 100%)	●	○
	Breeding selection	●	○
	Improved grazing management	●	●
	Use of feeds with zero impact on deforestation (r)	●	●
	Reduced use of specific veterinary medicines, eg some wormers	○	●
Energy generation	Anaerobic digestion (within an integrated mixed system)	●	○
	Wind (s)	●	○

Table 6: Summary of proposed actions and their impact (continued)

		Impact on GHG emissions	Impact on biodiversity
Energy generation (cont)	Hydro (t)	●	
	Solar (u)	●	○
Biodiversity/ Nature conservation	Whole Farm Plan (species priorities)	○	●
	Woodland maintenance and planting (integrated with farmed land) (v)	●	●
	Shrubs, hedgerow, wood pastures (w)	●	●
	Maintenance of natural pastures, marsh and peat land (x)	●	●
	Re-wilding of improved land (y)	●	●
Marketing	Local sales	●	○
	Public procurement	●	○
Other	Food waste reduction	●	○
	Plastic waste recycling	●	○
	Farm carbon audit	●	○

***Notes**:*

(a) IPM = integrated pest management, as practised in the UK. LEAF = Linking Environment and Agriculture
(b) Location appropriate mixed farming contrasted with continuous cropping
(c) Location appropriate
(d) Especially on systems with insufficient land to spread manure within NVZ regs or RB209 standards
(e) Target no surplus nutrients at field or farm level
(f) Soil used for growing arable, leys and permanent pasture, needs reliable Soil Organic Matter (SOM) monitoring
(g) Currently there is significant excess application
*(h) **Zurovec, 2021***
(i) Including minimising run-off, no field storage of high nitrogen or soluble nutrient manures
(j) Depends on soil type and location
(k) Including no harvesting in wet conditions
(l) No bare soil over winter
(m) Benefits to SOM, structure and fertility
(n) Particularly the most poisonous pesticides
(o) To meet specific wildlife targets
(p) 3-Nitroxypropanol which inhibits methane production
(q) Improved animal health and species for pollinators
(r) Not destroying forests to grow soya
(s) Appropriate siting to avoid risk to birds
(t) Limited application, biodiversity risk
(u) Negative effect on biodiversity of sited in fields
(v) In appropriate locations
(w) In appropriate locations and managed to provide stock shelter, and wildlife habitat and food
(x) No tree planting
(y) Management for specific biodiversity, depends on existing biodiversity

Table 7: Summary of proposed actions and their impact - Woodland management

		Impact on GHG emissions	Impact on biodiversity
Tree planting and woodland creation	Overall importance	HIGH	HIGH
	Native species - commercial forestry	●	●
	Non-native species - commercial forestry	●	●
	Native species - primarily conservation	●	●
	Woodland primarily for recreation or amentity	●	●
	Biofuels	●	●
Woodland management	Overall importance	HIGH	HIGH
	Regular broadleaf (even aged with clear cuts)	●	●
	Regular conifer (even aged with clear cuts)	●	○
	Irregular continuous cover (broadleaf)	●	●
	Irregular continuous cover (conifer)	●	●
	Irregular shelterwood (broadleaf)	●	●
	Irregular shelterwood (conifer)	●	●
	Non intervention	●	●
	Biofuel crops	●	●
	Riparian planting (habitat and flood mitigation)	●	●

D. The impact of food and food waste on climate and biodiversity

Why is food important for Climate Change?

The food we consume contributes to our carbon footprint at every stage of its life cycle:

- **Production -** the fertilisers, pesticides, animal feeds, water usage and energy used to grow or raise food (dealt with in the land use section of this chapter). Typical values are 6-10 calories of fossil fuel expended for every calorie of food produced.
- **Processing -** harvesting crops and dispatching animals, or the energy used in creating processed foods such as dairy products (only dealt with in this chapter if they occur on-farm).
- **Packaging -** emissions from the production of packaging materials.
- **Transportation -** from farm to processing plant, to retail and from retail to home.
- **Storage and cooking -** the electricity involved in storage (e.g. refrigerating) and cooking.
- **Waste -** food thrown away by individual consumers, processors and retailers, also waste at the farm level which can be significant because of the aesthetic/sizing standards of retailers (which consumers accept as "normal").

However, assessing the carbon footprint of food is complex. Most food-related GHG emissions occur at both ends of the life cycle: production and consuming/waste. Nevertheless, emissions from transport are important, air freight can add significantly to the carbon footprint whilst often (but not exclusively) locally produced, seasonal food will have the lowest footprint. Our food choices are arguably one of the strongest levers we have as individuals for altering our impact on Climate Change. Many studies and reports have detailed the GHG emissions from types of food product, generating an "emissions hierarchy" (Table 9). For example: the RMIT University study.

There are, however, important caveats. Whilst foods which tend to have the lowest Greenhouse Gas emissions are plant-based products, the way in which these crops are produced and stored creates large variations in their carbon footprint. For example, purchasing locally produced strawberries in season is likely to have a low carbon impact, whilst purchasing imported strawberries in December will not and refrigeration as a means of storage will have carbon impacts. Furthermore, there may be significant ecological reasons for grazing animals:

- In some areas they are essential to maintaining biodiversity.

- The majority of the land in South Shropshire is grassland.

- Rotational grassland can be an essential component of more sustainable arable rotations, most productively used by grazing with ruminants.

- Under the right circumstances grazing can aid carbon sequestration. (Sustainable Food Trust, 2021).

Although eliminating meat and dairy would bring the biggest savings, a significant reduction in meat and dairy products, rather than their complete elimination, can have a significant impact, estimated to save up to 34% of food production GHG emissions. Selecting lower emitting foods such as chicken and pigs over red meat and lamb will also bring carbon benefits (Blake, 2014). It is important to know how the animals are

Table 8: Summary of local actions for food and food waste

Community support	Reducing carbon emissions via lifestyle choices by providing information concerning meal planning, recipes, growing advice and recycling and supporting local campaigns to shift towards sustainable foods (local, fresh, unprocessed, seasonal, home grown)
Healthy eating campaigns	5-a-day Eatwell
Raising public awareness about food waste	Love Food Hate Waste Feeding the 5000 Disco Soup
The potential for diverting food waste	The Pig Idea
Support local and organic procurement	Initiatives that incorporate the food waste hierarchy into local decision-making, such as the Food for Life Award
Promote food waste collection schemes	For homes, food outlets and redirect for composting, energy recovery or animal feed (where appropriate) and support with the provision of composting tools, demonstrations, materials and community sites.
Reduce food packaging and waste	Encourage producers, processors, retailers and caterers to reduce environmental impacts, improve energy, water and resource efficiency (Data & Marketing Association, 2015)

Table 9: Food emissions hierarchy

Carbon impact of production	Food category
Low	Grains, fruits and vegetables, nuts and pulses
Medium	Non-ruminant meat such as chicken or pork
Medium	Fish, though significant variation depending on species and how they are harvested
High	Ruminant meat

kept since the carbon footprint of some livestock husbandry includes inputs from grain, corn and soya used as animal feed, and the opportunity cost of utilising land to grow animal, rather than human, food. Permanently housed pigs and poultry are also associated with high GHG emissions, including nitrous oxide, welfare conditions unacceptable to many, and sometimes linked to water pollution.

There is significant opportunity for improvement and the promotion of a "healthy" diet, for both people and the environment, bringing Public Health and its resources into the debate about carbon reduction. Globally 63% of people (higher in Western countries) die of chronic diseases such as cancer, diabetes and cardiovascular disease, which are significantly affected by diet. In Shropshire, estimated levels of excess weight in adults (aged 18+) are worse than the England average, and rising (Public Health England, 2019) and 16.6% of children in year 6 are classified as obese. Cardiovascular Disease (CVD) is the most common cause of death, accounting for 35% of annual deaths, and hospital admissions for obesity-related conditions almost trebled in the period 2013/14 to 2017/18.

The links between human well-being and environmental health are becoming better understood and, in general, foods that are associated with the largest environmental impacts, unprocessed or processed red meat, are consistently associated with the largest increases in disease risk (at least in affluent countries), whilst foods generally considered better for health may have the lowest environmental impact (Lancet Commission, 2019).

The importance of food waste

Whilst changing diet has a significant impact on carbon, reducing our food waste by at least 50% would reduce GHG emissions by 13-25% (Blake, 2014). There is significant potential to do this as globally, food waste accounts for more Greenhouse Gas emissions than for the total emitted by any single country in the world except for China and the United States (Food and

A butchers shop in Ludlow
(c) Paul Weston / Alamy Stock Photo

Agriculture Organization, 2013). Within the UK we over-consume by about 15% of our dietary needs, so simply living within recommended dietary intakes would reduce GHG emissions (estimated by up to 19% from food usage alone). The average UK diet is responsible for 150-280Mt CO_{2e} per year from the UK, or between 20-30% of UK emissions (including imported food) (Blake, 2014).

Food waste contributes to Greenhouse Gas emissions both directly (for example as methane emissions from landfill sites where food is decomposing) and indirectly, since waste implies that for a given level of consumption more food needs to be produced than is actually being consumed. Whilst local data is difficult to obtain, we know that Shropshire residents produce an average of 486kg of waste per person per year (Shropshire Council, 2020).

Not all of this is food waste, but a significant component will be: for example, in Powys 16% of waste in plastic sacks is food waste sent to landfill, and an average of 75kg per household is food waste that is recycled (usually via composting). Data for Herefordshire shows:

- 37% of all household waste is food and drink (1.9kg/household/wk).
- 59% of food waste was of a home-compostable type (1.1kg/hh/wk).
- just under a quarter (23%) of the home-compostable food disposed of was within its original packaging.
- 41% of food waste was non home compostable (0.7kg/hh/wk).
- Over half (53%) of the non-compostable food waste was still in its original packaging.
- On average 35% of all discarded food waste (0.65 kg/hh/wk) was still within its original packaging.

(Herefordshire Council, 2019)

A Womens Institute garden in Bridgnorth
(c) MH Country / Alamy Stock Photo

Policy drivers affecting food

There are two significant policy drivers from the UK Government which will impact on local food strategies, starting in 2021 (the National Food Strategy) or coming on stream in 2023 (the Waste Strategy). Whilst these policy drivers are likely to have a significant impact locally, especially on food businesses and the Local Authority, there is still immediate significant potential for local action, building on initiatives already happening in South Shropshire.

1. National Food Strategy

This is the first independent review of England's entire food system for 75 years. Part 1 was published in July 2020 which was an assessment of current issues, including the health consequences of a poor diet. Part 2 is due in 2021 and will contain recommendations on how we might transform the food system to address issues including Climate Change, biodiversity, pollution, antimicrobial resistance, zoonotics and the sustainable use of resources.

2. National Resource and Waste Strategy

In December 2018 the UK Government published a Resources and Waste Strategy for England, introducing measures to bring about a more sustainable circular economy (summarised in Table 10).

3. Public procurement

A third potent policy driver is the leverage of public procurement. Public procurement of food, such as for schools and hospitals, is normally let in lots via fixed term contracts that exclude other suppliers for the duration of the contract. Cost pressures, complex procurement regulations and high-volume requirements generally mean that only suppliers of a size to guarantee requirements are considered, and smaller, local, suppliers are excluded. If this changed, public sector procurement could be a major incentive to generating Short Food Supply Chains (SFSC), with the potential to bolster the local economy by up to £3 for every £1 spent (Landworkers' Alliance, 2020, Soil Association, 2020).

Table 10: Resources and Waste Strategy

Extended producer responsibility	Making packaging producers responsible for the cost of dealing with packaging waste, likely to target brand owners and online sellers
Deposit return schemes	Focusing initially on drinks containers (likely from 2023). See CPRE campaign.
Consistent recycling collections	All Councils will be required to collect the same core set of materials including weekly food waste and free garden waste collections, expected in 2023
Improved product packaging design and labelling	

Table 11: Food waste hierarchy

Land Management

There are no regulatory requirements for public sector bodies to procure food that meets sustainable or regional sourcing requirements. Government Buying Standards exist, but they are only mandatory on central Government departments, otherwise codes are voluntary, such as:

- the Government's Balanced Score Card (for projects worth more than £10m), an approach that considers wider issues (including energy efficiency and Climate Change impact) within procurement decisions.

- the Soil Association's Food for Life Served Here awards.

Dynamic Food Procurement

Dynamic Purchasing Systems (DPS) are a legally compliant form of public sector procurement allowing a wide range of suppliers to access a contract during its duration, rather than the fixed term lots of many contracts. A Dynamic Food Procurement National Advisory Board has been established and the intention is to evaluate the outcomes of a pilot project being run in the south west, and then roll out DPS across the rest of the UK.

Following an assessment of the impact that Covid 19 had on the food supply chain, the Board recommended the establishment of a regional food supply chain infrastructure that is *"served by short, fast light supply chains from field to fork – that nurture and support growth of SME* (small and medium-sized enterprises) *food producers."* (Dynamic Food Procurement National Advisory Board, 2020).

It is hoped that this approach will be reflected in the Future Food Framework being developed by the Crown Commercial Service, which is an executive arm of Government responsible for managing the procurement of public goods and services and leading on procurement policy for the UK Government.

Developing a local producers' operation to service local procurement would give critical mass when bidding for contracts, support the local economy and reduce the carbon footprint.

Local food initiatives

Most grass-roots initiatives involve some assessment of the food waste hierarchy (see Table 11).

There are commercial food waste collection services, such as that operated by Veolia for Telford & Wrekin Council but this does not extend into Shropshire. However, there are important initiatives already happening in South Shropshire which need to be recognised and supported:

1. **Open Food Network**

Open Food Network (OFN) is an open-sourced platform developed by an international team of software developers that allows producers to sell their produce online at prices that work for them. Within the UK there are 1,725 producers using the system, which enables them to create an online shop, collect payments, sell through other shops on the platform and access reduced-rate courier services. In South Shropshire there are currently four producers involved:

- Little Woodbatch Market Garden, Bishop's Castle

- Brook House, Craven Arms

- Euro Quality Lambs Ltd, Craven Arms

- The Green Woman, Ludlow

Producers may also be part of the Healthy Start Voucher Scheme which provides support for pregnant mothers and those with young children and may also therefore support the local economy and Short Food Supply Chains.

There are two key policy recommendations arising from these approaches:

- Government must recognise and reward the "public goods" that accrue from businesses producing sustainable and regionally produced food.

Practical measures that are recommended which lead to both healthy diets and reduced carbon emissions include:

- **Aim to be food waste free**
- **Eat more plant-based foods**
- **Eat less, but buy better quality local meat and dairy**
- **Buy local, seasonal and organic produce**
- **Support farmers markets and local box schemes**
- **Use local independent retailers**
- **Choose Fairtrade-certified products**
- **Select fish only from sustainable sources**
- **Eat a healthy balanced diet and less processed food**
- **Grow your own or join a community garden or food Co-op**

- To enable local producers to supply direct to the public or via public local procurement contracts there is a need for technical support in IT and logistics.

2. **Shropshire Food Poverty Alliance**

The Food Poverty Alliance is concerned with ensuring equitable access to food and enabling people to move from food poverty to food security.

- The Shropshire Alliance produced a Shropshire Action Plan in 2018.

One of the objectives of the Alliance is to increase access to affordable healthy food through community meals, cafes, pantries, growing projects and surplus food. Community projects have the potential to increase access and well-being and specific proposals include:

- Supporting community growing projects and linking farms to food co-ops at schools and community centres.
- Community cafes and meals.
- Accessing surplus food through community food hubs, pantries and fridges.
- Food delivery services to rural areas through partnerships with existing services.
- Building on innovations in social prescribing and voucher schemes for healthy food.

The Alliance has created the Shropshire Larder as a local information resource.

Local support for greater community-level resilience in addition to Short Food Supply Chains is a focus of many local community strategies, such as the:

- Bishop's Castle Climate and Ecology Action Plan
- Hands Together Ludlow

3. **Marches Grow Local**

Marches Grow Local (MGL) is a not-for-profit group based in Shropshire which works to strengthen a local food system in which more people eat more locally produced food. Its objectives are to:

- Strengthen the networks of local producers.
- Establish new food distribution channels appropriate to this rural area.
- Educate people about local food systems and their role in wider food production, distribution and consumption issues.
- Encourage more people to grow and produce local food by building skills, knowledge and resilience.
- Connect people who have land available to new food production ventures.

A more comprehensive list of the organisations and networks active within South Shropshire is in Appendix A, these form the stakeholders for delivering the pathway to zero carbon and enhanced biodiversity.

Next steps

As we stated at the beginning, our aim was to propose a menu of opportunities for land management, recognising the unique location is South Shropshire. We are arguing for an agro-ecological approach: producing food in ways that integrate ecology with farming. This requires that we view and manage land holistically, rather than segregating it into sites rich in biodiversity surrounded by agriculturally "productive" land that offers little of value to wildlife. This approach is not new to South Shropshire, as we have shown integrated farming has always been a part of local land management, but the scale needs to be significantly increased if we are to address the twin challenges of Climate Change and our declining biodiversity.

We've also demonstrated that we all have a role to play. Each of us is a customer and a consumer of agricultural products, each of us can make a difference through the way we shop, the food we eat, the values we hold and the campaigns, organisations or networks we choose to support.

"Each of us is a customer and a consumer of agricultural products, each of us can make a difference through the way we shop, the food we eat, the values we hold and the campaigns, organisations or networks we choose to support"

Appendix A: Organisations and projects in South Shropshire relevant to land use and biodiversity

Strategic Networks exist within the County that draw together stakeholders and this Report seeks to inform their deliberations. Two are particularly important:

- **The Shropshire Climate Action Partnership** - which has produced a County-wide zero Carbon plan.

- **The Marches Nature Partnership** (MNP) - a coalition between the Herefordshire, and the Shropshire, Telford and Wrekin Local Nature Partnerships (LNPs), enabling a strategic and co-ordinated approach to nature conservation across the area. There are national organisations that operate in South Shropshire, together with many more local networks and organisations.

We will require the combined impact of public, private and voluntary sectors to effectively tackle Net Zero and nature recovery in the coming decade.

Organisations	Description
Breed societies	Promoting various cattle and sheep breeds, such as the Clun Forest breed
British Hedgehog Preservation Society	Helping and protecting hedgehogs native to the UK
British Trust for Ornithology	A national hub for surveys of wild birds
Butterfly Conservation West Midlands	Promoting butterfly and moth conservation
Caring for Gods Acre	Protecting and rejuvenating biodiversity within churchyards and burial grounds
Community initiatives to combat flooding	**Ludlow Flood Forum** **Friends of Corve and Teme**, also focused on Ludlow
Community Groups with Climate and/or Food and/or Sustainability Strategies	• **Bishop's Castle Community Partnership** • **Clun Climate and Environment Group** • **Incredible Edible Ludlow** • **Sustainable Bridgnorth** • **Lightfoot Enterprises** • **Stretton Climate Care**
CPRE Shropshire	Independent charity promoting the sustainable use of land and other resources to protect Shropshire's landscape. Has planning expertise.
Country Land and Business Association	Membership organisation for landowners

Organisations (continued)	Description
Cuan Wildlife Rescue	Rescue, care for and rehabilitate sick and orphaned wildlife
Environment Agency	Statutory body, responsible for main rivers and aspects of flood management
Land, Life & Livelihoods	A community initiative working to care for land, life (soil, water, plants, animals) and people's livelihoods in the Clun Forest area
Landworkers Alliance	A union of farmers, foresters, growers and land-based workers working towards better food and land-use systems
Marches Meadow Group	Encouraging management and conservation of species rich-hay meadows
Middle Marches Community Land Trust	Offering advice and promoting sustainable agriculture and landscapes
National Farmers Union	Membership Trade Association for farmers, has initiated a zero-carbon strategy target of 2040. Local branches throughout South Shropshire
National Trust	Owns and manages local sites including Long Mynd and Wenlock Edge
Natural England	Statutory body, owns and manages National Nature Reserves
Organisations that promote local land management initiatives	• **Friends of Whitcliffe Common** • **Friends of Pontesford Hill** • **Knighton Community Woodlands Group** • **Redlake Valley Community Benefit Society**
Plantlife	Conservation charity running the national verges campaign and giving advice on meadow creation
Royal Society for the Protection of Birds	The UK's largest Nature conservation charity
Severn Rivers Trust	Environmental Charity promoting sustainable riverine management
Shropshire Botanical Society	Promoting the understanding and conservation of Shropshire's flora

Organisation (continued)	Description
Shropshire Community Wildlife Groups (See also Middle Marches Community Land Trust map)	• Upper Onny • Rea Valley • Clee Hill • Strettons Area • Upper Clun • Teme Valley • Camlad Valley
Shropshire Council	Has statutory responsibilities across the area, produces site-based reports that inform planning decisions and has a biodiversity officer to co-ordinate actions in the Shropshire Biodiversity Action Plan
Shropshire Federation of Young Farmers	Rural youth organisation with local branches spread through South Shropshire
Shropshire Hills AONB Partnership	Land management oversight within the AONB, which covers most of Ludlow constituency
Shropshire Ornithological Society	For the study and protection of birds in Shropshire
Shropshire Wildlife Trust	Wildlife conservation and membership organisation, local branches
Small Woods Association	Providing advice and information for woodland management
Tenant Farmers Association	Provides information and advice to tenant farmers
Trees for Shropshire	A not for profit organisation planting trees and conserving wildlife
Woodland Trust	The UK's largest woodland charity

Local projects	Description
Curlew Country	Promoting land management to support breeding curlews
Catchment Sensitive Farming	Multi-agency approach to reduce air and water pollution within specified catchments
Our Common Cause	Developing projects to reconnect people with Commons and improve public benefits
Restoring Shropshire Verges	Multi-agency approach to restore and create wildflower rich verges

Local projects (continued)	Description
Shropshire Pond Creation Scheme	Natural England and Shropshire Wildlife Trust initiative to reintroduce ponds
Slow the Flow	Creating natural, innovative ways to reduce flooding through land management
Stepping Stones Project	Multi-agency collaboration to create a Nature corridor between the Stiperstones and Long Mynd
Trees outside Woodlands Project, Agroforestry and Orchards Pilot Contact: Harold.Thacker@shropshire.gov.uk	Encourages tree planting focused on food production or that seeks to complement and enhance existing agricultural and horticultural systems
Upper Onny Farmers Group (contact via Shropshire Hills AONB)	A Test and Trial Group for the Defra Environmental Land Management Scheme

Barn Owl hunting in the late afternoon (c) Geoff Hall

Energy and Buildings

Introduction

This section of the Report addresses the task of adapting South Shropshire's energy supply and consumption systems and also refitting our buildings (non-domestic and domestic) to make them Net Zero Carbon (NZC) compliant.

What is Net Zero?

This means that the amount of Greenhouse Gas being put into the atmosphere by human activity (locally, nationally and globally) is no more than the amount of Greenhouse Gas that is being taken out of the atmosphere. This is the definition of NZC by the UK Government in the Energy White Paper, 2020:

Trends: These vary but:

- Globally, carbon emissions continue to rise at around 2% a year.

- They are steadily falling in UK and are down by over 40% since 1990, due to phasing out of coal and the increasing generation of electricity from renewables (but with only a 9% fall in our "stuff").

- Carbon emissions in our buildings have reduced by 14% since 1990.

- Emissions from transport have remained static.

In South Shropshire carbon emissions are currently:

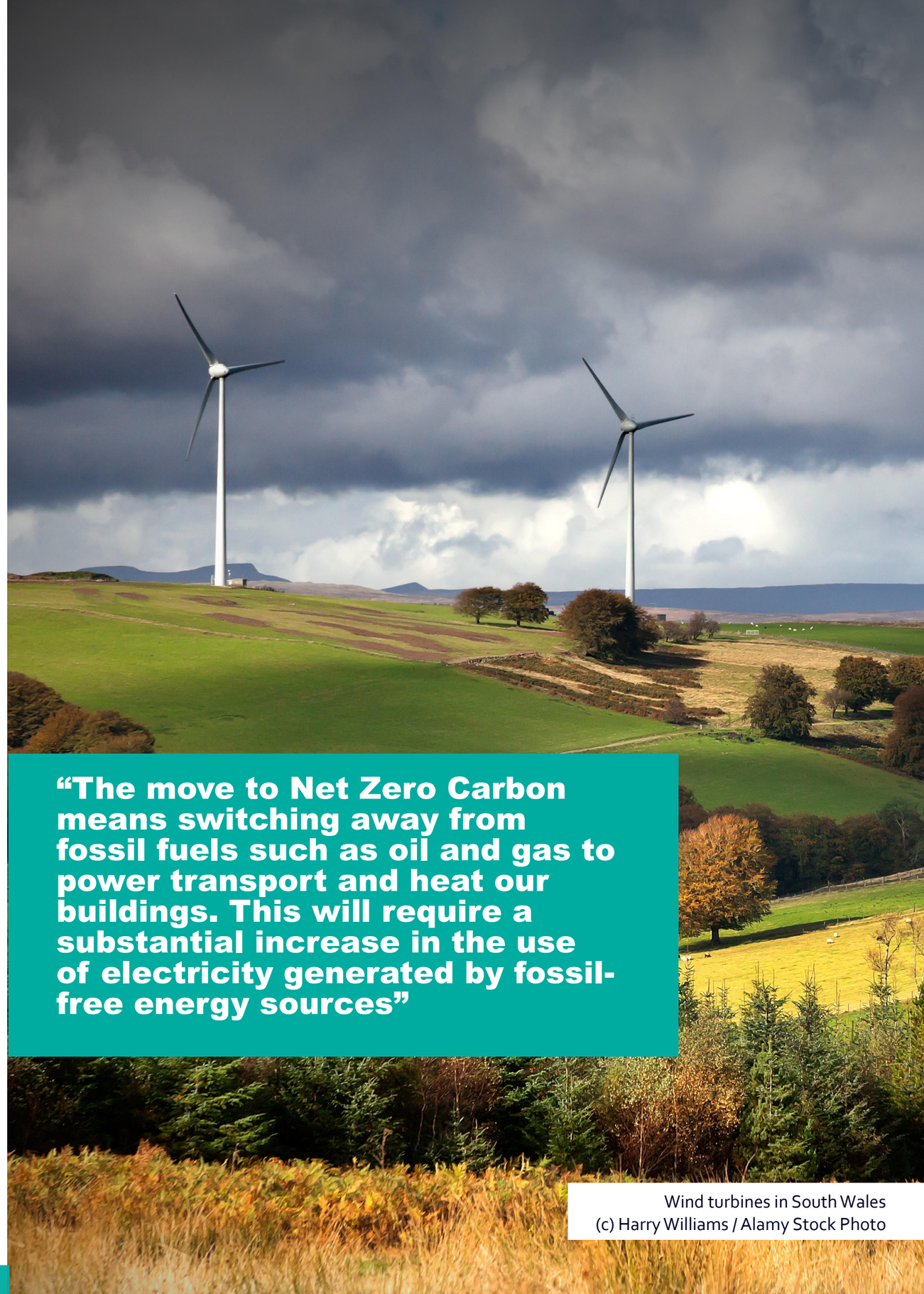
- 29% domestic

- 37% transport

- 34% industrial and commercial

The UK Government's goal is to achieve this huge transition nationwide by the legally binding target of 2050. This flows down through policy and investment decisions by key infrastructure organisations such as Western Power Distribution (WPD) who run the electricity network to all our homes and businesses, and Cadent who provide the mains gas network.

South Shropshire Climate Action (SSCA) and Zero Carbon Shropshire (ZCS) are grass-roots organisations which want to achieve NZC by the much more ambitious target of 2030. However, all agencies are clear that the 2020s can't be wasted. The



"The move to Net Zero Carbon means switching away from fossil fuels such as oil and gas to power transport and heat our buildings. This will require a substantial increase in the use of electricity generated by fossil-free energy sources"

Wind turbines in South Wales
(c) Harry Williams / Alamy Stock Photo

main changes have to take place in this decade. These underpin the transition by developing options and "learning-by-doing" in key areas; if faster progress proves possible it can be taken further, in support of the Paris Climate Agreement's goal of limiting the increase in global warming to 1.5°C.

How will we deliver Zero Carbon in our energy and buildings?

It's a mix of national and local policies – mostly national, but with scope to influence them locally.

The challenges include:

- Aiming for a 60% reduction in overall energy consumption, with the remaining 40% coming from renewable sources.
- A significant shift to electricity is expected for heating and transport, as the national trend of "coal out - renewables in" continues.
- Policy will drive forward the removal of fossil fuels from new homes, boilers and transport standards over the next 1-2 decades.
- Digital smart meters and energy storage in batteries and cars, enabling energy to be moved around, are expected to develop strongly over the next decade.
- Large scale local renewable energy generation seems to be an unlikely option in the short-medium term, due to policy, investment and attitudinal constraints in South Shropshire; a national solution around off-shore wind and nuclear energy seems the Government's preferred way forward.
- Domestic-scale photovoltaics (solar panels) combined with energy storage seem to be the most likely options for a local response over the next decade.
- The use of hydrogen for transport and heating is attracting a lot of attention, but no firm decision by Government is expected before 2025. So, it will be the second half of this decade before we see any real change.
- There's a fascinating role for the community voice. Will we be passive or active in helping to shape our energy future?
- Energy efficiency schemes for buildings – both homes and businesses - remain immature meaning that the local highly skilled jobs we need just aren't there.
- Too many people in South Shropshire continue to live in poorly insulated and expensive-to-heat homes. In some parts of the constituency, rates of poor insulation are running at double the national figures.

Realistic next steps:

- Create a local retrofit movement for homes creating local jobs and employment and raising skills. Around £1billion of new investment is needed in South Shropshire.
- Encourage and persuade: work around energy storage, people's attitudes and digitisation.
- Engage health services to significantly improve health and wellbeing for local residents.
- Open a discussion at community-level about the options and trade-offs, with a view to strengthening our constituency-level response.

Energy and Buildings: Our Key Messages

♦ The move to Net Zero Carbon means switching away from fossil fuels such as oil and gas to power transport and heat our buildings. This will require a substantial increase in the use of electricity generated by fossil-free energy sources.

♦ To accommodate this increased reliance on electricity, our buildings will need to be not only refitted with Carbon-free heating systems, but also made more energy-efficient through improved insulation and smart electricity management and storage systems.

♦ The efforts of local authorities, householders, businesses and community welfare agencies need to be co-ordinated into an effective local retrofit movement able to provide technical and financial advice, build successful businesses with a skilled workforce, and offer affordable zero-carbon warmth for all.

To assist these co-ordinated efforts, we propose a number of consultations and projects in order to:

♦ Agree a common methodology.

♦ Build the capacity of the local supply chain.

♦ Engage the public through on-line resources and a travelling roadshow on refitting homes.

♦ Integrate the Net Zero Carbon goal into the Fuel Poverty agenda and Social Prescribing.

Finally:

♦ We will work with our Member of Parliament to improve the delivery of the UK Government's NZC commitments through consistent policies and substantial long-term investment.

(c) Energy Diary, Lightfoot Enterprises (Angela Martin)

A. Energy supply and consumption systems

Trends in energy consumption

Using growth in carbon emissions as a measure of increases in energy use, global trends in carbon emissions are shown in Figure 4. The dramatic increase since the end of the Second World War has only been briefly interrupted by economic downturns and oil shocks. The fastest rate of increase in the 20th century was the 25 years to 1970; an annual average rate of more than 5%. The average growth rate since 1970 has been around 2%.

Since 1990 estimated UK Greenhouse Gas emissions have fallen from just under 800 million tonnes of CO_2 equivalent in 1990 to just over 435 $MTCO_2$-eq in 2018; a 45% cut.

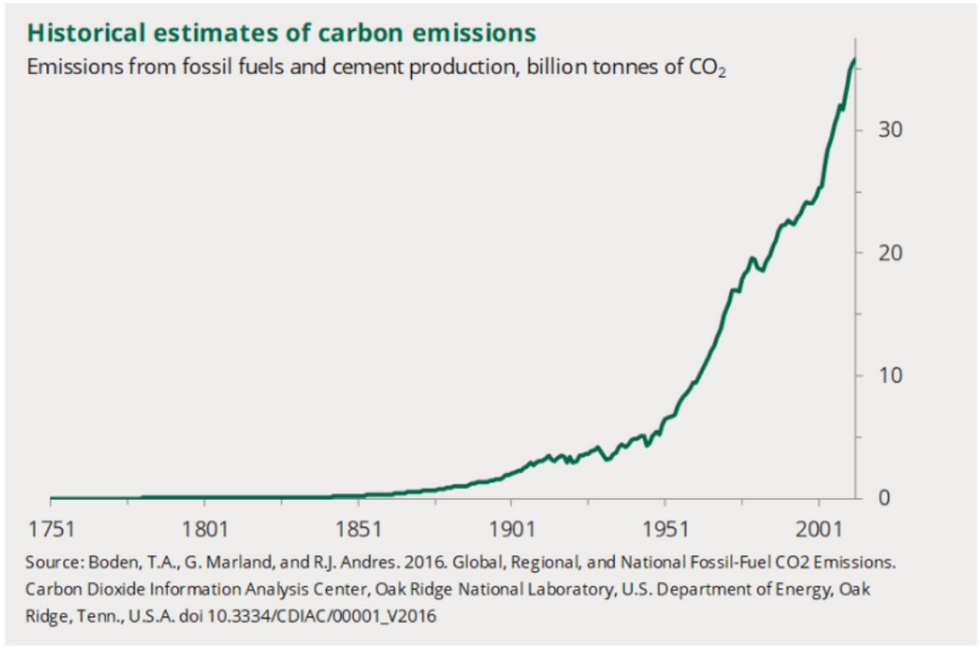
Figure 5 shows that cuts in emissions have been fairly consistent over this period.

These figures include emissions that are produced in the UK, known as 'UK territorial emissions'. They are produced in accordance with international reporting standards.

Background note

This data does not include emissions linked to the production of goods that are *consumed* in the UK but produced abroad, or emissions from international aviation and shipping. The Government estimates that emissions linked to the UK's *consumption* of goods, including imports but not exports, are around 70% higher than UK territorial emissions in 2017 at 772 $MTCO_2$-eq. The cut in *these* emissions in the two decades to 2017 was slower; 9% compared with 45% (shown in the chart above). From Bolton, 2020.

Fig 4: Historical estimates of global carbon emissions. Source: Bolton, 2020



This fall was driven by a reduction of coal in favour of gas for electricity during the 1990s, growth in renewables in the 2010s, particularly wind, and the recent cut in coal use. There was a larger percentage cut from waste management (69%), with smaller falls from business (31%) and the residential sector (14%). Emissions from transport hardly fell, and it became the largest source in 2016 (see Figure 6).

For transport the total distance travelled increased by 17% since 1990, roughly in line with population growth. Efficiency of new cars had also been steadily increasing since 1990 but this reversed between 2017-19, driven by the rapid increase in purchases of higher-emitting vehicles, particularly sports utility vehicles (SUVs), whose market share has risen from 7% in 2007 to 25% in 2019.

This growth has more than offset the benefit delivered by the increase in sales of electric vehicles (EVs) from 1.9% to 3.1% during 2017-19. Whilst not a trend, the current carbon emissions in Shropshire and South Shropshire are shown in Table 13 (overleaf).

Assuming that national trends apply to South Shropshire, then the underlying trends are:

- For buildings – gradually reducing due to the phasing out of coal and the increasing amount of renewable electricity being generated.
- For transport – a flat-lining of carbon emissions reductions.
- For industrial and commercial processes – a downward trend linked to efficiencies in resource handling.

Fig 5: Steady fall in UK Greenhouse Gas emissions. Source: Bolton, 2020

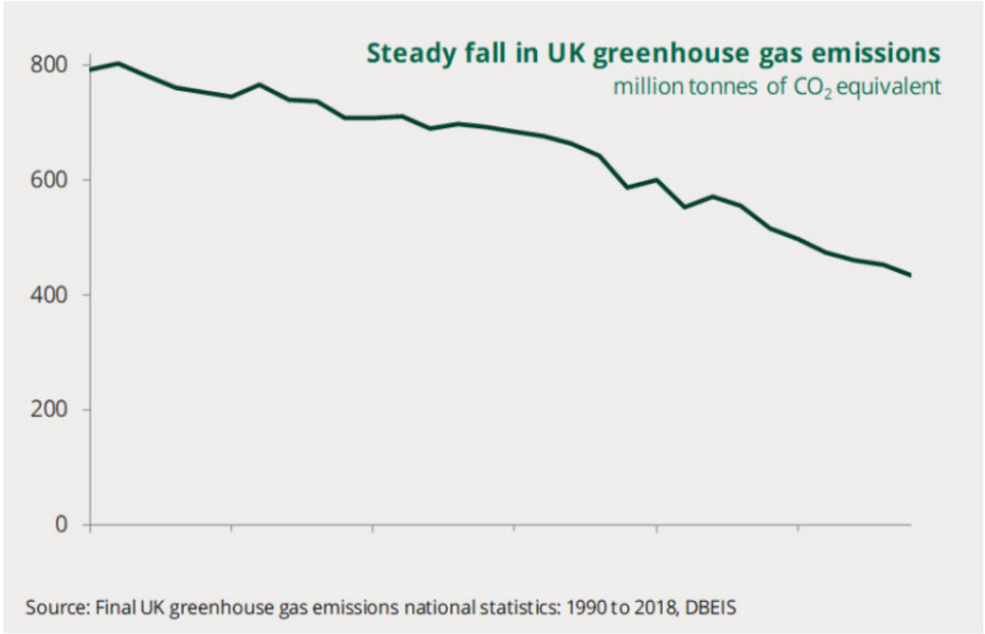
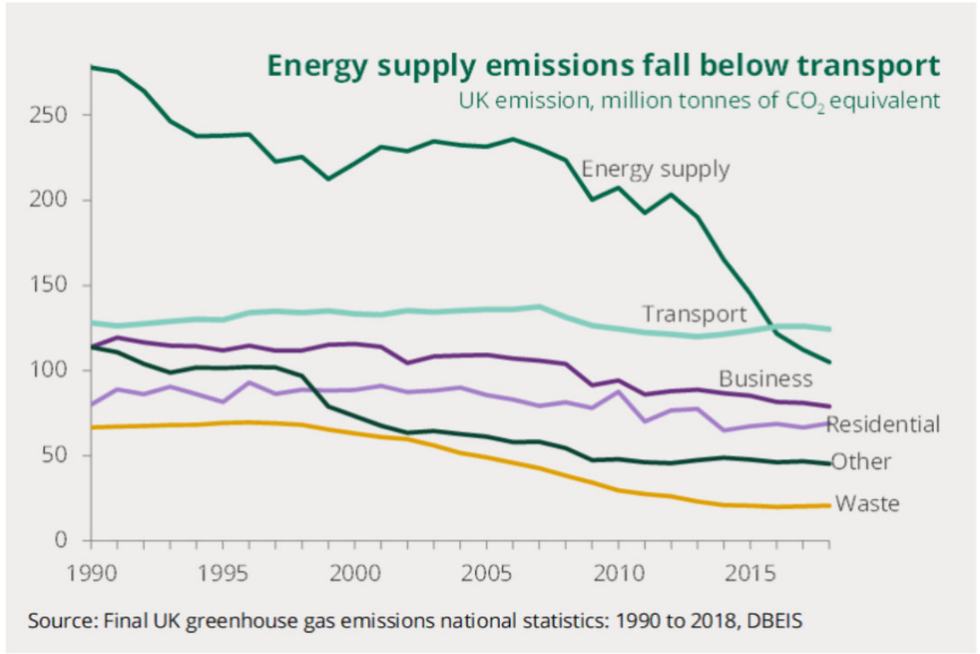


Fig 6: Energy supply emissions fall below transport. Source: Bolton, 2020



Source: Final UK greenhouse gas emissions national statistics: 1990 to 2018, DBEIS

Different views about the way forward

To achieve our NZC target we have to move away from fossil fuels for heating and powering our homes, for transport and for agriculture. So how are we going to achieve this? We will have to decide between different approaches, recognizing the contentious nature of some of the debates (eg around nuclear power).

The Centre for Alternative Energy in Machynlleth, Wales (CAT) envisages a NZC future without any energy being supplied by fossil fuels or nuclear power (our Government by comparison currently considers nuclear as part of the renewable energy options open to it). See Figure 7 overleaf.

To achieve CAT's vision of "Zero Carbon Britain" (ZCB) this means a 60% reduction in overall energy consumption, which is possible provided we make the necessary changes to our homes and lifestyles.

The remaining 40% of our energy requirement would need to come from renewable energy sources (see: CAT, 2019). If CAT's proposal of a 60% reduction/ 40% renewable generation were to be implemented across all sectors in South Shropshire, based on 2017 it would look like this (Table 14).

A key consideration in Government policy over the next 2-3 decades, which has underpinned much of the UK's current reductions on carbon emissions, is the combination of the phasing out of coal (to be completed by 2025) and the generation of renewable energy.

Table 12: Share of UK power generation by type. Source: The Moorlander

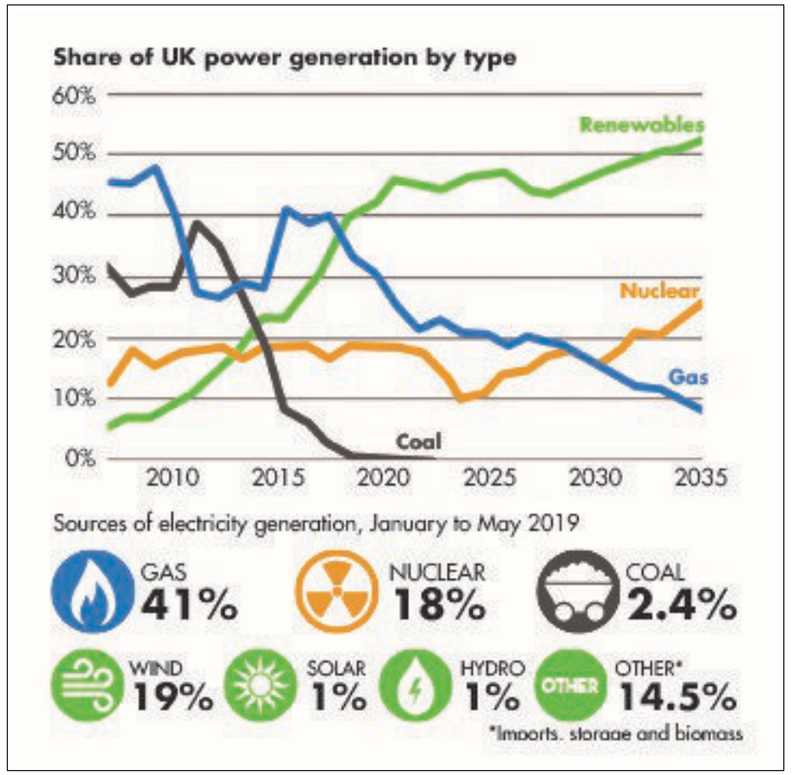
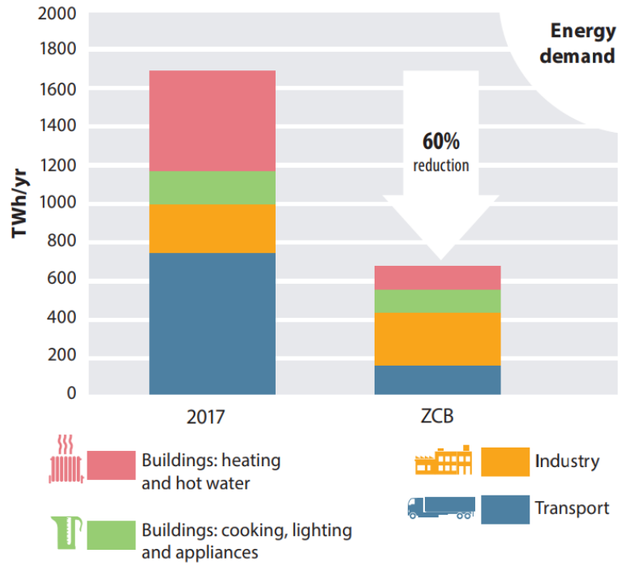


Table 13: Current carbon emissions in Shropshire and South Shropshire by sector

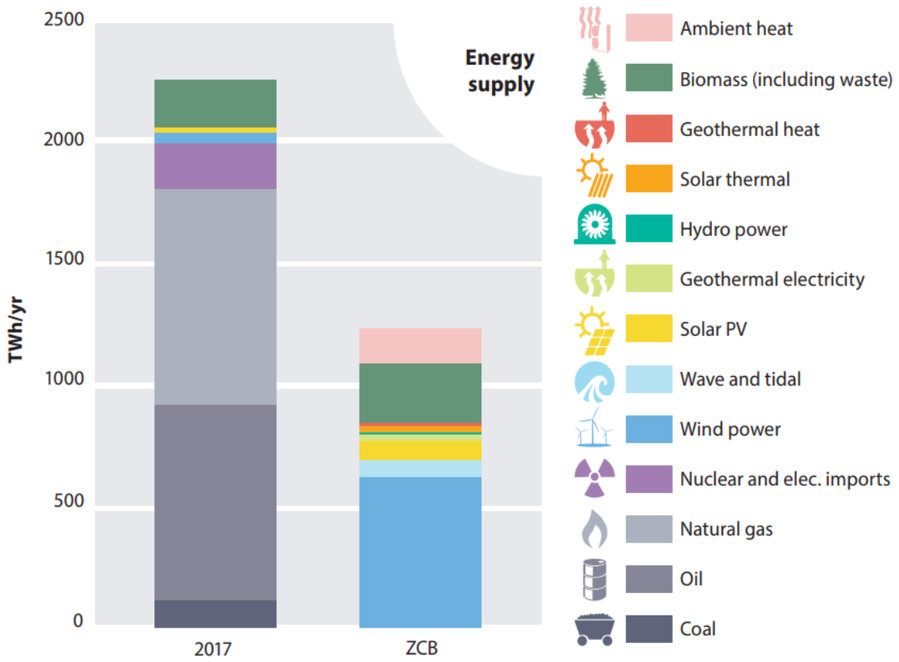
	Shropshire	South Shropshire	
	Tonnes Co2/year	Tonnes Co2/year	%
Domestic	503,300	143,800	29%
Transport	664,700	189,914	37%
Industrial & commercial	608,800	173,943	34%
Total	1,776,800	507,657	100%

Source: BEIS data from 2018. The split between Shropshire and South Shropshire is based upon an approximate split of homes between Shropshire and south Shropshire of 140,000 vs 40,000.

Fig 7: CAT's Zero Carbon Britain proposals are illustrated in the following diagrams (CAT, 2019) - with thanks to CAT



Total annual energy demand by sector in the UK in 2017 and in our scenario in terawatt-hours per year (TWh/yr)



Energy mix in our scenario – the amount of energy supplied by each renewable source.

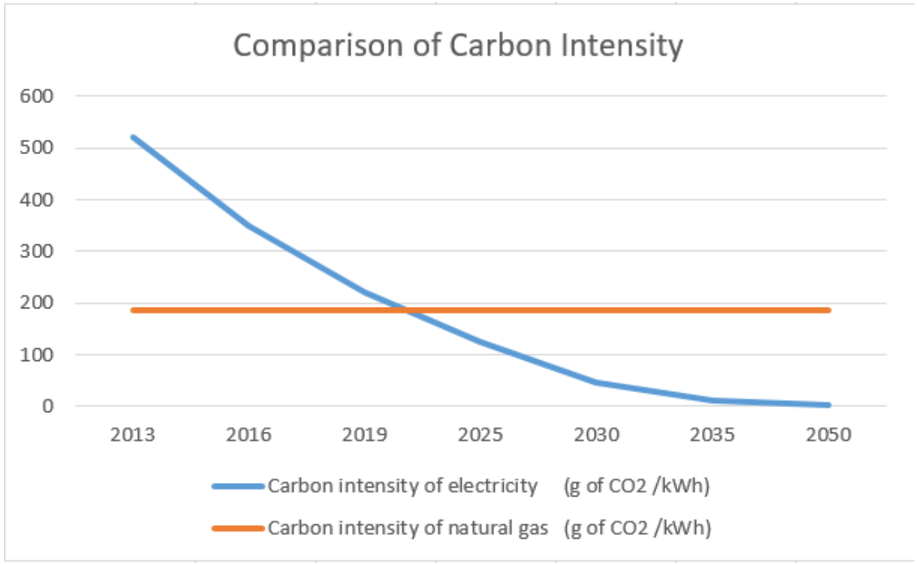
This has resulted in very significant reductions in the carbon intensity of electricity – a 60% drop over the last 10 years. This is set to continue as more renewables are built and come on stream, and the final coal-fired power stations are decommissioned. The trend is shown below (Figure 8).

So sometime around 2022-25 electricity will become a lower-carbon fuel than mains gas. From that point onwards, the balance shifts in favour of electricity for heating, rather than mains gas, which will be a major step towards achieving Net Zero Carbon. Unfortunately, unit prices for

Table 14 : Carbon emissions in South Shropshire in the 60% reduction/40% renewable generation scenario (based on 2017 figures)

South Shropshire	Tonnes Co2/year	60% reduction	40% generation
Domestic	143,800	86,280	57,520
Transport	189,914	113,948	75,966
Industrial & commercial	173,943	104,366	69,577
Total	507,657	304,594	203,063

Fig 8: Trend based on historical reductions and future projections (from CCC 2020)



Background note: carbon intensity

A range of fossil fuels are used to power our lives – oil, coal, petrol, mains gas, electricity etc. Each one of these produces different amounts of carbon and so contribute more, or less, to the Climate Emergency. Coal and oil are the worst performing on this scale – hence the reason for them being phased out.

By comparison, the carbon intensity of renewable electricity is zero. It is also variable in how much is available depending on how windy or sunny it is. As a result, the carbon intensity of electricity is also variable, depending on the quantity of renewables or fossil fuels being used to generate electricity at any particular moment.

electricity remain significantly higher than for gas (15p/kWh versus 3p), which will deter many people from replacing gas heating with the unfamiliar technology of heat pumps. This will affect many households in rural South Shropshire who have no mains gas and rely for heating on oil-fired Rayburns and Agas.

However, electricity is expected to become the preferred heating fuel once the price difference is reduced (for example, by variable rate tariffs), and this will open a huge surge in heat pumps replacing traditional fossil fuel boilers, and also a rapid switch towards electric vehicles. Legislation will help drive this and we could see bans on new oil boilers from 2028, petrol and diesel cars and vans from 2030 and new gas boilers from 2033 (from 2025 in new build homes – this is currently in consultation). See Climate Change Committee, 2020 and Energy White paper, 2020.

In this scenario, and in contrast to CAT's proposal for a 60% reduction, Western Power Distribution is expecting demand for electricity to double in South Shropshire by 2030 (see Branston, 2021). However, this will be offset by reductions in the demand for fossil fuel. We can expect a transformation in the way electricity is generated and used over the coming decades with key changes as follows:

- From central power stations to smaller, more local renewables generation with energy moving both ways.

- Local storage and smart digital becoming increasingly important.

- Engaged and empowered customers.

Figure 9 (opposite) summarises the differences between the centralised high-carbon electricity system of the past and the decentralised NZC-compatible system of the future, which is already starting to take shape.

What responses are required?

Increase energy efficiency to reduce demand: Regardless of how we get to Net Zero Carbon, there is a significant role to be played by energy efficiency in both domestic and non-domestic sectors. This is absolutely essential if we are to achieve a 60% reduction in current energy use in buildings and transport, as in the CAT proposals:

- For homes - insulation, efficient heating, heating controls, heat recovery and ventilation all require a shift in investment and social attitudes towards energy.

- For the non-domestic sectors – as above with the addition of improvements in large-scale waste management, industrial processes and the use of IT. For the manufacturing, construction and fuel supply industries, the Government must move from the current piecemeal approach to a comprehensive transition support framework.

Policy must tackle both the demand-side and supply-side for low-carbon products and ensure that the relevant infrastructure is available.

We will also need high standards of new-build and retrofit to avoid performance gaps. Long-term evaluation and learning are essential to ensure that savings are being realised, and to help confidence to grow.

We can also expect to see a role for smart energy management and energy storage emerging over the decade. The Future Business Plan of Western Power Distribution sees these as essential tools in achieving Net Zero Carbon as it, and the Government are currently shying away from the investment needed in the grid to allow significant renewable energy growth on UK mainland, including in South Shropshire.

These smart methods might include:

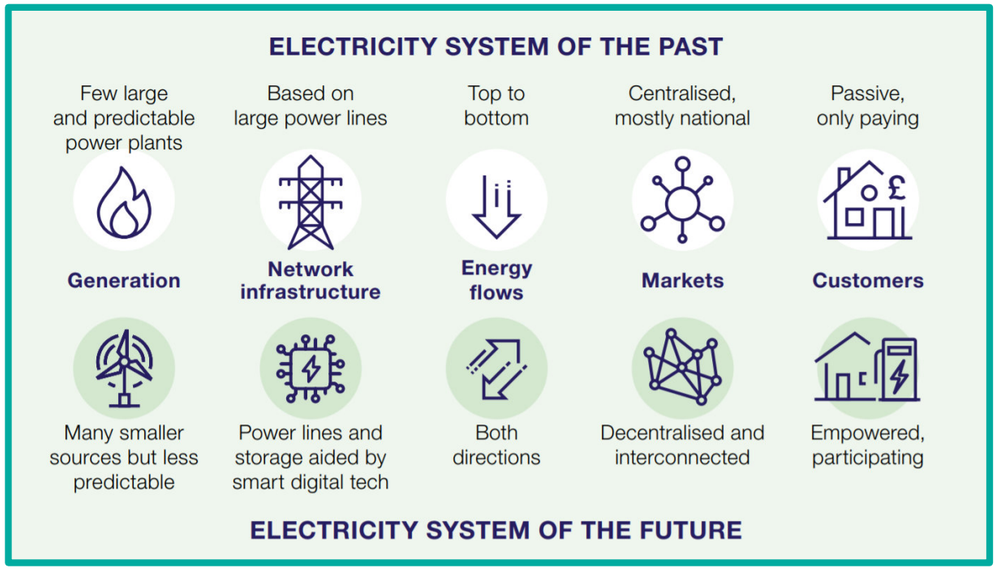
- Photovoltaic generation and local storage.

- The use of either batteries or electric vehicles to store electricity to support home energy use at peak times.

- Variable tariffs which will pay householders for excess electricity sold to the grid at times of key demand, and charge a premium at times of peak demand (4-8pm in winter).

- The bringing together of groups of homes to achieve this in a local community or mobile home site. This would allow the storage and/or local generation of electricity to be aggregated and returned to the grid at times of high demand. This has the potential to earn an income paid to householders by the operators of the electricity grid.

Fig 9: Electricity systems of the past and of the future.
Source: Western Power Distribution



• The inclusion of small-scale wind and hydro systems to help with generation at times when the sun is not shining and electricity is needed.

Large-scale investment in renewable energy generation

WPD expects electricity demand to double from 440 GWh pa to 880 GWh pa by 2030. To reconcile this with the NZC target would require investment in renewables in South Shropshire at something like the scale indicated in Table 15, opposite.

Given policy and investment constraints, alongside poor community acceptance, it seems very unlikely, in the short-medium term at least (c.2025) that solar farms and wind will have much of a role to play. So domestic photovoltaics (pv – solar panels) and some limited biomass seem to be the best way forward. Additionally, the "smart grid" aspirations of WPD and Government are only just now beginning to emerge. One householder in South Shropshire has managed to avoid using electricity from the grid for 4 days in a year by using battery storage combined with energy management through a smart meter.

The use of hydrogen

This is another controversial issue. It has an emerging role to play, probably linked to HGVs, shipping and industry. There could also be a role for hydrogen in the gas network for use in the home, but there will be no strategic decision before 2025 on the exact role hydrogen will play – see Cadent 2021-2026 business plan, 2019.

The Government's Hydrogen Strategy is due to be published in spring 2021. It will need to set out a vision for hydrogen's role in meeting Net Zero in the longer term, together with the actions, regulations and incentives needed to govern the supply of hydrogen and its end-use applications.

Domestic solar array near Clun (c) D. Thomlinson

Table 15: Investment required in renewables in South Shropshire to reach NZC

Technology	Each generating (GW/h)	Number needed	Generation potential	% To 2030 target (of 880GWh)	Remarks
Domestic solar	0.002	15000	30	3%	WPD estimates 50% urban roofs as suitable and 20% of rural roofs. If estimate 60% urban and 40% rural, and 40k in South Shropshire = c.15000 roofs
Solar farms	20	45	900	102%	Each at 25MW. How many suitable sites are there? Less than 5?
Big wind	6	145	870	99%	2.3MW turbine. Suitable sites need wind speeds of >8m/sec. How many are there? Planning, policy and grid constraint blockages are significant.
Medium wind	0.3	2900	870	99%	225kW turbine - again site numbers, grid and policy constraints?
Biomass	8	110	880	100%	Estimate from SCAP - in reality nearer 5%. 100kW anaerobic digester will produce 8GWh/pa. Can also feed biogas into grid.

People – us and our attitudes

Every policy document is clear – there's a role that people and communities can play in determining the choices which are opening up. This all depends on how much we are engaged in contributing to the options, and how much we choose to respond to that engagement. Historically, there has been no such engagement, with changes being around policy tweaks in the phasing out of coal etc. As we have seen, SUVs have worked against industry initiatives to improve vehicle efficiency. Inconsistent public attitudes can result in varied levels of electric vehicle or heat pump take up. This allows Government and industry to postpone investment in the infrastructure and policies needed to achieve Net Zero Carbon. There are questions around fairness, and even inter-generational justice – that is, who pays? And it even affects what we call "ourselves" – are we "consumers" just responding to monetary savings on our energy bills (as Government/ Ofgem think of us), or are we "citizens" able and willing to face difficult choices and uncertainties, and lobby for better? WPD sees public attitudes and commitment as playing a key role in deciding between the different scenarios, as illustrated in Table 16 from their Draft Business Plan 2023-28.

So which is it to be?

Some background on hydrogen

- Hydrogen, the odourless, colourless gas that makes up part of a water molecule, is gradually becoming recognised as both a clean and convenient burning fuel. It can be stored as a liquid or as compressed gas, so its versatility is notable, with uses for everything from the production of plastics and fertilisers to powering vehicles.

- Unlike natural gas, when hydrogen is burned it produces heat and water (H_2O) as opposed to carbon dioxide (CO_2).

- "Green hydrogen" has another unique and powerful benefit: by using renewable sources like wind energy to split water into hydrogen and oxygen, it effectively stores renewable electricity for later use.

- How does "green hydrogen" work? When wind turbines produce more energy than is needed, they must normally be slowed down — this is not ideal because energy supply equipment works best and most reliably when creating a steady flow of energy. But by creating hydrogen when energy demand drops (at night, on weekends, summertime and holidays, for example) the surplus wind energy can be stored in the form of hydrogen until demand increases. In this way, wind energy can be stored in large amounts for longer periods of time. So energy systems can become more flexible, evening out supply and demand of power by preventing the generation of too much, or not enough power. With a significant number of large, new offshore windfarms due to come online over the next few years, the challenge of balancing supply and demand will continue to grow.

- "Blue hydrogen" in contrast, uses fossil fuels to separate the hydrogen, and this is directly opposed to the achievement of the NZC target.

- The Government's 10-point plan to green the UK's economy, which was published in November 2020, speaks of providing 5GW of "low carbon hydrogen" production capacity by 2030, including home heating. "Low carbon hydrogen" means using fossil fuels, but removing the CO_2 by carbon capture and storage. This is obviously a more expensive and contentious process than "green hydrogen" and should be regarded with suspicion in respect of the NZC target.

Various different approaches to the use of hydrogen have been proposed, prompting mixed views from the industry:

- Blending up to 20% green hydrogen into the gas grid with existing natural gas could save around 6 million tonnes of carbon dioxide emissions every year, the equivalent of taking 2.5 million cars off the road (Ofgem, 2019).

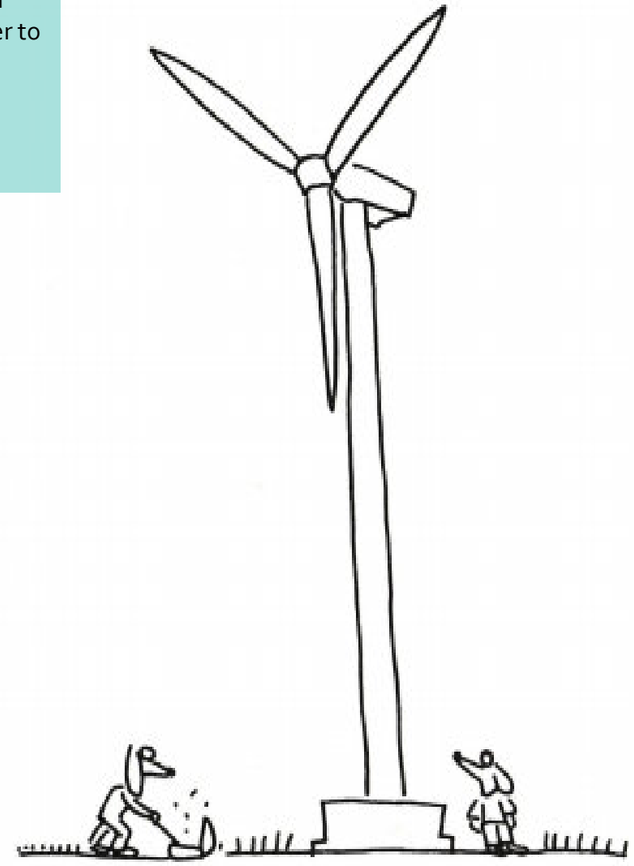
- Heat pumps powered by renewable electricity are six times more efficient for space heating than using the same power to make hydrogen to fuel boilers using electrolysis.

- Green hydrogen production creates opportunities to utilise pre-existing infrastructure, such as the gas network, in new and innovative ways (Brunel University, 2021).

- Zero-Carbon hydrogen has been injected into a UK gas network for the first time in a ground-breaking trial that could help reduce carbon dioxide emissions. The 20% hydrogen and natural gas blend is being used to heat 100 homes and 30 faculty buildings at Keele University in Staffordshire. (Guardian, 2020).

The costs of converting the gas network to hydrogen is unlikely to prove attractive to private investors as the risks are much greater than switching to an all-electric infrastructure. This would require Government support at a time when budgets are being squeezed by the costs of the Covid 19 pandemic.

Renewable electricity is largely funded by private investors as it has known costs and proven investment returns, so is a much cheaper way of producing power to heat homes (London Energy Transformation Initiative, 2021).



(c) Energy Diary, Lightfoot Enterprises (Angela Martin)

Table 16: Public attitudes and commitment towards renewables
Source: Western Power Distribution, Draft Business Plan 2023-28

Scenario	Description	Renewables		Electric Vehicles	
		Baseline 2020	2035	Baseline 2020	2035
System progression	Not hit NZC Low levels of system and societal change	1.4 GW	2.0 GW	1.4% of All vehicles	27%
System transformation	System change only - centralised, lots of hydrogen. Low citizen interest		2.7 GW		43%
Consumer transformation	System and societal change working together; new techs adapted; lots electrification of heat		3.6 GW		69%
Leading the way	Very high levels of system and societal change – rapid adoption of tech + fastest 'credible' pathway followed		3.3 GW		77%

B. Buildings

Non-domestic buildings

We are mindful that significant work is needed on non-domestic buildings, which include industrial premises, shops and offices, and public buildings like schools, hospitals and libraries which have their own governing bodies. We expect to participate in the programme of Zero Carbon Shropshire as it develops over time, so that we understand these needs and can contribute towards the achievement of NZC in these sectors.

Domestic buildings

Working in partnership

The following organisations are partners with SSCA in the development of a Marches-level retrofit project for homes over the next decade.

The aspirations of South Shropshire Climate Action, as set out below, will be developed and delivered in partnership with this wider emerging consensus.

- **Zero Carbon Shropshire (ZCS, also known as SCAP (Shropshire Carbon Action Partnership), Buildings Plan**

- **Herefordshire Green Network (HGN)**

- **Marches Energy Agency**

Installing photo voltaic solar panels on to the roof of a domestic house
(c) Washington Imaging / Alamy Stock Photo

In addition, we want to work closely with the following organisations in South Shropshire in delivering refit programmes at the local level: **Lightfoot (in Bishops Castle and Clun), Ludlow 21, Stretton Climate Care, Sustainable Bridgnorth**.

Types of housing

Shropshire Council's **Draft Housing Strategy 2020-2025**, 2020 states that "Around 39% of Shropshire's population lives in villages, hamlets and dwellings dispersed throughout the countryside. The remainder live in one of the market towns and key centres. (In South Shropshire) only Ludlow and Bridgnorth have populations in excess of 10,000."

South Shropshire's housing stock of around 40,000 homes includes of a wide variety of types, presenting a range of challenges in making them compliant with NZC:

- Ancient and historic houses in rural and urban settings, many of them listed.
- Isolated farm houses and cottages.
- Substantial Victorian and early 20th century homes, many converted into privately rented flats.
- Post-war council housing in towns and villages, and ex-council houses.
- Recent Housing Association developments for rent, including sheltered housing and flats.
- Starter homes for owner-occupation or shared equity.
- Owner occupier retirement homes in small estates, including many bungalows.
- Modern developments of detached owner-occupier housing, some in villages with no public transport.
- Static and mobile homes.

Trends in domestic energy efficiency

UK Energy in Brief 2020 (pages 37-38) describes the following increases in energy efficiency measures in homes between 2012 and 2019 in the UK:

- 250mm loft insulation: 6% increase from 15.70 to 16.67 million homes.
- Cavity wall insulation: 10% increase from 13.01 to 14.34 million homes.
- Installation of smart meters: increase from just 3000 to 19.16 million homes (= 37% of total homes).

See also the **English Housing Survey 2018-2019**, 2020: see the charts on page 7 of the Survey showing the average energy efficiency of homes to have improved since 2008 from EPC Band F (score 58) to Band D (score 63). The West Midlands has the lowest score in England (28%) for properties rated at EPC Bands A-C.

The EPC ratings and the proportion of homes in each Band are also illustrated (see Figure 10 opposite).

Latest Government guidelines

The most significant recent publication is the Government's document The Future Homes Standard: summary of responses and Government response, published by the Ministry of Housing, Communities and Local Government in January 2021.

The main changes can be summarised as follows (please note that the dates are aligned with the Government's target of

Fig 10: EPC ratings and proportion of homes in each band (English Housing Survey 2018-19

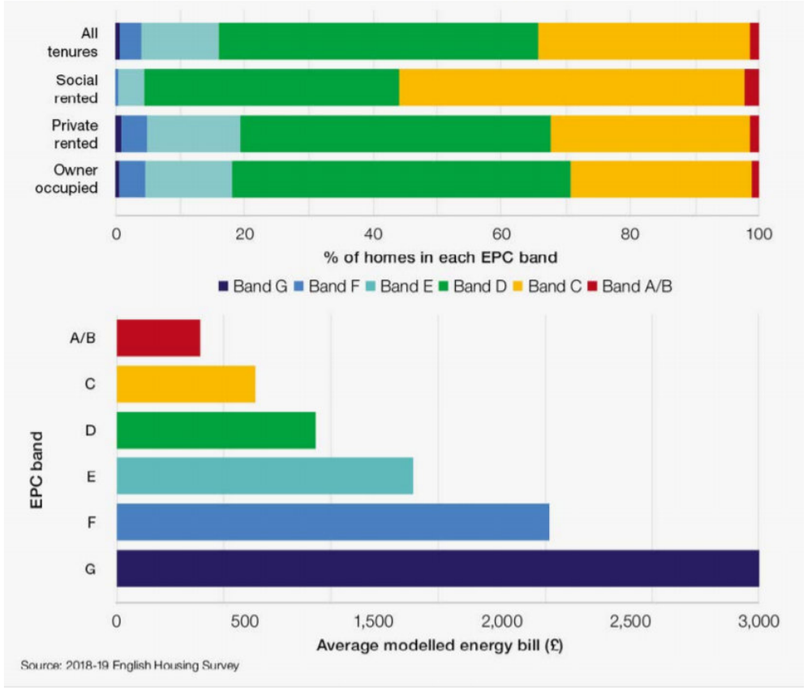
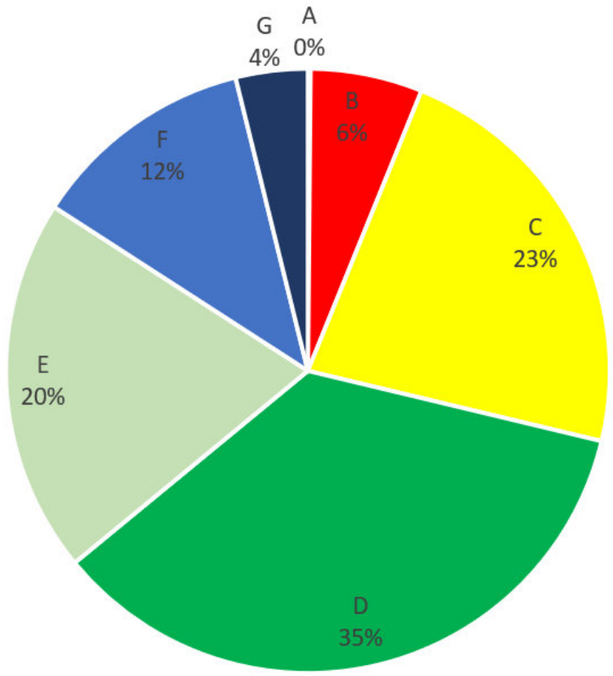


Fig 11: Local EPC figures for SY8 (Ludlow postcode)



2050 rather than our own more urgent 2030 goal, and they indicate proposals and actions by the Government and not by this Report):

1. New homes:

• Plans to radically improve the energy performance of new homes, with all homes to be highly energy efficient, with low carbon heating and to be Zero Carbon ready by 2025.

• These homes are expected to produce 75-80% lower carbon emissions compared to current levels. To ensure industry is ready to meet the new standards by 2025, new homes will be expected to produce 31% lower carbon emissions from 2021.

• Homes built under the Future Homes Standard will be future-proofed with low carbon heating and world-leading levels of energy efficiency. By delivering carbon reductions through the fabric and building services in a home rather than relying on wider carbon offsetting, the Future Homes Standard will ensure new homes have a smaller carbon footprint than in any previous Government policy. In addition, this footprint will continue to reduce over time as the electricity grid decarbonises.

2. Existing homes:

• Existing homes will also be subject to higher standards – with a significant improvement on the standard for extensions, making homes warmer and reducing bills. Replacement repairs and parts will be required to be more energy efficient.This includes the replacement of windows and building services such as heat pumps, cooling systems, or fixed lighting.

3. Heating systems:

• Heat pumps will play an important role, growing to a forecast 600k installations per annum by 2028. Concerns include:

The skills and supply chains for heat pumps require further support and expansion in order to meet the demand that will be created by introducing the Future Homes Standard.

• Heat pumps will require a change in behaviour and use by consumers used to operating traditional gas central heating systems.

• The noise, vibration and size of heat pumps installed in new homes.

• The use of refrigerants in heat pumps.

• As a result of the decarbonisation of the grid, the CO_2 emissions factor of electricity is becoming lower than that of natural gas (217g/kWh National Grid average in 2020 compared with a range of 210-380g/kWh for gas boilers, depending on their efficiency). Through Building Regulations Part L 2021, the installation of direct electric heating solutions in new homes could become an appealing low capital cost option for some developers. However, direct electric heating installed in new homes is likely to result in higher energy bills for occupants compared to gas heating.

• Gas boilers: the UK Government recently revealed on 18 November 2020 that the boiler ban date will be brought forward from 2025 to 2023, but this only applies to new homes built after 2023.

• Overheating: Improved insulation can increase overheating in summer. Air conditioning is not a satisfactory solution as it increases fuel consumption. Regulations need to include a proper balance between air-tightness and ventilation.

4. Certainty and consistency in setting energy efficiency standards:

• All levels of Government have a role to play in meeting the Net Zero target and local councils have been excellent advocates of the importance of taking action to tackle Climate Change (but is this true of Shropshire?)

• The Government wishes to ensure that we have a planning system in place which enables the creation of beautiful places that will stand the test of time, protect and enhance our precious environment, and support our efforts to combat Climate Change and bring Greenhouse Gas emissions to Net Zero by 2050.

5. Non-domestic buildings:

• The Government has also announced a consultation on higher performance targets for non-domestic buildings which will mean they will be Zero Carbon ready by 2025.

Refits

There is a general and technical literature about refits, including the following:

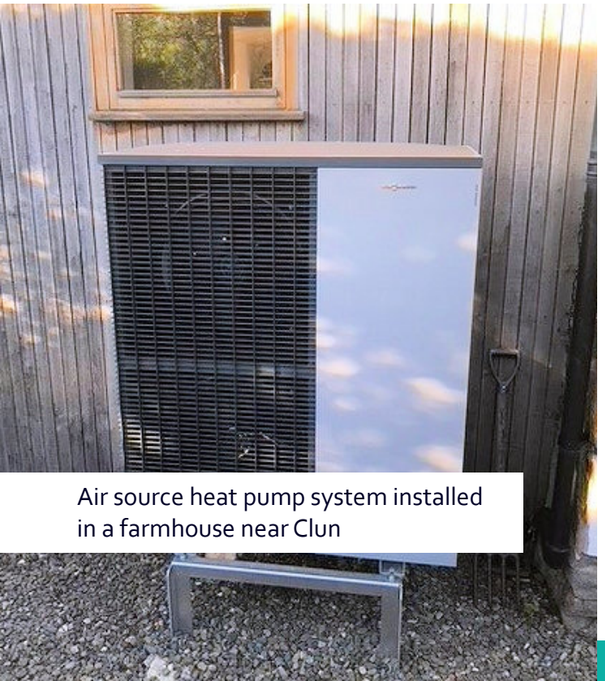
• The Construction Leadership Council's consultation document: Greening our existing homes – a national retrofit strategy

• EnerPHit: A Step by step Guide to Low Energy Retrofit (Traynor, 2019)

• The Centre for Alternative Technology has a useful paper on *Whole House Eco-Refit*, 2021

• The Passive House Resource describes the principles and standards of Passive Houses and applies them to refurbishments and refits.

• The TRUSTMARK leaflet: Whole House Refit – a consumer guide, 2020, is based on the current Energy Performance Certificate (EPC) methodology (see below) and aims only at the Government's target of getting all homes to EPC Band C by 2035.



Air source heat pump system installed in a farmhouse near Clun

Refit programmes: the challenge ahead

A successful refit programme will require an integrated approach to the following:

a) A vigorous and effective programme to improve insulation – a fabric first approach.

b) A huge upskilling of the local workforce able to deliver and deliver well; to include a rapid increase in apprenticeships and College training courses to expand the industry.

c) The availability of workable and stable investment programmes, including low-cost investment options for those able-to-pay and grants for those who are struggling; and offering equal and easily accessible refit incentives to occupants in different kinds of tenure and to landlords.

d) The willingness of householders to switch to electricity from 100% renewable suppliers.

e) The widespread use of residential properties for solar PV generation.

f) The use of 'smart' controls to improve the efficiency of heating systems.

g) The replacement of oil and gas boilers with heat pumps wherever possible.

h) The installation of heat networks to share heat between buildings.

iI) An integrated and NZC-compatible approach to fuel poverty, taking into account health and wellbeing factors (for example by social prescribing).

j) Good advice services for all forms of tenure, including those who do and those who do not need grants.

k) A special programme for historic and listed buildings.

l) A political consensus to prioritise long-term policies and incentives to sustain investment, training and jobs in this industry over the coming decades.

Such a programme will undoubtedly require unprecedented levels of public and private investment.

Investment figures to bring each home to NZC vary as follows:

- **EPC Band G to NZC: £45,000 per property** (Based on a 2 bed semi-detached bungalow with photovoltaic panels – based on a large array size, and solid floor insulation).

- **Band F to NZC: £41,000 per property** (Based on a 3 bed semi-detached house with solar thermal panels for hot water, photovoltaic panels and heating control upgrades).

- **Band E to NZC: £31,000 per property** (Based on a ground floor flat with heating changed to a heat pump, cylinder upgrades, external wall insulation, triple glazing and photovoltaic panels).

- **Band D to NZC: £27,500 per property** (Based on a first floor flat, with heating changed to a heat pump, cylinder upgrades, triple glazing and photovoltaic panels).

At a mid-value of around £35k per home this requires an investment of around £1.05 billion, just in South Shropshire. The new Green economy will generate new industries, jobs, wealth and tax revenues. But the pace of change required to reach the NZC targets cannot be left to the market. The Marches social housing provider Connexus, calculates a 25% cost difference between using current building standards and the Passive House standards which they achieved in a development in Much Wenlock (see photo opposite).

Government policies need to address the scale of the required public investment with the same single-minded urgency that they have given the Covid 19 pandemic.

Our Proposals

We propose that the following projects be implemented after investigation of their feasibility, cost and timing:

A. Agreeing a methodology

Marches Energy Agency (MEA) to convene an on-line consultation of our partners in the Marches involved in refitting buildings:

Aim: To explore the possibility of a shared methodology, to include:

i) A workable definition of Net Zero Carbon (NZC) as applied to residential buildings, which can be applied consistently and will enable both businesses and the general public to compare like with like. Should it be Net Zero Carbon (NZC) or Net Zero Emissions (NZE), and how should these be defined? Should this be based simply on current energy use, or include embedded energy in the buildings and furnishings? If so, how are these to be measured?

ii) The choice of a carbon calculator: There are many different carbon calculators available, each of them with its merits and using slightly different methodology. It would be helpful for individual households and communities to agree to consistently use the same set of calculators. See SCAP's Carbon Watchers project and Stretton Climate's Care suggestions below:

- Zero Carbon Shropshire's Carbon Watchers project offers individuals and groups of households a methodology for regular carbon footprinting using a calculator from four recommendations (for details see Communities section).

- For individual households, the calculator preferred by Stretton Climate Care is Carboncalculator.com. This also incentivises householders to switch to a renewable energy supplier by requiring them to enter the carbon emissions factor of their own electricity and gas supplier.

A passive house development near Much Wenlock by architects, Architype

These carbon emissions factors are listed on the website of electricityinfo.org.

- The IMPACT Community Carbon calculator estimates the carbon footprint of a local community such as a parish (see Figure 12 below).

iii) A recognised and reliable standard of accreditation: The current official Energy Performance Certificates (EPCs) indicate a property's energy efficiency in a range from Band A (most efficient) to Band G (least efficient). The national average is Band D. But the existing EPC computer programme compares the current performance of a heating system only with an improved system using the same fuel; it does not measure the improvement in the carbon footprint achieved by switching to a renewable alternative. This is now recognised as a fault in the EPC methodology which needs rectifying. Until this is available ***another model is needed which can command consensus.***

Alternatives include:

- Parity Projects operate their CROHM tool (Carbon Reduction Options for Housing Managers) to enable public and private landlords to design whole-house retrofit programmes for their housing stock, and for occupants in fuel poverty.

- Passivhaus Plus/ EnerPHit advocate much higher standards (Passive House Institute, 2016).

- PAS 2035 specifies the standards for all future retrofits (Rickaby, 2020).

- Should energy consumption be measured in in kWh/m²/pa? The EnerPHit standard is 30 kWh/m²/pa, compared with the Social Housing Decarbonisation Fund Demonstrator figure of 50 kWh/m²/pa

B. Building capacity

ZCS to convene a meeting of agencies in the local supply chain. This should take place after Covid restrictions are lifted, and include assessors, architects, builders, building material suppliers, heating installers, public and private landlords, estate agents, trading standards officers and representatives of the planning system and the Colleges (Herefordshire and Ludlow College and North Shropshire College).

Aim: To identify opportunities and problems, develop a co-ordinated approach and help local firms to scale up, especially those discouraged by previous experience. The agenda to include:

- The provision of professional refit assessment to householders, going beyond the EPC surveys (who would pay?).

- Promoting refit especially at the time of buying and selling properties.

- Developing College courses to upskill builders and other professionals and expand the number of trained apprentices and accredited installers.

- Co-ordinating the financial regimes, grants etc to sustain investment, training and jobs.

- Considering the refit needs of the public and private rented sector.

- Encouraging the integration of planning decisions and new housing developments with the views of CPRE and the wider NZC agenda. With Shropshire already set to build 30,000 new homes by 2030, how ready will these be to take their place in the new NZC world? What is the relationship between the location of new housing and the availability of public transport?

- Creating public awareness of bad practice by some firms both in the suitability and quality of their installations and/or in their sales methods.

- Rigorous evaluation of progress.

C. Engaging the public

1. SSCA, ZCS and HGN to make information about refitting homes to NZC standards available on-line.
We propose that the Herefordshire Green Network Building Retrofit Information Hub should be adapted to include information about Shropshire, and that it be made available Marches-wide by HGN and ZCS.

2. SSCA to roll out a roadshow across South Shropshire.

Aim: to supplement the visits by SSCA's Communications Group to Parish and Town Councils by a series of events for the general public, to inform local communities and encourage involvement in the refit programme. The roadshow would offer:

A) A "Climate Conversation" – a 'fortune teller's tent' which does not tell people what to do, but asks: *"What have you already done? What would you like to do?"*

B) A toolkit of information, contacts etc, including DIY options and materials for post-refit evaluation and feedback.

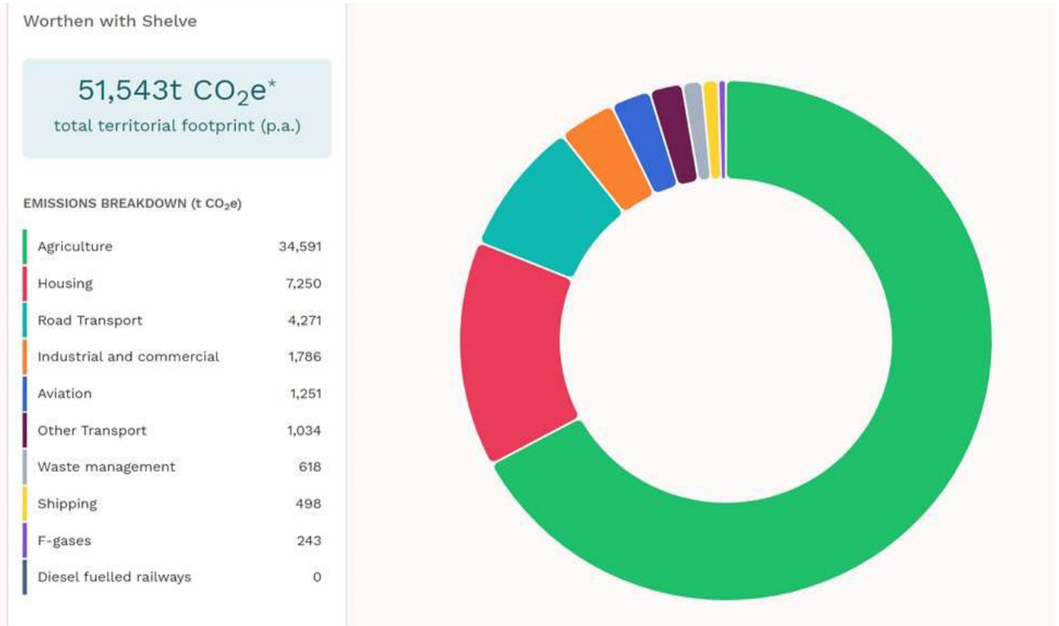
C) Case studies illustrating refitted homes in various types of housing stock. A range of Case Studies can be found on our website.

Examples of refit including a substantial DIY element:

- Eco-friendly renovation of a mediaeval house.

- Air-Source Heat Pump (ASHP) with underfloor heating.

Fig 12: Impact tool estimating the carbon footprint of a local parish



Progress of a bungalow towards NZC:

- Part One and part Two

Whole Estate Passive Houses:

- Connexus scheme at Callaughtons Ash, Much Wenlock (see page 89).

Particular issues:

- External Insulation

These and other case studies are available on the SSCA website.

D) Support by local volunteers (can we motivate and train some of the Covid support groups?).

D. Addressing the Fuel Poverty agenda

The Board of Health and Wellbeing in Shropshire be asked to convene a consultation between health and social work professionals, social housing providers, care agencies (including the Mayfair Community Centre, Church Stretton and the Shropshire Community Connectors).

Aims:

- to strengthen social prescribing in the context of NZC 2030.

- to identify difficulties which have arisen in co-ordinating the responses of the different agencies to the housing needs of people in fuel poverty.

- to adapt affordable warmth advice.

The background to this consultation is as follows: MEA regularly publicises the resources of "Keep Shropshire Warm," and circulates this information to a number of agencies which are able to identify households in need:

- Mental health support groups, *Community Centres, *Food banks.

- Medical services: GP's, Medical Centres, Community Care Co-ordinators.

Installing external cladding on a South Shropshire bungalow (c) Lightfoot Enterprises

- Social Workers, *Health Visitors, *Local church networks.

- Town and Parish Councillors, *Trustees of local charities.

However, experience has revealed a number of difficulties:

- An excellent scheme whereby health visitors were able to identify homes in fuel poverty with the help of a list of indicators was discontinued due to cuts.

- GDPR can frustrate the sharing of data.

- "Gatekeepers" such as Medical Centre managers may omit to put up notices publicising help for those in fuel poverty.

- The Covid crisis has overwhelmed health services with its own urgent priorities and restrictions.

When the Covid crisis is over there will be the opportunity for a new initiative to overcome these difficulties. The proposed consultation would aim to bring together the agencies listed above, and maybe some brave families who are willing to share their stories, in order to:

- Set the issues and difficulties in the context of the urgency of NZC 2030.

- Break down barriers between the different groups and build a sense of mutual understanding.

- Create a sense of common purpose between the different agencies around this target, and a determination to overcome the difficulties.

NB*:* It has to be acknowledged that the most urgent need of people in fuel poverty is for affordable warmth, and the properties in which they live might be unsuitable for Zero Carbon solutions such as heat pumps. Indeed, the efficient heating of their homes might well increase rather than reduce their carbon footprint in the short term. In such cases it is important that the interim refit makes passive provision for a future Zero Carbon upgrade, for example by fitting suitable piping and radiators.

E. Carrying out a field trial

SSCA and MEA to work closely with 50-100 local householders:

Aims:

A) **To implement refits,** especially when properties are bought or sold, develop good practice, learn from experience and identify problems.

B) **To explore new legal and financial models** to get off grant funding, attract community investment and support struggling/fuel-poor households.

What non-grant funding options are there?

- Ecology Building Society/ other mortgage lenders.

- Robert Owen Community loans offering 0% loans in Wales. Can we replicate that in Marches?

- Shropshire Green Bond - being developed by Shropshire Council: could this offer a route to funding, possibly like a local off-setting scheme or private investment? A 3-5% return rate (the same as community shares) might be about right for investors.

- What size of contribution would be acceptable to householders on moderate or low incomes?

F. Giving feedback to Government

SSCA to maintain a regular channel of contact with the MP for Ludlow

Aims:

- To keep our MP (and through him Parliament's Environmental Audit Committee, which he chairs) informed of the developing realities on the ground.

- To campaign for urgent, consistent and long-term policy commitments to the goal of NZC, backed by sustained investment.

- To collaborate with him in bringing our experience and concerns to the COP 26 Conference.

The impact of our proposals

Co-benefits

In addition to reducing our Energy and Buildings to NZC, there will be a range of co-benefits from the required investment, including:

- Healthier homes that are warmer and cheaper to run for those who are struggling.

- Jobs created through the manufacture and installation of measures to reduce and generate energy. This must build on existing businesses to create local opportunities for highly skilled careers.

- Stronger communities of people who are environmentally and politically literate, and have helped to inform and shape policy and investment decisions.

Letter from the future?

Little did we know what we were taking on when we launched Shropshire's "Net Zero Carbon by 2030" campaign a decade ago in 2020. The Covid crisis was dominating headlines and the Government's energies, and we were proposing a much quicker implementation than the Government's target of 2050. But in the event we were helped by four factors:

- The Covid crisis had shown everybody that we really could change our ways of living and working if we had to.

- The COP 26 event hosted by the UK in November 2021 led to a timely refocussing of attention on the urgency of the climate crisis.

- Continuing global and local manifestations of flooding, forest fires and extinctions all related to Climate Change reinforced the message.

- The realisation dawned on people that the Government's own 2050 target required the biggest changes to have been carried out by 2030 in any case.

These pressures led to a collective determination to "get on with it", and even the newspapers joined in. The overall effect was that by early 2022 we found that, rather than swimming against the tide, our help and advice was being sought, and we were run off our feet.

The housing refit programme was a major priority for us because it is so central to the life of every person and family. Once the Government had given a decade-long promise of financial support, new and improved models of heat pumps appeared on the market and the number of accredited suppliers of Zero Carbon heating systems increased rapidly, offering secure skilled employment and investment opportunities. This aspect of the refit programme was successfully carried out with the systematic thoroughness of the programme of conversion from coal gas to natural gas in earlier decades.

Major improvements in the rented sector were made possible by the new emphasis given to social housing in the Government's "levelling up" agenda. The refitting of substandard housing and flats was made a priority, and integrated interventions by the providers of housing, health and social services have brought improvements in health and wellbeing.

Regulatory changes now require all new properties, both for rent and owner-occupation, to be Zero Carbon compliant. There are good examples in South Shropshire of developments with shared heating systems fuelled by ground source heat pumps or biomass from waste. Many households are able to generate electricity for their own domestic use or vehicle recharging from solar arrays and smart PV/battery systems.

A major success in the privately owned sector has been the realisation that the best time to tackle the refitting of a whole property is on change of ownership. This has been assisted by:

- the improved EPC (Energy Performance Certificate).

- the financial incentives available through the UBYM (Upgrade Before You Move) scheme, which includes a grant to allow householders to find temporary accommodation while underfloor heat pump systems are installed.

The acceleration of the refit programme has encouraged a new culture of DIY co-operatives in conjunction with the growth of local Repair Workshops. These have brought down costs and provided advice and practical support. A special programme under this umbrella is available for the refit of Shropshire's many listed and other heritage buildings, supported by grants and loans and the expertise of the heritage bodies and CPRE.

We are not yet out of the woods on the Climate Emergency, but the last decade has definitely seen a turnaround. Changed patterns of energy generation and consumption and a much improved housing stock are moving us in the right direction and giving us cause for hope.

"The efforts of local authorities, householders, businesses and community welfare agencies need to be co-ordinated into an effective local retrofit movement which is able to provide technical and financial advice, successful businesses with a skilled workforce, and affordable zero-carbon warmth for all"

Transport

Introduction

Reducing climate damaging carbon emissions nationally in Shropshire and in the Ludlow constituency is possible (Whitelegg *et al*, 2010, Centre for Alternative Technology, 2017). It is possible, desirable and urgent and the reduction objective is supported by the declaration of a Climate Emergency.

Dealing with Climate Change and decarbonising transport produces a large number of co-benefits that are already accepted as important public policy objectives. The measures and interventions that are identified in this Report will substantially decarbonise transport in the Ludlow constituency. In addition, they will deliver a much fairer, cleaner, healthier quality of life for all 85,000 residents.

Not only this but transport policies and interventions that reduce car use and increase walking, cycling and public transport use whilst promoting accessibility to routine destinations in the constituency, will also reduce public and private costs. (Vivier, 2006).

Decarbonising transport is an unalloyed win-win strategy with multiple synergistic benefits that improve the quality of life of every resident.

A report by the Stockholm Environment Institute identified the wider societal gains and benefits associated with Zero Carbon transport that are not delivered by current transport policies (Whitelegg *et al*, 2010). They include:

- Reductions in air pollution and noise directly linked to reductions in car use.

- Much improved public health is derived from higher levels of walking and cycling and increased physical activity. Higher levels of physical activity as a result of more walking and cycling reduces non-communicable diseases such as obesity, diabetes and cardio-vascular disease. These public health gains are fully documented in WHO, 2020.

- Reduction and elimination of traffic congestion.

- Reduction and elimination of deaths and serious injuries in road traffic as a result of a general 20mph speed limit on all roads where pedestrians, bicycles and vehicles can mix (Whitelegg and Haq, 2007).

"Decarbonising transport is an unalloyed win-win strategy with multiple synergistic benefits that improve the quality of life of every resident"

A Land Rover drives down off the Long Mynd, near Church Stretton
(c) Paul Weston / Alamy Stock Photo

- Improved quality of life for older people, who after decades of driving may not be able to drive for health reasons.

- Economic benefits for local shops, local independent retailers and jobs as those who choose to walk, cycle and use a bus are more likely to shop in their local area. Interventions that promote more walking and cycling can increase local retail spend by 40% (Abrantes, Ellerton and Haines-Doran, 2016).

- A fairer society where transport spending by public bodies benefits all genders, all income and age groups and those on benefits. Spending on road building and electric vehicle charging points disproportionately benefit higher income groups at a time when bus support from public funds has reduced.

- Streets that are much more attractive and encourage social contact and community cohesion (Appleyard and Lintell, 1971; Appleyard *et al*, 1981).

- Streets that are child-friendly (Tranter and Tolley, 2020).

The Stockholm Environment Institute report outlined a detailed package of economic, behavioural and spatial interventions that would deliver a 100% reduction in transport carbon (surface transport only) in the UK by 2050.

The issue

Transport in the Shropshire Council area as a whole is responsible for 37% of all direct carbon dioxide emissions (BEIS, 2020). There are no published figures for the Ludlow constituency. In Table 19 (overleaf) we estimate carbon emissions from cars, HGVs, vans and buses in the Ludlow constituency.

The target SSCA has set for this project is Net Zero carbon dioxide emissions by 2030.

On 4th December 2020, the Prime Minister announced a target of a 68% reduction in Greenhouse Gases on a 1990 base by 2030. The Climate Change Committee in its Sixth carbon budget (Climate Change Committee, 2020) recommended a 78% reduction in UK territorial emissions between 1990 and 2035. This is equivalent to a 63% reduction from 2019. If we are to get as close as possible to Net Zero Carbon by 2030 it is important that we reduce the surface transport contribution as much as possible and as soon as possible.

The SSCA Transport group here sets out how transport emissions can be reduced by reference to a robust evidence base. If policies, planning and spending are re-set to deliver all the recommendations we make in this Report we are confident that we can bring forward the Climate Change Committee recommended reduction by five years to substantially achieve that objective by 2030. We can reduce surface transport carbon in the Ludlow constituency by 48%. We also identify a number of interventions that are additional to those that can deliver the 48% reduction and recommend that these are adopted by all local and central Government, NHS and business organisations.

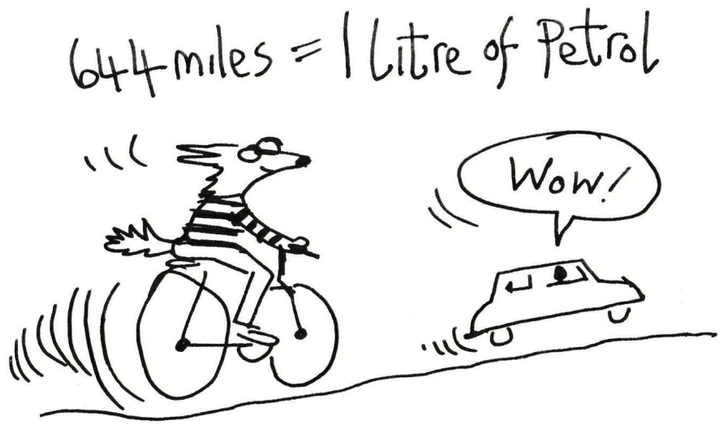
The contribution of the transport sector to UK domestic GHG emissions is 28%. Shropshire's equivalent figure is 37%. Nationally transport emissions are 4% higher than in 2013 and only 3% lower than in 1990 (DfT, 2020).

Shropshire's transport CO2e emissions (thousands of tonnes) have increased every year since 2013 with a very small "dip" in 2018 when compared with 2017. These emissions were 687,000 tonnes in 2013 and 758,000 tonnes in 2018 (BEIS, 2020).

These data relate to the whole of the area covered by Shropshire Council. The performance of different segments of land transport sources reveals large increases in

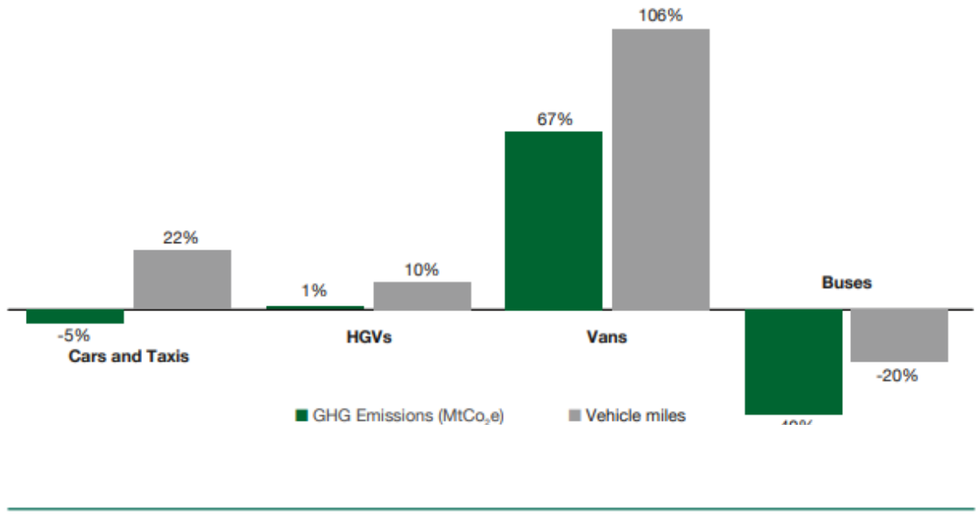
Transport: Our Key Messages

- **Transport is responsible for 37% of Shropshire's direct CO_2 emissions.**
- **Achieving Net Zero Carbon by 2030 requires substantial reductions in transport carbon.**
- **The evidence that transport reductions can be achieved is very strong indeed.**
- **We have identified what needs to be done and based on best practice, what must be done to achieve transport carbon reduction.**
- **A Net Zero Carbon transport future gives all age groups, all income groups and those with disabilities and health problems much wider choices about how they travel and how they gain access to hospitals, schools, colleges and shops.**
- **Reducing transport carbon delivers significant improvements across a large number of wider policy objectives including the improvement of air quality, road safety and public health. It supports rural communities, assists in retaining our young people in rural areas and supports the local economy.**



(c) Energy Diary, Lightfoot Enterprises (Angela Martin)

Fig 13: Change in road transport GHG emissions and traffic (vehicle miles), 1990-2018 (Department for Transport, 2020, page 14)



GHG emissions from vans and HGVs, a large decrease from buses and a small decrease for cars.

Hopkinson and Sloman, 2018 have commented on the relatively poor performance of the transport sector in terms of decarbonisation:

"The transport sector is lagging in terms of carbon reductions and more action is needed beyond the measures set out in the 5th carbon budget. The IPCC has set out the scale and urgency of the challenge. To limit global temperature rise to 1.5°C will need deep emission cuts from all sectors as quickly as possible.

Even if all new cars and vans are zero-emission by 2030, which will reduce emissions significantly, it will still be necessary to reduce miles driven. The scale of traffic reduction required may be in the order of 20-60% by 2030, depending upon the implementation of other policy measures.

We therefore need to develop and assess policy scenarios that could achieve large reductions in traffic volume. There is significant scope to shift car journeys (and mileage) to other modes. There is most potential for change in urban areas, but we will need to reduce traffic elsewhere too. The current focus in national transport policy on building new roads will make matters worse, because it will increase car dependency and traffic. The Government should therefore cancel all new road construction until transport carbon emissions are in line with carbon budgets and use the money to invest in sustainable transport infrastructure and services. This will not only help us work towards Net Zero emissions by 2050, but will also result in better air quality, safer roads, healthier lifestyles and more vibrant and convivial towns and cities. How we do this will be outlined in future papers."
(Hopkinson and Sloman, 2018)

SOUTH SHROPSHIRE CLIMATE ACTION

Surface transport carbon (CO_2e) emissions

Current emissions have been set out in the Climate Change Committee, 2020 Sixth Carbon Budget. The key points are:

- Emissions from surface transport in 2019 were 113 $MtCO_2e$, which accounted for 22% of total UK GHG emissions. This makes surface transport the UK's highest emitting sector.
- Cars account for 61% (68 $MtCO_2e$) of surface transport emissions and a larger share (78%) of UK road travel (in terms of vehicle-kilometres).
- HGVs account for 17% (19 $MtCO_2e$) of total surface transport emissions, despite making up just 5% of road vehicles.
- The remaining emissions are shared between vans (17%), buses (3%), other 3%.

Table 17: CO_2e emissions from surface transport for the area covered by Shropshire Council and in the Ludlow constituency

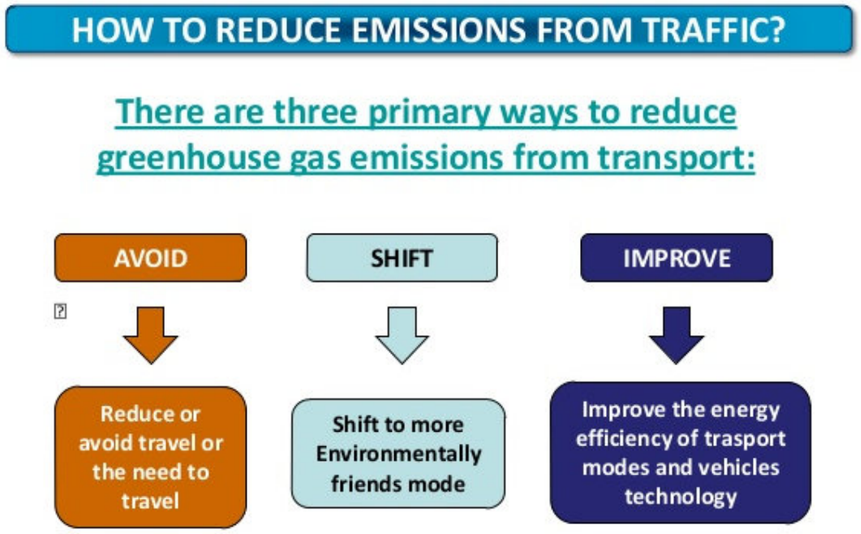
	% (Note 1)	Thousands of tonnes, Shropshire	Thousands of tonnes, Ludlow constituency *(Note 2)*
Cars *(Note 3)*	60	455	118.3
HGVs	17	129	33.5
Vans	17	129	33.5
Buses	3	22.5	5.85
Other	3	22.5	5.85
	100	758	197

Note 1: *Source of percentages attributable to cars, HGVs, vans and buses: Climate Change Committee, 2020 Sixth Carbon Budget. Source of Shropshire CO_2 data is BEIS, 2020. Source of Ludlow constituency CO_2e data are our own calculations. The Shropshire total (column 3) is multiplied by 26.3%. 26.3% is the Ludlow constituency population as a percentage of the total population of Shropshire.*

Note 2: *The Ludlow constituency has a total population of 85,112 (Who Shall I Vote For). The population of Shropshire (the area covered by Shropshire Council and not including Telford and Wrekin) is 323,136 (Shropshire Council, 2019). The Ludlow constituency population total is 26.3 % of the Shropshire total and the kt CO_2e for the Ludlow constituency is very approximately 26% of the kt for Shropshire as a whole.*

Note 3: *The Climate Change Committee list cars as 61%. The actual percentage is 60.32 so we have followed standard practice and listed that as 60%*

Fig 14: How to reduce emissions from traffic? (Deutsche Gesellschaft für Internationale Zusammenarbeit, 2019)



Current CO2e emissions in Shropshire and the Ludlow constituency are summarised in Table 17.

Avoid-Shift-Improve

This Report adopts the widely accepted conceptual framework underpinning sustainable transport's role in reducing carbon emissions. This is referred to as the Avoid, Shift, Improve concept or A-S-I.

Avoid:

The "avoid" component includes planning and transport policies that avoid adding extra Carbon to the inventory. In the Shropshire context this would lead to the cancellation of the North West Relief Road which will add extra Carbon in construction and in operation (Whitelegg, 2021). It would also include a new approach to the planning of 30,000 new homes in Shropshire. Many of these new homes are on greenfield sites and poorly served by walking, cycling and bus infrastructure. They build in extra carbon emissions throughout the lifetime of the buildings. Planning permission would only be granted if the location and pre-occupancy infrastructure delivered reductions in car dependency and maximised walking, cycling and bus use.

Avoid also includes new ways of working that have been prominent as a result of Covid 19 measures. Virtual meetings and working from home are not a universal substitute for physical alternatives, but they can reduce car use and should be promoted where this is appropriate.

Shift:

Shift is widely understood in sustainable transport and there is huge potential for reducing car use and switching a proportion of those trips to walk, cycle and bus use. Policies that promote "modal shift" have been in place for many years e.g. they can be found in Shropshire Council's Local Transport Plan 3, 2011-2026 (Shropshire Council, 2011). Unfortunately the policies have not been translated into physical changes and budgets and Shropshire Council has imposed cuts in bus services and funding and still has poor quality walking and cycling infrastructure. It has also rejected the general, wide-area, default 20mph speed limit policy on streets where pedestrians, cyclists and vehicles mix, contrary to World Health Organisation recommendations (Stockholm Declaration, 2020) and has also announced that it will demolish Shrewsbury bus station and weaken the attractiveness of an integrated bus and rail public transport offer (Shropshire Star, 2020).

Improve:

There is currently a great deal of support for electric vehicles. This support takes many different forms e.g. public funding for EV charging points, lower taxation for EVs, grants to encourage exchange of petrol and diesel cars for an EV. However a faster switch to EVs is necessary but not sufficient to deliver the required amount of Carbon reduction (Hopkinson and Sloman, 2018). Transport policy dominated by EVs does not deliver the required amount of Carbon reduction. Whitelegg *et al*, 2010 produced a zero carbon transport plan for the UK based on a 50% reduction in car use with the remaining 50% being be Zero Carbon.

Electric vehicles still produce deadly PM2.5 emissions from brake and tyre wear and road surface abrasion and do not deliver the public health and active travel gains associated with reductions in car use itself.

The A-S-I approach follows a hierarchy: "avoid" measures should be implemented first, secondly "shift" and finally the "improve" measures.

For the avoidance of doubt, this has a specific meaning in Shropshire and a specific order of priority:

1. Avoid includes cancelling the North West Relief Road and adopting the full guidance on new homes to minimise car dependency and maximise walking, cycling and public transport across all 30,000 planned new homes. (Transport for New Homes, 2019).

2. Shift includes adopting a full range of funded infrastructure and service-level changes to improve walking, cycling and public transport and shift car trips to the sustainable modes.

3. Improve includes support for the replacement of all fossil fuelled vehicles by zero Carbon alternatives.

This is the approach adopted by the transport thematic group of the Ludlow constituency project.

Report structure

The transport thematic group was organised around six issue-based contributions. They are:

1. Buses, trains and public transport integration
2. Car sharing
3. Walking and cycling
4. HGVs
5. Vans
6. Behavioural change, including Travel Plans (TPs) and Personalised Journey Planning (PJP).

All contributions are focused on producing a strong evidence base showing how we can reduce Carbon emissions from the main sources of those emissions (cars,

HGVs, vans) and exactly what we must do in the distinctive geography and circumstances of the Ludlow constituency to get as near as possible to Net Zero transport carbon by 2030. The severity and urgency of the Climate Change crisis and the recognition of this that led to the declaration of a Climate Emergency by Shropshire Council now requires specificity.

Exactly what will we now do to reduce transport carbon emissions in the Ludlow constituency?

The time for general policy statements and aspirational documents that are not translated into any meaningful action or change (Shropshire Council, 2011) is now over. The future will not be like the past. It will be very different. Here we show that in the Ludlow constituency we will deliver carbon reduction specificity and we intend to share how we did it with the world at COP 26 in Glasgow in November 2021.

Executive Summaries of the six decarbonisation strands follows.

1. Buses, trains and public transport integration

Transport scientists highlight the need to do more than switch to electric or hydrogen powered vehicles to reduce transport carbon emissions in the future (Hopkinson and Sloman, 2018). Part of the solution will be a need to design a public transport network which encourages people to shift some journeys from car to bus and train (Redman *et al,* 2013).

The primary aim of this work is to outline an integrated public transport network in the Ludlow constituency that meets the needs of people. A real alternative will give people a choice and reduce car journeys as advocated in the A-S-I model. A shift to bus and train travel requires lifestyle changes, especially for the 43% of journeys between 5-25 miles which are made by car at present (Brand, Anable and Morton, 2019). In the rural Ludlow constituency buses are important given that there are only two rail lines, both operating north to south. The factors which encourage use of a bus network are well researched: frequency, reliability, attractive door to door journey times, and relative cost vis-à-vis the car (Transport Focus, 2020). If rural services are reliable, offer attractive journey times, safety and comfort then more passengers will be attracted to the network hence reducing car trips. This, of course, presumes that there is a planned delivery by a local authority in conjunction with bus and train operators (Walker *et al,* 2020).

Journeys are often habitual and perceptions of cost ingrained. An RAC Foundation report indicated that bus fares have risen by an average of 55% since 2010 whereas the total cost of motoring has risen by less than 20% which is 10% less than the average cost of living (RAC Foundation, 2020). There is clearly a need for affordable fares to be adopted and this is reinforced by several attitudinal surveys (National Travel Survey Attitudes Study, 2020).

Integration of buses and trains is an essential element of the transport system bringing together modes, sectors, operators and institutions, with the aim of increasing net social benefits (Preston, 2012). A useful model of transport integration, the integration ladder, offers a model for the Ludlow constituency (Hull, 2005). This involves a quality partnership, voluntary or formal, which increases benefits to society, works for bus operators and attracts new customers (Song, Preston and Hickford, 2014). Other researchers advocate the idea of local authorities taking more control of bus services so as to improve integration. Three quarters of the Climate Assembly delegates supported the option to bring public transport into public ownership to develop better services (Anable, 2020). A good example is Cornwall Council prioritising an integrated public transport network over roads in line with its Local Transport Plan (Cornwall Council, 2020).

Pulse or clock face bus services are common in northern Europe where passenger transport is designed and operated at a regional level. The network is scheduled to connect, bus to bus, bus and train on an hourly pattern (Peterson, 2016). One example is Graubünden, an Alpine community with a population density of 27.9 per square kilometre where a pulse based public transport system works well, and reduces car trips (Peterson, 2016) This provides a good comparison as Ludlow constituency has 56 people per square kilometre.

An integrated network in the Ludlow constituency

The key first step on the 'integration ladder' involves Shropshire Council: changing policy, investment and budgetary adjustment to deliver sustainable transport. Four dimensions of integration to achieve a sufficiently attractive network
are as follows:

Integration of public transport information:

This includes web-based timetables, maps and fares, printed timetable displays at key locations, real time information at all key interchanges, such as in market towns and an app for public use (as is the case with Arriva and Diamond) which shows where their vehicles are on any given route.

1. Physical integration of public transport services: It is proposed to have

The bus to Shrewsbury
(c) PA Images / Alamy Stock Photo

three levels of service and co-mobility hubs at the key towns.

2. Conventional principal bus network based on the pulse (clock face) principle, hourly every day such as Ludlow to Shrewsbury.

3. Secondary network possibly with a flexi-bus operation, two hourly, daily such as Bridgnorth to Kidderminster via Arley.

4. Demand-responsive transport for deeper rural areas, as in the west of the constituency such as the Bishop's Castle area.

Physical integration will also require the integration of school buses into overall service patterns for rural communities (Preston, 2012).

Integrating the network with hubs: The key interchanges would be developed into co-mobility hubs at Bridgnorth, Ludlow, Craven Arms and Church Stretton.

Integration of fares and ticketing: Multi-operator ticketing, revision of short distance fares.

Estimated reduction in CO_2 emissions: A major change as envisaged by the Secretary of State for Transport, Grant Shapps:

"The scale of the challenge demands a step change in both the breadth and scale of ambition and we have a duty to act quickly and decisively to reduce emissions." (Department for Transport, 2020, page 3)

A review of Local Sustainable Transport fund recorded an annual increase in patronage of 2.5 million trips replacing 12 million car kilometres per year and a reduction of 2,300 tonnes of CO_2 per annum (Department for Transport, 2018).

The Climate Change Committee, 2020 has forecast that 2-4% of car kilometres can be switched to bus and train by 2030. It also notes that between 9-12% of trips can be shifted to buses. Given the rural nature of the Ludlow constituency, the lower level of 9% is realistic. We are confident that if all our suggestions for improvement in bus service provision and integration are implemented this 9% shift translates into a 9% reduction in CO_2 emissions. This should be an appropriate target to achieve by 2030.

2. Car sharing

'Why drive around sitting next to an empty armchair with an empty sofa behind you?'

The evidence in this paper for promoting car sharing, and thus reducing transport carbon emissions, is drawn from practical experiences in the UK and, to a lesser extent the rest of Europe. Car sharing takes numerous forms, but all are part of a transition from private car ownership towards shared mobility as part of the actions to deal with Climate Emergency. Increased car sharing is one of the changes that must be made to meet the 13.5% annual transport emission reduction targets to reach zero by 2030.

Evidence for this has come from many sources: the UK Climate Change Committee and central Government Departments for Transport and Business and Industrial Strategy, the Welsh Government, Public Health England and NHS Trusts. The Local Government Association and Shropshire County Council have also been called upon as key sources for policy matters. Scientific evidence has been elicited from research bodies such as the Tyndall Centre, (CAT) Centre for Alternative Technology) and other academic institutes involved in Climate Emergency research. Bodies such as the UK Citizens Assembly and Ipsos Mori have provided a perspective on the behaviour needed to effect change. Motoring and consumer organisations such as the AA, RAC and 'Which' have also informed the research on these matters. West Midlands employers and car sharing organisations, such as Liftshare and CoWheels have provided examples of existing car sharing schemes. The evidence reveals that workplace car schemes, for example, typically save about 1 tonne per car sharer each year.

Actions

Before widespread reductions in journeys and emissions can be expected from the public, preparatory work is essential. Change will not happen unless people are prepared for it; they will not be prepared if they do not understand the reasons why shared transport, or collaborative mobility, will be essential in future.

To help people to understand this, electronic platforms and printed materials are needed in South Shropshire, as elsewhere, to explain the environmental impact of people's choice of transport modes, and to encourage people to change from using the fossil-fuelled private car, especially for single occupancy. Three key messages to encourage change are available now in these publications:

1. The space required to transport sixty people (The *Munster* poster).

2. The graph which shows emissions/ passenger kilometre for different travel modes (From the Institute for Sensible Transport).

3. The financial and environmental costs of reliance on single occupancy cars (CoMo).

When the public see these, they are more likely to become aware of their personal annual CO_2 transport emissions, how much CO_2 is emitted by a unit of petrol or diesel, and the monthly and annual average costs of running their vehicle/s. They will consider options to change their personal transport usage and how those changes can contribute to cost and emission savings targets.

Specific reductions in journeys and emissions can only be estimated. They depend on how successfully people change their behaviour in response to their understanding of the ill effects of their previous travel behaviour and the benefits of changing.

Alongside the preparatory work described above to motivate change by individuals, South Shropshire Climate Action will engage with the authorities to encourage and provide advice on establishing two new car-share clubs/schemes by January 1st, 2023. The first will be a community-based club in a settlement of less than 1,000 inhabitants. A large employer will be approached in a bigger market town (such as Bridgnorth, Ludlow or Cleobury Mortimer and so on) to investigate starting up a Liftshare scheme.

Thirdly, the creation of a demand-responsive transport service, known as the *Tandem*-system, will be investigated for South Shropshire. This is a more effective and flexible system than what was known as *Dial a Ride*.

Results

Annual savings **per person** from car sharing, in money and CO_2 emissions, can be seen in the coloured panel on p.110, when we compare a single occupancy car with another taking one extra passenger.

Extra passengers increase the savings proportionately, so that a single occupancy internal combustion-engine (ICE) car which

took three passengers for five days a week from Bridgnorth to Ludlow saves £2506 and 1.83 tonnes. In an electric car there would be further savings of 1.52 tonnes of CO_2 and £410.60. If the five-day-a-week Bridgnorth-to-Ludlow trip was done in an electric car there would be no extra emissions savings to those saved in an ICE car, but there would be substantial money savings. Passenger contributions of £1.80 per passenger per day could offset the extra cost of buying the electric car.
One car fewer not only removes 1.774 tonnes a year: it also increases the personal income of the disposing owner by £3500-£5700 a year.

Conclusion

Car-share is very important and relevant to the geography of rural Shropshire and the distinctive characteristics of the Ludlow constituency. We know that we can substantially increase bus use, walking and cycling in this area but there will still be gaps in provision and car share can plug those. We have reviewed all the evidence on car share and its impact on reducing car miles and reducing carbon and we note the conclusion of Martin and Shaheen, 2012 that a 27% reduction in car miles can be obtained per car share club member. We recommend that car share clubs, funding, marketing etc be promoted in our area with a target of 1000 members and the recruitment of 1000 members will reduce carbon emissions by 546 tonnes.

For a return journey on one day a week:

Cleobury Mortimer to Ludlow saves £102 and 144 kg of CO_2

Bridgnorth to Ludlow saves £167 and 244 kg of CO_2

Clun to Craven Arms saves £84 and 116.76 kg of CO_2

For a return journey on five days a week:

Cleobury Mortimer to Ludlow saves £510 and 722 kg of CO_2

Bridgnorth to Ludlow saves £835 and 1.2 tonnes of CO_2

Clun to Craven Arms saves £418 and 583.8 kg of CO_2

Car share signage on a Shropshire road
(c) David Pimborough / Alamy Stock Photo

3. Walking and cycling

Cycling and walking are often referred to jointly as "active travel" but each is a distinct method of transport and only sometimes do they overlap. A main point of this Report is that bicycles are vehicles, while walking is the oldest, most trustworthy, carbon-free method of transport available. During the twentieth century motorised transport became dominant, private car ownership the norm. Our urban and rural environments are primarily organised for the purpose of driving vehicles. Cyclists and walkers must make do with what space is left over from what is given to cars, lorries, buses and delivery vehicles. Because cars are large items, whether stationary or moving, and are solid obstacles requiring hard surfaces the required infrastructure takes precedence over people and places.

In this Report we show that the local environment can be redesigned to allow people to walk or cycle. We also show that this only happens when adults and children can do so in safety. We draw a clear distinction between people who cycle or walk for leisure, and those who travel to school or work or for other utility purposes by walking or cycling. To achieve the decarbonisation of transport it is important that anyone capable of travelling by foot or bicycle does so. We describe some of the many measures that can be taken to make active travel a realistic and practical choice, and still have room for leisure walkers and cyclists.

Research shows that it has become normal for many short journeys to be taken by car, these include the school journey. We examine the barriers that prevent children from using active travel to get to school.

In local towns such as Ludlow or Cleobury Mortimer many children do walk to school, often happily chatting away and filling narrow pavements. They take their chances at crossings which may be but often are not clearly marked. Children are no longer protected from crossing busy roads by a lollipop person. In local rural areas the infrastructure at present is designed for cars, leaving cyclists and walkers exposed to chance, sporadic traffic bringing danger. Not surprisingly very few parents allow their children to cycle or walk independently to schools in these conditions.

With the widespread ownership of cars it has become usual for an adult to take the car and for children to be 'dropped off' as the adult concerned goes on to work. In pre-Covid days, in many areas time also became a barrier as the speed and convenience of cars encouraged many people to work or play at distances too far away to reach by walking or cycling. The Report discusses the role of behavioural change in adapting to new transport practices. In all our communities in and around our towns and villages, a safer environment for cycling and walking to school can be created.

In examining the effect the reliance on private cars has on networks between our towns, villages and hamlets we found very high rates of obesity in adults and children are recorded in Shropshire; further, we found out that during the primary years rates of obesity increase. Obesity affects overall levels of health and wellbeing, especially in combination with air pollution.

During the Covid crisis a much greater awareness of the link between physical and mental health has developed and the Report outlines ways in which active travel as cyclists and walkers can improve all types of wellbeing. For a more detailed discussion of these interrelated issues of health, wellbeing and transport please see the detailed reports www.southshropshireclimateaction.org.

As outlined above there are many barriers to active travel and we propose measures to address these which will have a major beneficial impact on how people live. All our measures to some extent rely on imaginative forward planning: links are also needed to facilitate public transport so that an integrated public transport system can provide a network of bus services linked to transport hubs, to provide an infrastructure for cyclists and walkers to travel in safety.

The Government has published a report titled 'Gear Change' committing finance and high quality design principles to active travel. If enacted these measures could be very effective but clear commitment, money and intervention by national Government and Shropshire Council is needed if we are to see substantial change and development to match the Government's intention "for half of all journeys in towns and cities to be cycled or walked by 2030". The Action Plan states that high quality design (as specified in Cycle Infrastructure Design, 2020) costs an estimated £1.4 million per kilometre compared a new road estimated to be about £13 million per kilometre.

In South Shropshire, we propose all the major towns should be reviewed to improve the infrastructure for walkers and cyclists. Such a review could choose to set a 20mph speed limit in all towns and villages, which would immediately improve safety and reduce CO_2 emissions. The state and width of footpaths and pavements and the condition of the road surfaces also need to be reviewed as potholes present a hazard to cyclists, and trip hazards to walkers.

Specific suggestions for cyclists and walkers

Keeping in mind the aim of replacing half of all shorter car journeys by cycling and walking these measures matter to us all.

A. Implement a sustained county-wide campaign to promote the benefits of a shift from cars to cycling and walking.

B. Implement area-wide 20 mph in all towns and villages.

C. Create a Shropshire-wide agreed 'formula' for calculating the potential for active travel in rural areas between towns and their hinterland. This would specify the research and feasibility studies required to assess potential.

D. Appoint 'Cycling & Walking Champions' for each local area (based on Local Joint Committees?).

E. Designate 'Cycle Support Groups' in each LJC.

F. Provide free, regular cycle training classes for all communities.

G. Provide segregated cycle ways on all A and B roads recommended by the 'formula'.

H. Provide cycle-friendly routes on minor roads recommended by the 'formula'. Measures could include speed restrictions, restricted access and installation of foot and cycle paths.

I. Traffic-free town centres with priority given to active transport and permitted access for essential services and disabled people.

J. Safe and secure cycle parking provision at all destination points.

K. Install segregated cycle ways, wherever

Cycling above the Redlake Valley
(c) Sarah Jameson

feasible, (integrated with stand-alone walking and cycling paths where this makes for more direct journeys) from residential areas and Transport Hubs to all schools and colleges.

L. Provide dedicated cycle routes, wherever feasible, to Public Transport Hubs allowing a smooth transition for active travellers to train and bus services.

M. Provide continuous dedicated cycling routes wherever feasible from residential areas and Transport Hubs to all local services (shopping, hospitals, doctors' surgeries, libraries, leisure centres, sports facilities etc. and employment centres).

N. Places of work should be addressed. Wherever feasible installation of segregated cycle ways (integrated with stand-alone walking and cycling paths) can make for more direct journeys from residential areas and Transport Hubs to all schools and colleges.

Zero-Carbon rated E-bikes

1. If zero carbon rated e-bikes were used to replace the majority of car trips (15 km or less) carbon emissions would be halved and would save about 30M tonnes of carbon per year in England.

2. The greatest opportunities for reducing carbon with e-bikes are in rural areas because town and city dwellers have other low carbon options. South Shropshire could save substantial carbon emissions if the many deterrents to cycling (especially road safety) were resolved. This finding has been confirmed by Centre for Research in Energy Demand Solutions.

3. Reports indicate that 50% of car journeys of 15km and less could transfer to active travel but the actual miles represented by this shift are not known. If we assume that these journeys account for half of total mileage and there is a 55% shift then this would result in a saving of 55% x 118,300 tonnes divided by 2 = 32,532 tonnes CO_2 / year. This represents 27.5% of emissions from car travel and 16.5% of total emissions from all land transport.

E-Scooters

1. E-scooters carbon emissions are higher than trains, buses e-bikes, electric and hybrid cars and petrol powered scooters. Their average emissions per scooter mile are over 200gs of CO_2 which only compares favourably with lifetime emissions from an average fossil-fuelled car which emits 400gms of CO_2. They are still illegal in the UK and evidence is weak e.g. they may well replace walk and cycling trips.

2. E-Scooters can only be considered as a small part of an integrated transport strategy where they could be useful as last mile transport for train and bus travellers, and as an alternative to car travel for children going to school. In South Shropshire their introduction could add weight to the requirement for improved walking and cycling infrastructure. They may also help to persuade people to transfer to bicycles as a faster, safer alternative for longer journeys.

Cargo Bikes

One new type of bike offers a radical way to decarbonise our local area as these vehicles are designed to carry loads of up 250 kilos, goods or people. Cargo bikes are zero carbon ready electric or pedal bicycles modified to carry heavy loads and passengers. Evidence from businesses which already use them demonstrates significant CO_2 reduction compared to petrol or diesel transport e.g. 6,700kg of CO_2 per bike each year. They can replace up to 95% of van deliveries within towns and smaller settlements.

One requirement for successful operation of a cargo bike scheme is a consolidation centre. They are adaptable to many situations. The "last mile" is the stage where main road freight deliveries are distributed to businesses and consumers across the UK's towns and cities. Rather than take juggernauts into town centres, loads are distributed to smaller vehicles at a 'consolidation centre', usually on the outskirts of town. The last-mile delivery is the most costly part of the service towards its final target. Over the past decade, mainly due to the growth of Internet shopping, delivery has become dominated by smaller diesel vans. This in turn has had a major effect on urban air quality and traffic congestion. Cargo bikes, together with ultralow emission vehicles are an alternative, sustainable, emission free means of last mile deliveries.

Cargo bikes can also be adapted for delivering mail, passengers and even first responders. Both manual and electric assist cargo bikes are zero rated for CO_2 emissions and their substitution for any petrol or diesel transport has a major impact on carbon reduction, partly through simply reducing traffic while increasing employment opportunities. As there is the further benefit of cleaner air and reduced expenses for businesses, cargo bikes are an important tool in the future decarbonisation of transport. For a fuller discussion of cargo bikes go to www.southshropshireclimateaction.org.

We recommend that urban freight consolidation centres and e-cargo bike facilities are established in Ludlow, Bridgnorth and other towns. This, we suggest, would be funded by a combination of van delivery organisations, supermarkets, Royal Mail, Shropshire Council and the Marches LEP. It will be a demonstration project to reveal the results of shifting van deliveries in rural and small market town areas to e-cargo bikes and electric vehicles. In Ludlow a cargo bike pilot plan for local deliveries has just started. The bike carries up to 280kilos and deals well with hills and narrow streets.

Conclusions

In this ambitious plan our primary purpose must be to decarbonise transport, and we have described many ways that towns and villages can be modified to achieve a far greater number of active travellers. We have shown that active travel brings many co-benefits to cyclists and walkers while at the same time creating a more hospitable environment for all the non-human creatures that live with us and which, to a degree that is only now becoming crystal clear, we depend upon.

If all our recommendations dealing with the totality of walking and cycling are adopted in the Ludlow constituency we estimate that we can achieve a carbon reduction of 16.5% of car emissions (Table 20). A key stepping stone to achieve this aim lies in a modal shift of the school journey from car to walking and cycling. The potential of e-cargo bikes for carbon reduction is further discussed in the section on vans.

4. HGVs

HGVs nationally are responsible for 19 Mt CO_2e, 17% of all surface transport carbon emissions despite just making up 5% of all vehicles (Climate Change Committee, 2020). There are no published data for the Ludlow constituency but in Shropshire HGVs are responsible for approximately 129,000 tonnes of CO_2e/pa (see Table 17). This estimate is based on applying the 17% national figure to the BEIS, 2020 data for Shropshire. This gives an approximation of the CO_2 burden attributable to HGVs in Shropshire. The equivalent figure for the Ludlow constituency is 35,000 tonnes of CO_2e (Table 17).

In this Report we consider HGVs on the A49 only. The A49 is a major national road and this status is reflected in the organisation

charged with overall responsibility for the A49, Highways England. The attractiveness of focussing on one nationally significant road is that it can be used as a pilot for all A roads in the Ludlow constituency and by extension all A roads in England.

We submitted an FOI request to Highways England in November 2020 for HGV traffic counts on the A49 at or near the Ludlow vehicle census point. Highways England did not reply. The 2013 data revealed a daily average HGV count (north and south bound combined) at the Ludlow census point of 837.

We also asked Highways England for CO_2 data on the roads it is responsible for. They did not answer.

There is a large amount of literature on measures and suggestions for decarbonising HGVs (Greening *et al*, 2019). Many of these suggestions can only be taken up by national Government and will require substantial infrastructure investment e.g. lorries powered by overhead electricity in the same way as trams and a national strategy to transfer road freight to rail. In this section of the Report we concentrate on one measure that can be put in place on the A49 in Shropshire and is relatively inexpensive and can be implemented in less than 3 years and will reduce HGV carbon.

This is the "Averaging Speed Camera" (ASC) measure and is currently in place on the A77 in Scotland: *"The latest figures covering the last three years to July 2015 indicate that there has been a 77% reduction in fatal casualties and a 74% reduction in serious casualties compared with the original baseline published in 2005."*

The main purpose of ASC is to reduce fatalities and serious injuries on roads receiving this treatment. The reduction in deaths and serious injuries is the result of compliance with speed limits. We also know that lowering speed limits lowers CO_2 emissions.

Extensive scientific research on the relationship between average speed of HGVs and fuel consumption reveals that fuel consumption is at its lowest at 50kph (Hill *et al*, 2011). The lowest level of fuel consumption can be taken as a proxy measure for the lowest level of CO_2 emissions from HGVs.

Heavy lorries on the A49 at Church Stretton
(c) Sarah Jameson

ASC provides a low cost technology that can bring about a change in HGV average speeds in Shropshire to deliver a reduction in carbon emissions from this source.

Professor Alan McKinnon at the Kuehne Logistics University, Hamburg (Germany) is a world expert on freight transport, logistic and carbon and has said:

"In summary, the available evidence suggests that a reduction of around 10% in the average speed of trucks would significantly cut fuel consumption, CO_2 and total operating costs with minimal impact on the wider performance of logistical systems" (Mckinnon, 2016).

The impact of the A49 ASC initiative on reducing transport carbon in the Ludlow constituency

The science is clear. The A49 ASC project, if adopted, would reduce CO_2e emissions from HGVs. We have not estimated the percentage reduction in HGV carbon that can be obtained from our suggested intervention. We do not have up-to-date data on HGV numbers and route specific carbon emissions for HGVs.

To the best of our knowledge those organisations responsible for delivering carbon reductions in line with national policy (DfT, Highways England and Shropshire Council) have not investigated the science around speed limits and carbon reduction for HGVs and we recommend that they do so.

Recommendation

Based on the science and the well-established efficacy of "averaging speed cameras" we recommend that the whole of the A49 route through Shropshire should have a speed limit for HGVs set at 50kph. This will reduce HGV carbon emissions and this reduction can be calculated when we have up-to-date data on HGV activity in our area. It will also deliver an early action that increases the probability of achieving the objective of Net Zero carbon emissions by 2030.

We recommend that Highways England allocate funds and initiate the A49 ASC Shropshire project immediately.

Impact

- Reducing transport carbon from HGVs by implementing a maximum average speed, monitored by cameras, of 50kph has a number of co-benefits in addition to reducing carbon.

- It reduces the probability of death and injury for all road users. It would make the A49 a much safer road.

- It reduces health damaging noise (Ryabowski *et al*, 2014).

- It reduces health damaging vehicle exhaust emissions (Lutfie *et al*, 2018).

- The 50kph average speed limit will not damage the economy or the viability of those companies involved in road freight transport. It reduces fuel use with cost saving benefits to the road freight sector and has an impact on supporting the local economy (Mckinnon, 2016).

5. Light Goods Vehicle (vans)

- Vans are responsible for 16% of the carbon emissions from road transport sources (DfT, 2020).

- Van traffic has increased by 104% since 1990 (DfT, 2020).

- Van emissions have increased by 19% since 2012 from 16.4MtCO2eq in 2012 to 19.4MtCO2eq in 2019.

- DfT forecasts project van mileage growth of 79% between 2010 and 2040 compared to 9% for cars and 22% for HGVs.

- Van traffic is the fastest growing sector of road traffic and the growth is forecast to continue and there is evidence that van mileage is significantly higher on rural A roads than on motorways.

- Vans are responsible for producing 129,000 tonnes of CO2e in Shropshire and we estimate (based on population share) that this is 33,500 tonnes in the Ludlow constituency (Table 17).

The trend is clear. There is a strong rate of growth of van mileage. This predates the Covid 19 pandemic and its boost to online shopping and it is forecast to increase in future years.

What measures and interventions are available to reduce CO2 emissions?

The UK Government has committed to all new cars and vans "to be effectively zero emission" by 2035 "or earlier if a faster transition appears to be feasible as well as including hybrids for the first time" (DfT, 2020, para 3.12).

The commitment to replace diesel vans with zero carbon alternatives, whilst welcome, does not deal with the full range of measures that are available to deal with the carbon emission of vans and these include urban logistics and the availability of freight consolidation approaches to reducing van miles. This corresponds with the "Avoid" segment in the widely accepted "Avoid, Shift, Improve" sustainable transport methodology (Creutzig *et al*, 2018) - see also p.102 of this Report. Dealing with Climate Change and transport decarbonisation requires the full weight of "Avoid, Shift, Improve."

The A-S-I framework suggests a clear policy intervention based on well-established case studies to deal with the "last mile" problem and shift as many van deliveries as possible from motorised vans to e-cargo bikes and to establish "freight consolidation centres" to achieve this result.

We have included the detail around e-cargo bikes in the full Report on walking and cycling and the Report is available on the project web site.

We also recommend the provisions of freight consolidation centres.

Urban Logistics and Urban Freight Consolidation Centres (UFCC)

This approach to reducing road freight activity, lorry and van miles and reducing carbon is well known and supported by robust evidence (Bartle *et al*, 2016). The concept is based on the principle that HGVs and LGVs operating over long distances and/or serving multiple final destinations e.g. shops, businesses and homes will as much as possible remain on the principal road network (A roads and motorways) and will not deliver to the final destination. They will leave the principal road network and unload at a depot where all the packages and non-bulk goods would be reassembled in the same way that a Royal Mail sorting office works and then loaded onto smaller vehicles and where appropriate e-cargo bikes.
"The 17 UFCC evaluation studies (containing evidence) reviewed by Allen et al, 2012 report a 30-80% reduction in vehicle trips, 30-45% reduction in vehicle kilometres, 15-100% improvement in vehicle load factors and 25-60% reduction in vehicle emissions" (Bartle *et al*, 2016).

Recommendations

We recommend that Shropshire Council, in close co-operation with leading operators of vans (DHL, UPS etc), establish a demonstration UFCC initiative in our local towns and monitor results in terms of reducing van mileage and carbon emissions. This initiative would follow best practice on UFCCs and would include:

- A lorry ban in those towns and an agreement that loads intended for delivery within a defined area are off-loaded at the UFCC for final delivery to the customer by zero carbon modes.

- The onward delivery would be catered for by e-cargo bikes and zero carbon vans depending on load characteristics and distance (weight, volume).

The impact of the proposal:

Reducing van kilometres is essential if we are to get as near as possible to Net Zero transport carbon by 2030. 2050 is far too late.

We estimate that based on published information on the impact of freight consolidation centres and the provision of e-cargo bikes that if our recommendations are adopted we will reduce CO2e from van deliveries in the Ludlow constituency area by 5%.

Reducing van numbers in Ludlow, Bridgnorth and Bishop's Castle is an important step on the way to low traffic neighbourhoods (Sustrans, 2020). Reduced vehicle numbers contribute to a safer environment for walking and cycling which in turn contributes an additional layer of carbon reduction.
Removing vehicles, reducing road traffic danger and promoting a calmer and more attractive place character is a desirable policy goal and is closely associated with measures and interventions that reduce carbon emissions.

6. Behavioural change

The issue is behavioural change and the potential for large numbers of people who currently travel by car to transfer a proportion of those trips to walk, cycle and bus. Behavioural change has rather obvious links to the ways we can improve the infrastructure that promotes walking and cycling and encourages car users to switch to the bus but it also addresses the potential for change within current patterns of tavel. The issues discussed here are travel plans (TPs) and personalised journey plans (PJPs).

Behavioural change is well known and well documented in transport planning and policy but has not been funded or implemented on a scale large enough in Shropshire to harvest its benefits for reducing congestion, improving public health and reducing carbon emissions. Both TPs and PJPs are supported in the Shropshire Council Local Transport Plan LTP3, (Shropshire Council, 2011) but have not been funded or supported in the 10 years since LTP3 was published.

Travel Plans (TPs)

A Travel Plan, or TP, is a long-term management strategy for an occupier or site that seeks to deliver sustainable transport objectives through positive action and is articulated in a document that is regularly reviewed (Department of Transport, 2009):

Travel plans are well-understood in UK transport planning and have a good track record of success in reducing car trips and transferring those trips to walk, cycle and local public transport depending on

location and the nature of the destination. Travel plans fall into 3 main categories: workplace, school and residential.

There is a fourth category and this is not addressed in this Report. Car travel for leisure and tourism accounts for 30% of all car trips. This is much larger than other journey purposes e.g. commuting (15% of all trips) and shopping (20% of all trips), (DfT National Travel Survey, 2019). An early example of a "Visitor Travel Plan" is the "Tourism without Traffic" project (Transport 2000, 2001).

The DfT funded "Smarter Choices" report (Cairns *et al*, 2004) includes a very useful summary of the success of travel plans in reducing car use.

The authors of the "Smarter Choices" report summarise the impact of workplace travel plans as follows:

"Taken overall, the 20 organisations had reduced the number of cars driven to work by 14 for every 100 staff. This represented an average reduction of 18% in the proportion of commuter journeys being made as a car driver. This is the average – the medians were similar, with a median reduction of at least 12 cars per 100 staff, and a median percentage reduction of at least 15%, showing that even after giving less emphasis to the few extreme cases, organisations were typically achieving sizeable cuts in car use."

More recently the Welsh Government transport commission concluded that workplace Travel Plans could reduce car use by 10-20**%** (South East Wales Transport Commission, 2020).

Workplace travel plans have always included measures that reduce the number of commuter trips. Historically this has included the 9-day fortnight which gives the employee the opportunity to concentrate 10 days work into 9 days resulting in a 10% reduction of car trips. More recently the Covid 19 experience and the widespread adoption of working from home (WFH) has taken this into an entirely new dimension and WFH is likely to make a significant contribution to reducing car commuting and reducing carbon in the future (Hook *et al*, 2020).

School travel plans (STPs) have an important role to play in reducing car use for the school run and reducing air pollution and carbon emissions caused by this journey purpose.

The English experience of STPs has been extensively reviewed by Cairns, Newson and Davis, 2010 and these plans provide a very efficient, low cost way of decarbonising transport:

"Cutting car use and reducing conflict at the school gate. Twenty-six of our 30 case study schools had reduced car use – two of them by more than half. On average, these 26 had cut car use by almost a quarter."

Residential Travel Plans shape the design and location of new housing including the funding of infrastructure to minimise car use and maximise walking, cycling and bus use. This was included in Shropshire Council's LTP3 in 2011 (Policy E11, Location and design of new development). It has not been implemented.

Personalised Journey Planning (PJP)

PJP is a systematic programme of direct contact and supportive working with a target population to explain and encourage use of alternatives to the car. It is non-judgmental and takes into account the very many constraints that impinge on travel choices especially for those living in rural areas and those households with multiple demands related to dual career families. PJP utilises high quality information on alternatives to the car and in co-operation with a local authority and a privatised bus company can also offer heavily discounted bus fares (Haq *et al*, 2007).

PJP is widely regarded as successful in reducing car use and reducing carbon emissions e.g. the York "Intelligent Travel" project.

The York "Intelligent Travel" project was a DfT funded project carried out by the Stockholm Environment Institute, the City of York Council and bus companies operating in York. The York project produced a 16 percentage point reduction in car trips in the areas targeted. This result was compared to similar areas not included in the intervention plan and these non-intervention areas experienced a 5% increase in car trips.

The PJP intervention converted a potential 5% increase in car trips into a 16 percentage point reduction.

Recommendations

1. Every school in South Shropshire regardless of its status as Church of England, academy, local authority or private must adopt a school travel plan based on national guidance and the case study evidence we have presented.

2. Every workplace in South Shropshire with more than 100 employees must have a workplace travel plan that conforms to BSI PAS500 (BSI, 2008), the workplace travel plan standard.

3. Every workplace taking into account the nature of the work carried out by staff will maximise the working from home potential to reduce commuting by car to the place of work.

4. Every new residential development in South Shropshire must be subject to a

Traffic and parked cars in Ludlow
(c) Jeff Morgan 11 / Alamy Stock Photo

residential travel plan that embraces everything that has to be done to minimise car use by new residents and put in place before first occupancy and maximise the use of walk, cycle and bus.

5. We recommend a tourism travel plan that will initially be focussed on the Shropshire Hills AONB and modelled on the "Tourism without traffic" plan in Sussex (Transport 2000, 2001).

6. We recommend a close working partnership between the Shrewsbury and Telford Hospitals NHS Trust, Shropshire Council and the privatised bus companies to design, fund and implement a major upgrade in bus services for all Shropshire residents making use of RSH and PRH facilities. Access to our major hospitals must be provided in ways that allow residents to access facilities when they do not have a car or access to a car and in ways that minimise carbon emissions. This major upgrade should include a "one ticket" system so that residents do not have to buy separate tickets for separate privatised bus companies and the ticket price should be minimal. We also recommend a free bus service from Shrewsbury bus station to the Royal Shrewsbury Hospital (RSH). This will attract a proportion of those who currently use cars and also provide a significant marketing opportunity to bring new public transport users into the possibilities provided by attractive buses.

7. We recommend the development and testing of a best practice "Mobility as a Service" (MaaS) model to support behavioural change. MaaS uses Apps and smart phone technology to provide all those wishing to make a journey with a full suite of information on all options for that journey including walking, cycling, bus, tram, taxi, metro, use of personal car and car share (Dale *et al*, 2019).

Carbon reduction potential of a combined TP, PJP and MaaS programme in the Ludlow Constituency

The combined impact of TPs (workplace, school and residential), PJPs and MaaS is very difficult to estimate. It is nevertheless important to adopt all our recommendations and closely monitor carbon outcomes. We know that area wide PJPs can reduce car trips by 16% and we know that TPs can reduce workplace car use by 10-20% and school trip car use by 25%. We do not know the percentage reduction we could expect from carefully planned new housing designed to deliver carbon reduction. It is the judgement of the transport team that in total, well-funded behavioural change interventions can reduce car use and carbon by 25%.

We recognise that behavioural change interventions overlap with the interventions identified in the walking, cycling and public transport sections and this could result in double counting. It is the view of the transport team that the double-counting possibility does not materially affect our carbon reduction estimates. This is discussed in Whitelegg *et al*, 2010. More importantly overlap is strength and not a weakness and there is a much increased probability of modal shift away from the car and towards sustainable transport when multiple interventions coincide in space and time and are delivered to a well-defined target area.

Estimating the impact of all decarbonisation initiatives in the Ludlow Constituency in the six policy areas described above

It is important to note that any estimation of percentage decarbonisation in the Ludlow constituency is very difficult indeed. In Table 17 we listed the CO_2 totals for the whole of the area covered by Shropshire Council and our estimate of transport CO_2 for the Ludlow constituency.

Given a substantial research effort and investigation it is possible to specify a number of interventions in a specific geographical area and calculate the total CO_2 reduction that follows from the adoption of those measures and interventions. This has been done in the case of London and published as Visioning and backcasting for transport in London. VIBAT London (Halcrow Group, 2009).

"The study considers the pathways towards a 60% reduction in transport CO_2 emissions by 2025, and an 80% reduction by 2050, on 1990 levels. The ultimate goal is thus 20% transport: a transport system that facilitates a high quality of life within London yet emits just 20% of CO_2 emissions based on 1990 levels."

"The study has reviewed over 150 individual policy interventions that may help reduce transport CO_2 emissions. Individual measures work best within packages, allowing complementary measures to work together and mitigation impacts to be quantified."

The study identified 11 policy "packages" and quantified the percentage reduction in carbon in London from the implementation of those packages. These were selected to be relevant to London and include low emission vehicles, congestion charging, parking charges, public transport investment, walking and cycling, behavioural change and freight transport. The authors selected a 60% reduction target by 2025 measured against a "business as usual" projection of what would be the case in 2025 without the policy packages, the packages delivered 28% of that target. The percentage reductions and package details are not relevant to the Ludlow constituency but the methodology is robust and could be applied to our policy packages.

The importance of the London VIBAT study is that packages of measures and interventions to reduce transport carbon can be subjected to an evaluation that quantifies the percentage contribution to a reduction target.

The SSCA Transport team is not financially resourced and does not have the resources and capacity to apply the VIBAT methodology in the Ludlow constituency area. Nevertheless we think it is very important to follow the approach of the VIBAT study and to signal the potential of our interventions to reduce transport carbon in the Ludlow constituency by the maximum amount possible.

Table 18 contains our estimates of how much transport carbon we can strip out of the carbon emissions generated by cars in the Ludlow constituency. The table addresses the shift component only of the Avoid-Shift-Improve approach to transport decarbonisation.

The percentage reductions in CO_2e are the total reduction we can achieve by 2030 on a 2018 base. They are not an annual figure and they are not broken down by intermediate estimates e.g. what we could achieve by 2025.

Discussion

The percentage reductions in transport carbon in Table 18 underestimate the potential for carbon reduction in the Ludlow constituency. They do not cover the full range of interventions available to a highway, transport and planning authority. The list of interventions that have proven impacts on reducing car use and reducing carbon and not yet evaluated include:

- Car parking strategies in combination with modal shift strategies to reduce car use and reduce carbon emissions from cars.

These strategies include pricing policies and reduction of town centre parking space numbers in step with increases in Park and Ride parking space provision.

- Free car parking on residential streets by non-residents would be replaced by widely used residents parking schemes. Residents would still be able to park on their streets. Pavement parking would be abolished as is now the case in London and Scotland and careful consideration would be given to the workplace parking levy (Dale *et al*, 2019) car-free housing and car-free towns (Enoch *et al*, 2014).

- Travel plans for tourism based on the "Tourism without traffic" model (Transport 2000, 2001). A best practice co-ordinated strategy for reducing car trips, switching car trips to public transport and increasing visitor numbers not arriving by car is urgently needed in the Shropshire Hills AONB (Transport 2000, 2001).

- Linking the planning and design of new housing to transport decarbonisation policies.

Electric car charging point
(c) andreas160578 / Pixabay

Table 18: Percentage reduction in transport carbon generated by cars in the Ludlow constituency by suggested interventions

Intervention	% Reduction in transport carbon by 2030 on a 2018 base and tonnes of Co2e	Principal sources of evidence
Bus, rail and integrated public transport	9% 10,647 tonnes	Climate Change Committee, 2020
Walking and cycling	16.5% 19,519 tonnes	Team judgement and Brand, 2021
Behavioural change (1) travel plans and (2) personalised journey planning combined (3) Mobility as a Service App	25% 29,575 tonnes	South East Wales Transport Commission, 2020 Hag *et al*, 2007. Intelligent Travel: Personalised Travel Planningi in the City of New York
Car share *(Note 1)*	<1% 1183 tonnes	Martin and Sheehan, 2011
HGVs	Not calculated	
Vans	Please refer to Table 20	Allen *et al*, 2012 Bartle *et al*, 2016

Notes: *The full evidence base for the percentage reduction estimate is included for each policy package and is available on the project web site with references.*

Note 1: *The calculated reduction in carbon emissions is based on an initial target of recruiting 1000 new car share club members. The potential take-up rate is larger than this but we prefer a modest start and then a steady build-up to achieve a much higher participation rate and higher carbon reduction by 2030.*

We conclude that modal shift from cars to alternatives to the car achieved by improvements to public transport, walking and cycling infrastructure and behavioural change interventions can reduce CO2e emissions from cars by 60,924 tonnes, a 51.5% reduction. This reduction of 60,924 tonnes is from the "shift" component of the Avoid-Shift-Improve methodology

In Table 20, we complete the picture with our combined estimate of CO2e reductions from all 3 components in the Avoid-Shift-Improve framework and this includes vans and electric vehicles.

Table 19: New homes planned in the Ludlow constituency

Bishops Castle	150
Bridgnorth	1800
Broseley	250
Church Stretton	200
Cleobury Mortimer	200
Craven Arms	500
Ludlow	1000
Much Wenlock	120
Grand total	4,220

New housing policies for transport decarbonisation

"Right now, too many housing developments lack local shops and services, decent public transport and cycle routes. Some streets even lack pavements. The result is that the people who live there must drive for almost every journey: a recipe for traffic, air pollution and Climate Change."
Transport for New Homes, 2021

Approximately 4,220 new homes are planned for the Ludlow constituency (Shropshire Star, 2020, Table 19).

All planning permission for new homes in the Ludlow constituency should be subject to conditions that minimise car use and explicitly minimise carbon emissions. Planning permission for new homes should take account of the checklist for new housing developments:

- A location within or closely connected to an existing settlement that has a clear centre.
- A welcoming environment, not dominated by car parking.
- Local facilities easily accessible without a car.
- Frequent public transport services in place from Day 1 of occupation. Transport for New Homes, 2019.

Avoid-Shift-Improve

In the introduction to this Report we set out the importance of the widely accepted "Avoid-Shift-Improve" framework for our work. We now summarise our conclusions following that framework (Table 20).

Wintles development, Bishops Castle
(c) Lorraine Waumsley

Table 20: Transport decarbonisation classified by the "Avoid-Shift-Improve" framework

		Tonnes of Co2e reduced in the Ludlow constituency	Notes
Avoid	Cancel the NWRR Link all planning permissions for new housing to reducing car use	Not included Not included	*Note 1*
Shift	Modal shift as a result of measures and interventions listed in Table 18 51.5% of 118,300 tonnes	60,924.5	Car trips replaced by bus, train and integration, walking and cycling and behavioural change
Improve vans ***Reduction in miles undertaken by petrol/diesel vehicles and replaced by electric vehicles.***	5% of 33,500 27% of 118,300	1675 31,941	*Note 2*
Total		94,540	

Note 1: *The NWRR is a road in the NW quadrant of Shrewsbury. It will generate c.70, 000 tonnes of additional CO2e (embodied carbon) in the time period we are addressing in the Ludlow constituency Net Zero Carbon project. Our target date is 2030.*

It is the view of the SSCA Transport group that the NWRR should be cancelled. When devoting a great deal of research and case study work to identify the interventions that can reduce CO2e emissions it would be wrong to remain silent about a decision by Shropshire Council to add 70,000 tonnes of these emissions. It is not included in the total CO2e reduction in Table 20 as it is an addition to the Shropshire Council area total emissions and not an addition that can be allocated to the Ludlow constituency. However there are four reasons why the cancellation of this road is directly relevant to the Ludlow constituency:

1. It is the view of Shropshire Council that the road will benefit all Shropshire's residents and promote economic growth for the whole county and is of wider regional significance than the Shrewsbury area.

2. The NWRR is partly funded by CIL money (Community Infrastructure Levy) and this money is provided by housing developers across the whole county including housing developments in the Ludlow constituency.

3. It directly affects the Ludlow constituency in several ways including depriving the report area of capital expenditure on sustainable transport projects and using council tax income from the Ludlow constituency to increase CO2 emissions.

4. It sets a precedent that large-scale road building is perfectly acceptable while at the same time neglecting alternative zero carbon transport interventions which are feasible, practiced elsewhere and are now undergoing rapid development and deployment in Herefordshire as an alternative to the Hereford Bypass and in South-East Wales as an alternative to the M4 relief road.

Note 2: *We have adopted the findings of the Climate Change Committee, 2020 Sixth Carbon budget (2020). It concluded:*

New Battery Electric Vehicle (BEV) sales will take time to feed through to the fleet as the average car remains in use for around 14 years. In our analysis, BEVs will comprise 27-37% of the car and van fleet in 2030, rising to 56-67% by 2035 and 81-88% by 2040 (central assumptions 35%, 65% and 87% respectively) (Climate Change Committee, 2020B).

We do not have data on the likely take-up rate of electric vehicles in any part of Shropshire by the year 2030 so we have adopted the lower estimate of the range suggested by the Committee (27-37%) and we have assumed that 27% of the Ludlow constituency vehicle fleet will be BEV in 2030 and this translates approximately into a 27% reduction in CO2 emissions from cars. We note that much higher percentages are quoted for the period after 2030 but we are focussed on what can be achieved by 2030. Table 20 summarises the potential of all the measures and interventions we have researched and recommended.

Total CO2e emissions (2018) from transport in the Ludlow constituency was 197,000 tonnes. The measures and interventions we have recommended will reduce this 2018 total by the year 2030 by 94,540 tonnes. This is 48% of the 2018 total transport carbon emissions in the Ludlow constituency.

We have shown that we can reduce CO2e emissions by 94,540 tonnes by 2030 on a 2018 base. If the NWRR goes ahead it will add 70,000 tonnes of CO2e emissions in the same time period. This has the effect of wiping out 74% of the carbon reduction we have calculated as possible in the Ludlow constituency.

The 70,000 tonnes is a Shropshire Council estimate of embodied carbon associated with the NWRR. This is the carbon generated by all the materials and construction activity associated with the new road. It does not include operational carbon (vehicles using the road when opened).

A calculation could be made of embodied carbon from sustainable transport interventions e.g. cycle paths. This has not been done and the available evidence shows that sustainable transport interventions have very low embodied carbon impacts. 48% does not deliver Net Zero transport carbon by 2030 but it is a huge step in the right direction.

Next Steps

In 2020 the Welsh Government cancelled the M4 relief road and established a commission to produce non road building alternatives that would deliver transport outcomes in line with sustainability, Climate Change and future generation objectives. (South East Transport Commission, 2020). This must now be done in Shropshire. The conclusion of the Commission is clear on next steps:

"The publication of this report concludes the work of the SE Wales Transport Commission. It is now for the Welsh Government to decide how to take forward the recommendations" (South East Transport Commission, 2020, para 389).

Our conclusion is also clear. The publication of the Ludlow constituency project Net Zero Carbon by 2030 Report on reducing transport carbon in the constituency concludes the work of the Transport team.

It is now for Shropshire Council, DfT, the Marches LEP, the NHS, the Shropshire Hills AONB, the bus companies, businesses and the Welsh Government (now responsible for rail services in Shropshire) to take forward the recommendations.

There is a Climate Emergency, there is a way of dealing with that emergency and the time for hesitation and aspirational statements is now over. Locally, nationally and globally we need dramatic action to deal with this emergency and dramatic action means specificity, budgets and trackable implementation of measures and interventions.

Timing: Our work has been focused on what must be done by 2030.

Climate science is clear that we must maximise decarbonisation as much as possible by 2030 if we are to stand a chance of avoiding the very serious consequences of failing. Pushing back this target date to 2050 or any other date later than 2030 is not an option and will store up insurmountable difficulties if we have to find ways of meeting more stringent targets against a baseline figure of higher CO2e emissions.

- **We recommend that the lead on implementation is taken by Shropshire Council for the very simple reason that it is the legal highway, transport and planning authority and has control and responsibility for the full implementation of all the measures we have identified in our walking, cycling, bus, integrated public transport, car share and behavioural change submissions.**

- **Shropshire Council has no control or influence over train services. The responsible body for trains in Shropshire is the Welsh Government and we recommend that Shropshire Council opens a dialogue with the Welsh Government about improving train services and implementing full integration on fares, ticketing, information and bus-rail connections.**

- **We recommend that the Council adopt all the recommendations that we have made by the end of the financial year 2023-24. We recommend that all budgets needed to support all these recommendations are included in the budget set for 2024-2025 and that implementation begins in April 2025.**

- **We recommend that a progress report is made to full Council at yearly intervals so a report would be submitted by the end of March in each of the 5 years, 2025-2030.**

"The measures and interventions that are identified in this Report will substantially decarbonise transport in the Ludlow constituency. In addition they will deliver a much fairer, cleaner, healthier quality of life for all 85,000 residents"

Communities and Education

Introduction

There are an infinite number of ways for a community to contribute to the attainment of zero carbon and the increase of biodiversity. People begin at the point where they are. With appropriate conversations, however, questions arise: what do they wish to do? What do they need to know? Initial meetings with trusted individuals are a means for this to happen. Once there is dialogue with the community group or school group, ideas will flow. Sharing good practice and working together within and between communities, also avoids reinventing the wheel.

In Part 1, this section of the Report seeks to look at ways in which community climate action can work well over the whole of the UK, then reviews current work in Shropshire, looking for examples of best practice here. This is followed by a series of suggested solutions - the outcome of the working groups in the SSCA Communities and Schools group. These have been devised by sharing good practice amongst ourselves and with the wider community.

In Part 2 we review education, focusing on the climate content of the curriculum. We describe how the subject can be embedded into the curriculum, including relevant resources, through conversations with teachers about their ideas. The aim is to empower the next generation to reduce climate breakdown, increase personal and community resilience and improve the natural world they live in. Sharing ways of making change happen is the key to community action on climate.

The ideas and practices described in this Report are only a start. There will be many other ideas to come. People's ingenuity and creativity is vital for change to happen, and it is vital to harness this to inspire and motivate others. Sharing ways of making change happen is the key to community action on climate.

1. Community

South Shropshire Climate Action is working to make climate action a focal point of every choice we make by sharing ideas and good practice across the region.

"There are an infinite number of ways for a community to contribute to the attainment of zero carbon and the increase of biodiversity"

School children from Church Preen school in Shropshire May Pole dancing at the Acton Burnell summer fete
(c) Peter Wheeler / Alamy Stock Photo

To reduce CO_2 levels and address the ecological crisis there are changes that individuals can make now. Some require collective action within a community and others depend on Government policy and funding.

Individuals may choose to take part in campaigning within their community, region or at national level. The important thing is to do what we can as soon as possible. Different communities will have different priorities and possibilities. We can learn from, and be inspired by, what others have achieved.

We know that reducing carbon emissions nationally and internationally will eventually have a direct effect on global warming, which is the biggest risk to human civilisation on this planet. However, many people in our area are either not convinced about this crisis, or have little idea of what they can do to address it, individually or collectively.

How can businesses, schools and communities in South Shropshire achieve zero carbon by 2030 when progress to date has been so slow? Christiana Figueres, who led the 2015 Paris Climate Agreement argues cogently that, while we cannot see all the changes that will be necessary, we must start urgently on what we ***can*** do and hold on to a vision of what a sustainable future might look like (Figueres and Rivett-Carnac, 2020).

In Shropshire, where energy is currently derived around 80% from fossil fuels, it is important to be realistic about the scale of changes needed to cease using these by 2030.

For South Shropshire to become Net Zero Carbon by 2030 organisations, businesses and communities will need to participate collaboratively to achieve rapid decarbonisation. There will need to be large-scale restorations of biodiversity and the natural environment. Vibriant, resilient and inclusive communities are needed to achieve a sustainable future.

As we have seen in this Report, there is a pressing need to reduce carbon in our buildings and travel. Councils have specific duties and powers, voluntary groups can help spread knowledge and often harness enormous support for particular projects, while schools have the extra responsibility to prepare the citizens of tomorrow to see the transformation through to the future.

What is being done now: what do we know about how to take action?

Over the whole of the UK there are many Climate Emergency plans developed by all types of groups (Climate Emergency UK). Demonstrating that climate action has become a real grassroots movement. County, Town and Parish Councils have declared Climate Emergencies; some are adopting climate plans, some are advanced in this, others still developing. Some focus purely on their own assets, others have plans for the whole community. Several examples are described below.

Devon County Council

One example of a county taking this forward is the response to Climate Change in Devon, where the County Council have been working on the Climate Emergency since 2005. Their Climate Emergency response states:

"There is global recognition of the urgent need to do something to address Climate Change. The Climate Change Act (2008) sets in place legally binding carbon emission reduction targets for the UK as part of the UK Government's move towards a low carbon Economy. The 2018 UK Climate Projections suggest that Devon can expect

Communities and Education: Our Key Messages

- **Taking Action on Climate Change locally – we all have ideas, practice and resources to share.**
- **Taking action nationally – Climate Change needs to underpin every decision made by individuals, communities, councils and governments.**
- **Conversations and the developing Toolkit will be key in promoting community climate action.**

(c) Energy Diary, Lightfoot Enterprises (Angela Martin)

hotter, drier summers and warmer, wetter winters. A warmer atmosphere and oceans are projected to cause more extreme storm events and a rise in sea level. Information about the anticipated effects of Climate Change on southwest England is available in the Climate Change and Energy paper of the State of Environment report."

Devon plans to "*protect, manage and plan green infrastructure to help build resilience to the predicted effects of Climate Change and mitigate against its extreme global impacts, by: promoting more sustainable travel through the use of green infrastructure corridors; promoting the use of natural resources to generate renewable and sustainable power; promoting the benefits of green infrastructure in helping to reduce the impact of flooding; developing a comprehensive network of habitats, enabling for habitat resilience, enhancement of biodiversity and allowing for species migration; planning, designing and managing green infrastructure to moderate temperature extremes in urban environments"*
(Devon County Council, 2021).

Birmingham Council

Urban councils have other priorities, for example, Birmingham focuses on buildings (retrofit), energy, transport (public and EV infrastructure, air quality and waste (Birmingham City Council). This pattern is similar for other urban councils. But they too value their green spaces and have ambitions to plant thousands of trees.

Herefordshire County Council

In our neighbouring county, the Herefordshire Green Network project, The Great Collaboration "Leading to a Zero Carbon Herefordshire" is an invitation to communities to come together.

Discussion, information sharing, inspiration and peer-to-peer support is at the core of this work supporting Parish Councils and their local communities. Around the county people are starting to respond to Herefordshire's declaration of a Climate and Ecological Emergency with their own shared, locally relevant, practical projects and plans. They have a resource page for communities and have contacted many Town Councils, encouraging them to promote climate actions in their areas. Both Council and communities are focused on the Climate Emergency challenge.

Centre for Sustainble Energy - best practive for community climate action

The Centre for Sustainable Energy has reviewed the best practice for community driven Climate Change initiatives and here we present their findings (in an adapted form): Beginnings, Challenges and finally Successful Characteristics:

Beginnings:

- The majority of community-led initiatives interviewed for their research were initiated by one individual, with peers, with one purpose.

- No two initiatives demonstrated the same model of engagement.

- The group then engaged with other local community groups and political decision makers e.g. Friends of the Earth and Parish Councils.

- These generated further interest and community support for the group. Initiatives then entered a phase of wider consultation and action planning via footprint surveys, events and workshops.

- The role of external support and a core team of committed individuals were key components of successfully making this transition.

- Furthermore, maintaining a positive mission focus, such as that demonstrated by Ashton Hayes and Transition Totnes, was critical component for success.

Challenges:

- Maintaining the positive mission focus.

- Engaging the community in their vision to enable the group to engage in local political structures.

- Best practice case studies moved from the action planning phase to the deployment of measures, a move which often throws up difficulties for community groups.

- Sustaining the interest of the group.

- Making real progress towards the goal.

- Providing consistency in the message to the community and politicians alike.

- Succession: community-led initiatives are heavily reliant on volunteer time, and this can be very intensive, particularly when volunteers also have full time jobs (which many do).

Characteristics of success:

- High levels of enthusiasm and energy amongst volunteers.

- Making sure additional volunteers are recruited along the way so there is someone to 'handover the reins' to, particularly for leadership roles.

- New ideas may arise with 'new blood' - a definite benefit.

- Building on people's strengths. Identifying the different skills and interests of community group members and building on these.

- Enabling volunteers to do what they are good at, and enjoy.

Climate Emergency walk, Church Stretton (c) Jon Cooke

- Establishing a community group to pursue action on climate is a slow and long-term process.

- Building on any successes and milestones achieved, no matter how small, to demonstrate to volunteers and the wider public the impact of the group's efforts, helping to maintain and enhance motivation and interest.

- Trust: a key benefit of community groups acting at a local level and led by local residents, is the implicit level of trust that is involved. People are more likely to trust and listen to their neighbour than instruction from a higher level.

- As with any initiative that requires households to change behaviour or install measures, it is important to be sensitive to the different attitudes, motivations, understanding, tolerances and capacities of all individuals in the community.

- Establishing an action plan which sets out the group's aim(s), how the group will deliver this/these aim/s, timescales and allocation of responsibilities.

- Ensuring all members of the group are working to the same agenda, avoiding the potential for conflict or misunderstanding at a later date. Having an established action plan can also help with securing funding for 'Next Steps'.

- Having a focal point in the community, for example insulating a well-known community building or installing renewables on community buildings, such as the church or local school, can significantly help with awareness raising. Is this possible in each of our towns? See Bishop's Castle Community Land Trust.

- Having a physical feature in the community provides a visual stimulant, topic for discussion and a clear example of what the community group can achieve.

- Communities need to be able to articulate a strong vision for how their projects deliver direct benefits to the community rather than just focusing on addressing the climate crisis alone.

- Projects which facilitate relationships between people and different organisations within a community are more effective (Institute of Public Policy Research).

What is being done now? Some examples from the UK

Another Way, based in Cumbria, helps people to live in a more environmentally friendly way and to form communities that can achieve real and sustainable change. It describes easy steps all can take to protect the planet's health and our own.

"If one person spreads a message to ten people on one day, and the next day those ten people told ten more each, then in only ten days, the whole world would have been educated. The work of Another Way centres around this belief; that one individual has the power to catalyse change and that ***each one of us can change our habits right now, without waiting for anyone else.*** *If all seven billion of us made one difference, imagine how many problems could be solved."*

Amy Bray, who started Another Way, promotes student ambassadors, a powerful idea to spread the work in communities.

What we eat: Feast to Save the Planet is a useful, interesting introduction of the carbon cost of different foods. Our diet is a very important element in our overall carbon footprint.

Keeping warm: Improving insulation in homes and workplaces and installing low energy lighting and heating systems, as well as installing solar panels, are well established ways of reducing our carbon footprint. While these are expensive to install, they will pay for themselves in the long term. Good practice: A real challenge is to reduce fuel poverty by improving social housing. Saving the planet in Brighton one draughty home at a time - Sussex Bylines is an example of how this is being done. However, many privately rented and owned homes are also inadequately heated and insulated, and grants and loans are scarce.

Good practice from Manchester

Community retrofit is a good way to do the complex work that is required in retrofitting. Research, funded by the Chesshire Lehmann Fund, was evaluated under Carbon Co-op Carbon Co-op's Community Green Deal project; this examined policy implications relating to fuel poor households and the future roll out of whole house retrofit at a national level. Community Green Deal was a programme of whole house retrofits of owner-occupied homes in Greater Manchester which started in 2012, with the first phase completed in 2014. A **whole house** approach (or 'deep' retrofit) involves the design and application of multiple improvements as part of a holistic package. It has the potential to deliver substantial improvements in energy efficiency, resulting in lower fuel bills, lower carbon emissions and a more comfortable home. Qualitative insights from house holders form part of the findings. Cooperative and community elements suggest potential to catalyse street-based installations radiating out from whole house retrofit pioneers.

Residents of the pilot scheme say '*We believe the process of improving our homes to 2050 standards will be quicker, easier and cheaper if we work together, teaming up with friends and neighbours to share experience, knowledge and reduce costs through bulk purchase. Established in 2008, we are a group of Greater Manchester residents who have started to carry out changes in our own houses and communities. We've teamed up with housing specialists to look at what more we can do where we live. As a co-operative, a community benefit society, our organisation is owned and run by the householders who make up its members. We have no external shareholders or owners making profits, all resources are kept within the co-operative. We benefit from award winning technical expertise, partners URBED are among the leading retrofit specialists in the UK and authored the Greater Manchester Retrofit Strategy'.*

Community Land Trusts (CLTs)

Community land trusts (CLTs) are set up and run by people to develop and manage homes as well as other assets important to the community (other assets are community energy, food growing, homes, or land). Homes-based CLTs act as long-term stewards of housing, ensuring that it remains genuinely affordable, based on what people actually earn in their area, not just for now but for every future occupier.

The Lands End Peninsula CLT in Cornwall has deliveried or enabled more than 230 affordable homes and has more projects in the pipeline.

CLTs can also set up community shops, take over the local pub, develop workspaces or other community assets or enterprises.

Renewable energy: Many community groups are considering how they can make their communities more sustainable by generating renewable energy. This not only satisfies the appetite in many communities for caring for the environment, but it also provides an opportunity for a CLT too. The technologies most suitable to a particular location will depend on a number of site-

specific factors, including the size of the development and its heating and electricity requirements, the natural resources available to it within the land boundary and whether gas is available for heating or not. The advantage of a community owned renewable energy system is that larger, shared systems tend to be more efficient and better value for money than smaller, individual ones and by sharing the costs of the project, potentially large sums of money can be raised to fund the capital costs, without necessarily needing a bank loan. These are generally recouped over time through schemes such as the Feed in Tariff (FIT) and Renewable Heat Incentive (RHI), which pays generators to produce renewable energy.

Good practice: The Community Energy Scheme in Stoke on Trent is a collaboration between the Council and Community Energy which puts free solar panels on tenants' roofs and allows them to buy the energy at competitive rates. Surplus energy is sold on.

Solar panels on a domestic roof
(c) A. Weeks

Ride-on is a social enterprise in Devon that takes unwanted bikes and restores them to ensure they are roadworthy. These bikes can be then purchased at a reduced price. They also run a variety of sessions including bike confidence for adults and children and courses on maintaining your bike.

Some examples of good practice from Shropshire:

Energy

Solar farms: Telford & Wrekin Council is an example of solar energy generation by a Council as a cost-effective way of reducing its carbon footprint.

Pomona Solar Co-operative is harnessing the power of the sun for the benefit of people in Herefordshire, generating its own clean power without needing to import fossil fuel. They provide a local and ethical investment opportunity for local people, helping to diversify the rural economy, keeping jobs and savings locally, as well as improving energy security and helping reduce Herefordshire's carbon footprint.

They currently have 300kW of solar panels, installed in 2015, silently generating emission-free electricity that is being sold direct to some local businesses, with surplus being exported to the grid. Each year these panels generate about 280,000 kWh (284,198 kWh in 2019) and they can be expected to do the same for many years to come.

The installation is owned by approximately 100 members currently. They are now looking to add more installations around the county, partnering with local communities and businesses that might have good rooftop sites. They are seeking village halls, schools, large workshops or warehouses, farm buildings or factories. They suggest ways to partner with them via the website (see link above).

Land

Fordhall Organic Farm is a community owned family-run farm in Shropshire where organic management practices work with Nature to conserve soil, water quality and biodiversity and to produce quality food without using energy consuming fertilisers. This Shropshire farm is the first community owned farm in England and has over 8000 shareholders.

Stretton Wetlands Interest Group purchased, after an appeal for funds, a field in the valley bottom which often flooded. Ithe land is now being helped to revert back to marshy conditions and is being added to the Nature reserves alongside the A49. These wetter areas encourage wildlife and hold on to rain in wet weather, gradually releasing it downstream and thus helping to relieve flooding at times of very heavy rainfall.

In Church Stretton, the Coppice Leasowes Nature reserve is run by the Town Council but is heavily dependent on volunteers. Cattle graze the land for part of the year helping to conserve the grassland. There are natural ponds on site. It is now a much more varied area and useful example of collaboration between a Town Council and its community.

The Stepping Stones: This programme takes an innovative, landscape-scale approach to conservation and aims to connect wildlife habitats by strengthening or creating 'stepping stones' and corridors of habitat between the two core sites of the Long Mynd and the Stiperstones and beyond. In practice, this means linking areas of heathland, flower-rich grasslands and broadleaved woodland by a network of wildlife-rich hedgerows, road verges, hillsides and streamside wetlands. Again, they depend on volunteer support.

RSVP (Restoring Shropshire's Verges Project). Roadside verges are usually cut several times per year by mowing machines but there is increasing interest now in letting wildflowers grow in the spring and early summer and only mowing them once the flowers have set seed. It is sometimes difficult to know the ownership of a verge (i.e. whether Shropshire Council or a local Town or Parish Council) - and thus who is responsible for mowing. Community groups should check before campaigning.

RSVP developed from a project in the small community of Edgton in the Shropshire Hills AONB and aims to restore verges throughout South Shropshire.

To do this, RSVP is working with Shropshire Council and local communities to manage roadside verges for the benefit of wildlife. The key is agreeing grass cutting regimes with the Council, mini-meadows of local

Botany group out on Stapeley Hill
(c) Sarah Jameson

wildflowers to thrive which will provide habitat for wildlife, food for pollinators and store carbon.

Under the stewardship of the National Trust and Caring for God's Acre and supported by Shropshire Wildlife Trust and local volunteers, work is continuing on the practical management of demonstration verges throughout South Shropshire and beyond.

With the help of local botanist Rob Rowe, further surveying and mapping will establish the status and location of more verges with the potential to become corridors of wildflower-rich meadows. There are 1000's of miles of roadside verges in Shropshire, and with good management, there are significant cost savings to be made for the Council. In addition, RSVP is running a pilot project on the use of verge "arisings" (the grass cuttings) in an anaerobic digester. Another objective is the education of the wider public about the value of wildflower-rich grassland and how 'neat and tidy' is not always the best thing for wildlife! This work contributes to the Nature Recovery Network.

Nature Recovery Networks (NRNs):
"Every space in Britain must be used to help wildlife." (Sir David Attenborough)

The Ludlow Branch of Shropshire Wildlife Trust and other local Wildlife Trust groups in the county are participating in a nationwide campaign to establish a Nature Recovery Network. This is a focal point of the work of the Wildlife Trusts to establish a diverse and sustainable natural world. A Nature Recovery Network is defined as:

"A joined-up system of places which allow plants, animals, seeds, nutrients and water to move from place to place and enables the natural world to adapt to change ...

Protected Nature reserves alone cannot meet the needs of wildlife or our society. We need to restore and protect their places in the landscape that are still rich in wildlife. It is our aim to stitch fragmented wild places together and give Nature the chance to renew itself."

The aim of the NRN groups, beginning in spring 2021, is to map and survey defined local areas to find good existing habitat. There are two requirements to achieving this. Firstly, working closely in tandem with the county-wide organisation, Shropshire Wildlife Trust, to coordinate activities and to provide the necessary training and expertise. Secondly is partnership with local organisations, both statutory and voluntary, landowners and farmers, businesses and private individuals. There are plans afoot to work with youth organisations, schools and colleges which will be crucial.

"Nature recovery networks link existing areas of good wildlife habitat via a series of stepping stones. This is managed for the benefit of wildlife, whether as hedges, flower-rich grassland or wetland, whatever is appropriate. Restoring connections will give plants and animals freedom to move from place to place, helping them to adapt to change. Making space for Nature will benefit wildlife and people. The Wildlife Trusts are calling for laws to require all relevant parts of central and local Government to work together to map, plan and create a Nature Recovery Network."

The ultimate aim is the creation of "a Nature Recovery Network that extends into every part of our towns, cities and countryside, bringing wildlife and the benefits of a healthy natural world into every part of life. Letting flowers bloom along road verges, installing green roofs across town skylines, planting more street trees to give people shady walks in the

summer, encouraging whole communities to garden for wild plants and animals. A network that brings wildlife into every neighbourhood would also provide fairer access to Nature for everyrone.

Community transport: Shropshire Community Transport Consortium aims to help provide flexible and accessible community-led solutions in response to unmet local transport needs. It often represents the only means of transport for many vulnerable and isolated people, espeiclaly those who are older or people with disabilities. In rural areas like South Shropshire where the public transport system is minimal (or non existent), community transport is a valuable lifeline. Using everything from minibuses to mopeds, typical services include voluntary car schemes, community bus services, school transport, hospital transport, dial a ride, wheels to work and group hire services. Most are demand responsive, taking people from door to door, but a growing number are scheduled services along fixed routes where conventional bus services are not currently available. As community transport is always run for a social purpose and never for a profit, it is often the most reliable, resilient and accessible way of ensuring the broadest range of transport needs can be met. (Active Travel initiatives are discussed in detail in the Transport section of this Report).

Young people: South Shropshire Youth Forum in Ludlow is working with Shropshire Wildlife Trust's Ludlow Branch Nature Recovery Network programme. A number of activities are aimed at encouraging young people to take part in conservation and Nature recovery.

The AONB's Shropshire Hills Young Rangers programme gives young people (aged 12-16) new opportunities for exploration, learning and adventure in the great outdoors. Led by qualified and experienced outdoor leaders and youth workers, Young Rangers offers a meaningful and fun activities in the special landscape of the Shropshire Hills. The teenagers are encouraged to help protect and conserve some of Shropshire's most important wildlife, landscapes and habitats. There are opportunities for outdoor learning and skills development, including countryside crafts, navigation training, bushcraft and wildlife surveying. Leadership skills are built, too. This can help increase representation of young people in decisions which affect them and our local landscape.

Recycling and repairing: Ludlow Repair Café has been running since 2017 and is part of the international Repair Café network. It is an example of an action that could be extended further throughout South Shropshire.

The idea behind every Repair Café is to prevent, or at least postpone, as many items as possible being thrown away thereby adding to landfill. Owners are either reminded or 'shown' that repairs are, on the whole, possible, which in turn re-introduces a forgotten skill or introduces a new one. And every item which has its life extended has saved its owner the cost of buying new - so there is both a 'planet-saving' and a money-saving feel-good factor!

Repair Cafés are 100% community-based and community-dependent. Everyone involved with a Repair Café is a volunteer, all bringing different skills and different experiences, enthusiasms and a real wish to make things work again.

Repair Cafés do not charge a fee but invite donations to cover essential costs. Ludlow's Repair Café passes on any surplus donations to the Ludlow Furniture Scheme which shares a similar ethos.

Connecting people and wellbeing, sharing good practice

Social prescribing is a free and confidential service to improve health and wellbeing. With the support of a trained adviser working from local medical practices across Shropshire, people can access further support and community groups in their area such as: Walking for Health, Befriending, Housing Advice, Fitness Classes, Lunch Clubs, Employment Support. Social prescribing can help if people feel lonely or isolated or wish to improve their health or get more active or involved in their local community.

Community Connectors network: Voluntary and community organisations are increasingly supporting people with multiple and complex needs, with less resources. The aim of the Community Connectors is to develop a network of people across the area who are well informed about local services and support who can signpost others with information.

Green Shropshire Xchange is a network of local environmental groups in Shropshire and Telford and Wrekin promoting communication and education on the subjects of Climate Change and Sustainable Living. They work to promote community action to conserve, protect and enhance the environment, sustainable development, promote positive environmental actions and impacts.

Challenges and Responses in Shropshire

Community Planning issues: Communities have little control regarding the planning of new homes and the services that are needed for significant numbers of people to move into rural areas such as Shropshire. These are rarely discussed in a holistic way, though Local Area Plans are the way forward. Parish Design Statements and Parish Plans could be used further to address these matters. Although it may be good for communities to welcome new people and young families into their midst, giving energy to the community in many ways, and helping with school numbers, some of the downsides are complex and cannot be easily addressed at the Town or Parish Council level.

There are plans for many new homes in South Shropshire, and so far, new rural homes tend to be built with fossil fuel heating systems and often little consideration given to the transport needs of residents. Car ownership is universally assumed. As we discuss in the Energy and Buildings section of this Report, these new homes need to be built to be low-carbon, energy and water efficient and climate resilient, but this has not yet passed into law.

The costs of building to a high energy efficiency specification are not prohibitive and getting design right from the outset is vastly cheaper than forcing retrofit later. Homes from 2025 should be heated through low carbon sources and have ultra-high levels of energy efficiency alongside appropriate ventilation. Reducing overheating risks in new builds is needed, alongside more ambitious water efficiency standards, property-level flood protection in flood risk areas, and increasing requirements for greenspace and sustainable transport in planning and guidance.

These complex questions that are so important in communities are difficult to resolve without regular Place Plans, or Village/Town Plans that are wide reaching in their scope and sharing of ideas amongst people and communication and consultation with Shropshire Council. CPRE Shropshire (also run with volunteers)

can be consulted by communities or individuals on specific planning matters.

Community–owned solar power: This was initially successful in the UK, with small groups of dedicated volunteers formed all over the UK to deliver a variety of schemes, from small rooftop installs on parish halls to utility-scale solar farms. These schemes provide very low-carbon energy exactly where it is needed at the heart of our communities and deliver an exciting array of positive outcomes: social cohesion, ethical investment, community benefit funds, training, education and employment. Above all, perhaps, they have shown that ordinary people are willing and able to work together to address Climate Change through thriving social businesses that they themselves initiate, fund, and manage.

These projects allowed the money previously lost out of the local economy to remain in Shropshire and work up to 12 times more efficiently than it would have done if simply paying for energy generated and provided by a non-UK owned energy conglomerate.

The community solar movement in the UK was jump-started in 2011 with the introduction of Feed-in Tariffs (FiT) – the Government's support mechanism for small renewables. The tariffs made solar financially viable and together communities did the rest. But that support mechanism ended completely on 31 March 2019. With that current models for community solar simply stopped making sense and were no longer practicable. Community energy faced a stark choice: either give up on community solar or come up with a new model.

The Big Solar Co-op is a new post-subsidy model for Shropshire and beyond. It builds on what Sharenergy (a not-for-profit Shrewsbury based organisation) has learned working long term with community solar projects across the country. A nationwide co-operative movement, with the scale and effectiveness to work even in the absence of any Government subsidy or policy support, it will build significant new community-owned solar over the next 10 years. More suitable - rooftop, non-domestic - sites are needed and training will be available to enable people to be a site finder or array designer.
See also The Great Collaboration.

(c) Carla Sam Design

Greening Towns: Bishop's Castle:
Following in the footsteps of the Middle Marches CLT and National Trust's 'Stepping Stones' project, Greening BC will aim to become an urban "stepping-stone". The project's outcome will be a visually greener and more Nature-friendly market town with improved environmental connections to its rural hinterland. The community will be involved in the design, delivery and the future of the project to ensure their commitment and the project's sustainability, and a full understanding of any impacts this initiative may have on, for example, the local farming community. The initial phase will be a Community consultation followed by a series of activities arising out of the consultation, which will form the groundwork for a funding bid.

Food Resilience Strategy: Bishop's Castle:
Bishop's Castle is tackling the issue of where food comes from. *"Imagine a Bishop's Castle that is blooming: where fruit and veg are growing in public places and are picked at their peak. Where Community gardens are bringing together new gardeners and experienced growers to learn side by side, as children watch the seeds they've planted start to sprout. Where the food you've grown alongside your neighbours is shared with the satisfaction of knowing where it came from, and that you're giving your loved ones the gift of health."*

That is part of the opening paragraph in the Bishop's Castle Community Food Resilience Strategy, which is intended to enable local people to take stock of what is happening in the local food system: what resources there are, issues or gaps, who needs support, and who can lend skills. This information will inform future targeted actions (Mike Watkins, February 2021).

Proposed solutions for Shropshire

The South Shropshire Community Action Community and Education group have alraedy instigated a number of working groups to further develop resources and practices that will help to encourage climate actions in our community.

We offer local organisations a variety of appropriate resources, possibly a Q and A (or questionnaire) asking them what they are doing and where they need help. For example, for a Town Council which has not yet declared a Climate Emergency an introductory talk might be helpful, such as the one offered by Allan Wilson, Shropshire Association of Town Councils.

We promote Climate Conversations with Town and Parish Councils or any other community group. Where there is particular interest in land and biodiversity, Phil Holden of the Shropshire Hills AONB offers a discussion about local concerns and options.

We need to reduce food miles so should explore and investigate 'grow local' initiatives, allotments and community gardens. We should be looking at achieving a circular economy – reduce, re-use, recycle.

As the country rebuilds communities and the economy after Covid 19, when so many aspects of our lives have changed, or are changing, we need to make sure that it is a green recovery (e.g. more emphasis on working from home, at least for part of the week, major changes to the energy infrastructure, meaning new jobs retrofitting houses and commercial buildings, transport and so on.

Many organisations have been accused of 'greenwash' - making proposals which sound good but lack substance or clear

A Resource Toolkit

A new SSCA resource for approaching community groups about climate action. This is a useful way to stimulate ideas and conversations.

Table 21: The South Shropshire Climate Action Communities Toolkit

Reduce fossil fuels	Increase renewable energy	Increase tree planting and biodiversity	Protect soils (which hold vast carbon reserves)	Use less stuff (which uses carbon to produce)	Eat sustainably
Better insulation in homes and workplaces	Solar panels on homes, offices, public buildings	Reforestation and re-wilding	Peatlands – Use peat-free compost	Stop throw away culture – only buy what you need	Reduce 'food miles' by looking for local produce
Gradually replace petrol / diesel vehicles with EVs (and hydrogen fuels)	Hydroelectric schemes	Public parks and gardens	Modify agriculture to build up healthy soil	Resist being a slave to fashion	Grow more food locally – gardens & allotments
Increase walking & cycling	On-shore wind	Nature reserves	Promote sustainable agriculture	Repair and repurpose – through charity shops or 'repair cafes'	Eat more vegetables and choose what is in season
Travel less, especially flying	Switch to renewable electricity	Wetlands (these also help reduce flooding)	Keep soils in the fields rather than being washed into rivers	Don't hoard things 'just in case'	If you eat meat, look for good quality, local, pasture-fed, organic (if affordable)
Low energy lighting – homes, public building, streetlights	Energy storage, batteries, hydrogen production	Rivers	Reduce amounts of nitrates, phosphates and pesticides, herbicides etc on land where possible	Increase recycling	Reduce food waste – buy or cook only what you will use
				Avoid plastic packaging	Compost food waste

dates and deliverables. Every effort should be made to define who is doing what and when. Organisations should be held to account for all aspects of their operations.

Town and Parish Councils (TPCs)

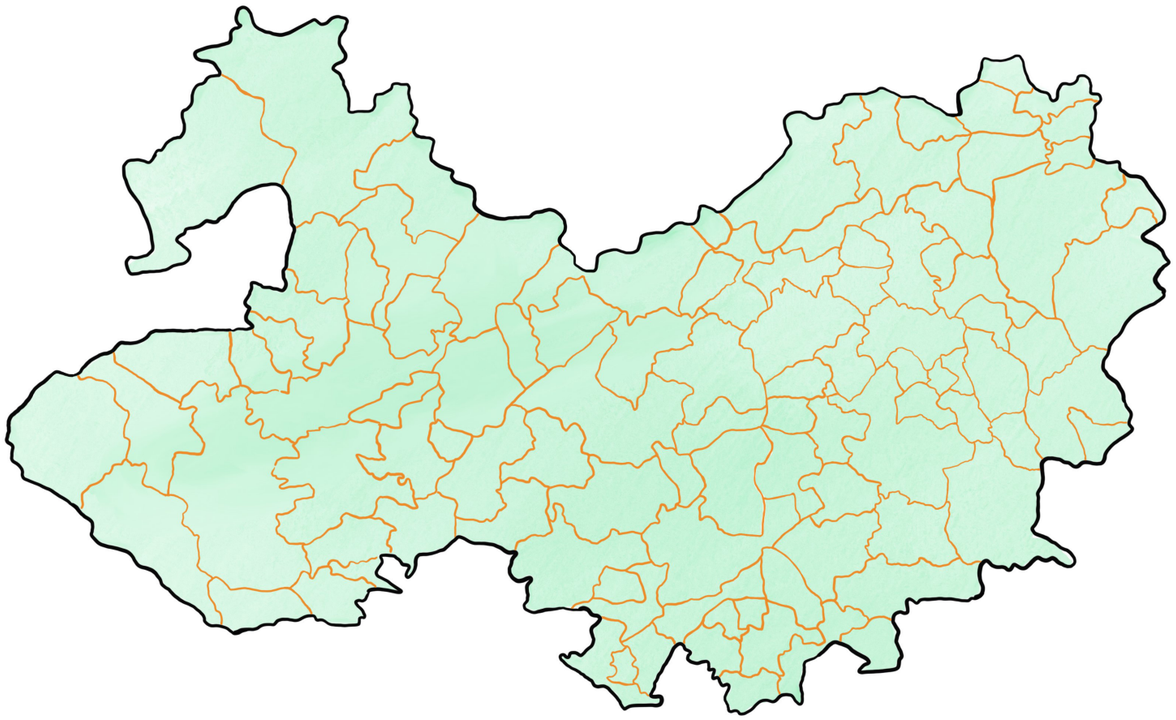
Climate Conversations: South Shropshire Climate Action have begun what hopefully will be the beginning of many conversations throughout South Shropshire. The idea is a simple one. A meeting is set up (online at the moment) with members of a community such as a Parish Council, WI group, a youth club, or any group of concerned people - to talk about how we can reduce the causes and effects of Climate Change and wildlife loss. The emphasis is on practical, local, and meaningful action.

The discussions are about what the group have already done, what they would like to do, what their local issues are and what they might need help with. It is very much a two-way process -after all it is a conversation, not a lecture! Ideas and inspiration are picked up from some communities and shared with others. Together, it is possible to help each other make more of a difference.

It would be unhelpful to claim to have all the answers, far from it, but it is possible to help to point people in the right direction, put them in contact with someone who can help or suggest that elusive idea....'Why didn't I think of that?'

In just one climate conversation we took part in, the following topics emerged in the discussion:

Fig 15: Map of South Shropshire (defined by the area of the Ludlow Parliamentary constituency) and Civil Parish boundaries. Click here for a larger version of this map (pp 14-15)



- Cutting energy use in older houses.
- Electric car chargers.
- Farm plastics recycling or replacement.
- Improving rural transport.
- Nature recovery networks.

Much has already been done here in South Shropshire. Between the many scattered and rural communities meaningful and practical projects **are** happening. Our aim is to draw these together, showcasing the successes and providing inspiration and support to each other.

Town and Parish Councils: Comparing progress, sharing good practice:

The map of the Ludlow constituency shows the Town and Parish Councils - 105 of them. Of these, about 15 have declared Climate Emergencies, and they may have various plans for future climate actions. We will also be contacting and sharing good practice with groups in neighbouring counties, such as Herefordshire and Powys.

We feel it would be useful to have an interactive map on the SSCA website of TPCs within the Ludlow constituency, with links to pages where TPCs outline their progress to cut carbon and improve the ecology of their areas, and further share good practice.

An example of a Town or Parish Climate "Action plan"

Wem Town Council have developed a resource outlining all the various elements of the town (buildings, energy, transport, green spaces etc), with particular plans for carbon reduction and increasing biodiversity. This plan (Table 22) sets out in clear steps how to begin a local strategy:

Calculate your carbon footprint:

There are many carbon footprint calculators and this might be a good way for a community to start. There are carbon calculators for communities, for families and individuals, as well as those for schools and businesses. See, for example, the calculator from the Carbon Trust.

To see the ranking of carbon emissions for Parish Councils in South Shropshire (each one is different due to land use, etc) see the Impact Carbon Calculator (see page 90 of this Report for a sample readout).

Calculators are important as we all have a carbon footprint and each decision we make has a direct impact on the size of this. Combined with family, friends and neighbours this will accumulate into the community footprint - and so on. By reducing our individual carbon footprint our community footprint will reduce, bit by bit, month by month. Take part in the countywide project to reduce Shropshire's overall carbon footprint. There is more information about this on the South Shropshire Climate Action and Zero Carbon Shropshire's websites.

GDP, consumption, waste and carbon emissions:

Governments and economists have used Gross Domestic Product (GDP) as a measure of the health and strength of a country's economy for decades. However, this is a misleading measure. It is not reasonable that a country can demonstrate a rising GDP by chopping down its forests to sell the timber, extracting ever increasing numbers of fish from the sea and using fossil fuels to generate the power. This disregard of the degrading of natural resources is being questioned (Dasgupta, 2021).

Table 22: Parish and Town Council Climate Emergency Action Plan

	S/M/L Term	Time commitment • Low • • Medium • • • High	Cost £ Low ££ Medium £££ High	Notes
Lobbying and Leadership				
Organisational Review of Policies to align with Climate Emergency Commitment				
Publicise commitment				
Join Global Covenant of Mayors				
Request support for carbon neutral status				
Climate Emergency Page on website				
Make reference to Climate Emergency and need for renewable energy measures when commenting on planning applications				
Add Climate Emergency References in all new contract specifications and Tenders and add to the evaluation process				
Carbon Reduction of Assets				
Undertake Carbon Footprint Audit				
Undertake a Buildings Audit to identify any efficiency measures				
Replace Street Light heads with LED				
Consider climate impact on new purchases of plant & machinery				

Table 22: Parish and Town Council Climate Emergency Action Plan (continued)

	S/M/L Term	Time commitment • Low • • Medium • • • High	Cost £ Low ££ Medium £££ High	Notes
Reduce carbon footprint of toilets				
Consider carbon footprint of any buildings to be taken on by the Town Council in the future				
Reduce carbon footprint of Town Council office activities				
Renewable Energy				
Request energy from Town Council's electricity providers is renewable				
Explore potential for installing solar/wind mitigating measures on Council land/ buildings				
Transport				
Explore infrastructure requirements and power capacity for electric vehicles				
Improve pathways and encourage walking & cycling				
Waste minimisation				
Paperless Council meetings				
Encourage contractors to have a "Zero to Landfill" policy				
Review litter bin locations				
Litter picking				
Ensure all waste is recycled and reused wherever possible				

Table 22: Parish and Town Council Climate Emergency Action Plan (continued)

	S/M/L Term	Time commitment • Low • • Medium • • • High	Cost £ Low ££ Medium £££ High	Notes
Open Spaces				
Develop Open Space Management Plans				
Any future Public Open Space adoption to include any Climate Emergency Needs				
Develop a long-term approach to tree planting, including, encouraging community tree planting and identifying locations for bulk planting				
Purchase peat-free compost				
Continue replacement of floral planters with built-in water reservoirs to reduce the need for watering				
Verges				
Community Engagement				
Consider amending Town Council's grant application form to request evidence of applicants' commitment to tackling the Climate Emergency				
Establish area forum to encourage the community to embrace the Climate Emergency agenda				
Encourage Councillors to promote Climate Change				

Table 22: Parish and Town Council Climate Emergency Action Plan (continued)

	S/M/L Term	Time commitment • Low • • Medium • • • High	Cost £ Low ££ Medium £££ High	Notes
Community Engagement (cont)				
Publicize and promote achievements in reducing the Council's carbon footprint if done				
Eco Day				
Investigate the production of reusable "*Wem Cups"* for use in takeaways and at town events				
Young People				
Include Climate Emergency in any youth activity				
Liaise with schools about Climate Emergency initiatives for young people with appropriate incentives				
Monitoring				
Report quarterly reviews against plan				
Undertake annual carbon footprint audit				

Virgin forest can only be cut down once, so in terms of contributing to the economy is it enough to measure the value of the forest as just the price gained from selling the timber, opening up the land for agriculture and settlement? Should we not also include in the balance the myriad of lifeforms that will lose their habitats, the contribution the forest makes in storing carbon, influencing weather and providing sources for new pharmaceutical products? These things are known as natural capital to economists; ecosystems to the rest of us. This, as well as the education, health and well-being of a population and the stuff we produce and buy, taken together ideally, would be a more sustainable measure of a nations' health and so wealth.

The fixation on GDP to measure each country's health has fuelled the consumerism that we see in "developed" economies. More and more is bought, encouraged by the myriad of products designed to only last a short period. Difficult to repair, they are thrown away and upgraded. This consumerism and waste have been major contributors to increased carbon emissions and hence Climate Change. It is important to cut unnecessary waste and encourage people to be thoughtful about their consumer choices. By undertaking a carbon foot printing exercise, we can understand more fully the impact of our daily and life choices and this might hopefully motivate change.

In the UK, the official figures for Greenhouse Gas emissions (GHG) only count emissions within the UK. This is to avoid double accounting, so if a product is made in Bangladesh the carbon used to make and transport that good is added to Bangladesh's emissions even though the product is made to satisfy the demand in the UK. As the WWF report 2020 shows, an estimated 46% of a person's carbon footprint is missing from official figures. As a consequence, the progress on lowering the UK's GHG emissions is not as good as it seems on paper. This makes it imperative that people become more aware of what they, as individuals, can do to lower their own footprint - to think carefully about what and how often they consume, to ensure resources are used efficiently and kept in circulation for as long as possible. These ideas are explored more fully in the Consumption and Resources section of the ZCS website. Individual consumer decisions can have significant impacts on carbon saving.

Carbon Watchers Project: To initiate such change within Shropshire, the Carbon Watchers Project is being set up (by ZCS) where small groups can support each other to reduce their carbon footprint. Encouraging repairing, swapping, sharing, refusing single use items, supporting the local economy will not only reduce emissions but will help communities to thrive.

There are many Carbon Footprint Calculators. We review the best here:

www.footprintcalculator.org

An individual ecological footprint is calculated, showing how much of the Earths' resources would be needed if everyone lived similarly. It measures the CO_2 emissions and the amount of land that would be required to produce the products consumed and to absorb the CO_2 emitted. Data are from UN data sets and it is a useful resource because all countries of the world can be compared. The methodology and data sources used are explained.

www.carbonindependent.org/index.html

An independent site run by a scientific researcher Ian Campbell, who is UK based. The calculator is very easy to use and can be filled in with bands or with actual figures

www.chrismadden.co.uk

from bills etc. There is a step plan to reduce personal footprints by 10% per annum over the next 10 years. The calculator builds in average embedded carbon based on your consumption. The methodology and data sources used are explained.

https://zero.giki.earth

A very easy to use calculator that is available as a mobile app as well as computer version. People are encouraged to enter actual figures wherever possible and answer questions to increase the accuracy of the scoring. There is also an app available that enables the bar codes on products to be scanned on a smart phone to get a breakdown of the carbon embedded in the product, https://badges.giki.earth . Journeys can be planned and all areas of your life can be considered with tips and help to reduce your footprint. It is very easy to use and the methodology and data sources used are explained.

https://calculator.carbonsavvy.uk

This is a new calculator, fully available in Spring 2021. It looks likely to be comprehensive and has information and carbon saving tips that are emailed if you sign up.

Conclusion

All these calculators are using figures calculated on actual CO_2 emissions divided by the population as the base and then by putting in actual spend/usage/lifestyle choices the figure is raised or lowered to reflect more accurately the personal/household score.

How these adjustments are made will mean that it is unlikely to have the same score by imputting the same figures into each calculator, but they should not be wildly different. The main thing is to choose the most appealing one. By repeating your carbon calculations every six months you should be able to track your progress towards zero carbon.

Next steps

The Toolkit describes the working groups that are emerging in South Shropshire. Some of them are active and working now (e.g., Climate Conversations, dialogues with Parish and Town Councils, action plans and matrices, community energy projects, food resilience, verges and Nature recovery, repair cafes and carbon calculators). Some are simply ideas, which require further development. There will be others yet to emerge from the current sharing of ideas and consideration of the next steps.


Tree planting in the Stiperstones
(c) Charlie Bell, National Trust

2. Education

In **Schools** carbon reduction and ecological recovery involves both:

- Reducing the carbon emissions of the school in day-to-day operations, just as any other community facility.

- Educating the children and their families about sustainability and climate action when there is still currently scant reference to these topics in the National Curriculum and little guidance or support from Government and local authorities.

The current Government's approach to Sustainability in schools is hands off:

"The Department for Education is committed to sustainable development and believes it is important to prepare young people for the future. Our approach is based on the belief that schools perform better when they take responsibility for their own improvement. We want schools to make their own judgements on how sustainable development should be reflected in their ethos, day-to-day operations and through education for sustainable development. Those judgements should be based on sound knowledge and local needs" (DfE, 2012).

This can be contrasted with the position in Scotland where Education for Sustainability is a core requirement (Education Scotland, 2021).

It is not easy at the current time to determine what measures are being implemented in schools to reduce their carbon emissions and to educate children about carbon reduction and sustainability. There are some examples of good practice, but as Climate is not a core curriculum subject, provision is patchy and many professionals are not sure what resources to use.

What is being done now?

Schools are communities which need to evaluate their carbon footprint (Lets Go Zero), the biodiversity of their land and also the climate crisis content in their curriculum (Eco Schools). Schools and colleges may have climate action plans in place, some more developed than others. The Zero Carbon Schools conference in Herefordshire in 2020 revealed that many teachers find it difficult to source good advice on managing carbon reduction in their school or curriculum materials on climate.

There are a number of organisations (e.g. Ashden, Eco-Schools, Energy Saving Trust) that support schools to make reductions in their carbon usage. However, the actions taken by schools are variable and depend on their governance and interest and enthusiasm of the Head, governors and teachers. Some Councils provide clear guidance on sustainability on their websites and have dedicated school sustainability officers (e.g., Reading, 2021, Solihull, 2021). The support in Shropshire is limited and difficult to find. There appears to be nothing specifically aimed at helping schools although there are some links to relevant organisations. Herefordshire Council has produced a very useful energy audit for schools.

In 2013 towards the end of the UN Decade of Education for Sustainable Development (ESD) (2005-2014) the UNESCO Policy Brief No 9 focused on the UK stated (scroll down the page to download the document):

- In England ... there is currently less policy emphasis on sustainable development and this has inhibited the wider adoption of good practice in ESD (Education for Sustainable Develoment). Currently, the Department of Education promotes sustainable schools in an advisory role only.

"Save the Planet" poster (c) Bryony John, Orleton CE Primary School

Currently, the Department of Education promotes sustainable schools in an advisory role only as Government Support for ESD has diminished over time. Ben Ballin (2019), the secretary of the *West Midlands Sustainable Schools Network* [@wmsussch] commented in 2019 on the student led climate strikes inspired by Greta Thunberg by asking 'How had we got to the point where young people were demanding such a strongly-directed response from the education system?' He went on to say 'It is not, after all, as if there have been no attempts by government to put the environment and/or climate change and/or sustainable development on the education agenda in England.' He provided a Timeline (Appendix 2) showing the long and winding road of policy and emphasis shifts, of passing responsibility from one agency to another, of stuttering stops and slow reboots.

This hands-off position does not sit well with the Government's commitment to the UN Sustainable Development Goals (SDGs) that they signed up to in 2014. SDG 4.7 requires the Government by 2030 to *"ensure that all learners acquire the knowledge and skills needed to promote sustainable development."* In February 2021 this split within Government was further highlighted with Boris Johnson's address to the UN Security Council on climate and security where he stated *"ahead of the COP 26 summit we're going to be putting Climate Change firmly at the top of the agenda."*

In contrast in Scotland, ESD is a national priority with the Learning for Sustainability Action Plan that requires all teachers and schools to show where they include ESD within the curriculum and school activities. It is an indictment of our education system that a recent graduate reflected that she did not remember learning about Climate Change or sustainability while at school in Shropshire and it was only during her university education that she became more aware and active in this area. Contrast this with the actions and concerns of many young people spurred on by Greta Thunberg and the Friday strikes.

In Shropshire, support is offered through the Shropshire Learning Gateway. Sustainability is mentioned within the guidance for Design and Technology, Geography and Science. There are also opportunities to include ESD in all curriculum areas and for all ages if students "are to be prepared for the future" if teachers recognise the urgency of the climate crisis amongst their many priorities which have increased throughout Covid 19. Some examples of organisations providing support for reducing carbon usage and Education for Sustainable Development:

- Ashden's LessCO_2 programme presents a series of half day workshops spread through the year, peer mentoring, expert advice and resources, empowering staff and equipping them to make changes and improvements to their school to reduce their energy usage, save money on bills and lower their CO_2 emissions.

A framework for achieving Net Zero Carbon buildings has been developed by the UK Green Building Council. It incorporates both the emissions from construction as well as the emissions from operational use. Schools can strive to be Net Zero Carbon buildings that are highly energy efficient and fully powered from on-site and/ or off-site renewable energy sources and to be Net Zero in new build projects.

- Eco-schools is a global programme engaging 19.5 million children across 67 countries, making it the largest educational programme on the planet. For over 25 years Eco-Schools has been empowering children to drive change and improve their environmental awareness through the simple **Seven-Step framework** in order to achieve the international Eco-Schools Green Flag. Eco-Schools develop pupils' skills, raises environmental awareness, improves the school environment and creates financial savings for schools as well as a whole host of other **benefits.**

- Charities promoting sustainability in schools and in the curriculum are active. For example, the National Association for Environmental Education (NAEE).

- Sustainability and Environmental Education (SEEd) is another charity whose goal is to 'broaden and deepen the practice of education for sustainability and environmental education. SEEd uses policy informed by practice to influence Government and other organisations: *"We are working to change societal attitudes and norms towards sustainability and environmental issues through educators and the education system."*

- The Sustainable School's Whole School Approach and the Sustainable Schools Alliance (SSA), membership programme for schools are SEEd projects that help schools embed sustainability and learning for sustainability throughout the school. The SSA has a network of schools across the UK who are working towards a Whole School Approach and schools can apply for recognition of the work they do on an annual basis.

- The Green Schools Project is a UK charity who believe that young people have the ability to drive action to tackle the climate and ecological crisis at a local, national and global level. The Youth Strike 4 Climate movement has proved that beyond doubt. As a result, in 2019 Green Schools Project saw a big rise in interest from teachers and headteachers, who are increasingly becoming aware that they need to be doing more to address an issue that will define the future of their students. A survey commissioned by Oxfam found that 69% of teachers think there should be more teaching about Climate Change in schools, and the NUS and Green Schools Project's survey of young people's attitudes towards the environment found that 86% agree that *"all schools should do things that help the environment."*

Carbon reduction is needed in schools. A starting point is to research local and national organisations that can provide schools and teachers with advice, resources and activities. This will enable schools to work both on reducing their carbon usage and develop a curriculum that better prepares students for the future decisions they may need to take. There are good opportunities for learning about energy, biodiversity, transport, resources and recycling that all have a clear connection to Climate Change.

- The Top Tips for sustainability in schools have been used by SSCA to produce a matrix that gives some suggestions of actions that schools as institutions can make to reduce carbon usage. Schools may have already considered many of the actions identified but we have tried to pull the ideas together with links to useful websites and organisations that can help. This is an interactive process with SSCA able to respond to needs identified by schools as well as making suggestions. It is important to find out what schools are already doing and their future needs.

- The energy audit has proved popular and transport to and from school is discussed in the Transport section of this Report. Forest schools are popular in primary schools and nurseries, and the Shropshire Wildlife Trust has input into some schools in South Shropshire. Outdoor learning alongside efforts to improve school land by encouraging biodiversity and growing food must be welcomed.

Making contact with interested schools and teachers is a key element of the strategy to widen climate subjects. School websites give an indication of the ethos of the school and often indicate whether they are already involved in ESD through activities such as eco-schools. Contact with the Shropshire Learning Gateway will also be an important starting point as they already co-ordinate termly CPD with school clusters.

Resources, activities and events

The Energy Diary is an activity for primary and secondary school children to discover what energy is used in their homes. The Diary was designed as a teaching activity to help busy families to cut down their energy use. Devised by Lightfoot, it was enthusiastically received in a number of schools in Powys from 2005 to 2008. The diary was revised during 2020 and re-designed to be available on the Lightfoot website, with a printable version for download. Lightfoot encourages feedback and pictures about the diary. A biodiversity teaching resource is under development.

Woodlands and wild areas**:** Bishops Castle Community College Students go into forest settings to learn about the diversity there and how they may be managed sustainably. There are small group projects, drama workshops, a visit to a local sawmill, den building, learning how to fell and log small trees, walks and talks from National Trust, Forestry Commission, and Shropshire Wildlife Trust.

The work, organised by Lightfoot, has been funded largely by the Shropshire Hills Area of Outstanding Natural Beauty since 2017. Every Friday afternoon is devoted to the Enrichment programme, where students pick a topic for the term. So, for a term our volunteers provide an outdoor activity either on the school grounds or a minibus ride away.

In 2020, the Covid 19 crisis resulted in basing all events in Bishops Castle, within walking distance of the college, and have included activities at the Wintles Fruit Labyrinth and Woodland, and at Little Woodbatch Market garden as well as sustainable woodland management in the school grounds.

Group from Bishops Castle Community College experiencing a (c) Helen Plastow

The John Muir Award is an environmental award scheme focused on wild places. It encourages everyone to connect with, enjoy and care for our wild places. Groups of young people of upper primary level and above can participate, families or individuals. It is non-competitive, inclusive and accessible. The Shropshire Hills AONB delivers the Award into local schools.

Conference: Zero Carbon Schools Herefordshire

Twenty-one primary schools (two from Shropshire) and four secondary schools signed up for a ground-breaking zoom conference called Zero Carbon Schools which took place on Thursday 15th October 2020. During the one-day event, experts spoke to eco reps, eco leads and head teachers in workshops which covered carbon emissions, youth activism and energy saving within schools. The idea was devised by The Marches Climate Education Group, an informal group of teachers and educationalists whose aim is to put Climate and the biodiversity emergencies at the centre of the school curriculum.

Richard Vaughan, Sustainability and Climate Change Manager at Herefordshire Council said *"This event was a fantastic collaboration between the Marches Climate Education Group, Greenschools Project, teachers, workshop leaders and Herefordshire Council."*

Schools were given the Energy Saving Guide developed by Herefordshire Council and piloted by Orleton Primary, Whitecross Secondary and the Steiner Academy. Katie Horne, leader of the Fridays 4 Future team at Whitecross commented *"the guide is a really great piece of work which enables all schools to audit their energy use and put in place straightforward actions to save energy, thereby reducing emissions, and also saving money!"*

Hub Schools: The Marches Climate Education Group has set up a team of hub schools. Bryony John from Orleton Primary explained *"the training means hub schools will be well placed to help their neighbouring schools as they embark on their energy saving journey. Hub schools are typically schools which have been environmentally active for some years and are passionate about sharing best practice.'"*

There was a consensus that schools would be able to work together to achieve a significant collective impact on carbon emissions.

The aim is to work with schools in three ways:

1. **Managing school buildings and resource organisation:** Reducing carbon usage within the building and the general management of the school by helping them become more energy efficient and sustainable.

2. **Curriculum:** Supporting the school curriculum by identifying curriculum opportunities, providing resources, suggesting teaching activities and finding knowledgeable local people to talk to students.

3. **Acting as a forum:** SSCA can also be a forum where teachers interested in teaching about carbon reduction and Climate Change can meet and share ideas The strategy for contacting schools, teachers and governors has several strands:

- Identify interested schools. teachers, governors and other staff though personal contacts.

- Build up a database of schools with contact details and information based upon publicly available information from school websites and other local knowledge. For

example, there is a list of schools in Shropshire available as a starting point.

- Work with staff from Shropshire Learning Gateway to make contact with schools and teachers. Contact has already been made with Ben Ballin, Primary Geography CPD Associate who is also secretary of the West Midlands Sustainable Schools Network. We hope to be able to identify projects to work on together.

- Make contact with identified schools / teachers / governors / other staff offering them the resources we have and asking them to complete a simple Survey Monkey questionnaire that asks them about the curriculum, support they might need and any resources and ideas they can share.

- From the contacts made it is hoped that networks can be made for sharing resources and ideas and hub schools to co-ordinate these groups.

Much of the work so far has been on identifying areas that schools and teachers need support with and how best to communicate the ideas.

In Appendix 2 we show how we are developing the website and areas that we can work with schools to reduce carbon emissions.

Acting as a forum: Once contact has been made with schools, teachers, governors and head teachers, the best ways to share ideas and resources will be identified. At the moment suggestions include social media, the website and meetings (virtual or real). With teachers' permission it may be possible to keep a spreadsheet record of schools' interests and activities to better facilitate the sharing of ideas.

Next Steps

Imagine South Shropshire of the future where communities have worked together to reduce our carbon emissions to achieve Net Zero, whilst making our land a productive, sustainable and a bio-diverse environment, attracting business and visitors into the area.

In this area we have been supported by strategies from central Government and Shropshire Council to make the best choices for ongoing health and wellbeing for our communities. These positive developments have been encouraged by well-considered sustainable funding streams from Government and businesses. The economics of living in a rural area have been developed from a virtual *free for all* to one where landowners are able to devote their land to production of meat, arable crops, woodlands, carbon capture, areas for maximum biodiversity improvement, flood mitigation, soil retention and river improvement as part of an integrated national plan to reduce carbon, enhance biodiversity and feed the nation.

As communities work together to achieve this vision, children, working families and individuals and older people, Town and Parish Councils, community groups, businesses and schools find their roles in helping to achieve carbon zero and mitigate the ecological crisis.

Each town or village has an integrated plan for improving the quality and warmth of homes, installing renewable energy at community or individual house or business level, encouraging sustainable transport such as biking, electric vehicles and walking more, reducing the impact and damage of heavy lorries where possible. Greening our shared spaces, gardens and land where possible to drive back the rate of species extinctions and make a return to the rich biodiversity of the past.

In such a community the education of both children and adults widens so that it is understood that each choice made when purchasing has an impact on global carbon emissions and the biodiversity of the earth. As a consequence a circular economy develops, where recycling is maximised, waste is reduced or recycled, learning to repair and re-use where possible (swop-shops, repair cafes) and buying local (food and many other items), is established thus reducing the need to travel for shopping. This way money often stays in local circulation.
Community buildings such as schools, community centres, churches, medical facilities etc have all been evaluated for their carbon and energy efficiency, and so are operating to the best possible standards, with the maximisation of biodiversity and carbon capture ability of any associated land.

The schools themselves will have climate studies in the curriculum for all ages, so that our children can continue the work that has been started to make the world a healthier place to live and to give them more sustainable future lives.

By looking at the problem in a holistic way, there is a way forward. Sometimes looking at the problem from the community level is the easiest way to make small but significant steps along a future roadmap. This has begun in many Parish and Town Councils where Climate Emergencies have been declared.

Shropshire Council can help to mitigate the climate crisis by supporting the efforts of many hundreds of climate crisis pioneers in Shropshire. They can do this by making a strategy for Shropshire covering all the aspects of the climate crisis. This task should not be left to individuals across the county, but so far, there has been no other choice. They can do this by helping to link together the entire community so that we are working together and sharing our best ideas and practices.

By being able to share good practice with neighbours easily, using the interactive map on the website, it will be possible for Town and Parish Councils, community groups, schools and colleges to evaluate how well they are reducing carbon emissions and improving biodiversity in their areas. It will enable us to see what neighbouring Town and Parish Councils are doing and encourage links and cooperation.

Targeted funding will need to go to communities to achieve zero carbon and greater biodiversity and will require a well-considered national strategy. It is hoped that future Government will prove this is possible to do. Without this it is not easy to see who will make the necessary actions to mitigate climate collapse.

This could be by targeted funding for retrofit of poorly heated homes, businesses, community and public buildings and the installation of renewable energy; reducing diesel/petrol vehicles and moving to renewables (electric, hydrogen fuels); subsidising carbon capture in land, sustainable agriculture for food production and environmental improvement of the biota on land; toughening waste disposal, recycling, flood potential and river catchment improvement, pollution of rivers, soils etc.

Conclusions

Climate Change is waiting for none of us. Time is of the essence. There is a lot of inspiring action already happening here in Shropshire and in the wider world, and rather than each community or group re-learning how best to make a difference, we can all work better by sharing the wealth of experience already in our midst.

The SSCA is now evaluating resources to identify the practical actions which can be taken and offer them on the website specifically tailored to meet community needs. The value is to share stories, and questions from schools and colleges, Town and Parish Councils, WIs, Rotary and Probus, youth groups and any other interested organisations.

Reaching out is possible through an SSCA Twitter page, a Facebook page, and a Facebook Closed User Group set up for a teachers' network. Recent Climate Change action is reported through the website Blog, in press releases and as items for community newsletters, and church and parish magazines.

There is no single way but many ways for an organisation to reduce its carbon footprint and improve biodiversity. People need to begin at the point at which they are. What do they wish to do and what do they need to know? Initial conversations are the means for this to happen.

It may be a small start: a regular litter pick for example; meeting the challenge of changing the lightbulbs in the town for low energy bulbs; setting up a local produce market might be a more ambitious plan. These actions can be the basis of a future area climate plan, which can then be developed. Importantly it is then owned by the community and all the various talents of individuals involved can be harnessed for the whole. A plan can then be developed.

Sharing good practice is vital to making the impact on climate mitigation and turning the direction to improve biodiversity. Working together between communities, seeing what the neighbours are doing and not reinventing the wheel but building on ideas and actions

It is important that young people are empowered to understand the complexities of the climate crisis, so that they can see that every decision they will make in the future has an impact on carbon emissions and the natural world. It is they who will have the task of making the world habitable, as the Climate Changes gather speed.

Empowering people to begin to think about climate involves encouraging dialogue with the community group or school, then ideas will flow. Resources can be made available (via websites such as ours), and through sharing ideas and good practice.

The ideas and practices described in this Report are only a start. There will be many other ideas to come. Human ingenuity and creativity are vital for change to happen, and it is necessary that this is harnessed to inspire and motivate others.

Starting young on a CPRE Shropshire litter pick
(c) Connor Furnival

Appendix 1: School Management and Organisation

This section gives some suggestions of actions that schools as institutions can make to reduce carbon usage. You may already have considered many of the actions identified here but SSCA has tried to pull the ideas together with links to useful websites and organisations that can help. We would also like to hear about any actions that have been taken so that we can share them with others. We also want to support you in discussing particular issues and problems.

The Top Tips for Sustainability in Schools for Sustainability in Schools document (DfE, 2012) identifies the main sources of Greenhouse Gas emissions in schools: Energy, Transport, Land (Food), Resources and Recycling.

The matrix below uses these headings to outline some of the areas that schools can consider and act upon. The document identifies many organisations that support schools and the links on the matrix provide shortcuts to relevant websites or resources.

Table 23: Top Tips for sustainability in schools (DfE, 2012)

Land and Biodiversity	Energy and Buildings	Transport	Resources	Recycling
Using the school grounds and local area	Energy Audit Reducing carbon use	Travel - local and worldwide	Sustainable purchasing for schools	Reducing waste
Habitats and sustainability	Building Schools better for energy and health	Technology	Resource 'stories' - eg source, manufacturing, use, disposal	Pollution, eg plastics

Curriculum and preparing young people for the future

When contacting schools, it is essential to have some resources available or links to good sources of material on carbon reduction, sustainability and ecological recovery. Over the last few months, we have started to collate resources, materials and useful links that can be suggested to schools.

This strategy is our first. and we intend to develop this further with the help of teachers.

1. Primary Curriculum
2. Secondary Curriculum

Primary Curriculum

Sustainability and Climate Change can be introduced to very young children through stories, cartoons and practical activities. Introducing simple sustainability ideas while talking about the topics below is an excellent start.

Table 24: Key Stage 1 (5-7 year olds)

Land and Biodiversity	Energy and Buildings	Transport	Resources	Recycling
Habitats and wildlife: school grounds, local, worldwide	Energy: keeping buildings warm or cool	Different types of transport	What are things made of?	What waste do we make?
Weather and clothes	Different types of buildings and materials	Journeys: getting to school, visits	Where do the raw materials come from?	What can we do with it?

Secondary Curriculum

In the Secondary Curriculum there are references to Climate Change and Sustainability in the Science and Geography National Curricula. The Government's commitment to the Paris Accord and their targets for Net Zero Carbon by 2050 alongside the actions and interest of many young people in Climate Change and Sustainability should encourage teachers and schools to think about the opportunities in all other subjects. Some opportunities for English, Mathematics, Technology, Art and Design, Modern Foreign Languages, History and Citizenship are identified in the table overleaf. We would welcome suggestions for other subjects.

Table 25: Key Stage 3 (11-14 year olds)

Subject	Land and Biodiversity	Energy and Buildings	Transport	Resources	Recycling
Science	Habitats, biodiversity, climate	Energy	Vehicle types	Materials	Reducing waste
Geography	Extreme weather, flooding	Energy sources	Sustainable transport	Clothing	
English	Weather impacts	"You did not act in time" - Greta Thunberg	Transport issues - viewpoints		
Mathematics	Climate Change measurement	Energy use	Comparing vehicle use		
Technology	Food	Power for the world	Future vehicles	Reducing resource use	Circular economy
Art and Design		Building design	Future vehicles		
History	Farming and land use over time	Industrial Revolution, energy	Vehicle types over time	Innovations in technology	
Citizenship					

""Save the Earth" poster (c) Bryony John, Orleton CE Primary School

"Climate Change is waiting for none of us. Time is of the essence. There is a lot of inspiring action already happening here in Shropshire and in the wider world, and rather than each community or group re-learning how best to make a difference, we can all work better by sharing the wealth of experience already in our midst."

Removing Himalayan Balsam and litter from the River Clun (c) Mary Eminson

Appendix 2: Timeline of Environmental Education and Education of Sustainable Development in England

1988: The first National Curriculum for England and Wales includes Environmental Education as a 'cross curricular dimension'.

1992: Agenda 21, Chapter 36 requires local and national Government to "Promote Education, Public Awareness and Training" of sustainable development. A plethora of initiatives, projects and Local Government posts ensues.

1998: The Holland Report proposes 'key concepts for sustainable development' – this coincides with a broadening of curriculum concerns to embrace statutory Citizenship Education.

2000: A new National Curriculum for England features environment, sustainability and global citizenship as strong elements within Science, Geography, Design Technology, Citizenship and PE. There are passing references to Climate Change. Sustainable development is prominent in the curriculum's values, purposes, aims and aspects.

2000s: Sustainable Development and Global Citizenship are promoted by QCA as non-statutory whole school dimensions.

2006-10: DEFRA's Sustainable Schools Framework proposes 8 doorways. It is well-resourced but non-statutory. Regional governments play a key support role and it gets a mention on the Ofsted self-evaluation framework.

2006-8: DEFRA's Climate Challenge Fund aims to raise awareness about Climate Change. £8.6 million is distributed in grants via 83 project delivery partners, of which £1.9 million is provided to projects explicitly targeted at young people.

2010: The Coalition Government comes in with a new broom, and sweeps away the Sustainable Schools Framework, regional government and former sustainability champions QCA. In 2016, the Department of Energy and Climate Change is abolished.

2014: Another new National Curriculum for England sees Environmental Education weakened and some references (e.g., in Primary Geography) removed. However, there are explicit references to Climate Change in Secondary Science (KS4) and Geography (KS3 / GCSE). The growing number of academies are not obliged to follow this curriculum.

2014: SDG 4.7, signed by the UK Government, requires it by 2030 to "ensure that all learners acquire the knowledge and skills needed to promote sustainable development."

Contact

The South Shropshire Climate Action Newsletters and Blog posts are available on the website as well as a Facebook Closed User Group for teachers. The website pages on Community and Education outline our work so far and are continuing to be developed as a resource for communities and schools, and all educators.

Glossary of Abbreviations

AONB	Area of Outstanding Natural Beauty
ASC	Averaging Speed Camera
ASI	Avoid, Shift, Improve concept
BEV	Battery Electric Vehicle
BEIS	Department for Business, Energy and Industrial Strategy
Bn	Billion (also 'b' or 10^9 in notation)
CAP	Common Agricultural Policy
CAT	Centre for Alternative Technology
CFMPs	Catchment Flood Management Plans
CH_4	Methane
CIL	Community Infrastructure Levy
CLT	Community Land Trust
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
CPD	Continuing Professional Development
CROHM	Carbon Reduction Options for Housing Managers
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DPS	Dynamic Purchasing Systems
ELMS	Environmental Land Management Scheme
EPC	Energy Performance Certificate
ESA	Environmentally Sensitive Areas
ESD	Education for Sustainable Development
EV	Electric Vehicle
FIT	Feed in Tariff
FOI	Freedom of Information
g/kWh	Grams of CO_2 per kilowatt-hour of energy generated
GDP	Gross Domestic Product
GDPR	General Data Protection Regulation
GHG	Greenhouse Gas
GVA	Gross Value Added
GW	Gigawatt
GWh	Gigawatt hours
H_2O	Water
ha	Hectare
HGN	Herefordshire Green Network
HGV	Heavy Goods Vehicle
HNV	High Nature Value
ICE	Internal combustion engine
IPM	Integrated Pest Management
kWh	Kilowatt hour (kWhr) 1 KWh = 3.6 MJ
$kWh/m^2/pa$ net	Kilowatt hours per square metre per annum of floor area
LEAF	Linking Environment and Agriculture
LED	Light Emitting Diode [lighting]
LEP	Local Enterprise Partnership (Marches LEP; inc.Herefordshire, Shropshire, T&WC)
LFA	Less Favoured Area
LGV	Light Goods Vehicles (less than 3.5 tonnes in weight)
LJC	Local Joint Committee
MaaS	Mobility as a Service
MEA	Marches Energy Agency
$MtCO_2e$	Metric tons of carbon dioxide equivalent
NCA	National Character Area
N_2O (NOx)	Nitrous Oxide
NHS	National Health Service
NFM	Natural Flood Management
NNR	National Nature Reserve
NRN	Nature Recovery Network
NVZ	Nitrate Vulnerable Zones
NWRR	North West Relief Road
NZC	Net Zero Carbon
NZE	Net Zero Emissions
OFN	Open Food Network
PJPs	Personalised Journey Plans
PM	Particulate Matter
PV	Photo-voltaic (Solar energy panel)
RHI	Renewable Heat Incentive
RSVP	Restoring Shropshire's Verges Project
SAC	Special Area of Conservation
SCAP	Shropshire Climate Action Partnership
SDGs	Sustainable Development Goals
SFSC	Short Food Supply Chains
SME	Small or Medium sized Enterprises
SOM	Soil Organic Matter
SSCA	South Shropshire Climate Action
SSSI	Site of Special Scientific Interest
STPs	School Travel Plans
SUV	Sport Utility Vehicle
t Cha^{-1}	Topsoil organic carbon storage
TPCs	Town and Parish Councils
TPs	Travel Plans
UBYM	Upgrade Before You Move
UFCC	Urban Freight Consolidation Centres
UKFS	UK Forest Standard
WFH	Working From Home
WPD	Western Power Distribution
ZCB	Zero Carbon Britain [The CAT outline & toolkit programme]
ZCS	Zero Carbon Shropshire

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